

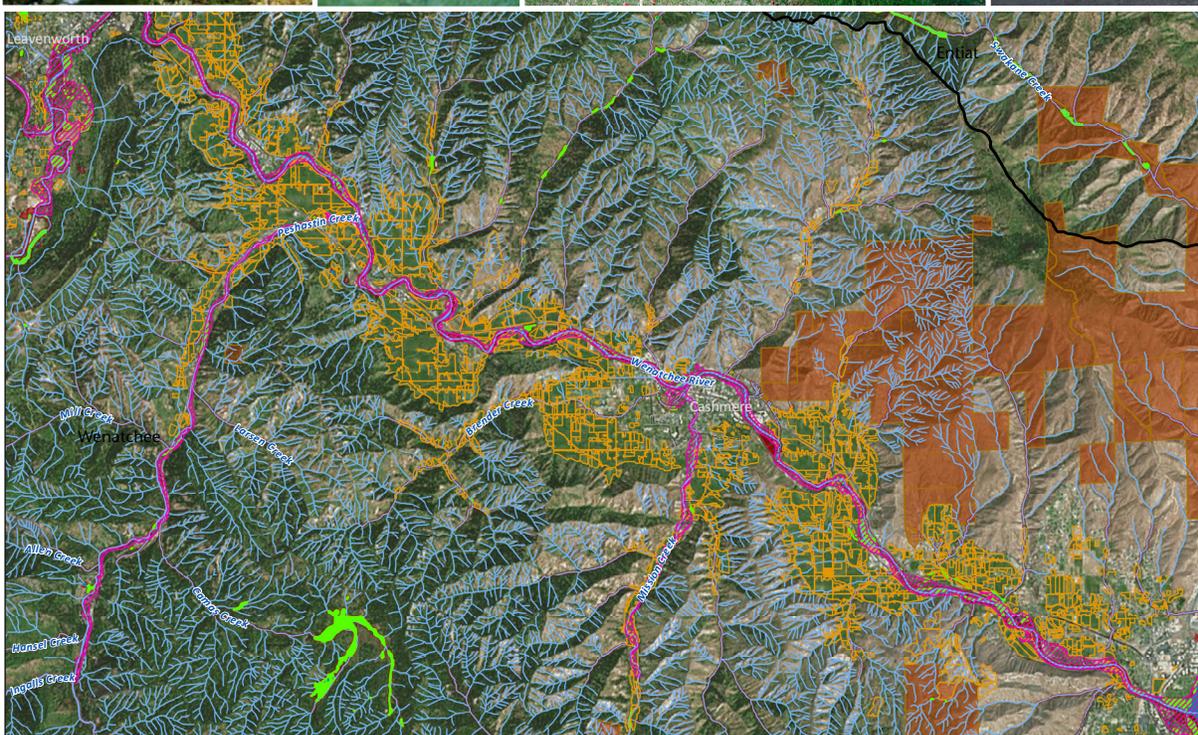
# Draft

Chelan County



## VOLUNTARY STEWARDSHIP PROGRAM

APPENDICES B-I | June, 2014



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# **DRAFT VOLUNTARY STEWARDSHIP WHITE PAPER**

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- B. Mapping Sources and Chelan County Code Critical Area Designation and Classification Criteria
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## APPENDIX B-1.

### SUMMARY OF GEOGRAPHIC INFORMATION SYSTEM SOURCES AND METHODS

Feature	Data Sources and Methods	Limitations or Data Gaps
<b>Agriculture</b>	<p><b>Wenatchee Basin:</b> Cascadia Conservation District, 2013</p> <p><b>Chelan, Entiat, and Squilchuck-Stemilt:</b> The agriculture data was created manually in ArcGIS using several sets of aerial base map images, Washington State Department of Agriculture (WSDA), and United States Department of Agriculture (USDA) datasets as references. The WSDA crop section layer was used to define the extent for visual identification of agricultural production (i.e. a guide for which sections contain agriculture); we then used aerial imagery to visually scan each section for agriculture. General crop categories (e.g., orchard/vineyard, pasture, fallow, etc.) were assigned based primarily on the aerial imagery, as well as in reference to parcel agriculture current use taxation status, and USDA and WSDA designations.</p>	<p>The Chelan, Entiat, and Squilchuck-Stemilt results should be verified by the Working Group and Stakeholders given the scale of the USDA and WSDA resources and use of aerial photos.</p> <p>Rangeland data is based on Washington State Department of Natural Resources (DNR), Washington Department of Ecology (Ecology), and US Bureau of Land Management (BLM) sources.</p>
<b>Fish and wildlife habitat conservation areas</b>	<p>Class I Fish and Wildlife Habitat Conservation Areas.</p> <ul style="list-style-type: none"> <li>• Habitat which have a primary association with species listed by federal agencies as endangered or threatened or species listed by state agencies as endangered: Priority Habitats and Species Maps, via Washington Department of Fish and Wildlife (WDFW) (2014). Also the Stemilt-Squilchuck Community Vision habitat mapping has been included.</li> <li>• State natural area preserves (NAPs) and natural resource conservation areas: Not shown. There are three NAPs, Camas Meadows, Entiat Slopes, Upper Dry Gulch.</li> </ul> <p>Class II Fish and Wildlife Habitat Conservation Areas:</p> <ul style="list-style-type: none"> <li>• Naturally occurring ponds under twenty acres; waters of the state; lakes, ponds, streams, and rivers planted with game fish: DNR Watercourse (2006) and DNR Waterbody (2006) layers provide by Chelan County.</li> <li>• Priority habitats and species, including priority fish distribution and riparian zones: Priority Habitats and Species Maps, via Washington Department of Fish and Wildlife (WDFW) (2014). Also the Stemilt-Squilchuck Community Vision</li> </ul>	<p>State natural area preserves (NAPs) and natural resource conservation areas: Not shown.</p> <p>The Washington State DNR has provided GIS layers for high quality terrestrial and wetlands habitats, but use restrictions allow creation of a map for the County alone, and it cannot be published.</p>

Feature	Data Sources and Methods	Limitations or Data Gaps
	<p>habitat mapping has been included.</p> <ul style="list-style-type: none"> <li>• Mule deer and/or elk winter range and migration corridors: Priority Habitats and Species Maps, via Washington Department of Fish and Wildlife (WDFW) (2014). Also the Stemilt-Squilchuck Community Vision habitat mapping has been included.</li> </ul>	
<b>Wetlands</b>	National Wetland Inventory (2014) downloaded from USFWS website.	The data set underlying the layer is dated.
<b>Frequently Flooded Areas</b>	FEMA (1996) downloaded via Ecology's website.	
<b>Geologically Hazardous Areas</b>	<p>Erodible Soils: NRCS (USDA) (2013) from Chelan County. NRCS delineations of "Severe" and "Very Severe" erosion hazard are shown.</p> <p>Steep Slopes: NRCS (USDA) (2013) from Chelan County.</p> <p>Potential Landslide Hazard: DNR (2008) and via DNR website.</p> <p>Mapped Landslides: DNR (2010) and via DNR website.</p> <p>Channel Migration Zones (not included in County code; included as referenced in WAC 365-190-120 – not mapped in the Squilchuck-Stemilt basin): Source: The Watershed Company and Ecology 2011.</p>	
<b>Critical Aquifer Recharge Areas</b>	<p>Public Wells: Department of Health (2013) via Chelan County FTP.</p> <p>Potential Wellhead Protection Zone: BERK (2014) using recommended area per State of Washington Department of Ecology (Ecology) Critical Aquifer Recharge Areas Guidance Document. January 2005, Publication Number 05-10-028: <a href="https://fortress.wa.gov/ecy/publications/publications/0510028.pdf">https://fortress.wa.gov/ecy/publications/publications/0510028.pdf</a>. The Department of Health indicates 1,000 foot is used in their mapping sets for all Group B water systems, and any small Group A systems that have not calculated fixed radii or delineations for their sources. State law sets requirements for wellhead protection area zones (WAC 246-290-130 and 246-290-135).</p> <p>Possible Aquifer Borders: BERK (2014) per Ecology CARA Guidance (2005). Contour lines downloaded from County FTP and USGS Topo maps were used as reference in digitizing possible aquifer borders.</p> <p>Surficial Alluvial Geology: Division of Geology and Earth Resources (DGER), a part</p>	<p>Information depicted represents suggested data layers per the Ecology published CARA Guidance document (2005). CARA mapping depicted is potentially representative of physical features related to CARA but it is not a substitute for a certified geohydrologist created and DOE approved map.</p>

Feature	Data Sources and Methods	Limitations or Data Gaps
<b>Other Informational Layers</b>	<p>of DNR (2010) and downloaded via DGER site.</p> <p>Hydrologic Study Area (100 Ft as mapped; 25, 50 and 100 feet in table data): BERK (2014) using Streams, Waterbodies, and Wetlands datasets.</p> <p>Watershed Boundaries: Ecology (2011)</p> <p>303d Waters: Ecology (2012)</p> <p>Zoning: Chelan County (2014)</p>	

# APPENDIX B-2

## VSP White Paper: Chelan County Critical Area Definitions & Designation Criteria

### Critical Areas Definitions & Classification – Chelan County Code

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#### Definitions and Classification or Designation Criteria

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“**Critical areas**” include the following areas and ecosystems: (1) Wetlands; (2) Areas with a critical recharging effect on aquifers used for potable water; (3) Fish and wildlife habitat conservation areas; (4) Frequently flooded areas; and (5) Geologically hazardous areas. (CCC 14.98.485)

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“**Aquifer**” means a water-bearing stratum of permeable rock, sand or gravel. (CCC14.98.220)

“**Aquifer recharge**” means the movement or percolation (usually downward) of surface water through an unsaturated zone of soil or rock into a groundwater body. (CCC 14.98.225)

“**Aquifer recharge area**” means an area with a recharging effect on aquifers used for potable water. (CCC 14.98.230)

“**11.82.020 Designation.**” (1) There is insufficient scientific data at this time, to determine with any specificity the location of areas having a critical recharging effect on aquifers used for potable water within the boundary of Chelan County. However, the best available science suggests that a susceptibility determination will allow Chelan County to designate critical aquifer recharge areas using a conservative approach, which provides a worst case scenario for contaminant movement in the subsurface. Therefore, any area found via this chapter to be an area having a high susceptibility rating shall be designated a critical aquifer recharge area, and a map or maps maintained by the Chelan County department of building/fire safety and planning shall set forth such areas.

(2) In addition, sole source aquifer recharge areas designated pursuant to the Federal Safe Drinking Water Act, areas established for special protection pursuant to a groundwater management program, Chapters 90.44, 90.48 and 90.54 RCW, and Chapters 173-100 and 173-200 WAC; areas designated for wellhead protection pursuant to the Federal Safe Drinking Water Act, and aquifer recharge areas mapped and identified by a qualified groundwater scientist shall also be designated as critical aquifer recharge areas.

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**Fish and Wildlife Habitat Conservation Areas:** Not defined in County code—see GMA definition and classification criteria.

“**11.78.060 Fish and wildlife habitat conservation areas classification and designation.**” (1) Classification. The following classifications shall be used in designating fish and wildlife conservation areas:

(A) Class I Fish and Wildlife Habitat Conservation Areas.

(i) State natural area preserves and natural resource conservation areas; and

(ii) Habitat which have a primary association with species listed by federal agencies as endangered or threatened under the Federal Register for the Endangered Species Act of 1973, or species listed by state agencies as endangered (WAC 232-12-014), threatened (WAC 232-12-011) or sensitive (WAC 232-12-011).

(2) Class II Fish and Wildlife Habitat Conservation Areas.

(A) Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat;

(B) Waters of the state;

(C) Lakes, ponds, streams, and rivers planted with game fish by a governmental or tribal entity;

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**Definitions and  
Classification or Designation Criteria**

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(D) Priority habitats and species as identified by the Washington State Department of Fish and Wildlife Priority Habitats and Species Program;

(E) Mule deer and/or elk winter range and migration corridors.

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**“Frequently flooded area”** means an area subject to flooding, as defined by FIRM, once every one hundred years. (CCC 14.98.855)

**“11.84.010 Classification.”** Those areas located within the one-hundred-year floodplain as defined by the Federal Emergency Management Agency are classified as frequently flooded areas.

Best available science will be used in the designation of the county’s frequently flooded areas. The flood insurance rate maps (FIRM) and floodway maps along with the Flood Insurance Study—Chelan County prepared by the National Flood Insurance Program (NFIP) are adopted as the formal designation for frequently flooded areas. Upon review and approval by the county, subsequent studies delineating the boundaries of the floodways and floodway fringe areas of the one-hundred-year floodplains for the county, or portion thereof, shall constitute the best available science and be utilized as the official designation information for frequently flooded areas. A review committee comprised of the directors of the department of building, fire safety and planning, and the public works department shall review each set of new information to make a recommendation to the Chelan County board of commissioners whether it should be adopted as new designation criteria. Before final adoption, this will be distributed for public and agency review.

When base flood elevation data is not available from the above information to designate frequently flooded areas, the above-defined review committee shall obtain, review and reasonably utilize any base flood elevation data and floodway data available from federal and state governmental agencies or other sources including but not limited to historical data, high water marks or photographs of past flooding to make the appropriate designations.

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**“Geologically hazardous areas”** means areas susceptible to erosion, sliding, earthquake, or other geological events. (CCC 14.98.865)

**“11.86.020 Classification.”** Classification of each geologically hazardous area will be based upon the risk to development. The following categories shall be used:

(1) Known or Suspected Risk. Areas that are susceptible to one or more of the following types of hazards shall be classified as a geologically hazardous area with a known or suspected risk and shall require a geologic site assessment as described in Section 11.86.070.

(A) Erosion hazard areas identified by the U.S. Department of Agriculture Soil Conservation Service Chelan County Soil Survey Manual as having a “severe” erosion hazard.

(B) Landslide hazard areas shall include areas potentially subject to landslides based on a combination of geologic, topographic and hydrologic factors. They include any areas susceptible to mass movement because of any combination of bedrock soil, slope (gradient), slope aspect, structure, hydrology, damage or removal of vegetative cover, or other factors. Examples of these may include, but are not limited to, the following:

(i) Sites that are located on or within two hundred fifty feet of areas of documented or historic failures, such as:

(a) Those areas delineated by the United States Department of Natural Resource Conservation Service as having a “severe” limitation for building site development.

(b) Areas designated as quaternary slumps, earthflows, mudflows, or landslides on maps published by the United States Geological Survey or the Department of Natural Resources Division of Geology and Earth Resources.

(c) Areas located on a landslide feature which has shown movement during the past ten thousand years or which is underlain or covered by mass wastage debris of that period.

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**Definitions and  
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- (d) Slopes that are adjacent to existing fault planes or similar geologic formations.
- (ii) Sites that are located on or within two hundred fifty feet from areas with all three of the following characteristics:
  - (a) Slopes steeper than fifteen percent; and
  - (b) Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
  - (c) Springs or groundwater seepage.
- (iii) Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action.
- (iv) Areas located on or within two hundred fifty feet from an alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding.
- (v) Steep Slopes. Any slope of forty percent or steeper with ten feet of relief or areas adjacent to these slopes, of which shall cover a distance equal to the vertical height of the slope or two hundred fifty feet, whichever is less.
- (vi) Areas that show evidence of, or are at risk from, sliding that may pose a threat to the public health and safety.
- (C) Sites that are located on or within five hundred feet from snow avalanche areas. Snow avalanche areas include areas that show evidence of, or are at risk from, snow avalanches.
- (D) Upon examination of the subject property by a qualified professional pursuant to Section 11.86.065, if a determination is made that none of the foregoing conditions are present on or adjacent to the property, the qualified professional may state in letter form the circumstances under which the site assessment or report may be waived.
- (2) No Risk. Areas classified initially as geologically hazardous areas with a known or suspected risk or unknown risk may, upon further study, actually pose no risk to development or to the public health and safety. Where the administrator can determine that no risk from the geologically hazardous area is present, based upon geotechnical reports or best available science, these areas shall be classified as geologically hazardous areas determined to be of no risk.
- (3) Unknown Risk. Geologically hazardous areas may be present in the county that cannot readily be identified based upon the criteria of subsection (1) of this section. Geologically hazardous areas of unknown risk include areas where data is not available to determine the presence or absence of a geological hazard. The administrator may require a geologic site assessment and/or geotechnical report to determine the actual presence or absence of a geologically hazardous area.<sup>1</sup>

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**“Wetland” or “wetlands”** means areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas

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<sup>1</sup> The CCC does not address channel migration zones as a geologic hazard area; since the time the County prepared its regulations State rules have changed to include them at WAC 365-190-120; therefore draft maps have been included for this feature.

**Definitions and  
Classification or Designation Criteria**

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created to mitigate conversion of wetlands (RCW 36.70A.030). (CCC 14.98.1975)

**“11.80.030 Designation.”** (1) All wetlands in Chelan County meeting the definition of wetlands in RCW 36.70A.030(21) are designated wetlands.

(2) The approximate location and extent of wetlands in the county are displayed on the National Wetlands Inventory Maps and the Chelan County wetland inventory map, as it is developed. The wetland maps, along with other supportive documentation, are to be used as a guide to the general location and extent of wetlands. There may be wetlands that are not shown on the wetland inventory maps. There are also wetland areas that are mapped that are not necessarily wetlands. However, each potential wetland site must be evaluated by the administrator to determine the applicability of these requirements. In the event that any of the wetland designations shown on the maps conflict with the criteria set forth in this chapter, the criteria set forth shall take precedence.

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Source: Chelan County Code (June 2014)

# APPENDIX C. SUMMARY OF WATERSHED RESOURCE INVENTORY AREA PLANS

## Chelan, Entiat, Wenatchee and Squilchuck/Stemilt Watersheds

### INTRODUCTION & PURPOSE

The Voluntary Stewardship Program (VSP) is an optional, incentive-based approach to protecting critical areas while promoting agriculture. The VSP is allowed under the Growth Management Act (GMA) as an alternative to traditional approaches to critical areas protection, such as “no touch” buffers. A goal is to promote plans to protect and enhance critical areas where agricultural activities are conducted, while maintaining and improving the long-term viability of agriculture and reducing the conversion of farmland to other uses. In order to establish the program, a watershed work program is required and must contain goals and benchmarks for the protection and enhancement of critical areas. The work program must be approved by the Washington State Conservation Commission Director and the Departments of Fish and Wildlife, Ecology, and Agriculture.

The work plan must include several items, including applicable existing water quality, watershed management, farmland protection, and species recovery data and plans. It must also create measurable benchmarks through voluntary, incentive-based measures. As well, individual stewardship plans described in the program law are to contribute to the goals and benchmarks of the work plan; for the purposes of its efforts, Chelan County and partners intent to develop “stewardship checklists” to focus on simplicity and rely on many available conservation practices rather than detailed stewardship plans.

Chelan County has developed watershed plans for each Watershed Resource Inventory Area (WRIA) in the county including Chelan, Entiat, Wenatchee, and Squilchuck/Stemilt. These plans are a source of potential objectives and strategies that can be incorporated into the VSP Plan and the individual VSP “stewardship checklists” to be produced.

This document provides a high-level summary of WRIA defined issues and strategies, intending to focus on those relevant to critical areas, agriculture, and general watershed issues. For each watershed, a summary table is provided. For complete context and details on the strategies, each plan should be consulted.

### LIST OF REFERENCES

Watershed plans and associated reports reviewed for this summary include:

- Entiat Watershed
  - Entiat WRIA 46 Management Plan, October 2004.
  - Chelan County Conservation District, February 2006. Detailed Implementation Plan Entiat Water Resource Inventory Area (WRIA) 46, prepared for Entiat Watershed Planning Unit.
  - Upper Columbia Salmon Recovery Board, May 28, 2004. Entiat Subbasin Plan, Prepared for the Northwest Power and Conservation Council

- Lake Chelan Watershed
  - Upper Columbia Salmon Recovery Board, May 28, 2004, Lake Chelan Subbasin Plan, Prepared for the Northwest Power and Conservation Council
  - RH2 Engineering, Inc. January 2012, Lake Chelan Watershed Plan (WRIA 47) Final Draft. Prepared for Lake Chelan Watershed Planning Unit.
- Squilchuck/Stemilt Watershed
  - RH2 Engineering, Inc. MAY 2007. WRIA 40A Watershed Plan Final. Prepared for WRIA 40A – Squilchuck/Stemilt Planning Unit.
  - Trust for Public Land, Core GIS, and The Stemilt Partnership Chelan County, September 2008. Stemilt-Squilchuck Community Vision.
  - Upper Columbia Salmon Recovery Board, May 28, 2004. Upper Middle Mainstem Subbasin Plan, Prepared for the Northwest Power and Conservation Council.
- Wenatchee Watershed
  - WRIA 45 Planning Unit, April 26, 2006, Final Wenatchee Watershed Management Plan.
  - Wenatchee Watershed Planning Unit, April 2008 Wenatchee Watershed Planning Phase IV – Detailed Implementation Plan
  - Upper Columbia Salmon Recovery Board, May 28, 2004. Wenatchee Subbasin Plan, Prepared for the Northwest Power and Conservation Council.

## ENTIAT WATERSHED

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
Water Quality			
<ul style="list-style-type: none"> <li>As of 2006, Entiat River was listed as water quality impaired for pH - on 303(d) list</li> </ul>	<ul style="list-style-type: none"> <li>Promote and implement projects that improve water temperature conditions for aquatic species</li> <li>Educational events about Best Management Practices related to herbicide and pesticide application, nutrient management, and potential water quality issues associated with farming and livestock.</li> <li>Reassess and map areas of livestock access to streams</li> <li>Maintain current efforts and practices.</li> </ul>	<ul style="list-style-type: none"> <li>Continue ambient water quality monitoring of all water quality parameters (nutrients, nitrates, pH, temperature, fecal coliform, etc.) at Ecology site 46A070</li> <li>Monitor toxics bioaccumulation levels in fish</li> <li>Use existing FLIR data to help evaluate cold-water influences as thermal refugia for salmonids during periods of high water temperature within the system</li> </ul>	<ul style="list-style-type: none"> <li>Water quality monitoring of all water quality parameters (nutrients, nitrates, pH, temperature, fecal coliform, etc.) at Ecology site 46A070</li> <li>See <a href="#">2009 Report on monitoring activity</a></li> </ul>

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
Water Quantity			
<ul style="list-style-type: none"> <li>● Disparity between actual water use and the amount of water represented by rights and claims.</li> <li>● Documentation that most closely reflects actual water use is necessary for effective water resource management.</li> <li>● Some water right holders in the Entiat River watershed may not currently be exercising some/all of their water rights, yet while others need water.</li> <li>● Water conservation in the Entiat River watershed will help meet management goals and provide additional water for in stream and out-of-stream uses.</li> </ul>	<ul style="list-style-type: none"> <li>● Create a water resource management program that includes a reserve of water for future uses prioritized by use type</li> <li>● Implement Planning Unit Instream Flow recommendations and associated habitat and water quality actions.</li> <li>● Reserve water for new commercial, agricultural and light industrial enterprises should be limited to use in the lower Entiat River.</li> <li>● Establish tracking system with County for wells associated with new construction.</li> <li>● Track water rights applications, permits, claims, etc. and associated geographic and water volumes.</li> <li>● Address uncertainties in the water rights and claims records.</li> <li>● Share information about WRIA 46 water rights and claims data.</li> <li>● Ecology should continue to provide technical assistance and cost share on equipment for water metering.</li> <li>● CCCD should establish a reporting mechanism.</li> <li>● Develop a detailed water conservation, trust water, and water acquisition program for the Entiat River subbasin.</li> <li>● The NRCS and other partners should continue to provide technical and financial assistance to improve on-farm irrigation application efficiency, scheduling, and promote/improve water conservation.</li> </ul>	<ul style="list-style-type: none"> <li>● Streamflow monitoring</li> <li>● Promote community water metering to record actual water use and monitor gains and efficiency and losses attributable to new uses or changes in system operation.</li> </ul>	<p>Program took effect in Sept. 2005 which established administrative instream flows to protect aquatic resources in the Entiat and Mad River watersheds. These flows are monitored at three control points:</p> <ul style="list-style-type: none"> <li>● Entiat River near Entiat (Keystone gage)</li> <li>● Entiat River near Ardenvoir (Stormy gage)</li> <li>● Mad River at Ardenvoir (Mad near Mill Camp gage)</li> </ul>

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
Habitat			
<ul style="list-style-type: none"> <li>Channel geometry in the lower Entiat River (RM 16.2 to mouth) has been modified by past human activities including bank armoring, channelization, woody debris removal.</li> </ul>	<ul style="list-style-type: none"> <li>Restore channel shape, width-to-depth ratios, and aquatic habitat complexity through strategic implementation of instream structures and Large Woody Debris complexes, and reconnection of side-channel habitats and floodplain where feasible.</li> <li>Continue active restoration work in the “Bridge to Bridge” reach (~RM 3.2 - 4.5) to capitalize on connectivity to existing instream habitat restoration sites, and proceed upstream from there.</li> </ul>	<ul style="list-style-type: none"> <li>Cooperative monitoring of existing instream structures, associated channel geometry, and fish species utilization on an annual basis.</li> </ul>	<ul style="list-style-type: none"> <li>Installation of instream structures including rock cross-vanes, rock and wood clusters, barbs, and engineered log jams to restore aquatic habitat complexity, reduce accelerated bank erosion, and improve channel width-to-depth ratios;</li> <li>Construction of two (2) new off-channel areas and a rearing pond to benefit juvenile salmonids</li> </ul>
<ul style="list-style-type: none"> <li>Some existing surface water diversions and culverts in the Entiat River watershed are problematic for fish.</li> </ul>	<ul style="list-style-type: none"> <li>Prioritize replacing surface water diversions and culverts that present fish passage problems, and address unscreened or inadequately screened pumps and diversions as necessary.</li> </ul>		
<ul style="list-style-type: none"> <li>Riparian condition and bank stability has been altered by natural (fire) and human disturbances (agricultural encroachment, overgrazing, timber harvesting, recreation, timber road construction, and removal of vegetation). Riparian vegetation is necessary for bank stabilization, large woody debris recruitment, and stream temperature moderation.</li> </ul>	<ul style="list-style-type: none"> <li>Implement targeted riparian restoration and enhancement projects, based on priorities (see Entiat Ch. 9- Recommendations table- General stream bank planting recommendations from 1995 NRCS study).</li> <li>Restore riparian habitat through streamside revegetation projects with willing landowners.</li> <li>Perform public outreach to inform community members about benefits of maintaining riparian vegetation, Conservation Reserve Enhancement Program (CREP) and other options for cost share on revegetation projects or easement renting.</li> </ul>	<ul style="list-style-type: none"> <li>Abundance and distribution studies of native fish species of interest</li> <li>Macroinvertebrate community composition and population in the Entiat subbasin</li> <li>Continue annual fine sediment monitoring (via McNeil core samples) using existing reaches and transect sites.</li> </ul>	<ul style="list-style-type: none"> <li>Annual fine sediment monitoring (via McNeil core samples) using existing reaches and transect sites.</li> <li>Native shrub and tree planting along &gt; 1000 feet of stream bank to help restore riparian function and shading.</li> </ul>

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
<ul style="list-style-type: none"> <li>Past grazing and land use activities have resulted in extreme bank instability and exacerbated rates of erosion and sediment delivery.</li> </ul>	<ul style="list-style-type: none"> <li>Pursue conservation easement, lease, and options other than outright property acquisition with willing landowners to protect larger, undisturbed riparian areas.</li> <li>Pursue funding and/or use existing partnerships to monitor new habitat improvement projects.</li> <li>Monitoring results should be used to refine management recommendations as necessary.</li> <li>Coordinate road management with major land owners in intermingled ownership areas to help reduce erosion and sediment from road sources.</li> </ul>		
<ul style="list-style-type: none"> <li>Winter habitat conditions have been identified as a factor limiting salmonid survival in the Entiat River watershed. Of particular concern are the effects of cold water temperatures and anchor ice on egg and fry survival.</li> </ul>	<ul style="list-style-type: none"> <li>Pursue grant funding to implement riparian planting and channel geomorphology restoration projects in the bridge-to-bridge reach and other areas where enhancement of riparian and geomorphic condition might significantly enhance over-winter and other salmonid habitat conditions.</li> </ul>	<ul style="list-style-type: none"> <li>Thermograph deployment and monitoring of winter temperatures and the effects of anchor ice on salmonid survival.</li> <li>Monitor the effects of additional riparian vegetation and in-channel projects on winter water temperatures and anchor ice formation.</li> </ul>	

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
<ul style="list-style-type: none"> <li>The Entiat subbasin is utilized by salmonids protected as threatened and endangered under the Endangered Species Act (ESA).</li> </ul>	<p>Goal:</p> <ul style="list-style-type: none"> <li>Protection and restoration of fish habitat sufficient to assure adequate habitat for salmonid recovery and to provide certainty for land and water users in the watershed under the ESA.</li> </ul> <p>Strategies:</p> <ul style="list-style-type: none"> <li>Assure that actions are taken to implement channel geometry and riparian restoration recommendations, irrigation diversion structure improvements, and screening improvements.</li> <li>Develop a Habitat conservation Plan (HCP) and/or salmon recovery plan to gain certainty under the ESA.</li> </ul>	<ul style="list-style-type: none"> <li>Continue habitat and species monitoring.</li> <li>Annual salmon carcass collection and DNA sampling.</li> <li>Monitor salmonid outmigration via smolt traps</li> <li>Probabilistic habitat monitoring consistent with Upper Columbia Salmon Recovery Board (UCSRB) Regional Technical Team (RTT) "Monitoring Strategy for the Upper Columbia Basin" (Hillman 2004, draft) or revised guidance</li> </ul>	<ul style="list-style-type: none"> <li>Integrated Status and Effectiveness Monitoring Program – Entiat River<sup>1</sup></li> </ul>
<ul style="list-style-type: none"> <li>Wetlands along the upper mainstem Entiat River adjacent to the reach above the Potato Creek moraine serve important hydrologic and biologic functions in the Entiat River.</li> <li>Wetlands along the lower reach of the river have been modified by flood control work and development and only a few wetlands exist.</li> </ul>	<ul style="list-style-type: none"> <li>Assure that land use actions comply with existing regulations related to wetlands protection.</li> <li>Local, state, federal, and other partners should assist landowners with voluntary maintenance of existing wetlands, or enhancement of the few remaining wetlands and their function.</li> <li>Community outreach about benefits of wetlands, etc.</li> </ul>		

<sup>1</sup> [http://www.fws.gov/midcolumbiariverfro/pdf/2011\\_USFWS\\_Final\\_BPA\\_Report\\_01-31-2012.pdf](http://www.fws.gov/midcolumbiariverfro/pdf/2011_USFWS_Final_BPA_Report_01-31-2012.pdf)

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
<ul style="list-style-type: none"> <li>Fish habitat in the Entiat River watershed is adversely affected by excessive fine sediment, which can suffocate redds and cause substrate embeddedness.</li> </ul>	<ul style="list-style-type: none"> <li>Use monitoring results to refine management recommendations as necessary.</li> </ul>	<ul style="list-style-type: none"> <li>USFS and partners should continue annual fine sediment monitoring (via McNeil core samples) using existing reaches and transect sites.</li> </ul>	
<ul style="list-style-type: none"> <li>Watershed and riverine resource management is driven by a number of natural processes including sediment. The sediment budget, bedload transport dynamics, and its relationship to channel geomorphology in the mainstem Entiat River are not completely understood.</li> </ul>	<ul style="list-style-type: none"> <li>Initiate sediment budget, sediment transport, and/or analysis of bedload dynamics using acceptable methods (e.g. scour chains) to improve our understanding of this aspect of the system.</li> <li>Continue its support of the ongoing assessment of gravel clusters, and results of the study should be presented to the EWPU.</li> </ul>		
<ul style="list-style-type: none"> <li>Noxious weed infestations are common in disturbed areas throughout the WRIA, especially along roads and right of ways, and in abandoned pastures and cultivated fields. Noxious weeds reduce the biotic integrity and diversity in the watershed effecting quality of life for people, fish, and wildlife.</li> </ul>	<ul style="list-style-type: none"> <li>Develop a comprehensive weed control program with landowners, the County Weed Control Board, and State and other federal agencies.</li> <li>Encourage voluntary landowner efforts to control noxious weeds on their properties.</li> <li>Explore potential for use of biological agents (e.g., weevils) for noxious weed control.</li> </ul>		

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions (highlights)
Wildlife			
<p>Wildlife species protected as threatened or endangered under the Endangered Species Act use habitat on public lands and some private lands within the Entiat WRIA.</p> <p>Known species in the Entiat subbasin:</p> <p><i>Threatened (Federal designation):</i></p> <ul style="list-style-type: none"> <li>• Bald eagle</li> <li>• Canada lynx</li> <li>• Gray wolf</li> <li>• Grizzly bear</li> <li>• Marbled murrelet</li> <li>• Northern spotted owl</li> </ul> <p><i>Designated:</i></p> <ul style="list-style-type: none"> <li>• Critical habitat for the northern spotted owl</li> </ul>	<ul style="list-style-type: none"> <li>• Provide guidance to landowners in the Entiat River subbasin to promote land practices that are beneficial for wildlife; protect and restore riparian and terrestrial lands; and provide information about how to mitigate land use actions such that riparian and terrestrial species thrive.</li> <li>• Continue to apply for grant funds for priority riparian and terrestrial habitat projects.</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor the success of habitat improvement projects.</li> </ul>	
<p>Mule deer inhabit the watershed and are a focal species of interest due to significant economic, recreational, and cultural value. Maintaining populations is limited in part by habitat loss due to development and overgrazing and deer control efforts necessitated by agricultural damage.</p>	<p>Objective:</p> <ul style="list-style-type: none"> <li>• The population management objective for mule deer will be to increase or maintain populations within the limitations of available mule deer habitat and landowner tolerance (agricultural damage).</li> </ul> <p>Strategies:</p> <ul style="list-style-type: none"> <li>• Model the Chelan PMU mule deer population (which extends beyond the subbasin border).</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor harvest level of bucks and antlerless deer using mandatory hunter report system.</li> <li>• Use winter aerial and ground surveys to classify mule deer to determine post-hunt buck/fawn to doe ratios, spring fawn to adult ratios, and population size trends.</li> </ul>	
<p>Plant species that are listed under the ESA and/or are species of concern for State and Federal agencies are present within the Entiat WRIA. Plants with cultural resource significance also exist.</p>	<ul style="list-style-type: none"> <li>• Provide information to the public regarding the identification, significance, and protection of plant resources in the Entiat WRIA.</li> </ul>		

## LAKE CHELAN WATERSHED

Issues	Strategies/Objectives	Monitoring Plans or Recommendations	Implementation Status / Actions
Water Quality			
<ul style="list-style-type: none"> <li>Elevated concentrations of organochlorine pesticides, PCBs, and dioxins/furans in fish tissues, and elevated water quality constituents including phosphorous, pH, dissolved oxygen, and invasive exotic plants.</li> </ul>	<ul style="list-style-type: none"> <li>Minimize movement of contaminants in Lake Chelan and Roses Lake and its tributaries (residues persist in soils, most often agricultural lands)</li> <li>Meet Lake Chelan Total Maximum Daily Load for DDT/PCB</li> <li>Meet Lake Chelan Total Maximum Daily Load for Total Phosphorous</li> <li>Managing irrigation drain return flows that discharge to surface water</li> <li>Develop Long Term Monitoring Plan</li> </ul>	<ul style="list-style-type: none"> <li>Monitor fish tissue concentrations</li> </ul>	
Water Quantity			
<ul style="list-style-type: none"> <li>Need additional data and analysis to quantify beneficial use and return flow estimates to support water quality modeling, water use planning, and watershed management.</li> <li>Most available water used is discharged through Lake Chelan and used for power generation.</li> <li>Conversion of lands and beneficial uses of water in the Wapato, Manson and lower Lucerne sub-basins from irrigation to domestic use will affect groundwater recharge, base flow, and water quality in these sub-basins.</li> </ul>	<ul style="list-style-type: none"> <li>Improve the documentation of beneficial water use</li> <li>Use improved water balance estimates</li> <li>Promote joint comprehensive analysis and prioritization of future municipal/domestic use</li> <li>Evaluate regional growth patterns</li> <li>Evaluate potential future irrigation demand</li> </ul>	<ul style="list-style-type: none"> <li>Initiate surface water and groundwater monitoring</li> </ul>	

Issues	Strategies/Objectives	Monitoring Plans / Recommendations	Implementation Status / Actions
Habitat			
<ul style="list-style-type: none"> <li>● Shrub steppe: Degradation of mule deer and Brewer's sparrow habitat from intensive grazing</li> <li>● Eastside Riparian wetlands: Beaver and red-eyed vireo habitat degradation from livestock overgrazing which can widen channels, raise water temperatures, reduce understory cover</li> <li>● Ponderosa pine: Habitat diversity and function has been lost from invasion of exotic vegetation and grazing</li> <li>● Fish: Fish population impacts include habitat degradation and loss; land development, conversion, and management; agricultural practices; fish-passage barriers; dam operations; flooding; species introductions; interspecific breeding; competition for resources; disease; harvest; and hatchery and stocking operations. Development of barriers at tributary mouths has negatively affected spawning and subsequent fry survival of WSCT (trout).</li> </ul>	<p><i>Objectives</i></p> <ul style="list-style-type: none"> <li>● Maintain and/or enhance habitat by improving agricultural practices, livestock grazing practices, and road construction in/on/adjacent to habitat</li> <li>● Provide sufficient quantity and quality shrubsteppe habitat to support the diversity of wildlife as represented by sustainable focal species populations</li> </ul> <p><i>Strategies</i></p> <ul style="list-style-type: none"> <li>● Implement habitat stewardship projects with private landowners</li> <li>● Develop and implement a coordinated, cross-jurisdictional comprehensive weed control</li> <li>● Develop and implement a coordinated, cross-jurisdictional road management plan</li> <li>● Support the Lake Chelan Fishery Plan (LCFP) objectives</li> <li>● Support habitat restoration efforts to improve limiting factors for both fish and wildlife.</li> <li>● Support developing a detailed implementation plan that includes prioritized fish and wildlife actions.</li> </ul>	<ul style="list-style-type: none"> <li>● Support the monitoring and understanding of habitat and species interactions and reproduction by coordinating LTMP activities with Lake Chelan Fishery Forum (LCFF)</li> </ul>	

## SQUILCHUCK/STEMILT WATERSHED

Issues	Strategies/Objectives	Monitoring Plans / Recommendations	Implementation Status / Actions
Water Quality			
<p>Primary concerns include levels of dissolved gases, changes in stream temperatures, turbidity levels and exposure to environmental contaminants above biological thresholds for fish species utilizing the river.</p>			
Water Quantity			
<ul style="list-style-type: none"> <li>• The need for adequate water supplies (including storage) to provide reliable supplies for existing out-of-stream (domestic, <b>agriculture</b>, municipal, commercial, industrial and fire suppression) needs;</li> <li>• The need for adequate water supplies (including storage) for future uses of water in the watershed, including domestic, <b>agriculture</b>, municipal, commercial, industrial;</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor stream flow and groundwater levels to update water balance of the quantities of runoff, recharge, water use and return flow</li> <li>• Document water diversion, storage and actual water use to update water balance estimates and increase the benefits of new storage opportunities</li> </ul>		
Water Storage			
<ul style="list-style-type: none"> <li>• Over half of total storage capacity in the watershed is lost due to seepage from active reservoirs in WRIA 40A</li> <li>• Water lost to free water evaporation</li> <li>• Water lost from leakage of water in ditches and evaporation in ditches</li> </ul>	<ul style="list-style-type: none"> <li>• Significant storage opportunities exist to minimize storage system loss</li> <li>• Improve diversion, storage and conveyance monitoring</li> <li>• Improve storage and conveyance efficiency</li> <li>• Improve reliability of water supplies</li> <li>• Expand existing storage capacity</li> <li>• Rehabilitate inactive reservoirs</li> <li>• Modify storage operations</li> </ul>		

	<ul style="list-style-type: none"> <li>• Construct new reservoirs</li> <li>• Collaboration with WDFW</li> </ul>		
Habitat and Wildlife Resources			
<p>Focal habitats are impacted by land use and human actions. Public and private land management should support conservation of wildlife resources—including focal habitats.</p>	<p>Objectives:</p> <ul style="list-style-type: none"> <li>• Maintain and/or enhance the function of focal habitats by improving agricultural practices, fire management, weed control, livestock grazing practices, and road management</li> <li>• Provide biological and other conservation measures to sustain focal species populations</li> </ul> <p>Strategies:</p> <ul style="list-style-type: none"> <li>• Conduct studies to determine the necessary amount, quality, and connectivity of focal habitats</li> <li>• Work with CCNRD and other State and local agencies to protect identified wetland, riparian and ground water recharge areas</li> <li>• Implement habitat stewardship projects with private landowners</li> <li>• Consider using conservation easements to limit development and provide for sustainable harvest and forestry practices to enhance habitat and provide for wildlife resources protection.</li> <li>• Implement federal, state, and tribal management plans, other conservation plans, or recovery plans to conserve the focal species</li> <li>• Develop and implement a coordinated, cross-jurisdictional comprehensive weed control management plan (e.g., Moses Coulee Cooperative Weed Management Area)</li> <li>• Develop and implement a coordinated, cross-jurisdictional road management plan</li> </ul>	<ul style="list-style-type: none"> <li>• Select survey protocol and measure abundance of focal species</li> <li>• Select survey protocol and measure diversity and richness of species assemblages</li> <li>• Use probabilistic sampling procedure to determine selection of monitoring and evaluation sites</li> <li>• Establish permanent census stations to monitor bird population and habitat changes</li> </ul>	

Aquatic/Fish			
<p>Three ESA listed fish species can be found in the Columbia River and middle Columbia watershed. Human activities impact the habitat for these focal species.</p>	<p>Objectives:</p> <ul style="list-style-type: none"> <li>• Ensure (and reduce threats to) the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distribution across the species' native range, so that the species can eventually be delisted</li> </ul>	<p>Develop a monitoring plan that addresses:</p> <ul style="list-style-type: none"> <li>• Current habitat conditions; abundance, distribution, life-stage survival, and age-composition of ESA-listed fish in the Upper Columbia Basin (status monitoring);</li> <li>• How these factors change over time (trend monitoring);</li> <li>• Effects that tributary habitat actions have on fish populations and habitat conditions (effectiveness monitoring)</li> </ul>	

## WENATCHEE WRIA WATER BASIN

Issues	Strategies	Monitoring Plan / Recommendations	Implementation Status/Actions
Water Quality			
Stream temperature exceeds state/fed water quality-on 303(d) list		<ul style="list-style-type: none"> <li>Continued monitoring</li> </ul>	<ul style="list-style-type: none"> <li>Lake Wenatchee Water Quality Monitoring program<sup>2</sup></li> <li>Monitoring station on Wenatchee River at Wenatchee<sup>3</sup></li> <li>Monitoring station on Wenatchee River at Leavenworth<sup>4</sup></li> </ul>
Dissolved oxygen (DO) exceed federal water quality standards (303(d))	<ul style="list-style-type: none"> <li>Consider/implement management practices</li> </ul>		
Fecal coliform exceeds state/fed standards - on 303(d) list	<ul style="list-style-type: none"> <li>Identify and mitigate sources</li> </ul>	<ul style="list-style-type: none"> <li>Continued monitoring</li> </ul>	
pH exceeds state or federal water quality standards - on 303(d) list	<ul style="list-style-type: none"> <li>Consider/implement management practices</li> </ul>		
DDT exceeds fed/state water quality standards- on 303(d) list	<ul style="list-style-type: none"> <li>Preventing bank erosion and limiting transport of soils to streams, particularly when developing old orchards</li> <li>Filtration by riparian areas and wetlands</li> <li>Phased monitoring approach</li> <li>Comprehensive groundwater monitoring</li> </ul>		
Water Quantity			
Low to non-existent instream flows (either seasonal or year-round)	<ul style="list-style-type: none"> <li>Implementation of the instream flow rule</li> <li>Management of reservation</li> <li>Continued monitoring</li> <li>Track water availability and meter new uses</li> </ul>		<ul style="list-style-type: none"> <li>Six active water quantity monitoring stations.<sup>5</sup></li> </ul>

<sup>2</sup> [http://www.co.chelan.wa.us/nr/water\\_resources/resources\\_management/waterquality.htm](http://www.co.chelan.wa.us/nr/water_resources/resources_management/waterquality.htm)

<sup>3</sup> <http://www.ecy.wa.gov/apps/watersheds/riv/station.asp?sta=45A070>

<sup>4</sup> <http://www.ecy.wa.gov/apps/watersheds/riv/station.asp?theyear=&tab=notes&scrolly=0&sta=45A110>

<sup>5</sup> <https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?wria=45>

Issues	Strategies	Monitoring Plan / Recommendations	Implementation Status/Actions
	<ul style="list-style-type: none"> <li>● Increase water availability for instream flows</li> <li>● Maintain instream flows</li> <li>● Exempt wells: assess the influence of groundwater withdrawals on surface water</li> </ul>		
Habitat			
<ul style="list-style-type: none"> <li>● Riparian and off-channel habitat have been significantly lost or degraded</li> <li>● Floodplain function has been impaired</li> <li>● Loss of stream sinuosity</li> <li>● Loss of channel sinuosity</li> <li>● Loss of floodplain function</li> </ul>	<p>Objectives:</p> <ul style="list-style-type: none"> <li>● Maintain and/or enhance the function of focal habitats by improving agricultural practices, fire management, weed control, livestock grazing practices, and road management</li> <li>● Provide biological and other conservation measures to sustain focal species populations</li> </ul> <p>Strategies:</p> <ul style="list-style-type: none"> <li>● Conduct studies to determine the necessary amount, quality, and connectivity of focal habitats</li> <li>● Restore watershed, riparian, wetland, habitat diversity (e.g. riparian plantings)</li> <li>● Emphasize conservation connectivity of high-quality riparian wetlands habitat</li> <li>● Achieve permanent protection of riparian wetlands through acquisition, conservation easement, cooperative agreements, etc</li> <li>● Increase riparian vegetation where needed (methods: control noxious weeds, use livestock fencing)</li> <li>● Protect existing stream banks, floodplain and riparian vegetation, upland and wetland habitat</li> <li>● Promote local planning and zoning to maintain or enhance riparian wetlands habitat</li> </ul>	<ul style="list-style-type: none"> <li>● Establish permanent census stations to monitor bird population and habitat changes.</li> <li>● Use rigorous sampling methods to establish links between habitat enhancement prescriptions, changes in habitat conditions, and target wildlife population responses</li> </ul>	<ul style="list-style-type: none"> <li>●</li> </ul>
<ul style="list-style-type: none"> <li>● Channelization- any activity that moves,</li> </ul>	<ul style="list-style-type: none"> <li>● Implement channel migration zone, channel connectivity,</li> </ul>		

Issues	Strategies	Monitoring Plan / Recommendations	Implementation Status/Actions
straightens, shortens, cuts off, diverts, or fills a stream channel, whether naturally or previously altered <ul style="list-style-type: none"> <li>Roads and railroads cut off habitat</li> </ul>	off-channel study projects		
<ul style="list-style-type: none"> <li>Barriers to Fish migration (culverts, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Provide improved fish passage</li> </ul>		<ul style="list-style-type: none"> <li>Fish passage: Dual-frequency Identification Sonar (DIDSONTM) camera at Leavenworth National Fish Hatchery<sup>6</sup></li> </ul>
<ul style="list-style-type: none"> <li>Increased sedimentation</li> <li>Sediment delivery</li> </ul>	<ul style="list-style-type: none"> <li>Reduce sediment inputs/sedimentation</li> </ul>		
Large woody debris and gravel recruitment	<ul style="list-style-type: none"> <li>Enhance woody debris</li> </ul>		

Note: See Wenatchee Tributary Issues/Strategies in Attachment

<sup>6</sup> [http://www.fws.gov/midcolumbiariverfro/pdf/Fish%20Passage%20Report%202013\\_Final.pdf](http://www.fws.gov/midcolumbiariverfro/pdf/Fish%20Passage%20Report%202013_Final.pdf)

**ATTACHMENT: STRATEGIES FOR TRIBUTARIES IN THE WENTACHEE WATERSHED**

Strategies	Lower Wenatchee	Mission (AG)	Peshastin (AG)	Chumstick	Icicle (AG)	Upper Wenatchee/Chiwaukum	Chiwawa	Nason	White, Little Wenatchee, Lake Wenatchee
<b>Water Quality</b>									
Stream temperature: continued monitoring	x	x	x	x	x				
Dissolved oxygen : consider/implement BMPs	x								
Fecal coliform: continued monitoring		x		x					
Fecal coliform: identify and mitigate sources				x					
pH: consider/implement BMPs	x								
DDT									
Phosphorous levels									
<b>Water Quantity</b>									
Implementation of the instream flow rule									
Management of reservation									
stream flow: continued monitoring	x		x		x				
Track water availability and meter new uses		x	x	x	x				
Increase water availability for instream flows		x	x	x	x				
Maintain instream flows						x			
<b>Habitat</b>									
Restore watershed, riparian, wetland, habitat diversity (e.g. riparian plantings)	x	x	x	x	Category 2 for salmon recovery		Category 1		
Increase riparian vegetation where needed (methods: control noxious weeds, use livestock fencing)	x	x	x	x	x				
Protect existing stream banks, floodplain and riparian vegetation, upland and wetland habitat	x	x	x	x	x	x			
Implement channel migration zone, channel connectivity, off-channel study projects	x								
Reduce sediment inputs/sedimentation				x	x				
Provide improved fish passage					x				
Enhance woody debris						x			
<b>Policy, Education</b>									
Educate the public/Public outreach on water limitations, water conservation, water quality issues	x			x					
Coordinate interaction with landowners and public		x							

## APPENDIX D.

### Comparison of Census of Agriculture Mapping and VSP White Paper Agriculture Mapping

In 2012 the Census of Agriculture reported 890 farms on 75,820 acres, with 776 of these farms on 31,537 acres consisting of harvested cropland such as orchards. The total number of acres reported in the Census at 75,820 is less than the combined agricultural and range land acres defined for this VSP White Paper at 103,800 acres. Also the acreage of harvested cropland at 31,537 in the Census is higher than the 27,616 acres determined for this VSP White Paper.

In 2007, the Census of Agriculture reported 979 farms on 93,883 acres, closer to the estimates of acreage in this White Paper.

These differences between the 2012 Census data and the mapping prepared for this White Paper may be due to different methods. For example:

- The Census is mailed to a mailing list of farmers and ranchers and may not be complete, nor all the forms returned.<sup>1</sup> In 2012, the Census tried to achieve a 75% response rate in each county through a variety of means.
- The Census reports acreage based on harvest. Depending on the type of activity acres could be over or under reported.
  - If two or more crops were harvested from the same land during the year (double cropping), the acres were counted for each crop. Therefore, the total acres of all crops harvested could exceed the acres of cropland harvested.
  - For interplanted crops or “skip-row” crops, acres were reported according to the portion of the field occupied, whether by a crop or whether it was idle land. If a crop was interplanted in an orchard or vineyard and harvested, then the entire orchard or vineyard acreage was reported under the appropriate fruit crop and the interplanted estimated crop acreage was reported under the appropriate crop.
  - If a crop was planted but not harvested, the acres were not reported as harvested.
  - Crops that were only grazed were reported as “Other pasture and grazing land that could have been used for crops without additional improvements.”
- While the maps developed for this VSP White Paper consider Washington State Department of Agriculture (WSDA), and United States Department of Agriculture (USDA) maps and data, boundaries are based on a review of 2013 aerial photos with some review of the few years prior to confirm presence or absence of agriculture.<sup>2</sup>

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<sup>1</sup> See Census of Agriculture Methodology. Available: [http://www.agcensus.usda.gov/Publications/2012/Full\\_Report/Volume\\_1\\_Chapter\\_1\\_US/usappxa.pdf](http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1_Chapter_1_US/usappxa.pdf).

<sup>2</sup> Source of Agricultural Mapping for VSP White Paper: 1) **Wenatchee Basin:** Cascadia Conservation District, 2013. 2) **Chelan, Entiat, and Squilchuck-Stemilt:** The agriculture data was created manually in ArcGIS using several sets of aerial base map images, Washington State Department of Agriculture (WSDA), and United States Department of Agriculture (USDA) datasets as references. The WSDA crop section layer was used to define the extent for visual identification of agricultural production (i.e. a

Regardless of the data differences, it is clear in the Map Folio, Appendix A, that a significant share of private, non-federal land is in agricultural or range land use, and it is an important industry in the county. An order of magnitude review of acreage changes over time through the Census of Agriculture, County current use taxation, and quality control review and monitoring of the maps created for this analysis is appropriate to determine if there is a fundamental change in acreage of agricultural and range land over time.

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guide for which sections contain agriculture); BERK then used aerial imagery to visually scan each section for agriculture. General crop categories (e.g., orchard/vineyard, pasture, fallow, etc.) were assigned based primarily on the aerial imagery, as well as in reference to parcel agriculture current use taxation status, and USDA and WSDA designations.

# APPENDIX E. CHELAN COUNTY VOLUNTARY STEWARDSHIP PROGRAM

## Critical Area Stressors and Potential Tools/Metrics

Based on available information, this document provides a broad summary of typical agricultural activities, how they may affect critical areas, and some conservation practices intended to better conserve or protect the critical area. This document is not an exhaustive review of activities and effects. Selected publications are footnoted for reference. For complete information, please consult federal and state agencies and organizations with expertise in the critical area or agricultural practice.

Similarly, a summary of the regulations that may apply to an agricultural activity (apart from County critical area regulations) is included to demonstrate the type of regulations that could reduce impacts of agricultural activities on critical areas. However, because regulations are amended often, and contain many details not described in the table, this information is only a rough guide as to what an agricultural operator may need to consider.

Regarding “Potential Economic Benefits” some organizations providing technical advice have provided assistance to agricultural operators to meet their economic needs – such as minimizing erosion along watercourses to retain land in productive use, reducing use of fertilizers and pesticides resulting in cost savings and improved product quality, conducting soil moisture monitoring and hard lining irrigation resulting in reduced water inputs and increased product quality. As the preparation of the Voluntary Stewardship Program continues, examples and ideas from agricultural operators and technical assistance organizations will be gathered and included in the table.

**Matrix: Stressors and Potential Tools/Metrics**

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Example Relevant Regulations <sup>17, 18, 19, 21</sup> (excluding critical area regulations)	Sample of Potential Objectives & Conservation Practices	Case Studies: Economic Benefits / Success Stories of Conservation Practices
1.	Building of roads, buildings, creation of impervious area	Fish and Wildlife Habitat Conservation Area (FWHCA): Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas Geologically Hazardous Areas	Streams, Fish: Increased total and effective impervious area, increased stormflow volume, peak flow intensity and frequency, and channel erosion. Increased fine sediment. <sup>7</sup> See altering hydrology regarding diversions and culverts. Critical Aquifer Recharge Areas: Likely reduction in local groundwater recharge and summer base flows (in non-glacial fed streams). <sup>7</sup> Avian: Flight obstruction. <sup>2</sup> Mammals: Loss of habitat connectivity. <sup>2</sup> Frequently Flooded Areas, Geologically Hazardous Areas: Erosion from vegetation removal and clearing; placement of structures in hazard areas (e.g. landslides, channel migration zones, floodways).	Chelan County building permits according to International Building Code. Chelan County Zoning Code for setbacks, lot coverage, etc. Chelan County Code Chapter 13.18 Construction and Post-Construction Stormwater Runoff Control Program. County, State, or Federal Access/Driveway Permit for proposed access approaches onto any road within the County, including private and County roads or to Forest Service Roads or State Highways.	Roads shall be located to serve the purpose intended, to facilitate the control and disposal of surface and subsurface water, to control or reduce erosion, to make the best use of topographic features, and to include scenic vistas where possible. The roads should generally follow natural contours and slopes to minimize disturbance of drainage patterns. Roads shall be located where they can be maintained and where water management problems are not created. To reduce potential pollution, roads shall be located away from water bodies and watercourses...(NRCS Conservation Practice Standard Access Road (Ft.) Code 560) Width of roadside clearing. Placement (e.g., bisecting quality habitat, ridges vs. stream bottoms, proximity of road to important habitat). Raise roads to reduce mortality and place close to safe passages. A growing literature suggests that roads by wetlands and ponds commonly have the highest roadkill rates; thus avoid road placement by wetlands and ponds. (WDFW) <sup>2</sup> Maintain or decommission roads and trails in riparian areas. (UCSRB) <sup>20</sup> Preserve free natural drainage when designing and constructing bridges, roads, fills. (FEMA) <sup>8</sup>	Still under development. Related concepts shown below:  Reduce roads to minimum necessary, and decommission or realign as appropriate. <sup>46</sup>  <ul style="list-style-type: none"> <li>● USFS Icicle Creek Minimum Roads Analysis and Road System Improvements</li> <li>● USFS Little Wenatchee River Minimum Roads Analysis and Road System Improvements</li> <li>● USFS Mission Creek Minimum Roads Analysis and Road System Improvements</li> <li>● USFS Upper Peshastin Creek Roads Inventory</li> </ul> Redesign unpaved agricultural roads to reduce runoff and erosion: Many unpaved farm lanes are channels for runoff of sediment and nutrients from adjacent fields into nearby streams. A USDA funded project incorporated Environmentally Sensitive Maintenance Practices (ESMPs) on 5 private farm lanes in the watershed to reconnect natural drainage patterns and reduce the pollution associated with these lanes in Kishacoquillis Watershed in Mifflin County, PA. The ESMPs that were utilized were selected for their suitability for each specific site and focused primary on the control of surface drainage through the reduction of concentrated run-off and the use of natural drainage patterns. The practices were also chosen for their economic feasibility, in order that they might be easily replicated on farm lanes at other beneficial sites. (PennState, for USDA) <sup>47</sup>

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2.	Installation of fences	FWHCA: Streams, Fish, Wildlife	Mammals: Physical movement barriers <sup>2</sup>	Chapter 16.60 RCW Fences. Chelan County Zoning Code limits the height of fences. See 11.88.170 Accessory uses and structures.	<p>Linear feet and placement, maximum height of fencing, thresholds for the amount of permeability or size of underpasses. (WDFW)<sup>2</sup></p> <p>Where mule deer and/or elk range the top wire will not be higher than 38 inches with the top two wires 10 inches apart and stretched tight to reduce the hazard of tangling deer and elk in the fence). Where Deer and Elk are present and can be expected to cross the fence give consideration to all smooth wire fencing to minimize hazards to wildlife and address maintenance issues. Another effective technique is to place 1 inch dia. PVC pipe sleeves over the top wire in a 3 or 4 wire fence at locations where game trails intersect the fence and in fence corners. (NRCS Conservation Practice 382)</p>	<p>Construction of the US 97A Wildlife Fence began Sept. 7 and was complete Oct. 27, 2010. The 2010 addition, funded by the legislature in March, 2010, constructed 1.55 mile of fence along US 97A between MP 206.40 and MP 207.95. A half-mile of fence around an orchard already existed and was extended on both ends. This stage added 5,800 feet of fencing, four cattle guards, wire gates and one-way push gates. This one-way gate allows access for people and lets wildlife caught below the fence to push through, back uphill to their usual habitat.(WSDOT)<sup>45</sup></p> <p>Landowners often use fencing to mark property boundaries, enclose orchards, pastures and rangelands, and divide fields; guidelines for wildlife-friendly fencing can help benefit animals and farmers. The "Landowner's Guide to Wildlife Friendly Fences" teaches landowners how to "build fences with wildlife in mind," providing low cost options with long-run savings. A Utah State University study found that on average, there is one animal tangled for every 2.5 miles of fencing, and the majority of these animals were caught on the top two wires. Additionally, 70% of fence-related deaths were on fences higher than 40 inches. The guide helps users to achieve cost savings and improved habitat conditions by: 1) considering placement of fences, especially near wetlands and riparian habitats 2) implementing gaps in fencing or lay-down sections, 3) placing fences on level ground, 4) building fences 40 inches high or lower, using a high visibility fence, and 5) using electrified fencing only seasonally. The guide then provides users with a variety of option examples. (Montana Fish, Wildlife and Parks)<sup>22</sup></p> <p>Dick Klick of Augusta, Montana found that replacing some of his old fence with more wildlife-friendly designs resulted in a fence that's easier to maintain since there are less maintenance issues triggered by animals, Additionally, it stands up to snow drifts and crossings easier. The animals are given a safer passage while the landowner gains time and costs. Klick has said of his new fencing, "I don't like to see a quarter-mile fence strewn across the place by wildlife. We must work with animals up here." (Montana Fish, Wildlife and Parks)<sup>22</sup></p>

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3.	Use of synthetic or organic fertilizer / pesticides	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	<p>Stream and Groundwater Water Quality Degradation: Excess nutrients in surface and groundwater; pesticides transported to surface and groundwaters: excess pathogens and chemicals from manure, biosolids or compost applications, excessive salts in surface and groundwater; petroleum, heavy metals and other pollutants transported to receiving water.<sup>1</sup></p> <p>Fish: Pesticides can be toxic to fish. Disruption of salmonids' ability to avoid prey when combinations of common pesticides, at levels commonly found in receiving waters, are present.<sup>6,7</sup></p> <p>Mammals: Effects from nutrient loading, contamination of habitat.<sup>2</sup></p> <p>Amphibians: Absorption by amphibians and reptiles of pollutants including pesticides, heavy metals, and sodium and chloride (from deicing salts). These cause contamination of breeding ponds, and of aquatic/ground surfaces utilized by reptiles and amphibians.<sup>2</sup></p>	<p>Proper disposal of pesticide hazardous wastes (Resource Conservation &amp; Recovery Act (RCRA))</p> <p>Irrigation ditches or other instances of pesticide application on, over, or near water bodies subject to NPDES - Water Related Pesticides Rule.</p> <p>Certification and training regulations require pesticide applicators meet certain training requirements before they apply pesticides labeled "for restricted use." The purpose is to assure proper application of the pesticide and to ensure that restricted entry provisions protecting applicators and farm worker's health are met. (Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA))</p> <p>Under the Federal Food Drug &amp; Cosmetics Act (FFDCA), EPA establishes Maximum Residue Levels (tolerances) (MRL). (Food Quality Protection Act)</p> <p>A farmer cannot inject any contaminant into an underground source of drinking water using a well if the contaminant may cause a violation of any primary drinking water regulation or may adversely affect the health of persons. Underground Injection Control. (Federal Safe Drinking Water Act)</p> <p>RCW 17.21Pesticide application act, Washington</p> <p>RCW 15.58 Pesticide control act, Washington</p> <p>Chapter WAC 16-228 General Pesticide Rules</p> <p>Chapter 16-202 WAC, Application of Pesticides and Plant Nutrients through Irrigation Systems</p> <p>Chapter 16-201 WAC Fertilizer Bulk Storage and Operational Area Containment Rules.</p> <p>WAC 16-231-800 What are restrictions for herbicide use in Douglas and Chelan counties?</p> <p>WAC 16-231-805 What are use restricted herbicides in Douglas and Chelan counties?</p> <p>EPA, No-spray areas for aerial and ground spraying of certain pesticides near salmon supporting waters (5 pesticides pending; 7 pesticides already covered).</p>	<p>Fertilizer Storage: In a dry area? The storage area for all inorganic fertilizers (e.g. powders, granules or liquids), is well ventilated and free from rainwater or heavy condensation. Storage cannot be directly on the soil. As long as the storage requirements on the material safety data sheet are complied with, bulk liquid fertilizers can be stored outside in containers. (Global Gap CB 5.4.4)</p> <p>Is the application of all fertilizers done according to the specific needs of the crop and soil condition? (Global Gap CB 5.1.1)</p> <p>Has assistance with implementation of IPM systems been obtained through training or advice? (Global Gap CB 7.1)</p> <p>Are pesticides stored, handled, disposed and managed to prevent runoff, spills, leaks and leaching? (NRCS Conservation Practice Standard 319)<sup>1</sup></p> <p>Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments. (NRCS, Nutrient Management (Ac.), Conservation Practice Standard 590)</p> <p>Distance from water bodies and critical foraging areas, percentage treated area, low impact development techniques; percentage forest cover. (WDFW)<sup>2</sup></p> <p>Establish an integrated pest management (IPM) program to modify pesticide use or improve timing, etc. (Washington State University, et al.; NRCS Conservation Practice Standard 595)<sup>9</sup></p> <p>Store pesticides in a structure with a concrete pad and curb to contain spills and leaks. Locate pesticide storage and mixing areas as far away from water conveyances as possible. (NRCS Conservation Practice Standard 319; University of California Cooperative Extension<sup>10</sup>)</p> <p>Consider application method, pesticide persistence, location (slope, soil type) and weather during and after application. (NRCS Conservation Practice Standard 595; University of California Cooperative Extension<sup>10</sup>)</p> <p>Pesticide Applicator's License (WSDA)<sup>49</sup></p>	<p>Jesus Limón of Limón and Sons Orchard in Wenatchee has successfully implemented integrated pest management (IPM) practices on his orchard. Over the course of three years, Limón was able to convert to completely organic practices. He credits his transition to education through local classes on IPM, citing that "knowledge is the best thing you can acquire." His success did not go unnoticed and spurred similar action at the farms nearby. Limón says that focusing on how the bug populations' function helped him look at the whole picture of how other critters, such as hawks, mice, and snakes, interact with the property as well. (American Farmland Trust, Friends of Farmland 2010)<sup>23</sup></p> <p>In a partnership between American Farmland Trust, Agflex Inc. and a Maryland based agriculture consultant, manure injection was found to provide both environmental and economic benefits. The process injects manure so that nutrients are closer to the plant roots. This provides more nutrients to the plant, while reducing risks of runoff. In the study where seven farmers utilized this process, economic benefits came from the ability to apply 7 less pounds of nitrogen per acre, as well as an increase in returns of an average \$6.00 per acre. (Friends of Farmland)<sup>24</sup></p> <p>A 2003 national study by the U.S. EPA summarizes nutrient management effects. Precision farming provides tools for tailoring production inputs to specific plots (or sections) within a field. By treating each plot as much or as little as needed, farmers can potentially reduce the costs of seed, water, and chemicals; increase overall crop yields; and reduce environmental impacts by better matching inputs to specific crop needs. (EPA)<sup>25</sup></p> <p>The Skagit Conservation District Newsletter highlighted a story about no-till practices. Eliminating or reducing tilling of soil allows the soil structure to remain intact and enables better water infiltration by keeping the soil pores open, thus reducing run-off. No-till practices also allowed Montana farmer Darryl Crowley to reduce his fuel usage by 50%. "We went from using between 15,000 and 20,000 gallons of fuel to half of that." (Skagit Conservation District)<sup>26</sup></p>

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4.	Storage or use of hazardous materials	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	Threat to surface and groundwater quality and aquatic species.	<p>Any farm facility with the total capacity to store more than 1,320 gallons of any oil in above ground storage or more than 42,000 gallons below ground. Prepare and a Spill Prevention Control and Countermeasures (SPCC) plan. (Clean Water Act/Safe Drinking Water Act)</p> <p>Farms storing more than 25 gallons of used oil in underground or above-ground tanks, Meet storage and transport technical requirements. (Resource Conservation &amp; Recovery Act (RCRA))</p> <p>Washington State operates a federally-approved Underground Storage Tank (UST) program. The state law, and not federal law, applies to these types of storage facilities.(Energy Policy Act/Underground Storage Tank Compliance Act)</p>	<p>The EPA’s Spill Prevention, Control, and Countermeasure regulations provide guidelines on practices for achieving compliance (US EPA, Clean Water Act/Safe Drinking Water Act): Secondary containment areas, installation of berms or dikes around bulk storage containers, use of sorbent materials and drip pans in oil transfer areas, periodic inspection and testing of pipes and containers.</p>	<p>Storage tank chemical discharge into soils and runoff can cause contamination issues as a result of corrosion, failed piping systems, spills, overfills, and human error. Resource, such as the EPA’s “Source Water Protection Practices Bulletin,” can guide landowners on how to manage their storage tanks to prevent spills, as well as provide guidelines on prevention measures such as secondary containment areas. According to the EPA, a one gallon oil spill can contaminate one million gallons of water and be damaging to aquatic habitats. Preventing this type of occurrence is beneficial to the environment as well as a landowner who stands the chance of high cost from cleanup and the impacts of soil contamination on their crops. (EPA)<sup>27</sup></p> <p>Being in compliance with the EPA’s Spill Prevention Control Countermeasures (SPCC) program means gathering information about a storage site and planning for spill prevention. Different organizations, such as Washington Association of Wheat Growers, help guide farmers through the process of coming in compliance with EPA’s SPCC. Through being aware of one’s inventory of hazardous materials, procedures for handling the materials, areas for improvement, and having a response plan, an SPCC makes landowners more aware of their potential impacts on their land and the environment. (wheatlife.org.)<sup>28</sup></p>

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5.	Altering hydrology due to ditches, canals, and other irrigation facilities; creation of artificial stormwater ponds	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas	<p>Fish: Passage limitations to water bodies historically important in-stream and off-channel habitats. Water diversions without proper passage routes disrupt migrations of listed fish species. Unscreened diversions trap or divert juvenile spring Chinook, steelhead, and bull trout resulting in reduced survival.<sup>20</sup></p> <p>Mammals and Amphibians: Physical movement barriers; change from natural water level variation, loss of habitats maintained by flooding; spread of non-native species <sup>2,3</sup></p> <p>Wetlands: Agriculture can reduce the amount of water available to wetlands by either diverting water that would otherwise reach pre-existing wetlands, or imposing more efficient irrigation practices that reduce the amount of leakage reaching irrigation-related wetlands. <sup>4,5</sup></p> <p>In some areas of the Columbia Basin Plateau where irrigation development projects exist, irrigation has altered flows, in most rivers and streams increasing flows in late spring and early summer. Irrigation projects have also increased the number of lakes for water storage, and increased groundwater returns; all of these alterations alter the width of riparian areas and the number and size of associated wetlands. In areas without irrigation system-altered hydrology, the lack of surface water flows can place increased reliance on groundwater pumping for agricultural irrigation. Alterations, including increased water availability where irrigation development projects exist, or reduced groundwater levels from ground water pumping, can result in changes in riparian vegetation, including an increase in the invasion of exotic species.<sup>14</sup></p>	<p>State water right permit or certificate.</p> <p>State hydraulic permit approval if action affects use, divert, obstruct, or change the natural flow or bed of state waters (does not include entirely artificial watercourses).</p>	<p>Maximum allowable depth and/or width of ditches, timing/depth of seasonal canal flooding, Linear feet and placement. (WDFW)<sup>2</sup></p> <p>On sites with soils of moderately rapid to very rapid permeability, or where erosive water velocities will occur, the canals and laterals shall be lined or piped according to the appropriate NRCS Practice Standard(s) for ditch and canal linings or pipelines. (NRCS Conservation Practice Standard Irrigation Canal or Lateral (Ft.) Code 320)</p> <p>Irrigation pipeline installed to convey water for storage or application, as part of an irrigation water system. The purpose of this practice is to efficiently deliver or convey water from a source of supply to points of application or storage to facilitate management of irrigation water. The practice reduces erosion, conserves water, and protects water quality. Underground pipelines serve as an integral part of the irrigation water distribution system and significantly improve the overall efficiency of the system. (NRCS Conservation Practice 430)</p> <p>Design and construct road culverts and screens consistent with the newest standards and guidelines. Remove, modify, or replace dams, culverts, and diversions that prevent or restrict access to salmon or trout habitat and/or cause loss of habitat connectivity. (UCSRB)<sup>20</sup></p> <p>Address fish passage and screening concerns, as much as possible, in other restoration and protection efforts. Effectively operate and maintain culverts and other instream structures. (UCSRB)<sup>20</sup></p>	<p>After ten years of development, a new type of fish screen came on the market in 2009 that helps save money, and is fish friendly. The screens are sold by nonprofit Farmers Conservation Alliance for use in irrigation structures. The screens, unlike others, are self-cleaning, have no moving parts, require no maintenance, and are safe for all stages of the fish life-cycle. Savings associated with low maintenance can pay for the Farmers Screen within three to five years. The screens have been successfully installed around the northwest. (Good Fruit Grower)<sup>29</sup></p> <p>Chelan County Natural Resources Department (CCNRD) worked with the Peshastin Irrigation District to convert 9,300 feet of a ditch from an open canal to a closed pipeline. The project objectives were to enhance fish passage in Peshastin Creek for Chinook salmon, steelhead and bull trout by reducing seepage in the irrigation canal and creating a water savings resulting in less diversion and increased instream flows. (Chelan County Natural Resources Department)<sup>30</sup></p> <p>Chelan County PUD owns and operates a surface water irrigation system which delivers water to seven (7) landowners through a pipeline and open channel system (circa 1909) located between Entiat River Miles (RM) 1.49 and 3.45. The system diverts 4.52 cfs in the mainstream Entiat River, while actual water need has been established at 2.24 cfs. Additionally, 8-9 cfs savings will be realized along the 0.15 mile long diversion structure. Objectives of this project are to decommission the PUD irrigation pipeline and delivery system, upgrade to modern and efficient delivery systems located closer to the point of use (creating water savings), improve lower Entiat River instream flow conditions, enhance off-channel habitat conditions, and prevent juvenile fish entrainment.(CCD)<sup>36</sup></p>

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6.	Irrigation	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	<p>Excessive irrigation can affect water quality by causing erosion, transporting nutrients, pesticides, and heavy metals, or decreasing the amount of water that flows naturally in streams and rivers. It can also cause a buildup of selenium, a toxic metal that can harm waterfowl reproduction.<sup>3</sup></p> <p>Irrigation can result in the creation and maintenance of wetlands in locations where they did not previously exist.<sup>4</sup></p> <p>Agricultural practices in irrigated areas can lead to accumulation of salts in the upper soil horizons. Irrigation may leach out the accumulated salts.<sup>4</sup></p>	State water right permit or certificate.	<p>Farmers can reduce NPS pollution from irrigation by improving water use efficiency. They can measure actual crop needs and apply only the amount of water required. Farmers may also choose to convert irrigation systems to higher efficiency equipment. (USEPA)<sup>3</sup></p> <p>See also NRCS Conservation Practices 590 and 595 regarding pesticide/nutrient transport and NRCS Conservation Practices 430, 441, 442, 449, 533 that are irrigation related. For example Practice 449 indicates “Limited irrigation water supplies shall be managed to meet critical crop growth stages.”</p> <p>Is there a water management plan to optimize water usage and reduce waste? There must be a written action plan, which aims to optimize water usage on the farm. This can be either an individual plan or a regional activity if the farm is participating in and/or covered by such. (Global Gap CB 6.2.2)</p>	<p>WSU Study Regarding Vineyards in Eastern Washington: “Deficit irrigation, when done properly, can improve grape quality...Deficit irrigation benefits include substantial savings in irrigation water, limiting unnecessary shoot growth, manipulating berry size, and modifying wine style in the vineyard. Having a more open canopy sets off a chain of positive events—better fruit exposure and air circulation in the fruit zone leads to reduced disease pressure and improved fruit -quality.” (Good Fruit Grower)<sup>31</sup></p> <p>Tim Dahle, cherry grower and board member of the Dalles Irrigation District in Oregon, worked to find funding for water meter upgrades. As the new technology became more affordable, his grant application efforts paid off. The district partnered with the U.S. NRCS and the Bonneville Power Administration to pay for equipment and attain technical expertise. In 2010, the districts old propeller flow meters (which were only read manually four times per year) were replaced with digital meters that are accurate, easy to read, can be read remotely, and have higher capacity. This technology works along with soil moisture sensors and a web-based irrigation scheduling system. As a result, real-time data enables growers stay under their water allotment, use enough water without risking a station shut down, and water more quickly under the new capacity. Overall, water and power are both conserved. (Good Fruit Grower)<sup>32</sup></p> <p>By working with the NRCS’s Environmental Quality Incentives Program on his Yakima farm, Manuel Imperial was able to save water and reduce topsoil runoff. On his 1000 acre row-crop farm Imperial had been using an open ditch, tube, and flood irrigation system. The system was wasteful and flushed a lot of topsoil away. With an Irrigation Water Management system, Imperial can now filter dirty water and apply only as needed. This saves him time and water, while keeping chemicals and water out of the Yakima River. The Incentives Program also helped Imperial set up nutrient and pest management systems, reducing his cost of chemicals. (NRCS)<sup>33</sup></p>
7.	Flood control facilities and floodplain fill	FWHCA: Streams, Fish, Wildlife Wetlands Frequently Flooded Areas Geologically Hazardous Areas	<p>Accelerated runoff, blocked runoff, interrupted groundwater flow, and increased pollution loadings; sedimentation; barriers to movement of animals to their preferred habitat and water bodies.<sup>2</sup></p> <p>Armoring banks with stone, concrete, or other resistant material in order to stem the movement of the channel and reduce erosion.<sup>13</sup></p>	Chelan County Code Chapter 3.20 Flood Hazard Development.	<p>Minimize floodplain fills and other actions that require fills. (FEMA Floodplain Management: Principles and Current Practices, 2008)</p> <p>Use minimum grading requirements and save as much of the site from compaction as possible. (FEMA)<sup>8</sup></p> <p>Support methods used for grading, filling, soil removal, and replacement, etc. to minimize erosion and sedimentation. (FEMA)<sup>8</sup></p> <p>Distances of uses; relocation of structures. (FEMA)<sup>8</sup></p>	Cascadia Conservation District (CCD) was awarded funding from the Department of Ecology’s Husseman Account for a riparian restoration project on Colockum Creek. This project works to help a local landowner recover (restore his property) from the 80,000-acre wildfire and large-scale flood events last fall by: re-building pasture fence, improving water quality, removing invasive weed species, restoring wildlife habitat, and reducing erosion.(CCD) <sup>34</sup>

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8.	Clearing of vegetation, including riparian and wetland conversion, or location of agriculture related structures in riparian and wetland critical areas	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas Geologically Hazardous Areas	<p>Fish: Reduced delivery of large woody debris. Reduced bank stability and loss of bank habitat structure and complexity. Reduced shading and temperature control.<sup>7</sup> Sedimentation from land and water management activities is a cause of habitat degradation in some salmon and trout streams.<sup>20</sup></p> <p>Mammals: Removal of habitat, habitat fragmentation, simplification of structure<sup>2</sup></p> <p>Amphibian: Loss/simplification of breeding habitat (direct loss, or changes such as native wetland vegetation to reed canary grass), including loss of suitable egg laying habitat (e.g., suitable emergent species, and suitable insolation for lentic breeders, and needs for terrestrial breeders). Loss/simplification of active season habitat. Loss of overwintering habitat. Loss of refugia (especially in extreme weather years). Habitat becomes a sinks/trap.<sup>2</sup></p> <p>Wetlands: Agriculture may affect wetlands directly through conversion of the wetland to fields or pasture. This is often done by direct filling or tilling, by draining through tiles or channels, or by removing the wetland vegetation and planting upland vegetation.<sup>4</sup></p> <p>Geologically Hazardous Areas: Erosion, sedimentation, slope stability.</p>	<p>Section 404 of the Clean Water Act establishes a permit program to regulate the discharge of dredged or fill material into the waters of the U.S., including wetlands.</p> <p>Endangered Species Act (ESA): Designed to protect endangered and threatened species from federally funded or directed activities (e.g., pesticide usage, wetlands destruction).</p> <p>Best Management Practices (BMPs) and controls required on any point sources on or near impaired water body. (Clean Water Act)</p>	<p>Retaining vegetation along waterways through agricultural areas improves water quality by increasing shade, filtering solutes and suspended particles and decreasing bank erosion and manure impacts. (WDFW)<sup>11</sup></p> <p>The Washington State Conservation Reserve Enhancement Program (CREP) provides incentives to property owners to restore and improve salmon and steelhead habitat on private land by planting native trees, shrubs, and grasses along streams that support salmon or steelhead. The program is jointly managed by the Farm Service Agency and the Washington State Conservation Commission. (WDFW)<sup>11</sup></p> <p>The NRCS Environmental Quality Incentives Program (EQIP) “provides financial and technical assistance to agricultural producers in order to address natural resource concerns and deliver environmental benefits such as improved water and air quality, conserved ground and surface water, reduced soil erosion and sedimentation or improved or created wildlife habitat.”<sup>15</sup></p> <p>Has consideration been given to the conversion of unproductive sites (e.g. low lying wet areas, woodlands, headland strip or areas of impoverished soil, etc.) to conservation areas for the encouragement of natural flora and fauna? (Global Gap AF 6.2.1)</p> <p>Improve riparian conditions by increasing filtration capacity through vegetation planting, CREP enrollment, selected livestock fencing, and similar practices, including intermittent streams that contribute to priority areas. (UCSRB)<sup>20</sup></p>	<p>CCNRD Chumstick/Eagle Riparian Restoration 2007. Riparian enhancement planting along Chumstick and Eagle Creek to address water quality issues. Native plants were installed on private properties with 16 different willing landowners.(CCNRD)<sup>35</sup></p> <p>The Wenatchee River Riparian Enhancement project is located on a private apple and pear orchard. The third generation owner of the property intends to continue agriculture uses over the long term. The project consisted of installing native plants, an irrigation system and herbivory protection (exclusion fencing) along 5 separate planting areas where the existing riparian vegetation was minimal or non-existing. The project replaced and fixed portions of the wildlife exclusion fence by adding in additional fence posts and fence fabric as needed. The purpose of the fence is to minimize the impacts of beaver activity to the riparian planting project and the landowners adjacent orchard. (CCNRD)<sup>43</sup></p> <p>Environmental and economic benefits made the Walla Walla Dry Creek restoration project successful. Jeff Shulke estimates that the cost of farming an acre on the edge of Dry Creek was about five times as much as one acre elsewhere on his 3,000 acre farm because of maintenance and overlaps of sprays and fertilizers. Working voluntarily with NRCS and Walla Walla County Conservation District enabled Shulke to transition streamside buffer areas from managed land back to a self-regulating state. Dry Creek is now cleaner, home to wildlife habitat, and has natural erosion control measures in place. CREP pays a soil rental rate for cropland that is taken out of production and helps fund the establishment and maintenance of the restored area. (NRCS)<sup>37</sup></p> <p>Good riparian buffer management can provide the following economic benefits: reduced costs post-storm events; protection from regulatory fines; healthier crops and livestock; and lower fertilizer, seed, machinery, and labor costs. The environmental benefits are notable and National Sustainable Agriculture Information Service cites NRCS’s Conservation Reserve Program and Wildlife Habitat Incentives Program as good resources for landowners. (National Sustainable Agriculture Information Service )<sup>38</sup></p> <p>A program certifying vineyards in the Willamette Valley that were following practices to protect and restore salmon watersheds has grown to include more than half the wine grape acreage of Walla Walla Valley in and several vineyards in eastern Washington. The Pacific Northwest certification program Salmon Safe, Inc., has found success with its market-based approach to encourage watershed protection. (Good Fruit Growers)<sup>41</sup></p>

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Example Relevant Regulations <sup>17, 18, 19, 21</sup> (excluding critical area regulations)	Sample of Potential Objectives & Conservation Practices	Case Studies: Economic Benefits / Success Stories of Conservation Practices
9.	Shade trees replacing shrub-steppe	FWHCA: Streams, Fish, Wildlife	Amphibians: Change in micro-climate and structural characteristics of habitat. <sup>2</sup>		Avoid conversion. Percentage natural vegetation. (WDFW) <sup>2</sup>	Restoration of native sagebrush steppe habitat in central Washington has been found to have potential for attracting beneficial insects, while serving as a home to around 30 butterfly species. The steppe's natural landscape is made up of low shrubs with perennial grasses. Through avoiding conversion or restoring the native habitat, farmers can create the potential for beneficial insects while reducing maintenance needs through the use of native vegetation. (Good Fruit Grower) <sup>39</sup>
10.	Planting of agricultural lands (in areas not previously under agricultural production) or replanting	FWHCA: Streams, Fish, Wildlife Wetlands Geologically Hazardous Areas	<p>Avian: Removal of habitat, simplification of structure.<sup>2</sup></p> <p>Mammals: Habitat fragmentation, removal of habitat, simplification of structure, increased non-native and invasive plant species, loss of forage.<sup>2</sup></p> <p>Amphibians: Decreased landscape complementation; e.g., breeding habitat may still exist, however, overwintering habitat, or essential summer habitat features in proximity with breeding habitat may no longer be available.<sup>2</sup></p> <p>Wetlands: Wetlands in tilled areas may experience greater water level fluctuations. Disruption of the soil through tilling and grazing can create a source of sediment than can be transported further downgradient. Sediments may also be carried by winds from tilled fields.<sup>4</sup></p> <p>Geologically Hazardous Areas: Soil erosion, potential alteration of steep slopes depending on location/type of production.</p>	Chelan County Zoning Code and Shoreline Master Program regarding use allowances.	<p>Established lanes or travel ways that facilitate animal movement. (NRCS Conservation Practice Standard Animal Trails and Walkways (Ft.) Code 575)</p> <p>Producers participating in Farm Service Agency (FSA) and the Natural Resources Conservation Service programs with property identified as highly erodible land are required to maintain a conservation system of practices that keeps erosion rates at a substantial reduction of soil loss. (NRCS)<sup>16</sup></p> <p>NRCS Conservation Practice 327 promotes cover between rows: "In perennial crop systems such as orchards, vineyards, berries and nursery stock, establish vegetation to provide full ground coverage in the alleyway during mowing and harvest operations."</p>	<p>Still under development. Related concepts shown below:</p> <p>Cover Crops:</p> <p>One of the biggest benefits of cover crops is reducing soil erosion from wind and water. Wind and water erosion can strip the upper soil layers, removing up to 2.5 inches of soil in a growing season, according to Olmstead. Cover crops also help protect the soil surface from high traffic during the season and can increase traction for equipment, an important consideration in the Northwest where harvest extends into the fall when rainfall typically takes place. (Good Fruit Grower)<sup>40</sup></p> <p>Planting an erosive slope:</p> <p>Foster Creek Slope Stabilization: In Spring 2006 the Douglas County Watershed Planning Association identified the need for erosion control and sediment reduction at a site approximately one mile south of Bridgeport near SR 17 and mainstem Foster Creek. The site consisted of an eroded slope potentially delivering sediment into Foster Creek and on to the Columbia River during high flows. The initial point of the erosion was a leak in an old wooden irrigation pipeline. The leak undermined the slope and over time the erosion climbed further up the slope. In October 2007, the Foster Creek Conservation District, high school volunteers, and local landowners worked to stabilize the slope using erosion control matt and fiber logs. The erosion control matt provided immediate and uniform slope protection from rain and surface water runoff. Fiber logs were installed along the contours of the slope to serve as a terrace to break the slope into segments. The fiber logs will decrease the speed of runoff, hold the matt down, and collect further sediment. The materials are designed to decompose over time. The slope was seeded with native grass seed including Sandberg bluegrass, bluebunch wheatgrass, thickspike wheatgrass, and Idaho fescue collected from North Central Washington. The project was installed on private property owned by cooperating landowner. (Foster Creek Conservation District)<sup>48</sup></p>

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Example Relevant Regulations <sup>17, 18, 19, 21</sup> (excluding critical area regulations)	Sample of Potential Objectives & Conservation Practices	Case Studies: Economic Benefits / Success Stories of Conservation Practices
11.	Allowing livestock in riparian areas	FWHCA: Streams, Fish, Wildlife Wetlands	Streams, Fish: Sedimentation, bank stability, loss of shade; introduction of organics (waste). Mammals: Trampling and grazing, causing loss of cover and forage, destruction of bank structure, compaction of soil, trampling of burrows. <sup>2</sup> Amphibians: Direct impact to pond breeding amphibians or their incubating embryos may occur near the shoreline if areas are trampled or grazed. Eastern WA may have the most difficult regeneration issues after disturbance (Note, in some cases effects of grazing in wetlands can be positive for amphibians). <sup>2</sup> Wetlands: Livestock grazing in streams and riparian wetlands also has documented effects on the physical structure of wetlands. <sup>4</sup>	State hydraulic project approval for cattle crossings of streams on agricultural lands. Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC Chelan County Code regarding livestock at 11.88.030 Livestock.	Limit animal access to waterways, fence off and concentrate agricultural activities away from streams, wetlands, and riparian areas, and prevent water runoff of farm or animal waste to streams. (WDFW) <sup>11</sup> Maintain or improve fencing or fish friendly stream crossing structures to prevent livestock access to riparian zones and streams. (UCSRB) <sup>20</sup> Provide alternative sites for stock watering. (UCSRB) <sup>20</sup> Livestock producers who restrict or eliminate access to streams and/ or farm ponds and convert to a cleaner, alternative water source can expect increased productivity, and improvements in riparian vegetation and in-stream water quality. (Zeckoski and Lunsford 2012) <sup>12</sup> Also see NRCS Conservation Practices: 528 Prescribed Grazing, 382 Fencing, 314 Watering Facilities, 560 Access Road and others. For example, Practice 528 indicates prescribed grazing "... may be applied on all lands where grazing and/or browsing animals are managed. Removal of herbage by the grazing animals is in accordance with production limitations, plant sensitivities and management goals. Frequency of defoliations and season of grazing is based on the rate of growth and physiological condition of the plants. Duration and intensity of grazing is based on desired plant health and expected productivity of the forage species to meet management objectives. In all cases enough vegetation is left to prevent accelerated soil erosion."	The primary objective of the Tillicum Creek Fence project is to restore degraded riparian and stream channel areas while continuing to provide grazing opportunities to authorized grazing permit holders. The Tillicum Creek Fence project excludes livestock from those portions of Tillicum and Indian Creeks that are immediately adjacent to temporary livestock handling locations. The fencing protects approximately 0.7 miles of streambank and riparian vegetation along steelhead spawning areas, as well as protects newly restored 750 linear feet along Tillicum Creek and 250 linear feet along Indian Creek to the confluence of Tillicum Creek. Plantings that occurred along these creeks in fall 2010 restored nearly 0.8 acres of native trees, shrubs and grasses. (CCD) <sup>42</sup> In an effort to protect the riparian areas as well as fish habitat, ranchers can work with Washington Department of Fish and Wildlife to restore their shoreline habitats, reduce their environmental footprint, while improving their own cattle operations. Using NRCS CREP funding, Tom Hendrickson's Asotin Creek ranch in the Snake River basin implemented over four acres of conservation cover, 37 acres of plantings, 100 acres of riparian forest buffer, two livestock crossings, five miles of fencing, and nine watering systems. Hendrickson found the project to be a "win-win," citing that the fencing and buffers protect the creek, while also helping the ranch manage their cattle. Environmentally, cattle are excluded from sensitive erosion areas, and sediment loading is minimized, kept away from spawning beds. The project was financially feasible through the use of partnership opportunities, and the overall health of the Hindrickson's ranch has increased notably. (NRCS) <sup>44</sup>

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# APPENDIX F. INTERSECTION OF AGRICULTURAL LANDS AND CRITICAL AREAS

## DRAFT Baseline Analyses – June 30, 2014

See Appendix B for Sources and Limitations.

Questions: What information is of interest? How should we consider adjacency versus intersection?

### Agricultural Lands in 100 ft Hydrologic Study Area by WRIA

	Total Acreage	Agricultural Lands Intersecting Hydrologic Study Area (100 Ft)	% in Study Area
Chelan	10,102	294	3%
Entiat	1,228	123	10%
Wenatchee	10,289	572	6%
Squilchuck/Stemilt	5,997	61	1%
<b>Total</b>	<b>27,616</b>	<b>1,050</b>	<b>4%</b>

### Agricultural Lands in CAO Hydrologic Study Area by WRIA

	Total Acreage	Agricultural Lands Intersecting Hydrologic Study Area (CAO)	% in Study Area
Chelan	10,102	502	5%
Entiat	1,228	197	16%
Wenatchee	10,289	964	9%
Squilchuck/Stemilt	5,997	135	2%
<b>Total</b>	<b>27,616</b>	<b>1,799</b>	<b>7%</b>

### Rangelands in 100 ft Hydrologic Study Area by WRIA

	Total Acreage	Rangelands Intersecting Hydrologic Study Area (100 Ft)	% in Study Area
Chelan	21,317	336	2%
Entiat	17,183	593	3%
Wenatchee	22,664	1,527	7%
Squilchuck/Stemilt	15,021	235	2%
<b>Total</b>	<b>76,184</b>	<b>2,691</b>	<b>4%</b>

### Rangelands in CAO Hydrologic Study Area by WRIA

	Total Acreage	Rangelands Intersecting Hydrologic Study Area (CAO)	% in Study Area
Chelan	21,317	542	3%
Entiat	17,183	861	5%
Wenatchee	22,664	1,766	8%
Squilchuck/Stemilt	15,021	388	3%
<b>Total</b>	<b>76,184</b>	<b>3,556</b>	<b>5%</b>

**Agricultural Lands in 100 ft, 50 ft, and 25 ft Hydrologic Study Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Hydrologic Study Area (100 Ft)	% in Study Area (100 Ft)	Agricultural Lands Intersecting Hydrologic Study Area (50 Ft)	% in Study Area (50 Ft)	Agricultural Lands Intersecting Hydrologic Study Area (25 Ft)	% in Study Area (25 Ft)
Chelan	10,102	294	3%	131	1%	62	0.6%
Entiat	1,228	123	10%	58	5%	33	3%
Wenatchee	10,289	572	6%	268	3%	150	1%
Squilchuck/Stemilt	5,997	61	1%	24	0.4%	13	0.2%
<b>Total</b>	<b>27,616</b>	<b>1,050</b>	<b>4%</b>	<b>481</b>	<b>1.7%</b>	<b>259</b>	<b>0.9%</b>

**Rangelands in 100 ft, 50 ft, and 25 ft Hydrologic Study Areas by WRIA**

	Total Acreage	Rangelands Intersecting Hydrologic Study Area (100 Ft)	% in Study Area (100 Ft)	Rangelands Intersecting Hydrologic Study Area (50 Ft)	% in Study Area (50 Ft)	Rangelands Intersecting Hydrologic Study Area (25 Ft)	% in Study Area (25 Ft)
Chelan	21,317	336	2%	174	1%	96	0.5%
Entiat	17,183	593	3%	367	2%	248	1%
Wenatchee	22,664	1,527	7%	1,346	6%	1,256	6%
Squilchuck/Stemilt	15,021	235	2%	131	0.9%	81	0.5%
<b>Total</b>	<b>76,184</b>	<b>2,691</b>	<b>4%</b>	<b>2,018</b>	<b>3%</b>	<b>1,682</b>	<b>2%</b>

**Agricultural Lands in Floodplain Study Area by WRIA**

	Total Acreage	Agricultural Lands Intersecting 100-year Floodplain	% in Floodplain
Chelan	10,102	179	2%
Entiat	1,228	97	8%
Wenatchee	10,289	282	3%
Squilchuck/Stemilt	5,997	6	0.1%
<b>Total</b>	<b>27,616</b>	<b>564</b>	<b>2%</b>

**Rangelands in Floodplain Study Area by WRIA**

	Total Acreage	Rangelands Intersecting 100-year Floodplain	% in Floodplain
Chelan	21,317	6	0.0%
Entiat	17,183	24	0.1%
Wenatchee	22,664	1,221	5%
Squilchuck/Stemilt	15,021	8	0.1%
<b>Total</b>	<b>76,184</b>	<b>1,259</b>	<b>2%</b>

**Agricultural Lands in Wellhead Protection Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Wellhead Protection Areas	% in Wellhead Protection Zone
Chelan	10,102	849	8%
Entiat	1,228	132	11%
Wenatchee	10,289	2,305	22%
Squilchuck/Stemilt	5,997	618	10%
<b>Total</b>	<b>27,616</b>	<b>3,904</b>	<b>14%</b>

**Rangelands in Wellhead Protection Areas by WRIA**

	Total Acreage	Rangelands Intersecting Wellhead Protection Areas	% in Wellhead Protection Zone
Chelan	21,317	91	0.4%
Entiat	17,183	949	6%
Wenatchee	22,664	900	4%
Squilchuck/Stemilt	15,021	49	0.3%
<b>Total</b>	<b>76,184</b>	<b>1,990</b>	<b>3%</b>

**Agricultural Lands in Possible CARA Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Possible CARA Areas	% in Possible CARA Areas
Chelan	10,102	1,537	15%
Entiat	1,228	996	81%
Wenatchee	10,289	4,440	43%
Squilchuck/Stemilt	5,997	287	5%
<b>Total</b>	<b>27,616</b>	<b>7,261</b>	<b>26%</b>

**Rangelands in Possible CARA Areas by WRIA**

	Total Acreage	Rangelands Intersecting Possible CARA Areas	% in Possible CARA Areas
Chelan	21,317	799	4%
Entiat	17,183	1,035	6%
Wenatchee	22,664	1,974	9%
Squilchuck/Stemilt	15,021	39	0.3%
<b>Total</b>	<b>76,184</b>	<b>3,847</b>	<b>5%</b>

**Agricultural Lands in PHS Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting PHS Areas	% in PHS Areas
Chelan	10,102	3,628	36%
Entiat	1,228	1,117	91%
Wenatchee	10,289	5,282	51%
Squilchuck/Stemilt	5,997	1,200	20%
<b>Total</b>	<b>27,616</b>	<b>11,226</b>	<b>41%</b>

**Rangelands in PHS Areas by WRIA**

	Total Acreage	Rangelands Intersecting PHS Areas	% in PHS Areas
Chelan	21,317	20,215	95%
Entiat	17,183	16,838	98%
Wenatchee	22,664	20,967	93%
Squilchuck/Stemilt	15,021	10,948	73%
<b>Total</b>	<b>76,184</b>	<b>68,968</b>	<b>91%</b>

**Agricultural Lands in Mule Deer Habitat Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Mule Deer Habitat	% in Mule Deer Habitat
Squilchuck/Stemilt	5,997	88	1%
<b>Total</b>	<b>5,997</b>	<b>88</b>	<b>1%</b>

**Rangelands in Mule Deer Habitat Areas by WRIA**

	Total Acreage	Rangelands Intersecting Mule Deer Habitat	% in Mule Deer Habitat
Squilchuck/Stemilt	15,021	106	1%
<b>Total</b>	<b>15,021</b>	<b>106</b>	<b>1%</b>

**Agricultural Lands in Elk Habitat Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Elk Habitat	% in Elk Habitat
Squilchuck/Stemilt	5,997	450	8%
<b>Total</b>	<b>5,997</b>	<b>450</b>	<b>8%</b>

**Rangelands in Elk Habitat Areas by WRIA**

	Total Acreage	Rangelands Intersecting Elk Habitat	% in Elk Habitat
Squilchuck/Stemilt	15,021	723	5%
<b>Total</b>	<b>15,021</b>	<b>723</b>	<b>5%</b>

**Agricultural Lands in Mapped CAO Landslide Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Mapped Landslide Areas	% in Mapped Landslides
Squilchuck/Stemilt	5,997	3,678	61%
<b>Total</b>	<b>5,997</b>	<b>3,678</b>	<b>61%</b>

**Rangelands in Mapped CAO Landslide Areas by WRIA**

	Total Acreage	Rangelands Intersecting Mapped Landslide Areas	% in Mapped Landslides
Squilchuck/Stemilt	15,021	2,575	17%
<b>Total</b>	<b>15,021</b>	<b>2,575</b>	<b>17%</b>

**Agricultural Lands in Potential Landslide Hazard Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Potential Landslide Hazard Areas	% in Potential Landslide Area
Chelan	10,102	0	0%
Entiat	1,228	-	0%
Wenatchee	10,289	374	4%
Squilchuck/Stemilt	5,997	2,567	43%
<b>Total</b>	<b>27,616</b>	<b>2,941</b>	<b>11%</b>

**Rangelands in Potential Landslide Hazard Areas by WRIA**

	Total Acreage	Rangelands Intersecting Potential Landslide Hazard Areas	% in Potential Landslide Area
Chelan	21,317	196	1%
Entiat	17,183	174	1%
Wenatchee	22,664	3,217	14%
Squilchuck/Stemilt	15,021	3,992	27%
<b>Total</b>	<b>76,184</b>	<b>7,580</b>	<b>10%</b>

**Agricultural Lands in Erodible Soil Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Erodible Soils	% in Erodible Soils
Chelan	10,102	754	7%
Entiat	1,228	44	4%
Wenatchee	10,289	612	6%
Squilchuck/Stemilt	5,997	715	12%
<b>Total</b>	<b>27,616</b>	<b>2,125</b>	<b>8%</b>

**Rangelands in Erodible Soil Areas by WRIA**

	Total Acreage	Rangelands Intersecting Erodible Soils	% in Erodible Soils
Chelan	21,317	14,352	67%
Entiat	17,183	14,309	83%
Wenatchee	22,664	18,196	80%
Squilchuck/Stemilt	15,021	6,300	42%
<b>Total</b>	<b>76,184</b>	<b>53,157</b>	<b>70%</b>

**Agricultural Lands in CAO Steep Slope Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Steep Slope Areas	% in Steep Slopes
Chelan	10,102	6,873	68%
Entiat	1,228	807	66%
Wenatchee	10,289	6,214	60%
Squilchuck/Stemilt	5,997	4,667	78%
<b>Total</b>	<b>27,616</b>	<b>18,561</b>	<b>67%</b>

\* includes 250 ft buffer on slopes >15% and >40%

**Rangelands in CAO Steep Slope Areas by WRIA**

	Total Acreage	Rangelands Intersecting Steep Slope Areas	% in Steep Slopes
Chelan	21,317	21,194	99%
Entiat	17,183	17,064	99%
Wenatchee	22,664	21,296	94%
Squilchuck/Stemilt	15,021	14,405	96%
<b>Total</b>	<b>76,184</b>	<b>73,959</b>	<b>97%</b>

\* includes 250 ft buffer on slopes >15% and >40%

**Agricultural Lands in Channel Migration Zone Areas by WRIA**

	Total Acreage	Agricultural Lands Intersecting Channel Migration Zone	% in Channel Migration Zone
Chelan	10,102	0	0%
Entiat	1,228	132	11%
Wenatchee	10,289	425	4%
Squilchuck/Stemilt	5,997	-	0%
<b>Total</b>	<b>27,616</b>	<b>557</b>	<b>2.0%</b>

**Rangelands in Channel Migration Zone Areas by WRIA**

	Total Acreage	Rangelands Intersecting Channel Migration Zone	% in Channel Migration Zone
Chelan	21,317	7	0.0%
Entiat	17,183	93	0.5%
Wenatchee	22,664	1,278	6%
Squilchuck/Stemilt	15,021	-	0%
<b>Total</b>	<b>76,184</b>	<b>1,378</b>	<b>2%</b>

**Agricultural Lands in 100 Ft Hydrologic Study Area, Floodplain, and/or CMZ by WRIA**

	Total Acreage	Agricultural Lands Intersecting Hydro Macro 100 Ft	% in Critical Areas
Chelan	10,102	424	4%
Entiat	1,228	245	20%
Wenatchee	10,289	1,065	10%
Squilchuck/Stemilt	5,997	63	1%
<b>Total</b>	<b>27,616</b>	<b>1,797</b>	<b>7%</b>

**Rangelands in 100 Ft Hydrologic Study Area, Floodplain, and/or CMZ by WRIA**

	Total Acreage	Rangelands Intersecting Hydro Macro 100 Ft	% in Critical Areas
Chelan	21,317	341	2%
Entiat	17,183	600	3%
Wenatchee	22,664	1,600	7%
Squilchuck/Stemilt	15,021	235	2%
<b>Total</b>	<b>76,184</b>	<b>2,776</b>	<b>4%</b>

**Agricultural Lands in CAO Hydrologic Study Area, Floodplain, and/or CMZ by WRIA**

	Total Acreage	Agricultural Lands Intersecting Hydro Macro 100 Ft	% in Critical Areas
Chelan	10,102	611	6%
Entiat	1,228	302	25%
Wenatchee	10,289	1,385	13%
Squilchuck/Stemilt	5,997	136	2%
<b>Total</b>	<b>27,616</b>	<b>2,434</b>	<b>9%</b>

**Rangelands in CAO Hydrologic Study Area, Floodplain, and/or CMZ by WRIA**

	Total Acreage	Rangelands Intersecting Hydro Macro 100 Ft	% in Critical Areas
Chelan	21,317	547	3%
Entiat	17,183	864	5%
Wenatchee	22,664	1,808	8%
Squilchuck/Stemilt	15,021	388	3%
<b>Total</b>	<b>76,184</b>	<b>3,606</b>	<b>5%</b>

CHELAN COUNTY VOLUNTARY STEWARDSHIP PROGRAM  
APPENDIX F: COMPENDIUM OF AGRICULTURE AND CRITICAL AREA INTERSECTION TABLES

<b>Zoning Designations - Agricultural Lands by WRIA (Acres)</b>					
<b>Zoning Designations</b>	<b>Chelan</b>	<b>Entiat</b>	<b>Squilchuck/ Stemilt</b>	<b>Wenatchee</b>	<b>Total</b>
Commercial Agricultural Lands	5,675	664	3,224	4,677	14,240
Rural Residential/Resource 5	1,180	272	778	2,381	4,611
City Urban Growth Area	926	185	68	1,044	2,223
Rural Residential/Resource 10	631	3	823	523	1,980
Rural Residential/Resource 2.5	714	68	145	843	1,771
Rural Residential/Resource 20	557	35	571	374	1,537
Rural Industrial	10		216	11	237
Rural Village	4	0	98	107	209
Rural Recreational and Resource	17		39	68	124
Commercial Forest Lands	7		32	23	62
Rural Waterfront	17			28	45
Rural Public Lands and Facilities	29			2	31
Commercial Mining Lands	27	0			28
Rural Commercial			3	7	10
Open Water Features	1			0	1
<b>Grand Total</b>	<b>9,795</b>	<b>1,228</b>	<b>5,996</b>	<b>10,089</b>	<b>27,108</b>

<b>Zoning Designations - Agricultural Lands by WRIA (Percent)</b>					
<b>Zoning Designations</b>	<b>Chelan</b>	<b>Entiat</b>	<b>Squilchuck/ Stemilt</b>	<b>Wenatchee</b>	<b>Total</b>
Commercial Agricultural Lands	58%	54%	54%	46%	53%
Rural Residential/Resource 5	12%	22%	13%	24%	17%
City Urban Growth Area	9%	15%	1%	10%	8%
Rural Residential/Resource 10	6%	0%	14%	5%	7%
Rural Residential/Resource 2.5	7%	6%	2%	8%	7%
Rural Residential/Resource 20	6%	3%	10%	4%	6%
Rural Industrial	0%	0%	4%	0%	1%
Rural Village	0%	0%	2%	1%	1%
Rural Recreational and Resource	0%	0%	1%	1%	0%
Commercial Forest Lands	0%	0%	1%	0%	0%
Rural Waterfront	0%	0%	0%	0%	0%
Rural Public Lands and Facilities	0%	0%	0%	0%	0%
Commercial Mining Lands	0%	0%	0%	0%	0%
Rural Commercial	0%	0%	0%	0%	0%
Open Water Features	0%	0%	0%	0%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

CHELAN COUNTY VOLUNTARY STEWARDSHIP PROGRAM  
APPENDIX F: COMPENDIUM OF AGRICULTURE AND CRITICAL AREA INTERSECTION TABLES

<b>Zoning Designations - Rangelands by WRIA (Acres)</b>					
<b>Zoning Designations</b>	<b>Chelan</b>	<b>Entiat</b>	<b>Wenatchee</b>	<b>Squilchuck/ Stemilt</b>	<b>Total</b>
Rural Residential/Resource 20	20,864	16,604	19,125	8,366	64,960
Commercial Forest Lands	1	311	1,821	6,147	8,280
Rural Residential/Resource 10	289	165	790	369	1,614
Rural Residential/Resource 5	14	75	745	14	848
Commercial Agricultural Lands	72	2	1	81	156
Rural Recreational and Resource			128		128
Rural Public Lands and Facilities	71		0		71
Rural Residential/Resource 2.5	0	14	25		39
Commercial Mining Lands			22		22
City Urban Growth Area	4	10	2		15
Rural Waterfront	0		1		1
Open Water Features	0		1		1
Rural Commercial		0			0
Rural Industrial	0				0
<b>Total</b>	<b>21,315</b>	<b>17,183</b>	<b>22,661</b>	<b>14,977</b>	<b>76,135</b>

<b>Zoning Designations - Rangelands by WRIA (Percent)</b>					
<b>Zoning Designations</b>	<b>Chelan</b>	<b>Entiat</b>	<b>Squilchuck/ Stemilt</b>	<b>Wenatchee</b>	<b>Total</b>
Rural Residential/Resource 20	98%	97%	84%	56%	85%
Commercial Forest Lands	0%	2%	8%	41%	11%
Rural Residential/Resource 10	1%	1%	3%	2%	2%
Rural Residential/Resource 5	0%	0%	3%	0%	1%
Commercial Agricultural Lands	0%	0%	0%	1%	0%
Rural Recreational and Resource	0%	0%	1%	0%	0%
Rural Public Lands and Facilities	0%	0%	0%	0%	0%
Rural Residential/Resource 2.5	0%	0%	0%	0%	0%
Commercial Mining Lands	0%	0%	0%	0%	0%
City Urban Growth Area	0%	0%	0%	0%	0%
Rural Waterfront	0%	0%	0%	0%	0%
Open Water Features	0%	0%	0%	0%	0%
Rural Commercial	0%	0%	0%	0%	0%
Rural Industrial	0%	0%	0%	0%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

**APPENDIX G. VSP WORK PLAN DEVELOPMENT – JOBS AND SIDEBOARDS**

COUNTY	VSP GROUP	COMMISSION AND TECHNICAL PANEL	STATE ADVISORY COMMITTEE
DO	DO	DO	DO
<p>Opt-in Designate Participating Watersheds</p> <p>Nominate Priority Watersheds</p> <p>Solicit Letters of Interest for VSP Group</p> <p>Accept \$ / Contract from CC Director</p> <p>Confer with Tribal Governments and Stakeholders</p> <p>Designate VSP Work Group(s)</p> <p>Designate Administration Entity</p> <p>Protect Critical Areas under Section 9 if Plan not approved within 3 years of funding</p>	<p>Develop 10-Year Plan to <b>protect critical areas while maintaining and enhancing the viability of agriculture</b></p> <p>Seek input from tribes, agencies, and stakeholders</p> <p>Determine planning area, where Agricultural activities overlap with designated Critical Areas</p> <p>Designate Tech Assist Provider &amp; Producer Participation TA Process</p> <p>Ensure Technical Assistance Provided to Operators</p> <p>Develop Individual Stewardship Plan Approach</p> <p>Set Protect &amp; Enhance Goals &amp; Benchmarks designed to result in protection of critical areas and voluntary enhancement of critical areas within 10-Years of funding</p>	<p>Technical Panel has 45 days after plan submission to make recommendation to Director on Approval</p> <p><i>Approve if-</i>at end of 10 Years, considering Work Plan and other plans and regs:  a) <i>Critical Areas</i> will be <i>Protected</i>; and  b) <i>Ag Viability</i> will be <i>Maintained</i> and <i>Enhanced</i></p> <p>If SAC recommends Approval Director Must Approve.</p> <p>Director determines whether Work Plan Goals &amp; Benchmarks are being met for:  a) Protection and  b) Enhancement</p>	<p>Determine Priority Watersheds.</p> <p>Resolve Approval Disagreements—If Plan not approved within 2 Yrs, 9 months of funding, Plan goes to Statewide Advisory Committee for Resolution</p> <p>Consult with Director on whether Goals &amp; Benchmarks are being met</p>

DO (cont'd)	DO (cont'd)	DO (cont'd)	DO (cont'd)
<p>Protect Critical Areas under Section 9 if Plan Goals and Benchmarks not met after adaptive management efforts</p>	<p>Incorporate Development Regs into Plan (existing as of Opt-in date)</p> <p>Review, rely upon and incorporate existing programs, plans and data related to water quality, watershed management, farmland protection and species recovery</p> <p>Establish CA Protection baseline and <i>baseline monitoring</i> plan</p> <p>Ensure ISP process contributes to meeting goals and benchmarks</p> <p>Submit Biennial Status Reports to County and Commission on VSP Plans and Accomplishments; and 5-Year Goals &amp; Benchmarks Report to County and Director</p> <p>Do Adaptive Mgmt if Protection Goals &amp; Benchmarks not being met</p> <p>Determine additional Voluntary Stewardship actions and funding needed if VSP enhancement goals and benchmarks not being met</p> <p>Account for potential withdrawals when establishing goals and benchmarks.</p>		

DON'T	DON'T	DON'T	DON'T
<p>Don't regulate critical areas on lands used for ag activities (unless narrow exceptions apply)</p> <p>Don't require ag operations to discontinue ag activities legally existing before July 11, 2011</p> <p>Don't prevent an operator from withdrawing from the program</p> <p>Don't require operator to continue voluntary measures after expiration of applicable contract</p> <p>VSP doesn't interfere with/supplant ability of operator to work with CD or participate in conservation programs;</p> <p>VSP doesn't prohibit voluntary sale or lease of land for conservation purposes;</p> <p>VSP doesn't limit authority of a state agency, local government or landowner to carry out obligations under any other federal, state or local law;</p> <p>VSP doesn't grant counties or state agencies additional authority to regulate critical areas on lands used for agricultural activities</p>	<p>Don't develop stewardship practices that may have unintended adverse consequences for other habitats, species and critical areas.</p> <p>Don't administer the program in a manner that prevents eligibility for environmental incentives</p> <p>Don't require operators to implement additional practices if watershed group determines that additional or different practices are needed to achieve goals and benchmarks:</p> <p>Operators implementing individual stewardship plans are presumed to be working toward protection and enhancement of critical areas</p> <p>Operators may volunteer to implement such additional or different practices, and are eligible for funding to revise practices upon volunteering;</p>		

## APPENDIX H. CHELAN COUNTY VSP PERFORMANCE MEASUREMENT FRAMEWORK (EXAMPLES)

**Issues, strategies, objectives, and indicators drawn from a synthesis of Chelan County watershed plans developed for each Watershed Resource Inventory Area.**

**Issue:** Loss of (and damage to) riparian habitat by agricultural land uses

Strategies	Output indicators	Participation indicators	Outcome indicators
Restore riparian habitat through streamside re-vegetation projects with willing landowners.	<ul style="list-style-type: none"> <li>■ Number of outreach events</li> <li>■ Number/percentage of landowners contacted</li> <li>■ Number of event attendees</li> <li>■ Tracking system in place for monitoring program participation</li> </ul>	<ul style="list-style-type: none"> <li>■ Number of land owners participating in the program</li> <li>■ Linear feet of streamline restored through program</li> </ul>	<p><i>Note these indicators may be most effective for evaluating the effectiveness of strategy implementation if using a before-after-control-impact (BACI) design with stratified random sampling as described in the Upper Columbia Monitoring Strategy (Hillman 2004).</i></p> <ul style="list-style-type: none"> <li>■ Annual fine sediment monitoring using existing reaches and transect sites.</li> </ul>
Fence riparian areas impacted by livestock damage with willing landowners.	<ul style="list-style-type: none"> <li>■ Number of outreach events</li> <li>■ Number/percentage of landowners contacted</li> <li>■ Number of event attendees</li> <li>■ Tracking system in place for monitoring program participation</li> </ul>	<ul style="list-style-type: none"> <li>■ Number of land owners participating in the program</li> <li>■ Linear feet of fencing installed</li> </ul>	<ul style="list-style-type: none"> <li>■ Abundance and distribution of native fish species of interest</li> <li>■ Macroinvertebrate community composition and population</li> </ul> <p><i>Challenge: With these results would it be possible to know what is the effect of agricultural practices versus many other activities in watersheds?</i></p>

### CHELAN COUNTY VSP RECOMMENDED STRATEGIES, ACTIONS, TIMELINES, AND MILESTONES (EXAMPLES)

**Issue:** Loss of (and damage to) riparian habitat by agricultural land uses

Strategy	Action	Milestones			Long-Term goal
		Year 1	Year 2	Year 3	
Fence riparian areas impacted by livestock damage with willing landowners.	<ul style="list-style-type: none"> <li>■ Assist landowners with conservation practices</li> </ul>	<ul style="list-style-type: none"> <li>■ Host info sessions on conservation practices and assistance options</li> <li>■ Tracking system in place for monitoring program participation</li> <li>■ 2-3 new farms in place</li> </ul>	10 VSP stewardship farms implemented with new fencing constructed	10 VSP stewardship farms implemented with new fencing constructed	All livestock fenced out of streams and alternative off-stream stock watering sites implemented, when/where feasible

## MEMORANDUM

Appendix I. Critical Area Stressors  
and Potential Sustainability &  
Safety Checklists

**DATE:** June 30, 2014

**TO:** Mike Kaputa, Director, Chelan County Natural Resource Department; Lee P Duncan, Natural Resource Specialist, Chelan County Natural Resources

**FROM:** Lisa Grueter, AICP, Manager and Jennifer Tippens, Analyst

**RE:** Sample of Producer Checklists addressing Sustainability and Food Safety

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This memo provides a summary of producer checklists created for agricultural activities to audit and certify quality operations and production practices in order to assure food safety, worker safety, and environmental sensitivity. Some of these checklists are widely used by growers in Chelan County and the conservation practices may be a source for the Voluntary Stewardship Work Plan and eventually individual Stewardship Plans which may take the form of a checklist or supplement to existing checklists. A matrix of topics and standards in the checklists in relation to potential critical area stressors is attached. A description of each type of checklist reviewed is provided below.

### GLOBAL G.A.P. [GOOD AGRICULTURAL PRACTICE]

Global G.A.P. is the most widely accepted private sector food safety certification in the world. They have more than 228 certified products and over 132,000 certified producers in more than 110 countries.

GLOBAL G.A.P.'s roots began in 1997 as EUREPGAP, an initiative by retailers belonging to the Euro-Retailer Produce Working Group. British retailers working together with supermarkets in continental Europe become aware of consumers' growing concerns regarding product safety, environmental impact and the health, safety and welfare of workers and animals.

Their solution: Harmonize their own standards and procedures and develop an independent certification system for Good Agricultural Practice (G.A.P.).

The EUREPGAP standards helped producers comply with Europe-wide accepted criteria for food safety, sustainable production methods, worker and animal welfare, and responsible use of water, compound feed and plant propagation materials. Harmonized certification also meant savings for producers, as they would no longer need to undergo several audits against different criteria every year.

Over the next ten years the process spread throughout the continent and beyond. Driven by the impacts of globalization, a growing number of producers and retailers around the globe joined in, gaining the European organization global significance.

To reflect both its global reach and its goal of becoming the leading international G.A.P. standard, EurepGAP changed its name to GLOBALG.A.P. in 2007. GLOBALG.A.P. today is the world's leading farm assurance program, translating consumer requirements into Good Agricultural Practice in a rapidly growing list of countries – currently more than 100.<sup>1</sup>

There is a checklist specific to Fruits and Vegetables with the latest checklist dated 2013, and this is considered in the attached matrix. There is also a checklist for GLOBAL G.A.P. Livestock Certification not addressed in the attached matrix. GLOBAL G.A.P. is fairly comprehensive addressing food safety as well as some environmental concerns.

## SAFE QUALITY FOOD (SQF)

Safe Quality Food (SQF) is a food safety management system recognized by retailers and foodservice providers around the world. The Safe Quality Food Institute Mission is “to deliver consistent, globally recognized food safety and quality certification programs based on sound scientific principles, consistently applied across all industry sectors, and valued by all stakeholders.”<sup>2</sup>

The SQF certification program is intended to reduce assessment inconsistencies and costs of multiple assessment standards. The SQF Program is recognized by the Global Food Safety Initiative (GFSI) and links primary production certification to food manufacturing, distribution and agent/broker management certification. SQF is administered by the Food Marketing Institute (FMI).

SQF is more focused on food safety than environmental issues.

## PRIMUSLABS GAP

The PrimusLabs GAP program<sup>3</sup> addresses the food safety topics of site selection, adjacent land use, fertilizer usage, water sourcing and usage, pest control and pesticide monitoring, harvesting practices (including worker hygiene, packaging storage, field sanitation and product transportation) and food defense. Standard Operating Procedures (SOP) are developed and incorporated into the GAP program, providing guidance with respect to potential points for contamination and preventative or corrective measures to mitigate their effects. The PRIMUSLABS GAP is more focused on food safety than environmental issues.

## USDA GOOD AGRICULTURAL PRACTICES AUDIT PROGRAMS

The USDA offers voluntary independent audits of produce suppliers throughout the production and supply chain. SCI Division Good Agricultural Practices (GAP) and Good Handling Practices (GHP) audits focus on best agricultural practices to verify that fruits and vegetables are produced, packed, handled, and stored in

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<sup>1</sup> Available: [http://www.globalgap.org/uk\\_en/who-we-are/history/](http://www.globalgap.org/uk_en/who-we-are/history/)

<sup>2</sup> Available: <http://www.sqfi.com/about-sqfi/>

<sup>3</sup> Available: <http://www.primuslabs.com/Services/StandardGAP.aspx>

the safest manner possible to minimize risks of microbial food safety hazards.<sup>4</sup> The audits verify adherence to the recommendations made in the U.S. Food and Drug Administration’s Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables and industry recognized food safety practices.

## CALIFORNIA SUSTAINABLE WINEGROWING PROGRAM

The California Sustainable Winegrowing Program is a voluntary comprehensive set of producer standards designed to design, develop, implement and report on a comprehensive sustainability program addressing site select and design, selection of stock, preparation of soil, use of irrigation, fertilizes, and chemicals, food and worker safety, environmental protection, marketing, etc. It is the more comprehensive system from an environmental perspective. The guidebook provides four levels of standards for each criterion, economic and feasibility information, example implementation, and other helpful information. While it is focused on winegrowing many of the standards appear applicable to other operations such as orchards.

Its mission is:

- Establishing voluntary high standards of sustainable practices to be followed and maintained by the entire wine community
- Enhancing winegrower-to-winegrower and vintner-to-vintner education on the importance of sustainable practices and how self-governing will enhance the economic viability and future of the wine community
- Demonstrating how working closely with neighbors, communities and other stakeholders to maintain an open dialogue can address concerns, enhance mutual respect, and accelerate results

It’s values include:

- Produce the best quality winegrapes and wine possible
- Provide leadership in protecting the environment and conserving natural resources
- Maintain the long-term viability of agricultural lands
- Support the economic and social wellbeing of farm and winery employees
- Respect and communicate with neighbors and community members; respond to their concerns in a considerate manner
- Enhance local communities through job creation, supporting local business and actively working on important community
- Honor the California wine community’s entrepreneurial spirit
- Support research and education as well as monitor and evaluate existing practices to expedite continual improvements<sup>5</sup>

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<sup>4</sup> Available: <http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP>

<sup>5</sup> Available: [www.sustainablewinegrowing.org](http://www.sustainablewinegrowing.org)

# APPENDIX I. CHELAN COUNTY VOLUNTARY STEWARDSHIP PROGRAM

## Critical Area Stressors and Potential Sustainability & Safety Checklists

Based on available information, this document provides a broad summary of typical agricultural activities, how they may affect critical areas, and some conservation practices intended to better conserve or protect the critical area. This document is not an exhaustive review of activities and effects. Selected publications are footnoted for reference. For complete information, please consult federal and state agencies and organizations with expertise in the critical area or agricultural practice.

The potential effects of agricultural activities on critical areas are addressed in some measure through existing producer checklists designed to promote sustainable practices, food and worker safety, and other goals. In particular, use of pesticides and fertilizer, storage of hazardous materials, and irrigation practices are well covered by existing checklists.

**Matrix: Stressors and Potential Tools/Metrics**

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Global Gap [Good Agricultural Practices] <a href="http://www.globalgap.org/uk_en/for-producers/crops/FV/">http://www.globalgap.org/uk_en/for-producers/crops/FV/</a>	Safe Quality Food Institute <a href="http://www.sqfi.com/">http://www.sqfi.com/</a>	PrimusLabs GAP <a href="http://www.primuslabs.com/Services/StandardGAP.aspx">http://www.primuslabs.com/Services/StandardGAP.aspx</a>	USDA Produce GAPs Harmonized Food Safety Standard: Field Operations & Harvesting Checklist <a href="http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP">http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP</a>	California Sustainable Winegrowing Program (Voluntary Sustainable Practices) <a href="http://www.sustainablewinegrowing.org">www.sustainablewinegrowing.org</a>
1.	Building of roads, buildings, creation of impervious area	Fish and Wildlife Habitat Conservation Area (FWHCA): Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas Geologically Hazardous Areas	Streams, Fish: Increased total and effective impervious area, increased stormflow volume, peak flow intensity and frequency, and channel erosion. Increased fine sediment. <sup>7</sup> See altering hydrology regarding diversions and culverts. Critical Aquifer Recharge Areas: Likely reduction in local groundwater recharge and summer base flows (in non-glacial fed streams). <sup>7</sup> Avian: Flight obstruction. <sup>2</sup> Mammals: Loss of habitat connectivity. <sup>2</sup> Frequently Flooded Areas, Geologically Hazardous Areas: Erosion from vegetation removal and clearing; placement of structures in hazard areas (e.g. landslides, channel migration zones, floodways).		5.2.4 Laneways, Races, Entrances, Exits and Loading/Unloading Ramps (the focus is on livestock health and safety)			4-11 Management of Erosion from Roads, Ditches, and Culverts
2.	Installation of fences	FWHCA: Streams, Fish, Wildlife	Mammals: Physical movement barriers <sup>2</sup>		5.2.1.1 Fields, yards, and other open areas where livestock are housed shall be fenced. The site entry point shall be controlled by a lockable gate.  5.2.2.1 Pens, yards and lairage shall be designed, located, constructed and maintained so as to minimize stress, injury or disease and have minimal impact on the surrounding area and natural resources.  5.2.11.2 Measures shall be in place to exclude domestic and wild animals from feed cultivation and from production animals.	Adjacent Land Use 2.04.02a: Have physical measures been put in place to restrain domestic animals, grazing lands, (includes homes with hobby farms, and noncommercial livestock) and their waste from entering the growing area (e.g. vegetative strips, wind breaks, physical barriers, berms, fences, diversion ditches.)?  See also 2.04.02b, 2.04.02c		

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Global Gap [Good Agricultural Practices] <a href="http://www.globalgap.org/uk_en/for-producers/crops/FV/">http://www.globalgap.org/uk_en/for-producers/crops/FV/</a>	Safe Quality Food Institute <a href="http://www.sqfi.com/">http://www.sqfi.com/</a>	PrimusLabs GAP <a href="http://www.primuslabs.com/Services/StandardGAP.aspx">http://www.primuslabs.com/Services/StandardGAP.aspx</a>	USDA Produce GAPs Harmonized Food Safety Standard: Field Operations & Harvesting Checklist <a href="http://www.ams.usda.gov/AMsv1.0/HarmonizedGAP">http://www.ams.usda.gov/AMsv1.0/HarmonizedGAP</a>	California Sustainable Winegrowing Program (Voluntary Sustainable Practices) <a href="http://www.sustainablewinegrowing.org">www.sustainablewinegrowing.org</a>
3.	Use of synthetic or organic fertilizer / pesticides	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	<p>Stream and Groundwater Water Quality Degradation: Excess nutrients in surface and groundwater; pesticides transported to surface and groundwaters: excess pathogens and chemicals from manure, biosolids or compost applications, excessive salts in surface and groundwater; petroleum, heavy metals and other pollutants transported to receiving water.<sup>1</sup></p> <p>Fish: Pesticides can be toxic to fish. Disruption of salmonids' ability to avoid prey when combinations of common pesticides, at levels commonly found in receiving waters, are present.<sup>6,7</sup></p> <p>Mammals: Effects from nutrient loading, contamination of habitat.<sup>2</sup></p> <p>Amphibians: Absorption by amphibians and reptiles of pollutants including pesticides, heavy metals, and sodium and chloride (from deicing salts). These cause contamination of breeding ponds, and of aquatic/ground surfaces utilized by reptiles and amphibians.<sup>2</sup></p>	<p>CB 5: Fertilizer Application Nutrient Requirement Quantity/Type Records of Application Fertilizer storage Organic fertilizer</p> <p>CB 7: Integrated Pest Management</p> <p>FV 5.5 Pest Control</p>	<p>5.7.4 Soil Amendment 5.7.5 Agricultural Chemicals</p> <p>7H.3.1 Agricultural Chemicals/Plant Protection Products Application rates Container disposal Storage</p> <p>7.7.1 Use of Fertilizers -proper storage -focus on application, handling and storage to protect human health</p> <p>7.7.2 Soil Amendment 7.7.3 Purchasing Chemicals 7.7.4 Agricultural Chemicals 7.7.4.1 Crop protection action plan</p>	<p>Fertilizer/Crop Nutrition 2.07.01 – 2.07.08 Crop Protection 2.09.01 – 2.09.11a</p>	<p>2.3 Agricultural Chemicals/ Plant Protection Products 2.3.1 Use of agricultural chemicals shall comply with label directions and prevailing regulation. 2.3.3 Agricultural chemicals shall be applied by trained, licensed or certified application personnel, as required by prevailing regulations. 2.3.4 Water (mixed with) used for solutions containing agricultural chemicals shall not be a source of product or field contamination. 2.3.5 Agricultural chemical disposal shall not be a source of product or field contamination. 2.6 Soil Amendments (aka fertilizers) 5.3 Fertilizers and Biosolids 5.5 Agricultural Chemicals</p>	<p>Soil/Nutrient Management 4-1 Plant Tissue Analysis 4-2 Soil Nutrient Analysis 4-3 Nutrient Management 4-4 Nitrogen Management 4-5 Fertigation 4-6 Amendments for Water Penetration 4-7 Amendments for pH 4-8 Preserving or Increasing Organic Matter 4-9 Soil Compaction 4-12 Non-Point Source (NPS) Pollution Prevention* within the Vineyard Block (e.g., soil, water, biological, bacteriological, chemical runoff)</p> <p>Pest Management Criteria 6-1 Vineyard Monitoring for Insect and Mite Pests 6-2 Training of Employees for Insect and Mite Monitoring 6-3 Economic Thresholds and Pest-Natural Enemy Ratios for Leafhoppers, Mites, and Thrips 6-4 Minimizing Risks from Insecticides and Miticides 6-5 Cultural Practices for Insect and Mite Management 6-6 Dust Abatement in and around Vineyards for Mite Management 6-7 Use of Weather Data and Degree-Days for Managing Moth Pests 6-8 Portion of Vineyard Treated for Mites or Leafhoppers 6-9 Mealybug Management 6-10 Soil-Borne Pest Management after Planting 6-11 Vineyard Monitoring for Disease</p>

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Global Gap [Good Agricultural Practices] <a href="http://www.globalgap.org/uk_en/for-producers/crops/FV/">http://www.globalgap.org/uk_en/for-producers/crops/FV/</a>	Safe Quality Food Institute <a href="http://www.sqfi.com/">http://www.sqfi.com/</a>	PrimusLabs GAP <a href="http://www.primuslabs.com/Services/StandardGAP.aspx">http://www.primuslabs.com/Services/StandardGAP.aspx</a>	USDA Produce GAPs Harmonized Food Safety Standard: Field Operations & Harvesting Checklist <a href="http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP">http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP</a>	California Sustainable Winegrowing Program (Voluntary Sustainable Practices) <a href="http://www.sustainablewinegrowing.org">www.sustainablewinegrowing.org</a>
								6-12 Powdery Mildew Management 6-13 Minimizing Risks from Fungicides for Powdery Mildew and Botrytis Control 6-14 Pruning for Canker Management 6-15 Bunch Rot Management 6-16 Pierce’s Disease Management where Blue-Green Sharpshooter is Primary Vector 6-17 Vineyard Monitoring for Weeds 6-18 Weed Knowledge 6-19 Weed Management 6-20 Herbicide Leaching Potential 6-21 Area Treated with Herbicides 6-22 Vineyard Monitoring for Vertebrate Pests 6-23 Vertebrate Pest Management 6-24 Predation by Vertebrates 6-25 Low-Volume Vine Canopy Sprayers 6-26 Sprayer Calibration and Maintenance 6-27 Spray Coverage 6-28 Spray Buffer Zone 6-29 Spray Drift 6-30 Pesticide Storage 6-31 Pesticide Mixing and Loading 6-32 Pesticide Emergency Response Plan 6-33 Winery Pest Management

#	Activity	Critical Areas of Interest	Potential Effects of Activity on Critical Areas	Global Gap [Good Agricultural Practices] <a href="http://www.globalgap.org/uk_en/for-producers/crops/FV/">http://www.globalgap.org/uk_en/for-producers/crops/FV/</a>	Safe Quality Food Institute <a href="http://www.sqfi.com/">http://www.sqfi.com/</a>	PrimusLabs GAP <a href="http://www.primuslabs.com/Services/StandardGAP.aspx">http://www.primuslabs.com/Services/StandardGAP.aspx</a>	USDA Produce GAPs Harmonized Food Safety Standard: Field Operations & Harvesting Checklist <a href="http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP">http://www.ams.usda.gov/AMSV1.0/HarmonizedGAP</a>	California Sustainable Winegrowing Program (Voluntary Sustainable Practices) <a href="http://www.sustainablewinegrowing.org">www.sustainablewinegrowing.org</a>
4.	Storage or use of hazardous materials	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	Threat to surface and groundwater quality and aquatic species.	AF 5: Waste and Pollution Management CB 5: Fertilizer Application Fertilizer storage	5.6.2 Storage of Hazardous Chemicals, Toxic Substances, and Petroleum Products  7.6.1 Storage of Hazardous Chemicals, Toxic Substances, and Petroleum Products			11-1 Planning, Monitoring, Goals, and Results 11-2 Good Housekeeping – Dumpster Area 11-3 Hazardous Materials – Hazardous Material Storage and Replacement 11-4 Hazardous Materials – Hazardous Waste Disposal 11-5 Paint and Paint Thinners 11-6 Aerosol Cans 11-7 Protection of Storm Water and Process Wastewater 11-8 Fuel Storage – Aboveground Storage Tanks (ASTs) or Portable Tanks 11-9 Winery Sanitation Supplies
5.	Altering hydrology due to ditches, canals, and other irrigation facilities; creation of artificial stormwater ponds	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas	Fish: Passage limitations to water bodies historically important in-stream and off-channel habitats. Water diversions without proper passage routes disrupt migrations of listed fish species. Unscreened diversions trap or divert juvenile spring Chinook, steelhead, and bull trout resulting in reduced survival. <sup>10</sup> Mammals and Amphibians: Physical movement barriers; change from natural water level variation, loss of habitats maintained by flooding; spread of non-native species <sup>2,3</sup> Wetlands: Agriculture can reduce the amount of water available to wetlands by either diverting water that would otherwise reach pre-existing wetlands, or imposing more efficient irrigation practices that reduce the amount of leakage reaching irrigation-related wetlands. <sup>4,5</sup> In some areas of the Columbia Basin Plateau where irrigation development projects exist, irrigation has altered flows, in most rivers and streams increasing flows in late spring and early summer. Irrigation projects have also increased the number of lakes for water storage, and increased groundwater returns; all of these alterations alter the width of riparian areas and the number and size of associated wetlands. In areas without irrigation system-altered hydrology, the lack of surface water flows can place increased reliance on groundwater pumping for agricultural irrigation. Alterations, including increased water availability where irrigation development projects exist, or reduced groundwater levels from ground water pumping, can result in changes in riparian vegetation, including an increase in the invasion of exotic species <sup>9</sup>			Ground History 2.03.05: Has flooding from uncontrolled causes occurred on the growing area(s) since the previous growing season?		

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6.	Irrigation	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas	Excessive irrigation can affect water quality by causing erosion, transporting nutrients, pesticides, and heavy metals, or decreasing the amount of water that flows naturally in streams and rivers. It can also cause a buildup of selenium, a toxic metal that can harm waterfowl reproduction. <sup>3</sup> Irrigation can result in the creation and maintenance of wetlands in locations where they did not previously exist. <sup>4</sup> Agricultural practices in irrigated areas can lead to accumulation of salts in the upper soil horizons. Irrigation may leach out the accumulated salts. <sup>4</sup>	CB 6: Irrigation/Fertigation Predicting Irrigation Requirements Irrigation/Fertigation Method Quality of Irrigation Water Supply of Irrigation/Fertigation Water	7.5.1 Water Description Plan required 7.5.2 Irrigation Water 7.5.3 Treatment of Irrigation Water 7.5.4 Water System Risk Assessment 7.5.5 Water Management Plan (although focus is more to ensure the quality and safety of the water supply)	Irrigation Water Use: 2.08.01 – 2.08.09	2.4 Agricultural Water 2.4.1 Water System Description 2.4.2 Water System Risk Assessment 2.4.3 Water Management Plan	Vineyard Water Management Criteria 5-1 Water Management Strategy 5-2 Monitoring and Amending Quality of Irrigation Water 5-3 Off-Site Water Movement 5-4 Irrigation System 5-5 Distribution Uniformity for Irrigation Systems 5-6 Filters and Lines 5-7 Water Budget 5-8 Measuring Water Use 5-9 Soil Water-Infiltration Rates and Water-Holding Capacity 5-10 Soil Moisture and Plant Water Status Monitoring Methods 5-11 Planned Deficit Irrigation through Regulated Deficit Irrigation
7.	Flood control facilities and floodplain fill	FWHCA: Streams, Fish, Wildlife Wetlands Frequently Flooded Areas Geologically Hazardous Areas	Accelerated runoff, blocked runoff, interrupted groundwater flow, and increased pollution loadings; sedimentation; barriers to movement of animals to their preferred habitat and water bodies. <sup>2</sup> Armoring banks with stone, concrete, or other resistant material in order to stem the movement of the channel and reduce erosion. <sup>8</sup>					

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8.	Clearing of vegetation, including riparian and wetland conversion, or location of agriculture related structures in riparian and wetland critical areas	FWHCA: Streams, Fish, Wildlife Wetlands Critical Aquifer Recharge Areas Frequently Flooded Areas Geologically Hazardous Areas	Fish: Reduced delivery of large woody debris. Reduced bank stability and loss of bank habitat structure and complexity. Reduced shading and temperature control. <sup>7</sup> Sedimentation from land and water management activities is a cause of habitat degradation in some salmon and trout streams. <sup>10</sup> Mammals: Removal of habitat, habitat fragmentation, simplification of structure <sup>2</sup> Amphibian: Loss/simplification of breeding habitat (direct loss, or changes such as native wetland vegetation to reed canary grass), including loss of suitable egg laying habitat (e.g., suitable emergent species, and suitable insolation for lentic breeders, and needs for terrestrial breeders). Loss/simplification of active season habitat. Loss of overwintering habitat. Loss of refugia (especially in extreme weather years). Habitat becomes a sinks/trap. <sup>2</sup> Wetlands: Agriculture may affect wetlands directly through conversion of the wetland to fields or pasture. This is often done by direct filling or tilling, by draining through tiles or channels, or by removing the wetland vegetation and planting upland vegetation. <sup>4</sup> Geologically Hazardous Areas: Erosion, sedimentation, slope stability.	AF 6: Environment and Conservation AF 6.1 Impact of Farming on the Environment and Biodiversity AF 6.1.1 Does each producer have a management of wildlife and conservation plan for the enterprise that acknowledges the impact of farming activities on the environment?  AF 6.1.2 Has the producer considered how to enhance the environment for the benefit of the local community and flora and fauna and is this policy compatible with sustainable commercial agricultural production and does it strive to minimize environmental impact of the agricultural activity?  AF 6.2.1 Has consideration been given to the conversion of unproductive sites (e.g. low lying wet areas, woodlands, headland strip or areas of impoverished soil, etc.) to conservation areas for the encouragement of natural flora and fauna?				The following criteria are included: 8-1 Ecosystem Processes – Resource Base Ecosystem Biodiversity 8-2 Watershed Management – Watershed Awareness 8-3 Ecosystem Management – Native Woodlands 8-4 Ecosystem Management – Riparian Habitat 8-5 Ecosystem Management – Aquatic Habitats: Streams, Rivers, and Wetlands 8-6 Habitat Enhancement for Wildlife 8-7 Conservation Easements 8-8 Sensitive Species 8-9 Sensitive Species and Collaboration with Partners Example riparian habitat criteria: 8-4 Ecosystem Management – Riparian Habitat Category 1: The vineyard is planted up to the edge of the watercourse to maximize the land area used for producing winegrapes (in accordance with legal requirements). Category 2: Vines are not planted up to the edge of the watercourse but no vegetated buffer exists. Category 3: Banks of watercourses have vegetated buffer strips adjacent to the waterway. Category 4: Banks of water courses have vegetated buffer strips adjacent to the water way <b>And</b> Outside the buffer strip is a row of trees and shrubs that shade part or the entire water course.

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9.	Shade trees replacing shrub-steppe	FWHCA: Streams, Fish, Wildlife	Amphibians: Change in micro-climate and structural characteristics of habitat. <sup>2</sup>					
10.	Planting of agricultural lands (in areas not previously under agricultural production) or replanting	FWHCA: Streams, Fish, Wildlife Wetlands Geologically Hazardous Areas	Avian: Removal of habitat, simplification of structure. <sup>2</sup> Mammals: Habitat fragmentation, removal of habitat, simplification of structure, increased non-native and invasive plant species, loss of forage. <sup>2</sup> Amphibians: Decreased landscape complementation; e.g., breeding habitat may still exist, however, overwintering habitat, or essential summer habitat features in proximity with breeding habitat may no longer be available. <sup>2</sup> Wetlands: Wetlands in tilled areas may experience greater water level fluctuations. Disruption of the soil through tilling and grazing can create a source of sediment than can be transported further downgradient. Sediments may also be carried by winds from tilled fields. <sup>4</sup> Geologically Hazardous Areas: Soil erosion, potential alteration of steep slopes depending on location/type of production.	CB 4: Soil Management 4.3 Are field cultivation techniques used to reduce the possibility of soil erosion?	5.1.1.1 The farm and facilities shall be such that adjacent and adjoining buildings, operations and land use do not interfere with safe and hygienic operations on the property. 5.1.1.2 A soil map shall be prepared and risk assessment conducted to evaluate and document the risk to forage or livestock associated with prior land use, adjacent land use, and other environmental factors including structures and equipment. Consideration shall be given to the following: i. History of land use. ii. Topography. iii. Adjacent land use. iv. Other factors that may impact on the ability to supply safe products. 5.1.1.3 The analysis shall be re-evaluated in the event of any circumstance or change that may impact on the production of safe products. 5.1.1.4 Where risks are identified, control measures shall be implemented to reduce the identified hazards to an acceptable level.  Same in 7.1 Site Requirements		2.1.1. The food safety plan shall, initially and at least annually thereafter, evaluate and document the risks associated with land use history and adjacent land use, including equipment and structures.	3-8 Environmental Due Diligence* for a New Vineyard Site or a Replanting (including conversion from other agricultural uses) 3-14 Vineyard Layout 3-18 Conservation of Habitat for Wildlife and Pest Predators 3-19 Creation of Habitat for Wildlife and Pest Predators  4-10 Surface Water Diversions for Erodible Sites

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11.	Allowing livestock in riparian areas	FWHCA: Streams, Fish, Wildlife Wetlands	Streams, Fish: Sedimentation, bank stability, loss of shade; introduction of organics (waste). Mammals: Trampling and grazing, causing loss of cover and forage, destruction of bank structure, compaction of soil, trampling of burrows. <sup>2</sup> Amphibians: Direct impact to pond breeding amphibians or their incubating embryos may occur near the shoreline if areas are trampled or grazed. Eastern WA may have the most difficult regeneration issues after disturbance (Note, in some cases effects of grazing in wetlands can be positive for amphibians). <sup>2</sup> Wetlands: Livestock grazing in streams and riparian wetlands also has documented effects on the physical structure of wetlands. <sup>4</sup>			Adjacent Land Use 2.04.02a: Have physical measures been put in place to restrain domestic animals, grazing lands, (includes homes with hobby farms, and noncommercial livestock) and their waste from entering the growing area (e.g. vegetative strips, wind breaks, physical barriers, berms, fences, diversion ditches.)?  2.04.02c: Are measures in place to reduce or limit the animal intrusion (i.e., monitoring field perimeter for signs of intrusion)?	2.5.1 The operation has a written risk assessment on animal activity in and around the production area. 2.5.2 The operation routinely monitors for animal activity in and around the growing area during the growing season. 2.5.3 Based on the risk assessment, there shall be measures to prevent or minimize the potential for contamination from animals, including domestic animals used in farming operations.	

1 Natural Resource Conservation Service (NRCS), United States Department of Agriculture (USDA). 2014. Conservation Delivery Streamlining Initiative (CDSI) Resource Concerns Checklist. Also see individual conservation practices at NRCS, USDA. 2008. Available: [http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/references/?cid=nrcs143\\_026849](http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/technical/references/?cid=nrcs143_026849).

2 Washington Department of Fish and Wildlife (WDFW). 2009. [Landscape Planning for Washington's Wildlife: Managing for Biodiversity in Developing Areas. Appendix C: Stressor Tables.](#)

3 U.S. Environmental Protection Agency Nonpoint Source Control Branch. March 2005. Protecting Water Quality from Agricultural Runoff. EPA 841-F-05-001. Available: [http://water.epa.gov/polwaste/nps/agriculture\\_facts.cfm](http://water.epa.gov/polwaste/nps/agriculture_facts.cfm). Accessed: June 11, 2014.

4 Washington State Department of Ecology et al. March 2005. Wetlands in Washington State: Volume 1: A Synthesis of the Science. Published by the Department of Ecology's Shorelands and Environmental Assistance Program, P.O. Box 47600, Olympia, WA 98504-7600. Ecology Publication #05-06-006. Available: <https://fortress.wa.gov/ecy/publications/publications/0506006.pdf>.

5 A general "tool" is "Encourage the voluntary use of management practices, farm conservation plans, and incentive-based programs to improve agricultural practices in and near wetlands." See Washington State Department of Ecology et al. April 2005. Wetlands in Washington State: Volume 2 – Protecting and Managing Wetlands. Published by the Department of Ecology's Shorelands and Environmental Assistance Program, P.O. Box 47600, Olympia, WA 98504-7600. Ecology Publication #05-06-008. Available: <https://fortress.wa.gov/ecy/publications/publications/0506008.pdf>.

6 Aktar, et al. 2009. Impact of pesticides use in agriculture: their benefits and hazards. Interdiscip Toxicol. Mar 2009; 2(1): 1–12. Published online Mar 2009. doi: 10.2478/v10102-009-0001-7 PMID: PMC2984095. Includes references to sources in Washington State. Available: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2984095/>.

7 Washington Department of Ecology and AHBL Inc. June 2013. Eastern Washington Low Impact Development Guidance Manual. Available: <http://www.wastormwatercenter.org/ew-lid-guidance-manual/>.

8 King County. 2004. The Effects of Agricultural Operations on Critical Areas. Executive Report – Best Available Science Volume II, Assessment – February 2004. Available: <http://your.kingcounty.gov/des/cao/PDFs04ExecProp/BAS-Vol-II-AppendixA-04.pdf>.

9 Anchor QEA, LLC. June 2013. Final Draft Semi-Arid Riparian Functions and Associated Regulatory Protections to Support Shoreline Master Program Updates. Prepared for Grant County.

10 Upper Columbia Salmon Recovery Board. 2007. Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. Available: <http://www.ucsr.org/library/plans/>. Accessed June 27, 2012.