FINAL (REVISED)

KITTITAS COUNTY REGIONAL SHORELINE MASTER PROGRAM UPDATE - SHORELINE INVENTORY AND CHARACTERIZATION REPORT

Ecology Grant No. 1200054

Kittitas County,
City of Cle Elum,
Town of South Cle Elum,
and City of Ellensburg
Shoreline Master Program Updates

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Kittitas County Community Development Services,
City of Cle Elum Department of Community Development,
Town of South Cle Elum, and City of Ellensburg Department of Community Development

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CHAPTER 1. INTRODUCTION

1.1 Background and Purpose

Kittitas County and its municipalities are undergoing comprehensive updates of their Shoreline Master Programs (SMPs) to improve protection of shoreline environments and ensure their continued use and enjoyment. The update is also required by the Shoreline Management Act (SMA) of 1971 and the implementing rules known as the shoreline guidelines[1].

In order to obtain the best value for limited state grant funds, Kittitas County and three of its municipalities (the Cities of Cle Elum and Ellensburg and the Town of South Cle Elum) are jointly updating their SMPs. The County and its municipalities are conducting comprehensive SMP updates in two phases. The first phase is the development of an inventory and characterization of the shorelines within the county. This report provides the inventory and characterization study. In the next phase of the project, the County and its municipalities will update their shoreline management policies and regulations.

The shoreline inventory and characterization process involves assessing the lakes, streams, and rivers that are classified as "shorelines of the state" and their adjoining "shorelands" and characterizing the broader landscape surrounding these lands and waters. The Inventory and Characterization Report (ICR) must be based on the most current, accurate, and complete scientific and technical information available that is applicable to the issues of concern. The ICR serves multiple purposes, such as:

- Identifying shoreline resources and areas that provide value to county residents, recreationists, property owners, businesses, and other stakeholders to ensure they are managed appropriately according to the goals of the SMA;
- Assessing and documenting current shoreline conditions to establish a baseline against which future conditions can be compared;
- Providing a basis of information to assign Shoreline Environment Designations (which is one of the next tasks in the update process); and

[1] Revised Code of Washington (RCW) 90.58 and Washington Administrative Code (WAC) 173-26, Part III.

- Presenting information for future SMP policy and regulatory decisions related to shoreline use and development, shoreline ecology, and public access.

This study was prepared by Environmental Science Associates (ESA) with technical assistance from Central Washington University's Center for Spatial Information and Research (CSIR).

1.2 Shoreline Inventory Area and Methods

The emphasis of this report is on lakes, rivers, and streams and their associated shorelands that are subject to the SMA (see box). In general, the Shoreline Inventory Area is a relatively narrow zone of land and water associated with designated shorelines of the state.

Shoreline Jurisdiction – Definitions and Terminology

The SMPs of the County and its municipalities govern all non-federal shorelines of the state as defined in RCW 90.58.030, including shorelines and shorelines of statewide significance.

Shorelines are rivers and streams (or segments thereof) with a mean annual flow of 20 cubic feet per second (cfs) or more and lakes greater than 20 acres, together with their underlying lands and associated shorelands.

Shorelines of Statewide Significance include rivers with mean annual flow of 200 cfs or more or the portion downstream from the first 300 square miles of drainage area and lakes 1,000 acres or larger.

Shorelands refers to the lands extending landward for 200 feet in all directions from the ordinary high water line; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all associated wetlands.

Kittitas County contains 51 streams and 44 lakes and ponds that are subject to the SMA for a total regulated shoreline length of approximately 680 miles. Except as it pertains to characterizing ecosystem-wide processes, this inventory and characterization does not directly discuss waterbodies outside the jurisdiction of the County and its municipalities or shorelines within the Alpine Lakes Wilderness Area.

Please note that the Shoreline Inventory Area may differ from the actual SMP jurisdiction in some areas. The extent of shoreline jurisdiction will be determined during the SMP development processes of the County and its municipalities. The precise determination of shoreline jurisdiction at a parcel-basis is may require site-

specific studies, and is generally determined when development within or near shoreline jurisdiction is proposed.

In accordance with Washington State Department of Ecology (Ecology) 2011 SMP guidelines, this shoreline inventory and characterization is based on the most current, accurate, and complete scientific and technical information that is both relevant and reasonably available (WAC 173-26-201(3)(c)). Key sources of information used in this report include watershed planning documents, salmon habitat assessment documents, U.S. Bureau of Reclamation basin planning studies, and other relevant technical studies and documents. Mapping information and other studies from state agencies (including Washington Department of Fish and Wildlife, Ecology, and Washington State Department of Transportation) and the Yakama Nation were also used.

1.2.1 Data Gaps

The draft ICR was reviewed by the Kittitas County SMP Technical Advisory Committee (TAC), Ecology, and the public at-large, and their review comments have been addressed in this final draft. With their assistance, most of the recognized data gaps in the initial draft have been resolved by the consultant team. However, there are three desired data sets that are not available, which are described below:

- Several members of the TAC commented that the available fish distribution data was inaccurate and out-of-date for some waterbodies. Updated fish use data was requested from the Washington Department of Fish and Wildlife, but a new dataset was not provided. Therefore, the consultant team updated the fish use information in the report text based upon anecdotal information and observations from TAC members. It should be noted that fish distribution in the County is not static, as fish are occasionally reintroduced, populations expand their range, fish passage barriers are removed, etc. (Mark Teske, personal communication).

- The Federal Emergency Management Agency (FEMA) is currently revising the floodplain mapping in Kittitas County. However, communication with FEMA indicates that the revised floodplain mapping will not be completed until fall of 2013.

- There is no comprehensive dataset of erosion hazard areas within the County. In addition, the existing critical aquifer recharge (CARA) data are very coarse scale. The data may be revised by the County at a later data.

1.3 Report Organization

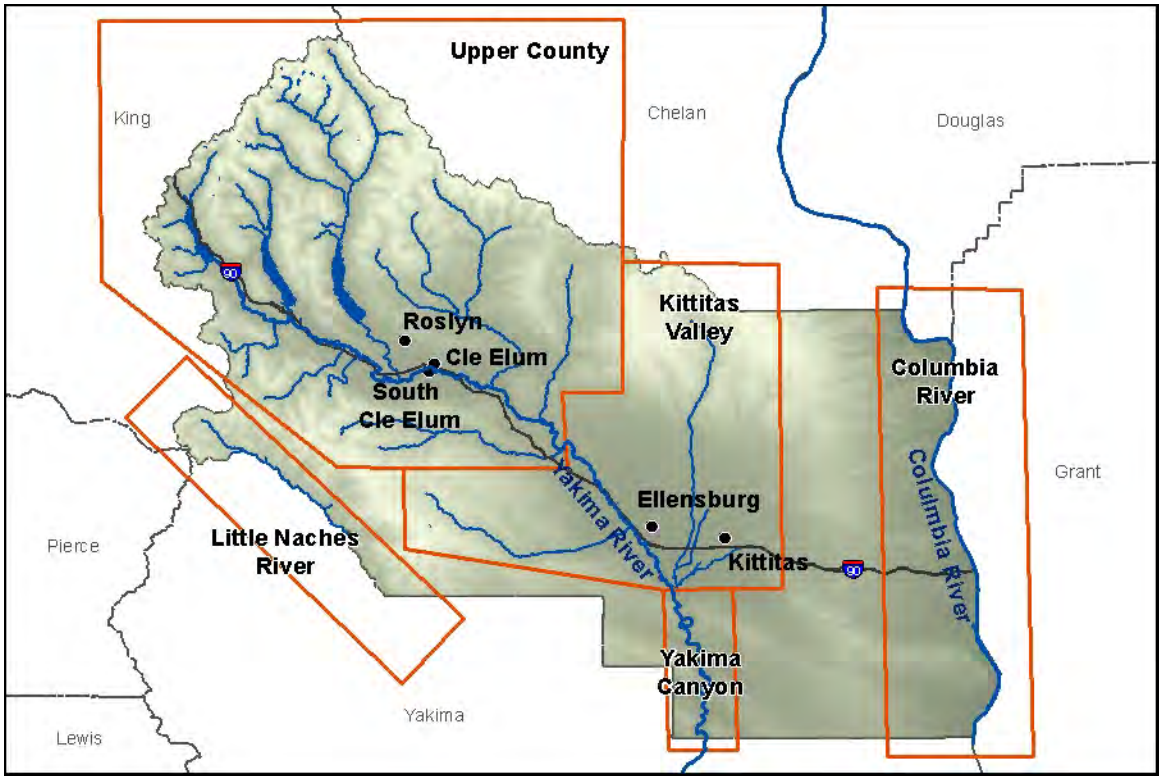
This inventory and characterization report is organized into the following chapters and appendices:

Chapter 2 provides the ecosystem profile of Kittitas County and its shorelines. This chapter describes an overview of the physical, ecological, hydrological, and land use characteristics of the county, organized by the three basins (i.e., Water Resource Inventory Areas [WRIAs]) that occur within the county. Chapter 2 also contains a summary of management recommendations for county shorelines.

Chapters 3 through 6 contain detailed descriptions of the SMA-regulated shorelines within the county and its municipalities. For each shoreline segment or "reach", a summary sheet illustrating baseline conditions and management opportunities provides an "at-a-glance" reference to accompany the characterization text.

Chapters 3 through 6 are organized by river basin and landscape position within the county. Chapter 3 describes "Upper County" shorelines, Chapter 4 describes "Kittitas Valley" shorelines, Chapter 5 describes "Yakima Canyon" and "Little Naches River" shorelines, and Chapter 6 describes the "Columbia River" shoreline (Figure 1-1). Shorelines within the city of Cle Elum and town of South Cle Elum are described in Chapter 3, and shorelines within the city of Ellensburg are described in Chapter 4.

Figure 1-1. Kittitas County shoreline inventory areas – Upper County, Kittitas Valley, Yakima Canyon, Naches River and Columbia River - for Chapters 3 through 6



Chapter 7 summarizes the relationship between SMPs and other land use / regulatory plans and programs.

Chapter 8 describes potential new water-dependent and preferred shoreline uses that may occur along the shorelines of Kittitas County and its municipalities.

Chapter 9 is a list of the references used to prepare this report.

Abbreviations and terms are explained in the **Glossary and Abbreviations** section.

Appendix A contains maps depicting important information referenced in the text (Table 1-1).

Appendix B explains the information and data used to create the reach sheets.

Table 1-1. Kittitas County Shoreline Inventory Map Themes and Numbers

Map Number and Theme	Content
Folio #1: Habitats and Shoreline Modifications	• Wetlands • Priority Fish Distribution • Overwater Structures • Hydromodifications • Fish Passage Barriers • Public Lands
Folio #2: Hazard Areas	• FEMA Floodway • FEMA Floodplain • Steep Slopes • Landslides
Folio #3: Land Cover	• Land Cover
Folio #4: Land Use and Public Access	• Land Use • Public Access Points • Trails
Map #5: Zoning	• Zoning

Appendix C contains the channel migration zone maps, associated data tables, and mapping methodology.

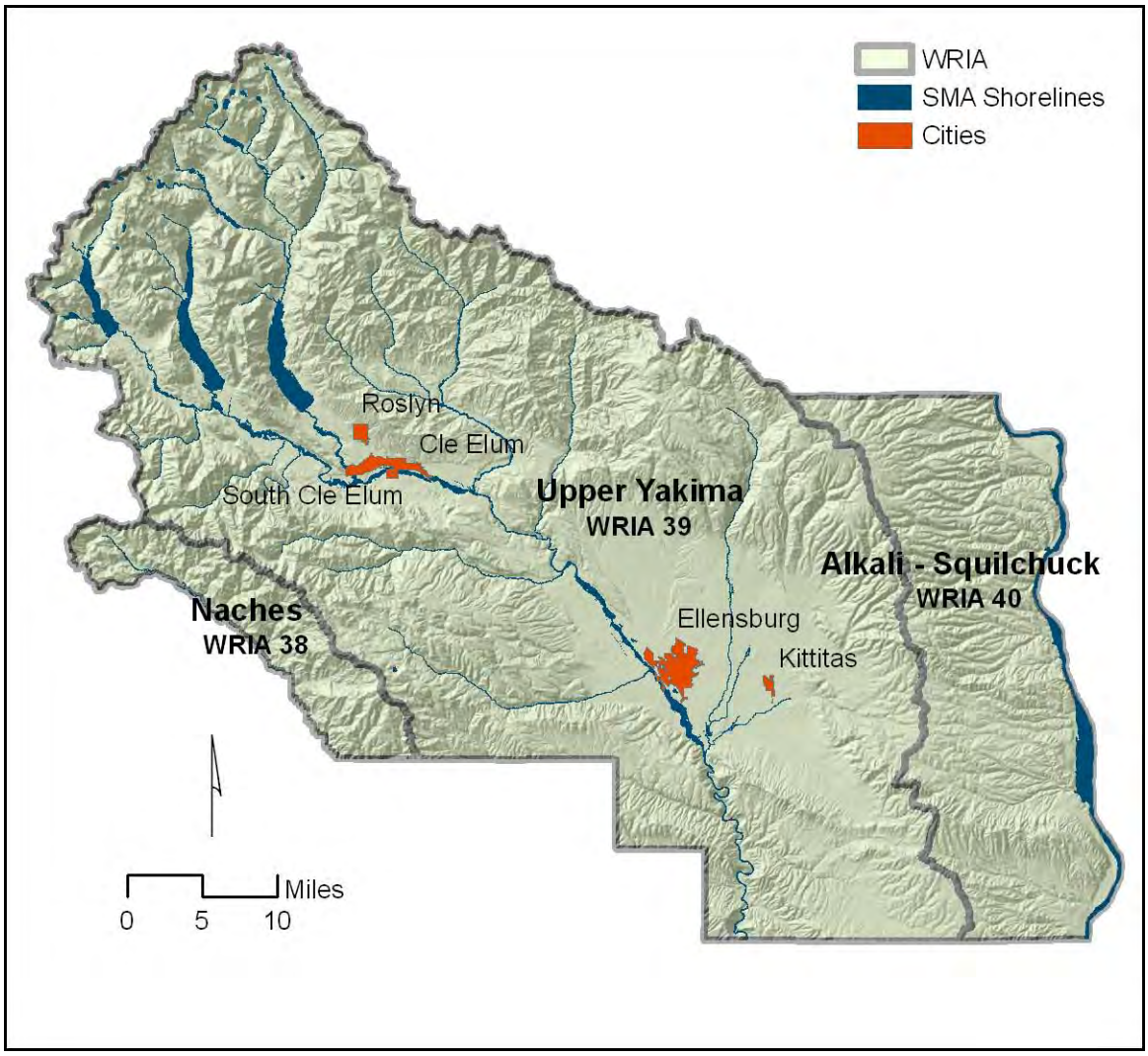
CHAPTER 2. ECOSYSTEM PROFILE

2.1 Introduction

Kittitas County is situated in central Washington on the eastern slopes of the Cascade Mountains, between the Cascade Crest and the Columbia River in the Columbia River basin. The county is contained within three major basins: Upper Yakima (Water Resource Inventory Area [WRIA] 39), Alkali – Squilchuck (WRIA 40), and Naches basin (WRIA 38). Of the 2,297 square miles that constitutes Kittitas County, the majority, 78 percent, lies within the Upper Yakima basin (WRIA 39), which drains into the Yakima River. The Alkali – Squilchuck basin (WRIA 40) comprises 17 percent of the county in the eastern portion and drains into the Columbia River. The remaining 5 percent of the county is contained in the Naches basin (WRIA 38) on its southwestern edge and drains into the Little Naches River, which becomes the Naches River joining the Yakima River in Yakima County. Figure 2-1 shows the locations of the WRIAs in Kittitas County.

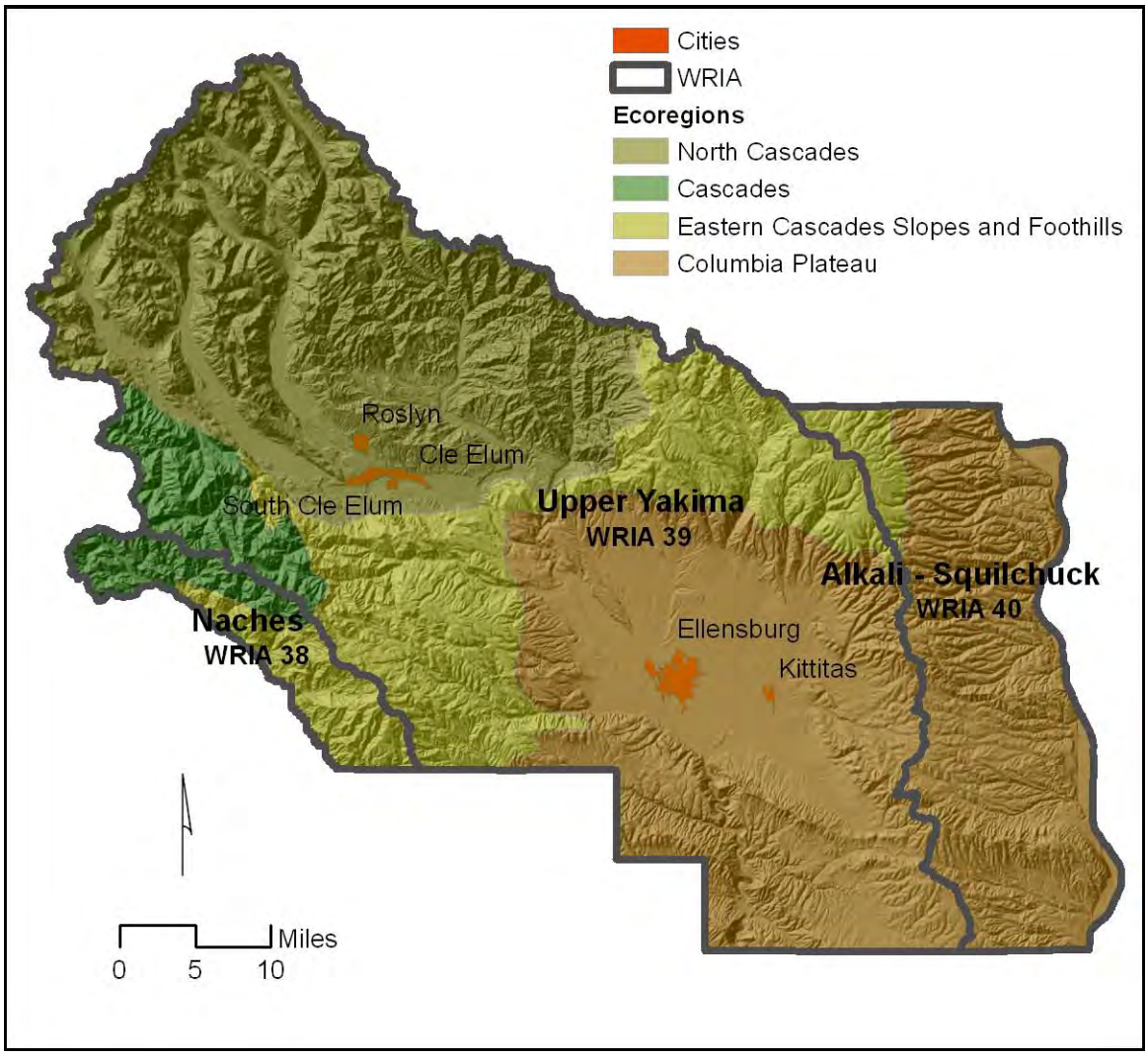
Four different ecoregions are found within Kittitas County: North Cascades, Cascades, Eastern Cascades Slopes and Foothills, and Columbia Plateau (Figure 2-2). The North Cascades ecoregion, found in the northwestern portion of the county, is characterized by glaciated valleys and narrow-crested ridges punctuated by rugged, high relief peaks approaching 8,000 feet above mean sea level (AMSL). It is forested with fir, hemlock, and, in the drier eastern margins, pine. The Cascades ecoregion, located in southwestern Kittitas County, is similar to the North Cascades, but in contrast has more gently undulating terrain, the climate is more temperate, and there is less occurrence of ponderosa pine. The Eastern Cascades Slopes and Foothills ecoregion bisects the central portion of the county. This ecoregion receives less precipitation than the North Cascades and Cascades and has higher temperature extremes. It is forested with open stands of ponderosa pine and some lodgepole pine. To the east of the Eastern Cascades Slopes and Foothills lies semi-arid shrub-steppe and grasslands that are part of the Columbia Plateau ecoregion (EPA 2011). In this region, low-lying land adjacent the Yakima River valley floor has mostly been converted to irrigated agriculture. The Columbia River runs through this ecoregion on the eastern edge of the county. Its banks in the southeast section have the lowest elevation in the county at 475 feet AMSL.

Figure 2-1. Locations of WRIAs in Kittitas County.



Source: Washington State Department of Ecology

Figure 2-2. Ecoregions covering Kittitas County.

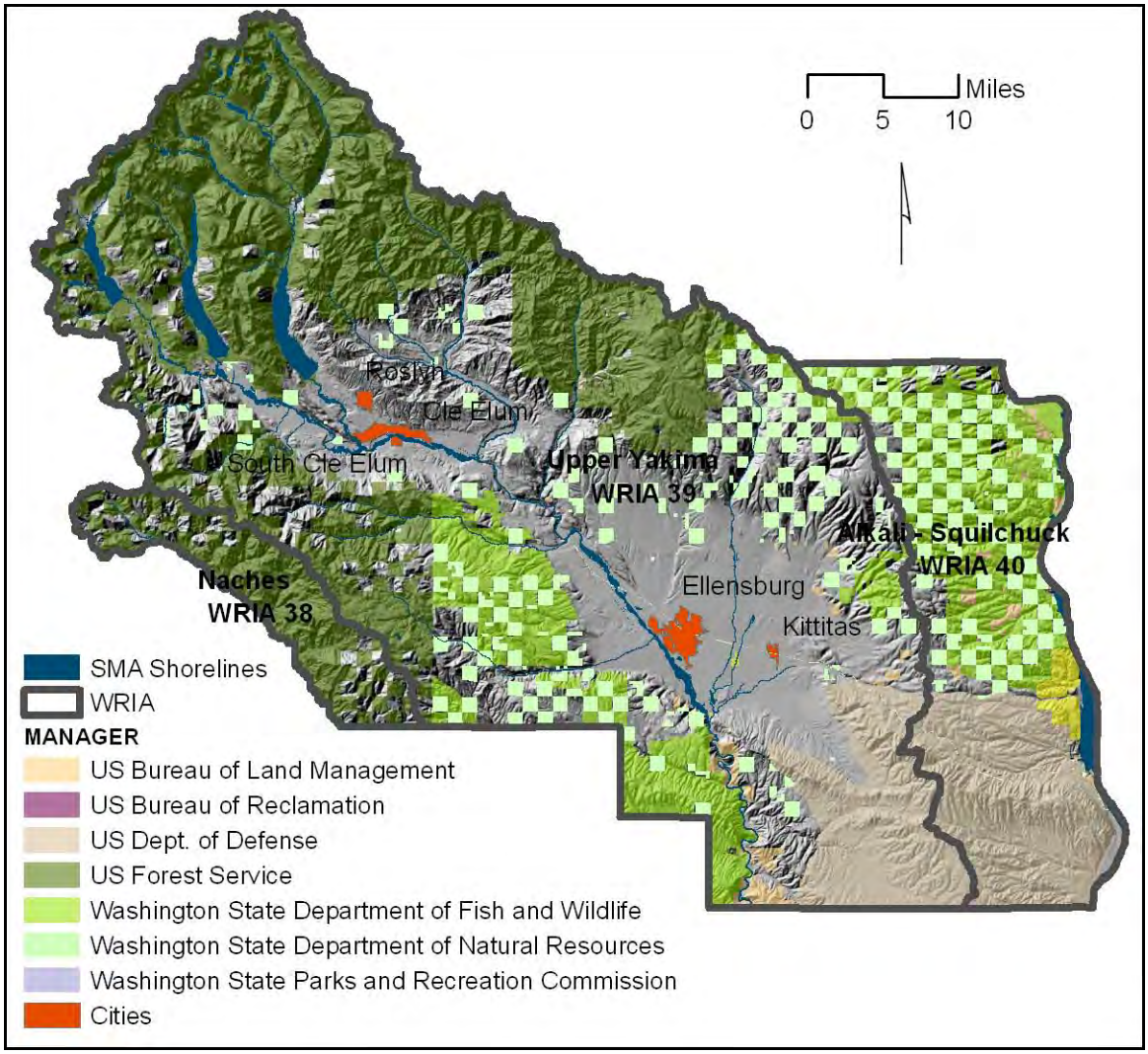


Source: United States Environmental Protection Agency

Kittitas County contains a mix of federal, state, and private land. Almost two-thirds, 68 percent, of land in the county is publicly owned, leaving 32 percent in private holdings, as shown in Figure 2-3. Forty-two percent of the land is federally managed and 26 percent is state managed. The U.S. Forest Service manages 30 percent of the land as the Wenatchee National Forest, with approximately 17 percent of that land being part of the Alpine Lakes Wilderness. The Department of Defense manages 11 percent of the land as the Yakima Training Center, and the U.S. Bureau of Land Management is the steward of 1 percent of the land. Fourteen percent of the land is managed by Washington State Department of Natural Resources, 11 percent by Washington State Department of Fish and Wildlife, and 1 percent by Washington State Parks and Recreation Commission. Privately owned farmland consists of 13

percent of county area and is primarily devoted to the production of grass hay, cereal grain, and livestock (USDA 2007). Private forestland consists of 1 percent of land area (Cascade Land Conservancy 2009).

Figure 2-3. Public land ownership in Kittitas County.

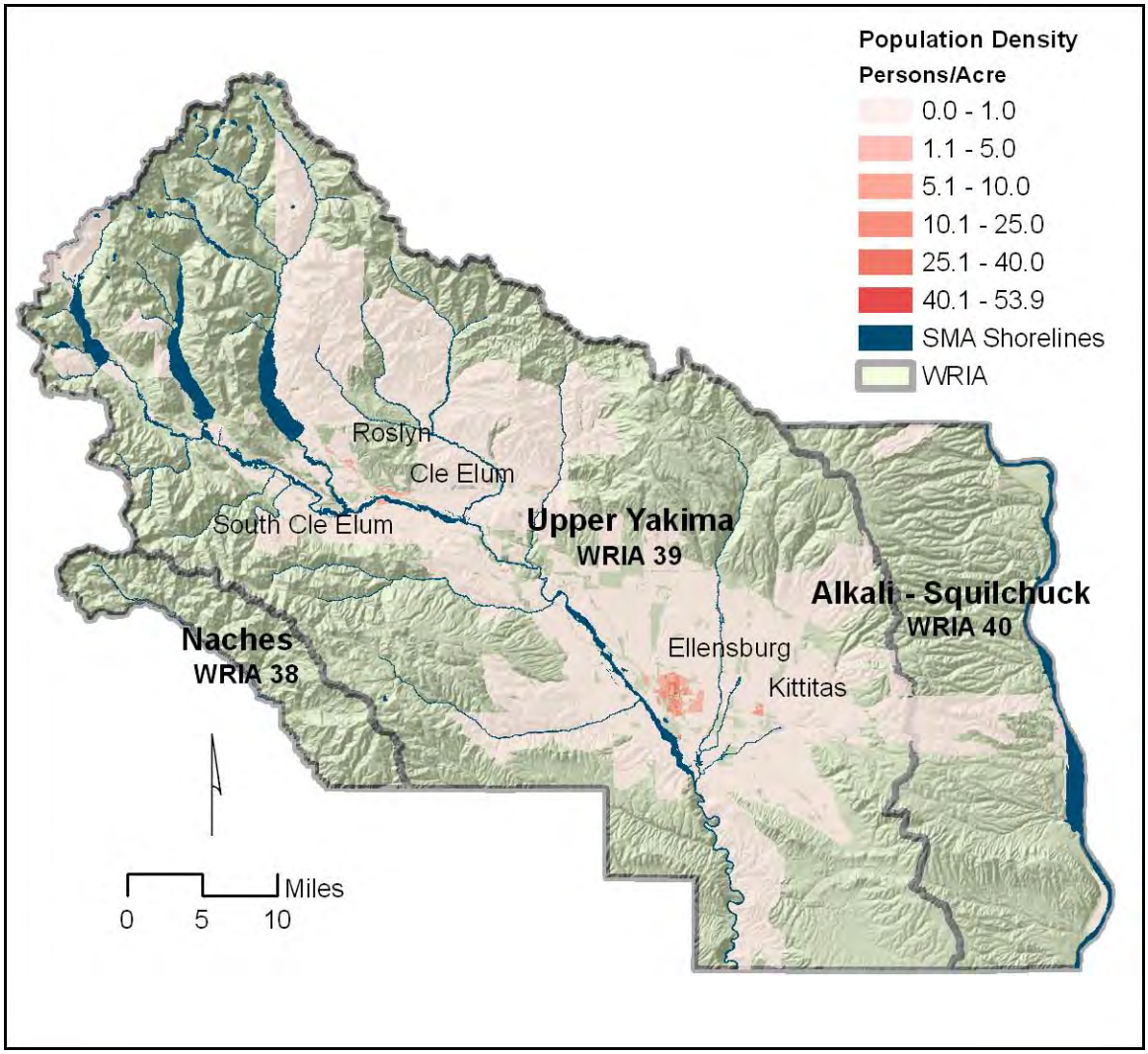


Source: Washington Department of Natural Resources

Kittitas County has a population density of 17.8 persons per square mile, which is low compared to 101.1 for the State of Washington. The vast majority of Kittitas County's population of 40,915 (U.S. Census 2010) resides in the Upper Yakima basin (WRIA 39) in and around the five incorporated cities in the county: Ellensburg, Cle Elum, South Cle Elum, Kittitas, and Roslyn. Of these five cities, the largest population center is Ellensburg with 18,174 residents. The city is located adjacent to the Yakima River in the semi-arid Columbia Plateau ecoregion and surrounded by

irrigated agriculture. The second largest population center in the county is the conglomeration of Cle Elum, South Cle Elum, and Roslyn, located near the Yakima River and Cle Elum River in the North Cascades ecoregion. These three cities have a combined total of 3,222 residents. In comparison, the Alkali – Squilchuck (WRIA 40) basin has approximately 192 residents, while the Naches basin is unpopulated. (U.S. Census 2010). Figure 2-4 shows population densities in Kittitas County for 2010 based on United States Census blocks.

Figure 2-4. 2010 population density in Kittitas County.



Source: United States Census Bureau

2.1.1 Upper Yakima Basin (WRIA 39)

The Upper Yakima basin (WRIA 39) is 2,139 square miles in size, with 1,816 square miles in Kittitas County. The basin lies within all four ecoregions covering Kittitas County and drains into the Yakima River, which flows 214 miles from its headwaters near the Cascade Crest above Keechelus Lake, southeastward to its confluence with the Columbia River, south of the city of Richland in Benton County. The boundary between the Upper and Lower Yakima basins is at the confluence of the Yakima and Naches River, north of the city of Yakima in Yakima County. The Upper Yakima basin in Kittitas County contains 17 subbasins, 7 of which drain into shorelines of the state or shorelines of statewide significance that have confluences with the Yakima River, as shown in Figure 2-5. Three of these subbasins, Lake Cle Elum, Teanaway River, and Swauk Creek, are almost all entirely contained within the North Cascades ecoregion and have streams with confined channels. Taneum Creek is almost entirely located in the Eastern Cascades Slopes and Foothills ecoregion. Manastash Creek, Wilson - Naneum, and Kittitas subbasins have confined channels at their headwaters in the Eastern Cascades Slopes and Foothills ecoregion, which then empty out onto low-gradient alluvial fans in the Columbia Plateau ecoregion before reaching their confluence with the Yakima River.

There are three large glacially formed lakes near the headwaters of the Yakima River that have been converted to reservoirs, which regulate the flow of the Yakima River and part of the Cle Elum River. These include Keechelus and Kachess Lakes in the Easton subbasin and Cle Elum Lake in the Lake Cle Elum basin.

2.1.2 Naches Basin (WRIA 38)

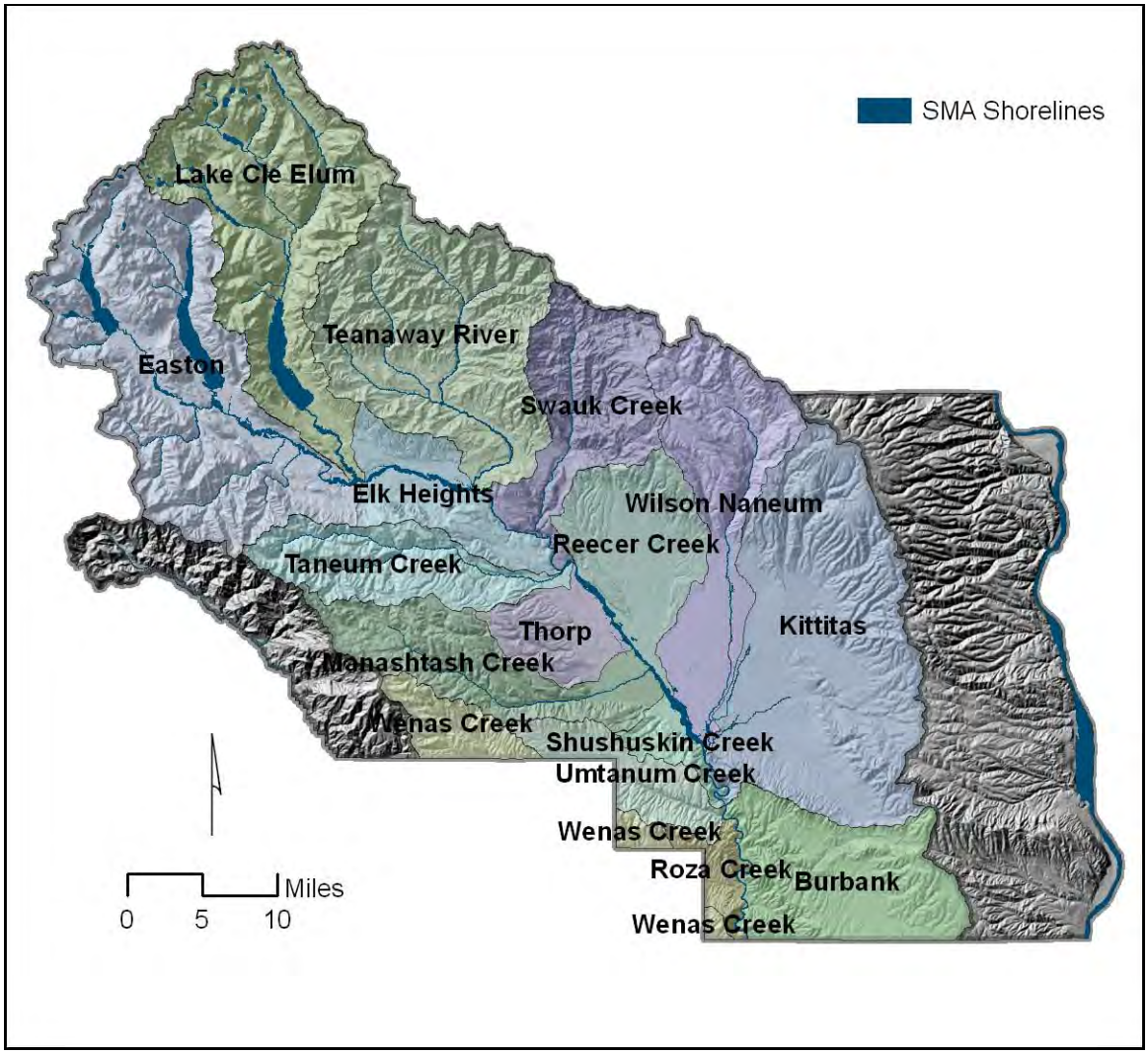
The Naches basin (WRIA 38) is 1,105 square miles in size and drains into the Naches River, which originates in the crest of the Cascade Mountains as the Little Naches River. The Naches River begins at the confluence of the Little Naches and Bumping Rivers and empties in the Yakima River north of the city of Yakima in Yakima County. The 112 square miles of the Naches basin within Kittitas County drain into the Little Naches River, which is approximately 20 miles long with 14 miles forming a portion of the county's southwestern border.

2.1.3 Alkali – Squilchuck Basin (WRIA 40)

The Alkali – Squilchuck basin (WRIA 40) is 842 square miles in size with 403 square miles in Kittitas County. The basin drains into the Columbia River, which in most of Kittitas County is a reservoir behind Wanapum Dam. The Alkali – Squilchuck basin is almost entirely within the Columbia Plateau ecoregion with the exception of a small portion in the northwest that is part of the Eastern Cascades Slopes and Foothills

ecoregion. Upstream of Kittitas County the river has its headwaters on the west slopes of the Rocky Mountain Range and drains portions of British Columbia, Washington, Idaho, and Montana.

Figure 2-5. Subasins of the Upper Yakima Basin.



2.2 Climate, Geology, and Landforms

2.2.1 Climate

The climatic conditions of Kittitas County range from alpine near the summit of the Cascade Range, to arid in the lower valleys. The eastern slopes of the Cascade Range lie in a rain shadow from westerly Pacific Ocean storms. In the summer, westerly winds from the Pacific are weak and the rain shadow effect is most pronounced.

Conversely, in winter, the westerly winds are strongest causing moisture to spill over the mountains (Ferguson 1999). Mean annual precipitation ranges from 140 inches near the Cascade Crest to 7 inches near the Columbia River (Table 2-1). Sixty-one to 81 percent of the annual precipitation falls from October to March, both in the alpine and arid regions of the basin. Mountainous areas in the Upper Yakima and Naches basins receive most of their precipitation in the form of snow from November to March, and as rain during the rest of the year. Snowpack is generally retained through late spring with isolated areas of perennial snow fields remaining all year in the mountains (Pearson 1985). Chinook winds (i.e., warm air that descends down the eastern slopes of the Cascades) and rain-on-snow events often cause rapid melting of the snowpack, which can lead to severe soil erosion and stream channel flooding in the valleys (Reclamation 2002).

Table 2-1. Mean-annual precipitation by Upper Yakima River subbasin, 1951-1980. (Source: Rinella et al. 1991.)

Subbasin	Mean Annual Precipitation (inches)
Cle Elum	80-140
Easton	40-80
Upper Naches	
Teanaway River	20-40
Swauk Creek	
Elk Heights	
Taneum Creek	
Manastash Creek	
Wilson Creek	10-20
Reecer Creek	
Thorp	
Umtanum Creek	
Wenas Creek	
Burbank Creek	
Roza Creek	

2.2.1.1 Upper Yakima

Near the Cascade Crest, average maximum monthly temperatures at Stampede Pass ranged from 29.1 to 65.2° F. The lowest average monthly minimum temperature was 21.0°F. Average annual precipitation totaled 87.8 inches with an annual average snowfall of 439.3 inches (1944 to 2012 period of record) (Western Regional Climate Center 2012).

At Cle Elum, average maximum monthly temperatures ranged from 34.8 to 81.4°F. The lowest average monthly minimum temperature was 19.8° F. Average annual precipitation totaled 22.51 inches with an annual average snowfall of 83.3 inches (1899 to 2012 period of record) (Western Regional Climate Center 2012).

At the lowest elevations of the Upper Yakima basin in Ellensburg, average maximum monthly temperatures ranged from 34.2 to 84.0°F. The lowest average monthly minimum temperature was 18.7°F. Average annual precipitation totaled 8.89 inches with an annual average snowfall of 27.4 inches (1899 to 2012 period of record) (Western Regional Climate Center 2012).

2.2.1.2 Naches

The Naches basin within Kittitas County has a climate similar to North Cascades ecoregion areas of the Upper Yakima basin. Higher elevation climate is much like Stampede Pass and lower elevations are similar to Cle Elum.

2.2.1.3 Alkali-Squilchuck

On the southeastern edge of the Alkali-Squilchuck basin, at Trinidad, the average maximum monthly temperatures ranged from 34.9 to 92.1°F. The lowest average monthly minimum temperature was 20.6°F. Average annual precipitation totaled 7.77 inches with an annual average snowfall of 22.8 inches (1902 to 1961 period of record) (Western Regional Climate Center 2012).

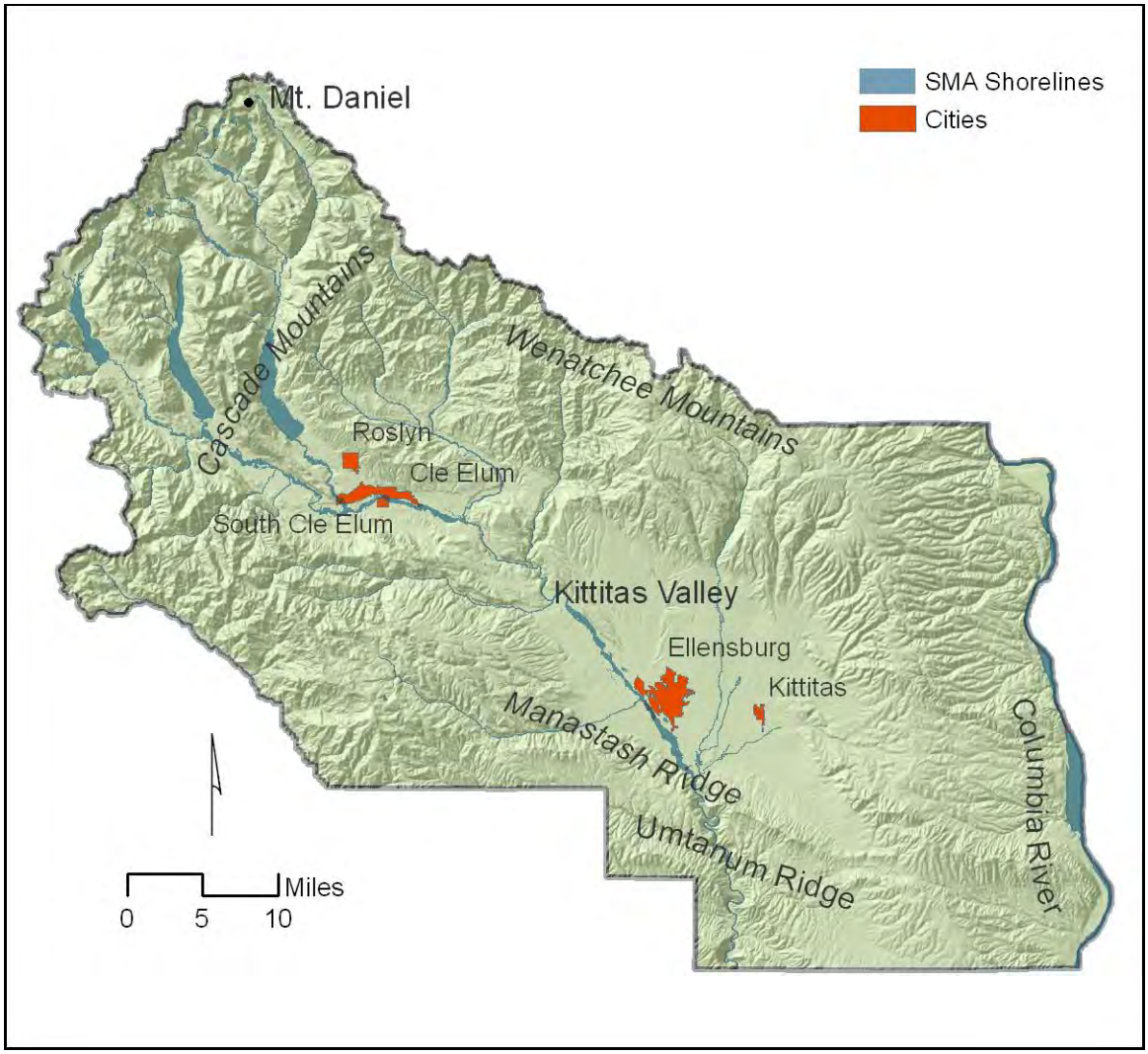
Average maximum monthly temperatures at Priest Rapids Dam, roughly 9 miles south of Kittitas County on the eastern edge of the basin, ranged from 40.5 to 91.4°F. The lowest average monthly minimum temperature was 27.1°F. Average annual precipitation totaled 6.99 inches with an annual average snowfall of 5.9 inches (1902 to 1961 period of record) (Western Regional Climate Center 2012).

2.2.2 Geology and Landforms

The geology of Kittitas County can be spatially grouped by two broad physiographic regions: the Cascade Mountains and the Columbia Plateau. Figure 2-6 shows the major landforms in Kittitas County. The Cascade Mountains are in the west and northwest portion of the county and contain the upper valley of the Yakima River surrounding Cle Elum. Elevation ranges from 6,000 feet or more in the mountains to 1,900 feet around Cle Elum. The highest point in the county, Mount Daniel, at 7,986 feet, is in this region. The Columbia Plateau is in the eastern portion of the county and contains the lower valley of the Yakima River, which surrounds Ellensburg and is locally referred to as the Kittitas Valley. Kittitas Valley, in the Upper Yakima basin, is at an elevation of approximately 1,600 feet. It is formed by the Wenatchee

Mountains, approximately 5,000 feet in elevation, along its northern edge, and Manastash and Umtanum Ridges paralleling the southern edge, averaging 2,500 to 2,800 feet in elevation.

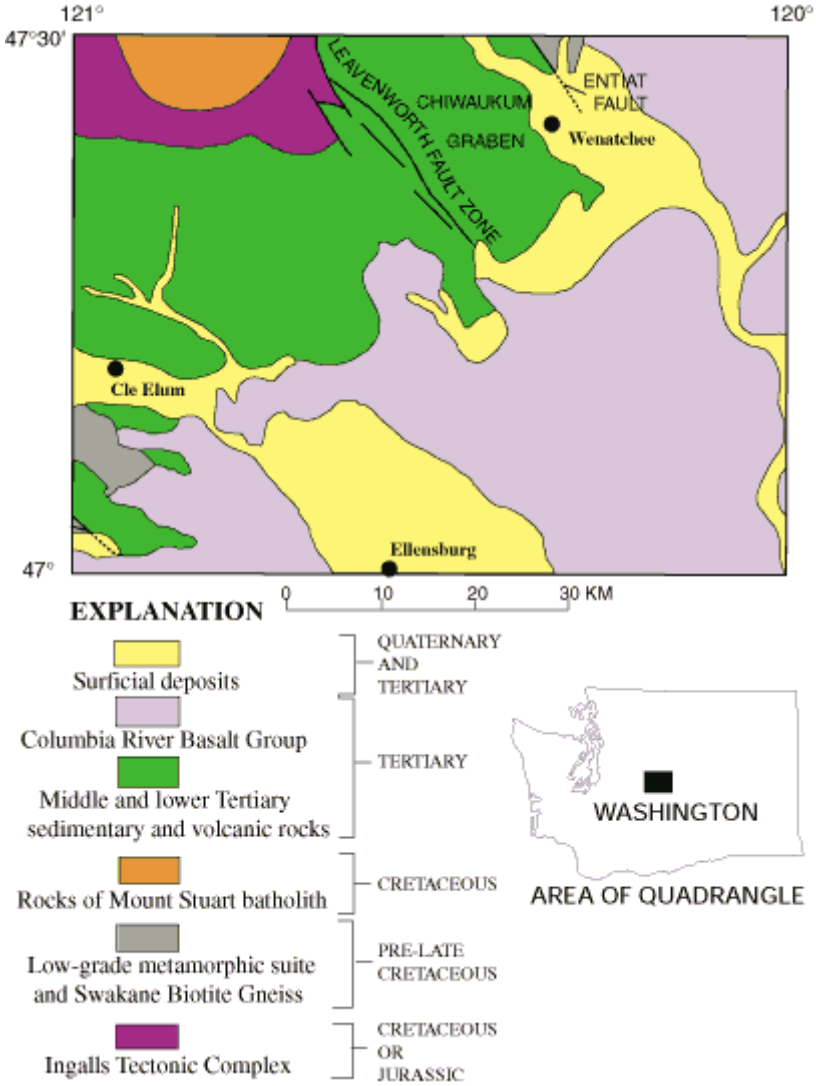
Figure 2-6. Major landforms in Kittitas County.



The Cascade Mountains, in the western portions of the Upper Yakima and Naches basins, are primarily composed of igneous, sedimentary and metamorphic rocks of varying ages (Reclamation 1979). East of the Cascades, the Columbia Plateau, which contains the eastern portions of the Upper Yakima basin and the entire Alkali-Squilchuck basin, is underlain by flows of the Columbia River Basalt Group, which are interfingered with sandstones, siltstones, and conglomerates of the Ellensburg Formation that are derived from sediment eroded or erupted from the Cascade

Range (Kittitas County 2004). Figure 2-7 shows the generalized geologic formations of the region.

Figure 2-7. Generalized Geologic Map of the Wenatchee 1:100,000 quadrangle



Source: Tabor et al.

The Kittitas Valley and the Wenatchee Mountains are a valley and ridge system resulting from the Yakima Fold Belt, as are Manastash and Umtanum Ridges. Regional tectonic stresses created the southeast-trending ridges and valleys, and these stresses are likely still active today (Reidel et al. 1994).

Kittitas Valley is filled with alluvial material derived from the surrounding basalt mountains and glacial deposits. Pleistocene-age glaciers originating in the Upper Yakima basin contributed sediment from their source to the Kittitas Valley. Younger,

post-glacial sediments are derived from the surrounding basalt mountains. The alluvial fans and deposits in the valley are composed of these sediments (Kittitas County 2004).

Along the Columbia River, in the Alkali-Squilchuck basin, basalt forms steep cliffs and talus slopes that extend to the shoreline. The talus is primarily composed of sand-, gravel-, cobble- and boulder-sized basalt resulting from freeze-thaw spalling of cliff faces. Other deposits along the Columbia River shoreline include alluvium, alluvial fans, dune sand, loess, artificial fill, and riprap. The alluvium is composed of clay, silt, sand, and gravel from reworked loess, flood deposits, and other sediment formations. Dune sands consist of deep, well-drained soils along the margins of alluvial floodplains (FERC 2006).

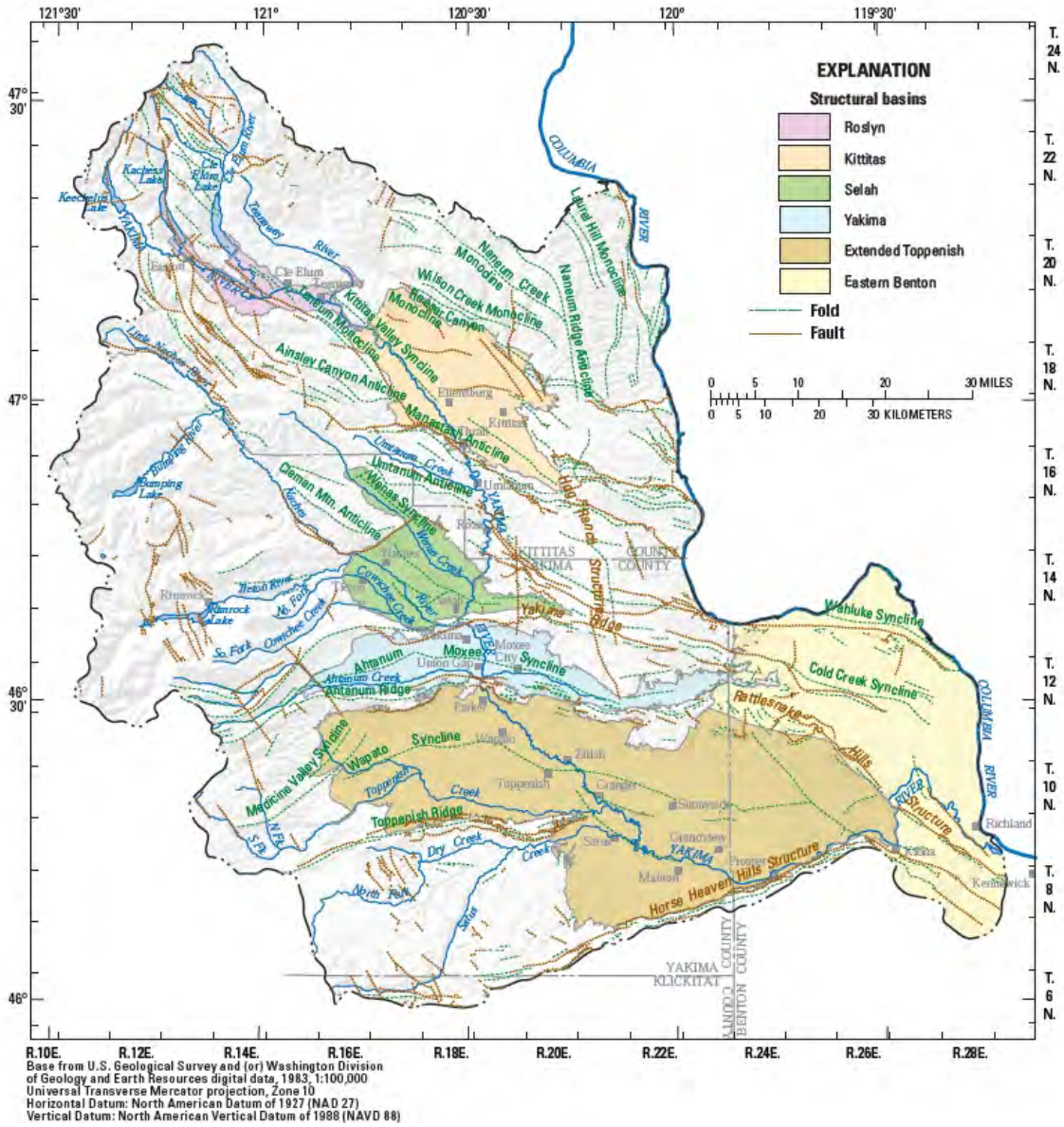
Recharge potential, or the likelihood that water will infiltrate through surface materials into the underlying aquifer system, is dependent on four physical conditions: soil permeability, surficial geologic materials, depth to water, and topography. Yakima River basin aquifers are recharged by infiltration of surface and irrigation water, precipitation, and upward migration of water from deeper aquifers. Recharge zones for basalt aquifers are along ridges and in areas of higher altitude, where basalt is exposed at the surface. Recharge rates are moderate or high, with the most infiltration taking place where interbeds, fractures, and other permeable zones surface. Recharge rates in post-basalt aquifers are considered moderate, except in areas north and northwest of Ellensburg, where the recharge rate is low. Recharge rates in the unconsolidated aquifers are variable. Areas dominated by alluvial deposits have high recharge rates, while areas dominated by aeolian or glacial deposits show moderate to low rates of infiltration (Wyrick et al. 1995).

In Kittitas County, folding and faulting affect the direction of regional groundwater flow, influence hydraulic gradients, and can create flow channels or barriers. Some faults of the Yakima Fold Belt have been identified as hydraulic barriers, while others have proven to be conductive and may connect deep basalt formations with shallower aquifers and surface springs. Folding of this nature increases the frequency of fractures on ridges, enhancing aquifer hydraulic conductivity (Reclamation and Ecology 2011a).

The Roslyn and Kittitas structural groundwater basins are situated in the western portion of the Upper Yakima basin. The Roslyn basin includes the Cle Elum River and reservoir, Keechelus and Kachess reservoirs, the Teanaway River and Swauk Creek, as shown in Figure 2-8 (Reclamation and Ecology 2011a). Covering about 70 square miles, the Roslyn basin is composed of alluvial, lacustrine, glacial, fine-grained lacustrine clay, silt, coarse-grained sand, and gravel deposits. The thickness of the Roslyn basin ranges from zero to 700 feet. The Roslyn basin, as well as the northwestern reaches of the county (including the Naches basin), is situated over older, undefined bedrock.

The Kittitas basin includes Taneum, Wilson, Naneum, and Manastash Creeks (Reclamation and Ecology 2011a), in the eastern portion of the Upper Yakima basin. Covering approximately 270 square miles, the Kittitas basin is composed of floodplain alluvial deposits, loess, glacial terrace, Thorp gravel deposits, Ellensburg formation, and undefined continental sedimentary deposits. The thickness of the Kittitas basin ranges from zero to 2,120 feet (Ely et al. 2011). The Kittitas basin, as well as the eastern and southeastern reaches of the county, are situated over the Columbia River Basalt Group (CRBG) and associated interbeds. The thickest underlying hydrogeologic unit of the CRBG is the Grande Ronde basalt, which has been estimated to be as thick as 15,000 feet in the central Yakima River basin (Kahle et al. 2009). The CRGB holds multiple aquifers in various strata and formations, which are collectively called the Columbia Plateau Aquifer System (Reclamation and Ecology 2011a).

Figure 2-8. Structural groundwater basins of the Yakima River basin.



Source: Reclamation and Ecology, 2011.

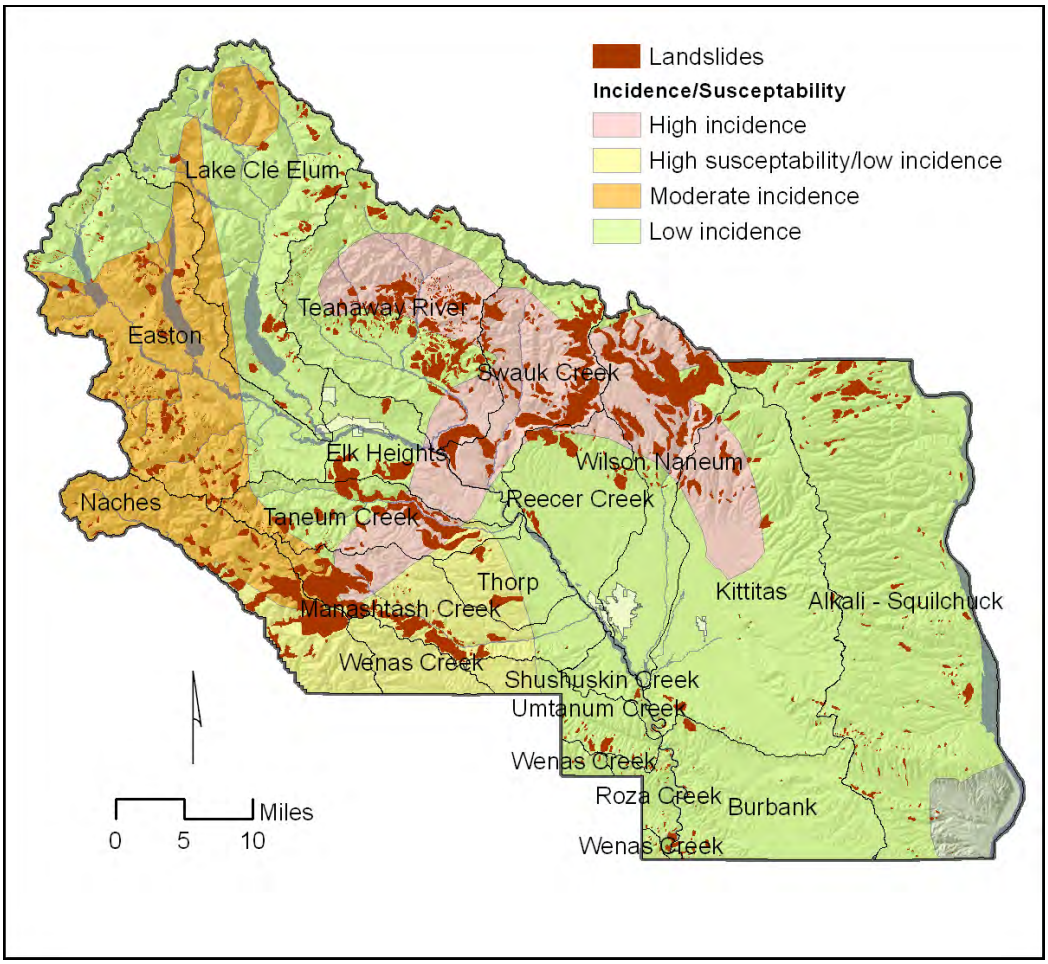
2.2.3 Geologic and Flooding Hazards

2.2.3.1 Landslides

Slopes at the headwaters of the Teanaway River, Wilson - Naneum, and Kittitas subbasins as well as the majority of the Swauk Creek subbasin are identified as having high incidence of landslides. Additionally, the upper Yakima River canyon

between the confluences of the Teanaway River and Swauk Creek with the Yakima River is also identified as having high incidence of landslides (Godt 2001). Large landslides have occurred in the upper canyon area. For example, in 1970 a landslide destroyed a half-mile section of State Route 10 along the river 7 miles northwest of Ellensburg. A year later a second slide of the same size occurred in the same area without any destruction (Daily Record 2010). The Manastash Creek subbasin is identified as having moderate and high landslide incidence near its headwaters, and high susceptibility but low occurrence throughout the remainder of its confined canyon. The lower portion of the Taneum Creek subbasin, where it is still confined before entering the Yakima River valley, is also identified as having areas of high landslide susceptibility, but low incidence of landslides (Godt 2001). Figure 2-9 shows the locations of known active and dormant landslides in the study area as well classified areas of frequency of incidents and susceptibility. Table 2-2 lists the percentage of area in each WRIA and subbasin of active and dormant landslides.

Figure 2-9. Locations of active and dormant landslides and areas of landslide incidence and susceptibility.



Sources: Washington State Department of Natural Resources and Godt 2001

Table 2-2. Area of active and dormant slides by WRIA and subbasin.

Basin	Landslide Area (%)
Alkali – Squilchuck	3.58
Naches	16.03
Upper Yakima	9.04
Burbank	1.33
Easton	5.36
Elk Heights	9.49
Kittitas	2.07
Lake Cle Elum	3.15
Manastash Creek	21.24
Reecer Creek	6.21
Roza Creek	5.24
Shushuskin Creek	1.57
Swauk Creek	24.01
Taneum Creek	19.18
Teanaway River	13.09
Thorp	4.61
Umtanum Creek	3.97
Wenas Creek	0.55
Wilson Naneum	22.50

2.2.3.2 Debris Flows

The lower Yakima River canyon has been identified as an area of low incidence of landslides, but in the recent past it has experienced large debris flows due to high intensity precipitation events. For example, on July 3, 1998, a severe thunderstorm triggered several debris flows in ravines in the canyon that covered State Route 821 in eight separate places. Every ravine draining westward into the Yakima River along a 2-mile section near the north end of the canyon was affected. Six flows reached into the river and one covered almost 60 percent of the river channel. Figure 2-10 depicts three of the slides that occurred on that day. There have been many other debris flows in the same vicinity in the recent past. These events were also triggered by high-intensity storms on August 10, 1952, June 21, 1967, and July 24, 1977 (Kaatz 2001).

Figure 2-10. July 3, 1998 debris flows in the Yakima River canyon.

Source: Kaatz 2001.

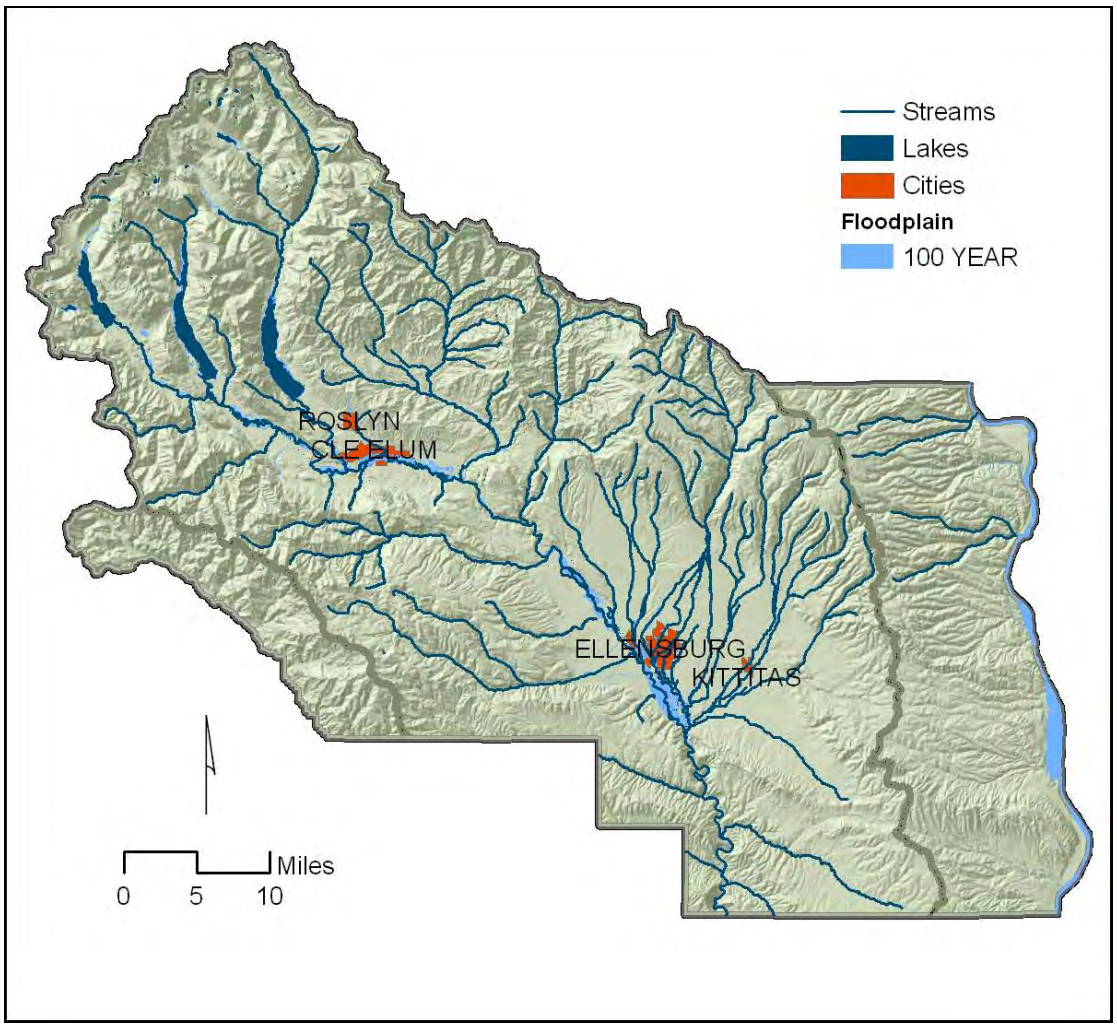
2.2.3.1 Flooding

Flooding is a natural process that is integral to functioning river ecosystems. Floodplains support high levels of biodiversity and primary productivity, provide off-channel refuge habitat for fish, attenuate flood damage, filter surface waters, and allow for groundwater recharge (Opperman et al. 2010).

Despite these benefits, however, flooding can pose a hazard to people and property. The most extensive areas of flood hazard in Kittitas County are located in the unconfined reaches of the Yakima River near the populated areas of Cle Elum and

Ellensburg. The widest portion of the Yakima River's 100-year floodplain is in the lower section of the Upper Yakima basin near Ellensburg, north of the confines of the lower Yakima River canyon. At its maximum width, just south of Ellensburg, the floodplain is approximately 1.5 miles wide. Immediately adjacent to Ellensburg, extensive hydromodifications as well as Interstate 90 confine the floodplain. Near Cle Elum the floodplain is much less extensive, approximately one-third of the maximum width near Ellensburg. Figure 2-11 shows the extent of the 100-year floodplain in Kittitas County.

Figure 2-11. Location of the 100-Year floodplain in Kittitas County.



Source: Federal Emergency Management Agency

Flooding has also been a concern in the lower Teanaway River. Several bridges on county and state roads cross the Teanaway River, forming constrictions to the flow of floodwater. Entrained sediment from mass wasting sites upstream is deposited at these constrictions, increasing the hazard of flooding. Additionally, transportation

infrastructure, bank hardening, and other types of hydromodifications have disconnected the river from portions of the historic floodplain (Molash et al. 2011). Disconnection reduces the ability of the entire system to absorb flood events and increases stream velocity.

Manastash Creek and streams in the Wilson - Naneum and Kittitas subbasins do not have extensive floodplains, but they do cross low-gradient alluvial fans after spilling out of higher gradient canyons. Alluvial fans form where an upland catchment drains into a valley and sufficient sediment material is available to form a fan. Sediment from landslides in the upland is deposited on the fan when it is entrained by high-energy streamflows and carried downstream. The sediment is dropped on the valley floor where the gradient changes and stream energy is reduced, creating a cone-shaped fan with a convex form. Fans often have a single incised channel, but during times of high flow or when sediment or woody debris dams a channel, it can avulse and form a distributary channel, reclaim an abandoned channel, or begin sheet flow across the surface. This results in a radial pattern of active and abandoned channels (NRC 1996). This type of stream pattern can make it difficult to predict where flooding will occur. The slopes in the canyons above these fans are identified as having high incidents of landslides that can provide sediment for transport during high flow such as rain-on-snow events or unusually intense localized rainfall. Rain-on-snow events have caused repeated flooding of Manastash, Naneum, and Wilson Creeks in the past (Daily Record 2011, 1974). Figure 2-12 shows the incised stream channel of Manastash Creek in the background and the braided channels created by avulsions in the foreground during a flood event in May 2011.

Figure 2-12. Manastash Creek and channel avulsions on Manastash alluvial fan.

Source: Kittitas County Public Works

2.3 Vegetation and Land Cover

Vegetation and land cover in Kittitas County are highly variable. Vegetative cover is influenced primarily by soils, moisture, and temperature, all of which vary topographically. Most of the western portion of the county is forested; near the Cascade Crest, this area also contains permanent snowfields, alpine meadows, and some areas of serpentine soils that support rare plant communities (USGS 2011). As precipitation decreases in an eastward gradient following the rain shadow of the Cascade Mountains, the dominant forest composition shifts from hemlock and fir, to pine species. At lower elevations in the eastern part of the county, shrub-steppe dominates the natural vegetation and irrigated agriculture is abundant on the Yakima River valley floor. Higher elevations within this region retain winter snowpack longer into the spring and are forested, primarily by pine and spruce. Figure 2-13 shows the major ecological systems in Kittitas County.

Figure 2-13. Major ecological systems in Kittitas County.

2.3.1 Major Montane Ecological Systems

2.3.1.1 North Pacific Mountain Hemlock Forest

Hemlock forests are found near the Cascade Crest and at high elevations, below subalpine parkland and alpine zones. *Tsuga mertensiana* (mountain hemlock) and *Abies amabilis* (Pacific silver fir) are the characteristic dominant tree species (Rocchio and Crawford 2008). These forests are predominantly located in the Upper Yakima basin in the Easton and Lake Cle Elum subbasins (USGS 2011).

2.3.1.2 Northern Rocky Mountain Subalpine Woodland and Parkland

This ecological system is widely distributed at high elevations and forms a mosaic of stunted tree clumps, open woodlands, and herb or dwarf-shrub-dominated openings occurring above closed forest ecosystems and below alpine communities. The system includes open areas with clumps of *Pinus albicaulis* (whitebark pine) and woodlands dominated by *Pinus albicaulis* or *Larix lyallii* (subalpine larch), which are found in the Upper Yakima basin in the northern portions of the Easton, Lake Cle Elum, and Teanaway subbasins (Rocchio and Crawford 2008, USGS 2011).

2.3.1.3 North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-Fir Forest

This ecological system also occurs near the Cascade Crest, mainly east of the North Pacific Mountain Hemlock Forests**.** Here *Tsuga heterophylla* (western hemlock) and *Abies amabilis* (Pacific silver fir) or *Abies procera* (noble fir) dominate the canopy with *Pseudotsuga menziesi* (Douglas-fir) interspersed (Rocchio and Crawford 2008). These forests are found in the Upper Yakima basin in the Easton, Lake Cle Elum, and western Teanaway River basins as well as the western portion of the Naches basin (USGS 2011).

2.3.1.4 East Cascades Mesic Montane Mixed-Conifer Forest and Woodland

East of the North Pacific Dry-Mesic Silver Fir-Western Hemlock-Douglas-Fir Forest**,** where precipitation decreases to 40 to 80 inches annually, land cover is dominated by *Tsuga heterophylla, Abies grandis* (grand fir) and *Pseudotsuga menziesii* between 2,000 and 4,000 feet. Common shrubs include *Mahonia nervosa* (dwarf Oregon-grape), *Paxistima myrsinites* (Oregon boxleaf)*, Acer circinatum* (vine maple)*, Spiraea betulifolia* (white spiraea)*, Symphoricarpos hesperius* (trailing snowberry)*, Rubus parviflorus* (thimbleberry), and *Vaccinium membranaceum* (thinleaf huckleberry)

(Rocchio and Crawford 2008). These forests are prevalent in the Upper Yakima basin in Easton, Lake Cle Elum, Teanaway River, Taneum Creek, and portions of the Swauk Creek and ElkHeights subbasins as well as throughout most of the Naches basin (USGS 2011).

2.3.1.5 Northern Rocky Mountain Dry Mesic Montane Mixed Conifer Forest

Continuing eastward, vegetative land cover transitions to *Pseudotsuga menziesii* and *Pinus ponderosa* (ponderosa pine) with understories of graminoids such as *Pseudoroegneria spicata* (bluebunch wheatgrass), *Calamagrostis rubescens* (pinegrass), *Carex geyeri* (elk sedge), and *Carex rossii* (Ross' sedge) (Rocchio and Crawford 2008). These forests are found along a north to south band within the central portion of the Upper Yakima basin in the Teanaway River, Elk Heights, Taneum Creek, Manastash Creek, and Wenas Creek subbasins. They also dominate the northern high elevations of the Swauk Creek, Wilson Naneum, and Kittitas subbasins (USGS 2011).

2.3.1.6 Rocky Mountain Subalpine Dry Mesic Spruce Fir Forest and Woodland

At elevations above the eastern *Pseudotsuga menziesii* and *Pinus ponderosa* forests, Rocky Mountain Subalpine Dry Mesic Spruce Fir Forest and Woodland occur. Tree canopies are dominated by *Picea engelmannii* (Engelmann spruce) and *Abies lasiocarpa* (subalpine fir) either mixed or alone. Mixed conifer/*Populus tremuloides* (quaking aspen) stands and *Mahonia repens* (creeping mahonia) are not uncommon (Rocchio and Crawford 2008). This system is found mainly on ridgetops in the Upper Yakima basin in the northern portions of Lake Cle Elum and Teanaway River subbasins, the western high elevations of the Taneum Creek and Manastash Creek subbasins, and the upper elevations of Wilson -Naneum subbasin as well as the northeastern high elevations of the Naches basin (USGS 2011).

2.3.1.7 North Pacific Alpine and Subalpine Dry Grassland

At elevations above the Northern Rocky Mountain Dry Mesic Montane Mixed Conifer Forest and Rocky Mountain Subalpine Dry Mesic Spruce Fir Forest and Woodland forests, North Pacific Alpine and Subalpine Dry Grassland are found. The dominant species is *Festuca idahoensis* (Idaho fescue), intermixed with forbs (Rocchio and Crawford 2008). These grasslands are limited to small areas at some of the highest elevations supporting vegetation in the Upper Yakima basin in the Easton, Lake Cle

Elum, Teanaway River, Taneum Creek, and Manastash Creek subbasins as well as the Naches basin (USGS 2011).

2.3.1.8 Northern Rocky Mountain Ponderosa Pine Woodland and Savanna

These woodlands and savannas occur at the lower treeline/ecotone between grasslands or shrublands at lower elevations and more mesic coniferous forests at higher elevations. *Pinus ponderosa* is the predominant conifer, though *Pseudotsuga menziesii* may be present in the tree canopy. The understory can be shrubby, with *Artemisia tridentate* (big sagebrush), *Arctostaphylos uva-ursi* (kinnikinnick), *Physocarpus malvaceus* (mallow ninebark), *Purshia tridentate* (bitter brush), *Symphoricarpos albus* (common snowberry), *Prunus virginiana* (chokecherry*)*, *Amelanchier alnifolia (*western serviceberry), and *Rosa* spp. (rose) being common. More open stands support grasses such as *Pseudoroegneria spicata*, *Hesperostipa* spp. (needle and thread), *Achnatherum* spp. (Indian ricegrass), or *Festuca idahoensis*. The more mesic portions of this system may include *Calamagrostis rubescens* or *Carex geyeri* (Rocchio and Crawford 2008). These forests are concentrated in a narrow band at elevations just above the shrub-steppe ecotone primarily in the Upper Yakima basin in the Wenas Creek, Manastash Creek, Thorp, Elk Heights, Swauk Creek, Reecer Creek, Wilson - Naneum, and Kittitas subbasins (USGS 2011).

Ponderosa pine habitat was historically extensive in the inland Northwest. Logging, grazing, invasive species, and fire suppression over the past century have led to the decline of old-growth ponderosa pine forests and their replacement with younger Douglas-fir-dominated forest. Wildlife species such as the white-headed woodpecker and Lewis' woodpecker depend on and are considered indicator species for healthy ponderosa pine forests (YSFWPB 2004).

Mixed stands of ponderosa pine-Oregon white oak (*Quercus garryana*) occur east of the Cascade Mountains, as far north as the Yakama Nation. Oak-dominated woodlands in eastern Washington are more restricted to drier sites transitioning to shrub-steppe or grassland (Johnson and O'Neil 2001).

Oregon white oak is the only native oak species in Washington. Numerous wildlife species are closely associated with oak habitats, such as woodpeckers, neotropical migrant birds, reptiles, and several oak-obligate invertebrate species. Human activities have led to significant declines in oak habitat over the past century. Major impacts have included fire suppression, urban development, agriculture, cutting of oaks for firewood, and livestock grazing (Larsen and Morgan 1998).

2.3.2 Shrub-Steppe Ecological Systems

Shrub-steppe was historically an abundant habitat type, covering over 10 million acres in Washington before the 1800s. With the development of irrigation systems, much of this habitat was converted to agriculture. Approximately 40 percent of the historic shrub-steppe acreage remains today, and this habitat is considered a rare and unique ecosystem. Numerous wildlife species are closely associated with shrub-steppe habitat, such as the Brewer's sparrow and greater sage grouse (YSFWPB 2004).

The largest remaining areas of shrub-steppe are located on the Yakima Training Center, the Yakama Nation Reservation, the Hanford Nuclear Reservation, and several WDFW-owned properties. Scattered shrub-steppe areas also remain on private land, particularly on steep ridges within ranchland. The diversity of native plants and wildlife in the remaining shrub-steppe habitats is impacted by overgrazing, invasive vegetation, wildfires, and habitat fragmentation (YSFWPB 2004).

Shrub-steppe systems occur as a complex mosaic in eastern Kittitas County, as described below.

2.3.2.1 Columbia Plateau Scabland Shrubland

These open dwarf-shrublands occur on sites with little soil development and extensive areas of exposed rock, gravel, or compacted soil. Total vegetation cover is typically low, generally less than 50 percent, and is dominated by *Artemisia rigida* (rigid sagebrush) along with other shrub and dwarf-shrub species, particularly *Eriogonum spp.* (buckwheat) as well as scattered forbs, including species of *Allium* (onion), *Antennaria* (pussytoes), *Balsamorhiza* (balsamroot), *Lomatium* (desert-parsley), *Phlox* (phlox), and *Sedum*(stonecrop) (Rocchio and Crawford 2008).

2.3.2.2 Inter-Mountain Basins Big Sagebrush Shrubland

Big sagebrush shrublands are found in broad basins between mountain ranges, on plains and in foothills between 4,900 and 7,550 feet, and are dominated by *Artemisia tridentate* (basin big sagebrush). Other common shrubs include *Purshia tridentata* (antelope bitterbrush), *Chrysothamnus viscidiflorus* (yellow rabbitbrush), and *Symphoricarpos oreophilus (*mountain snowberry). Perennial herbaceous cover is typically less than 25 percent. Common graminoid species can include *Achnatherum hymenoides, Elymus lanceolatus* (thickspike wheatgrass), *Festuca idahoensis*, *Hesperostipa comate, Leymus cinereus* (basin wildrye), *Poa secunda* (Sandberg bluegrass), or *Pseudoroegneria spicata* (Rocchio and Crawford 2008).

2.3.2.3 Inter-Mountain Basins Big Sagebrush Steppe

This system is primarily grassland with scattered shrubs, dominated by perennial grasses and forbs (more than 25 percent cover). Shrubs include *Artemisia spp.* (sagebrush*)* and/or *Purshia tridentataI* (bitterbrush) in an open to moderately dense shrub layer with 25 percent or more total perennial herbaceous cover, distinguishing it from Inter-Mountain Basins Big Sagebrush Shrubland which has more shrubs and less grass (Rocchio and Crawford 2008).

2.3.2.4 Inter-Mountain Basins Montane Sagebrush Steppe

These grassy shrublands are found on mountain foothills and slopes, in areas ranging from deep soils to shallow stony flats and ridgetops. In general, this system shows an affinity for mild topography, fine soils, some source of moisture in the soil or more mesic sites, zones of higher precipitation, and areas of snow accumulation. This is a diverse system composed primarily of *Artemisia tridentata ssp.* and *Vaseyan (*mountain big sagebrush)*,* but *Purshia tridentata* may codominate*.* Other common shrubs include *Symphoricarpos* spp., *Amelanchier* spp., *Ericameria nauseosa* (rubber rabittbrush)*, Ribes cereum* (wax currant), and *Chrysothamnus viscidiflorus*. Most stands have over 25 percent perennial herbaceous cover. Varied native bunchgrasses are almost always codominant. Higher in the mountains, wildflowers become abundant (Rocchio and Crawford 2008). This system occurs in small areas in the Upper Yakima basin at high elevations in the north of Naneum - Wilson and Kittitas subbasins as well as the northwest high elevations of the Alkali –Squilchuck basin (USGS 2011).

2.3.2.5 Columbia Plateau Steppe and Grassland

This system is composed of extensive grasslands dominated by perennial bunch grasses and forbs (more than 25 percent cover), sometimes with a sparse (below 10 percent cover) shrub layer. These grasslands are composed of *Pseudoroegneria spicata*, *Festuca idahoensis,* often with introduced annual *Bromus tectorum* (cheatgrass) present (Rocchio and Crawford 2008). This system is more dominant in southeastern Upper Yakima basin in the Kittitas and Burbank subbasins and higher elevations on the western edge of the Alkali-Squilchuck basin (USGS 2011).

2.3.2.6 Columbia Basin Foothill and Canyon Dry Grassland

This grassland type is found on steep open slopes with rocky or gravelly soils that have patchy, thin, wind-blown surface deposits. The grassland is dominated by

patchy native bunchgrass cover and some forbs. *Pseudoroegneria spicata* and *Festuca idahoensis* are common species. Occasional deciduous shrubs include *Symphoricarpos* spp., *Holodiscus discolor* (oceanspray), *Rhus glabrum* (smooth sumac), and *Ribes* spp. (currant) (Rocchio and Crawford 2008). This system is distributed at mid-elevations in Thorp, Manastash Creek, Sushuskin, Umtanum Creek, Roza Creek, and Kittitas subbasins and the Alkali-Squilchuck basin (USGS 2011).

2.3.3 Riparian Ecological Systems

Riparian areas were not historically widespread in this arid region, but they have declined from approximately 2 percent to 0.5 percent of the landscape in the inland Northwest. Riparian areas have been affected by altered stream flow regimes, reduction in beaver populations, overgrazing, and invasive vegetation. Most riparian systems of the Columbia Plateau have been degraded, but some high-quality areas remain (YSFWPB 2004). The mosaic of different riparian habitats is discussed below.

2.3.3.1 Columbia Basin Foothill Riparian Woodland and Shrubland

This system is found primarily in the Eastern Cascades Slopes and Foothills and Columbia Plateau ecoregions in the low-elevation canyons and draws or on floodplains. It is characterized by *Populus balsamifera* ssp. *trichocarpa* (black cottonwood), *Alnus rhombifolia* (white alder), *Populus tremuloides* (quaking aspen), *Betula occidentalis* (water birch), and *Pinus ponderosa*. Important shrubs include *Crataegus douglasii* (black hawthorn), *Philadelphus lewisii* (mock orange), *Cornus sericea* (redosier dogwood), *Salix lucida* spp. *lasiandra* (Pacific willow), *Rosa nutkana* (Nootka rose), *Rosa woodsii* (Woods' rose), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (choke cherry), and *Symphoricarpos albus* (Rocchio and Crawford 2008).

2.3.3.2 North Pacific Montane Riparian Woodland and Shrubland

At higher elevations on steep streams and narrow floodplains above the foothills, but below the alpine environments, riparian areas are dominated by *Pinus contorta var. murrayana* (lodgepole pine), *Populus balsamifera* spp. *trichocarpa, Populus tremuloides, Alnus incana ssp. tenuifolia* (thinleaf alder), *Alnus viridis* spp. *crispa* (green alder), *Alnus viridis* ssp. *sinuata* (Sitka alder), *Alnus rubra* (red alder), *Rubus spectabilis* (salmonberry), *Ribes bracteosum* (stink currant), *Oplopanax horridus*

(devilsclub), *Acer circinatum*, and several *Salix* (willow) species (Rocchio and Crawford 2008).

2.3.4 Upper Yakima Land Cover

The Upper Yakima basin land cover is a mix of forest, shrub-steppe, agriculture, and developed land. Approximately 51 percent of the Upper Yakima basin is forested and 21 percent is regenerating harvested forest. Cultivated crops constitute 6 percent of land cover, and pasture/hay covers an additional 6 percent. Both cover types occur mostly in the Columbia Plateau ecoregion surrounding Ellensburg and in the flat valley bottoms near the city of Cle Elum and in the Teanaway subbasin. Barren rock and ice cover approximately 1 percent of the basin near the Cascade Crest and in the foothills, and open water also constitutes 1 percent coverage.

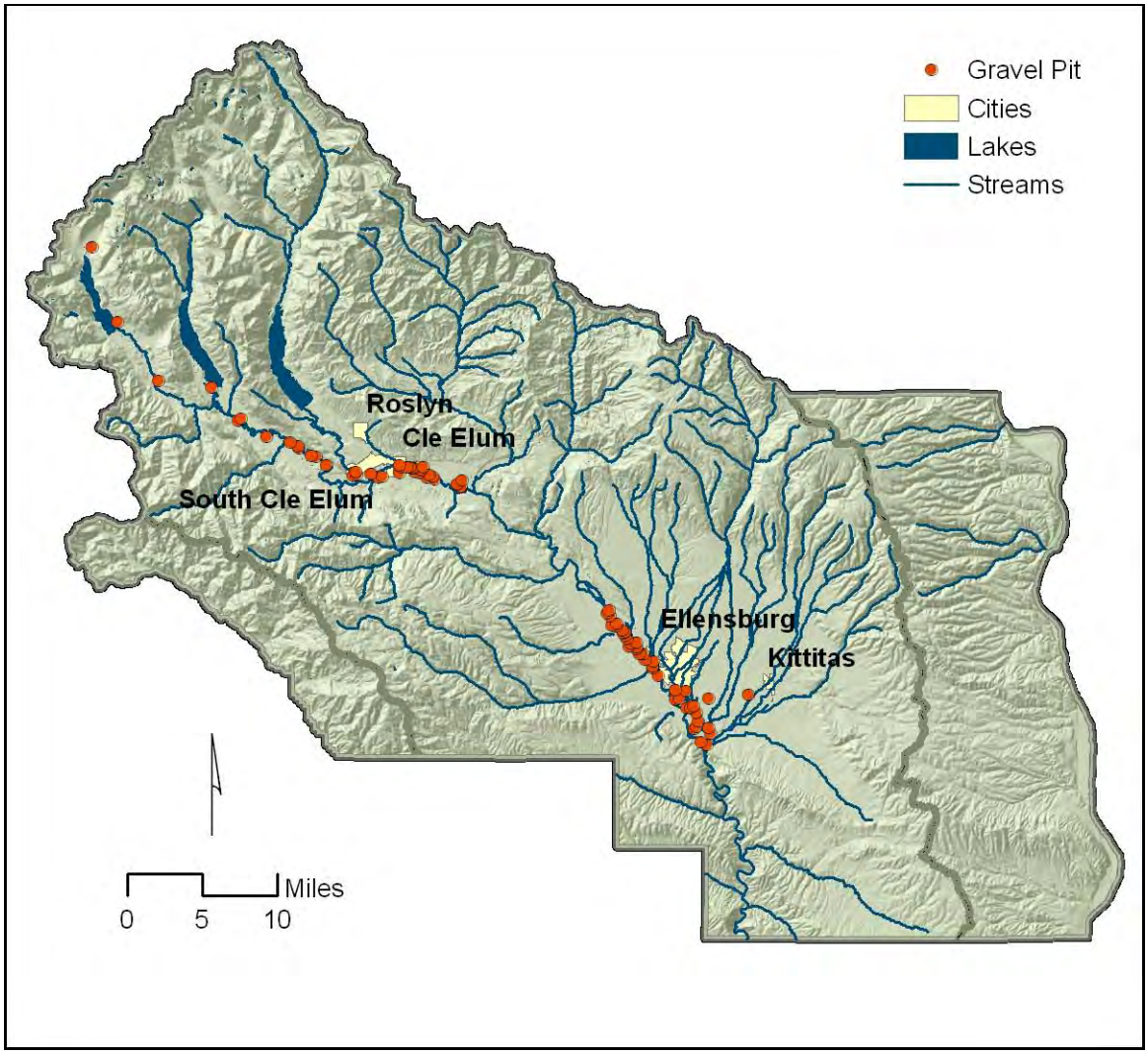
Natural vegetation in the basin is highly variable. Forest cover is dominated by East Cascades Mesic Montane Mixed Conifer Forest and Woodland in the western portion of the basin (14 percent) and Northern Rocky Mountain Dry Mesic Montane Mixed Conifer Forest in the central basin as well as higher elevations in the east (12 percent). Shrub-steppe and grassland constitute 14 percent. The dominant shrub and grassland systems are intermixed and cover fairly equal areas: Columbia Plateau Steppe and Grassland (4 percent) and Columbia Basin Foothill and Canyon Dry Grassland (3 percent), Inter-Mountain Basins Big Sagebrush Shrubland (3 percent), and Columbia Plateau Scabland Shrubland (2 percent) (USGS 2011). Small stands of *Quercus garryana* (Oregon white oak) occur near the Swauk River's confluence with the Yakima River. Although the species is not a dominant vegetation type in the basin, it is unique because it is the northernmost extent of the species east of the Cascades (Nason 2004).

Developed areas constitute a small portion of the basin. Medium- and high-intensity development account for 0.07 percent of land area, and low-intensity development covers 1 percent. Areas either in use or zoned for industrial and light-industrial uses constitute 0.2 percent of the basin and are concentrated in and around the cities of Ellensburg, Cle Elum, and Kittitas. As of 2006, impervious surface covered approximately 1.2 percent of the basin, increasing by 0.02 percent since 2001 (MRLC 2011).

Current mining in the Upper Yakima basin consists of gravel mining and gold mining, but coal mining was a major land use near Roslyn and Cle Elum from the late 1880s to 1960 (YSFWPB 2004). An extensive network of coal shafts is located belowground near the Yakima and Cle Elum Rivers, and large tailings piles still remain above. Gravel mining has been extensive in the Upper Yakima basin. Numerous abandoned gravel pits are located within the Yakima and Cle Elum River

floodplain. As of 2001, active gravel mining was limited to only a few locations. Figure 2-14 shows the locations of abandoned and active gravel mines in the county.

Figure 2-14. Location for active and abandon gravel pits in the Upper Yakima basin.



Gold mining was significant in the Swauk Creek drainage during the late 1800s. Placer and hardrock mining methods significantly altered the lower portion of the Swauk Creek drainage. Historic placer mining in Swauk Creek, beginning in 1870, altered the channel, substrate, and banks. Methods of mining included sluicing, hydraulicing, and dredging. Streambanks and hillsides were hydrauliced to expose aggregate rock for sluicing, which resulted in filled sediment. Dredging was conducted in Swauk Creek in the 1920s and sporadically up until the1950s. Large tailings and piles of boulders left on the banks still remain (Haring 2001). Gold

mining still occurs in the area, but on a much smaller scale (YSFWPB 2004). Most current mining is small-scale suction dredging (Haring 2001).

Recreation is an important land use in the Upper Yakima basin, and includes hunting, fishing, camping, hiking, wildlife viewing, and boating. The forested and shrub-steppe habitats offer hunting for several species during prescribed seasons, including deer, elk, cougar, bear, bighorn sheep, and grouse. The agricultural areas provide hunting for pheasants and quail, while the shrub-steppe offers chukars. The Yakima River from Cle Elum to Roza Dam is a highly regarded catch-and-release trout stream. It is fished from both the streambank and drift boats. There are many designated camping areas on public lands throughout basin, and dispersed camping is prevalent along streambanks in the Lake Cle Elum, Teanaway River, and Manastash Creek subbasins. Boating occurs in many areas of the county. Large power boats utilize the reservoirs near the headwaters of the Yakima River, and both the upper Yakima River canyon above Ellensburg and the lower canyon are popular for rafting and floating. The lower canyon is also a popular wildlife viewing area for bighorn sheep and other species (YSFWPB 2004).

2.3.5 Naches Land Cover

The Naches basin is predominantly forested; only 0.05 percent of the basin in Kittitas County is developed and consists almost entirely of forest roads. One percent is exposed bedrock (USGS 2011). Impervious surface covered 0.2 percent of the basin in 2006 and there was no change in area of cover since 2001 (MRLC 2011). Over 72 percent of land cover is evergreen forest and 21 percent is regenerating harvested forest. Similar to the Upper Yakima basin, the forests are dominated by East Cascades Mesic Montane Mixed-Conifer Forest and Woodland (36 percent) and Northern Rocky Mountain Dry Mesic Montane Mixed Conifer Forest (15 percent) (USGS 2011).

2.3.6 Alkali-Squilchuck Land Cover

The Alkali-Squilchuck basin is dominated by shrub-steppe. Shrub and grassland constitute 82 percent coverage in the basin. Inter-Mountain Basins Big Sagebrush Steppe dominates with 51 percent coverage. The largest grassland system is Columbia Basin Foothill and Canyon Dry Grassland, which makes up 9 percent of the area. Cultivated cropland and pasture/hay covers 2 percent. Three percent of the basin is open water (USGS 2011).

Approximately 10 percent of the basin is forested by Northern Rocky Mountain Ponderosa Pine Woodland and Savanna (8 percent), Rocky Mountain Subalpine Dry Mesic Spruce Fir Forest and Woodland (1 percent), and Northern Rocky Mountain Dry Mesic Montane Mixed Conifer Forest (1 percent) (USGS 2011).

Developed land consists of 0.4 percent of the basin (USGS 2011). Impervious cover in 2006 was 0.4 percent with no change since 2001 (MRLC 2011). There are no industrial land uses or zoned areas in the basin, with the exception of the Wanapum Dam hydroelectric power generation facility.

Recreational land use is also important in the Alkali-Squilchuck basin. Hunting occurs on public land in the northern portion of the basin. Additionally, swimming, boating, and fishing are popular in the Wanapum Dam reservoir.

2.3.7 Transportation Infrastructure

Major highway, rail, and trail infrastructure has been developed in Kittitas County in both the Alkali-Squilchuck and Upper Yakima basins. The majority of the infrastructure is contained in the Upper Yakima basin.

Major east–west transportation routes are provided by Interstate 90, U.S Highway 10, Burlington Northern Santa Fe Railroad, and the John Wayne Heritage Trail. In Kittitas County, Interstate 90 begins at the Columbia River near Vantage, in the Alkali-Squilchuck basin. Farther west, the highway enters the Upper Yakima basin and closely follows the Yakima River. After ascending the east slope of the Cascades, the highway skirts the shores of Keechelus Lake, before leaving the county at Snoqualmie Pass. The former major east–west highway, U.S. Route 10, lies to the north of Interstate 90 and parallels sections of the highway. It connects Ellensburg and Cle Elum, following the Yakima River through the upper Yakima River canyon. Additionally, the Burlington Northern Santa Fe Railroad and the bed of the former Chicago-Milwaukie Railroad, now the John Wayne Heritage Trail, follow the Yakima River before exiting the county near Keechelus Lake. This infrastructure crosses the river multiple times throughout its course in the county. In addition to transportation infrastructure, the construction of revetments, riprap banks, and other hydromodifications have disconnected the river from its floodplains (Vaccaro 2011).

Interstate 82 and U.S. Route 97 provide north–south transportation routes through the county. Interstate 82 intersects with Interstate 90 near Ellensburg. It passes over Manastash and Umtanum Ridges, east of the lower Yakima River canyon. U.S. Route 97 intersects with Interstate 90 near Ellensburg. The highway follows Swauk Creek before leaving the county over Blewett Pass, in the Wenatchee Mountains.

Transportation infrastructure can impact ecological processes by disconnecting streams from their floodplains, restricting channel migration, creating barriers to fish passage, and increasing pollution-generating stormwater runoff. These alterations are discussed in Section 2.7.

2.4 Surface Water and Groundwater

2.4.1 Surface Waters

2.4.1.1 Upper Yakima and Naches Basins

The Upper Yakima River basin drains the Yakima River, including its major tributaries, the Kachess, Cle Elum and Teanaway Rivers. Minor tributaries within the basin include Wilson, Manastash, Taneum, Swauk, Cabin, Big, and Little Creeks. The Naches River basin within Kittitas County drains the Little Naches River, which becomes the Naches River at its confluence with Bumping River. Major tributaries to the Naches River are the American, Bumping, Rattlesnake and Tieton Rivers. Minor tributaries to the Naches River occurring in Kittitas County are Pileup, Quartz, Milk and Gold Creeks (Anderson 2008).

Once glacial lakes, storage reservoirs within the Upper Yakima and Naches basins are Lakes Keechelus, Kachess and Cle Elum (Upper Yakima), and Bumping and Rimrock Lakes (Naches, located outside Kittitas County). Table 2-3 outlines the physical characteristics for each reservoir.

Table 2-3. Physical characteristics for Upper Yakima and Naches River basin reservoirs (Period of Record: 1920-1999). (Source: Reclamation 2002)

Reservoir	Drainage Area (mi^2)	Depth (ft)	Sept 30 Min Historical Storage (acre-ft)	Sept 30 Average Historical Storage (acre-ft)	Sept 30 Max Historical Storage (acre-ft)
Cle Elum	203.0	Max – 258 Mean - 109	12,900	118,000	359,500
Kachess	63.6	Max - 430	20,100	107,200	227,200
Keechelus	54.7	Max – 310 Mean – 96	4,800	40,500	126,900
Bumping	70.7	Max – 117 Mean - 45	2,400	7,900	24,600
Rimrock	187.0	174*	200	74,500	145,100

* =FERC (1990) did not specify whether this is a maximum or minimum depth.

Because snowmelt accounts for a majority of spring and early summer runoff, the snowpack is often referred to as the "sixth reservoir," (Anchor QEA and HDR Engineering 2011). Just 30 percent of the total natural average annual runoff can be stored within these reservoirs; therefore, irrigation projects depend heavily on the

timing of spring/summer runoff (from snowmelt and rainfall). In an average year, water demand through June is met by this spring/summer runoff, after which reservoirs, then at peak storage, can be utilized (Reclamation and Ecology 2011a).

Surface waters at the highest reaches of the Naches and Upper Yakima basins flow through valleys carved by glacial activity. As these basins lose elevation, channels become incised as they move through narrow canyons. The valley floors of Ellensburg hold deep alluvial floodplains made up of glacial outwash materials. As the Upper Yakima basin meets the lower basin, the main channel begins to meander atop open floodplains of wind-blown soils and lake-bottom silts originating from the Missoula Floods (Bretz 1969). Pre-irrigation maps illustrate that the channel system in these basins was much more complex than current conditions, and contained innumerable side channels and dense riparian vegetation. Overbank flows were much more common, with floodwaters infiltrating floodplain alluvia and discharging naturally into channels to sustain summer flows (Parker and Story 1916; Kinnison and Sceva 1963).

The Yakima River basin (including the Upper Yakima and Naches subbasins) generates a mean annual unregulated streamflow (adjusted) of about 5,600 cubic feet per second (cfs). If left unregulated, flows in the Upper Yakima and Naches basins would be dominated by snowmelt with peak discharges occurring in May or June and would then decline to groundwater-dominated flows in August or September. These flows would be augmented by late fall precipitation and further snowmelt, with Chinook winds occasionally causing winter high water events (Conley et al. 2009).

Historic hydrologic exchanges between the river and aquifer systems have been altered as surface flows are used to supply irrigation water to croplands, and associated canals and drainage systems receive the groundwater that would have historically discharged into the stream channel. This produces an annual regulated streamflow of about 3,600 cfs (Vaccaro and Sumioka 2009).

Major floods have often dominated the landscape from mid-November through February. Usually resulting from rain-on-snow events, these floods historically have provided the hydraulic energy to intermittently reshape the river channel. Current reservoir management has reduced the frequency and distribution of these “channel-forming” flood events (Reclamation 2002).

The implementation of the management policy termed “flip-flop” has altered the natural hydrology of the Upper Yakima basin. First conceived in 1981, flip-flop refers to the release of all water needed by the Wapato Irrigation Project and the Sunnyside Valley Irrigation District, in Yakima County, from the Upper Yakima reservoirs until September. Concurrently, releases from Rimrock and Bumping reservoirs are curtailed. Then in early September, releases are reversed, and the

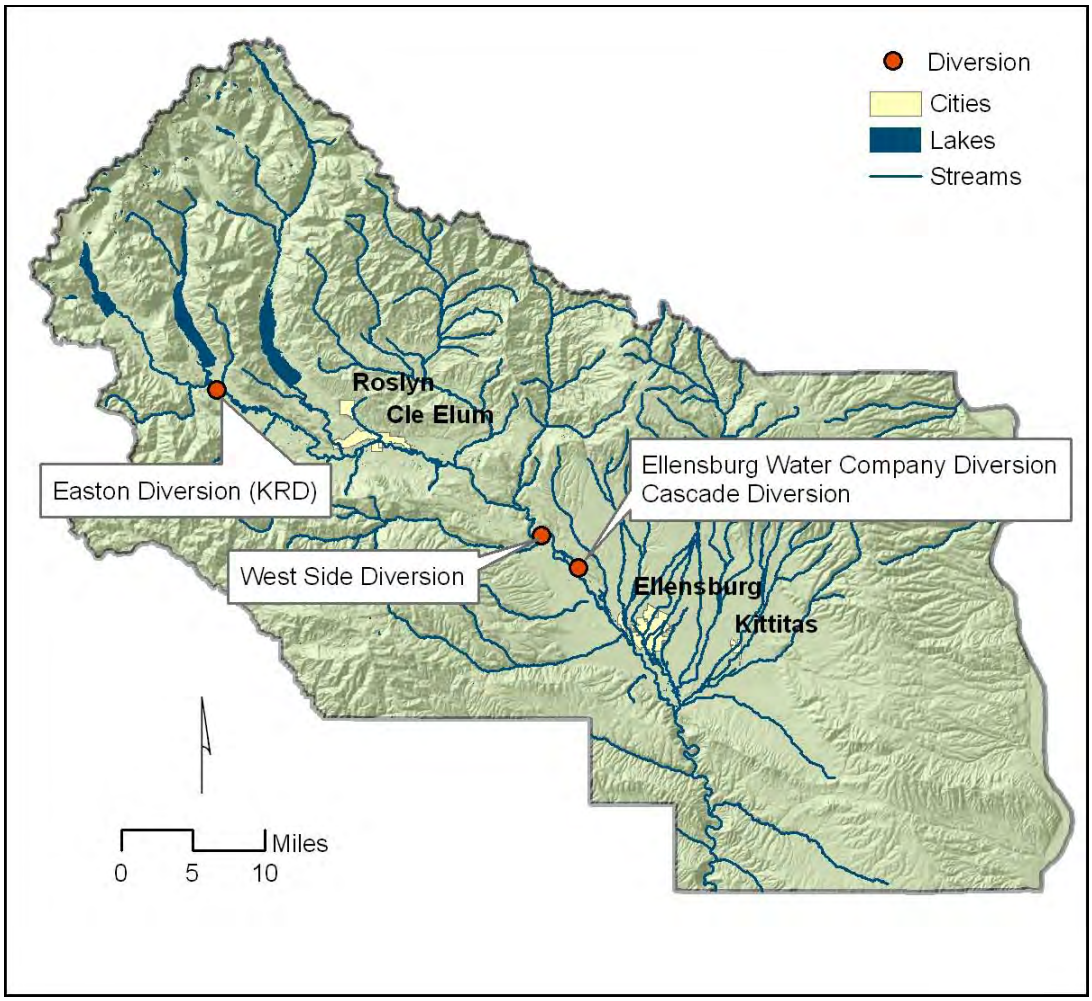
majority of the needed streamflow is provided by Rimrock and Bumping reservoirs, while flows from the Upper Yakima reservoirs are reduced by as much as 3,000 cfs (Anderson 2008). The purpose of flip-flop is to encourage returning Chinook salmon to spawn at lower river stages in the fall, ensuring that the flows needed to keep redds watered are upheld, while still low enough to protect them during their incubation period (November through March) (LeMoine and Brock 2004).

A similar operation, referred to as "mini flip-flop," is performed between Keechelus and Kachess Lakes in years of sufficient water supply for similar reasons downstream from Easton and Cle Elum Dams. Irrigation releases from Keechelus Lake are greater than from Kachess Lake from June through August. Then, in September and October, irrigation releases from Keechelus Lake are decreased and correspondingly increased from Kachess Lake (YRBWPU and TCWRA 2001).

Surface water diversion in the Upper Yakima basin is approximately 583,000 acre-feet per year. Operational spill from irrigation canals, field runoff, and canal seepage return a portion of the diversion back to the river. The return flows enter the Yakima River upstream of the head of the lower Yakima River canyon, south of Ellensburg. The diversion of water during the early part of the irrigation season contributes streamflow during the middle and later part of the season. The U.S. Bureau of Reclamation found that about one-half of the total volume of surface water diverted returns to the Yakima River. About one-half of that volume returns to the river the same month that the diversion occurs. The lag time for the remainder of the return flow is generally two months. That portion of flow is derived from water that percolates into shallow groundwater aquifers (YRBWPU and TCWRA 2001).

Keechelus and Kachess Lakes are used in conjunction with the other major reservoirs to provide a portion of the stored water to meet Yakima River demands in the Upper Yakima and Lower Yakima basins. A larger portion of the supply is diverted for irrigation in the Upper Yakima basin above the confluence of the Yakima and Cle Elum Rivers where Kittitas Reclamation District's (KRD) Easton Diversion Dam is located. Figure 2-15 shows major irrigation diversions between Kachess Lake and Ellensburg (YRBWPU and TCWRA 2001).

Figure 2-15. Major irrigation diversions between Kachess Lake and Ellensburg.



The Roza Dam, which is located above the confluence of the Yakima and Naches Rivers at the southern end of the lower Yakima River canyon, diverts water for irrigation used in the Lower Yakima subbasin and for hydroelectric power. It has a passable fish ladder and receives stored water from all three reservoirs located in the Upper Yakima basin (YRBWPU and TCWRA 2001).

2.4.1.2 Alkali-Squilchuck

The main body of water running through the Alkali-Squilchuck basin is the Columbia River. The Columbia River originates in British Columbia, Canada, between the Continental Divide and Selkirk Mountains. Tributaries to the Columbia River are generally snow-fed, and have low winter flows and high spring and summer peaks concurrent with snowmelt, which constitutes 60 percent of the natural runoff to the Columbia River during May, June, and July. Glacier melt also contributes to late summer and early fall flows after the snow has melted and precipitation is low (Ecology 2007).

Storage within the basin is provided by the Wanapum Dam and associated reservoir, Wanapum Lake. See Table 2-4 for a description of estimated physical characteristics of the Wanapum reservoir. Variation in elevation of the reservoir can be as high as 11.5 feet. The greatest fluctuations in reservoir elevation usually occur from mid-October to late November in order to aid salmon spawning downstream of Priest Rapids Dam (Grant PUD 2012).

Table 2-4. Estimated physical characteristics of the Wanapum reservoir. (Source Source: Grant PUD 2003.)

Reservoir Characteristic	Estimate
Normal max operating elevation (ft)	571.5
Min operating elevation (ft)	560.0
Storage at normal max elevation (acre-ft)	693,600.0
Surface area (acres)	14,680.0

Operation of the Columbia River hydropower system has caused the river's hydrologic seasonality to flatten, as historically high summer flows have decreased while historically low winter flows have increased, with overall decreasing flow velocities. All flow variability has not been lost, however; discharge variability is still prominent between years and over days as flows are altered to meet demands for hydroelectric power (Ecology 2007).

2.4.2 Groundwater

2.4.2.1 Upper Yakima and Naches Basins

Both the Upper Yakima and the Naches basins have been generally conceptualized as being downwelling at their headwaters, losing surface water to the hyporheic and groundwater systems, and upwelling, or gaining surface water from the hyporheic and groundwater systems, at the terminus of the basin, where sedimentary aquifers "pinch out" (Haring 2001; Reclamation 2002). Groundwater occurs under confined, semiconfined, unconfined, and perched conditions (Vaccaro et al. 2009). Groundwater recharge occurs when basalts are exposed at the ground's surface to precipitation on the anticlinal ridges. Recharge is relatively dependent on localized conditions, as folding and faulting has divided the Yakima basin into multiple, independent subbasins (Reclamation 2002). Regionally, groundwater recharge occurs along the western margin of the Columbia Plateau where the underlying basalts fuse with sediments and rocks at higher elevations in the Cascade Range (Reclamation and Ecology 2011a). Recharge in the upper reaches of the Yakima and Naches basins is a result of precipitation seepage, while the lower reaches of these basins receive most of their groundwater recharge from irrigation runoff and returns (Vaccaro and Olsen 2007). Based on a coarse-scale analysis, aquifer recharge areas along the mainstem upper Yakima River and the lower reaches of its tributaries have a "high" risk of pollution susceptibility (ESA, 2011). The remainder of the Upper Yakima and Naches Basin watershed within the County has a "moderate" risk.

Vaccaro (2011) found that gains and losses to surface water actually occur over the entirety of these river systems, with groundwater generally flowing parallel to the river. Gains and losses are localized, and are a condition of water table elevation, streambed/water surface elevation, variability in the vertical and lateral extent of the aquifer, contrasts in lithology, and stream channel orientation and complexity. Vertical hydraulic gradient (VHG) measurements can illustrate how water moves between the shallow ground aquifer and the river. Estimates of VHG in the Yakima River basin (including the Naches basin) are generally low, indicating that surface-groundwater exchanges are largely vertical, and flow from ridges to streams and rivers in the valleys (Reclamation and Ecology 2011a; Vaccaro 2011). Larger VHG values represent extremely localized geologic conditions. Both of these basins can be considered groundwater dependent ecosystems (GDE). Here, streamflow is largely supported by groundwater that has seeped into the stream channel, and provides thermal refugia for salmonids during high summer and freezing winter temperatures (Vaccaro 2011).

2.4.2.2 Alkali-Squilchuck

The overburden aquifer of the Columbia Plateau readily transmits water, as the aquifers are generally coarse-grained and therefore highly permeable within a few feet of the ground's surface and become fine-grained and less permeable with depth. Groundwater level contours generally mimic ground surface topography, and water level data suggest that over most of the Columbia Plateau, groundwater flow direction is downward except near discharge areas, which are generally located near rivers and streams (WSEFSEC 2004).

Applied irrigation water and precipitation provide for groundwater recharge. Recharge to deep, confined aquifers is generally less than 1 inch per year, but in irrigated areas can be as much as 10 inches per year. In 2000, Kittitas County withdrew 223,550 acre-feet from the Columbia River basin surface waters for irrigation purposes; however, no groundwater was withdrawn (Ecology 2007). Based on a coarse-scale analysis, aquifer recharge areas along the Columbia River within the County have a "low" risk of pollution susceptibility, although some areas south of Vantage have a "high" risk (ESA, 2011).

2.4.3 Instream Flows

2.4.3.1 Upper Yakima and Naches Basins

Beginning in 1977, water supplies in the Pacific Northwest were becoming increasingly inadequate to meet the needs of water consumers, including those of the Yakima River basin. On October 12, 1977, Washington State filed an adjudication of the Yakima River basin to determine the priority and quantity of existing water rights (Reclamation 2002). Known as the Aquavella adjudication, this process is still ongoing, and has hindered the State's ability to adopt instream flow requirements into the Washington Administration Code (Beecher, personal communication, 2012). Despite the State's inability to adopt instream flow requirements for the Yakima basin, the United States Congress adopted Title XII of Public Law 103-434 on October 31, 1994. Title XII established new target flows to be maintained past the Prosser and Sunnyside diversion dams, in the lower Yakima River basin, using criteria based on Total Water Supply Available (TWSA) (Reclamation 2002). See Table 2-5 for an outline of target flows based on TWSA. Releases from storage reservoirs in the Upper Yakima basin need to be adjusted in order to meet downstream target flows (Reclamation 2002).

Table 2-5. Title XII target flows to be maintained past Prosser and Sunnyside diversion dams, based on TWSA. (Source: Reclamation 2002.)

TWSA (million acre-feet)				Parker and Prosser Flows (cfs)
Apr-Sept	*May-Sept*	*June-Sept*	*July-Sept*	
3.2	2.9	2.4	1.9	600
2.9	2.65	2.2	1.7	500
2.65	2.4	2.0	1.5	400
Less than above TWSA				300

Target flows listed in Table 2-5 are not instantaneous flow requirements, and are subject to fluctuation caused by project operations. For any period exceeding 24 hours, however, flows at the Sunnyside diversion dam cannot be reduced to less than 65 percent of target flows, and flows at the Prosser diversion dam cannot be reduced more than 50 cfs from target flows (Reclamation 2002).

2.4.3.2 Alkali-Squilchuck

Prior to 1980, no instream flows had been set for the Columbia River. In 1980, the Washington Administrative Code adopted a rule which outlined minimum flows for multiple reaches of the Columbia River. These water rights are considered "interruptible" because the right is subject to interruption when forecasted river levels fall below flows outlined by this rule (Ecology 2007). Rights can be interrupted in accordance with two situations:

1) For the first 4,500 cfs of water rights issued following senior water right issuances:
    a. If the March 1 forecast for April-September runoff at the Dalles, Oregon is between 60 and 88 million acre-feet (MAF), voluntary water conservation practices will be encouraged.
    b. If the March 1 forecast for April-September runoff at the Dalles, Oregon is 60 MAF or less, junior water rights will be curtailed if actual flows fall below the minimum average weekly flows as established by WAC-173-564-040.
2) For any appropriations issued in excess of the first 4,500 cfs of water rights following senior water right issuances:
    a. If the March 1 forecast for April-September runoff at the Dalles, Oregon is 88 MAF or less, junior water rights will be curtailed if actual flows fall below the minimum average weekly flows as established by WAC-173-564-040.

Often, the March 1 forecast is higher than the benchmarks outlined in this rule, but weekly flows during the summer are lower than the minimum average weekly flows as established by WAC-173-564-040. In this scenario, water rights are not interrupted, despite not meeting minimum average weekly flow requirements (Scott, personal communication, 2012).

See Table 2-6 for minimum instantaneous and minimum average weekly flows at the Wanapum control station. This rule allows for the Director of Ecology to reduce these minimum flows by 25 percent if the director "deems it to be an overriding public interest requirement" to do so. However, outflow from Priest Rapids Dam can never be less than 36,000 acre-feet, and the flow from the Columbia River must produce at least 39.4 MAF per year at The Dalles, Oregon (WAC 173-563-050(1)).

Table 2-6. Minimum instantaneous and minimum average weekly flows at the Wanapum control station. (Source: WAC-173-564-040)

Month	Min. Instantaneous Flow (1,000 cfs)	Min. Avg. Weekly Flow (1,000 cfs)
Jan	10	30
Feb	10	30
Mar	10	30
Apr 1-15	20	60
Apr 16-25	30	60
Apr 26-30	50	110
May	50	130
June 1-15	50	110
June 16-30	20	80
Jul 1-15	20	80
Jul 16-31	50	110
Aug	50	95
Sep	20	40
Oct 1-15	20	40
Oct 16-31	20	40
Nov	10	30
Dec	10	30

2.5 Water Quality

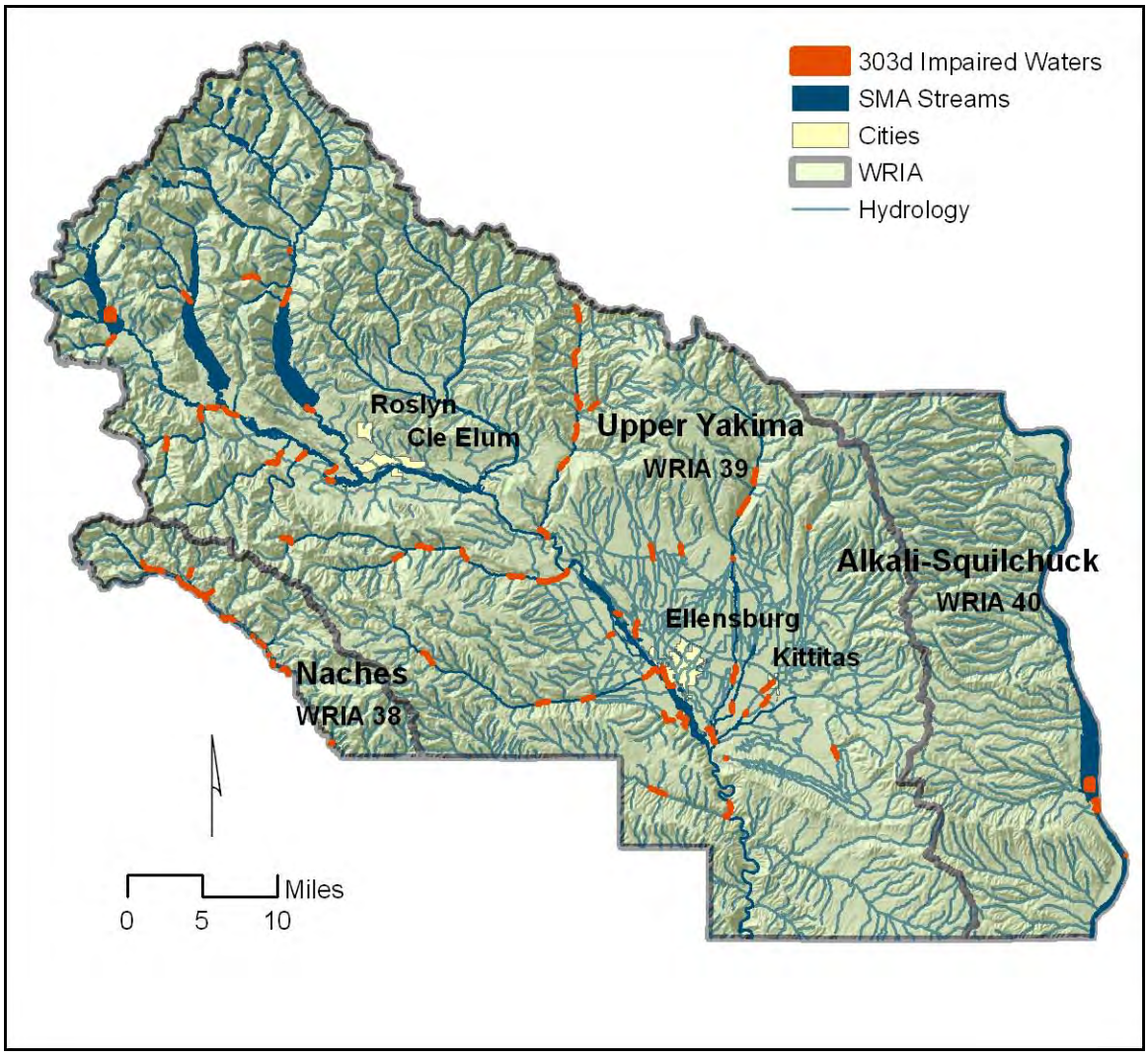
2.5.1 Upper Yakima

The latest (2008) 303(d) list of impaired waters for WRIA 39 in Kittitas County shows 23 locations with impairments in water temperature; 9 impairments in pH; 4 impairments in dissolved oxygen; 7 impairments in fecal coliform; 2 impairments in dioxin; 2 impairments in PCBs; and 1 impairment in chlordane (Table 2-7). Figure 2-16 shows the area of impairment in the Upper Yakima basin.

Table 2-7. 303(d) impaired waters in the Kittitas County portion of WRIA 39. (Source: Ecology 2009d)

Location	303(d) Impairment	Location	303(d) Impairment
Big Creek	Temperature	Naneum Creek	Temperature
Bull Ditch Diversion	pH		pH
Cabin Creek	Temperature	Reecer Creek	Temperature
Caribou Creek	Temperature		Fecal Coliform
Cle Elum River	Temperature	Robinson Creek	pH
Coleman Creek	Temperature		Fecal Coliform
Cooke Creek	Dissolved Oxygen	Sorenson Creek	Fecal Coliform
	Temperature	Taneum Creek	Temperature
Cooper River	Temperature		Fecal Coliform
Currier Creek	Fecal Coliform		Dissolved Oxygen
Gale Creek	Temperature	Thorp Creek	Temperature
Iron Creek	Temperature	Turbine Ditch	pH
Keechelus Lake	Dioxin	Umtanum Creek	Temperature
	PCB	West Side Channel	pH
Little Creek	Temperature		Fecal Coliform
Log Creek	Temperature	Williams Creek	Temperature
Lookout Creek	Temperature	Wipple Wasteway	pH
Manastash Creek	Temperature	Yakima River	Temperature
	Fecal Coliform		Dissolved Oxygen
	Dissolved Oxygen		pH
	pH		Chlordane
Meadow Creek	Temperature		PCB
Swauk Creek	Temperature		Dioxin

Figure 2-16. Areas of 303(d) list impaired waters in WRIAs 38, 39, and 40.



Source: Department of Ecology

Water quality in the Yakima basin becomes progressively degraded from the headwaters to the terminus (Haring 2001; Reclamation and Ecology 2011a). Causes of elevated temperatures in the Upper Yakima basin include removal of riparian vegetation, modifications in channel morphology, and changes in floodplain connection, hyporheic flows, and energy regimes (Reclamation 2002). Elevated temperatures in the Cle Elum River subbasin have been observed directly above and below Cle Elum Lake. Downstream from the reservoir, higher water temperatures are likely due to dam impoundment and nearby forestry practices, while above the reservoir, elevated temperatures are likely resultant of surface waters flowing through the warm, shallow Tucquala Lake (Lieberman and Grabowski 2007). Temperatures in the Teanaway River subbasin are also elevated, and may be

attributed to several sources: reduced riparian shade; increased channel width to depth ratios; streambank instability; and decreased summer instream flows (Creech 2003a).

In a 1987-1991 study by the U.S. Geological Survey, over 110 different organic compounds were observed in the Yakima River basin (Reclamation 2002). Organochlorine pesticides (OCPs) are often associated with agricultural practices, mainly irrigation return flows and subsequent sedimentation (Creech 2003b; Reclamation 2002). Turbidity and total suspended sediment loading in the mainstem Yakima River can also be attributed to snowmelt flowing through small streams in the Cascade Range (Anderson 2008). Sedimentation in the Upper Yakima basin has many sources, including irrigation return flows, erosion of earthen roads and culverts, and streambank instability. Streambank instability is principally caused by high winter flows that remove large sections of the streambank, and removal/disturbance of riparian areas by recreational users (Creech 2003b).

Despite being banned over 30 years ago, OCPs and polychlorinated biphenyls (PCBs) persist in the environment as they bind to soil particles where they were once legally used. Irrigation water flowing through these soils picks up sediments and attached OCPs, and carries them into basin surface waters. In some instances, old reserves of OCPs may still be used in the present day. Erosion from other managed areas, such as orchards or forests controlled for insects, may also introduce OCPs back into the environment. Resuspension of channel-bottom sediments during high flows or other disturbances may also cause the reintroduction of these chemicals into the environment (Creech 2003b). Chlordane in the Upper Yakima River and dioxin in Keechelus Lake are now meeting standards, and should be removed from the 303(d) list during the next assessment phase, if applicable (Johnson et al. 2010).

Drought may cause water quality issues in the following irrigation season. Kittitas County water purveyors observed an increase in the number of timothy hay fields that were plowed and seeded in the 2002 and 2006 irrigation seasons. Drought caused junior water right deliveries to be interrupted in 2001 and 2005, resulting in damage to perennial hay crops and subsequent increased plantings the following year (Satnik and Olsen 2005).

Fecal coliform (FC) contamination is often observed downstream of livestock operations or where faulty septic systems are suspected (Reclamation 2002). From April through October, FC levels in the Wilson Creek subbasin regularly exceeded state water quality standards but were not in violation of these standards for the 2008 303(d) assessment phase in Kittitas County. Known sources of FC contamination in the Wilson Creek subbasin are domestic pets, humans, and livestock or wildlife activity. Human sources include leaking or faulty septic systems, leaking or broken sewer lines, failures at the Kittitas wastewater treatment plant, or

travelers or recreational users who leave human waste near waterways. Livestock and wildlife can increase FC contamination by either depositing waste directly into surface waters or through runoff carrying it to nearby waterways, as well as by resuspending FC bacteria by walking through stream channels (Creech 2006).

Levels of pH and dissolved oxygen tend to react to changes in other water quality parameters. Dissolved oxygen may violate state water quality standards when temperatures increase or as processes requiring oxygen (e.g., decomposition) occur. The pH may increase as water levels decrease and aquatic plants flourish, altering the chemistry of the water (Reclamation 2002). High nutrient loading, as is found in the Yakima River basin, can cause macrophyte and phytoplankton populations to grow, which can also result in elevated pH levels and swings in dissolved oxygen concentrations as these organisms grow and decompose (Reclamation and Ecology 2011a).

2.5.2 Naches

The latest (2008) 303(d) list of impaired waters for the Naches basin in Kittitas County shows five locations with impairments in water temperature (Table 2-8). Figure 2-16 shows the areas of impairment in the Naches basin.

Table 2-8. 303(d) impaired waters in the Kittitas County portion of WRIA 38. (Source: Ecology 2009c.)

Location	303(d) Impairment
Bear Creek	Temperature
Blowout Creek	Temperature
Gold Creek	Temperature
Little Naches	Temperature
Mathew Creek	Temperature

During the summer months (June – October) some sections of the upper Naches River show temperatures above the 23°C lethal limit for salmonids (Brock 2008). Non-point sources of thermal pollution in the Naches basin may be attributed to (1) riparian vegetation loss and disturbance, causing a reduction in shade; (2) channel morphology changes; and (3) changes in hydrology. Riparian vegetation loss or disturbance can be attributed to direct removal of riparian vegetation for roads or timber harvest, or hydrograph alteration to such an extent that vegetation cannot complete its life cycle requirements. Channel morphology changes result from elimination of large woody debris (LWD) for flood control; elevated sediment loading from forest road construction; timber harvest; channel constriction or diking for flood control; streambank erosion and resultant sedimentation from root

structure removal and aggravating land use practices within the basin; or changes in sediment/energy regimes causing channel incision or aggradation. Changes in hydrology may be due to modified streamflows from timber harvest areas that cause an increase in spring runoff and a decrease in summer base flows. (LeMoine and Brock 2004).

2.5.3 Alkali-Squilchuck

The latest (2008) 303(d) list of impaired waters for WRIA 40 in Kittitas County shows one location with violations in temperature standards, and another with violations in temperature, pesticide, and PCB standards (Table 2-9) Figure 2-16 shows the areas of impairment in the Alkali-Squilchuck basin.

Table 2-9. 303(d) impaired waters in the Kittitas County portion of WRIA 40. (Source: Ecology 2009b.)

Location	303(d) Impairment
Columbia River at Priest Rapids Lake	Temperature
	DDD
	DDE
	PCB
Columbia River at Wanapum Lake	Temperature

Surface water temperatures in the Columbia River often exceed 20°C. Increases in water temperature can be attributed to construction of the Columbia River dam and reservoir system, causing an increase in residence time for impounded waters, and the increased temperature of inflows from upstream tributaries which have lost riparian cover and shade (NRC 2004).

Chlorinated pesticides such as DDT (dichloro-diphenyl-trichloroethane), and its derivative products DDD (dichloro-diphenyl-dichloroethane) and DDE (dichloro-diphenyldichloro-ethylene), as well as PCBs, are considered legacy chemicals because they are no longer in production or use but may find their way into the environment through various mechanisms (Johnson 2007). The U.S. Geological Survey has found elevated concentrations of these legacy chemicals, as well as elevated nutrient levels and other pollutants in fish tissues and bed sediments (USGS 2006). Elevated concentrations of such pollutants are largely caused by the intensive agricultural and irrigation practices common on the Columbia River. Compounding the negative effects of agriculture on water quality is the presence of instream structures such as dams and irrigation impoundments, which have been shown to reduce water quality by inhibiting mixing, trapping contaminated sediments, and introducing high concentrations of dissolved gases (Ecology 2007).

Bioaccumulation of toxic pollutants in fish is also common in the Columbia basin. Aroclors, zinc, aluminum, and DDE were found in the highest concentrations of Columbia Basin fish by the Environmental Protection Agency (EPA 2002), with DDE being the most commonly found pesticide in fish tissue.

Sampling between 2002 and 2004 in the Sand Hollow irrigation basin revealed violations in state water quality standards for several parameters. Sand Hollow, a 60-square-mile irrigation basin, empties into the Columbia River directly across from Vantage, Kittitas County. Ninety-five percent of the basin is irrigated cropland. Within this basin, violations for the following water quality parameters occurred during the time of study: water temperature, dissolved oxygen, and pH. Nitrate levels during the non-irrigation season exceeded the EPA's Maximum Contaminant Level for potable water. Concentrations of the insecticides azinphos-methyl, chlopyrifos, lindane and the herbicide dinoseb exceeded aquatic-life benchmarks (Wagner et al. 2006).

A 2005 Ecology report concluded that groundwater quality in the Washington State portion of the Columbia plateau is "good." Where groundwater quality issues did arise, the study attributed the problems to nitrates, metals, pesticides, and other non-point pollution (Ecology 2005). Nitrates have been found in Columbia basin wells that exceed drinking water standards, while pesticides have been shown to persist in nitrate-contaminated wells, occasionally exceeding Maximum Contaminant Level for potable waters (Williamson et al. 1998).

2.6 Fish and Wildlife Species and Habitats

2.6.1 Aquatic Species and Habitats

2.6.1.1 Wetlands and Deep Water Habitats

Wetlands in the Yakima and Columbia River basins occur along major streams and rivers, usually where the water table is at or near the land surface or the surface is covered by shallow water. Wetlands are especially prominent throughout the Kittitas Valley and into the lower Yakima River floodplain. In the Upper Yakima and Naches basins, wetlands are found along smaller tributaries at seeps or springs, at high elevation wet meadows, and along the shorelines of natural lakes (Reclamation 2002; Reclamation and Ecology 2011a). Table 2-10 lists area of wetlands mapped by the National Wetlands Inventory in each basin and subbasin. Long-term irrigation has created new wetlands and altered existing wetlands throughout the region (US Army Corps of Engineers, 2008).

Western toads (*Bufo boreas*), now scarce in their historic range, depend on montane coniferous wetlands for breeding (YSFWPB 2004). Other species common to wetlands are the great blue heron (*Ardea herodias*), muskrat (*Ondatra zibethicus*), Canada goose (*Branta canadensis*), mallard duck (*Anas platyrhynchos)*, common snipe (*Gallinago gallinago*), raccoon (*Procyon lotor*), Cascade frog (*Rana cascadae*) and Pacific tree frog (*Pseudacris regilla*) (Reclamation 2002).

Table 2-10. Area of wetlands in each basin and subbasin in Kittitas County.

Drainage Basin	Emergent Wetland		Forested/Shrub Wetland		Total Wetland	
	acres	***% of drainage area***	***acres***	***% of drainage area***	***acres***	***% of drainage area***
Alkali – Squilchuck	129.9	0.05	126.7	0.05	256.6	0.10
Naches	95.6	0.13	304.0	0.42	399.6	0.55
Upper Yakima	5774.9	0.47	6596.8	0.53	12371.7	1.00
Burbank	5.1	0.01	44.6	0.06	49.7	0.07
Easton	415.7	0.25	2358.9	1.40	2774.6	1.65
Elk Heights	138.7	0.33	350.5	0.84	489.2	1.17
Kittitas	1011.5	0.59	100.4	0.06	1111.9	0.65
Lake Cle Elum	460.1	0.32	1435	1.01	1895.1	1.33
Manashtash Creek	81.6	0.13	177.6	0.29	259.2	0.42
Naches	95.6	0.13	304.0	0.42	399.6	0.55
Reecer Creek	1035.0	1.77	245.4	0.42	1280.4	2.19
Roza Creek	14.4	0.12	38.1	0.32	52.5	0.44
Shushuskin Creek	55.0	0.46	184.2	1.54	239.2	2.00
Swauk Creek	60.6	0.09	144.9	0.21	205.5	0.30
Taneum Creek	29.4	0.06	209.2	0.41	238.6	0.47
Teanaway River	130.2	0.10	245.2	0.18	375.4	0.28
Thorp	92.6	0.33	81.8	0.29	174.4	0.62
Umtanum Creek	0.2	0.00	78.1	0.29	78.3	0.29
Wenas Creek	0.7	0.00	6.2	0.02	6.9	0.02
Wilson Naneum	2148.5	2.51	592.5	0.69	2741.0	3.20

Storage reservoirs in the Upper Yakima basin and at Wanapum Lake serve as deepwater habitat for hydrophytic vegetation and fish communities. Construction of dams at the lower end of these once natural glacial lakes (Upper Yakima only) has eliminated the potential for sockeye (*Oncorhynchus nerka)*, Chinook (*Oncorhynchus tshawytscha)*, and coho (*Oncorhynchus kisutch)* salmon to spawn above the reservoirs.[1] This has caused a reduction in productivity in these lakes, as they historically relied on the carcasses of salmon spawning upstream to provide them with nutrients (Mongillo and Faulconer 1982). Today, these lakes are considered unproductive, oligotrophic lakes with low nutrient levels, phytoplankton and zooplankton volume, chlorophyll α concentrations, and total organic carbon. Low densities of zooplankton may reduce the lakes' abilities to support resident fish populations, including reintroduced salmon (Lieberman and Grabowski 2007).

The Washington Department of Ecology maintains a list of the most threatening, non-native aquatic invasive plant species. Invasive non-natives can be described as plants that have been introduced into Washington either on purpose or accidentally, usually as ornamental plants for water gardens or aquariums. These plants are dangerous when they are introduced into an area without natural enemies like disease or plant-eating insects that would keep the plant population in check. Consequently, non-native invasive plants tend to thrive and often outcompete native plants (Ecology n.d.). Table 2-11 displays the distribution of these species in Kittitas County. All locations monitored occur within the Upper Yakima WRIA.

Crack willow (*Salix fragilis*) is another invasive species of riparian areas. Introduced as a fast-growing ornamental, it has escaped cultivation and can form pure stands. These willows are prone to damage by wind, snow, and ice and can spread by detached twigs that float downstream (U.S. Forest Service n.d.)

Table 2-11. Distribution of most threatening non-native aquatic invasive plant species. (Source: Ecology n.d)

Location	Species	
	Common Name	Scientific Name
McCabe Pond	Yellow flag iris	*Iris pseudacorus*
	Eurasian water-milfoil	*Myriophyllum spicatum*
	Reed canarygrass	*Phalaris arundinacea*
	Curly leaf pondweed	*Potamogeton crispus*

[1] Sockeye were reintroduced to Cle Elum reservoir by the Yakama Nation starting in 2009.

Location	Species	
	Common Name	Scientific Name
Mattoon Lake	Yellow flag iris	*Iris pseudacorus*
	Purple loosestrife	*Lythrum salicaria*
	Eurasian water-milfoil	*Myriophyllum spicatum*
	Reed canarygrass	*Phalaris arundinacea*
	Curly leaf pondweed	*Potamogeton crispus*
	Cattail	*Typha* spp.
	Beggar-tick	*Bidens* spp.
Freeway Pond	Purple loosestrife	*Lythrum salicaria*
	Reed canarygrass	*Phalaris arundinacea*
	Curly leaf pondweed	*Potamogeton crispus*
	Cattail	*Typha* spp.
Unnamed Pond (17N-19E-02)	Purple loosestrife	*Lythrum salicaria*
	Eurasian water-milfoil	*Myriophyllum spicatum*
Lavender Lake	Eurasian water-milfoil	*Myriophyllum spicatum*
	Reed canarygrass	*Phalaris arundinacea*
	Cattail	*Typha* spp.
Wild Duck Lake	Reed canarygrass	*Phalaris arundinacea*
	Yellow flag iris	*Iris pseudacorus*
	Cattail	*Typha* spp.
Millpond	Reed canarygrass	*Phalaris arundinacea*
	Cattail	*Typha* spp.
Kiwanis Pond	Yellow flag iris	*Iris pseudacorus*
Private Pond (20N-16E-10)	Eurasian water-milfoil	*Myriophyllum spicatum*

2.6.1.2 Instream Habitat and Salmon Populations

Historically, the Yakima River basin supported large stocks of anadromous Pacific salmonids, with runs estimated to be as high as 300,000 to 960,000 fish per year in the 1880s (Natural Resources Law Center 1996). Spring and fall Chinook, steelhead (*Oncorhynchus mykiss),* sockeye, and coho currently inhabit the Upper Yakima basin, while summer Chinook have become locally extinct. However, the Yakama Nation currently has a summer Chinook reintroduction program. In the Kittitas County portion of the Naches basin, spring runs of Chinook are depressed, while fall runs are absent. (Reclamation and Ecology 2011a; WDFW 2008). Spring Chinook spawn and juveniles rear in the Little Naches, Naches, and upper reaches of the Yakima River. Steelhead spawn and juveniles rear in the Naches and Yakima Rivers and their tributaries. Extirpated in the 1980s, coho were reintroduced in the late-1990s and now spawn and rear as juveniles largely in the Wapato and Ellensburg reaches of the Yakima River as well as the lower reaches of the Naches River, below its confluence with the Tieton River. Coho spawning and rearing has also been known to occur in Taneum, Wilson, Reecer, Big and Pileup Creeks, as well as in the North Fork of the Little Naches River (Reclamation and Ecology 2008). Spring, summer, and fall Chinook, steelhead, coho, and sockeye salmon are all present in the Kittitas County portion of the Columbia River basin, while summer steelhead use Tekison, Brushy, Whiskey Dick, and Johnson Creeks for spawning and juvenile rearing (Ecology 2008).

Sockeye salmon were extirpated from the Yakima basin in the early 1900s. In 2009, the Yakama Nation began reintroducing sockeye into Cle Elum reservoir. The sockeye were captured at Priest Rapids Dam on the Columbia River and transported to Cle Elum reservoir. The sockeye have been using the interim fish passage facilities on Cle Elum Dam to migrate downstream.

Past and current management practices are the primary factor to localized extinctions and depressed anadromous Pacific salmonid populations. Storage reservoir management, along with associated active removal of LWD and riparian vegetation, has created low flow conditions in many reaches. Low flows can cause a reduction in fish passage with associated sedimentation impeding spawning success. Instream irrigation diversions can also cause low flows and increased sedimentation. In the upper reaches of the Yakima basin, sedimentation from road construction and other timber harvest practices has also been prevalent (Reclamation and Ecology 2011a).

In the northernmost reaches of the Upper Yakima basin, above the storage reservoirs, there are no constructed barriers. Streams in these upper, forested reaches generally exhibit good habitat conditions, with high-value gravels and gradients well-suited for salmon spawning and rearing. In the Cle Elum subbasin,

LWD is abundant and settles in low-gradient, unconfined channel reaches, increasing habitat complexity and channel stability, while lessening bed scour (Reclamation and Ecology 2011a).

2.6.2 Riparian Species and Habitats

Riparian areas occur adjacent to flowing water at the ordinary high water mark, and extend into the portion of the terrestrial landscape that is influenced by or directly influences the aquatic ecosystem. The wildlife, vegetation, water tables, soils, and microclimate of terrestrial ecosystems in riparian areas are largely influenced by perennial or intermittent water supplies. At the same time, these factors influence the biological and physical properties of the aquatic ecosystem of the riparian area of which they are a part (WDFW 2008). Intact riparian communities provide food, water, and cover for many wildlife species. Vegetation in the riparian zone provides food and cover for insects emerging from the associated water, as well as resident insect populations. These insects in turn make up the base of the food web for mammals, birds, reptiles, amphibians, and invertebrates that inhabit the riparian area. Because of these important ecological interactions, riparian areas are generally considered to be high-value wildlife habitat.

Approximately 90 percent of Washington's terrestrial vertebrate species depend on riparian areas to carry out essential life activities (Reclamation 2002). Riparian areas are used for breeding habitat, migration corridors, and seasonal ranges (Ecology 2007; YSFWPB 2004). Examples of wildlife common to riparian areas include Canada goose, mallard duck, wood duck *(Aix sponsa)*, pintail duck (*Anas acuta)*, ruffed grouse (*Bonasa umbellus)*, black-capped chickadee (*Poecile atricapillus)*, yellow warbler (*Dendroica aestiva)*, downy woodpecker (*Picoides pubescens)*, beaver (*Castor canadensis)*, raccoon, and Pacific tree frog (Reclamation 2002).

Forested riparian areas provide additional habitat resources, such as snags that supply breeding habitat for cavity-nesting mammals and birds, and are a food source for insect-eating birds. Downed trees and dense vegetation provide cover for small mammals and amphibians that require a reliable water source. The high density of prey species makes forested riparian areas especially attractive to foraging reptiles (Kauffman et al. 2001). Larger mammals such as elk (*Cervus elaphus)* and deer (*Odocoileus hemionus* and *O. virginianus)* use forested riparian areas as refuge from high summer temperatures (Knutson and Naef 1997).

The condition of riparian areas in the Yakima River basin ranges from severely degraded to nearly pristine. The least disturbed riparian habitat is generally found in the forested headwater reaches, becoming progressively more degraded as the river and its tributaries flow through valley floors where agriculture, grazing, and

regulated streamflow become prevalent (Reclamation 2002, Reclamation and Ecology 2011a). In the lower reaches of the Yakima River, large woody debris is often removed to avoid disrupting or damaging irrigation diversion and delivery systems. Low-flow conditions as a result of reservoir management practices cause reduced fish passage, while sedimentation and channelization from logging and road construction impede spawning access (Reclamation and Ecology 2011a).

2.6.3 Terrestrial Species and Habitats

2.6.3.1 Shrub-Steppe and Grassland

Shrub-steppe habitats generally have a lower diversity of wildlife than dry forests due to fewer vegetation layers (Vander Haegen et al. 2001). However, shrub-steppe habitats are still complex and may generally have riparian areas, canyons and diverse topography (WDFW 2008). Higher temperatures and arid conditions shape plant community composition, which in turn influences the presence and distribution of associated wildlife species (Vander Haegen et al. 2001).

Several species depend on shrub-steppe habitat, including striped whipsnake (*Masticophis taeniatus*), pygmy rabbit (*Brachylagus idahoensis*), Washington ground squirrel (*Urocitellus washingtoni*) and sagebrush vole (*Lemmiscus curtatus*). Some birds are considered sagebrush obligates, including sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*) and Brewer's sparrow (*Spizella breweri*), and both sharp-tailed grouse (*Tympanuchus* phasianellus) and greater sage grouse (*Centrocercus urophasianus*) (Dobler et al. 1996). Where larger true steppe or grassland components can be found within shrub-steppe habitats, long-billed curlew (*Numenius americanus*) and savannah sparrow (*Passerculus sandwichensis*) are also found (Ecology 2007).

Wildlife species commonly found in but not necessarily confined to shrub-steppe habitat include western skink (*Plestiodon skiltonianus*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), common raven (*Corvus corax*), turkey vulture (*Cathartes aura*), Great Basin pocket mouse (*Perognathus parvus*), bushy-tailed woodrat (*Neotoma cinerea*), Nuttall's cottontail (*Sylvilagus nuttallii*), northern pocket gopher (*Thomomys talpoides*), yellow-bellied marmot (*Marmota flaviventris*), badger (*Taxidea taxus*), coyote (*Canis latrans*), bats, and mule deer (Reclamation 2002).

Shrub-steppe is the principal native habitat type in the Columbia Plateau ecoregion; however, broad conversion to agricultural land has left just 5 percent of the historic coverage in relatively intact condition. Approximately 26 percent of the relatively intact shrub-steppe habitat is dominated by native sagebrush and grasses, with an undisturbed crytopgram crust (thin layer of lichen and moss which suggests an

intact community), and containing a largely native shrub and grass understory. Despite disturbances from grazing, off-road vehicles, and other human activities, these shrub-steppe habitats still provide food, cover, and nesting habitat for many wildlife species. Shrub-steppe also provides significant vegetative cover during the winter, when surrounding agricultural fields do not have a cover crop (Reclamation 2002).

Moderately disturbed shrub-steppe habitats showing degradation from non-native plant infestations, grazing, and other disturbances are more common (Reclamation 2002). One of the least disturbed areas of shrub-steppe in Washington State is the Yakima Training Center (YTC) (Dobler et al. 1996). Valley floors near these least-disturbed tracts of shrub-steppe serve as movement corridors for land animals, especially those with large home ranges like deer and elk. The YTC hosts a small population of elk that move northwest from the Arid Lands Ecology Preserve and south from the Quilomene and Colockum Wildlife Areas (Reclamation and Ecology 2011a).

2.6.3.2 Eastside Forests and Woodlands

Eastside mixed coniferous, upland aspen, ponderosa, and lodgepole pine forests occur primarily throughout the eastern Cascades. These forests provide snags for roosting bats (e.g., *Myotis* species) and cavity-nesting birds such as nuthatches, chickadees, and woodpeckers. Downed wood and multistory vegetation under closed canopies provide cover for breeding salamanders, such as the Larch mountain salamander (*Plethodon larselli*), songbirds and small mammals, like the yellow-pine chipmunk (*Tamias amoenus*) and western red-backed vole (*Clethrionomys californicus*). Regenerating shrub/seedling areas supply important habitat for rodents and reptiles, such as the American pika (*Ochotona princeps*) or meadow vole (*Microtus pennsylvanicus*) (Sallabanks et al. 2001).

In 2010, three large canids were observed through multiple remote camera images in the Teanaway subbasin. In June 2011, a lactating adult female canid was captured, and genetic analysis determined the animal was a gray wolf (*Canis lupus*), a descendent of the Lookout Pack. At the end of 2011, three adults and four pups were observed in the pack, which is considered to have a successful breeding pair (WDFW 2011a).

Forests in the Upper Yakima and Naches basins have been severely degraded due to removal of dead standing trees (snags) and loss of old-growth forest conditions. Fire suppression has created overly dense forest stands, while harvest has removed the largest, oldest trees. Many species, like the white-headed woodpecker (*Picoides albolarvatus*) and western gray squirrel (*Sciurus griseus*), depend on mature, cone-bearing evergreens, particularly in the winter months. These species also rely on

downed mature growth for important life stages, such as feeding and nesting (YSFWPB 2004).

Because of current management practices, forest stands east of the Cascades have become vulnerable to bark beetle infestation. Bark beetles, once considered beneficial to coniferous forests, are now seen as pests, as they have destroyed millions of acres of fire-suppressed forests no longer in balance with soil and climate conditions. Besides fire suppression and overstocking, many other factors increase the eastern Cascade forests' vulnerability to bark beetle infestation: thinning shock, soil compaction, trunk and root injury during logging, infections by root disease and dwarf mistletoe, defoliation by other insect pests, windthrow, fire scorch, snow and ice damage, and poor growing conditions (Halloin 2003).

2.6.3.3 Alpine/Subalpine

Alpine and subalpine habitats can be found in the northernmost reaches of the Upper Yakima basin. Alpine zones are composed of rugged, partially vegetated landscapes with snowfields covering rocky ridges above the treeline. These areas can be characterized by steep terrain, high winds, prolonged snow cover, and intense ultraviolet radiation. Compared to lower elevation habitats, alpine zones are structurally simple, with fewer plant species. Wildlife species in the alpine zone have become adapted to short, intense breeding seasons and seasonal migrations to and from breeding habitat patches and wintering areas. Subalpine parklands are found just below alpine zones, above continuous montane forest (Martin 2001).

Few wildlife species can be considered year-long alpine or subalpine residents. Some examples include the white-tailed ptarmigan (*Lagopus leucurus*), horned lark (*Eremophila alpestris*), mountain goat (*Oreamnos americanus*), bighorn sheep (*Ovis Canadensis*), American pika, and water voles (*Microtus richardsoni*). Some species breed across wide elevation gradients, including those found in alpine and subalpine zones. These include Canada geese, long-legged myotis (*Myotis volans*), white-tailed jackrabbits (*Lepus townsendii*), yellow-bellied marmots, coyotes, wolverines (*Gulo gulo*), and mountain lions (*Puma concolor*) (Martin 2001).

2.6.3.4 Agricultural and Vegetated Urban

The Upper Yakima basin contains large tracts of agricultural land. Pasture, hay, corn and wheat are the dominant uses, with orchards and vineyards at a lesser degree (Reclamation 2002). Livestock grazing has caused a shift in plant community composition from large perennial grasses and other shrub-steppe natives to cheat grass and other invasives (WSEFSEC 2004). However, some low-intensity crops, such as wheat, corn and barely, do provide some benefit for wildlife species, like the western meadowlark (*Sturnella neglecta*) and horned lark, which have adapted to

agricultural lands (Ecology 2007). Other species common to agricultural areas include the gopher snake (*Pituophis catenifer*), brown-headed cowbird (*Molothrus ater*), ring-necked pheasant (*Phasianus colchicus*), red-tailed hawk, northern harrier (*Circus cyaneus*), black-billed magpie (*Pica hudsonia*), Canada goose, coyote, striped skunk (*Mephitis mephitis*), and deer mouse (*Peromyscus maniculatas*) (Reclamation 2002).

Vegetated urban areas have similar plant communities to shrub-steppe habitat, with the addition of non-native weed species and ornamentals. Some areas have been cleared of all native vegetation, and are now dominated by trees, shrubs, and lawns that are intensely managed through pruning, mowing, fertilizing, and cultivating. These areas include residential properties, parks, and golf courses, and are important for large numbers of wintering waterfowl, especially Canada geese and mallard ducks. Other species common to vegetated urban areas include American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), striped skunk, bats and deer mouse (Reclamation 2002).

2.6.4 PRIORITY HABITATS AND SPECIES

The Priority Habitats and Species (PHS) List, published by the Washington Department of Fish and Wildlife, is a catalog of species and habitats considered to be priorities for management and conservation. Priority species call for protection measures for survival owing to their population status, susceptibility to habitat modification, and/or commercial, recreational, or tribal importance. Priority habitats are habitat types or conditions that are unique or important to a wide range of species (WDFW 2008).

Table 2-12 identifies priority habitats found in each of the three WRIAs of Kittitas County. Table 2-13 shows the percentage of priority habitat in each WRIA. Table 2-14 identifies priority species found in each of the three WRIAs of Kittitas County, and the state and federal listing status of the species. Table 2-15 represents the PHS noted to occur in Kittitas County but could not be verified using geospatial analysis.

Table 2-12. Priority habitats found in each of the three WRIAs of Kittitas County. (Source: WDFW 2008)

Priority Habitat	Associated Species	Upper Yakima	Naches	Alkali-Squilchuck
Alpine glaciers with exposed rock ridge, slopes, and cliffs with talus slopes		✓		

Priority Habitat	Associated Species	Upper Yakima	Naches	Alkali-Squilchuck
Aspen stands		✓		
Bald eagle foraging area		✓		
Bald eagle communal roost		✓		
Bald eagle winter roost				✓
Biodiversity corridor	Sage grouse	✓		
Breeding site	Golden eagle	✓		
Brushy areas mixed with herbaceous dry vegetation		✓		
Bighorn sheep winter range		✓		
Bighorn sheep lambing area		✓		
Bighorn sheep core area				✓
Burrowing owl breeding area				✓
Cliffs – Yakima River Canyon	High raptor concentration	✓	✓	
Cliffs – Selah Creek Canyon		✓	✓	
Cliffs – Columbia River Canyon				✓
Dusky grouse wintering area		✓	✓	
Dusky grouse nesting/brood rearing area		✓		
Elk winter range	Wenas herd	✓		
	Colockum herd			✓
	Quilomene herd			✓
Elk concentration area		✓	✓	
Elk calving area		✓	✓	✓
Elk feeding area		✓		
Elk migration corridor	Quilomene herd	✓	✓	✓
	Colockum herd	✓	✓	✓

Priority Habitat	Associated Species	Upper Yakima	Naches	Alkali-Squilchuck
Ginko cliff habitat				✓
Great blue heron rookery		✓		
High quality shrub-steppe	Big sagebrush, bluebunch wheatgrass, stiff sagebrush, sandberg bluegrass			✓
Mule deer winter range		✓	✓	✓
Mountain goat summer range		✓	✓	
Mountain goat winter range		✓	✓	
Meadow Natural climax seral stage Wet sedge and rush		✓	✓	
Oak woodlands		✓		
Old growth ponderosa pine		✓		
Ridge tops with peaks, cliffs, and outcroppings		✓		
Subalpine shrubby/forested area		✓		
Talus slopes	Pika	✓	✓	
West bar cliff habitat				✓
Wetlands	Waterfowl concentrations; heavily used by deer, elk and blue grouse			
Riverine upper perennial		✓	✓	
Palustrine		✓	✓	✓
Lacustrine limnetic		✓		✓
Lacustrine littoral				✓
Shallow ponds/gravel pits		✓		

Table 2-13. Percentage of priority habitat area in each of the three WRIAs of Kittitas County

Habitat Type	Percentage of WRIA (%)		
	WRIA 38	WRIA 39	WRIA 40
Alpine Areas		0.17	0.01
Aspen Stands		0.01	
Bald Eagle		0.01	
Big Game		0.11	
Bighorn Sheep		7.52	7.49
Biodiversity Areas And Corridor		2.91	
Chukar			3.89
Cliffs/bluffs	1.53	0.51	0.82
Common Loon			2.86
Dusky Grouse		0.09	
Elk	6.18	23.25	73.26
Golden Eagle		0.07	0.03
Harlequin Duck	0.05		
Loggerhead Shrike	0.46	0.01	
Long-billed Curlew		0.02	
Meadows		0.40	
Mountain Goat	11.54	7.39	
Mule Deer	0.01	17.45	76.67
Northwest White-tailed Deer		0.01	
Oak Woodland		0.02	
Old-growth/Mature Forest		0.12	
Peregrine Falcon		0.03	
Rocky Mountain Elk	3.41	2.07	
Ruffed Grouse		0.02	
Sage Grouse		0.30	1.19
Sagebrush Vole		0.02	
Sharptail Snake		0.03	
Shrub-steppe			0.79
Talus Slopes	1.49	0.72	
Waterfowl Concentrations			2.85
Wetlands	0.05	0.14	
Wood Duck		0.02	

Table 2-14. Priority species found in each of the three WRIAs of Kittitas County.

	Priority Species	Federal Status	State Status	Upper Yakima	Naches	Alkali-Squilchuck
Fish	Coho salmon	Threatened (lower Columbia)		✓	✓	✓
	Kokanee salmon					✓
	Sockeye salmon	Threatened (Ozette Lake) Endangered (Snake River)	Candidate	*		✓
	Bull trout	Threatened	Candidate* (bull trout only)	✓	✓	✓
	Eastern brook trout			✓	✓	✓
	Mountain whitefish			✓	✓	✓
	Rainbow trout			✓	✓	✓
	Spring Chinook	Threatened (lower Columbia)	Candidate	✓	✓	✓
	Fall Chinook	Threatened (lower Columbia)	Candidate	✓		✓
	Summer Chinook	Threatened (lower Columbia)	Candidate			✓
	Summer steelhead	Threatened	Candidate	✓	✓	✓
	Westslope cutthroat			✓	✓	✓
	Brown trout			✓		✓
	Largemouth bass			✓		✓
	Smallmouth bass					✓
	Walleye					✓
	Sand roller					✓

	Priority Species	Federal Status	State Status	Upper Yakima	Naches	Alkali-Squilchuck
	White sturgeon					✓
	Piute sculpin		Monitored	✓		
	Mountain sucker		Candidate	✓		
	Pygmy whitefish	Spp. of Concern	Sensitive	✓		
	Burbot			✓		
Amphibians	Cascades frog		Monitored	✓	✓	
	Tailed frog		Monitored	✓	✓	
	Columbia spotted frog		Candidate	✓		
	Western toad	Spp. of Concern	Candidate	✓	✓	
	Tiger salamander					✓
	Larch mountain salamander	Spp. of Concern	Sensitive	✓		
Reptiles	Night snake		Monitored	✓		✓
	Sharptail snake	Spp. of Concern	Candidate	✓		
	Ringneck snake		Monitored	✓		
	Striped whipsnake		Candidate			✓
	Racer		Monitored	✓		✓
	Short-horned lizard		Monitored	✓		✓
	Southern alligator lizard		Monitored	✓		
Bivalves	Western floater		Monitored			✓
	Western pearlshell		Monitored	✓		
Birds	Golden eagle		Candidate	✓	✓	✓
	Bald eagle	Spp. of Concern	Sensitive	✓		✓
	Ferruginous hawk	Spp. of Concern	Threatened			✓
	Swainson's hawk		Monitored			✓

	Priority Species	Federal Status	State Status	Upper Yakima	Naches	Alkali-Squilchuck
	Osprey		Monitored	✓		
	Merlin			✓		
	American white pelican		Endangered			✓
	Marbled murrelet	Threatened	Threatened	✓		
	Great blue heron		Monitored	✓		
	Common loon		Sensitive			✓
	Foster's tern		Monitored			✓
	Caspian tern		Monitored			✓
	Rio Grande wild turkey			✓		✓
	Turkey vulture		Monitored	✓		✓
	Purple martin					✓
	Loggerhead shrike	Spp. of Concern	Candidate	✓		✓
	Long-billed curlew			✓		✓
	Vaux's swift		Candidate	✓		
	Black swift	Spp. of Concern	Monitored	✓		
	Western bluebird		Monitored	✓		
	Sage sparrow		Candidate			✓
	Sage thrasher		Candidate	✓		✓
	Chukar					✓
	Dusky grouse			✓	✓	
	Ruffed grouse			✓		
	Sharp-tailed grouse	Spp. of Concern	Threatened	✓		
	Greater sage-grouse	Candidate	Threatened	✓		✓
	Mountain quail			✓		
	Spotted owl	Threatened	Endangered	✓	✓	✓

	Priority Species	Federal Status	State Status	Upper Yakima	Naches	Alkali-Squilchuck
	Burrowing owl	Spp. of Concern	Candidate	✓		✓
	Great gray owl		Monitored	✓		
	Harlequin duck			✓	✓	
	Wood duck			✓		
	Northern goshawk	Spp. of Concern	Candidate	✓	✓	✓
	Peregrine falcon	Spp. of Concern	Sensitive	✓	✓	✓
	Prairie falcon		Monitored	✓		✓
	White-headed woodpecker		Candidate	✓		✓
	Three-toed woodpecker		Monitored	✓		
	Black-backed woodpecker		Candidate	✓		
	Lewis's woodpecker		Candidate	✓		
	Pileated woodpecker		Candidate	✓		
Mammals	Big brown bat			✓	✓	
	California myotis			✓	✓	✓
	Yuma myotis			✓		
	Fringed myotis		Monitored	✓	✓	
	Little brown myotis			✓	✓	✓
	Long-legged myotis		Monitored	✓	✓	
	Western long-eared bat		Monitored	✓	✓	✓
	Western small-footed myotis		Monitored	✓	✓	✓
	Townsend's big-eared bat	Spp. of Concern	Candidate	✓		
	Canyon bat		Monitored			✓
	Pallid bat		Monitored			✓
	Spotted bat		Monitored			✓

	Priority Species	Federal Status	State Status	Upper Yakima	Naches	Alkali-Squilchuck
	Elk			✓	✓	
	Mountain goat			✓	✓	
	Mule deer			✓	✓	✓
	Northwest white-tailed deer			✓		
	Bighorn sheep			✓		✓
	Gray wolf	Endangered	Endangered	✓	✓	
	Grizzly bear	Threatened	Endangered	✓		
	Wolverine	Candidate	Candidate	✓		
	Lynx	Threatened	Threatned	✓		
	Marten				✓	
	Fisher	Candidate	Endangered	✓		
	Black-tailed jackrabbit		Candidate			✓
	White-tailed jackrabbit		Candidate	✓		✓
	Townsend's ground squirrel	Spp. of Concern		✓		✓
	Western gray squirrel	Spp. of Concern	Threatened	✓		
	Sagebrush vole			✓		
	Pika			✓		

*Sockeye were reintroduced to Cle Elum Reservoir by the Yakama Nation starting in 2009.

Table 2-15. Priority species noted to occur in Kittitas County, but could not be verified using geospatial analysis. (Source: WDFW 2012)

	Priority Species	Federal Status	State Status
Fish	Pacific lamprey	Spp. of Concern	
	River lamprey	Spp. of Concern	Candidate
	Leopard dace		Candidate
	Umatilla dace		Candidate
Birds	Western grebe		Candidate
	E WA breeding concentrations of grebes, cormorants		
	Black-crowned night heron		
	Cavity-nesting ducks: Barrow's goldeneye, common goldeneye, bufflehead, hooded merganser		
	Tundra swan		
	Sooty grouse		
	E WA breeding occurances of phalaropes, stilts and avocets		
	Yellow-billed cuckoo	Candidate	Candidate
	Flammulated owl		Candidate
Mammals	Merriam's shrew		Candidate
	Preble's shrew	Spp. of Concern	Candidate
	Cascade red fox		Candidate
	Fisher	Candidate	Endangered
Invertebrates	Juniper hairstreak		Candidate
	Silver-bordered fritillary		Candidate

2.7 Summary of Ecosystem Conditions and Management Needs

Several organizations have conducted extensive research on ecosystem conditions and management needs in the Yakima River basin as well as the larger Columbia River basin. These include the Washington State Conservation Commission (Haring 2001), Northwest Power and Conservation Council (YSFWPB 2004), Yakima River Basin Watershed Planning Unit and Tri-County Water Resource Agency (YRBWPU and TCWRA 2001), and Yakima Basin Fish and Wildlife Recovery Board (Conley et al. 2009). This section was synthesized from reports published by these organizations, especially Conley et al., and literature cited previously in this chapter. Not all of the management needs and recommendations identified below can be fully addressed through the SMP; effective ecosystem management will require cross-disciplinary collaborative approaches across numerous regulatory and non-regulatory programs.

2.7.1 Upper Yakima Basin

Surface waters in Upper and Lower Yakima basin are highly regulated to provide water for irrigated agriculture and hydropower users. The reservoirs in the Upper Yakima basin are part of the Bureau of Reclamation's Yakima Irrigation Project, which operates in the entire Yakima River basin including 59,000 acres in the Upper Yakima basin. Irrigation has made the Yakima basin one of the most productive agricultural regions in the United States. In addition to the Reclamation system, many smaller irrigators and private landowners divert water from the Yakima River. Irrigation diversion and storage systems are essential to the Yakima basin's present economy, but they have also significantly impacted the ecosystem (Conley et al. 2009).

Prior to intensive human development by European settlers, alluvial floodplains in the Upper Yakima basin contained complex systems of braids and disconnected side channels, which absorbed peak flows and promoted infiltration of cold water into the underlying gravels. The complex channel system provided large areas of edge habitat for wildlife, and varying water temperatures and stream velocities for all freshwater life stages of salmonids. The areas of underlying gravel, infiltrated with cold water, hosted microbes and invertebrates that provided a food base for the entire ecosystem. As runoff from snowmelt receded through the summer, cool groundwater discharge upwelled from the gravel into the complex channel networks. This upwelling provided clear base flows during times of low flow and high air temperatures, creating areas with temperatures amenable to outmigrating salmon and steelhead smolts and returning adults. In winter, upwelling

groundwater prevented freezing and provided oxygenated water for incubating eggs and young fish (Ring and Watson 1999).

Currently, floodplain isolation, channel simplification, and the flip-flop regime have dramatically altered river-floodplain interactions and degraded the aquatic environment (Ring and Watson 1999). Extensive floodplains in the Easton, Cle Elum, and Ellensburg reaches of the Upper Yakima basin have been constricted by roads, railroads, and dikes associated with agriculture, development, and gravel mining (Conley et al. 2009, YSFWPB 2004).

2.7.1.1 Altered Flow Regime

- Restore riparian conditions in the lower reaches of Yakima River tributaries, and off-channel and floodplain habitats of the Yakima River.
- Develop a planting program for black cottonwood.
- Address the negative effects of flip-flop through alteration of reservoir operations.

Altering current flow regimes could greatly increase the quality of shoreline ecosystems in Kittitas County. These needs are difficult to address in the context of the Shoreline Master Program, but are mentioned because these processes limit the success of other restoration efforts.

River regulation for irrigation and flood control impound spring snowmelt, substantially increase summer flow, and decrease winter flow in the Yakima River and the lower reaches of its tributaries. However, in some locations, irrigation diversions substantially decrease summer flows. The flip-flop regimes dewater portions of the streambed along the upper Yakima and Cle Elum, which can occur over the short period of one week in early September. These operations result in streamflows across the basin that do not support the life-stage requirements of native salmonids (Stanford et al. 2002) and riparian species such as cottonwoods (Jamieson and Braatne 2001).

Black cottonwood is an important species in the Upper Yakima basin ecosystem. Loss of this species affects shade, input of large woody debris, temperature, channel width to depth ratios, and food sources for salmonids. Cottonwood is dependent on a gradual reduction in the spring snowmelt. A quick drop in spring flows prevents seedlings from establishing root systems before the substrates lose moisture, resulting in death. Also, increased streamflow throughout the spring and summer limits the exposure of suitable substrates for colonization and can lead to the replacement of cottonwood stands by other shrub and grass dominated riparian

vegetation such as *Elaeagnus umbellata* (Russian olive), *Salix lucida ssp. lasiandra* (Pacific willow), or *Phalaris arundinacea* (reed canarygrass) (Conley et al. 2009).

The negative effects of flip-flop could be addressed through alteration of reservoir operations, conservation, additional storage, and other measures. The Bureau of Reclamation, in collaboration with other subbasin resource managers and stakeholders, should work together to develop solutions to modifying the flip-flop regime without severely impacting agricultural production (Conley et al. 2009, YSFWPB 2004).

Additionally, effects of flip-flop and floodplain disconnection on salmonid habitat can be mitigated by restoring riparian conditions in the lower reaches of Yakima River tributaries, and off-channel and floodplain habitats of the Yakima River. Lower Reecer, Currier, Whiskey, Mercer, Wilson, Naneum, Coleman, Cherry, Manashtash, Taneum, Swauk, and Lmumma Creeks and the Teanaway River are all candidates for restoration (Conley et al. 2009). The process has already begun on some creeks such as Reecer and Taneum Creeks.

2.7.1.2 Floodplain Confinement

- Remove floodplain confining structures where land use is compatible with periodic flooding.
- Widen bridges to allow channel migration.
- Replace culverts with bridges to allow channel migration.
- Restore floodplain ecological functioning by placing large woody debris and engineered log jams, bank reshaping, and channel reconstruction.
- Retrofit existing roads with hydrological connectivity zones, which link wetlands, shallow aquifers and other hydrologic features.

Removal of floodplain confining structures such as embankments and other types of hydromodifications in areas with land use that is compatible with periodic inundation can restore river systems to more natural conditions and reduce flood risk. Reintroducing streams to their historic floodplain helps dissipate flood energy by spreading potentially fast moving, high volumes of water over a larger surface area, rather than to the confines of the stream channel. This dissipation of energy will decrease streambank erosion, and consequently, sedimentation and turbidity. Restoring surface water-groundwater interactions helps increase groundwater recharge through the infiltration of floodwaters. More frequent infiltration of surface water to groundwater will lower surface water temperatures through the lateral discharge of colder groundwater into the surface water column. Lower

stream temperatures can help restore historic numbers of temperature-sensitive aquatic species (NPCC 2007). The increased area for storage and conveyance of floodwater gained by removing confining structures can reduce flood risk in nearby areas, where land uses are incompatible with periodic flooding (Opperman et al. 2009).

A recent example, the setback of confining hydromodifications adjacent to Reecer Creek in Ellensburg, in conjunction with revegetation, increasing in-stream habitat complexity through placement of large rocks and LWD, and redesigned channel morphology, will increase the length of available fish habitat by 6,000 feet and add 69 acres of valuable floodplain habitat (NPCC 2007).

Other more localized structures that confine the floodplain are bridges and culverts. Narrow bridges and culverts can restrict stream channels from naturally migrating across the floodplain. Also, they act to constrict the movement of water during high flow events, which can cause flooding upstream and scouring downstream. Widening bridges or replacing culverts with bridges can minimize these effects.

Efforts to reduce confinement through hydromodification setbacks and other infrastructure changes will reduce the effect of the altered flow regime in the Upper Yakima basin and increase effective habitat area. Major areas of confinement created by road and railroad beds including Interstate 90 in the Yakima River, U.S. Route 97 on Swauk Creek, and SR 970 on the Teanaway River. In addition to reduction of confinement, activities to restore floodplain ecological functioning may include placing large woody debris and engineered log jams, bank reshaping, channel reconstruction, and other instream habitat work (Conley et al. 2009; YSFWPB 2004).

2.7.1.3 Impaired Fish Passage

- Eliminate barriers to fish passage such as irrigation diversion dams or culverts through removal, redesign, or retrofitting.
- Use bridges, bottomless culverts, or other approved methods to improve fish passage when designing new or modifying existing road crossings.

Passage barriers have significantly reduced the habitat available to salmonids in the Upper Yakima basin. Cle Elum, Kachess, and Keechelus Dams block upstream movements and allow only limited downstream movements. Cle Elum Dam has inundated or blocked an important component of Yakima River anadromous Pacific salmon habitat (YSFWPB 2004). (Interim fish passage facilities have been added at Cle Elum Dam in recent years.) Impassable dams, dry reaches below dams, unscreened diversions, and siphons have eliminated anadromous fish from portions of many Yakima River tributaries. In most of the Upper Yakima basin, the forested

watersheds above the agricultural zone contain very good habitat. The Yakima Tributary Access and Habitat Program, through the Kittitas County Conservation District and other project sponsors, is working to open up many of these areas. Additionally, Roza Dam is a potential bottleneck for outmigrating smolts (Conley et al. 2009). The Roza Dam spillway was modified in 2011, which may have resolved the smolt bottleneck.

A 2011 Fish Passage Inventory report conducted by the Washington State Department of Transportation cited 3,200 stream crossing-structures (i.e., culverts) in fish-bearing streams, with 1,978 of these structures reported as barriers to fish passage (WSDOT 2012). The most common conditions at culverts that impede fish passage are excess drop at culvert outlet; high stream velocity within culvert; inadequate stream depth within culvert; excessive turbulence within culvert; and accumulation of debris at culvert opening (WDFW 1999).

Furthermore, 1,521 WSDOT-owned fish passage barriers cited as needing modification or replacement were reported as having the potential to add more than 200 meters of upstream habitat if the barrier was removed (WSDOT 2012). Culverts can either be completely removed and replaced with bridges or retrofitted in order to enhance fish passage. Where appropriate, culverts are redesigned in a way that simulates natural stream conditions with a bottomless design that acts as a natural stream bed. This is achieved through constructing a culvert that is wider than, and has a similar slope to, the existing stream channel (WSDOT 2012).

2.7.1.4 Irrigation Diversion

- Increase irrigation efficiency to reduce the amount of water diverted from rivers.
- Install screens to block fish from entering irrigation canals.

Irrigation diversions and simplification of natural waterways for conveyance of water have had significant impact on tributaries to the Yakima River. Irrigation diversions have dewatered the lower reaches of Swauk, Taneum, Manastash and Big Creeks and the Teanaway River, creating flow and temperature conditions that reduce juvenile salmonid rearing capacity. Reecer and Wilson Creek systems flows have been increased in summer, and tributaries and side channels have been modified for irrigation water conveyance. Modifications include ditch cleaning, diking, and removal of vegetation (Conley et al. 2009).

Irrigation has detrimental effects on the ecosystem. It delays the recharge of aquifers, which increases the mean temperature of infiltrating water (Ring and Watson 1999). Return flows associated with irrigation use can increase stream

temperatures and transport sediment and contaminants into waterways (Conley et al. 2009).

Diversion structures and the practice of running irrigation ditches across natural streams can divert fish into canals that can kill fish when they enter pump systems or are stranded in irrigation ditches. Although major water diversions on the Yakima River are screened, numerous unscreened diversions exist on tributaries. These are being addressed in conjunction with efforts to remove passage barriers and improve riparian conditions in the lower reaches of tributaries surrounding Ellensburg (Conley et al. 2009).

Increasing irrigation efficiency can reduce the amount of water diverted from rivers, reducing return flows and associated water quality issues. Significant improvements have been made in recent decades by individual irrigators, as well as irrigation companies and districts assisted by programs through the USDA Natural Resources Conservation Service, Kittitas County Conservation District, the US Bureau of Reclamation and other entities. These efforts should be continued and expanded (Conley et al. 2009).

Many ongoing restoration efforts are being conducted to address issues with irrigation diversions. The Teanaway River has been the focus of water conservation projects by Yakima River Basin Water Enhancement Project (YRBWEP), Ecology, and Kittitas County Conservation District. WDFW, the Yakama Nation, and the Kittitas Conservation Trust have been active in Taneum Creek, where the two major passage barriers associated with irrigation diversion have been corrected allowing fish access to the upper reaches of the watershed. Manastash Creek had seven unscreened irrigation water diversions across the large alluvial fan in the lower reaches which blocked fish passage and contributed to dewatering the creek. The Manastash Creek Restoration Project, facilitated by the Kittitas County Conservation District, is working toward screening all irrigation diversions, correcting passage barriers and improving instream flow. The effort has resulted in removal of three fish passage barriers, screens for four of the irrigation diversions and significant water placed in the Trust Water Rights program to benefit instream flow in perpetuity (Anna Lael, personal communication).

2.7.1.5 Floodplain and Upland Watershed Development

- Floodplain and critical upland habitat should be protected through acquisition of land and conservation easements.
- Reduce impervious surface.

- Set back channel confining structures (hydromodifications) and remove bank armoring where land use is compatible with periodic flooding or channel migration.
- Remove unnecessary roads.

Floodplain development has resulted in major alterations in habitat in the Upper Yakima basin through bank armoring, roads, construction of hydromodifications, and increases in impervious surface. Development impairs riparian and aquatic habitat function by reducing connectivity between streams and adjacent riparian areas, floodplains, and uplands, elevating fine sediment yields, reducing large woody debris, reducing vegetative canopy and increasing stream temperatures, limiting salmonid rearing habitat, increasing water temperature fluctuations, and reducing flows in summer because of floodplain storage loss (Conley et al. 2009, YSFWPB 2004).

Development in floodplain areas is regulated by Kittitas County Public Works via the National Flood Insurance Program (NFIP). Certain types of development within floodplain boundaries are currently permissible given the successful acquisition of a flood development permit. Additionally, flood insurance is available for private landowners residing within a floodplain. Future development in flood hazard areas and floodplains should consider the interconnectedness of stream channels and their adjacent floodplains, as well as the financial impact of floodwaters on manmade structures. These future considerations could include exceeding minimum standards for the elevation of residential and non-residential structures above base flood elevation (Kittitas County 2011). In addition, future floodplain reconnections should be focused in areas most tolerant to inundation. These areas include pastureland, areas where flood-tolerant crops are cultivated, or where annual crops are grown in the dry season (Opperman et al. 2009).

Upland development for commercial, residential, and agricultural use also impacts shoreline ecological function. Increases in impervious area, reduced vegetative cover, roads, and stormwater systems all facilitate rapid runoff of surface water, which increases streamflows and sediment inputs after precipitation events. Rapid runoff reduces groundwater recharge and lowers base flows in streams. Overland flows in developed areas can contaminate groundwater and transport pollutants from upland areas to stream systems (Conley et al. 2009). These pollutants may include heavy metals, pesticides, and petroleum products.

Predicted population growth in Kittitas County has the potential to impact functioning habitat and reduce restoration opportunities (Conley et al. 2009). Areas that are under development pressure and contain important functioning shoreline habitat include the Teanaway River, Big and Swauk Creek watersheds, the

Ellensburg urban growth area, the Cle Elum and Roslyn area, and the alluvial fans surrounding Ellensburg such as the Manastash fan.

Existing habitat in the Upper Yakima basin should be protected through acquisition of land and conservation easements (YSFWPB 2004). Efforts already underway include the Yakama Nation's Side Channels Project, the Cascade Conservation Partnership and Mountain-to-Sound Greenway Programs, and YRBWEP's acquisition efforts. Habitat restoration should be integrated with these acquisition programs (Conley et al. 2009). Another area identified as a critical piece of habitat and a top priority for preservation is a fairly extensive wet meadow/wetland complex that exists in the lower Teanaway basin near its confluence with the Yakima River (YRBWPU and TCWRA 2001). The Kittitas County Conservation District, WSDOT, and Kittitas County have been active in the early stages of developing plans to mitigate effects of floodplain development in the Teanaway.

2.7.1.6 Recreation Impacts

- Educate recreational users about the techniques for low impact camping near shorelines.
- Educate recreational users about the impacts of off-road vehicle use in riparian and wetland areas.
- Enforce existing recreation regulations that are aimed at protecting ecological functions.
- Restore ecologically degraded recreation areas.

Large numbers of residents recreate along Upper Yakima basin waterways, as well as tourists from throughout the state and nation. Population growth may increase camping, hiking, fishing, and off-road vehicle (ORV) activities, especially on publicly owned lands. Impacts of recreational activities such as dispersed camping and ORV use can be significant in riparian areas. Areas heavily impacted by recreation are the Cle Elum and Teanaway Rivers, and Taneum, Manastash, Swauk, and Naneum Creeks. Relocating campsites and reducing soil compaction at dispersed campsites can improve watershed function. Existing education, enforcement, and restoration and protection initiatives should be maintained or expanded in areas with high recreational use (Conley et al. 2009, YSFWPB 2004).

2.7.1.7 Mining

- Monitor existing gravel pits that have been reconnected to streams for ecological changes and expand the practice if successful.

- Develop or enforce regulations that minimize the impact of placer mining on instream and riparian habitat based on the life cycle of fish utilizing the stream.

Floodplain gravel mining has had significant impacts on floodplains throughout the basin, especially along Interstate 90 and the lower reaches of the Cle Elum River. Hydromodification structures are often constructed to protect gravel pits from flood events, constricting the floodplain. Gravel pits are also susceptible to bursting, which can cause avulsion of the river channel. Gravel pits that are reconnected to the main channel through unplanned flood events can act as sediment sinks that increase upstream nick-points and head-cutting while also increasing stream power and erosion downstream. Ponds in abandoned gravel pits can warm adjacent river temperatures and act as reservoirs for bass, catfish, and other introduced species that compete with salmonids. Management of past, current, and future gravel pit operations should strive to minimize these impacts (Yakima River Floodplain Mining Impact Study Team 2004).

The potential of restoring natural floodplain habitats may be limited if a substantial amount of floodplain has been converted to gravel pit ponds. It may be possible in the short term to use these ponds to simulate side channel habitats that are found in a natural, dynamic floodplain. Restoring floodplains to conditions that existed prior to the development of pits may require a substantial amount of time to accomplish by natural sediment transport events. This is especially true for large-volume gravel pits in areas of low bedload transport (Collin 1995).

Efforts to reconnect gravel pits in an ecologically prudent manner to the main channel and provide habitat for anadromous salmonids have occurred near Cle Elum at Hansen Ponds. Monitoring reports related to the Hansen Ponds reconnection are limited, but suggest that the hydrology of the reconnected Hansen Ponds is highly correlated to that of the Yakima River. Juvenile anadromous salmonids were observed utilizing the ponds in this early monitoring study, suggesting that reconnected ponds may serve as suitable habitat for salmonid rearing. Additionally, water quality parameters (i.e., temperature, dissolved oxygen, pH, turbidity and specific conductivity) were compared between the reconnected Hansen Ponds and the disconnected I-90 ponds. All water quality parameters studied were higher at the disconnected I-90 ponds, but this result may be more due to the fact that the disconnected ponds were found to be more biologically active than the more oligotrophic Hansen Ponds (Parrish 2006). Monitoring efforts should continue and should be expanded to other abandoned gravel pits if successful.

Small-scale placer mining is conducted in the Swauk Creek subbasin using suction dredging (Haring 2001). Suction dredge mining can impact fish, invertebrates, riparian habitat, and water quality (Harvey and Lisle 1998).

Suction dredging impacts fish primarily during their reproductive stages. Fish eggs can suffer mortality by being entrained in the suction dredge. Mortality can also occur from predation after passing through the dredge (Griffith and Andrews 1981). In contrast, most juvenile and adult fish can avoid or survive entrainment by the dredge. Tailings piles created by dredging in summer can affect reproduction in fall spawning Chinook and coho salmon. Because the tailings are less stable than the undisturbed streambed during high winter flows, they make poor protective habitat for spawning (Harvey and Lisle 1999). Additionally, suspended sediment that is entrained in the stream from dredging may fill pools that are used by fish as resting areas during migration, or suffocate eggs (Harvey 1986).

Suction dredging destroys invertebrate populations mostly through predation (Thomas 1985). Entrainment in the suction dredge does not result in high levels of invertebrate mortality, but dislodged invertebrates are easily preyed upon by fish. Despite the heavy initial impact on invertebrates, it has been found that recovery of invertebrate populations can occur within 1 to 2 months (Harvey 1986).

Riparian habitat can be severely impacted by dredging outside of the wetted perimeter of the stream or under the edge of streambanks. Tailings deposited outside the areas of the wetted perimeter are less likely to be redistributed during high winter flows. Dredging under streambanks can cause them to collapse, which reduces cover habitat for fish and introduces sediment into streams. Sometimes boulders and large woody debris are removed, and riparian vegetation is cut to create more accessible areas in the streambed. These practices also negatively impact cover habitat. (Harvey and Lisle 1999).

Water quality can be affected in several ways. Fuel used to power the suction dredge motor can spill into the waterway and oil and grease can leak from dredge motors (USFS 2001).

2.7.1.8 Forest Practices

- Remove abandoned roads or decommission unnecessary existing roads.
- Employ best practices to prevent sediment from entering streams from the forest road network.
- Replant clearcuts.
- Allow fires to burn in areas where they do not threaten property / infrastructure.

Past forest harvest practices, road construction and maintenance, and fire suppression have all impacted shoreline ecosystems. A critical element of forest

practices that has impacted shoreline ecological functioning is road construction. Road construction has isolated creeks from floodplains, caused riparian damage, increased sediment runoff, and contributed to landslides. Harvesting and fire suppression have created conditions that accelerate runoff, increase landslides and sediment loading, elevate water temperatures, and increase streamflows or flood frequency due to loss of forest cover. Programs are underway to improve habitat conditions on federal, state, and private lands (Conley et al. 2009).

Forest health in the Upper Yakima basin is declining, especially at lower and middle elevations in the Naches, Swauk, Teanaway, and Cle Elum drainages. Fire suppression has increased the density of less fire- and pest-resistant tree species, increasing the likelihood of catastrophic fire or pest outbreaks. Periodic, low-level disturbances are beneficial to forest health, but landscape-scale fires would likely result in increased peak flows, lower summer flows, and increased sediment delivery for several decades, increasing the risk of extinction for salmonids (Conley et al. 2009).

Removal of abandoned or unnecessary forest roads would improve wetland and riparian conditions. The Teanaway Creek subbasin is especially prone to increases in peak flow resulting from changes in watershed condition. Watershed function could be improved by mitigating the impacts of roads located next to salmon-bearing streams and revegetating clearcuts on south-facing slopes (Conley et al. 2009).

2.7.1.9 Invasive Species

- Increase daily catch limits on non-native fish species.
- Employ mechanical, electrical, biological, or chemical means to suppress non-native fish populations.
- Educate the public about vectors for the introduction of non-native aquatic plants to waterbodies.
- Employ mechanical, biological, or chemical means to suppress non-native aquatic vegetation.

Introduction of non-native fish species including brook trout, brown trout, lake trout, bass, catfish, bluegill, sunfish, and crappie has affected bull trout populations through a combination of competition, predation, and hybridization. Brook trout hybrids have been observed in upper Cle Elum River where brook trout are numerous (USFS 2006).

Competition, predation, and hybridization between brook trout and native char should be eliminated or reduced by allowing higher harvest through increased daily limits for sport fishing and active suppression of brook trout through mechanical, electrical, biological, or chemical means (WDFW 2000).

Native aquatic plants provide food and habitat for fish and wildlife, stabilize shorelines and contribute to nutrient cycling. Non-native plants have few controls in their new habitat, which allows them to spread rapidly and destroy native plant and animal habitat.

2.7.1.10 Grazing

- Manage livestock grazing in riparian areas to prevent erosion, protect water quality, and control invasive vegetation.

When not properly managed, grazing practices can compact soil, destabilize streambanks, introduce sediment and wastes to streams, and favor the growth of invasive vegetation. These alterations can lead to increased water temperatures, streambed embeddedness, water pollution, and the loss of cover including pools, woody debris, and overhanging vegetation (USFS 2006, ATTRA 2003). However, several management measures can be used to reduce these impacts, such as rotational grazing, use of alternative water sources for livestock, limited access points to streams, and fencing (ATTRA 2003).

In addition, grazing can be used to control invasive vegetation in riparian areas, when used in combination with other measures such as herbicides or biocontrol. Grazing may be especially useful in inaccessible areas or for large weed infestations. The *Weed Control Methods Handbook* published by The Nature Conservancy (2001) recommends that landowners develop a grazing plan that addresses the type of livestock and species of weeds to be controlled, the timing and duration of grazing, livestock fencing and movement, and control of weed seed dispersal.

2.7.1.11 Reduction in Beaver Activity

- Encourage the presence of beavers in areas with compatible land use.
- Relocate nuisance beavers to areas with compatible land use.

In the Upper Yakima basin, the abundance and distribution of American beaver (*Castor canadensis*) have been greatly reduced through floodplain development and historic trapping. Floodplain development prevents opportunities to coexist with beaver due to the inherent risks of flooding that are associated with beaver activity.

Beavers influence riparian and wetland habitat quantity and quality, and increase summer base flows. Beaver dam construction increases the number of pools, wide channels, and creates wetland habitat. Beaver ponds support fish including coho and Chinook salmon and also capture sediment, increasing water quality downstream. Without beavers, streams have become disconnected from their floodplains and large woody debris supplies have been diminished. The loss of ecological functions that beavers provide directly diminishes riparian productivity (Lichatowich 1999).

Where beaver presence is compatible with land uses, it should be encouraged. Nuisance dams can be managed to reduce flood risks or beavers can be relocated to more appropriate locations (Conley et al. 2009).

2.7.1.12 Water Quality Improvement

- Reduce stream temperatures though activities that provide more shading.
- Reduce impervious surface.
- Remove abandoned forest roads or decommission unnecessary existing roads.
- Manage livestock in riparian areas.
- Implement best practices in agriculture to reduce runoff and erosion directly into streams.
- Educate pet owners about the benefits of properly collecting, bagging, and disposing of pet feces.
- Educate property owners about the benefits of properly maintained septic systems.

Elevated water temperature is the most common reason for state listing of water quality impairment in the Upper Yakima basin in Kittitas County. Degradation is largely derived from multiple non-point sources such as agricultural and forestry practices as well as urban stormwater runoff. Land management activities, such as forest management, grazing, agriculture, and development, can affect temperature adversely where they damage vegetation adjacent to streams, cause excessive erosion of streambanks, add sediment to streams, reduce instream flow, or return warmed waters to the stream.

Causes of elevated temperatures in the Upper Yakima basin include removal of riparian vegetation, modifications in channel morphology, and changes in floodplain

connection (Reclamation 2002). Many riparian areas have been heavily grazed or logged, reducing regeneration of cottonwood and other riparian species that shade shorelines (Conley et al. 2009). Changes in channel morphology can be caused by sedimentation, which has many sources, including irrigation return flows, erosion of earthen roads and culverts, and streambank instability (Creech 2003b). Changes in floodplain connection have been altered by development of transportation and urban infrastructure. Stormwater runoff from impervious surfaces in these areas can increase stream temperatures.

Levels of pH and dissolved oxygen are also impairment issues in some Upper Yakima basin streams. Dissolved oxygen may violate state water quality standards when temperatures increase or as processes requiring oxygen (e.g., decomposition) occur. The pH may increase as water levels decrease and aquatic plants flourish, altering the chemistry of the water

Impairment by fecal coliform is most prevalent in subbasins with agricultural and human development. Contamination is often caused by livestock operations, faulty septic systems, or domestic pets. Fecal coliform levels in streams can be reduced by keeping livestock away from creeks and implementing best management practices to prevent runoff from agricultural fields. Domestic pet owners should properly collect, bag, and trash feces. Property owners can inspect septic systems to make sure they are maintained and working properly.

Water temperatures can be cooled by shading the waterbody through adding and retaining streamside vegetation. Planting programs for cottonwood would benefit salmonids and the ecosystem as a whole (Conley et al. 2009).

See Section 2.7.1.10 for a discussion of managing livestock grazing in riparian areas.

2.7.1.13 Lake Shorelines

- Educate the public about vectors for the introduction of non-native aquatic plants to waterbodies.
- Educate the public about the techniques for low impact camping on lake shorelines.
- Preserve and protect the remaining intact riparian vegetation within recreation areas.

Lake shorelines in the Upper Yakima basin contain almost no development other than recreation and transportation. Most lakes are located on state and federal lands. The largest lakes in the basin are used for water impoundment. Lake shorelines on public lands may be subject to soil compaction from dispersed

camping. The greatest impact to the glacial lakes that have been converted to reservoirs is recreational development, fluctuating shorelines due their current function as storage impoundments, and contamination by stormwater runoff from transportation infrastructure.

Lake shorelines that are repeatedly exposed to drawdown tend to have low abundance and diversity of emergent, submergent, and floating vegetation. The level of abundance and diversity is controlled by the level of fluctuation (Wagner and Falter 2002). Additionally, there is loss of fine sediments and organic matter (Furey et al. 2004). These factors can create conditions for invasion of exotic species (Hudon 1997) and have negative impacts on benthic macroinvertebrates and fish habitat (Furey et al. 2006).

2.7.2 Naches

The portion of the Naches basin in Kittitas County is part of the Little Naches River subbasin. The upper subbasin contains a checkerboard of U.S. Forest Service and private timber company land. Timber harvest and associated roads have contributed to fine sedimentation in gravel beds. Over 35 percent of the harvestable timber was removed by 1992 and little timber harvest on public lands has occurred since that date. The area is now part of the Aquatic Conservation Strategy identified in the Northwest Forest Plan (USFS 1994).

Timber harvest and roads, lack of deep pools and habitat complexity associated with lack of large woody debris, increased frequency and magnitude of peak streamflows, and high water temperatures have contributed to fine sediment in salmonid spawning gravels in the Little Naches basin (Haring 2001).

The river has been channelized and disconnected from the floodplain. Placement of riprap to protect campgrounds from erosion has contributed to channelization (Wissmar et al. 1994). Additionally, after floods in the 1970s and 1980s, the main road accessing the Little Naches drainage was reconstructed and over 6,000 tons of large woody debris was removed from the channel, causing aggradation of the channel, disconnection of the main channel from side channel and wetland habitats, and dewatering of off-channel habitats (Conley et al. 2009).

Large woody debris installation projects have been implemented in this watershed with the intent of improving fish habitat and reducing threats to developed campgrounds. Additional projects should focus on improving fish habitat and reconfiguration of the road/embankment system (Conley et al. 2009).

2.7.2.1 Recreation Impacts

- Develop educational outreach regarding the potential impacts of ORV use.

Similar to the Upper Yakima basin, reduction of recreation impacts such as dispersed camping and ORV use would benefit ecosystem health. The Little Naches subbasin is an area of high use by ORVs. ORV groups and the U.S. Forest Service have developed a good working relationship and should continue to develop educational outreach regarding the potential impacts of ORV use (Conley et al. 2009).

2.7.2.2 Habitat Protection

Acquisition of areas in the Little Naches could be integrated into significantly larger landscape-scale protection efforts in the Little Naches watershed (Conley et al. 2009).

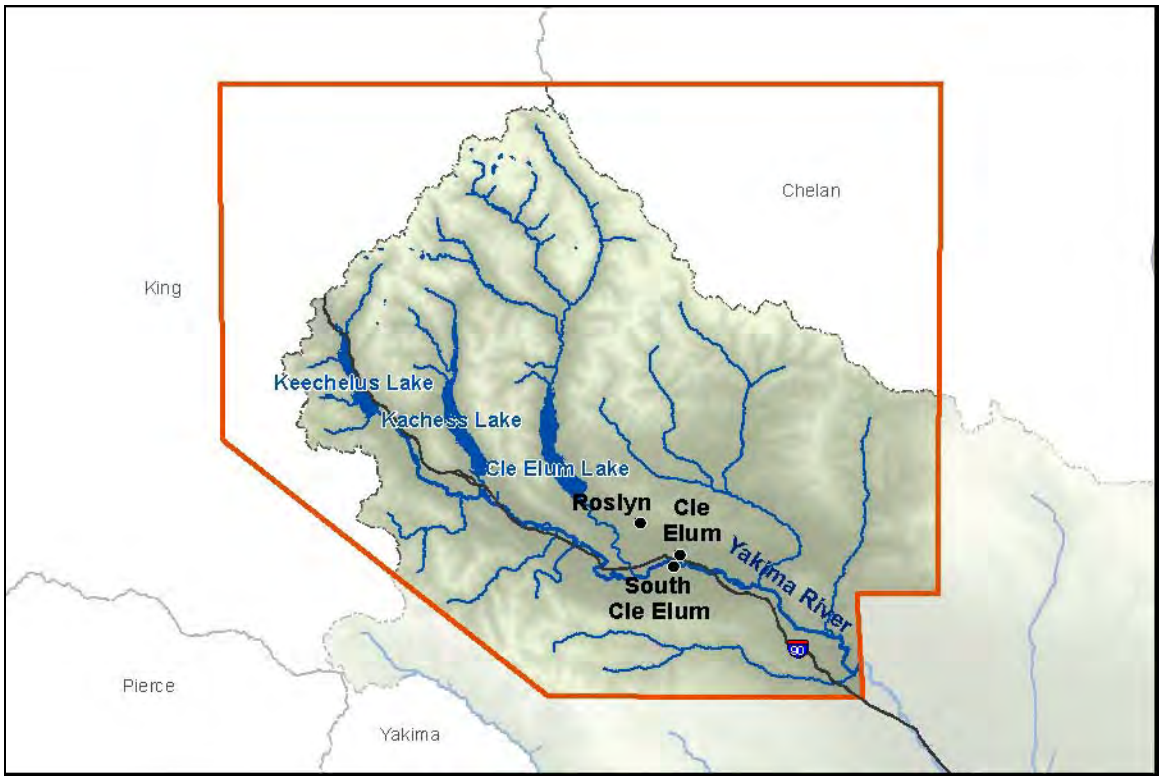
2.7.3 Alkali-Squilchuck

The Alkali-Squilchuck basin in Kittitas County contains the Wanapum Dam and part of the Priest Rapids Dam reservoirs, which are part of a large hydropower and irrigation complex that spans the length of the Columbia River in the United States. The reservoirs are subject to similar ecological concerns as reservoirs in the Upper Yakima basin. Minimal development exists on shoreline of the reservoirs, and the development that does exist is related to recreational infrastructure such as boat launches and camping, and transportation infrastructure. The reservoirs are subject to water level fluctuations from drawdown and the associated problems discussed previously for the Upper Yakima basin reservoirs. Water quality concerns also exist due to toxins and pollutants from agricultural runoff, but the majority of the sources are outside of Kittitas County in Grant County and upstream.

CHAPTER 3. UPPER COUNTY

This chapter describes the conditions within the shoreline inventory area of upper Kittitas County (including the City of Cle Elum and Town of South Cle Elum). The upper Kittitas County shorelines include the upper Yakima River and its tributaries from the Yakima River headwaters to the Taneum Creek confluence (Figure 3-1). The 35 streams and 29 lakes and ponds within the upper county are described in terms of their physical characteristics, ecological conditions, and human environment/land use characteristics. Readers are encouraged to review Chapter 2 and the maps in Appendix A for additional context on the information presented here.

Figure 3-1. "Upper County" shorelines.



Characteristics for the shoreline reaches are detailed on "reach sheets" included in this chapter. The information on the reach sheet is based upon available county-wide data sources that describe key physical, ecological, and land use characteristics. A description of the available data sources, including data limitations, is presented in Appendix B. Shoreline reaches located within the Alpine

Lakes Wilderness Area are generally not subject to shoreline jurisdiction, and therefore do not have reach sheets and are only briefly described below.

3.1 Keechelus Lake

Keechelus Lake is located at the headwaters of the Yakima River in the northwest portion of Kittitas County within the Cascade Range. It is designated as a "lake of statewide significance." The lake is an impoundment of the Yakima River behind Keechelus Dam, used as a reservoir to supply irrigation water as part of the Yakima Project.

3.1.1 Physical Characterization

Keechelus Lake was a natural lake prior to construction of Keechelus Dam on the upper Yakima River (RM 214.5) in 1917. Keechelus Lake measures approximately 5.5 miles long and 0.7 miles wide and is oriented in a northwest to southeast direction. The maximum depth is estimated at 310 feet. The lake surface area is 2,526 acres when filled to capacity. The active storage of the reservoir is approximately 157,800 acre-feet behind the 128-foot-high dam at the lake's southern extent (Haring 2001). Major tributaries to Keechelus Lake are described in Section 3.2.

Interstate 90 traverses the eastern shoreline of the lake. Steep slopes are mapped near the northeastern, central, and southwestern portions of the lake (Kittitas County 2012). The FEMA 100-year floodplain notably extends into the inventory area at several locations, including: near the mouths of Coal and Gold creeks, along the western shoreline south of the mouth of Cold Creek, south of the mouth of Roaring Creek, and along the shoreline between the mouth of Meadow Creek and Keechelus Lake Dam (FEMA 1996).

3.1.2 Habitats and Species

3.1.2.1 Fish Use

Keechelus Lake supports spawning of bull trout and kokanee. Other species present include burbot, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat (StreamNet 2010).

The lack of upstream fish passage facilities at Keechelus Dam has precluded anadromous salmonids from accessing approximately 9 miles of highly productive historic habitat (Haring 2001). The dam isolated the populations of bull trout and redband trout that live in Keechelus Lake and spawn in Gold Creek but cannot

migrate to the Yakima River below the dam. The Keechelus Lake bull trout stock is considered critical because of its low numbers and isolation (WSDOT 2005, 2008). Bull trout were listed as a threatened species (under the federal Endangered Species Act) in 1999.

Before construction of dams on the Yakima River in the early 1900s, Middle Columbia River steelhead had access to most of the upper Yakima River watershed including Keechelus Lake (Haring 2001; WSDOT 2005, 2008). Middle Columbia River steelhead were federally listed as threatened in 1999. Major factors for their decline in the Yakima River basin include the following (Conley et al. 2009):

- Alteration of streamflows due to development of irrigation systems;
- Fish passage barriers at roads and dams;
- Diking, channel simplification, and floodplain development;
- Impacts to riparian areas and upland hydrology due to grazing and forestry practices; and
- Changed ecological dynamics, including reduction in beaver populations, reductions in delivery of oceanic nutrients to headwaters by salmon, introduction of exotic species, and increased predation by native species.

Efforts are underway to restore anadromous fish habitat upstream of Keechelus Dam. The Integrated Water Resource Management Plan for the Yakima River basin proposes installing upstream and downstream fish passage facilities at Keechelus Dam, subject to further evaluation of alternatives to determine the most feasible approach for providing passage (Reclamation and Ecology 2011a).

The "K to K" pipeline is another project proposed under the Integrated Plan. Water would be conveyed from Keechelus Lake to Lake Kachess to reduce flows and improve habitat conditions during high flow releases below Keechelus Lake and provide more water storage in Lake Kachess for downstream needs. The pipeline may also help Lake Kachess refill after using inactive storage (Reclamation and Ecology 2011a).

3.1.2.2 Water Quality

Keechelus Lake is on Ecology's 303(d) list for polychlorinated biphenyls (PCBs) and dioxin. According to a 1993 assessment by Ecology, the trophic status of the lake was listed as oligotrophic, indicting a lack of nutrients such as phosphates, nitrates, and organic matter, and high dissolved oxygen levels (Rector 1996).

3.1.2.3 Riparian Habitat Conditions (Land Cover)

Within the shoreline inventory area, the shores of Keechelus Lake are largely unvegetated. I-90 runs along the eastern side of the lake, where the shoreline is steep with some near vertical rock outcrops. The John Wayne Heritage Trail borders the western side of the lake. Immediately outside of the shoreline inventory area, vegetation is mainly commercial timberland in various stages of succession. Some mature forest is present at the south end of the lake near I-90 (WSDOT 2005).

3.1.2.4 Wetlands

A fringe of unconsolidated shore, emergent, and scrub-shrub wetlands is associated with the shoreline of Keechelus Lake. The largest wetlands along the lakeshore occur where tributary streams enter the lake (WSDOT 2005).

Keechelus Marsh is a large wetland mapped immediately south of the lake.

3.1.2.5 Wildlife Habitats and Species

Several northern spotted owl occurrences (federally listed threatened species) are mapped in the vicinity of Keechelus Lake, although the lake itself is not within mapped critical habitat for this species.

Western toads, a state candidate species and federal species of concern, may opportunistically use seasonal wetlands and pools formed in the large delta exposed during the summer low pool of Keechelus Lake (WSDOT 2005).

As part of improvements to Interstate 90 between Hyak and Lake Easton, the Washington State Department of Transportation (WSDOT) is constructing "connectivity emphasis areas" or CEAs at several locations. The purpose of the CEAs is to restore or enhance connections between habitats on both sides of I-90 to benefit fish, wildlife, and hydrologic functions. CEAs are planned along Keechelus Lake at several stream crossings: Gold Creek, Rocky Run Creek, Wolf Creek, Resort Creek, Townsend Creek, and Price/Noble Creeks (WSDOT 2011).

3.1.3 Land Use

The entire eastern shore of Keechelus Lake is bordered by I-90, and the southern and western shorelines are primarily National Forest land. The WSDOT Hyak Operation Center is located at the northern end of the lake.

Although most of the land use on National Forest lands is outside the jurisdiction of the County's SMP, there are two "special use" authorizations identified within the

inventory area. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.1.4 Public Access

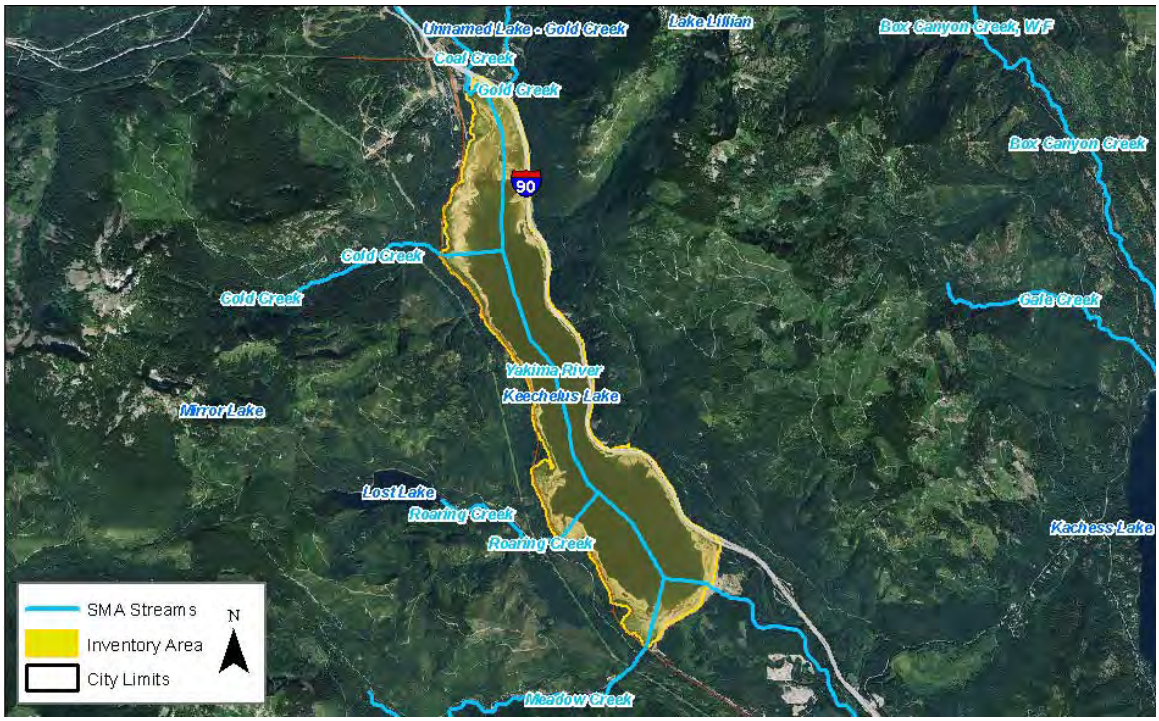
The John Wayne Heritage Trail borders the western shore of the lake; cross country ski trails roughly parallel the western and southern lake shorelines. A boat launch is also located on the western shore of the lake, which can be accessed from Forest Service Road 9070.

3.1.5 Reach Sheet

KEECHELUS LAKE

SHORELINE LENGTH:
49.5 Miles

WATERBODY AREA: 2,408.5 Acres
REACH INVENTORY AREA: 2,772.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The lake is located in a valley, oriented northwest to southeast. The 128-foot-high dam, located at the south end of the lake, regulates pool elevations between 2,517 feet and 2,425 feet.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX B)

Roughly one-third of the reach (32%) is located within the FEMA 100-year floodplain and a few landslide hazard areas (1%) are mapped along the eastern shoreline of the lake.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dioxin, PCB, and temperature.

LAND COVER (MAP FOLIO #3)

This reach is primarily open water (49%), unvegetated (19%), and other (10%). Limited developed land (7%), conifer-dominated forest (7%), shrubland (6%), riparian vegetation (1%), and harvested forest (1%) are also present.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the lake provides spawning habitat for bull trout and Kokanee salmon. The presence of burbot, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Patches of wetland habitat (3% of the reach) are mapped along the lake shoreline. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The lake level is controlled by a dam (barrier to fish passage), and I-90 borders the eastern shore.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail is located along the west shore of the lake; cross-country ski trails border the western and southern shorelines of the lake. A boat launch is located on the northwest shore of the lake.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) The primary land use around the lake is forestry (95%), with some rural land along the north shore of the lake (5%). Land ownership is 25% private and 75% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Land surrounding Keechelus Lake is zoned for commercial forestry (33%) at the north and south ends, and other (67%) [I-90 and John Wayne Trail] along the western and eastern shores.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 44 recorded sites and 1 National Register site located within the reach. Recorded sites include 22 precontact sites, 13 historic sites, and 9 sites that featured both precontact and historic components.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake provides habitat for several priority fish species (including spawning habitat for bull trout and Kokanee salmon), but is primarily managed as an irrigation reservoir and has listed water quality impairments.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The lake is connected to a large area of contiguous forest habitat to the west, but the eastern shore is closely bordered by I-90.
VEGETATION FUNCTIONS **Medium:** Over half of the lake circumference is bordered by forest cover, while the remaining shoreline has been altered by development (primarily I-90).	**HYDROLOGIC FUNCTIONS** **Medium:** The lake provides significant floodwater storage and it's the origin of the Yakima River, but it is managed as an irrigation reservoir.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Keechelus Dam is a complete barrier to fish passage.
- Many important cultural and archaeological sites are located along the lakeshore.

3.2 Keechelus Lake Tributaries

Tributaries to Keechelus Lake with mean annual flows greater than 20 cubic feet per second (cfs) include Gold Creek and Coal Creek (draining to the north end of the lake); Cold Creek (draining to the northwest portion of the lake); and Roaring Creek and Meadow Creek (draining to the southwest and southern sections of the lake shoreline, respectively). Tributary lakes over 20 acres in size in the watershed above the lake include Lost Lake, Mirror Lake, Alaska Lake, Joe Lake, and Lake Lillian. Joe Lake, Alaska Lake, and Lake Lillian are located within the Alpine Lakes Wilderness area and are only briefly described below.

3.2.1 Physical Characterization

Topography within the Keechelus Lake watershed is relatively flat to moderately steep, with extensive flat areas along Gold Creek. Gold Creek experiences low base flows in the summer/early fall and complete dewatering has been observed near the mouth of the stream, despite Gold Creek Pond contributing flow in the lower portion of the stream.

Landslide hazard areas are mapped along each of the tributaries. Lost Lake (the headwaters to Roaring Creek) has a relatively extensive landslide area mapped along its northwestern, southwestern, and eastern shores; the eastern shore landslide area extends over the upper reach of the stream (WDNR 2010). These tributaries have steep slopes mapped adjacent to their upper reaches, with the exception of Coal Creek (Kittitas County 2012). Channel migration zones are mapped along Coal Creek and the lower portion of Gold Creek. A residential subdivision is located within the Gold Creek migration zone.

The FEMA 100-year floodplain extends into and beyond the Coal Creek inventory area at its confluence with Keechelus Lake. The floodplain is also mapped along the downstream half of Gold Creek, extending outside of the inventory area for part of this segment. A portion of the western inventory area of Unnamed Lake-Gold Creek Reach 1 is located within the Gold Creek FEMA 100-year floodplain (FEMA 1996).

3.2.2 Habitats and Species

3.2.2.1 Fish Use

Table 4-1 summarizes mapped fish use in tributaries to Keechelus Lake. As discussed in Section 3.1.2, the Keechelus Lake Dam is a major barrier to anadromous fish passage into upper Yakima tributaries.

Natural falls at RM 11.4 on Gold Creek act as a barrier to upstream fish passage (Haring 2001). Three overwater structures (bridges associated with I-90 and FS Road 4832) are located over Gold Creek. Two mapped roads (SR 906 and Interstate 90) cross over Coal Creek; the latter road crosses the stream at multiple locations. In addition, two culverts on Coal Creek act as fish passage barriers. A culvert at the old Milwaukee Railroad grade (now the John Wayne Heritage Trail) crossing on Cold Creek (100 yards upstream from the mouth) is perched and is a complete barrier to fish passage. In addition, three road culverts on Meadow Creek exceed gradient criteria for fish passage design. Nine other fish passage barrier culverts are located on other tributaries to Keechelus Lake (Haring 2001).

Fish passage in Gold Creek is also impaired by channel confinement, lack of riparian vegetation, and upstream dewatering. The highway fill, cut slopes, and drainage structures for I-90 have affected the recharge and connectivity of aquifers in the Gold Creek basin, potentially contributing to dewatering of Gold Creek upstream of I-90. WSDOT recently completed new I-90 bridges over Gold Creek which may improve fish passage (WSDOT 2005; 2008).

As shown in Table 3-1, cutthroat trout are common in upper Yakima watershed streams. However, isolation of cutthroat populations by barriers and the presence of introduced brook trout pose threats to the persistence of the cutthroat trout population above Keechelus Dam (WSDOT 2005).

Table 3-1. Fish Use in Keechelus Lake Tributaries (Source: StreamNet 2010)

Species	Meadow Creek	Roaring Creek	Lost Lake	Mirror Lake	Cold Creek	Coal Creek	Gold Creek	Unnamed Lake - Gold Creek	Alaska Lake	Joe Lake	Lake Lillian
Bull Trout							S				
Rainbow Trout					P/M		P/M				
Westslope Cutthroat	P/M				P/M	P/M	P/M		P/M	P/M	P/M
Eastern Brook Trout			P/M				P/M				
Kokanee Salmon			P/M			S	P/M, S	S			
Burbot							P/M				
Mountain whitefish							P/M	P/M			

P/M = presence/migration; S = spawning

3.2.2.2 Water Quality

Lower Meadow Creek has a 303(d) listing for high water temperatures. WSDOT performed water quality monitoring of streams in the upper Yakima River watershed in 2001 as part of the I-90 improvements project. Their sampling found exceedances of state water quality standards in Coal Creek (temperature, turbidity, fecal coliform, dissolved oxygen, and heavy metals) and Gold Creek (temperature, dissolved oxygen). Possible reasons for high temperatures include a lack of riparian vegetation, disruption of groundwater flow by roads and drainage structures, and excessive sediment deposition leading to shallow water. Sediments may be eroded when stream channels are confined, such as by the I-90 bridges; sand applied to I-90 for traction may also contribute excess sediment. Low dissolved oxygen may result from elevated stream temperatures and decomposition of organic matter. Heavy metals are a common pollutant in roadway runoff. (WSDOT 2005)

3.2.2.3 Riparian Habitat Conditions (Land Cover)

The tributaries to Keechelus Lake flow mainly through managed forestland. I-90 crosses the riparian zone of Gold Creek and Coal Creek. The Summit at Snoqualmie Washington Ski Resort is located adjacent to lower Coal Creek. Limited residential development encroaches into the riparian zone along lower Roaring Creek (see Section 3.2.3).

3.2.2.4 Wetlands

Large wetlands are mapped along lower Coal Creek and lower Gold Creek. Before I-90 and the Keechelus Dam were constructed, the floodplain of Gold Creek was likely unrestricted and supported a diverse wetland and riparian community extending to a delta on the historic lake shoreline. Today, the edge of the lake is often drawn down to south of where Gold Creek crosses under I-90, and the Gold Creek delta is exposed (WSDOT 2005).

An unnamed lake is located adjacent to the lower reach of Gold Creek. This lake may have been a historic gravel pit excavated from scrub-shrub and emergent wetland (WSDOT 2005).

3.2.2.5 Wildlife Habitats and Species

One marbled murrelet sighting has been recorded in the Gold Creek Valley (WSDOT 2005). This species is federally listed as threatened.

The Washington Natural Heritage Program maps the Coal Creek shoreline inventory area as habitat for rare moss species.

WSDOT and others have identified the Gold Creek corridor as a "Connectivity Enhancement Area", or an area with high potential for reestablishing wildlife travel linkages. This area has a high incidence of deer and elk roadkill, indicating that these species use the area for a movement corridor despite the danger of crossing I-90. This area has also been identified as the best linkage area for other wide-ranging species sensitive to high road densities, such as fisher, wolverine, gray wolf, and grizzly bear. It also provides a good opportunity to link habitat for small mammal, bryophyte, lichen, fungus, vascular plant, and mollusk species that only occur in the Snoqualmie Pass area (WSDOT 2005).

3.2.3 Land Use

Extensive logging has occurred within the watershed and in the vicinity of each tributary. Other major landscape alterations include a utility corridor that parallels the western shoreline of Keechelus Lake and crosses Cold, Roaring, and Meadow Creeks.

The majority of Roaring Creek is located on commercial forest-zoned lands (both private and National Forest), with one moderate-density residential subdivision located near the creek mouth. Land use varies along Coal Creek; the upper and lower ends of the stream are located within the I-90 corridor, while the middle section flows through undeveloped, forested land that is zoned for planned unit development. Additionally, the Summit at Snoqualmie Washington Ski Resort is located adjacent to Coal Creek.

The downstream end of Gold Creek is bordered primarily by a moderate-density residential development, private commercial-forest zoned land, and undeveloped land zoned for planned unit development. The remainder of the creek is located on National Forest land.

The remaining stream reaches and lakes that drain to Keechelus Lake are located on National Forest land. According to National Forest mapping data, there is one “special use” authorization identified within the inventory area of Roaring Creek. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

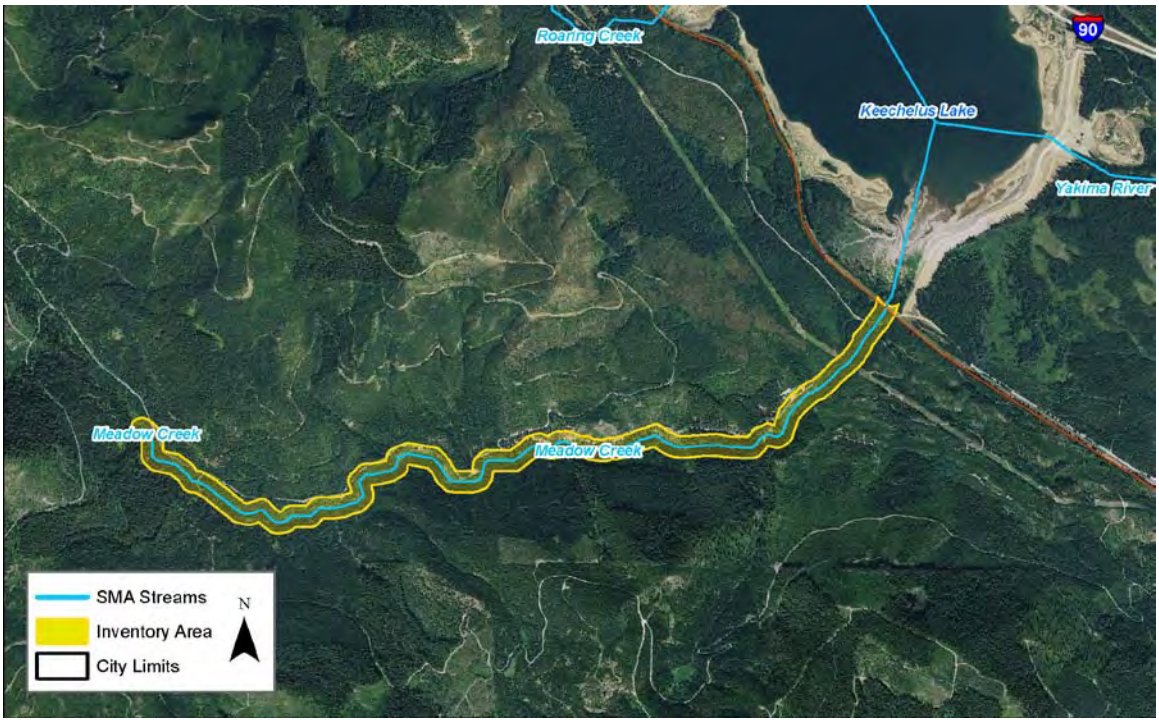
3.2.4 Public Access

Most of the lakes and streams that drain to Keechelus Lake can be accessed by hiking and/or cross-country ski trails, primarily on National Forest lands.

3.2.5 Reach Sheets

MEADOW CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
3.4 Miles	165.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is largely undeveloped; a forest service road borders most of the northern shoreline. The reach flows under a power line corridor, a forest service road, and the John Wayne Memorial Trail before draining to Keechelus Lake.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is harvested forest (41%), conifer-dominated forest (31%), and riparian vegetation (28%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A very limited amount (<1%) of the reach is located within the FEMA 100-year floodplain and a small number of landslide hazard areas (3%) are mapped.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW has not identified any priority fish species within this reach.

A very small amount (2%) of the reach is mapped as wetland. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road borders much of the northern shoreline. The John Wayne Trail and a Forest Service road cross the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road borders the northern regulated stream area and crosses the upstream and downstream portions of the reach; the John Wayne Heritage Trail and a hiking trail also cross the downstream portion of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 37% private and 63% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A single recorded historic site is located within the reach that was determined not eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

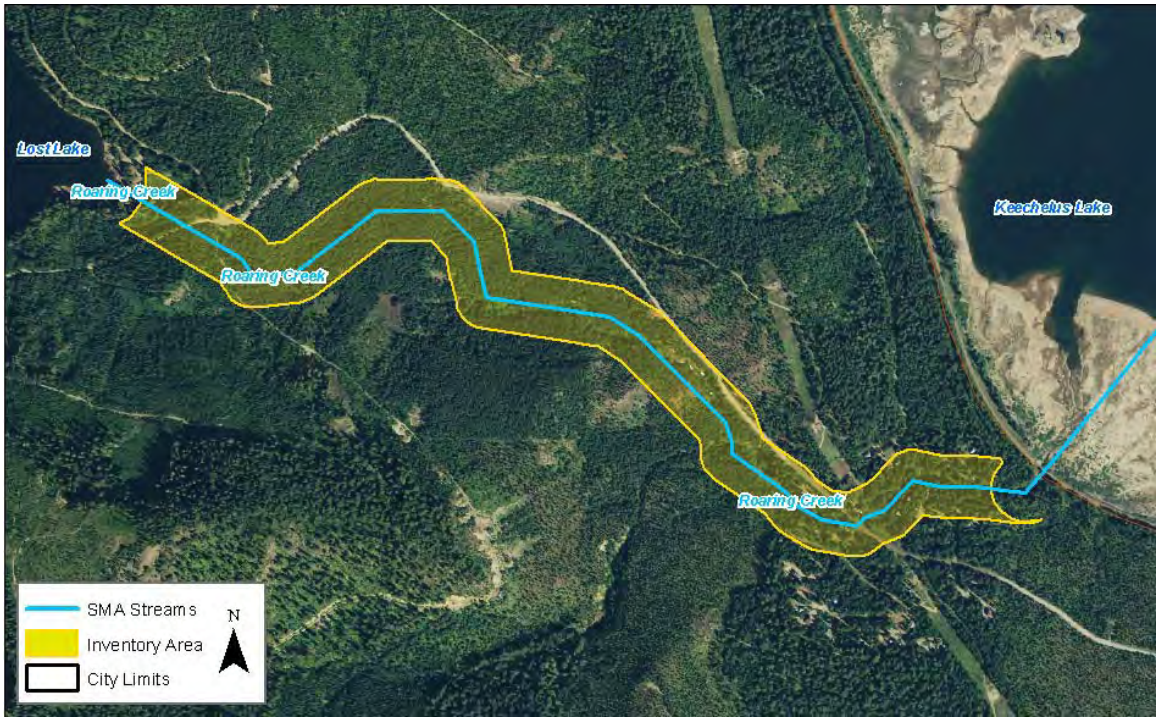
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, forest cover, but significant portions have been disturbed by timber harvest activities.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.
- New development should be set back an adequate distance to protect stream functions.

ROARING CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.3 Miles	63.6 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach descends approximately 600 feet in elevation within a narrow ravine and is generally confined within a single channel.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A limited extent (3%) of the reach is located within the FEMA 100-year floodplain. The upstream half of the reach (51%) has mapped landslide hazard areas.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mainly harvested forest (70%) and conifer-dominated forest (23%), with patches of riparian vegetation (6%) and developed lands (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW has not identified any priority fish species within this reach.

No wetlands are mapped in this reach, and no priority habitats or species are identified by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road crosses the upstream and downstream portions of the stream.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 68% public and 32% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (97%) and other (3%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 historic and 1 precontact site recorded within the reach. The recorded historic site has been determined not eligible for inclusion on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The stream is largely unaltered, but there is no documented priority fish use within the reach.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat to the west, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

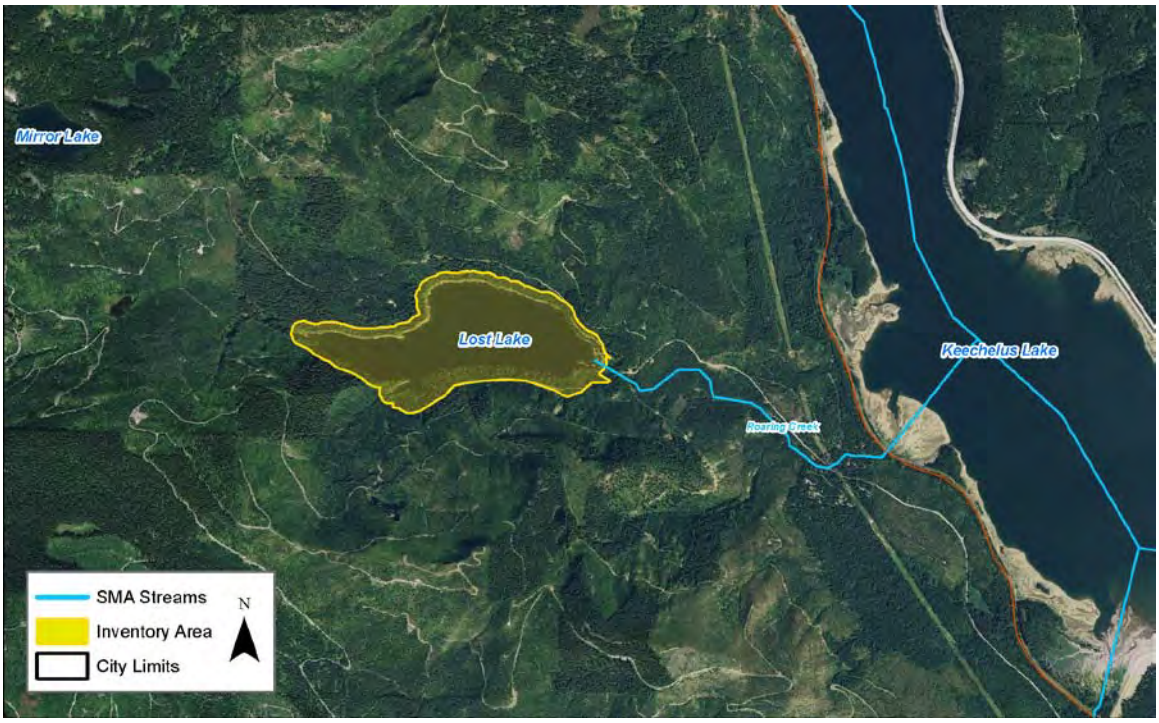
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, some resource lands within the reach have been converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

LOST LAKE

SHORELINE LENGTH:
5.3 Miles

WATERBODY AREA: 155.0 Acres
REACH INVENTORY AREA: 247.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is oriented east-west with a largely undeveloped shoreline. Lost Lake drains from its eastern shoreline to Roaring Creek and later to Keechelus Lake. Two forest service roads flank the eastern shoreline and limited camping is present at this location.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is open water (56%), conifer-dominated forest (34%), riparian vegetation (7%), and harvested forest (3%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Over half (61%) of the reach is located within the FEMA 100-year floodplain and numerous landslide hazard areas (40%) are also mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping identifies the presence of eastern brook trout and Kokanee salmon within the reach.

No wetlands are mapped within the reach. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Forest Service roads border some portions of the lake shore.	**PUBLIC ACCESS (MAP FOLIO #4)** The lake can be accessed from Forest Service Road 5480. Primitive camping sites and a boat launch are also present. Dog sled/snowmobile trails travel through the northeastern and southeastern portions of the regulated lake area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A single recorded precontact site is located within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The lakeshore is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The lake is bordered primarily by dense, unaltered forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The lakeshore is unaltered, and the lake has significant water storage potential.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

MIRROR LAKE

SHORELINE LENGTH:
0.9 Miles

WATERBODY AREA: 28.0 Acres
REACH INVENTORY AREA: 52.2 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located at the eastern base of Tinkham Peak and has an undeveloped shoreline. Mirror Lake drains from its southeastern shoreline, eventually to Lost Lake.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (54%) and open water (46%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping does not indicate the presence of any priority fish species within the reach.

A very limited extent (3%) of the reach is mapped as wetland. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no identified shoreline modifications within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The lake can be accessed via a trail from Forest Service Road 5480.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake is largely unaltered, but priority fish use is mapped.	**TERRESTRIAL HABITAT QUALITY** **High:** The lakeshore is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The lake is bordered primarily by dense, unaltered forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The lakeshore is unaltered, and the lake has significant water storage potential.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access to the reach.

COLD CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.0 Miles	96.3 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows west to east and drains directly to Keechelus Lake. Limited development is adjacent to the reach; a forest service road borders the northern shoreline. The stream also flows under a forest service road bridge, a power line corridor, and the John Wayne Memorial Trail.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (83%), riparian vegetation (12%), and harvested forest (5%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain; a small number of landslide hazard areas (6%) are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of rainbow trout and westslope cutthroat.

No wetlands are mapped within the reach. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road borders much of the northern shoreline. The John Wayne Trail and a Forest Service road cross the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail crosses the upstream portion of the reach is two locations and a cross country ski trial borders the northern regulated stream area. The John Wayne Heritage Trail and a hiking trail cross the downstream portion of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 2% private and 98% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** Historic features such as railroad tracks, campsites, rails, and a railroad grade from the Milwaukee Road Railroad were recorded within the reach. The historic features were determined not eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

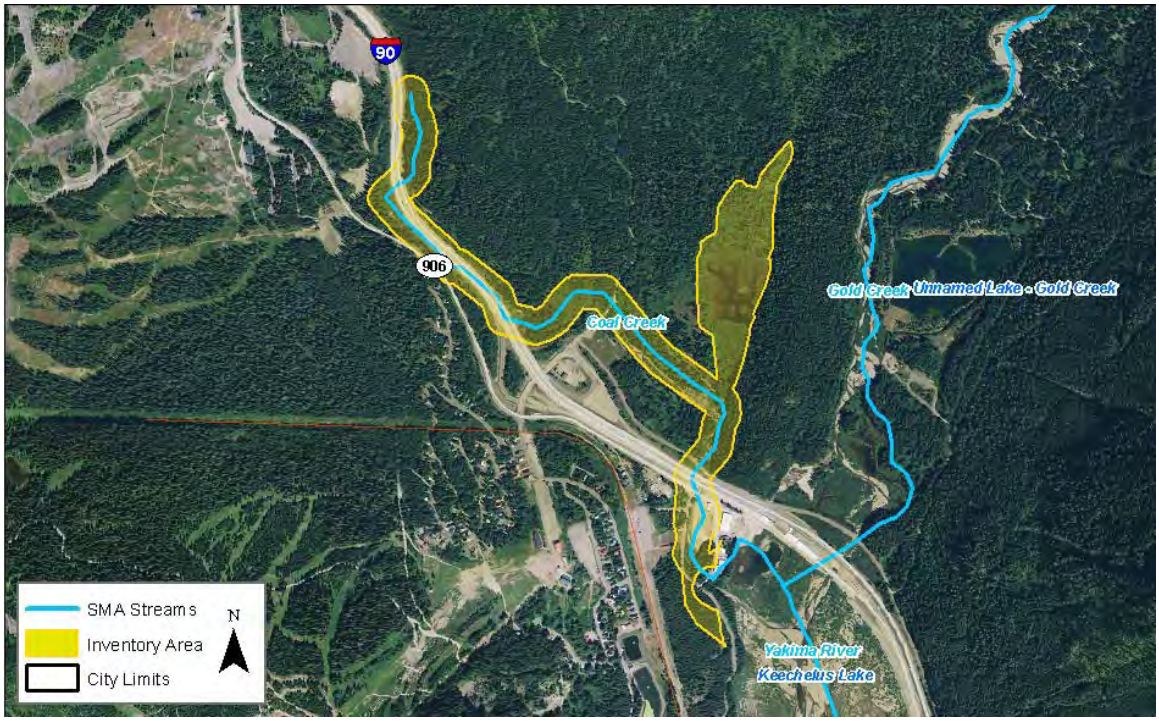
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

COAL CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.7 Miles	122.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach drops roughly 250 feet in elevation, flowing under several roadways that confine its movement. A downstream portion of the reach is unconfined and exhibits limited channel migration.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A small amount (8%) of the reach is located within the FEMA 100-year floodplain and a small number of landslide hazard areas (1%) are mapped near the upstream end of the reach. Over three-quarters (69%) of the reach has potential for channel migration.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by conifer-dominated forest (41%), other (27%), and developed lands (14%), with limited cover provided by harvested forest (7%), riparian vegetation (5%), unvegetated (4%), and shrubland (3%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for Kokanee salmon. The presence of westslope cutthroat is also mapped.

A large wetland (29% of the reach), which extends outside of the regulated shoreline, is mapped on the left bank of the stream. No priority habitats or species are identified in this reach by WDFW.

The Washington Natural Heritage Program maps the Coal Creek shoreline inventory area as habitat for rare moss species.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Portions of the reach are constrained by I-90, and two culverts act as fish passage barriers.	**PUBLIC ACCESS (MAP FOLIO #4)** A cross country ski trail borders the northern regulated stream area; a hiking trail crosses the stream in two locations near the upstream extent of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is rural (100%). Land ownership is 88% private and 12% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for mixed use (53%), with some areas of forest & range (12%), urban/suburban residential (6%), commercial (2%), and other [I-90] (22%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 historic site is recorded within the reach. The site is a portion of the Sunset Highway and Snoqualmie Pass Highway that was built circa 1928.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species (including spawning habitat for Kokanee salmon), but has two fish passage barriers and it heavily modified in areas by I-90.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains a large wetland and is connected to a large area of contiguous forest habitat to the west, but portions of the reach are in close proximity to I-90.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, mature forest cover, but significant areas have been impacted by the I-90 corridor.	**HYDROLOGIC FUNCTIONS** **Low:** Significant portions of the shoreline and its floodplain are modified by I-90.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Two culverts (associated with I-90) are fish passage barriers.
- Significant portions of the reach are bordered by undeveloped, private land. Future new structures should be set back an adequate distance to protect stream functions and protect structures from channel migration.
- The reach contains a rare moss species, mapped by the Washington Natural Heritage Program.

GOLD CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.8 Miles	360.2 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach transitions upstream to downstream from a narrow ravine to a broad single channel with frequent channel migration, except in the vicinity of the I-90 crossing.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 42% of the reach is located within the FEMA 100-year floodplain and a very limited amount of landslide hazard areas (<1%) are mapped in the reach. Over half (50%) of the reach has potential for channel migration.

WATER QUALITY

The reach meets water quality criteria for temperature, per the State's Water Quality Assessment.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is largely conifer-dominated forest (78%). The reach also contains the following land cover: riparian vegetation (8%), other (8%), developed land (3%), shrubland (2%), and unvegetated (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for bull trout and Kokanee salmon. The presence of burbot, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped at multiple locations along the stream (12% of the reach), primarily along the lower portion of the reach. Priority mountain goat summer range is mapped at the upstream end of this reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) I-90 crosses the reach at the downstream end.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail crosses the upstream portion of the stream at several locations.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along upper Gold Creek is forestry (59%), while land use along the lower creek is primarily rural (41%). Land ownership is 41% private and 59% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (59%), with some areas of forest & range (20%), mixed use (13%), and other (7%) at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 historic site is recorded within the reach. The site is a portion of the Sunset Highway and Snoqualmie Pass Highway that was built circa 1928.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The creek provides spawning habitat for priority fish species, but experiences low summer flows.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains significant wetland habitat and connectivity to large areas of forest habitat, but has been altered in some areas by I-90, residential development, and timber harvest.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, mature forest cover, but some riparian areas have been disturbed by I-90, residential development, and timber harvest.	**HYDROLOGIC FUNCTIONS** **Medium:** The upstream portion of the stream is relatively altered, but the downstream portion is impaired by channel confinement and low summer flows.

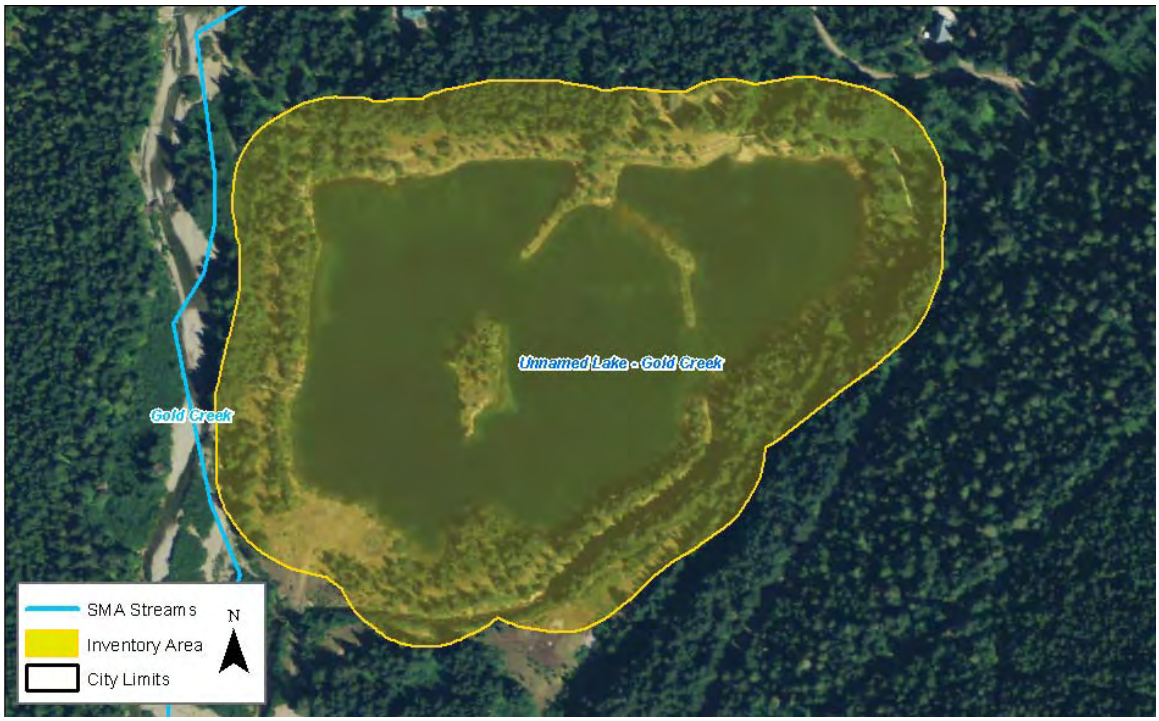
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from agriculture to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Decommission and revegetate any unused roads along the shoreline.
- Protect the high-quality forest and wildlife habitat within the reach.
- Low summer flows in the river are a limiting factor for salmon.

UNNAMED LAKE-GOLD CREEK

SHORELINE LENGTH:
1.3 Miles

WATERBODY AREA: 21.7 Acres
REACH INVENTORY AREA: 45.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

With a largely undeveloped shoreline, the waterbody drains to Gold Creek via a single channel at its southeastern extent.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 11% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The reach is within the channel migration zone of Gold Creek.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by open water (41%), conifer-dominated forest (39%), and other (12%). Shrubland (7%) and riparian vegetation (2%) are also present in this reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the lake provides spawning habitat for Kokanee salmon, and the presence of mountain whitefish is also mapped.

Approximately 3% of the shoreline is mapped as wetland habitat. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** Interpretive trails and a picnic area are located at the pond.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is primarily forestry (79%), and rural along the north shore of the lake (21%). Land ownership is 18% private and 82% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (79%), with mixed use (21%) along the northern lake shore.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake provides spawning habitat for priority fish species (Kokanee salmon), but fish use is relatively limited.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The lake has an undisturbed connection to Gold Creek to the west and is directly adjacent to undisturbed habitat areas, but much of the reach area is separated from adjacent habitat areas by roads and other development.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, mature forest cover, but some riparian areas have been disturbed.	**HYDROLOGIC FUNCTIONS** **High:** The lake has an unaltered hyporheic connection to Gold Creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Potential new development should be set back an adequate distance to protect riparian functions.
- Decommission and revegetate any unused access roads along lake shore.
- Explore restoration of former gravel pits to create more natural floodplain and riverine habitat.

3.3 Upper Yakima River

This section describes the upper Yakima River from its origin at the outlet of Keechelus Lake to the Taneum Creek confluence, a distance of approximately 47 miles. For this analysis, the upper Yakima River was divided into 5 reaches: Reach 5 (4.0 miles) extends from the Taneum Creek confluence to the Swauk Creek confluence, Reach 6 (6.3 miles) extends from the Swauk Creek confluence to the Teanaway River confluence, Reach 7 (10.4 miles) extends from the Teanaway River confluence to the Cle Elum River confluence, Reach 8 (7.4 miles) extends from the Cle Elum River confluence to the Little River confluence, Reach 9 (7.9 miles) extends from the Little Creek confluence to the outlet of Lake Easton, and Reach 10 (10.6 miles) extends from the Lake Easton inlet to the outlet of Keechelus Lake.

The Yakima River is designated as a "shoreline of statewide significance." Significant left-bank tributaries to the upper Yakima River include Kachess River, Cle Elum River, Teanaway River, and Swauk Creek. Right-bank tributaries include Cabin Creek, Big Creek, and Little Creek.

The upper Yakima River flows past the city of Cle Elum and the town of South Cle Elum. Shorelines within the jurisdictions of these municipalities are described below.

3.3.1 Physical Characterization

The upper portion of the Yakima River watershed lies in the Cascade Mountain Range, including the Alpine Lakes Wilderness Area. The watershed continues to the southeast on the eastern Cascade slopes and foothills. Much of the land adjacent to the upper portions of the river is forested; however, downstream of Cle Elum and South Cle Elum, development and agricultural activities have removed much of the forest. This lower portion of the watershed also experiences drier climatic conditions that favor different vegetation communities (e.g., shrub-steppe).

Relatively few railroad or vehicle bridges cross the river. The Lake Easton Dam is the only significant obstruction located in the channel.

Landslide hazard areas are mapped at two locations along the upper Yakima River: the left bank just downstream from Keechelus Lake Dam and both banks of the river just upstream from Lake Easton (WDNR 2010). Steep slopes are mapped in several locations along the river, primarily upstream from Lake Easton, downstream from the confluence with Little Creek, and from upstream of the Teanaway River confluence downstream to Taneum Creek (Kittitas County 2012). The upper Yakima River has a relatively wide channel migration zone that extends into residential and

agricultural areas, as well as the City of Cle Elum and Town of South Cle Elum. However, portions of the historic migration zone have been effectively disconnected from the active channel by I-90, railroads, and other public infrastructure.

Most of the reach inventory area located within the Upper Yakima River is mapped in the FEMA 100-year floodplain. Virtually all of reaches 7-10 are within the floodplain, except where railroads and steep topography limit flooding. Areas such as Elk Meadows, Elk Meadows Park, Pine Glen, and Sun Island have experienced damaging floods in the past (Tetra Tech, 2012). The middle portion of Reach 6 and the upstream and downstream portion of the left bank of Reach 5 are also mapped in the floodplain; Unnamed Lake 5 is mapped in the Yakima River Reach 7 floodplain (FEMA 1996). Virtually the entireties of Reaches 7-10 are mapped for potential channel migration, except for a short stretch where I-90 crosses the river in Reach 9.

From Keechelus Dam to Easton Dam, the Yakima River floodplain function is excellent, with a braided, meandering channel and numerous side channels (Haring 2001). The river has complex in-channel structure and an intact riparian corridor with little encroaching development. From Easton Dam to the confluence with the Cle Elum River, the channel exhibits similar characteristics, but with limited residential development within the floodplain. From the confluence with the Cle Elum River to the Teanaway River, the river is generally a large main channel, with some side channels. Downstream to Taneum Creek, the river is relatively confined as it flows through the Ellensburg Canyon (Haring 2001).

Interstate 90, a railroad corridor, and agricultural activities have degraded floodplain functions, particularly along the downstream portion of the upper Yakima River. These features and land use activities have resulted in bank modifications and channelization leading to a narrowed, single-channel river with numerous isolated side channels. This portion of the Yakima River experiences frequent bank sloughing and contains limited or no riparian cover (Haring 2001). Low levels of residential development occur along the banks of the river, with a few exceptions.

Unnamed Lake 5, which was a Yakama Nation project to provide off-channel habitat, is located downstream of South Cle Elum on the left bank of the river, between the river and I-90. The lake is approximately 0.3 mile long and 0.1 mile wide and is currently used by anglers. Unnamed Lake 5 was created from an old gravel pit; the Yakima River's floodplain is one of the most heavily mined floodplains in Washington State (Haring 2001). A hydromodification structure separates the lake from the river, although there is likely overbank flow during major storm events. A constructed berm divides the lake into two halves, but a break in the berm allows flow to pass between these two sections. Yakima River flows enter the upstream section of Unnamed Lake 5 through a small opening in the structure, flow between

the two halves, and then enter a channel separated from the river by a structure, reentering the river approximately 0.5 mile downstream.

3.3.1.1 City of Cle Elum

A short stretch of the Yakima River (Yakima River Reach 7) flows through the south-central city limits of Cle Elum. The river is listed as a shoreline of statewide significance in this reach. The upstream extent begins at the Fourth Street Bridge crossing and extends downstream approximately 0.5 mile. The river is confined by I-90, located on the left bank, within this stretch. In addition to the river, multiple ponds (i.e., Hansen Ponds) are located within the south-central and southeastern portions of the city, separated from the Yakima River by I-90 and a railroad right-of-way. Most of these ponds are old gravel pits and several are maintained as part of a city water treatment facility.

The entire inventory area is located within the FEMA 100-year floodplain (FEMA 1996) and the mapped channel migration zone.

3.3.1.2 Town of South Cle Elum

The Yakima River (Yakima River Reach 7) also flows through the northwestern boundary of the Town of South Cle Elum. The river is listed as a shoreline of statewide significance in this reach. This stretch of river only extends approximately 0.1 mile through the city. A railroad line borders the left bank of the river in this area.

The entire shoreline inventory area is located within the FEMA 100-year floodplain (FEMA 1996) and the mapped channel migration zone.

3.3.2 Habitats and Species

3.3.2.1 Fish Use

The mainstem upper Yakima River supports spawning and rearing of spring Chinook, summer steelhead, and bull trout. Other fish species documented in the river include coho salmon, rainbow trout, westslope cutthroat, and mountain whitefish. Introduced fish species include largemouth bass and eastern brook trout (StreamNet 2010). In addition, with the recent re-introduction of sockeye salmon to Lake Cle Elum, this species now uses the Yakima River.

Before construction of dams on the Yakima River in the early 1900s, Middle Columbia River steelhead (federally listed as threatened) had access to most of the upper Yakima River watershed. The Lake Easton Dam has a fish ladder that

generally allows passage in the winter and spring when steelhead would be migrating into the Easton to Keechelus Reach. While spawning and rearing habitat is still present between the Keechelus and Easton Dams, the numbers of steelhead returning to the upper Yakima River are small (Haring 2001; WSDOT 2005, 2008).

Bull trout in the upper Yakima River have been affected by hybridization and competition with brook trout, loss of prey base, altered river flow regimes, passage barriers, and poor water quality. Bull trout were federally listed as threatened in 1999. Although bull trout are present in the Yakima River, they are likely to occur in very low densities (Reclamation and Ecology 2011a; WSDOT 2005).

Many factors have caused the decline of upper Yakima basin fish populations, including the following (Reclamation and Ecology 2011a):

- In the 1900s, crib dams on the four natural glacial lakes (Cle Elum, Kachess, Keechelus, and Bumping) contributed to the extirpation of sockeye.
- Construction of five storage dams eliminated access to productive spawning and rearing habitat for sockeye, Chinook, coho, and steelhead salmon.
- Irrigation operations have altered streamflows, resulting in flows at certain times of the year that are too high in some reaches and too low in others to provide good fish habitat. This problem is worse during drought years.
- Land development (road construction, diking, gravel mining, and agriculture) has degraded riparian habitat and increased sediment in streams and rivers.
- Irrigation diversions have reduced flows and created fish passage barriers in tributary streams.
- The Columbia River dams and historic commercial fishing in the Columbia River and Pacific Ocean have also indirectly affected Yakima basin fisheries.

High summer flows in the upper Yakima River affect juvenile salmonid rearing habitat. The annual later summer “flip-flop” operation disrupts instream habitat and impacts aquatic insect populations (prey base for fish). Winter flows in the upper Yakima River are low, potentially impacting survival of overwintering juvenile salmonids (Reclamation and Ecology 2011a).

While high stream temperatures can be detrimental to fish (see Water Quality section below), release of cold water from the bottom of the Yakima Project reservoirs can also interfere with fish ecology in the Yakima River basin (Reclamation and Ecology 2011a).

Despite these challenges, anadromous fisheries in the Yakima River have recently improved as a result of better management, habitat and facility improvements, hatchery supplementation, and reintroduction efforts. Reintroduction of coho salmon in the Yakima basin began in the mid-1980s. Summer Chinook reintroduction is currently being undertaken (Reclamation and Ecology 2011a).

Efforts to restore coho salmon within the Yakima River basin rely largely upon releases of hatchery-produced fish. Natural reproduction of hatchery-reared coho salmon is now occurring in the Yakima River. The upper Yakima wild Chinook salmon population is supplemented with hatchery stock reared at the Cle Elum Supplementation and Research Facility (CESRF) and released from three acclimation sites (Reclamation 2011, Reclamation and Ecology 2011a). The CESRF has been operating since 1997 and is managed by WDFW and the Yakama Nation.

Additional major efforts to improve fish habitat and populations in the Yakima basin include the following (Reclamation and Ecology 2011a):

- The Yakima/Klickitat Fisheries Project is managed by WDFW and the Yakama Nation. Its goal is salmon reintroduction through supplementation along with habitat protection and restoration. Species currently being enhanced include spring, summer and fall Chinook salmon, coho salmon, sockeye salmon, and steelhead trout.

- The Yakima River Side Channels Project is managed by WDFW and the Yakama Nation through the Yakima/Klickitat Fisheries Project. It focuses on restoring habitat in the Easton, Ellensburg, Selah, and Union Gap reaches on the Yakima River and the Gleed reach in the lower Naches. Active habitat restoration actions include reconnecting structurally diverse alcoves and side channels, introducing large woody debris, fencing, and revegetating riparian areas

- The Yakima Tributary Access and Habitat Program has numerous participants including the Kittitas County Conservation District. The Program seeks to restore fish passage to Yakima River tributaries that historically supported salmon and to improve habitat through measures such as fish screening and fish passage improvements, riparian plantings, fencing, and irrigation system improvements.

- Reclamation is leading a cooperative investigation to study the feasibility of providing fish passage at the five large storage dams of the Yakima Project (Bumping Lake, Kachess, Keechelus, Cle Elum, and Tieton). Fish passage efforts at each dam are discussed in the relevant sections of this report.

Pacific lamprey is another native fish species that has recently become a focus of restoration efforts. The Columbia River basin historically supported abundant Pacific lamprey populations, but the population has steeply declined and is virtually non-existent in the upper Yakima watershed. Major factors in the species' decline include fish passage barriers, poor water quality, floodplain degradation, and highly altered stream hydrology (CRITFC 2011; Luzier et al. 2011).

City of Cle Elum

See Section 3.3.2.1.

Town of South Cle Elum

See Section 3.3.2.1.

3.3.2.2 Water Quality

The mainstem Yakima River is on Ecology's 303(d) list for high temperatures and low dissolved oxygen in the reaches just upstream of the Cle Elum River confluence and near Lake Easton. Total maximum daily loads (TMDLs) have been established for turbidity, suspended sediment, temperature, and organochlorine pesticides (Ecology 2002 & 2005).

The Department of Ecology has undertaken the Yakima River Watershed Toxics Study to evaluate levels of toxic contaminants in streams, rivers, reservoirs, and lakes from the Yakima River’s headwaters near Snoqualmie Pass to its confluence with the Columbia River. Levels of toxic compounds in Yakima River fish were recognized as a concern in the 1990s. During 2006 - 2008, Ecology collected hundreds of samples of fish and water to evaluate current levels of toxic compounds such as DDT, PCBs, and several others, many of which were historically used in agriculture or utilities but have been banned in recent years. These compounds attach to soil particles which are then washed downstream by precipitation or irrigation. Although the compounds have not been applied in recent years, they can persist in the environment. Ecology's study found that fish in the upper Yakima River are currently meeting or close to meeting human health criteria for all toxic substances tested except PCBs. The level of toxics generally increases in downstream areas. The months of greatest concern for human-caused turbidity, suspended sediment loading, and pesticide transport are during the irrigation season, April through October. Sediments and pesticides can also be mobilized during storms or rain-on-snow events (Johnson et al. 2010; Ecology 2009; Joy 2002).

City of Cle Elum

See Section 3.3.2.2

Town of South Cle Elum

See Section 3.3.2.2

3.3.2.3 Riparian Habitat Conditions (Land Cover)

Upstream of Lake Easton, the Yakima River runs through commercial forest land. Near the confluence of Big Creek, agricultural and rural residential uses become more common in the riparian zone. Development is most intensive in the Cle Elum and South Cle Elum areas. I-90 is a major feature within and parallel to much of the shoreline inventory area of the upper Yakima River mainstem. Big sagebrush-dominated shrubland becomes more prevalent in and along the river's riparian zone downstream of Swauk Creek.

City of Cle Elum

The Yakima River shoreline inventory area within Cle Elum is largely developed. I-90 runs along the river in this reach. Vegetated in this area is patchy and fragmented by roadways, structures, and excavated ponds.

Town of South Cle Elum

Much of the Yakima River floodplain south of I-90 in South Cle Elum has been developed for residential uses. A band of woody riparian vegetation 250 to 550 feet wide separates the river shoreline from developed areas.

3.3.2.4 Wetlands

Freshwater forested and shrub wetlands are located within the Yakima River floodplain. Large wetland areas are mapped in floodplain in the vicinity of Lake Easton and Lake Keechelus. Several excavated ponds (a remnant of past gravel mining) are located in the floodplain near Cle Elum, including Unnamed Lake 5.

City of Cle Elum

Several wetlands are mapped in the Yakima River shoreline inventory area within Cle Elum. However, most of these are artificially created ponds.

Town of South Cle Elum

Palustrine forested wetlands are mapped along the Yakima River in South Cle Elum.

3.3.2.1 Wildlife Habitats and Species

The area near Cle Elum on the north side of the Yakima River is mapped as an elk winter concentration area. Mule deer winter range is mapped along the river east of Cle Elum. A bald eagle nest is mapped along the river between Cle Elum and the Teanaway River confluence. A sharp-tailed snake area is mapped at South Cle Elum (federal species of concern, state candidate species).

Approximately one-third of the upper Yakima River shoreline inventory area is mapped as shrub-steppe habitat (USGS 1993). Shrub-steppe habitat is dominated by perennial bunchgrasses and shrubs such as sagebrush (WDFW 2008). Kittitas County has several types of shrub-steppe communities with different combinations of plant species, as described in Section 2.3.2 in Chapter 2. Shrub-steppe habitat supports numerous unique plant and wildlife species (Azerrad et al. 2011). While it was historically a common type of vegetation community in eastern Washington, shrub-steppe habitat has been largely converted to agriculture and is considered a priority habitat by WDFW (see Section 2.6.3.1).

As part of improvements to Interstate 90 between Hyak and Lake Easton, WSDOT is constructing "connectivity emphasis areas" or CEAs at several locations. The purpose of the CEAs is to restore or enhance connections between habitats on both sides of I-90 to benefit fish, wildlife, and hydrologic functions. CEAs are planned near the upper Yakima River at several locations: Bonnie Creek, Swamp Creek, Toll Creek, Cedar Creek, Telephone Creek, Hudson Creek, Easton Hill, and Kachess River (WSDOT 2011).

City of Cle Elum

Cle Elum is partially located within an elk winter concentration area and is near a mapped sharp-tailed snake area. A bald eagle nest is mapped southeast of the city.

Town of South Cle Elum

A mapped sharp-tailed snake area overlaps part of South Cle Elum.

3.3.3 Land Use

From the Taneum Creek confluence upstream to the Swauk Creek confluence, the Yakima River is bordered by agricultural land to the east and undeveloped forest and range-zoned land to the west. From the Swauk Creek confluence to the Teanaway River confluence, the Yakima River flows through primarily undeveloped forest and range-zoned land and is bordered to the east by SR 10.

Upstream of the Teanaway confluence, the Yakima River flows through a combination of undeveloped forest land (zoned primarily for rural residential development) and low- to moderate-density residential development. Further upstream, land use intensifies where the river is bordered by I-90 and flows through Cle Elum and South Cle Elum.

Between the City of Cle Elum and Lake Easton, the river is bordered primarily by moderate-density residential development and undeveloped forest land that is zoned for forest and range. Within this river segment, areas of high-density residential development are located at Pebble Beach Drive, the Wapiti Drive vicinity, and the Sun Island Drive vicinity. In addition, I-90 borders and crosses the river in several locations in this segment.

Just upstream of Lake Easton, the river is bordered primarily by undeveloped forest land, zoned for rural residential development and forest and range. The river is also crossed by two electric transmission line corridors. The remaining upstream portion of the river flows through National Forest land with a few scattered, privately-owned commercial forest-zoned parcels.

According to National Forest mapping data, there are three "special use" authorizations identified within the inventory area of the upper Yakima River. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.3.3.1 City of Cle Elum

East of Fourth Street and south of the BNSF railroad tracks, the Yakima River is separated from the City of Cle Elum by I-90, but a portion of the river's floodplain lies within city limits. Land use within this area is primarily industrial, and the Cle Elum Wastewater Treatment Plant is located to the east. The FEMA floodway does not extend into this area. Within the floodway, the City's UGA extends south of I-90 to the Yakima River, and encompasses Unnamed Lake 5. Lands within this UGA area are generally undeveloped and zoned for forest and range, with the exception of an industrial-zoned area east of the I-90/SR 10 interchange.

South of the Yakima River and east of South Cle Elum Way, land use along the river is primarily high-density residential, and Fireman's Park borders the river bank.

3.3.3.2 Town of South Cle Elum

The Yakima River borders the north end of the Town of South Cle Elum. Land use along the river in this area is primarily high-density residential, which is set back approximately 300 feet from the river bank.

3.3.4 Public Access

The upper Yakima River can be accessed at the following locations:

- The John Wayne Heritage Trail, which borders the upper Yakima for much of its length;
- Hanson Ponds, located southeast of the City of Cle Elum;
- Cle Elum Memorial Park and Fireman's Park;
- Undeveloped Washington State Parks land, located approximately 1 mile west of the City of Cle Elum;
- Easton Ponds;
- Lake Easton State Park; and
-
- A network of hiking, snowmobiling, and cross-country ski trails on National Forest land.

3.3.4.1 City of Cle Elum

The river can be accessed at Cle Elum Memorial Park and Hanson Ponds can be accessed from Hanson Ponds Road.

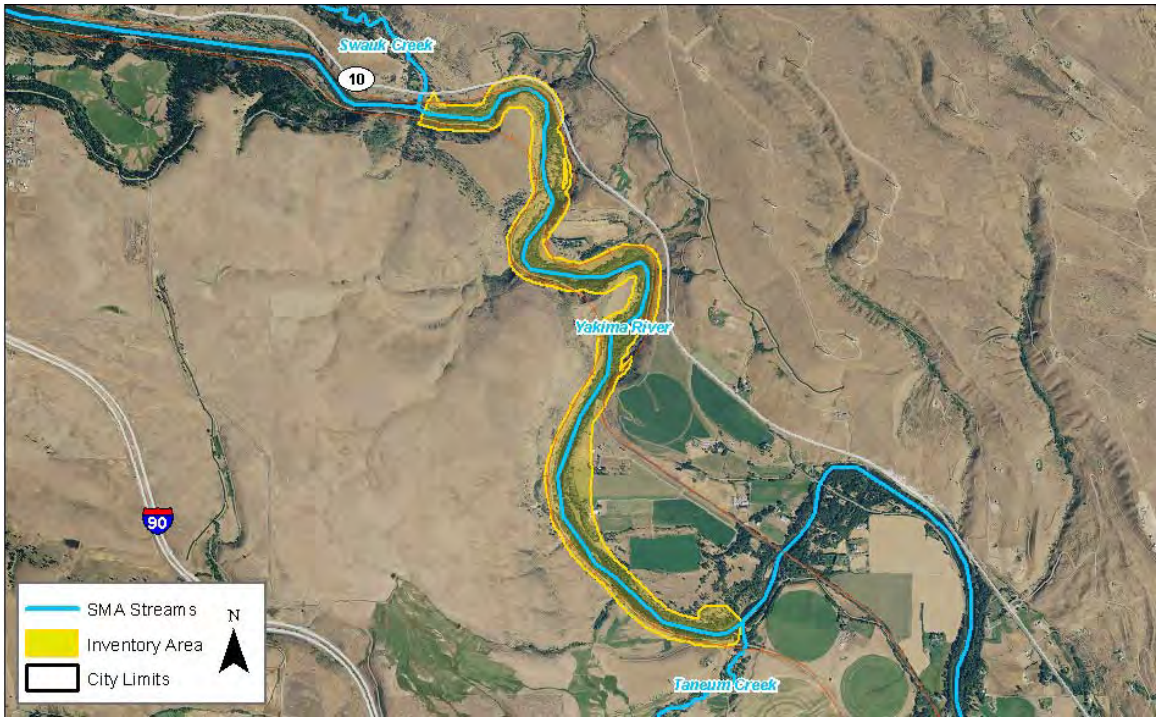
3.3.4.2 Town of South Cle Elum

The river can be accessed at South Cle Elum Way.

3.3.5 Reach Sheets

YAKIMA RIVER-REACH 5

SHORELINE LENGTH:	REACH INVENTORY AREA:
4.0 Miles	326.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

This single channel reach is confined due to steep canyon walls and by the John Wayne Trail on its right bank, and a railroad and Highway 10 along much of its left bank. The reach contains few side channels or gravel bars.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (70%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Over half of the reach (62%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, fecal coliform, and pH.

LAND COVER (MAP FOLIO #3)

The majority of the reach is covered by shrubland (36%), riparian vegetation (30%), and forest (17%), with some agricultural lands (8%), developed lands (5%), and open water (3%) cover types.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of coho salmon, sockeye salmon, bull trout, largemouth bass, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Patches of wetland habitat is mapped throughout the reach (8% reach total). Priority mule deer winter concentration range is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is constrained along most of its length by Highway 10 and the John Wayne Heritage Trail.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail is located along the majority of the western boundary of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is rural (100%). Land ownership is 78% private and 22% public (State and Bureau of Reclamation).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) In general, the eastern portion of the reach is zoned for agriculture (25%) while the western and northern portions are zoned for forest & range (47%) and other (28%) [John Wayne trail].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded historic sites within the reach.

SHORELINE FUNCTION ANALYSIS

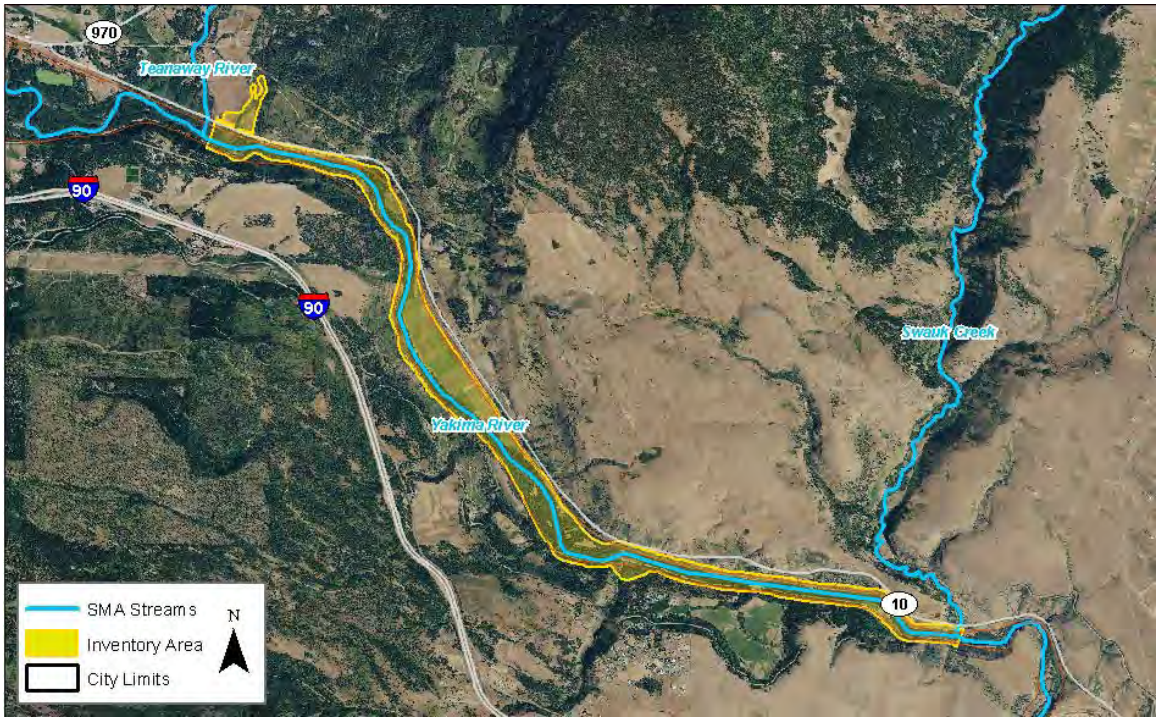
FISH HABITAT QUALITY **Medium:** The reach provides spawning habitat for priority fish species (including spring Chinook salmon), but water quality impairments and significant hydromodifications limit fish habitat quality.	**TERRESTRIAL HABITAT QUALITY** **Medium:** Some riparian forest and shrub areas remain along the channel (particularly along its fringes), but connections to adjacent habitats have been disturbed by transportation corridors.
VEGETATION FUNCTIONS **Medium:** Vegetation in much of the reach has been altered by development (primarily Highway 10 and the John Wayne Heritage Trail), but some riparian forest and shrub areas remain along the channel.	**HYDROLOGIC FUNCTIONS** **Low:** The reach has limited connection to a functional floodplain because of its steep canyon walls, and the presence of significant hydromodifications associated with Highway 10 and the John Wayne Heritage Trail.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Protect the high-quality shrub-steppe wildlife habitat within the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

YAKIMA RIVER-REACH 6

SHORELINE LENGTH:	REACH INVENTORY AREA:
6.3 Miles	614.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows in a single channel with low topographic relief on both banks and is confined by the John Wayne trail on the right bank and a railroad and Highway 10 on the left bank. Few side channels and gravel bars are located within the reach.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A large portion of the reach (71%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Approximately three-quarters (74%) of the reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL has been implemented.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily forest (66%), and open water (12%), with patches of riparian vegetation (9%), shrubland (5%), agricultural lands (4%), developed lands (3%), other (1%), and harvested forest (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of coho salmon, sockeye salmon, bull trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped throughout the river reach (3% of the reach). Priority mule deer winter concentration range and wood duck nesting habitat are also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is constrained along most of its length by Highway 10 and the John Wayne Trail.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail is located along the majority of the western/southern boundary of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is rural (100%). Land ownership is 87% private and 13% public (State).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for forest & range (67%), with rural residential (11%) at the upstream end and other (21%) [primarily John Wayne trail] extending along the reach.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 8 recorded precontact and historic sites are located within the reach. Recorded sites include 3 precontact sites, 4 historic sites, and 1 site that feature both precontact and historic components.

SHORELINE FUNCTION ANALYSIS

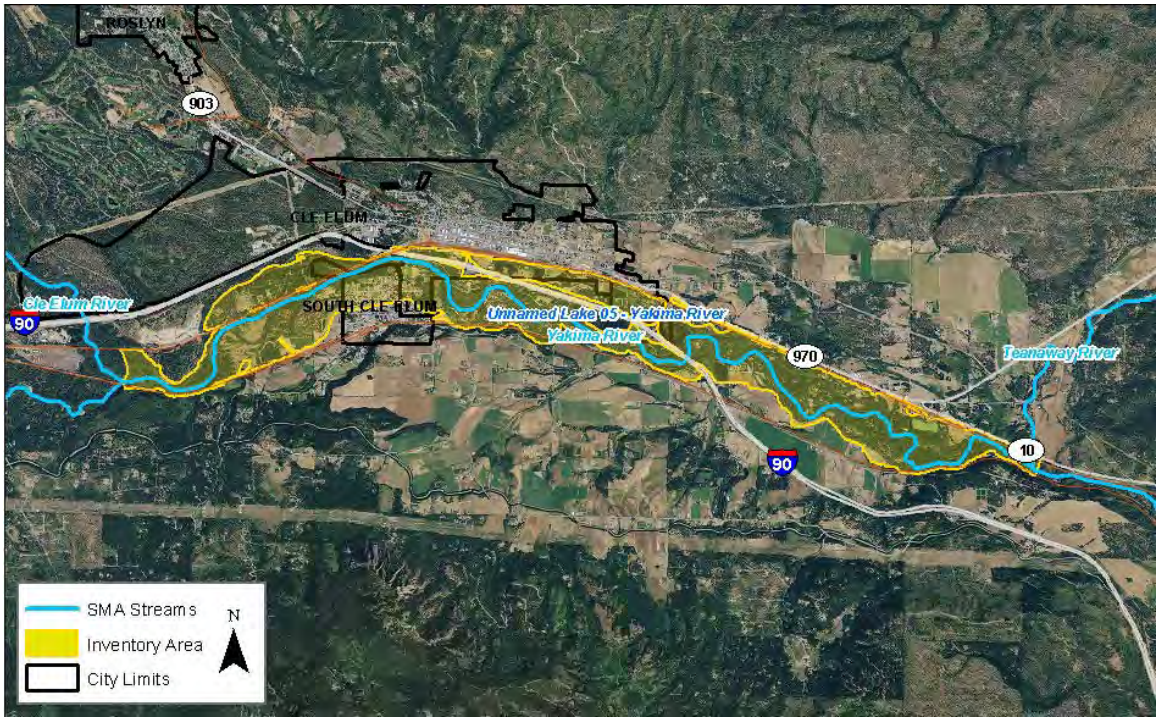
FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but high temperatures and significant hydromodifications limit fish habitat quality.	**TERRESTRIAL HABITAT QUALITY** **Medium:** Some riparian forest and shrub areas remain along the channel (particularly along its fringes), but connections to adjacent habitats have been disturbed by transportation corridors.
VEGETATION FUNCTIONS **Medium:** Vegetation in much of the reach has been altered by development (primarily Highway 10 and the John Wayne Heritage Trail), but some riparian forest and shrub areas remain along the channel.	**HYDROLOGIC FUNCTIONS** **Low:** The reach has limited connection to a functional floodplain because of the presence of significant hydromodifications associated with Highway 10 and the John Wayne Heritage Trail.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Several important cultural and archaeological sites are located within the reach.
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Protect the high-quality forest and shrub-steppe wildlife habitat within the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

YAKIMA RIVER-REACH 7

SHORELINE LENGTH:	REACH INVENTORY AREA:
10.4 Miles	2,310.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach transitions between single and multiple channels several times and is located in a low topographic relief valley, and the Teanaway River enters at the east end. Several gravel pits are present, and the channel is confined in several areas by the John Wayne trail, I-90, and Highway 10.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant area of the reach (96%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Most of the reach (87%) has potential for channel migration.

WATER QUALITY

TMDLs have been implemented for 4,4'-DDE, DDT, temperature, and turbidity.

LAND COVER (MAP FOLIO #3)

This reach contains significant riparian vegetation (37%), forest (26%), and agricultural lands (22%). A number of other land cover types are also present, including: unvegetated (8%), developed lands (6%), other (5%), shrubland (3%), and open water (3%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of coho salmon, sockeye salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also documented.

Wetland habitat is mapped along the river and at several locations adjacent to the river (18% of the reach). Priority sharp-tailed snake area is associated with a wetland complex on the left bank of the river; priority wood duck nesting habitat is mapped at the downstream end of the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

The reach is constrained along most of its length by Highway 10, I-90, the John Wayne trail, and other hydromodifications areas.

PUBLIC ACCESS (MAP FOLIO #4)

The John Wayne Heritage Trail is located along portions of the southern boundary of the reach. Access is also available via Hanson Ponds, the Teanaway Junction WDFW site, and Cle Elum Memorial Park.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use along the reach is primarily rural (75%), with urban (7%), parks & open space (6%), and other (6%) land uses mapped near Cle Elum/S Cle Elum. Land ownership is 93% private and 7% public (State and WDFW).

CONTAMINATED SITES

No identified contaminated sites are located within this reach. One hazardous waste generator is mapped near the center of the reach.

ZONING (MAP #5)

Lands within the reach are zoned for forest & range (45%), rural residential (22%), industrial (11%), urban/suburban residential (4%), agriculture (2%), commercial (1%), parks & open space (1%), and other (14%).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are 2 recorded precontact sites, and 4 recorded historic sites located in the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but water quality impairments and significant hydromodifications limit fish habitat quality.

TERRESTRIAL HABITAT QUALITY

Medium: Some significant wetland areas and riparian forest and shrub areas remain along the channel but connections to adjacent habitats have been disturbed by transportation corridors and other development.

VEGETATION FUNCTIONS

Medium: Vegetation in much of the reach has been altered by development (primarily Highway 10, I-90, the John Wayne Heritage Trail, and residential development), but patches of significant riparian forest and shrub areas remain along the channel.

HYDROLOGIC FUNCTIONS

Medium: There are significant hydromodifications associated with Highway 10, the John Wayne Heritage Trail, and other development within the reach. However, the river still has a connection to its floodplain in some areas, particularly in the more sinuous areas along the channel.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Based upon existing land use patterns in the area, resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forest/range lands to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Protect the remaining high-value forested floodplain and wildlife areas, where possible.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

UNNAMED LAKE 5

SHORELINE LENGTH:
1.0 Mile

WATERBODY AREA: 18.3 Acres
REACH INVENTORY AREA: 36.2 Acres

PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The waterbody is located adjacent to I-90 and is separated from the Yakima River by a berm. Yakima River flow travels through the waterbody. This feature is an artifact of gravel mining in the river's floodplain.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (83%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The reach is within the channel migration zone of the Yakima River.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mostly open water (38%), shrubland (25%), developed lands (16%), and unvegetated (11%), with some agricultural lands (7%), forest (2%), and riparian vegetation (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

No priority fish habitat is mapped within the reach by WDFW.

Wetland habitat is mapped at the north end of the reach (8% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The lake, which was created by gravel mining activities, is directly south of I-90.	**PUBLIC ACCESS (MAP FOLIO #4)** Access to the waterbody is provided by Hanson Ponds Road, which transitions to a gravel trail.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use is rural to the south of the lake (25%), parks & open space to the east and west (47%), and other [I-90] to the north (27%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for forest & range (44%) and other (56%) [I-90, to the north].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

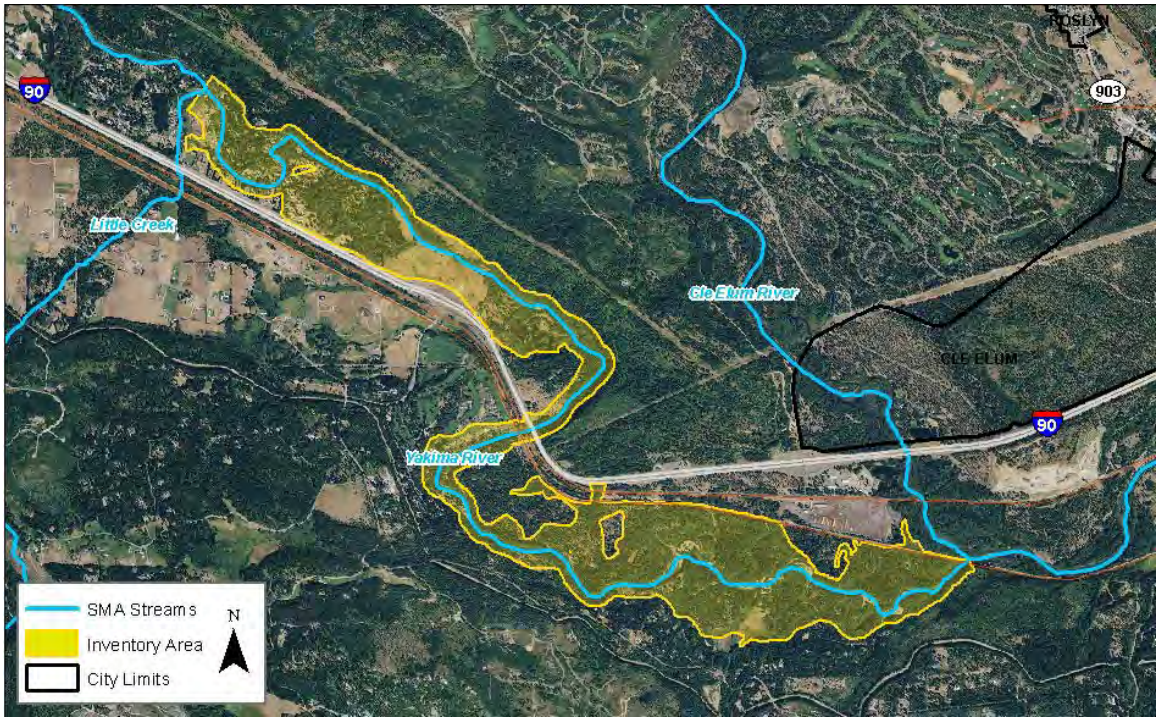
FISH HABITAT QUALITY **Low:** The lake is a manmade artifact of gravel mining, with no mapped priority fish use.	**TERRESTRIAL HABITAT QUALITY** **Low:** The lake has limited riparian vegetation cover, and most of the shoreline perimeter is modified by roads (including I-90).
VEGETATION FUNCTIONS **Low:** The lake has limited riparian vegetation cover.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining, and surrounded by hydromodifications.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Explore restoration of former gravel pits to create more natural floodplain and riverine habitat.

YAKIMA RIVER-REACH 8

SHORELINE LENGTH:	REACH INVENTORY AREA:
7.4 Miles	1,159.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach is confined to a single channel by residential development and steep canyon walls, while the downstream portion flows through low topographic relief and contains multiple gravel bars, oxbows, and side channels.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by forest (45%), riparian vegetation (34%), and agricultural lands (12%), with patches of other (4%), developed lands (3%), harvested lands (1%), and unvegetated (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Roughly 91% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Nearly the entire reach (88%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen and temperature. TMDLs has been implemented for dieldrin and temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead and juvenile rearing habitat for spring Chinook. The presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped along much of the river reach and a large wetland complex is located at the downstream end of the reach (20% of the reach). A priority elk winter concentration area is mapped at the upstream and downstream portions of the reach and wood duck nesting habitat is also mapped in the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Portions of the reach (approximately one-tenth) are constrained by hydromodifications, presumably to protect adjacent residences and I-90 at its bridge crossing.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses the river at several locations; access is also provided by undeveloped Washington State Parks land.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (99%), with some resort land (1%) near the middle of the reach. Land ownership is 84% private and 16% public (State).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for rural residential (51%) west of the river and forest & range (40%) east of the river, with patches of master planned resort (1%) and other (8%) [I-90].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded sites within the reach, 2 precontact sites and 1 historic property. The historic site consists of a historic structure circa 1908 and is considered eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

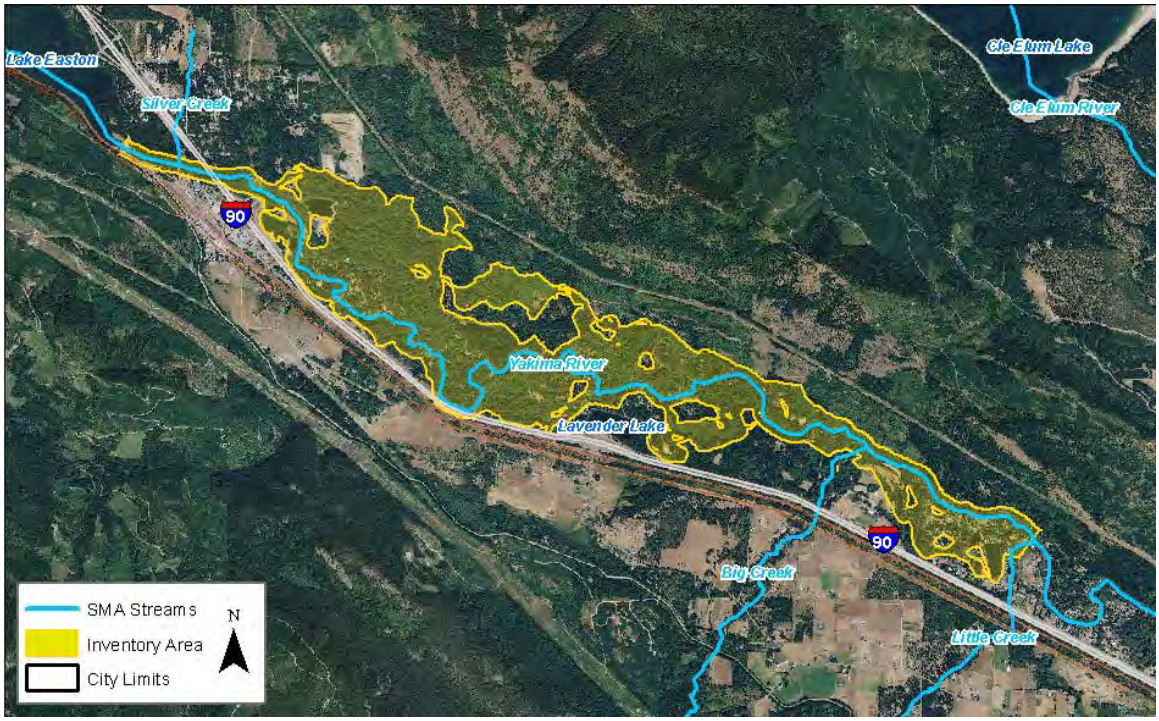
FISH HABITAT QUALITY **High:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The majority of the reach consists of dense forest and shrub habitat, but connections to adjacent habitats have been disturbed by transportation corridors and other development.
VEGETATION FUNCTIONS **High:** Some areas of alteration exist, but the majority of the reach consists of dense riparian forest and shrub habitat.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are constrained by I-90 within the reach, but the river still has a connection to its floodplain in some areas, particularly in the more sinuous areas along the channel.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Restoration opportunities identified within the reach include:
  - Potential acquisition of 23.5-acre parcel with mature riparian forest in a naturally functioning floodplain that supports high priority habitat along 0.4 mile of streambank. Project would protect habitat a gateway reach where approximately 50 percent of the Yakima Basin spring Chinook migrate into the Upper Yakima River system (YBFWRB, 2011).
- Several important cultural and archaeological sites are located within the reach.
- Address flooding issues experienced by Elk Meadows and Elk Meadows Park (Tetra Tech, 2012).
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Protect the remaining high-value forested floodplain and wildlife areas, where possible.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

YAKIMA RIVER-REACH 9

SHORELINE LENGTH:	REACH INVENTORY AREA:
7.9 Miles	1,430.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

This reach is largely unconfined (except for the upstream portion, which is confined by I-90 on the right bank), flows through low topographic relief via multiple channels, and contains numerous gravel bars and side channels.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A large portion of the reach (82%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Nearly the entire reach (94%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen and pH. The reach meets water quality criteria for fecal coliform.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mainly riparian vegetation (64%) and forest (28%) with limited developed lands (2%), other (2%), harvested forest (2%), open water (1%), and agricultural lands (1%) cover.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead and juvenile rearing habitat for spring Chinook. The presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Extensive wetland habitat is mapped along the river and at numerous locations on both banks (45% of the reach). The majority of the reach is mapped as containing priority elk winter concentration area.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Hydromodifications, some of which are associated with I-90 and residential development, are located along approximately one-third of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** Lake Easton State Park provides access at the upstream extent of the reach. A boat launch is located at Kinghorn Slough Access on the south side of the river, near the downstream extent of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (81%) with forestry to the northeast (17%), and commercial (1%) and urban (1%) lands along the upstream end of the reach. Land ownership is 81% private and 19% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for rural residential (36%) at the downstream end and forest & range (41%) and commercial forestry (15%) at the upstream end, with other (8%) [I-90] running the length of the reach.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 recorded precontact site within the reach.

SHORELINE FUNCTION ANALYSIS

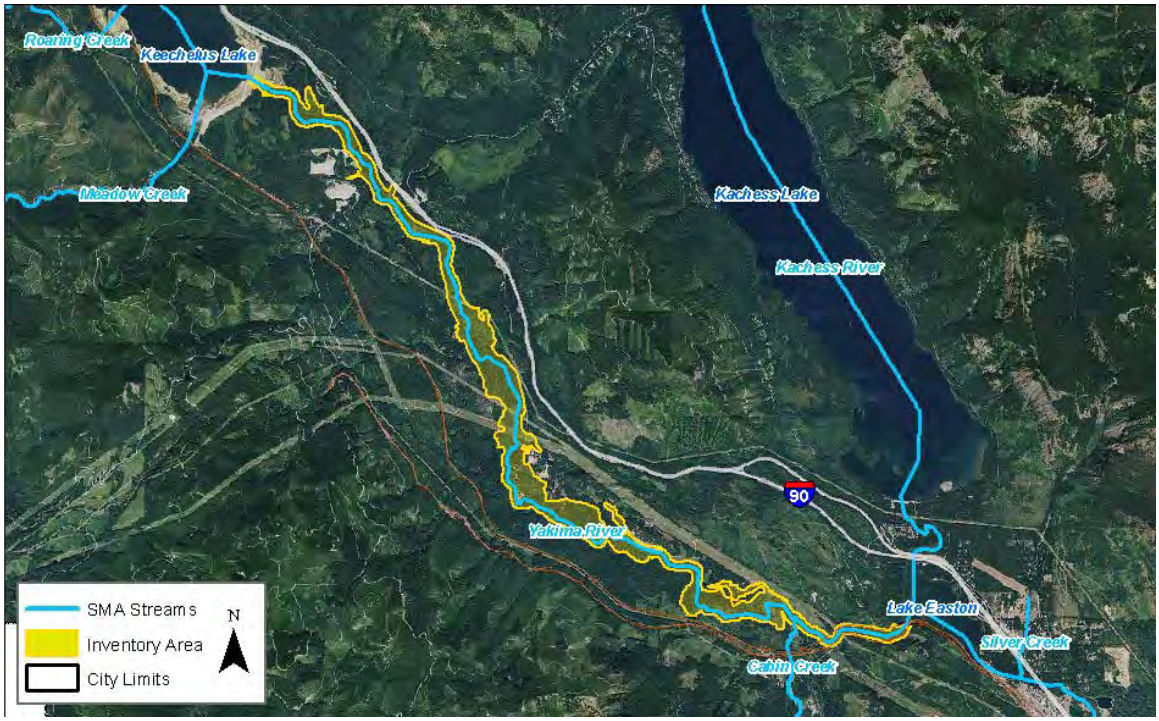
FISH HABITAT QUALITY **High:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The majority of the reach consists of dense forest and shrub habitat, but connections to adjacent habitats have been disturbed by transportation corridors and other development.
VEGETATION FUNCTIONS **High:** Some areas of alteration exist, but the majority of the reach consists of dense riparian forest and shrub habitat.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are constrained by I-90 within the reach, but the river still has a connection to its floodplain in some areas, particularly in the more sinuous areas along the channel.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Restoration opportunities identified within the reach include:
    - Potential acquisition and protection of 163.6 acres of high quality floodplain, riparian, and stream habitat. (YBFWRB, 2011).
- Elk Meadows, Elk Meadows Park, Pine Glen, and Sun Island have flooding issues (Tetra Tech, 2012).
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Protect the high-value forested floodplain and wildlife areas, where possible.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

YAKIMA RIVER-REACH 10

SHORELINE LENGTH:	REACH INVENTORY AREA:
10.6 Miles	1,098.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is largely unconfined (exception for the upstream portion is, which is confined by I-90 on the left bank and the downstream end is confined by a railroad on the right bank), flows through low topographic relief via multiple channels (in certain stretches), and contains numerous gravel bars and side channels.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily riparian vegetation (56%) and forest (37%), with limited harvested forest (4%), other (2%), and open water (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Much of the reach (78%) is located within the FEMA 100-year floodplain and very few landslide hazard areas (<1%) are mapped at the upstream and downstream ends of the reach. Nearly the entire reach (87%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL has been implemented

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and juvenile rearing habitat for bull trout and spring Chinook. The presence of eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped along the river throughout the reach (33% of the reach) and at multiple locations on both banks of the reach. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A portion of the upstream end of the reach is constrained by I-90, and a portion of the downstream end is constrained by a railroad corridor.	**PUBLIC ACCESS (MAP FOLIO #4)** Public access is provided by hiking and snowmobile trails/Forest Service roads that cross the river at several locations, and Easton Ponds.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (87%) with some rural lands (13%) at the downstream end. Land ownership is 17% private and 83% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (85%), with some forest & range (12%) and rural residential (3%) lands at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded historic sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The reach provides spawning and juvenile rearing habitat for priority fish species (including bull trout and spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.	**TERRESTRIAL HABITAT QUALITY** **High:** The majority of the reach consists of dense forest and shrub habitat and connections to large areas of relatively undisturbed habitat are present throughout much of the reach.
VEGETATION FUNCTIONS **High:** Some areas of alteration exist, but the majority of the reach consists of dense riparian forest and shrub habitat.	**HYDROLOGIC FUNCTIONS** **High:** There are generally low levels of hydromodifications and floodplain alteration within the reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Protect the high-value, intact wetland and floodplain areas within the reach.
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

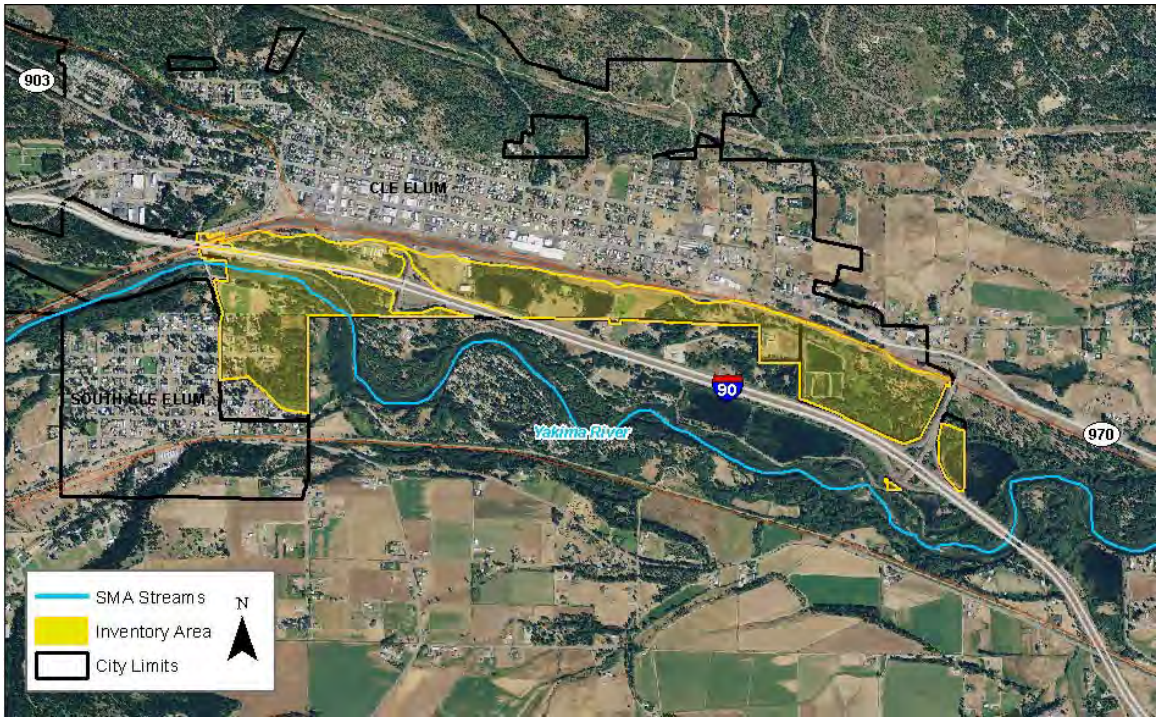
YAKIMA RIVER-CITY OF CLE ELUM REACH

SHORELINE LENGTH:

0.4 Miles

REACH INVENTORY AREA:

279.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

This single channel reach is confined by I-90 to the north and the South Cle Elum Way bridge at its upstream extent. The reach contains several gravel bars. Multiple ponds that were created from gravel mining the river's floodplain and water treatment ponds are located on the north side of I-90.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (98%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The entire reach has potential for channel migration.

WATER QUALITY

TMDLs have been implemented for 4,4'-DDE, DDT, temperature, and turbidity.

LAND COVER (MAP FOLIO #3)

The reach is primarily covered by agricultural lands (34%), developed lands (21%), and forest (18%), with limited riparian vegetation (9%), unvegetated lands (7%), shrublands (4%), other (4%), and open water (3%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shoes that the reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also documented.

Patches of wetland habitat are associated with ponds located within the reach (16% reach total). No priority species or habitats are mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Linear hydromodifications (associated with I-90) border the Yakima River.	**PUBLIC ACCESS (MAP FOLIO #4)** The Yakima River can be accessed at Cle Elum Memorial Park.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is industrial (28%), urban (16%), parks and open space (15%) and other (41%) [transportation rights-of-way]. Land ownership is 61% private and 39% public (City, County, and WSDOT).	**CONTAMINATED SITES** A hazardous waste generator is mapped in the southwestern portion of the reach, south of the Yakima River.
ZONING (MAP #5) Lands within the reach are zoned primarily for industrial use (71%), with areas of urban/suburban residential (10%), parks and open space (5%) and other (13%) [transportation rights-of-way] zoning.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A portion of the Burlington Northern-Santa Fe (formerly Northern Pacific) rail line crosses Oakes Avenue in Cle Elum. The rail line was built in 1886 and is potentially eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but, water quality impairments and significant hydromodifications limit fish habitat quality.	**TERRESTRIAL HABITAT QUALITY** **Low:** Vegetation in a majority of the reach has been removed by development, there connections to adjacent habitat areas are disturbed.
VEGETATION FUNCTIONS **Low:** Vegetation in a majority of the reach has been altered by development (primarily I-90).	**HYDROLOGIC FUNCTIONS** **Low:** There are significant floodplain alterations within the reach; primarily hydromodifications associated with I-90 .

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Protect the remaining forested riparian areas within the reach.
- Support efforts such as the Yakima River Side Channels Project and Yakima Tributary Access and Habitat Program.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Educate public works and/or parks and recreation departments about measures to protect and restore riparian areas.
- Identify city-owned properties where private mitigation and/or restoration grant funds may be used to improve riparian function.

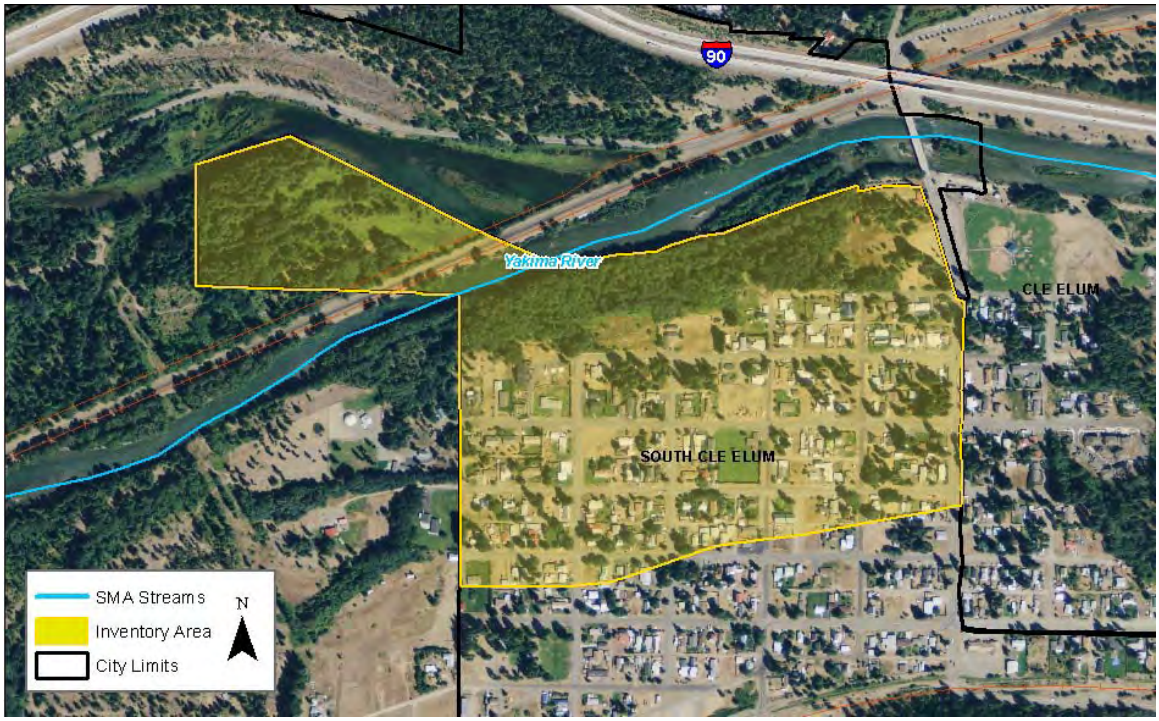
YAKIMA RIVER-TOWN OF SOUTH CLE ELUM REACH

SHORELINE LENGTH:

0.1 Miles

REACH INVENTORY AREA:

116.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

This single channel reach is confined by a railroad to the north.

LAND COVER (MAP FOLIO #3)

The majority of the reach is covered by agricultural lands (41%), developed lands (26%), and forest (16%). Other cover types include: riparian vegetation (10%), unvegetated lands (7%), and other (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach (99%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The entire reach has potential for channel migration.

WATER QUALITY

TMDLs have been implemented for 4,4'-DDE, DDT, temperature, and turbidity.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shoes that the reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also documented.

Wetland habitat is associated with the river within the reach (13% reach total). Priority sharp-tailed snake area is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Linear hydromodifications border the Yakima River at the northeast end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The river can be accessed at South Cle Elum Way.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is rural to the north (18%) and urban to the south (82%). Land ownership is 77% private and 23% public (City, County, and BPA).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for primarily for urban/suburban residential (47%) and commercial (11%) uses to the south, with areas of forest & range (18%) and other (23%) [transportation rights-of-way] zoning.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but, water quality impairments and significant hydromodifications limit fish habitat quality.	**TERRESTRIAL HABITAT QUALITY** **Low:** Some dense forest and shrub habitat remains on the south side of the river, but connections to adjacent habitat areas are disturbed.
VEGETATION FUNCTIONS **Medium:** Vegetation along the north side of the reach has been removed by a railroad track, but dense forest and shrub habitat remains on the south side.	**HYDROLOGIC FUNCTIONS** **Low:** There are significant floodplain alterations within the reach; primarily hydromodifications associated with I-90 .

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Protect the remaining wetlands and forested riparian areas within the reach.

3.4 Cabin Creek and Log Creek

Cabin Creek is a right-bank tributary to the Yakima River, entering upstream of Lake Easton at RM 205. The stream generally flows west to east. Log Creek is a right-bank tributary to Cabin Creek and flows south to north.

3.4.1 Physical Characterization

Cabin and Log Creeks experience flashy flows, largely because of widespread clearcuts in the upper watershed, coupled with periodic rain-on-snow events (Haring 2001). A large landslide event occurred at RM 3.6 (Falls Hill) on Cabin Creek and is the major sediment source to the lower stream. Flashy hydrology, coupled with the landslide, has led to significant channel instability below RM 3.6. Several other landslide hazard areas are mapped adjacent to the streams, upstream and downstream of the Falls Hill location (WDNR 2010). Steep slopes are mapped along most of the shoreline of the two streams (Kittitas County 2012). The FEMA 100-year floodplain occupies much of the downstream two-thirds of the Cabin Creek inventory area (FEMA 1996). Cabin Creek has a large and unpredictable floodplain and flood capacity (Tetra Tech, 2012). Channel migration zones are mapped along Cabin Creek and Log Creek.

The Cabin and Log Creek watershed is largely undeveloped, but timber harvest is a common land use. A Forest Service road parallels much of Cabin Creek and crosses the stream at multiple locations. Before entering the Yakima River, the streamflows under a railroad bridge and the John Wayne Heritage Trail, in addition to a utility corridor. A small residential development and old log yard, located on the left bank near RM 0.75, restrict floodplain connectivity. A Forest Service road borders Log Creek for much of its length and crosses the stream several times.

Like many of the other tributaries to the upper Yakima River, there are no irrigation dams or diversions on Cabin and Log Creeks. However, at least two waterfalls associated with the Falls Hill slide are barriers to upstream anadromous fish passage. In addition, two man-made barriers were identified elsewhere within the watershed (Haring 2001).

3.4.2 Habitats and Species

3.4.2.1 Fish Use

Cabin Creek supports spring Chinook juvenile rearing. Other fish species documented include rainbow trout, westslope cutthroat, and eastern brook trout (StreamNet 2010). Most of these species occur downstream of the impassable Falls

Hill landslide (RM 3.6); only cutthroat are present upstream of the landslide (Haring 2001). Several road culverts may also present fish passage barriers. Log Creek supports westslope cutthroat.

Flows in Cabin Creek are flashy due to large clearcuts in the upper watershed. High flows move large wood out of the stream channel. Pools and off-channel habitat are lacking (Haring 2001).

3.4.2.2 Water Quality

Lower Cabin Creek and lower Log Creek are on Ecology's 303(d) list for warm water temperatures. A TMDL has been implemented for this parameter on both creeks (Ecology, 2005).

Numerous landslides in the Cabin Creek watershed contribute excess sediment to the stream. Logging roads are another source of sediment to both Cabin and Log Creeks (Haring 2001).

3.4.2.3 Riparian Habitat Conditions (Land Cover)

Cabin and Log Creeks flow through commercial forestland in various stages of regeneration. The riparian zone along the lower part of Cabin Creek is generally intact, but riparian vegetation is in poor condition from RM 1 upstream due to severe floods and logging. Most of the upper drainage was logged before riparian buffer strips were required, and so the riparian vegetation is still early successional (Haring 2001). There are several stream crossings as discussed in Section 3.4.1.

3.4.2.4 Wetlands

Freshwater emergent, shrub, and forested wetlands are mapped along lower Cabin Creek. No wetlands are mapped in the Log Creek shoreline inventory area.

3.4.2.1 Wildlife Habitats and Species

Northern spotted owls (federally listed threatened species) have been mapped in the vicinity of Cabin and Log Creeks. Elk concentration and calving areas are also mapped in this area.

3.4.3 Land Use

Most of the land bordering Cabin and Log Creeks is private commercial forest lands, with some National Forest lands at the upstream ends of the streams. Some rural residential development is located along the lower mile of Cabin Creek. South of the

Easton Re-Load SnoPark, an approximately 1-mile stretch of stream frontage on Cabin Creek is permanently conserved and managed by the Cascade Land Conservancy.

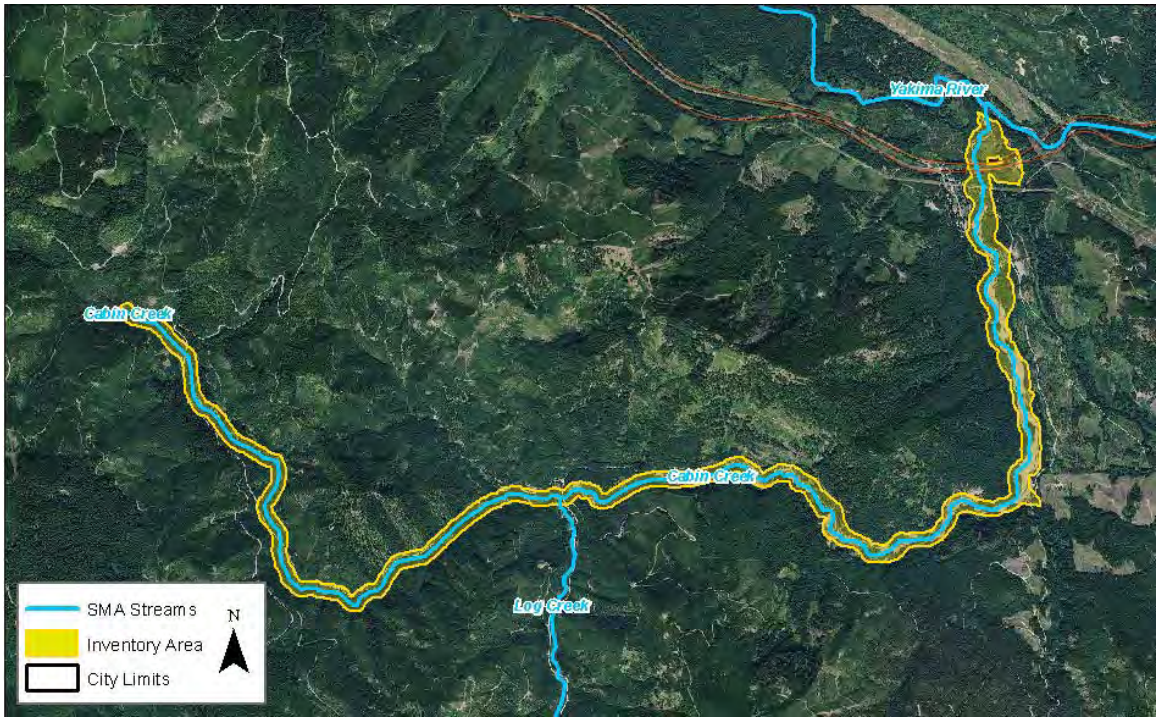
3.4.4 Public Access

Lower Cabin Creek can be accessed from the John Wayne Heritage Trail and the Easton Re-Load Snopark. The creek is bordered by a snowmobile trail/Forest Service road for almost its entire extent.

3.4.5 Reach Sheets

CABIN CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
9.1 Miles	520.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach is located within a narrow channel that exhibits limited migration; however, the downstream portion of the reach flows through a broad channel that allows for frequent channel migration. A Forest Service road limits channel movement in the middle portion of the reach.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Roughly one-third of the reach (33%) is located within the FEMA 100-year floodplain and several landslide hazard areas (9%) are mapped along the reach. Over half of the reach (67%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by conifer-dominated forest (49%), riparian vegetation (28%), and harvested forest (20%), with limited developed lands (2%) shrublands (1%), and other (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides juvenile rearing habitat for spring Chinook. The presence of eastern brook trout, rainbow trout, and westslope cutthroat is also mapped within the reach.

Wetland habitat is mapped fairly continuously on both banks of the downstream portion of the reach (17% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the reach and crosses the stream at multiple locations. The road culverts may be fish passage barriers.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail and Easton Re-Load Snopark allow access to the stream. A snowmobile trail/Forest Service road parallels most of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (83%) with rural lands along the downstream end (17%). Land ownership is 51% private and 49% public (State and Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (82%), with some forest & range (9%) and rural residential (9%) areas at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A National Register historic district is located within the reach. The Cabin Creek Historic District is a collection of cabins and buildings built around 1916.

SHORELINE FUNCTION ANALYSIS

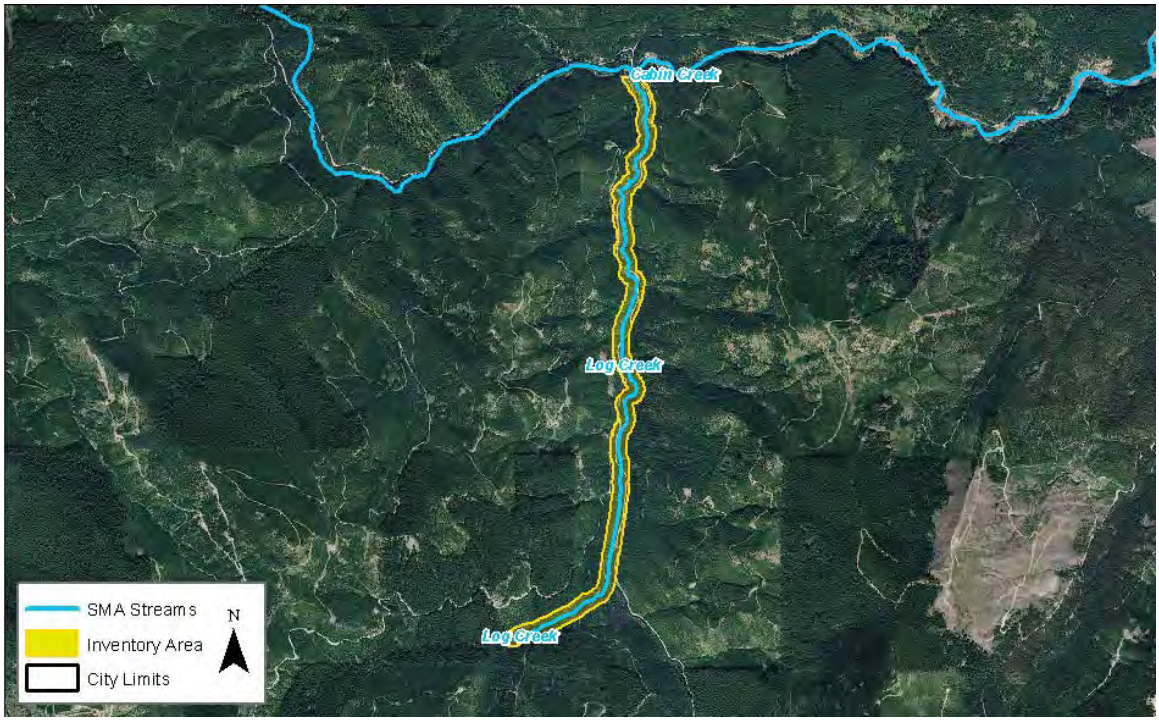
FISH HABITAT QUALITY **Medium:** The stream provides provides habitat for priority fish species (including rearing habitat for Spring Chinook) and is largely unaltered, but the flashy hydrograph and channel instability in the lower reach limits fish habitat quality.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** Much of the stream channel is unaltered, but flashy flows (attributed to clearcuts in the upper watershed) have altered the hydrology of the creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions.
- Cabin Creek has a large and unpredictable floodplain in the lower reach.
- The Cabin Creek Historic District is located within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Several road culverts within the reach may be fish passage barriers.
- Decommission or repair logging roads to reduce erosion.
- Protect the remaining forested floodplain and wetland habitat within the reach.

LOG CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
3.1 Miles	152.7 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located within a narrow valley and is confined by a forest service road for much of it length, with the exception of the downstream portion where the valley becomes broader.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain. Multiple landslide hazard areas (8%) are mapped within the reach. Over half of the reach (54%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mostly harvested forest (70%) and conifer-dominated forest (21%), with patches of riparian vegetation (8%) and other (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows westslope cutthroat habitat within the reach.

No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels much of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** Informal public access is available via the Forest Service road that parallels the stream.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 89% private and 11% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The stream has a generally well-vegetated riparian corridor, but a Forest Service road has impacted many areas. Natural barriers on Cabin Creek block anadromous fish access.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development (with the exception of a Forest Service road that parallels the stream).
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Low:** A Forest Service road parallels the stream and flashy flows (attributed to clearcuts in the upper watershed) have altered the hydrology of the creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions.
- The Forest Service road the parallels the reach has separated the river from its floodplain in many locations.
- The Cabin Creek Historic District is located within the reach.
- Several road culverts within the reach may be fish passage barriers.
- Decommission and revegetate any unused roads along the shoreline.

3.5 Lower Kachess River and Lake Easton

The lower Kachess River flows approximately 1.1 miles from the Kachess Lake Dam to Lake Easton, draining to the north shore of Lake Easton. The river is mapped as a shoreline of statewide significance from the confluence with Lake Easton, upstream for approximately 0.5 mile.

3.5.1 Physical Characterization

Lake Easton is approximately 1.3 miles long and 0.6 mile wide. In addition to the Kachess River, the Yakima River enters Lake Easton from the west. The Lake Easton Dam is located at the southeastern portion of the lake and impounds up to 4,000 acre-feet of water, covering approximately 516 acres. The dam has a fish ladder that facilitates anadromous access to upstream habitat; however, access may be impaired during some years (low flow) and during certain parts of the year (fish ladder operated from October-May) (Haring 2001). The lake is operated for irrigation diversion to the KRD Main Canal, rather than storage, unlike the three large reservoirs.

Several small landslide hazard areas are located along the left bank of the Kachess River and in the southwestern portion of the lake (WDNR 2010). A few steep slopes are mapped along the southern shoreline of Lake Easton and in the vicinity of the dam (Kittitas County 2012). The FEMA 100-year floodplain occupies much of the Kachess River inventory area, particularly the right bank of the reach, in addition to the northeastern, eastern, and southeastern shorelines of Lake Easton (FEMA 1996).

Interstate 90, in addition to two other roads, crosses the southern portion of the Kachess River/north end of Lake Easton. Fill material has been placed in the lake to facilitate construction of these transportation corridors. A utility corridor is also located at the base of the Kachess Dam, crossing over the river. A small residential community is located on the right bank of the river between Kachess Lake Dam and I-90. A railroad corridor is located along the southern shoreline of the lake and the John Wayne Heritage Trail crosses the mouth of the Yakima River at Lake Easton.

3.5.2 Habitats and Species

3.5.2.1 Fish Use

The lower Kachess River and Lake Easton are used by spring Chinook, coho salmon, bull trout, rainbow trout, westslope cutthroat, and mountain whitefish. Introduced species include eastern brook trout (StreamNet 2010).

Lake Easton provides spawning habitat for spring Chinook and summer steelhead (StreamNet 2010). The fish ladder at Easton Dam was reconstructed in 1987 to improve anadromous salmonid access to the reach from Easton Dam to Keechelus Dam. However, fish passage is still impaired in some years. Operation of the fish ladder varies from year to year based on the water supply outlook. The decision whether to keep the fish ladder open to allow passage of spring Chinook is based on predicted total water availability each year (Haring 2001).

3.5.2.2 Water Quality

The Yakima River at Lake Easton is on Ecology's 303(d) list for low dissolved oxygen and high water temperatures. A TMDL has been implemented for temperature (Ecology, 2005). WSDOT performed water quality monitoring of streams in the upper Yakima River watershed in 2001 as part of the I-90 improvements project. Their sampling found exceedances of state water quality standards in the Kachess River/Lake Easton (temperature, turbidity, dissolved oxygen, heavy metals). Possible reasons for high temperatures include a lack of riparian vegetation, disruption of groundwater flow by roads and drainage structures, and excessive sediment deposition leading to shallow water. Sediments may be eroded when stream channels are confined, such as by the I-90 bridges; sand applied to I-90 for traction may also contribute excess sediment. Low dissolved oxygen may result from elevated stream temperatures and decomposition of organic matter. Heavy metals are a common pollutant in roadway runoff. (WSDOT 2005)

3.5.2.3 Riparian Habitat Conditions (Land Cover)

The riparian zone of Lake Easton is forested but constricted on three sides by major roadways. The lower Kachess River (between Lake Easton and Lake Kachess) flows through forested areas with limited rural residential development.

3.5.2.4 Wetlands

No wetlands are mapped along the Lake Easton shoreline. A small portion of the lower Kachess River riparian area is mapped as wetland.

3.5.2.1 Wildlife Habitats and Species

An elk winter concentration area is mapped west of Lake Easton and the lower Kachess River.

The I-90 corridor near Lake Easton has been identified as an important movement corridor for wildlife as documented by camera traps and a high incidence of

roadkill. WSDOT has proposed constructing terrestrial wildlife crossings in this area to improve connectivity for mammals, amphibians, reptiles, and mollusks (WSDOT 2005).

3.5.3 Land Use

The upstream half of the lower Kachess River is located on National Forest land while the downstream half is bordered by a high-density residential development and private forest land. Almost the entire shoreline of Lake Easton is located within Lake Easton State Park.

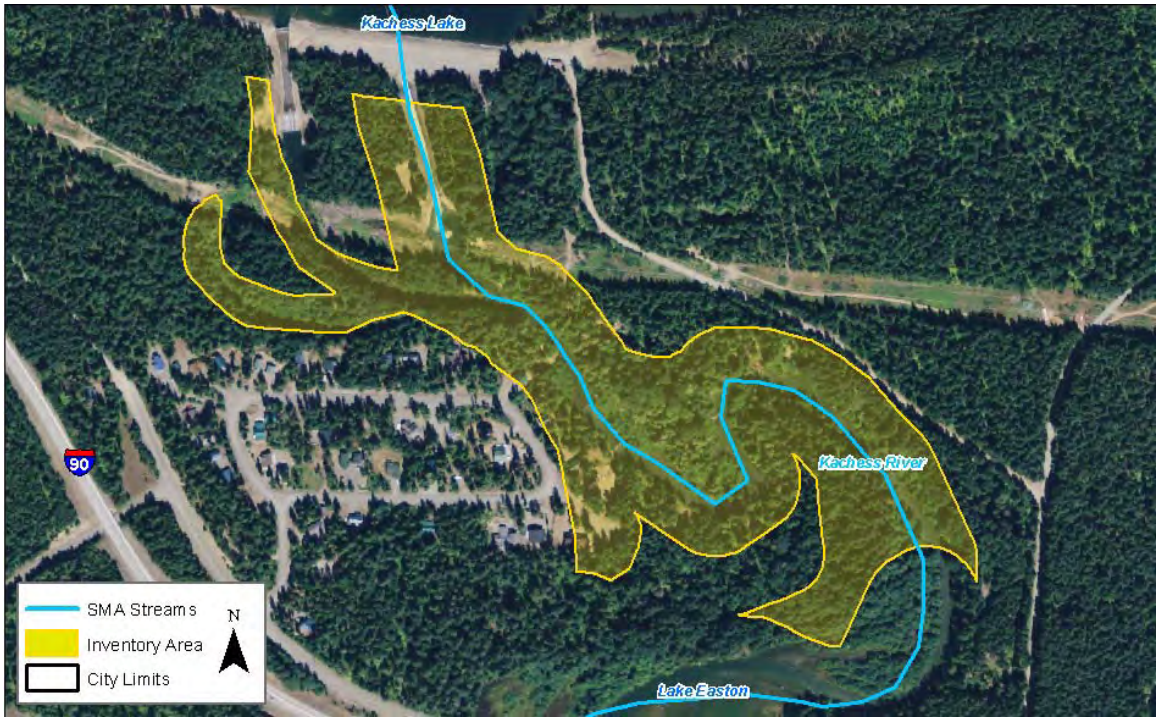
3.5.4 Public Access

Lake Easton can be accessed from Lake Easton State Park and the John Wayne Heritage Trail, and a boat launch is located on the northeast shore of the lake. National Forest land bordering the lower Kachess River can be accessed from Kachess Dam Road. However, access to much of the lower Kachess River is limited due to the restricted dam area.

3.5.5 Reach Sheets

KACHESS RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.7 Miles	43.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach only descends approximately 15 feet in elevation and is confined within a single channel that widens upstream of the confluence with Lake Easton, then constricts again at the I-90 crossing.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily forest (67%) and riparian vegetation (33%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 71% of the reach is located within the FEMA 100-year floodplain and a very limited number of landslide hazard areas (<1%) are mapped on the left bank.

WATER QUALITY

Dissolved oxygen data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, spring Chinook, and westslope cutthroat within the reach.

A couple patches of wetland habitat are mapped along the river in the reach (6% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** National Forest land that borders the lower Kachess River can be accessed from Kachess Dam Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (80%) with urban lands along the southwest end of the reach (20%). Land ownership is 27% private and 73% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) The reach is zoned for commercial forestry (38%) at the upstream end and forest & range (40%), rural residential (21%), and other (1%) at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach has a well-vegetated riparian corridor and mapped priority fish presence, but no spawning or rearing habitat is mapped.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach is well-vegetated and has some limited connections to larger areas of undisturbed habitat. However, habitat at the upstream and downstream ends of the reach has been altered.
VEGETATION FUNCTIONS **Medium:** The majority of the reach contains dense forest and shrub habitat, but the upstream and downstream ends have been altered (by Kachess Dam and I-90, respectively).	**HYDROLOGIC FUNCTIONS** **Medium:** The floodplain of the river is generally unaltered, but upstream flows are controlled by Kachess Dam.

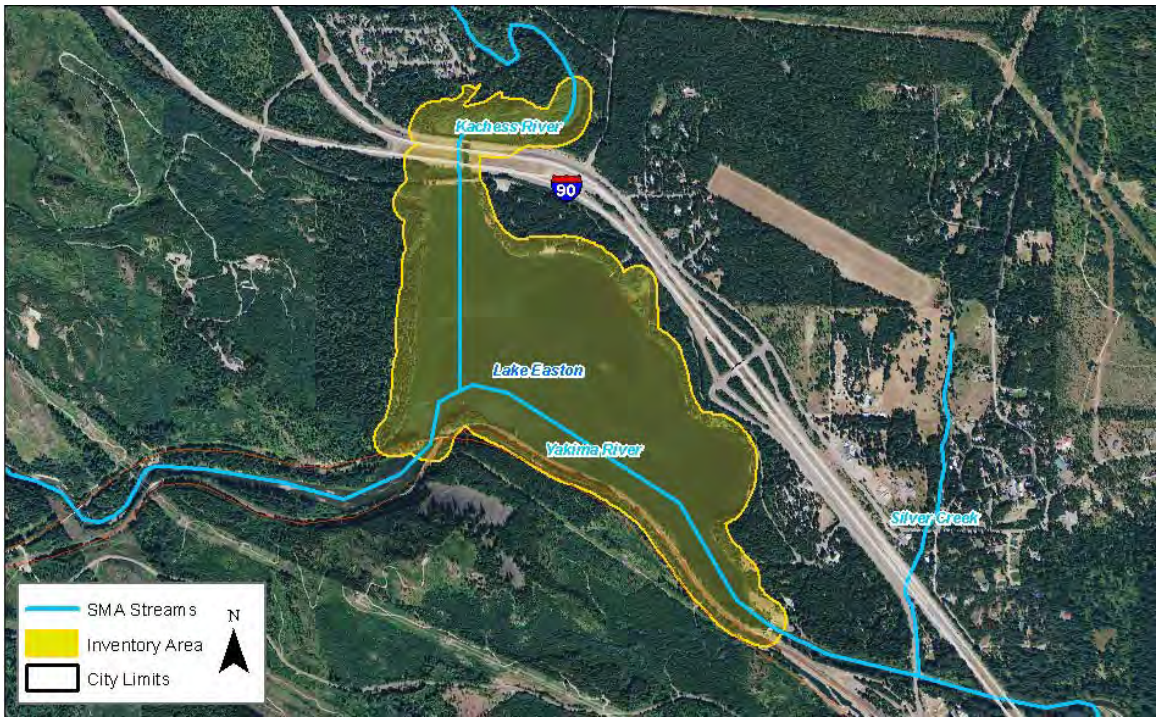
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and project structures from flooding and channel migration.
- Protect the high-value forested floodplain areas within the reach.
- Educate shoreline property owners about measures to protect and restore riparian areas.

LAKE EASTON

SHORELINE LENGTH:
8.0 Miles

WATERBODY AREA: 208.1 Acres
REACH INVENTORY AREA: 316.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The lake is located at the confluence of the Yakima River and Kachess River. The 66-foot-high dam, located at the southeast end of the lake, impounds the lake at 2,181 feet.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 33% of the reach is located within the FEMA 100-year floodplain and a few landslide hazard areas (1%) are mapped on the northern, western, and southern shorelines.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, pH, and temperature; a TMDL has been implemented for temperature.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mostly open water (64%), forest (21%), and riparian vegetation (12%), with patches of developed lands (3%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat are mapped within the reach.

A small area of wetland habitat is mapped along the shoreline of the lake (2% of the reach). No priority habitats or species are identified in this reach by WDFW.

The Lake Easton shoreline supports one rare plant species mapped by the Washington Natural Heritage Program.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

The lake level is controlled by a dam, which contains a fish ladder. I-90 crosses the lake in the Kachess River outlet, and the southern shore of the lake is constrained by railroad tracks.

PUBLIC ACCESS (MAP FOLIO #4)

The lake can be accessed from Lake Easton State Park, the John Wayne Heritage Trail, a boat launch located on the northeast shore of the lake, and a snowmobile trail/Forest Service road that crosses the north end of the lake.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use bordering the lake is primarily forestry (54%), rural (21%), and parks & open space (21%) lands, with some urban land (1%) at the southeast corner of the lake. Land ownership is 98% private and 2% public (State).

CONTAMINATED SITES

A State cleanup site (gas station) is located in the northern portion of the reach, adjacent to I-90.

ZONING (MAP #5)

Lands within the reach are zoned for rural residential (35%), forest & range (35%), and other (30%) [I-90 and John Wayne trail].

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are a total of 3 recorded precontact sites, 1 recorded historic site, and 1 site that features both precontact and historic features located within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Low: The lake is operated as an irrigation diversion reservoir, and has several water quality impairments.

TERRESTRIAL HABITAT QUALITY

Medium: The lake shore is well-vegetated and is connected to a significant area of contiguous forest habitat to the west, but other connections are disturbed by I-90 and the John Wayne Heritage Trail.

VEGETATION FUNCTIONS

Medium: The majority of the lake shoreline consists of dense forest and shrub cover, but some areas have been altered (I-90, Lake Easton Dam, and recreational uses).

HYDROLOGIC FUNCTIONS

Medium: The lake provides some floodwater storage potential, but it is managed as an irrigation diversion reservoir.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect riparian functions.
- The dam has a fish passage facility, but the facility is not operated year-round and access is impaired during low flow years.
- The lakeshore contains a rare plant species, mapped by the Washington Natural Heritage Program.

3.6 Kachess Lake

Kachess Lake is located in the northwestern portion of Kittitas County, and is designated as a "lake of statewide significance." The lake, located between Keechelus Lake and Cle Elum Lake, is one of the reservoirs operated to supply irrigation water as part of the Yakima Project.

3.6.1 Physical Characterization

The lake is oriented north-south and is fed primarily by three tributaries that drain to the northern half of the lake: Mineral Creek, Box Canyon Creek, and Gale Creek. Kachess Lake is approximately 10 miles long and 1 mile wide, covering 4,540 acres when at capacity, making the lake the largest major irrigation storage reservoir in the Yakima River watershed.

The active storage of the lake is approximately 239,000 acre-feet when at capacity. The dam, standing at 115 feet, was originally constructed in 1912 and then improved in 1935 (Haring 2001). A 2,877-foot constructed discharge channel carries water to the intake structure of the dam's outlet works. The channel was excavated from the natural lake, allowing for the natural lake to be used for storage (BOR 2009).

A few potential landslide areas are mapped on the eastern shoreline (WDNR 2010). The northwest and eastern shorelines are mapped with steep slopes (Kittitas County 2012). The FEMA 100-year floodplain is mapped within almost the entirety of the western shoreline inventory area. The southern shoreline is also mapped as being in the floodplain, but to a lesser extent (FEMA 1996).

Multiple roads are mapped on the western and eastern shorelines, primarily along the southern two-thirds of the lake. Limited residential development is located on the western shoreline and most of the watershed is forested, but has been impacted by logging practices. Multiple overwater structures are mapped along the lake's shoreline, with a concentration of structures located near the central portion of the western shore (WDNR 2009).

3.6.2 Habitats and Species

3.6.2.1 Fish Use

Kachess Lake supports bull trout rearing and spawning. Other fish that use the lake include kokanee salmon, rainbow trout, burbot, westslope cutthroat, and pygmy whitefish (StreamNet 2010).

The Integrated Water Resource Management Plan for the Yakima River basin proposes installing upstream and downstream fish passage facilities at Kachess Dam, subject to further evaluation of alternatives to determine the most feasible approach for providing passage (Reclamation and Ecology 2011a).

The Integrated Plan for the Yakima River basin also includes the Lake Kachess Inactive Storage project, which would be located just east of Interstate 90 near Easton. The project would tap into Lake Kachess and allow the lake to be drawn down approximately 80 feet lower than the current outlet. This would provide the ability to withdraw another 200,000 acre-feet of water from the lake, when needed, for downstream uses during drought conditions. Water would be conveyed through a pump station and outlet just downstream from Kachess Dam or a tunnel outlet to the Yakima River approximately 4.8 miles southeast of Kachess Dam. This project will include fish passage improvements at Box Canyon Creek to improve access for bull trout (Reclamation and Ecology 2011a).

The "K to K" pipeline is another project proposed under the Integrated Plan. Water would be conveyed from Lake Keechelus to Lake Kachess to reduce flows and improve habitat conditions during high flow releases below Lake Keechelus and provide more water storage in Lake Kachess for downstream needs. The pipeline may also help Lake Kachess refill after using inactive storage (Reclamation and Ecology 2011a).

3.6.2.2 Water Quality

Lake Kachess is not included on Ecology's 2008 list of waterbodies with impaired water quality. There is scant published water quality information for this lake.

3.6.2.3 Riparian Habitat Conditions (Land Cover)

Lake Kachess is surrounded by coniferous forest that is managed for timber harvest. Riparian vegetation is in various stages of succession. Roads and limited residential development encroach into portions of the riparian zone as described in Section 3.6.1.

3.6.2.4 Wetlands

Lake Kachess is a reservoir with steep shorelines that are unlikely to support wetlands. No wetlands are mapped along the lake shore.

3.6.2.1 Wildlife Habitats and Species

Most of the area immediately east of Lake Kachess is mapped as critical habitat for northern spotted owl (federally listed threatened species). This area is also mapped as elk and mountain goat wintering range.

3.6.3 Land Use

Kachess Lake is bordered by a "checkerboard" of public (National Forest) and private parcels. Most of the private parcels are zoned for commercial forestry, with the exception of two residential developments (one high-density and one low-density) located on the west shore of the lake.

According to National Forest mapping data, there are five "special use" authorizations identified within the inventory area. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.6.4 Public Access

Hiking and snowmobile trails/National Forest roads border much of the Kachess Lake shoreline. A boat launch and National Forest campground are located on the west shore of the lake, off of Kachess Lake Road.

3.6.5 Reach Sheet

KACHESS LAKE

SHORELINE LENGTH:
77.1 Miles

WATERBODY AREA: 4,367.8 Acres
REACH INVENTORY AREA: 5,182.6 Acres

PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The lake is located in a valley, oriented northwest to southeast. The 115-foot-high dam, located at the south end of the lake, regulates pool elevations between 2,262 feet and 2,193 feet.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A large extent of the reach (61%) is located within the FEMA 100-year floodplain; several landslide hazard areas (3%) are mapped on the eastern shoreline of the lake.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature.

LAND COVER (MAP FOLIO #3)

This reach is principally composed of open water (76%) and conifer-dominated forest (11%). Unvegetated (6%), riparian vegetation (4%), other (2%), and harvested forest (1%) are also present.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for bull trout. The presence of burbot, eastern brook trout, kokanee salmon, rainbow trout, westslope cutthroat, and mountain whitefish is also mapped.

Limited wetland habitat is mapped along the shoreline of the lake (3% of the reach). Priority cliff/bluffs are located at the northeast portion of the lake, elk winter concentration area is mapped east of the lake, and mountain goat winter range is located at the south end of the lake. Bald eagle also is mapped in the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The lake level is controlled by a dam (which is a fish passage barrier). There are approximately 10 docks mapped on the lakeshore, primarily along the western shore.	**PUBLIC ACCESS (MAP FOLIO #4)** Hiking and snowmobile trails/Forest Service roads border the northwest and southeast shorelines of the lake. A boat launch and National Forest campground are located on the northwest shoreline of the lake, off of Kachess Lake Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use around the lake is primarily forestry (83%) with some patches of rural (7%) and parks & open space (9%) lands also present. Land ownership is 13% private and 87% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (84%), with some areas of forest & range (5%), rural residential (1%), and other [I-90] (9%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 15 recorded precontact and historic sites are located within the reach. Precontact sites feature campsites, lithic material, and possible fish weirs while historic sites include depression era properties, refuse scatters, and campsites related to dam construction.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake provides habitat for several priority fish species (including spawning habitat for bull trout and Kokanee salmon), but is primarily managed as an irrigation reservoir and has a listed water quality impairment (high temperatures).	**TERRESTRIAL HABITAT QUALITY** **High:** The shorelands consist primarily of dense forest cover, and the lake has significant, unaltered connections to large areas of relatively unaltered habitat.
VEGETATION FUNCTIONS **High:** Nearly the entire lakeshore consists of dense, mature forest habitat	**HYDROLOGIC FUNCTIONS** **Medium:** The lake provides significant floodwater storage, but it is managed as an irrigation reservoir.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Based upon existing land use patterns in the area, resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forest lands to residential subdivisions). New development should be set back an adequate distance to protect riparian functions along the lakeshore.
- Kachess Dam is a complete barrier to fish passage. Participate in programs to install fish passage facilities at Kachess Dam.
- Protect the high-quality forest and wildlife habitat within the reach.
- Many important cultural and archaeological sites are located within the reach.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Decommission and revegetate any unused roads along the shoreline.
- Encourage new/existing docks to be joint-use structures designed to be fish-friendly (e.g., grating to allow light penetration, use of non-toxic materials).

3.7 Kachess Lake Tributaries

Three main tributaries (mean annual flow greater than 20 cfs) flow into the north half of Kachess Lake. Mineral Creek, which becomes the Kachess River 1.2 miles before entering the lake, drains to the north end of Kachess Lake. Box Canyon Creek and Gale Creek empty to the northwest portion of the lake, respectively. The outlet of Rachael Lake is Box Canyon Creek. The lake is within the Alpine Lakes Wilderness Area, and is only briefly discussed below.

3.7.1 Physical Characterization

Several landslide hazards are mapped along Gale Creek (WDNR 2010) and steep slopes are mapped adjacent to each of these tributaries (Kittitas County 2012). In addition, several Forest Service roads cross each of the tributaries one to multiple times. The FEMA 100-year floodplain is mapped in most of Kachess River Reach 2 inventory area, primarily on the right bank. The mouth of Box Canyon Creek is also mapped in the floodplain (FEMA 1996).

3.7.2 Habitats and Species

3.7.2.1 Fish Use

Table 3-2 summarizes fish use in tributaries to Lake Kachess. The lack of upstream fish passage facilities at Kachess Dam has prevented anadromous salmonids from accessing approximately 14 miles of highly productive historic habitat (Haring 2001).

A barrier falls located on Box Canyon Creek at RM 1.6 precludes upstream migration of resident fish (Haring 2001). Additionally, as Kachess Lake is drawn down in the summer/fall, the undefined channel at the mouth of Box Canyon Creek may become too shallow for passage by some fish species (e.g., bull trout, resident salmonids). The Bureau of Reclamation attempted to mitigate this by constructing a single channel through the inundation zone. A similar passage problem occurs at the mouth of the Kachess River. In addition, a culvert on Gale Creek was identified as a fish passage barrier (Haring 2001).

Table 3-2. Fish Use in Kachess Lake Tributaries (Source: StreamNet 2010)

Species	Gale Creek	Box Canyon Creek	WF Box Canyon Creek	Upper Kachess River (Reach 2)	Mineral Creek	Rachael Lake
Bull Trout		S		S, R	S, R, P/M	
Rainbow Trout	P/M	P/M		P/M	P/M	
Westslope Cutthroat	P/M	P/M	P/M	P/M	P/M	
Eastern Brook Trout		P/M		P/M	P/M	
Kokanee Salmon		P/M		P/M	P/M	

P/M = presence/migration; R = juvenile rearing; S = spawning

3.7.2.2 Water Quality

Lower Gale Creek is on Ecology's 303(d) list for high stream temperatures.

3.7.2.3 Riparian Habitat Conditions (Land Cover)

The Kachess Lake tributaries flow through coniferous forest that is managed for commercial timber harvest. The upper reaches of Mineral Creek are within alpine shrubland. I-90 crosses the upper Kachess River, confining the river's floodplain (WSDOT 2005).

3.7.2.4 Wetlands

Freshwater scrub-shrub and forested wetlands are mapped along much of the upper Kachess River. Mapped wetlands are scattered along the other upper tributary streams.

3.7.2.1 Wildlife Habitats and Species

The upper tributaries to Lake Kachess are located within mapped critical habitat for northern spotted owl (federally listed threatened species) and near mapped mountain goat range.

3.7.3 Land Use

The tributary stream reaches to Kachess Lake are primarily located on National Forest lands, and the upper portions of Box Canyon Creek and Mineral Creek are located within the Alpine Lakes Wilderness Area.

According to National Forest mapping data, there is one "special use" authorization identified within the inventory area of Gale Creek. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.7.4 Public Access

The tributary lakes and stream reaches to Kachess Lake are accessible via hiking and snowmobile trails/Forest Service roads.

3.7.5 Reach Sheets

GALE CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.7 Miles	131.5 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach roughly flows west to east and begins in a relatively broad valley that transitions to a narrow ravine downstream. The stream flows through a forested corridor and passes under two roads associated with the Kachess Lake Campground near the stream mouth.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (63%), harvested forest (21%), riparian vegetation (15%), and other (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A very small amount (1%) of the reach is located within the FEMA 100-year floodplain and a numerous landslide hazard areas (73%) are mapped.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of rainbow trout and westslope cutthroat.

A very small amount (1%) of the reach is mapped as wetland. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are two road crossings in the stream mouth.	**PUBLIC ACCESS (MAP FOLIO #4)** A dog sled/snowmobile trail/Forest Service road crosses the lower stream reach and a hiking trail crosses the reach near the stream mouth.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 25% private and 75% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

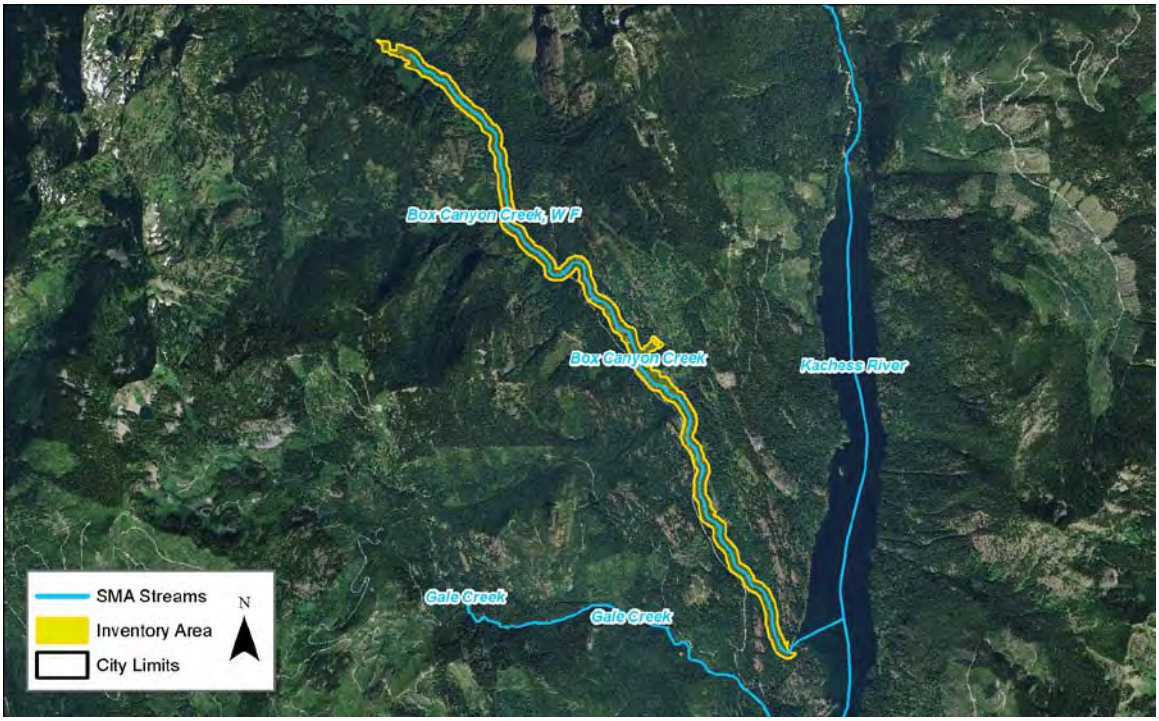
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, forest cover, but significant portions have been disturbed by timber harvest activities.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.
- New development should be set back an adequate distance to protect stream functions.

BOX CANYON CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.2 Miles	270.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows to the southeast. The upstream portion of the reach is in a broad valley with scrub-shrub and forested vegetation types; the downstream portion of the reach enters a relatively narrow, forested corridor. The stream flows under two forest service roads; another forest service road parallels much of the reach's western shoreline.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (72%), riparian vegetation (23%), harvested forest (3%), and shrubland (2%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A very limited extent (2%) of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for bull trout. The presence of westslope cutthroat, rainbow trout, eastern brook trout, and Kokanee salmon is also mapped.

Slightly less than a quarter (21%) of the reach is mapped as wetland. Priority mountain goat summer and winter ranges are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service Road parallels much of the western shoreline, and there are two road crossings within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail is adjacent to the upstream portion of the regulated stream area and another hiking trail crosses the mouth of the stream. However, trail access across the stream is limited to low flow months. The Rachel Lake Trailhead is also located adjacent to the regulated stream area, near the confluence with West Fork Box Canyon, Reach 1.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** The Lake Kachess Picnic Site was built by the CCC and existed from 1920 to 1942. The site was determined not eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

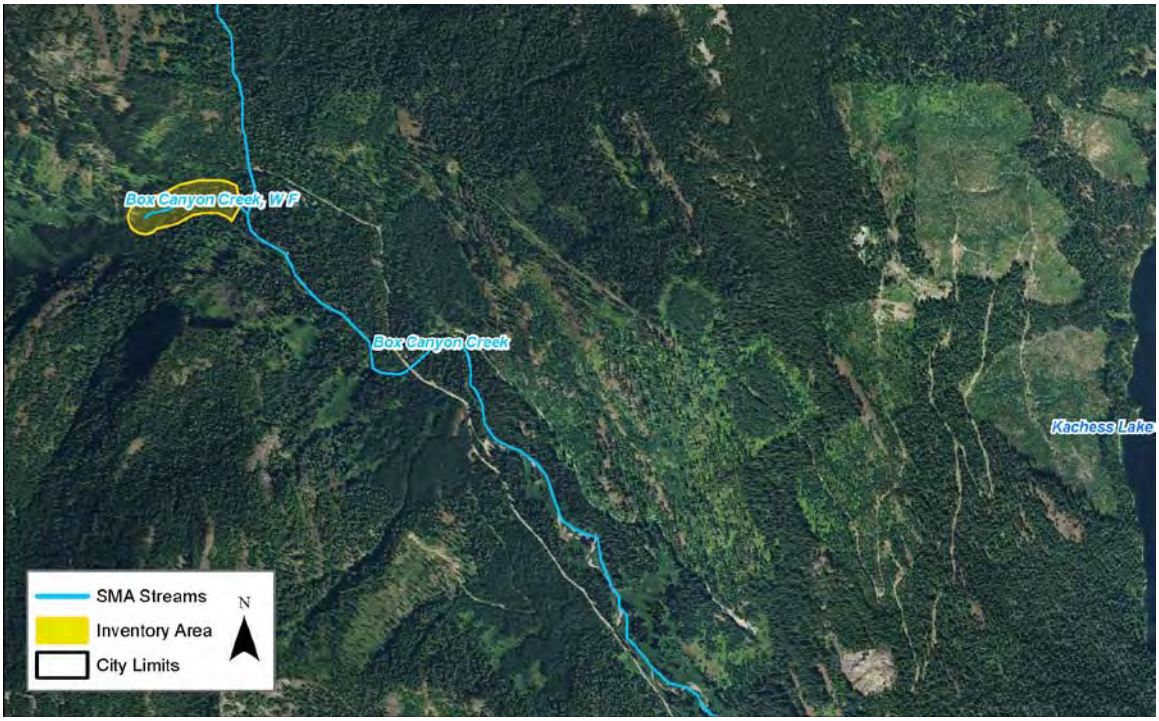
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning habitat for bull trout.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

WEST FORK BOX CANYON CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.2 Miles	12.5 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows west to east; the upstream portion is located in relatively flat scrub-shrub and forested habitat; downstream is forested and narrow.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and a small number of landslide hazard areas (1%) are mapped near the upstream end of the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (70%), riparian vegetation (27%), shrubland (2%), and harvested forest (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of westslope cutthroat within the reach.

No wetland is mapped within the reach. Priority mountain goat summer range is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no known public access to West Fork Box Canyon Creek.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

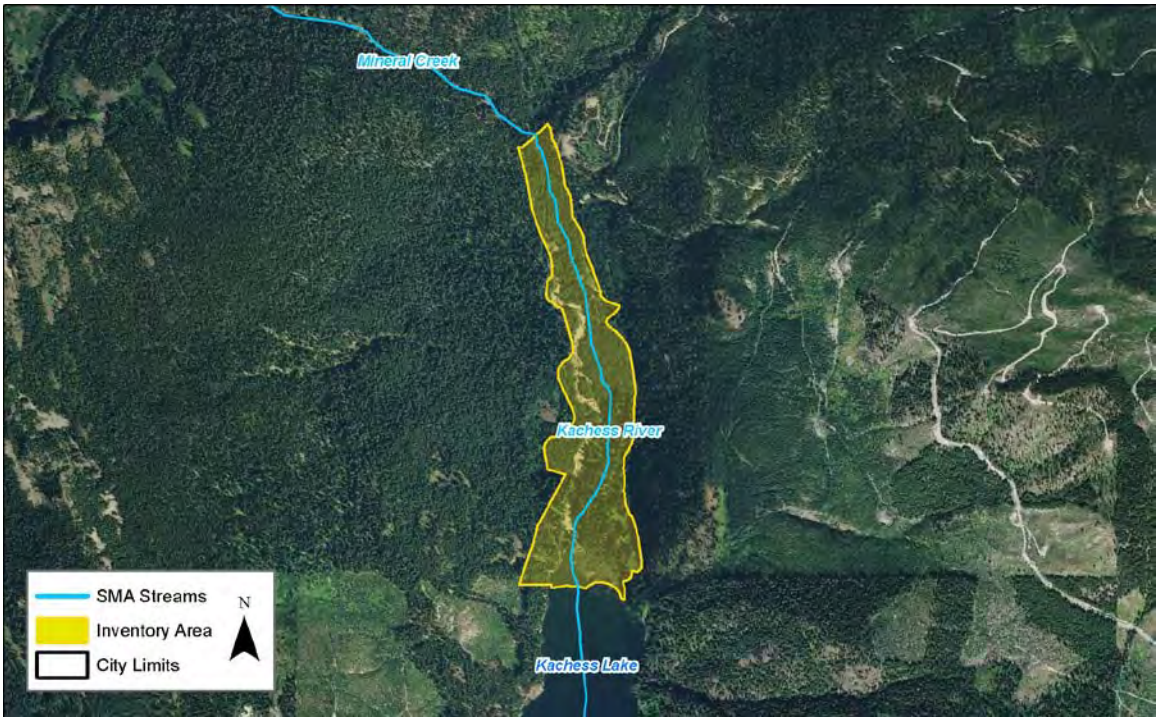
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for a priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access to the reach.
- Decommission and revegetate any unused roads along the shoreline.

KACHESS RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.2 Miles	107.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The undeveloped reach flows north to south. The stream corridor is forested and contains woody debris and wide banks.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Nearly half (46%) of the reach is located within the FEMA 100-year floodplain; no landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is riparian vegetation (69%), conifer-dominated forest (20%), harvested forest (6%), unvegetated (1%), and other (4%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for bull trout. The presence of rainbow trout, westslope cutthroat, eastern brook trout and Kokanee salmon is also identified

A significant portion (67%) of the reach is mapped as wetland. Priority bald eagle foraging area is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road crosses the stream approximately mid-reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail crosses the downstream portion of the reach in two locations and once again further upstream.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

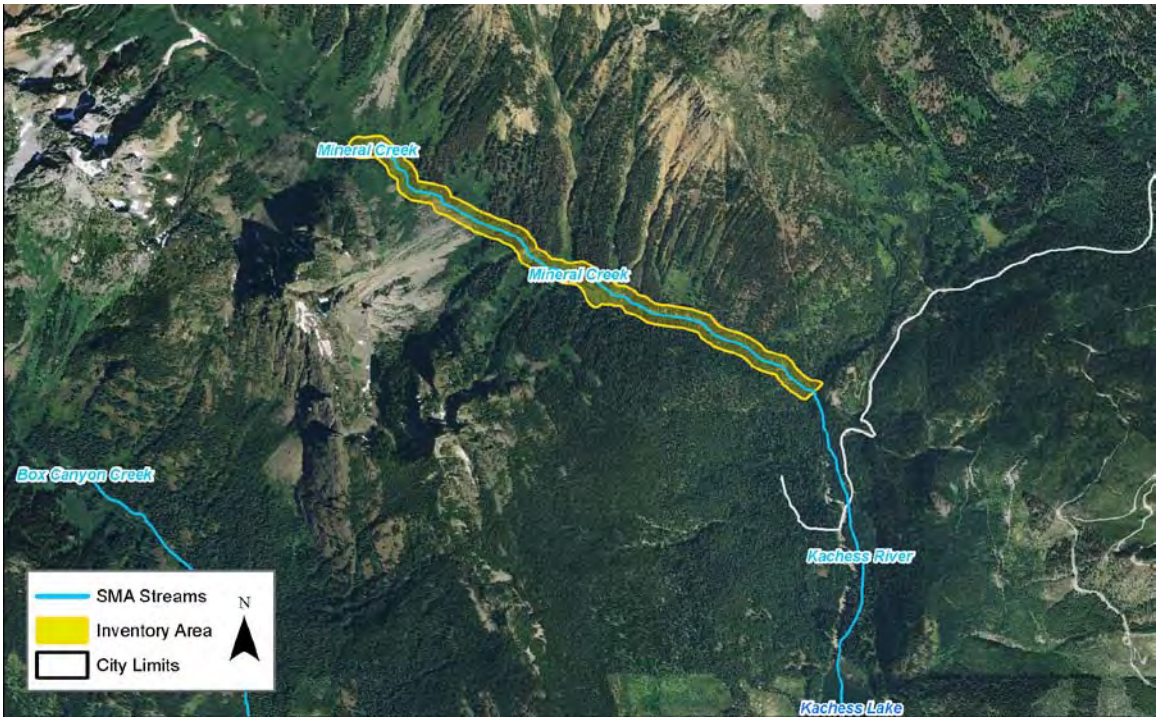
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-vegetated, contains significant wetland habitat, and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach is dominated by riparian shrub and mature forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The stream is largely unaltered and unconfined across a wide floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

MINERAL CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.1 Miles	103.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach drops roughly 1,000 feet in elevation, flowing to the southeast in a narrow ravine. The shoreline appears to experience frequent disturbance from avalanches.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A very small amount (1%) of the reach is located within the FEMA 100-year floodplain; no landslide hazard areas are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (59%), riparian vegetation (22%), and shrubland (19%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for bull trout. The presence of rainbow trout, westslope cutthroat, eastern brook trout, and Kokanee salmon is also identified.

Wetland is mapped in approximately 12% of the reach. Priority mountain goat summer range is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no identified shoreline modifications within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail parallels the downstream half of the reach, crossing it several times, and borders the northern half of the regulated stream area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat for bull trout.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- The shoreline appears to experience frequent disturbance from avalanches.

3.8 Silver Creek

Silver Creek flows from north to south and is a left-bank tributary to the Yakima River, entering the river at approximately RM 202.2.

3.8.1 Physical Characterization

The upstream portion of the stream is generally an unconfined, narrow, single channel. Downstream, residential developments and road crossings, including I-90, confine the channel. A streambed control feature is mapped near the mouth of the stream, at the Railroad Street Bridge crossing of the Yakima River, which acts as a partial fish passage barrier (WDFW 2010).

3.8.2 Habitats and Species

3.8.2.1 Fish Use

Silver Creek supports westslope cutthroat (StreamNet 2010). Fish passage barriers are mapped at roadway crossings on the lower part of the stream.

3.8.2.2 Water Quality

Silver Creek is not included on Ecology's 303(d) list of waterbodies with water quality impairments.

3.8.2.3 Riparian Habitat Conditions (Land Cover)

Silver Creek flows through rural residential areas. The upper portion of the stream has a narrow band of riparian trees which grows wider heading downstream. Roads constrict riparian vegetation along the lowest part of the stream.

3.8.2.4 Wetlands

No wetlands are mapped within the Silver Creek shoreline inventory area.

3.8.2.1 Wildlife Habitats and Species

Most of Silver Creek is located in a mapped elk wintering area.

3.8.3 Land Use

The downstream end of Silver Creek, south of its I-90 crossing, is bordered by railroad tracks. Upstream of I-90, the creek is bordered by high- and low-density residential developments.

3.8.4 Public Access

The lands bordering Silver Creek are private. View access is available from public road crossings.

3.8.5 Reach Sheet

SILVER CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.8 Mile	37.8 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach has low topographic relief, and the upstream portion is generally an unconfined, narrow, single channel. Downstream, residential developments and road crossings, including I-90, confine the channel.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

20% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by forest (42%), harvested forest (26%), and developed lands (22%), with limited other (5%) and riparian vegetation (5%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of westslope cutthroat in the creek.

No wetland habitat is mapped in the reach. A significant amount of priority elk winter concentration area is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A portion of the reach is constrained at the I-90 crossing. Fish barrier culverts are located at I-90 and Parks Rd.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to this reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (80%), with some urban (17%) and commercial (3%) lands near the center of the reach. Land ownership is 95% private and 5% public (State Parks).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for rural residential (67%), with commercial (12%) and other (21%) [I-90] at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** Fish habitat within the reach is limited by adjacent development and fish passage barriers.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach is surrounded by roads (including I-90) and residential development.
VEGETATION FUNCTIONS **Medium:** Some dense forest cover remains along the stream, but significant portions have been removed by adjacent development and I-90.	**HYDROLOGIC FUNCTIONS** **Low:** The reach contains significant hydromodifications and floodplain alteration.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Protect the remaining high-value forested floodplain areas, where possible.
- Two fish-barrier culverts are located within the reach (I-90 and Sparks Road).
- There is no public access to the reach.
- Restore fish passage at Railroad Street Bridge crossing and roadways.
- Educate shoreline property owners about measures to protect and restore riparian areas.

3.9 Lavender Lake

Lavender Lake is located on the right bank of the Yakima River, north of I-90, between Silver Creek (upstream) and Big Creek (downstream), at RM 198.

3.9.1 Physical Characterization

Lavender Lake is approximately 0.3 mile long and 0.1 mile wide and contains several acres of surface water. The lake is primarily used by anglers fishing for stocked rainbow trout. The west and north sides of the lake contain residential development, the east side of the lake is forested, and the south side is adjacent to the interstate. There is no permanent surface water connection between the lake and the Yakima River; however, the FEMA 100-year floodplain is mapped in a portion of the inventory area (FEMA 1996).

3.9.2 Habitats and Species

3.9.2.1 Fish Use

Lavender Lake is stocked with rainbow trout.

3.9.2.2 Water Quality

Lavender Lake is listed on the State's Water Quality Assessment list of 303 (d) waters for invasive exotic species.

3.9.2.3 Riparian Habitat Conditions (Land Cover)

Approximately half of the lake shoreline is forested, while the remainder consists of rural residential uses and roadways.

3.9.2.4 Wetlands

No wetlands are mapped along the Lavender Lake shoreline.

3.9.2.1 Wildlife Habitats and Species

Lavender Lake is located at the edge of a mapped elk wintering area.

3.9.3 Land Use

Lavender Lake is bordered by moderate-density residential development to the west and north, I-90 to the south, and undeveloped forest land (zoned R3) to the east.

3.9.4 Public Access

Public access to the southern shoreline of Lavender Lake is provided at Cresto Road.

3.9.5 Reach Sheet

LAVENDER LAKE

SHORELINE LENGTH:
1.0 Mile

WATERBODY AREA: 18.5 Acres
REACH INVENTORY AREA: 39.0 Acres

PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The shoreline of the lake, which is oriented west to east, contains limited development and is located between residential development and the Yakima River to the north and I-90 to the south. The lake does not drain to the Yakima River and likely was created by gravel mining.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily open water (43%), forest (33%), riparian vegetation (13%), and developed lands (10%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

About one-quarter of the reach (27%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Over half of the reach (52%) is located within the channel migration zone of the Yakima River.

HABITATS AND SPECIES (MAP FOLIO #1)

The lake is stocked with rainbow trout.

Wetland habitat is mapped on the northern shoreline of the lake (16% of the reach) and a priority elk winter concentration area is also mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) waters for invasive exotic species.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The lake, which was created by gravel mining activities, is directly adjacent to I-90 to the south.	**PUBLIC ACCESS (MAP FOLIO #4)** Public access to the southern shoreline of Lavender Lake is provided at Cresto Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use surrounding the lake is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for rural residential (44%) to the north and other (56%) [I-90] to the south.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** The lake is a manmade artifact of gravel mining, with no surface water connection to the Yakima River. There is no priority fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach is directly adjacent to I-90, but contains some dense forest cover and connects to an area of relatively unaltered habitat to the east.
VEGETATION FUNCTIONS **Medium:** Approximately half of the reach area contains dense forest cover, but significant areas have been altered by I-90 and adjacent residential development.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Develop a plan to control invasive aquatic vegetation.
- Educate shoreline property owners about measures to protect and restore riparian areas.

3.10 Big Creek

Big Creek is a right-bank tributary to the Yakima River, located between Lavender Lake upstream and Little Creek downstream. Big Creek generally flows from southwest to northeast and drains to the Yakima River at RM 195.8.

3.10.1 Physical Characterization

Several landslide hazard areas are mapped in the upper reach of the stream (WDNR 2010). Steep slopes are mapped along most of the stream's shoreline, upstream of about RM 1.5 (Kittitas County 2012). The FEMA 100-year floodplain is mapped within much of the downstream one-third of the inventory area (FEMA 1996). Big Creek has an unpredictable floodplain and flood capacity (Tetra Tech, 2012), and a channel migration zone is mapped along much of the creek.

Big Creek passes under and over multiple man-made features located in the lower portion of the stream, including Interstate 90 and several other roads, the John Wayne Heritage Trail, a railroad, an irrigation canal, and power line corridors.

The watershed was clearcut in the late 1800s and developed for agriculture, and water diversions on Big Creek were installed by the late 1880s.

3.10.2 Habitats and Species

3.10.2.1 Fish Use

Big Creek supports spawning spring Chinook and summer steelhead. Numerous spring Chinook juveniles rear in the lower reaches (Haring 2001). Other fish species documented in Big Creek include eastern brook trout, rainbow trout, and westslope cutthroat (StreamNet 2010).

In recent years, several projects have occurred to increase fish access and instream flows within Big Creek. These projects include an irrigation efficiencies program, screening of irrigation diversions, and the correction of a fish passage barrier at the Big Creek Waters Users dam (Anna Lael, personal communication). Low instream flows remain an issue, but work is ongoing to continue to secure water rights for instream flow improvements.

The Integrated Water Resource Management Plan for the Yakima River basin proposes modifications to laterals of the Kittitas Reclamation District (KRD) Main and South Branch canals to reduce seepage losses and allow greater flexibility in

KRD supply management. The water saved or transferred would be used to enhance instream flows in tributaries to the Yakima River, including Big Creek (Reclamation and Ecology 2011a).

3.10.2.2 Water Quality

The lower portion of Big Creek, just below the boundary of Wenatchee National Forest, is listed by Ecology for high water temperatures and a TMDL has been implemented (Ecology, 2005) This portion of the stream crosses a cleared utility corridor where the lack of shade may contribute to higher stream temperatures.

Excess sediment may also affect water quality in lower Big Creek, resulting from a lack of riparian vegetation and large wood (Haring 2001).

3.10.2.3 Riparian Habitat Conditions (Land Cover)

Coniferous forest occupies over half of the Big Creek riparian corridor, particularly in the upper reaches. Around one-quarter of the reach is used for timber harvest. Rural residential and agricultural uses dominate the lower part of the stream, where riparian vegetation is narrower and trees are scattered. Large wood was actively removed from the channel in the past, and there is currently little wood from the powerline crossing to the stream mouth (Haring 2001).

3.10.2.4 Wetlands

Scattered wetlands mapped along Big Creek compose less than 5 percent of the shoreline inventory area.

3.10.2.1 Wildlife Habitats and Species

Priority wildlife species mapped in the Big Creek watershed include northern spotted owl (federally listed threatened species), elk, and mountain goat.

3.10.3 Land Use

The downstream end of Big Creek, between its confluence with the Yakima River and I-90, is undeveloped forest land zoned for rural residential development. Between I-90 and the KRD Big Creek Siphon, land use is primarily low-density residential, with one moderate-density residential subdivision bordering the creek in the northwest. From the siphon to approximately 1 mile upstream, undeveloped forested land borders the creek which is zoned as forest and range. An electric

transmission line corridor also crosses the creek in this segment. The remainder of the creek flows through a "checkerboard" of National Forest and private forest land.

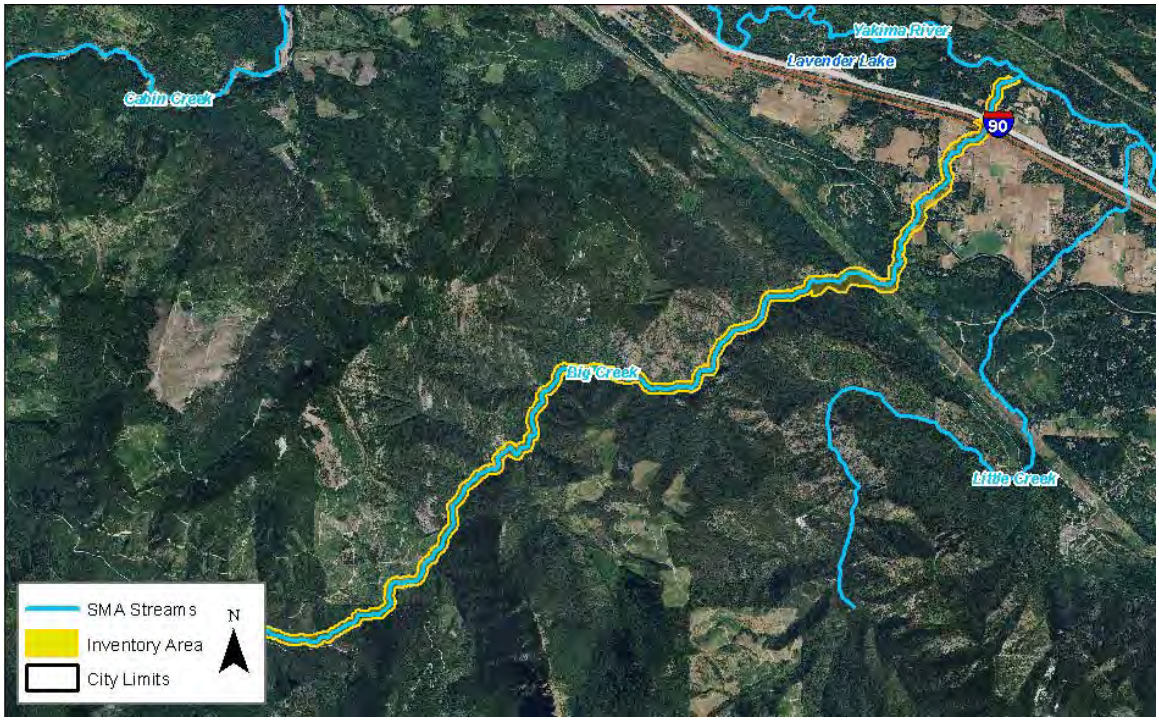
3.10.4 Public Access

A dogsled trail crosses Big Creek at the Big Creek Siphon, and a snowmobile trail/Forest Service road crosses the stream within the electric transmission line corridor. Starting on National Forest land, the Big Creek trail borders much of the upper stream.

3.10.5 Reach Sheet

BIG CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
10.4 Miles	531.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach primarily flows as a single channel through a narrow valley flanked by steep slopes. Downstream, the streamflows through flat terrain in a channel that exhibits limited migration.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A portion of the reach (21%) is located within the FEMA 100-year floodplain and a several landslide hazard areas (3%) are mapped at the upstream end of the reach. Over half of the reach (64%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

This reach is mostly covered by conifer-dominated forest (59%), harvested forest (18%), and riparian vegetation (17%), with small amounts of agricultural lands (3%), other (2%), and developed lands (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of rainbow trout, eastern brook trout, and westslope cutthroat is also mapped.

Limited wetland habitat is mapped along the river in several patches (2% of the reach) and priority elk winter concentration area is also mapped within the reach.

The Big Creek shoreline inventory area is mapped as habitat for rare plant species by the Washington Natural Heritage Program.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Shoreline modifications includes I-90 and railroad crossings at the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses the downstream portion of the stream. A dogsled trail crosses Big Creek at the Big Creek Siphon, and a snowmobile trail/Forest Service road crosses the stream within the electric transmission line corridor. Big Creek trail borders the middle portion of the stream and the North Ridge Trail parallels a segment of the stream downstream from here.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (68%) with rural lands (32%) along the downstream end. Land ownership is 58% private and 42% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (68%), with forest & range (15%), agriculture (10%), rural residential (4%), and other (3%) [I-90] areas at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The creek provides habitat for a variety of priority fish species (including spawning habitat for spring Chinook), but low summer flows and fish passage barriers are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains significant areas of dense forest cover and connections to large areas of relatively undisturbed habitat (primarily upstream), but habitat is altered in some areas by I-90, residential development, and timber harvest.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, mature forest cover, but some riparian areas have been disturbed by forest harvest (upstream) and agriculture, residential development, and I-90 (downstream).	**HYDROLOGIC FUNCTIONS** **Medium:** The upstream portions of the reach are relatively intact, but floodplain development and irrigation diversions have significantly altered the hydrology of the lower creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions), particularly at the downstream end of the reach. New development should be set back an adequate distance to protect stream functions and protect structures from flooding.
- Work is ongoing to secure water rights for improving instream flows.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- The reach contains a rare plant species, mapped by the Washington Natural Heritage Program.
- Participate in efforts to balance irrigation needs with fish passage flows.
- The downstream portion of the reach has an unpredictable floodplain and flood capacity.

3.11 Little Creek

Little Creek is a right-bank tributary to the Yakima River that enters at RM 194.6.

3.11.1 Physical Characterization

Multiple transportation corridors (I-90 and other roads, railroad, and the John Wayne Heritage Trail) and utility corridors (drainage canal and power line) cross the lower reach of Little Creek. The stream also traverses agricultural land and is flanked by sparse to moderate-density residential development.

The watershed was extensively logged and converted to agriculture in the late 1880s. Water diversions were established on the stream by 1881 (Haring 2001). The Little Creek channel may have been rerouted in the vicinity of the Yakima River floodplain to facilitate residential development (Haring 2001). The stream would have originally flowed through an area of wetlands and springs associated with the hyporheic zone of the Yakima River, but much of this area has been altered by development.

The FEMA 100-year floodplain is mapped within much of the downstream half of the inventory area (FEMA 1996). The floodplain in this area has an unpredictable floodplain and flood capacity (Tetra Tech, 2012).

3.11.2 Habitats and Species

3.11.2.1 Fish Use

Little Creek supports spring Chinook and steelhead rearing and potentially steelhead spawning in the lower reaches (Haring 2001). Other fish species mapped in the stream include rainbow trout and westslope cutthroat (StreamNet 2010).

The Integrated Water Resource Management Plan for the Yakima River basin proposes modifications to laterals of the Kittitas Reclamation District (KRD) Main and South Branch canals to reduce seepage losses and allow greater flexibility in KRD supply management. The water saved or transferred would be used to enhance instream flows in tributaries to the Yakima River, including Little Creek (Reclamation and Ecology 2011a).

3.11.2.2 Water Quality

The lower part of Little Creek is on Ecology's 303(d) list for high water temperatures. The lack of riparian vegetation and shade along this part of the stream may contribute to temperature issues.

Water quality in Little Creek may be affected by excess sediments, particularly during floods that transport streambed substrates (Haring 2001).

3.11.2.3 Riparian Habitat Conditions (Land Cover)

The upper three-quarters of Little Creek is located in managed forest land. The lower portion flows through rural residential/agricultural areas with scattered trees in the riparian zone.

Vegetation management along the power line crossing of Little Creek (near the center of the reach) limits tree cover (shade) and potential future large wood for the stream. Large wood is lacking in other parts of Little Creek as well because of past fires, channelization, and deliberate removal (Haring 2001).

3.11.2.4 Wetlands

A small portion of the Little Creek shoreline inventory area is mapped as wetland, located near the power line corridor crossing.

3.11.2.1 Wildlife Habitats and Species

No priority habitats or species are mapped near Little Creek.

3.11.3 Land Use

The downstream end of Little Creek, between its confluence with the Yakima River and I-90, is bordered by high-density residential development. Between I-90 and the KRD Little Creek Siphon, land use bordering the creek is primarily low-density residential and agriculture. From the siphon to the National Forest boundary (approximately 1.3 miles), undeveloped forested land borders the creek, with the exception of an electric transmission corridor that crosses the stream. Zoning within this segment is forest and range and agriculture (3-acre lots). The remainder of the creek flows through National Forest land.

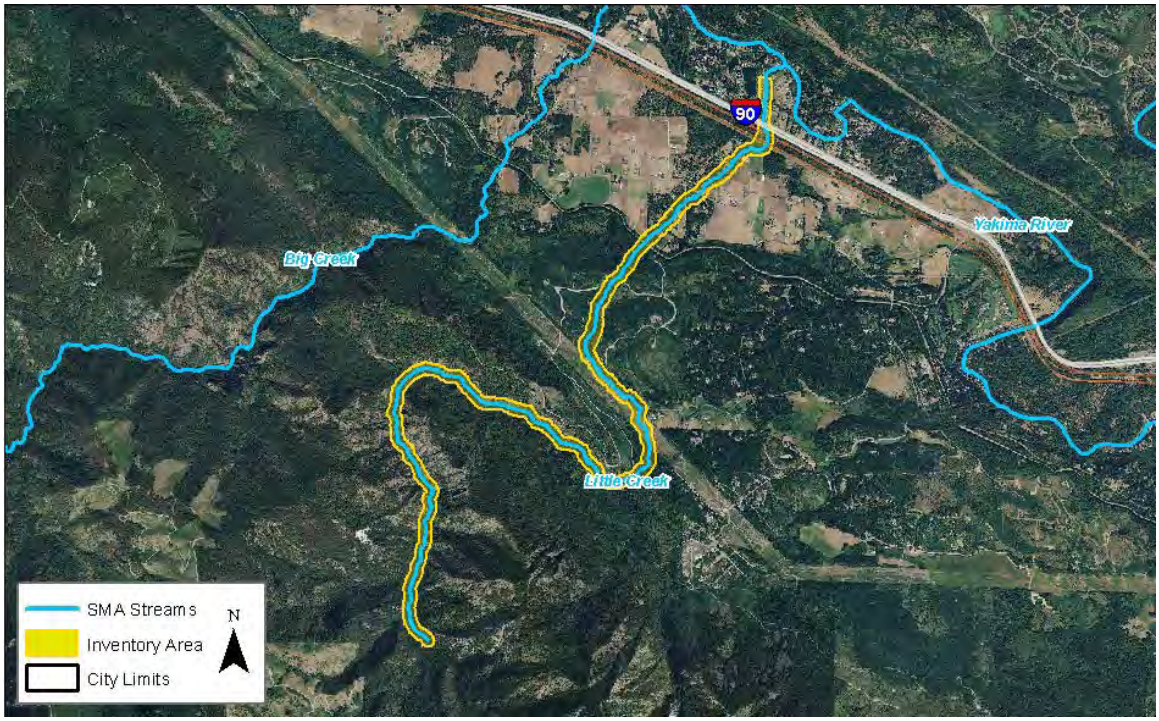
3.11.4 Public Access

A dogsled trail crosses Little Creek at the Little Creek Siphon, and a snowmobile trail/Forest Service road crosses the creek near the electric transmission line corridor. The John Wayne Heritage Trail crosses the creek at the downstream end.

3.11.5 Reach Sheet

LITTLE CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
7.1 Miles	351.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach primarily flows as a single channel through a narrow valley with steep slopes. The downstream portion of the streamflows through flat terrain, but the channel is more confined and has been rerouted in the vicinity of the Yakima River floodplain.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by conifer-dominated forest (61%), riparian vegetation (17%), and harvested forest (13%), with some agricultural lands (5%), developed lands (2%), and other (2%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 36% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for spring Chinook. The presence of, rainbow trout, summer steelhead, and westslope cutthroat is also mapped.

Wetland habitat is mapped in the middle portion of the reach (4% of the reach). No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 for temperature.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Identified shoreline modifications within the reach include I-90, railroad crossings, and a water diversion structure at RM 1.2.Other, unmapped diversion structures may be present, as well.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses the downstream portion of the stream. A dogsled trail crosses Little Creek at the Little Creek Siphon, and a snowmobile trail/Forest Service road crosses the stream near the electric transmission line corridor.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (54%) upstream and rural (46%) downstream. Land ownership is 46% private and 54% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (54%) along the upstream half and rural residential (17%), agriculture (14%), forest & range (10%), and other (5%) [I-90] along the downstream half.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 recorded historic site within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The creek provides habitat for a variety of priority fish species (including spawning habitat for spring Chinook), but low summer flows (and periodic channel dewatering) are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains significant areas of dense forest cover and connections to large areas of relatively undisturbed habitat (primarily upstream), but habitat is altered in some areas by I-90, residential development, and timber harvest.
VEGETATION FUNCTIONS **Medium:** Much of the reach area consists of dense, mature forest cover, but some riparian areas have been disturbed by forest harvest (upstream) and agriculture, residential development, and I-90 (downstream).	**HYDROLOGIC FUNCTIONS** **Medium:** The upstream portions of the reach are relatively intact, but floodplain development and irrigation diversions have significantly altered the hydrology of the lower creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions), particularly at the downstream end of the reach. New development should be set back an adequate distance to protect stream functions and protect structures from flooding.
- Participate in efforts to balance irrigation needs with fish passage flows.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- The downstream portion of the reach has significant flood hazard potential.

3.12 Lower Cle Elum River

The lower Cle Elum River flows approximately 8 miles from the Cle Elum Lake Dam to the Yakima River. The Cle Elum River is a left-bank tributary to the Yakima River, emptying at RM 185.6. The lower Cle Elum River is considered a shoreline of statewide significance.

3.12.1 Physical Characterization

Downstream of the dam, the river is confined within a single channel for approximately 1 mile. Downstream of this point, the river is typically characterized by a large channel with multiple large side-channel complexes that become engaged with the main channel when flows exceed 500 cfs (Haring 2001).

Several landslides and steep slopes have been mapped along the lower river (WDNR 2010; Kittitas County 2012). The FEMA 100-year floodplain is mapped in most of the inventory area, with some of the upstream portions of the inventory area, below the dam, outside of the floodplain (FEMA 1996). The mapped channel migration zone extends throughout the majority of the inventory area, including areas within the City of Cle Elum.

Residential development and golf courses, associated with the Suncadia development, are located on the left and right banks of the river at about RM 2 to RM 6.5. Upstream of the development, one bridge crosses the river; downstream of this development, the river flows under a powerline corridor, four roadways including I-90, and a railroad bridge. In addition to residential development, the lower watershed has been extensively logged. The lower Cle Elum River confluence with the Yakima River is located at the John Wayne Heritage Trail crossing of the Yakima River.

3.12.1.1 City of Cle Elum

A short stretch of the Cle Elum River (Cle Elum River Reach 1) flows through the western city limits of Cle Elum. The upstream extent begins at the Bullfrog Road and continues downstream until the I-90 bridge; a distance of approximately 0.8 mile. The river is listed as a shoreline of statewide significance in this reach. The stretch of river is largely undeveloped and contains a large left-bank bend with multiple channels. A small lake is located on the left bank of the river with several residential structures on its northern shoreline. The FEMA 100-year floodplain is mapped in most of the inventory area, with some of the upstream portions of the inventory

area (FEMA 1996) and the entire reach is located within the identified channel migration zone.

3.12.2 Habitats and Species

3.12.2.1 Fish Use

The lower Cle Elum River below Cle Elum Dam supports spring Chinook and summer steelhead spawning. The lower Cle Elum River is considered a high-density Chinook salmon spawning area; in most years, half of the spring Chinook salmon redds in the upper Yakima River watershed are found immediately upstream and downstream of the confluence of the Cle Elum and Yakima Rivers (Haring 2001). Currently, no steelhead occur upstream of Cle Elum Dam. Small numbers of steelhead may spawn in the Cle Elum River downstream from the dam. (Reclamation and Ecology 2011b).

Other species documented in the lower Cle Elum River include rainbow trout, westslope cutthroat, burbot, eastern brook trout, and mountain whitefish (StreamNet 2010).

Cle Elum Dam was constructed without fish passage facilities, blocking anadromous fish use from approximately 35 miles of highly productive historic habitat (Haring 2001). However, a temporary fish passage facility has recently been constructed at Cle Elum Dam, and sockeye salmon were subsequently re-introduced to the system. The Yakama Nation is currently studying the possibility of a permanent fish passage facility.

During the late 1800s and early 1900s, stream channels in the Cle Elum watershed were cleared in order to allow large rafts of logs to be floated downriver to lumber mills. This caused substantial damage to salmonid habitat (Haring 2001).

The natural hydrology of the Cle Elum River has been significantly altered by water storage for flood control and irrigation water delivery. High flows during the irrigation season provide fish access to side channels that provide summer rearing habitat. However, lowering of flows during flip-flop operations results in dewatering of the side channels, eliminating them as winter rearing habitat (Haring 2001).

Recently, the Kittitas Conservation Trust and other organizations installed large log jams in the lower Cle Elum River, which have deflected stream flows to re-activate the Domerie side channel (U.S. Department of the Interior, 2011). This work has created two stream miles of riparian habitat that provides rearing habitat for spring Chinook salmon (U.S. Department of the Interior, 2011).

City of Cle Elum

See Section 2.12.2.1.

3.12.2.2 Water Quality

Dispersed recreational activity along the Cle Elum River and Cle Elum Lake may increase the delivery of fine sediments (Haring 2001).

The Cle Elum River has water temperatures that are higher than the standard acceptable levels for fish immediately above and downstream of the reservoir. Downstream from the dam, higher water temperatures may be a result of dam impoundment and surrounding forest practices (Reclamation and Ecology 2011b).

City of Cle Elum

See Section 3.12.2.2.

3.12.2.3 Riparian Habitat Conditions (Land Cover)

The lower Cle Elum River flows through forested areas, some of which have been extensively logged. Several road crossings and utility corridors cross the river. See discussion above under Section 3.12.1.

City of Cle Elum

Most of the Cle Elum riparian zone within city limits is forested. There is limited residential development in the shoreline inventory area.

3.12.2.4 Wetlands

Approximately one-third of the lower Cle Elum River shoreline inventory area is mapped as wetland, primarily forested-shrub wetland habitat.

City of Cle Elum

A large forested wetland associated with the Cle Elum River is mapped within the city's shoreline inventory area.

3.12.2.1 Wildlife Habitats and Species

The lower Cle Elum River flows through a mapped elk winter concentration area.

City of Cle Elum

Within the city, the Yakima River flows through a mapped elk winter concentration area.

3.12.3 Land Use

Between I-90 and its confluence with the Yakima River, the Cle Elum River is bordered by undeveloped forest land that is zoned as forest and range. Upstream of the I-90 crossing, within the City of Cle Elum, the land bordering the river is mostly undeveloped forest land (zoned for planned mixed use) with a few single-family residential lots.

Upstream of Cle Elum city limits to the National Forest boundary, the river is bordered by undeveloped forest land zoned for master planned resort (Suncadia). Much is this land is protected within conservation easements. From the Cle Elum Dam to approximately 1 mile downstream, the river flows through National Forest lands.

According to National Forest mapping data, there are two "special use" authorizations identified within the inventory area. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.12.3.1 City of Cle Elum

The Cle Elum River flows through the west end of the City of Cle Elum. The river is generally bordered by undeveloped forest land, which is zoned for planned mixed use. A moderate-density residential development borders the river to the southeast.

3.12.4 Public Access

The lower Cle Elum River can be accessed from the Suncadia Conservancy, which borders the river from Bullfrog Road to the National Forest boundary. The Salmon Viewing Trail, which is ADA-accessible, is located off of Lake Cle Elum Dam Road, and Forest Service Road 4330 also provides river access.

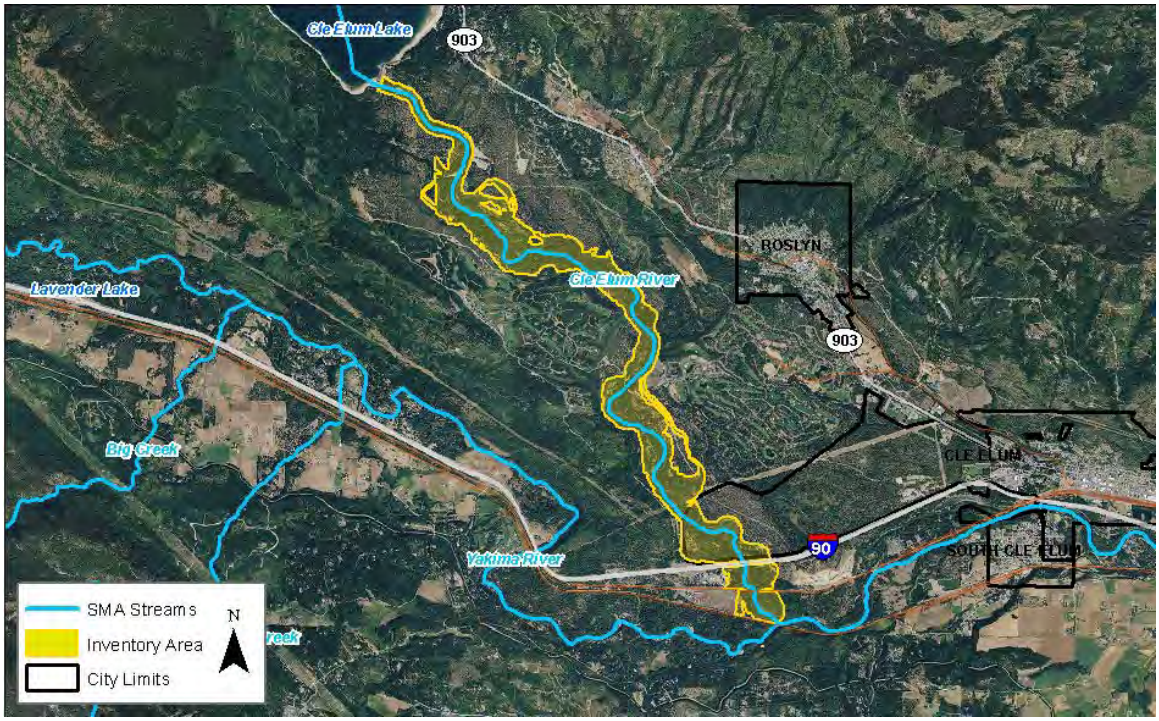
3.12.4.1 City of Cle Elum

There is no public access to this reach.

3.12.5 Reach Sheet

CLE ELUM RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
7.8 Miles	1,202 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach descends approximately 250 feet, contains multiple channels, numerous side channels and gravel bars, particularly upstream of the Suncadia development. The downstream portion of the reach passes under several bridges, including I-90, which constrain channel movement.

LAND COVER (MAP FOLIO #3)

This reach is primarily forest (38%) and riparian vegetation (38%), with some unvegetated (6%), agricultural lands (6%), harvested forest (5%), other (3%), open water (2%), and developed lands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (89%) is located within the FEMA 100-year floodplain and a few landslide hazard areas (2%) are mapped on both banks of the reach. Over three-quarters (81%) of the reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of sockeye salmon, burbot, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped

Wetland habitat is mapped along the river throughout the reach (37% of the reach). A significant amount of priority elk winter concentration area is located in the reach; wood duck nesting habitat is also mapped in the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are several crossing (bridges) over the reach, including I-90, a railroad, and 3 other roadways.	**PUBLIC ACCESS (MAP FOLIO #4)** The lower Cle Elum River can be accessed from the Suncadia Conservancy, which borders the river from Bullfrog Road to the National Forest boundary. The Salmon Viewing Trail, which is ADA-accessible, is located off of Lake Cle Elum Dam Road, and Forest Service Road 4330 also provides river access.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily resort (70%) with rural lands at the upstream and downstream ends of the reach (30%). Land ownership is 93% private and 7% public (Forest Service).	**CONTAMINATED SITES** A State cleanup site (pesticide dump) is located at the downstream end of the reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for master planned resort (70%), with forest & range (14%) along the upstream end and mixed use (11%), rural residential (1%), urban/suburban residential (1%) and other (3%) [I-90] at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 41 recorded precontact and historic sites are located within the reach. Recorded precontact sites include lithic scatters and burials while historic sites include bridges, refuse dumps, and waterlines.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.	**TERRESTRIAL HABITAT QUALITY** **High:** The majority of the reach consists of dense forest and shrub habitat and connections to large areas of relatively undisturbed habitat are present throughout much of the reach.
VEGETATION FUNCTIONS **High:** Some areas of alteration exist, but the majority of the reach consists of dense riparian forest and shrub habitat.	**HYDROLOGIC FUNCTIONS** **High:** There are generally low levels of hydromodifications and floodplain alteration within the reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forest and range to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect the high-value wetland, forested floodplain, and wildlife areas.
- The lower Cle Elum River is a high-density Chinook salmon spawning area.
- Upstream of the City of Cle Elum, much of the shoreland area is protected within conservation easements.
- Many important cultural and archaeological sites are located within the reach.
- Support efforts to balance irrigation needs with fish passage flows.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.

CLE ELUM RIVER-CITY OF CLE ELUM REACH

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.7 Miles	148.7 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream extent of the reach is confined by a road crossing; the downstream extent by an I-90 a crossing. This single channel reach transitions to multiple channels downstream and then back to a single channel at the I-90 crossing.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (98%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The entire reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

The majority of the reach is covered by riparian vegetation (51%) and forest (22%). Other cover types include: agricultural lands (8%), harvested forest (6%), other (6%), unvegetated lands (5%), and developed lands (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of sockeye salmon, burbot, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped

Wetland habitat is closely associated with the river, primarily the upstream portion of the left bank and entire right bank (36% reach total). Priority elk winter concentration area is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications mapped within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to this reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for mixed use (91%), urban/suburban residential (5%), and other (4%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded precontact sites, and 1 recorded historic site located within the reach. The recorded precontact sites mostly feature lithic scatters with 1 site also containing burials.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.	**TERRESTRIAL HABITAT QUALITY** **High:** The majority of the reach consists of dense forest and shrub habitat and connections to large areas of relatively undisturbed habitat are present throughout much of the reach.
VEGETATION FUNCTIONS **High:** Some areas of alteration exist (associated with residential development), but the majority of the reach consists of dense riparian forest and shrub habitat.	**HYDROLOGIC FUNCTIONS** **High:** There are generally low levels of hydromodifications and floodplain alteration within the reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.
- Protect the high-value wetland and forested floodplain areas.
- There is no public access to the reach.
- The lower Cle Elum River is a high-density Chinook salmon spawning area.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.

3.13 Cle Elum Lake

Cle Elum Lake is the eastern-most of the three reservoirs which supply irrigation water as part of the Yakima Project. The lake is designated as a "lake of statewide significance."

3.13.1 Physical Characterization

Cle Elum Lake is oriented north-south. It has an active storage capacity of approximately 436,000 acre-feet with a surface area of 4,800 acres when full. The maximum depth is approximately 258 feet. Lake levels fluctuate roughly 60 feet between the winter/spring and summer (Haring 2001). Major tributaries to the lake include the Cle Elum River and its tributaries and French Cabin Creek, all of which drain to the north end of the lake.

Several landslide hazard areas have been mapped within narrow canyons along the southwestern shoreline of the lake (WDNR 2010). Steep slopes are mapped near the northeastern shoreline and at many locations along the southwestern shoreline (Kittitas County 2012). The FEMA 100-year floodplain extends around the circumference of the lake, but is not mapped throughout the inventory area (FEMA 1996).

State Route 903 and Salmon La Sac Road roughly parallel much of the eastern lake shoreline. The roadways provide access to sparse to moderate-density residential development along the eastern and southeastern shorelines. Virtually no development is located along the north, west, or southwest shorelines of the lake. A limited number of Forest Service roads are mapped near the northwest portion of the lake.

Cle Elum Lake originally formed in the U-shaped glacial valley of the Cle Elum River with a capacity of approximately 100,000 acre-feet. In 1933, an earth and gravel-fill dam was constructed at the outlet of the lake to increase storage capacity for irrigation (Haring 2001). The Cle Elum Lake Dam is located at the south end of the lake. Below the 165-foot dam, the lake drains to the south via the Cle Elum River until its confluence with the Yakima River (BOR 2009).

3.13.2 Habitats and Species

3.13.2.1 Fish Use

The construction of a crib dam at Cle Elum Reservoir contributed to the local extinction of sockeye from the basin in the early 1900s. Later the U.S. Bureau of Reclamation (Reclamation) constructed Cle Elum Dam. The dam expanded a natural lake that historically supported populations of sockeye, coho, and spring Chinook salmon, steelhead, Pacific lamprey, bull trout, and other resident fish. Lack of passage at the dam blocked access to the lake and upstream habitat for anadromous salmonids and contributed to the extirpation of sockeye salmon runs in the Yakima River basin. The absence of passage has also isolated local populations of bull trout and may have prevented the recolonization of populations. (Reclamation 2011, Haring 2001).

Interim juvenile fish passage facilities were completed at Cle Elum Lake in 2005 to test the ability of juvenile fish to locate the passage facility and exit the reservoir (Reclamation 2007). Data gathered from the temporary passage facilities confirm that fish can navigate a downstream passage facility at the dam (Reclamation 2011).

No anadromous fish are present in the reservoir or the Cle Elum River upstream of the dam, with the exception of some sockeye and coho that have been introduced in recent years. Native resident fish in the lake include burbot, bull trout, kokanee salmon (spawning), westslope cutthroat, mountain and pygmy whitefish, rainbow trout, dace, suckers, sculpins, and a few other species. Introduced resident species in the lake include brown trout, eastern brook trout, and lake trout (StreamNet 2010, Reclamation and Ecology 2011b).

Cle Elum Reservoir is operated to meet irrigation demands, flood control, and instream flows for fish. Operational releases at Cle Elum Dam are affected by the presence of spring Chinook salmon redds in the Cle Elum River downstream from the dam (Reclamation and Ecology 2011b).

In 2001, Reclamation entered into an agreement with the Washington Department of Fish and Wildlife to assess the feasibility of providing passage for anadromous salmonids at five water storage projects in the Yakima River basin. The goal is to eventually restore anadromous salmonid runs to suitable habitats upstream from the dams and restore the connectivity of bull trout populations. State and tribal fisheries managers are developing a plan for the eventual phased reintroduction of sockeye salmon, coho salmon, Chinook salmon, and steelhead above the dams. The Yakama Nation and WDFW developed a reintroduction plan for anadromous fish species above the Yakima Project storage dams. The fish reintroduction plan helped

guide the development of alternatives for fish reintroduction at Cle Elum Dam (Reclamation 2007, 2011).

Between 2003 and 2005, biologists studied conditions in Cle Elum Lake to better understand the potential for reintroducing sockeye salmon. They found that Cle Elum Lake is relatively unproductive, with low nutrient levels, chlorophyll a concentrations, phytoplankton biovolume, zooplankton densities, and total organic carbon concentrations. The very low densities of zooplankton may limit the capacity of the lake to support fish. However, the carcasses of returning adult salmon are expected to return marine-derived nutrients to the system (Reclamation 2007, 2011).

The Integrated Water Resource Management Plan for the Yakima River basin proposes permanent fish passage facilities at the Cle Elum Dam including both downstream passage facilities for juvenile fish and upstream adult fish passage facilities. The Integrated Plan also proposes raising the maximum water level of Cle Elum Lake to increase the volume of available storage in the lake (Reclamation and Ecology 2011a).

3.13.2.2 Water Quality

Cle Elum Lake is listed by Ecology for high water temperatures at the upper and lower ends of the lake near the river inlet/outlet. The trophic status of the lake was classified as eutropic according to a 1993 assessment by Ecology (Rector 1996) indicating high mineral and organic nutrients and low dissolved oxygen content.

Dispersed recreational activity along the Cle Elum River and Cle Elum Lake may increase the delivery of fine sediments (Haring 2001).

3.13.2.3 Riparian Habitat Conditions (Land Cover)

The riparian zone of Cle Elum Reservoir consists of forested areas with limited and scattered residential development.

3.13.2.4 Wetlands

A small part of the lake's shoreline inventory area is mapped as freshwater emergent wetland.

3.13.2.1 Wildlife Habitats and Species

The area surrounding Cle Elum Lake is mapped as northern spotted owl critical habitat (federally listed threatened species), elk winter concentration area and mountain goat habitat. A bald eagle nest is mapped on the lake shoreline.

The forest and riparian habitat areas surrounding Cle Elum Reservoir are relatively undisturbed and provide high-quality habitat for a variety of native wildlife species. Many wildlife species in the Cle Elum River basin have a food web relationship with salmon as primary or secondary consumers (for example, black bear, bald eagle, river otter, common merganser, osprey) (Reclamation and Ecology 2011b).

Grizzly bear observations have been recorded in the vicinity of Cle Elum Reservoir (WDFW, 2009a; WSDOT 2005). The grizzly bear is a federal threatened and state endangered species. Grizzly bears are wide-ranging and omnivorous, and they make heavy use of salmon as a food source. Suitable habitat existed in the Cle Elum Reservoir area historically, but fairly high road densities, development, and increased human use have decreased the quality of the habitat. Small numbers of grizzlies may also be found in other areas of the Cle Elum River basin (Reclamation and Ecology 2011b).

Reproducing pairs of northern spotted owls have been observed in the Cle Elum Reservoir area. This species was federally listed as threatened in 1990 and is state-listed as endangered. It is known to be declining in the Cle Elum and Wenatchee areas. Spotted owls generally rely on older forested habitats. Critical habitat for northern spotted owl is designated near Cle Elum Reservoir and Cle Elum River. The U.S. Forest Service approach to managing habitat for this species is shifting away from site-specific reserves toward a landscape approach that recognizes the role of fires in east side, dry forest ecosystems (Reclamation and Ecology 2011b; USFS restoration strategy 2010).

3.13.3 Land Use

Over three-quarters of the Lake Cle Elum shoreline inventory area is located on National Forest lands. The remaining inventory area consists of moderate-density residential subdivisions and vacant land that is zoned for rural residential development.

According to National Forest mapping data, there are six “special use” authorizations identified within the inventory area. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.13.4 Public Access

Several National Forest recreation areas border Lake Cle Elum, including Speelyi Beach, Wish Poosh Campground (contains a boat launch), and Cle Elum River Campground. In addition, the northeastern shore of Lake Cle Elum is bordered by a snowmobile trail/Forest Service road.

3.13.5 Reach Sheet

LAKE CLE ELUM

SHORELINE LENGTH:
43.9 Miles

WATERBODY AREA: 4,509.9 Acres
REACH INVENTORY AREA: 5,095.1 Acres

PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The lake is located in a valley, oriented northwest to southeast. The 165-foot-high dam, located at the south end of the lake, regulates pool elevations between 2,240 feet and 2,210 feet.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant portion of the reach (75%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mainly open water (56%) and unvegetated (30%). Other (6%), conifer-dominated forest (5%), and riparian vegetation (2%) are also present.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for Kokanee salmon, and the lake now provides rearing habitat for sockeye salmon. The presence of burbot, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat are also mapped.

Approximately 14% of the reach is mapped as wetland habitat. Priority elk winter concentration area is located east and south of the lake and unique habitat features (e.g., cliffs, outcroppings, talus slopes) are located in the southern portion of the reach, suitable for mountain goat.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The lake level is controlled by a dam (barrier to fish passage).	**PUBLIC ACCESS (MAP FOLIO #4)** Several National Forest recreation areas border Lake Cle Elum, including Speelyi Beach, Wish Poosh Campground (contains a boat launch), and Cle Elum River Campground. In addition, the northeastern shore of Lake Cle Elum is bordered by a snowmobile trail/Forest Service road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the lake is primarily rural along the eastern and southern shores (55%) and forestry along the western and northern shores (38%), with patches of parks & open space (8%). Land ownership is 23% private and 77% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for rural residential (43%) along the east and south lake shores commercial forestry (37%) along the west and north shores, with some areas of forest & range (9%) and other (11%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 27 recorded precontact and historic sites are located in the reach. Recorded sites include 17 precontact sites, 5 historic sites, and 5 sites that feature both precontact and historic features.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake provides habitat for several priority fish species, but is primarily managed as an irrigation reservoir and has a listed water quality impairment (high temperatures).	**TERRESTRIAL HABITAT QUALITY** **High:** The shorelands consist primarily of dense forest cover, and the lake has significant, unaltered connections to large areas of relatively unaltered habitat.
VEGETATION FUNCTIONS **High:** Nearly the entire lakeshore consists of dense, mature forest habitat	**HYDROLOGIC FUNCTIONS** **Medium:** The lake provides significant floodwater storage, but it is managed as an irrigation reservoir.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, large tracts of resource lands within the reach have been converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance from the lakeshore to protect riparian functions.
- Fish passage has recently been constructed at Cle Elum dam, and sockeye have been re-introduced to the lake and its tributary streams.
- Many important cultural and archaeological sites are located within the reach.
- Protect existing forested areas and high-quality wildlife habitat.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Decommission and revegetate any unused roads along the shoreline.

3.14 Lake Cle Elum Tributaries

Tributaries to Lake Cle Elum with mean annual flows greater than 20 cfs include French Cabin Creek, Thorp Creek, Upper Cle Elum River, Scatter Creek, Fortune Creek, Cooper River, Delate Creek, Lemah Creek, Waptus River, Goat Creek, Trail Creek, Spinola Creek, Spade Creek, Chief Creek, and Shovel Creek. Lakes in the upper Cle Elum watershed larger than 20 acres include Tuck Lake, Robin Lake, Tucquala Lake, Cooper Lake, Spectacle Lake, Glacier Lake, Chikamin Lake, Pete Lake, Lake Michael, Deep Lake, Circle Lake, Waptus Lake, Spade Lake, Venus Lake, Lake Ivanhoe, Shovel Lake, and Lake Rowena.

The following streams are designated as "shorelines of statewide significance": Cooper River upstream to Cooper Lake, the Waptus River upstream to Waptus Lake, and the Cle Elum River two miles upstream of the confluence with Fortune Creek.

Delate Creek, Spectacle Lake, Chikamin Lake, the upper reaches of Lemah Creek, Pete Lake, Lake Ivanhoe, Lake Rowena, Shovel Creek, Shovel Lake, Chief Creek, Spade Creek, Spade Lake, Waptus Lake, Spinola Creek, Waptus River, Trail Creek, Goat Creek, Venus Lake, Circle Lake, Deep Lake, Lake Michael, Tuck Lake, Glacier Lake, and Robin Lake are located within the Alpine Lakes Wilderness Area, and are only briefly discussed below.

For this analysis, the upper Cle Elum River was divided into 6 reaches: Reach 2 (1.1 miles) extends from the Lake Cle Elum inlet to the Thorp Creek confluence, Reach 3 (2.1 miles) extends from the Thorp Creek confluence to the Cooper River confluence, Reach 4 (2.5 miles) extends from the Cooper River confluence to the Waptus River confluence, Reach 5 (5.4 miles) extends from the Waptus River confluence to the Fortune Creek confluence, Reach 6 (2.9 miles) extends from the Fortune Creek confluence to the Tucquala Lake outlet, and Reach 7 extends from the Tucquala Lake inlet to 5.7 miles upstream. The lower Cle Elum River (Reach 1) is described above in Section 3.12.

Cooper River was divided into 2 reaches: Reach 1 (4.5 miles) extends from the Cle Elum River confluence to the outlet of Cooper Lake and Reach 2 (4.7 miles) extends from the Cooper Lake inlet to the Lemah Creek confluence.

3.14.1 Physical Characterization

The headwaters of the Cle Elum River are located at the northern extent of Kittitas County, in the Alpine Lakes Wilderness of the Cascade Mountain Range. The majority of the Cle Elum River watershed is located above Cle Elum Lake Dam. The

watershed occupies approximately 208 square miles and contains 14 streams and rivers with mean annual flows greater than 20 cfs. Most of the rivers in the watershed drain to one of three major rivers: Waptus, Cooper, and Cle Elum Rivers. The Waptus and Cooper Rivers are tributaries to the Cle Elum River, which empties to the north end of Cle Elum Lake. The other shoreline regulated stream, which drains directly to Cle Elem Lake, is French Cabin Creek. An estimated 554 miles of Type 1 through Type 5 streams flow through the watershed.

A potential landslide area is mapped near the headwaters of the Cle Elum River (WDNR 2010). The Waptus, Cooper, and Cle Elum Rivers originate and flow through the Cascade Mountain Range and have steep slopes associated with some of their shorelines. However, in many areas, the rivers flow through narrow, relatively flat valleys, with steep slopes located at some distance from their shorelines (Kittitas County 2012). The FEMA 100-year floodplain is mapped in most of the downstream inventory area of Cle Elum River Reach 4 (FEMA 1996). The lower reaches of the Cle Elum and Cooper River have mapped channel migration zones, which overlap much of the Salmon la Sac campground and other recreation areas.

The upper watershed is primarily composed of National Forest lands, in addition to industrial forest and private development. Approximately half of the watershed contains mature forest habitat. From the early 1880s to the 1930s, significant coal and hard rock mining occurred in the upper watershed, which likely impacted the quality of fish habitat (Haring 2001).

Cooper Lake is located in a broad valley, oriented northwest to southeast, and is approximately 1.0 mile long and 0.2 mile wide. The Cooper River enters the lake at the northwest shoreline and exits at the southeast shoreline. A large stream delta/wetland complex is located at the mouth of the stream along the northwest shoreline. Steeps slopes are located near portions of the lake's northern and southern shorelines (Kittitas County 2012). The northern shoreline inventory area is mapped in the FEMA 100-year floodplain (FEMA 1996).

The Cooper River is a right-bank tributary to the Cle Elum River. The river is listed as a shoreline of statewide significance in this reach. The river is generally confined within a single channel in a narrow ravine. A bridge, associated with a residential development at the southeast end of the lake, crosses the reach near its upstream extent. Steeps slopes are located along the upstream and middle portions of the river reach (Kittitas County 2012). A small portion of the upstream inventory area of the river, on the left bank, and some of the downstream segments of the river are mapped in the FEMA 100-year floodplain (FEMA 1996).

3.14.2 Habitats and Species

3.14.2.1 Fish Use

The upper Cle Elum watershed supports kokanee and bull trout, as well as other resident salmonid and non-salmonid species. Kokanee and bull trout in this area spend their life in Cle Elum Reservoir, except for spawning and egg incubation to emergence (Haring 2001). No anadromous fish are present in the reservoir or the Cle Elum River upstream of the dam, with the exception of some sockeye and coho that have been introduced in recent years (Reclamation and Ecology 2011b). It is likely that the upper Cle Elum and Cooper river now provide spawning habitat for sockeye salmon.

Table 3-3 summarizes fish use in the upper Cle Elum watershed. Fish use has not been recorded by StreamNet (2010) for many of the small lakes in the upper watershed, likely as a result of fish passage barriers such as waterfalls in these steep upper reaches.

Table 3-3. Fish Use in Lake Cle Elum Tributaries (Source: StreamNet 2010) [1]

Species	French Cabin Creek	Thorp Creek	Upper Cle Elum River	Scatter Creek	Robin Lake	Tucquala Lake	Fortune Creek	Cooper River	Cooper Lake	Lemah Creek	Pete Lake	Waptus River	Goat Creek	Lake Michael	Trail Creek	Spinola Creek	Deep Lake	Circle Lake	Waptus Lake	Spade Creek	Spade Lake	Venus Lake	Chief Creek	Shovel Creek	Lake Ivanhoe	Shovel Lake	Lake Rowena
ull Trout			P/M			P/M	P/M	P/M	P/M										P/M								
Rainbow Trout	P/M		P/M			P/M	P/M	P/M	P/M			P/M			P/M				P/M					P/M	P/M		
Westslope Cutthroat		P/M	P/M		P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M		P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M	P/M
Eastern Brook Trout	P/M	P/M	P/M			P/M	P/M	P/M	P/M	P/M	P/M	P/M							P/M	P/M			P/M				
Kokanee Salmon			S					P/M	P/M																		
Burbot			P/M					P/M																			
Mountain whitefish			P/M					P/M	P/M																		
Sockeye salmon			S[2]					S[2]																			

1. P/M = presence/migration; S = spawning

2. Sockeye spawning in these stream is likely, due to the re-introduction of this species to Lake Cle Elum

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3.14.2.2 Water Quality

Dispersed recreational activity along the Cle Elum River and Cle Elum Lake may increase the delivery of fine sediments (Haring 2001).

The Cle Elum River has water temperatures that are higher than the standard acceptable levels for fish immediately above and downstream of the reservoir. Higher water temperatures in the upper reach of the Cle Elum River are likely a result of water flowing slowly through warm, shallow Tucquala Lake. Much of the upper Cle Elum watershed lies within the Alpine Lakes Wilderness Area and is therefore not affected by forest practices. Both Thorp Creek and the Cooper River, tributaries to the upper Cle Elum River, are also listed on the 303(d) list for temperature (Reclamation and Ecology 2011b).

3.14.2.3 Riparian Habitat Conditions (Land Cover)

Most of the upper Cle Elum River, upstream of Cle Elum Reservoir, is located in a steep, rocky canyon. The riverbed consists mainly of large boulders, cobbles, and gravels. Stream habitats are varied and include cascades, riffles, and pools suitable for spawning and rearing fish. Log jams and large woody debris are abundant in the river channel. The river valley widens and the gradient is low where the Cle Elum River flows through the wide and shallow Tucquala Lake. The mixed conifer forests and alpine meadows bordering the river are relatively undisturbed except for a gravel road and hiking trails (Reclamation and Ecology 2011b).

Human activities have altered riparian vegetation and reduced sources of large wood along several tributary streams in the upper watershed. Fortune Creek has been affected by timber harvest and motorized trail encroachment into the riparian area. The riparian zones of Thorp Creek and French Cabin Creek have been impacted by timber harvest, road encroachment, and dispersed recreation (Haring 2001).

Extensive areas of the lower Cooper River drainage have a high erosion risk. There is a checkerboard ownership between the National Forest and Plum Creek Timber Company (Haring 2001).

3.14.2.4 Wetlands

Scattered wetlands are mapped along streams and lakes in the upper Cle Elum watershed. Large wetland systems are mapped on the Waptus River, Delate Creek, Lemah Creek, and the Cooper River.

3.14.2.1 Wildlife Habitats and Species

The upper Cle Elum watershed is mapped as mountain goat habitat. Several northern spotted owl occurrences are mapped in the upper watershed, and much of the area is designated as critical habitat for this federally listed threatened species.

3.14.3 Land Use

The tributary lakes and streams to Lake Cle Elum are located on National Forest lands, with the following exceptions:

- The Cle Elum River is bordered by private land between Cooper and Waptus Rivers. Land use in this area is primarily commercial forest, but some high-density residential subdivisions are located adjacent to Cooper and Cle Elum Rivers.
- North of the Waptus River confluence, the Cle Elum River is bordered by private commercial forest-zoned lands, portions of which have been subdivided into moderate-density residential lots.
- A high-density residential subdivision borders the southeast corner of Cooper Lake.

According to National Forest mapping data, there are two "special use" authorizations identified within the inventory area (Thorp Creek and the Cle Elum River). A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

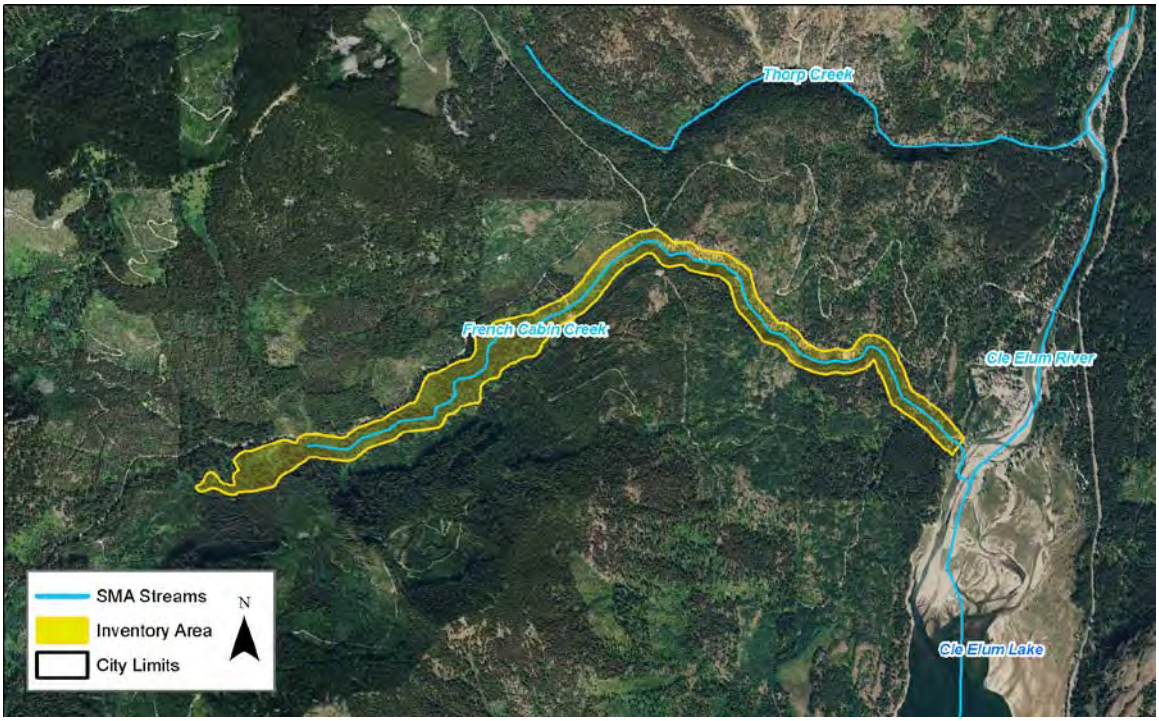
3.14.4 Public Access

The Lake Cle Elum tributary streams and lakes can be accessed from adjacent National Forest recreation areas and roads and a network of hiking, horse, and snowmobile trails.

3.14.5 Reach Sheet

FRENCH CABIN CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.9 Miles	175.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach begins in a large scrub-shrub and forested wetland, flowing to the northeast and then southwest, draining to the north end of Cle Elum Lake. The lower portion of the reach flows through a steep, narrow ravine.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (58%), riparian vegetation (35%), and harvested forest (7%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A limited amount (3%) of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of rainbow trout and eastern brook trout within the reach.

Approximately 43% of the reach is mapped as wetland. Priority big game is mapped within the reach.

WATER QUALITY

Temperature data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Two Forest Service roads cross the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A cross country ski/snowmobile trail/National Forest road borders the northern regulated stream area; primarily remaining outside of the regulated area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are primarily zoned for commercial forest (98%), with limited other (2%) composed primarily of forest service roads.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

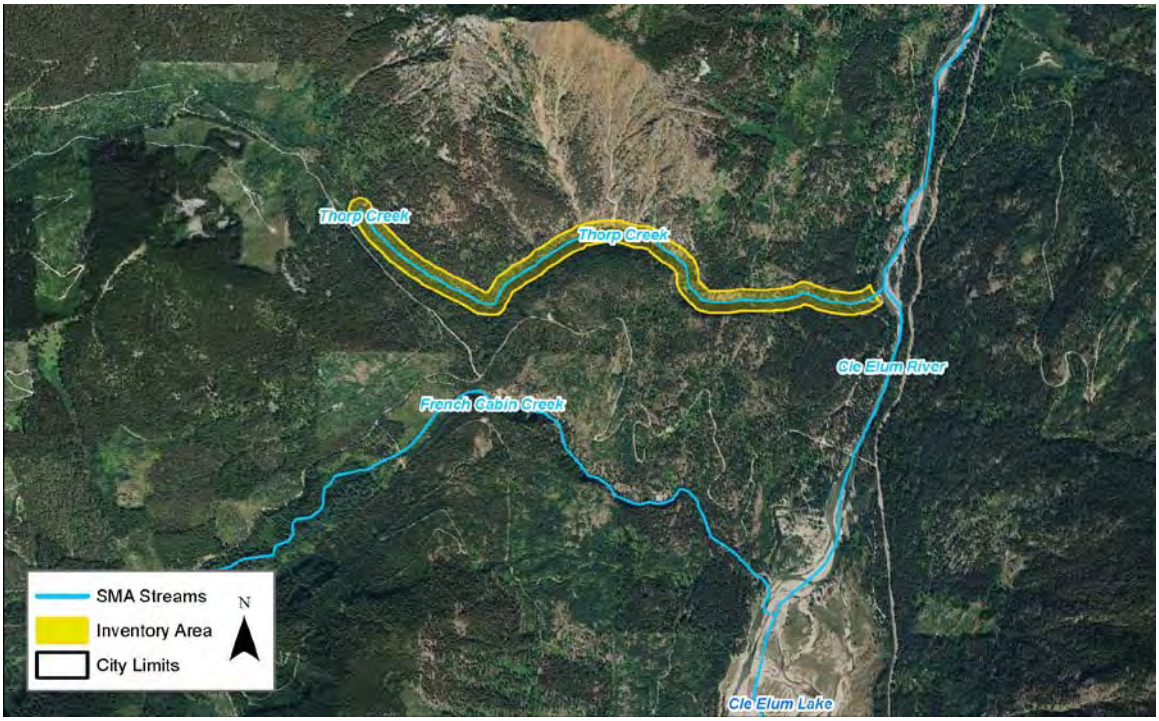
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- There is no identified public access to the reach.
- Decommission and revegetate any unused roads along the shoreline.

THORP CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.2 Miles	107.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows west to east and is undeveloped..

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (90%), riparian vegetation (7%), harvested forest (2%), and shrubland (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A small amount (1%) of the reach is located within the FEMA 100-year floodplain; no landslide hazard areas are mapped.

WATER QUALITY

Temperature data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of westslope cutthroat and eastern brook trout within the reach.

No wetlands are mapped within the reach; no priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A cross country ski/snowmobile trail/Forest Service road borders the upstream regulated stream area, but does not enter into the regulated area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

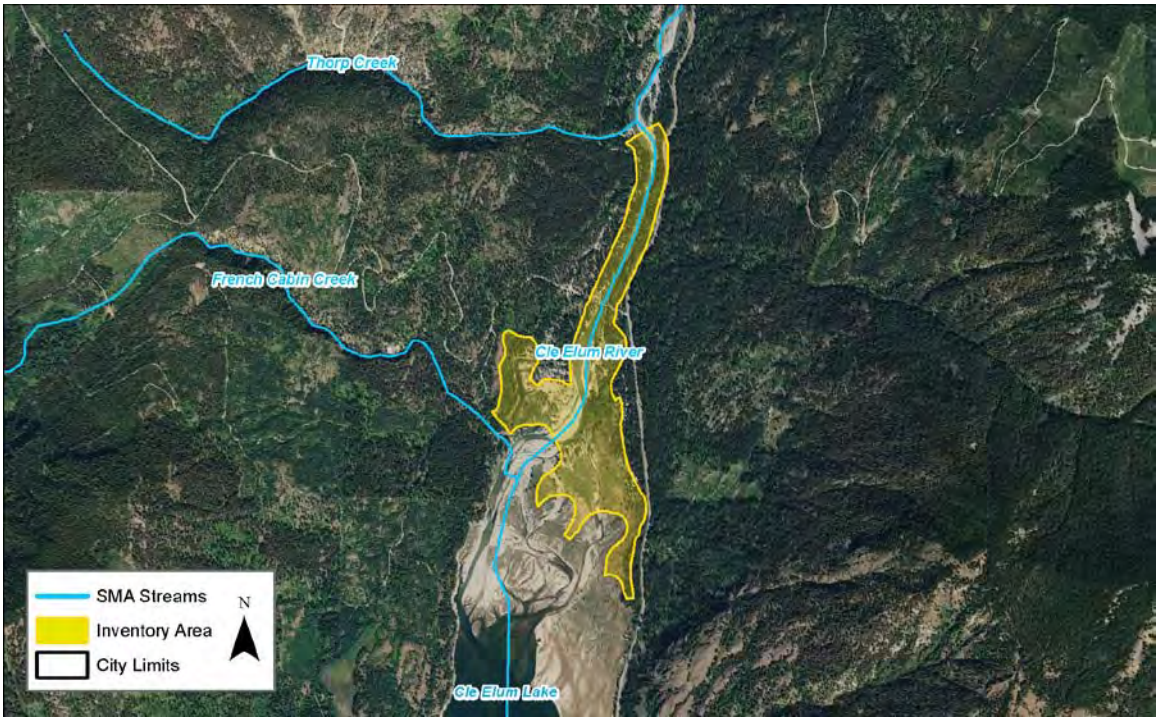
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access to the reach.
- Decommission and revegetate any unused roads along the shoreline.

CLE ELUM RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.1 Miles	165.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is undeveloped. A Forest Service road located west of the stream and Salmon La Sac Road to the east flank the stream. A Forest Service bridge crosses the reach near its mouth. The southern portion of the reach becomes inundated when Cle Elum Lake is full.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (34%), riparian vegetation (27%), unvegetated (2%), developed (1%), harvested forest (1%), open water (1%), and other (34%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A majority (89%) of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach (81%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for Kokanee salmon. The presence of bull trout, rainbow trout, westslope cutthroat, eastern brook trout, burbot, and mountain whitefish is also mapped. The reach now likely provides spawning habitat for sockeye salmon.

Wetlands are mapped within 34% of the reach and Priority big game and elk winter concentrations are mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Salmon la Sac Road borders the eastern side of the reach, and a Forest Service road crosses the stream at the lower end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A cross country ski/snowmobile trail/Forest Service road crosses the middle portion of the reach. A snowmobile trail/Forest Service road parallels the eastern border of the regulated stream area. A campground, Cle Elum River, is located adjacent to the eastern regulated stream area, near the stream mouth.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (9%) and parks & open space (1%). Land ownership is 1% private and 99% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are primarily zoned for commercial forest (89%), with some other (11%) composed primarily of bare ground associated with the stream mouth.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

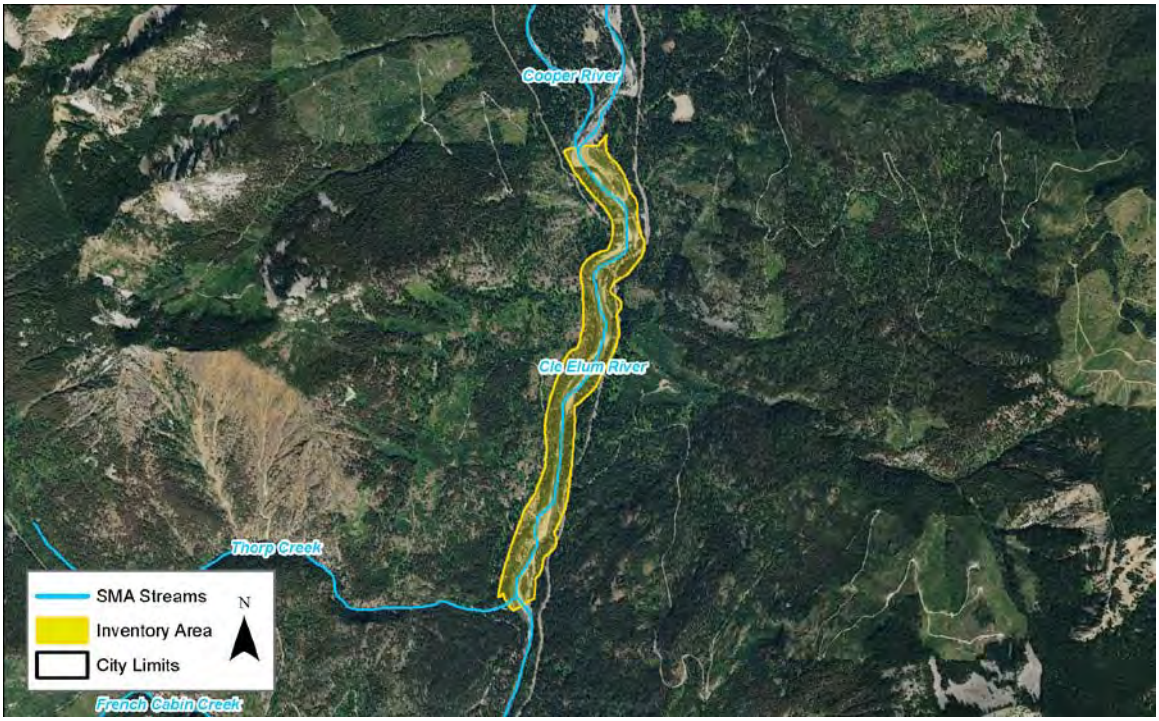
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning habitat for Kokanee and sockeye salmon (likely).	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-vegetated, contains significant wetland habitat, and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach is dominated by riparian shrub and mature forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The stream is largely unaltered and unconfined across a wide floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access to the reach.
- Decommission and revegetate any unused roads along the shoreline.

CLE ELUM RIVER-REACH 3

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.1 Miles	161.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows north to south and is undeveloped.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (59%), riparian vegetation (20%), unvegetated (10%), open water (4%), developed (2%), harvested forest (1%), and other (4%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Most (80%) of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach (79%) has potential for channel migration.

WATER QUALITY

Temperature data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of bull trout, rainbow trout, westslope cutthroat, eastern brook trout, Kokanee salmon, burbot, and mountain whitefish within the reach. The reach now likely provides spawning habitat for sockeye salmon.

A small area (9%) of the reach is mapped as wetland. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Salmon La Sac Road parallels the entire eastern border of the reach. A Forest Service road bridge crosses the upstream portion of the reach; another Forest Service road borders the western bank downstream.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service Road borders the eastern regulated stream area; crossing the upstream portion of the reach. The Red Mountain Campground is located on the eastern shoreline of the reach, near the confluence with Thorp Creek.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 precontact site and 2 historic sites recorded within the reach. One of the historic sites consists of a refuse scatter that is potentially eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

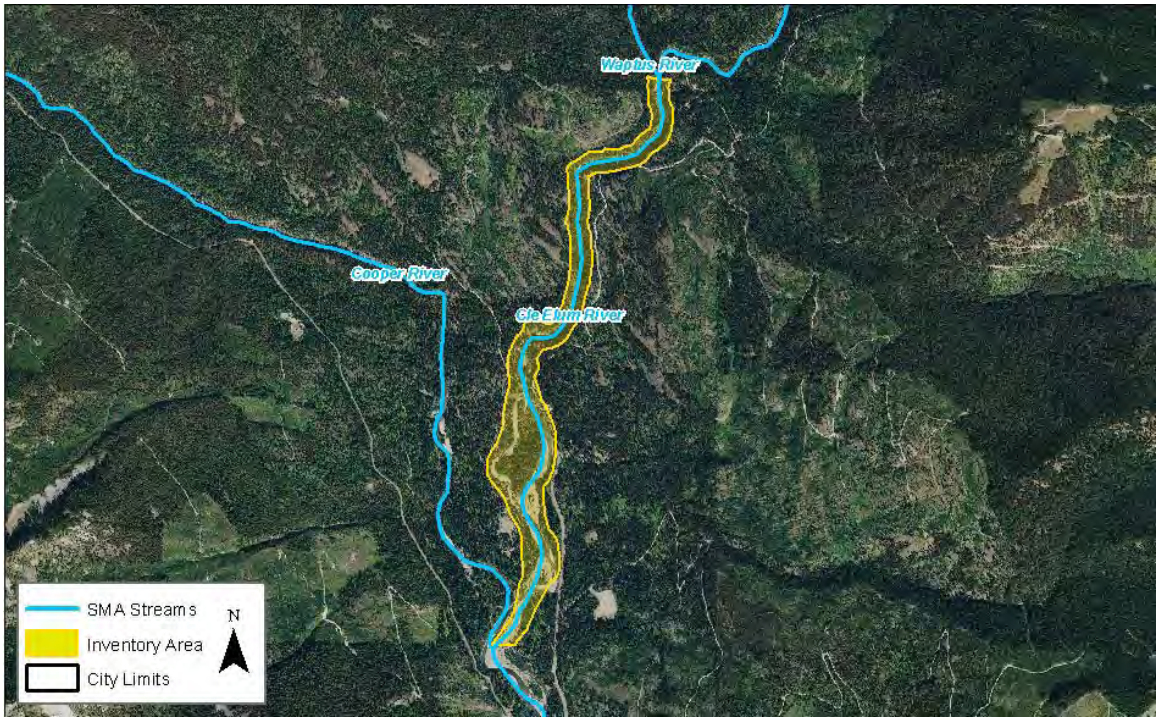
FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-vegetated and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream contains a fairly wide floodplain, but the floodplain connection is disturbed by Salmon La Sac Road.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

CLE ELUM RIVER-REACH 4

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.5 Miles	157.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach is confined to a single channel in a steep, narrow valley. Near the confluence with the Cooper River, the topography becomes less severe and the river splits into multiple channels with large gravel bars.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A little more than half (55%) of the reach is located within the FEMA 100-year floodplain and a limited amount of landslide hazard area (1%) is mapped at the upstream end of the reach. Over half (61%) of the reach has potential for channel migration.

WATER QUALITY

The reach meets water quality criteria for temperature, per the State's Water Quality Assessment.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily conifer-dominated forest (81%), and riparian vegetation (11%), with patches of other (4%), developed lands (2%), and grassland (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of burbot, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The reach now likely provides spawning habitat for sockeye salmon.

Wetland habitat is mapped along much of the river reach (7% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** This reach can be accessed by cross country ski and snowmobile trails/Forest Service roads at several locations.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 45% private and 55% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (97%) and other (3%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 recorded precontact site, and 2 recorded historic sites within the reach. The Salmon la Sac Guard Station (built 1912) is listed on state and national historic registries.

SHORELINE FUNCTION ANALYSIS

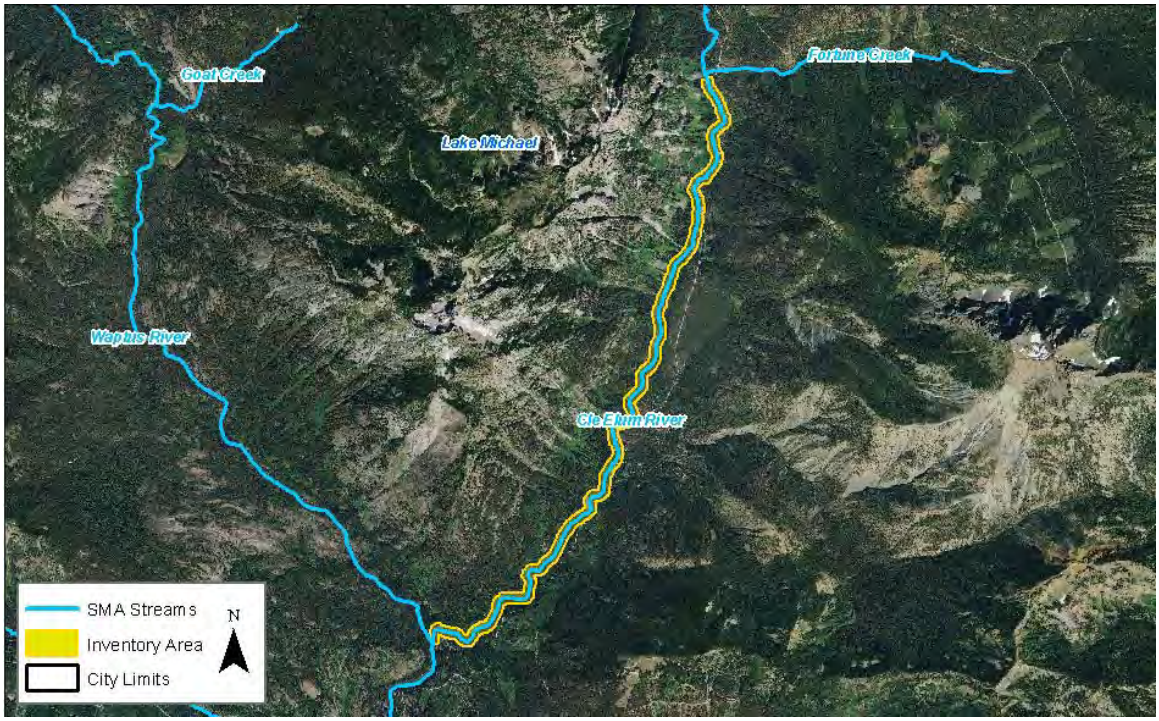
FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **High:** The stream channel and its floodplain are generally unaltered.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Privately-owned forest lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect the high-value, forested floodplain areas within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.

CLE ELUM RIVER-REACH 5

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.4 Miles	257.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located within a narrow valley with moderate to steep topographic relief; the river is generally confined within a single channel with numerous gravel bars.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach meets water quality criteria for temperature, per the State's Water Quality Assessment.

LAND COVER (MAP FOLIO #3)

This reach is mostly conifer-dominated forest (93%), and developed (4%), with limited riparian vegetation (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The reach now likely provides spawning habitat for sockeye salmon.

Very limited wetland habitat is mapped along the river (<1% of reach total), primarily along the downstream portion of the reach. No priority habitats or species are identified in this reach by WDFW.

The upper Cle Elum River shoreline inventory area supports one rare plant species mapped by the Washington Natural Heritage Program.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels most o the reach on the left bank.	**PUBLIC ACCESS (MAP FOLIO #4)** The Davis Peak Trail crosses the downstream extent of the stream and a snowmobile trail/Forest Service road provides access at multiple locations.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 14% private and 86% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (97%) and other (3%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 4 recorded historic sites within the reach. Recorded historic sites feature material related to the mining boom of the early 20th century and include historic structures and a mine.

SHORELINE FUNCTION ANALYSIS

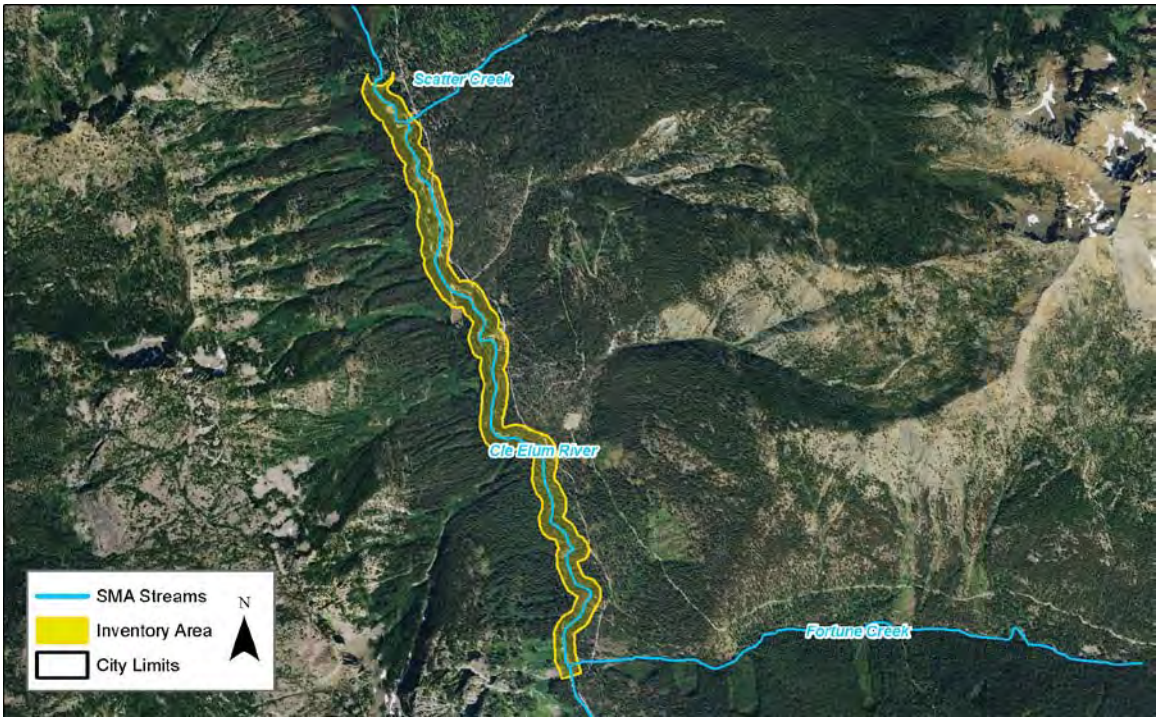
FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development, with the exception of a Forest Service Road.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **High:** The stream channel and its floodplain are generally unaltered, with the exception of a Forest Service Road.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Privately-owned forest lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect the high-value, forested floodplain areas within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- The reach contains a rare plant species, mapped by the Washington Natural Heritage Program.

CLE ELUM RIVER-REACH 6

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.9 Miles	157.5 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach roughly flows to the south in a flat valley bottom.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A very limited extent (<1%) of the reach is located within the FEMA 100-year floodplain; no landslide hazard areas are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (83%), riparian vegetation (13%), and developed (4%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The reach now likely provides spawning habitat for sockeye salmon.

A small area (8%) of the reach is mapped as wetland. Priority mountain goat range is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Salmon la Sac Road borders the eastern bank of the stream.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road is adjacent to the downstream regulated stream area; traversing into a small portion of this area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded historic sites located within the reach. The historic sites feature refuse scatters and a cabin site related to mining.

SHORELINE FUNCTION ANALYSIS

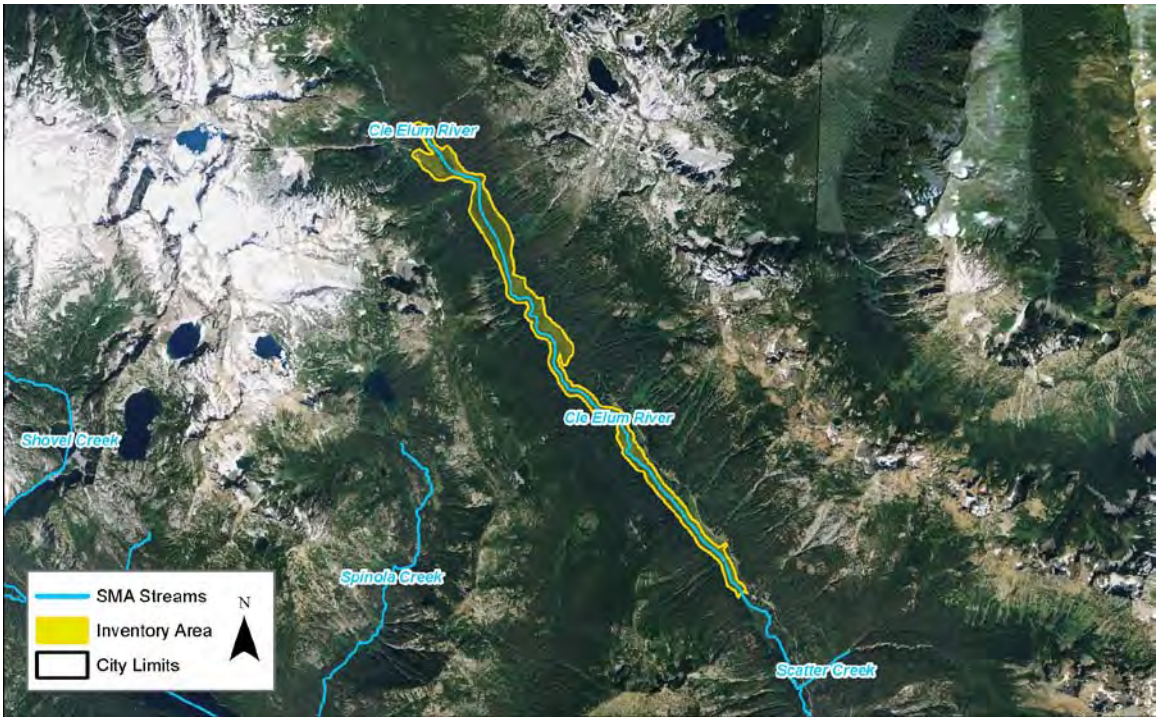
FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is well-forested, connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

CLE ELUM RIVER-REACH 7

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.7 Miles	466.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach generally flows to the southeast within a flat valley bottom, through Hyas Lake to Tucquala Lake.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 41% of the reach is located within the FEMA 100-year floodplain and a small number of landslide hazard areas (6%) are mapped.

WATER QUALITY

pH data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (57%), open water (21%), riparian vegetation (13%), and other (9%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach . The reach now likely provides spawning habitat for sockeye salmon.

Wetlands are mapped within approximately 31% of the reach. Priority elk and mountain goat range are mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the downstream portion of the reach along the eastern bank.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking/horse trail crosses the middle portion of the reach. A different portion of this trail borders the eastern boundary of the regulated stream area, but only enters this area at the northern reach extent. The Fish Lake Campground is adjacent to the eastern regulated stream area and the Tucquala Meadows Trailhead is located approximately mid-reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The stream provides habitat for several priority fish species, including spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is well-forested, connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but a road separates the river from portions of its floodplain.

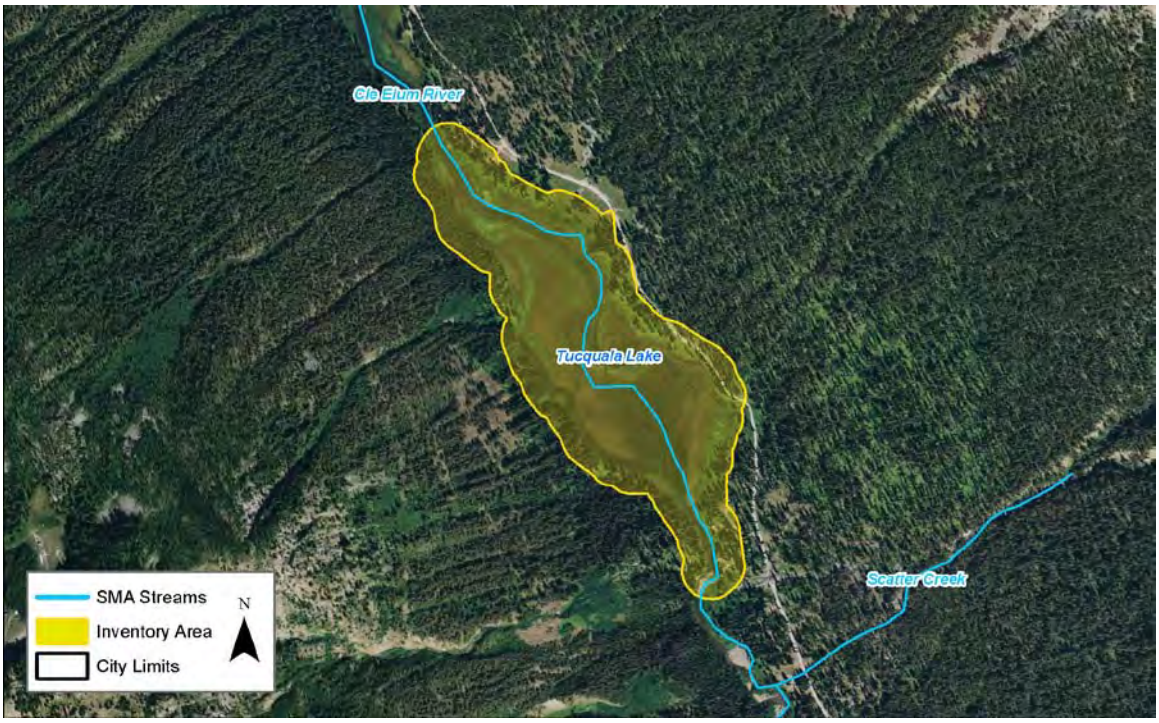
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

TUCQUALA LAKE

SHORELINE LENGTH:
3.6 Miles

WATERBODY AREA: 37.2 Acres
REACH INVENTORY AREA: 97.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is oriented roughly north to south. The Cle Elum River flows through the lake.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Over half (54%) of the reach is located within the FEMA 100-year floodplain; no landslide hazard areas are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (31%), riparian vegetation (22%), open water (21%), and other (25%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of bull trout, rainbow trout, westslope cutthroat, and eastern brook trout within the reach. The presence of sockeye salmon is now likely in the reach.

Approximately one-third (34%) of the reach is mapped as wetland. Priority mountain goat range is mapped within the entire reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the eastern lakeshore.	**PUBLIC ACCESS (MAP FOLIO #4)** The Lake can be accessed from Forest Service road 4330, and there are primitive campsites present.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 recorded historic site within the reach that features a can isolate.

SHORELINE FUNCTION ANALYSIS

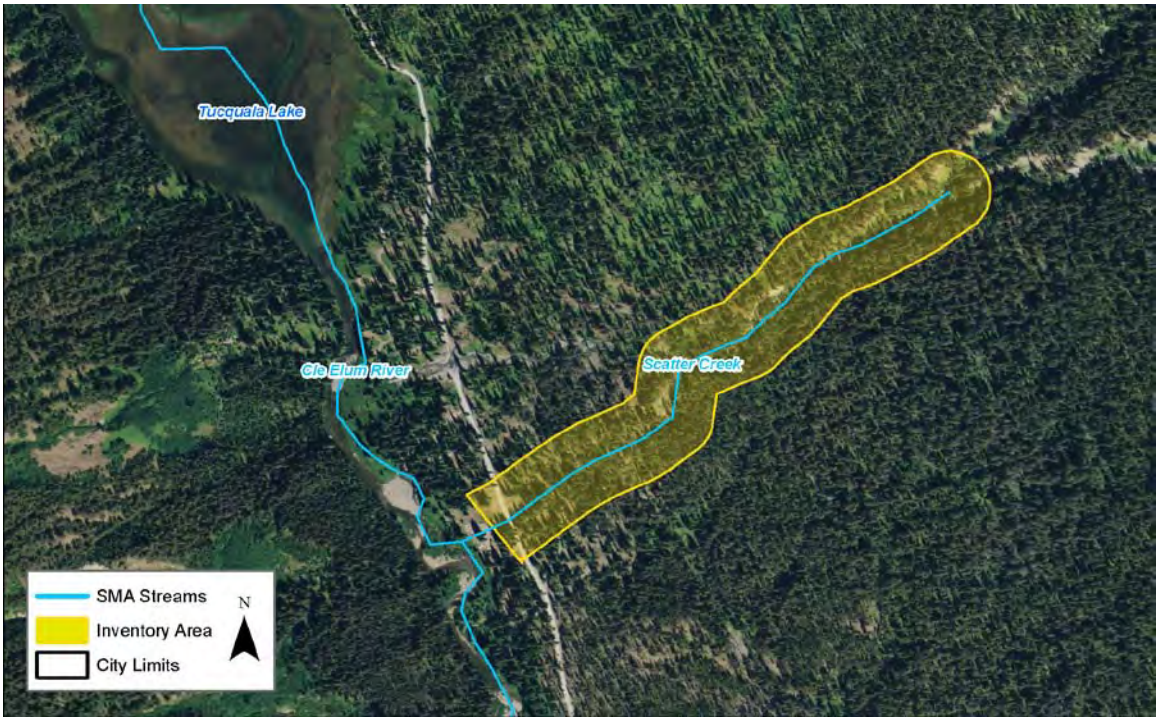
FISH HABITAT QUALITY **Medium:** The lake is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The lakeshore is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The lake is bordered primarily by dense, unaltered forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The lakeshore is generally unaltered, and the lake has significant water storage potential.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- There is no identified public access to the lake.
- Decommission and revegetate any unused roads along the shoreline.

SCATTER CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.5 Miles	27.7 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows to the west. It is undeveloped and located in a relatively flat valley bottom.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain; a small number of landslide hazard areas (7%) are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (99%) and developed (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping does not indicate the presence of any priority fish species within the reach.

No wetlands are mapped within the reach. Priority mountain goat range is mapped within the entire reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road crosses the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking trail traverses the majority of the regulated stream area, crossing the stream once. The Scatter Creek Trailhead is also located within this regulated area. A hiking/horse trail is located adjacent to the southern regulated stream area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There is 1 recorded historic cabin site located within the reach.

SHORELINE FUNCTION ANALYSIS

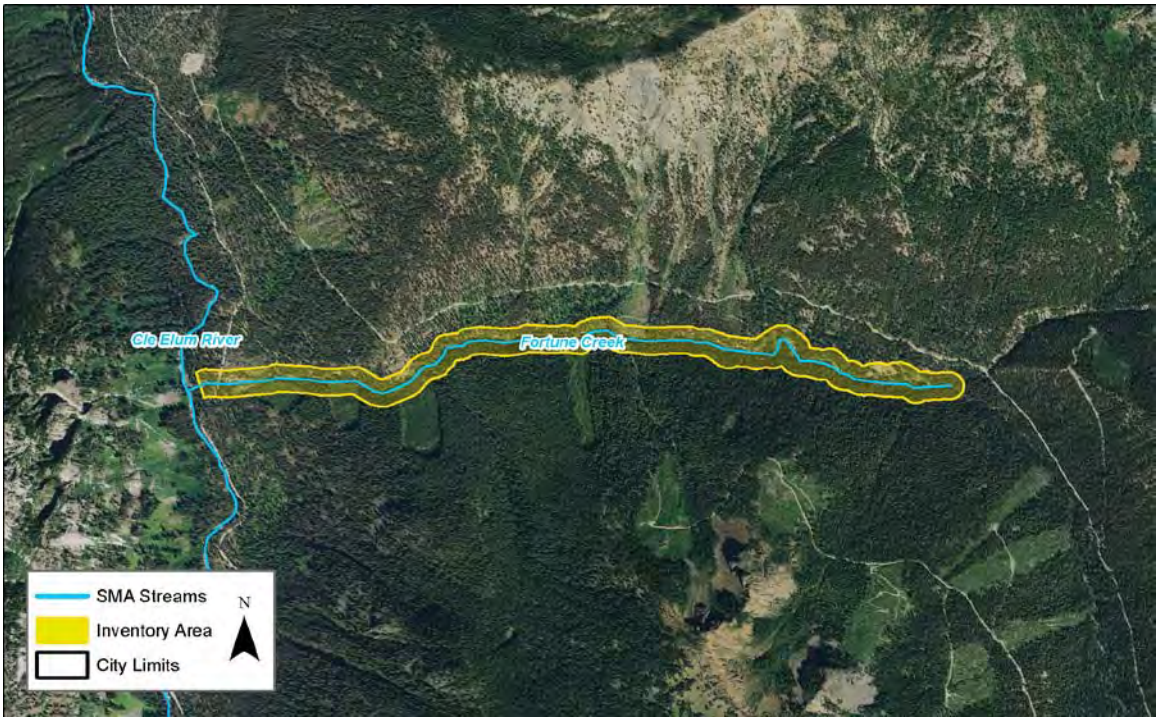
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered, but no priority fish use is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

FORTUNE CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.3 Miles	116.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows east to west in a relatively narrow valley that experiences disturbance from avalanches. Several clear-cuts are located along the southern bank of the stream.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (99%) and developed (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and a very small number of landslide hazard areas (1%) are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of bull trout, rainbow trout, westslope cutthroat, and eastern brook trout within the reach.

Limited (1%) wetland area is mapped within the reach and priority mountain goat range is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road crosses the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking/ATV trail borders the majority of the northern regulated stream area. The hiking trail branches into the regulated area, crossing the stream several times. A snowmobile trail/Forest Service road crosses the stream near the confluence with the Cle Elum River.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded historic sites that feature a wagon road from the late 1800s, and a cabin site related to mining. The wagon road was determined eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

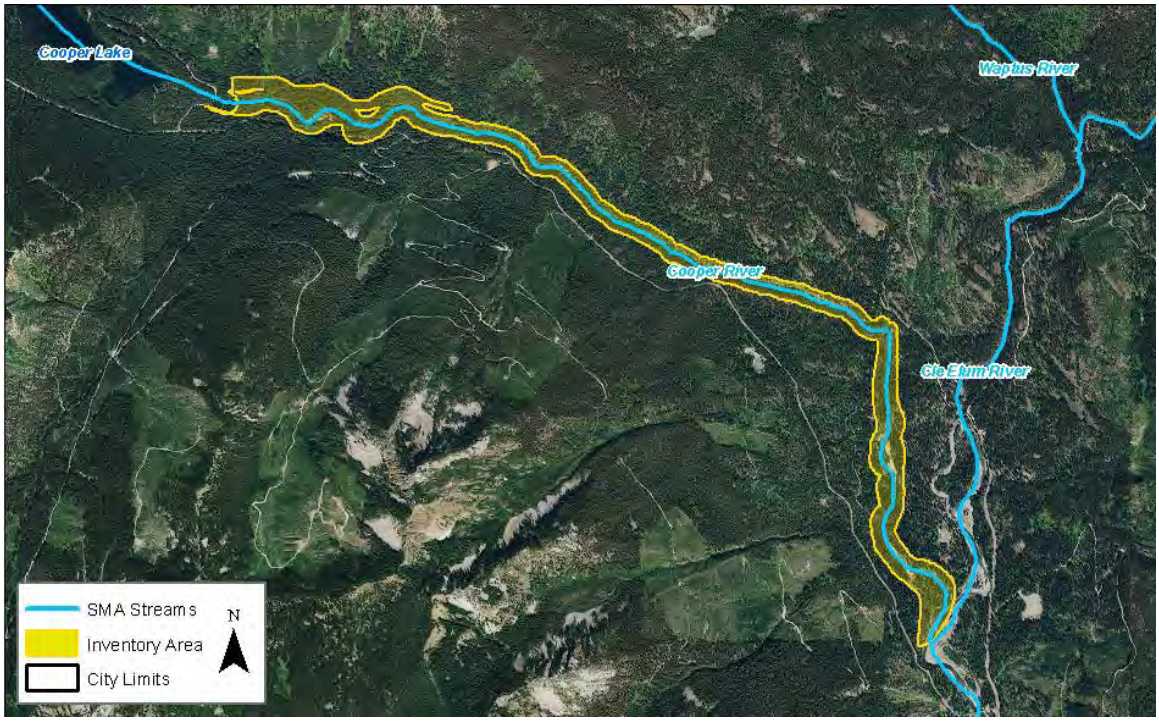
FISH HABITAT QUALITY **Medium:** The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The lake is bordered primarily by dense, unaltered forest habitat.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

COOPER RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
4.5 Miles	278.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located within a narrow ravine with steep to moderate (upstream to downstream) topographic relief. The river is generally confined within a single channel with few gravel bars.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is principally conifer-dominated forest (81%) and riparian vegetation (18%), with some harvested forest (1%) and other (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately one-third of the reach (73%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Over half of the reach (56%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of burbot, kokanee salmon, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The reach now likely provides spawning habitat for sockeye salmon.

Wetland habitat is mapped at the upstream and downstream portions of the reach (16% of reach total). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are mapped within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The Cooper River Trail, a snowmobile trail/Forest Service road, and cross country ski trails allow stream access.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 3% private and 97% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (99%) and other (1%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

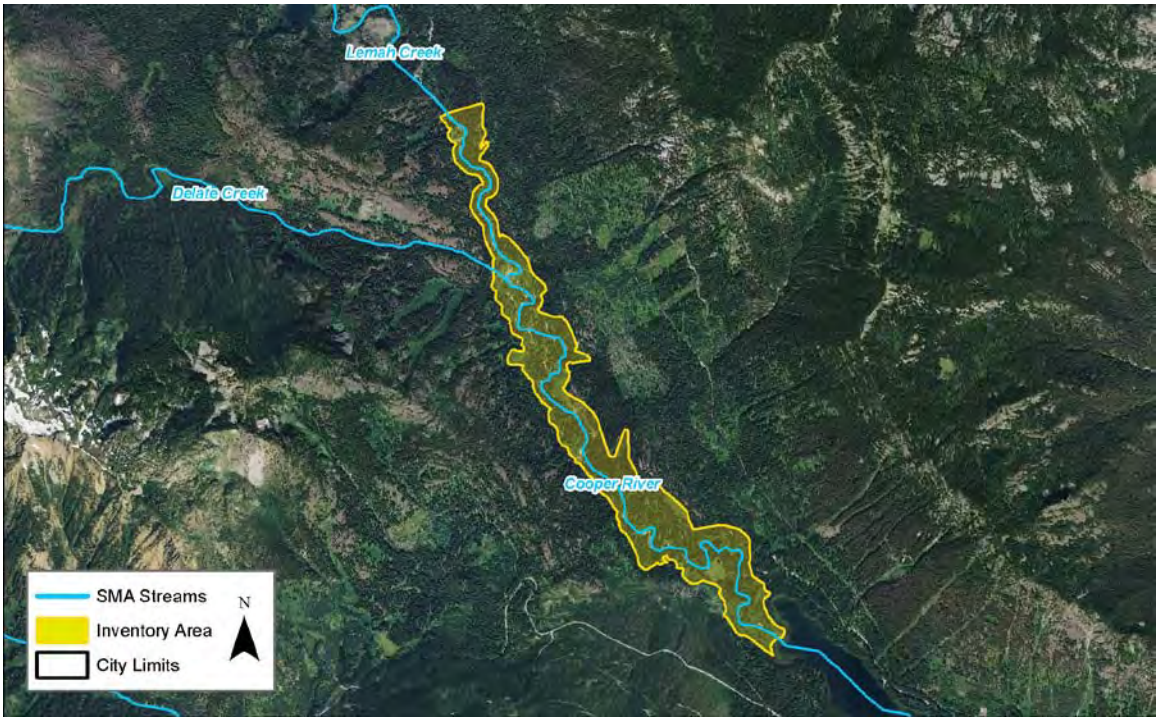
FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream channel is relatively unaltered, but the channel is located within a narrow ravine and has limited floodplain functions.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Privately-owned forest lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding.
- Protect the high-value, forested floodplain areas within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.

COOPER RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
4.7 Miles	424.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows southward in a flat, relatively broad valley. The stream is undeveloped and sinuous, particularly near the confluence with Delate Creek and at Cooper Lake.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is riparian vegetation (63%), conifer-dominated forest (34%), and other (3%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

About 39% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Most of the reach (81%) has potential for channel migration.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of bull trout, eastern brook trout, Kokanee salmon, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The reach now likely provides spawning habitat for sockeye salmon.

Wetlands are mapped within a significant portion (74%) of the reach. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking/horse trail is adjacent to the eastern regulated stream area and crosses into this area at the upstream and downstream reach extents. The Pete Lake Trailhead is located adjacent to the regulated stream area, near the confluence with Cooper Lake.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A recorded historic cabin built in the 1930s is located within the reach. The site is potentially eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The stream provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, and contains minimal existing development.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream channel is relatively unaltered and unconfined across are relatively wide floodplain.

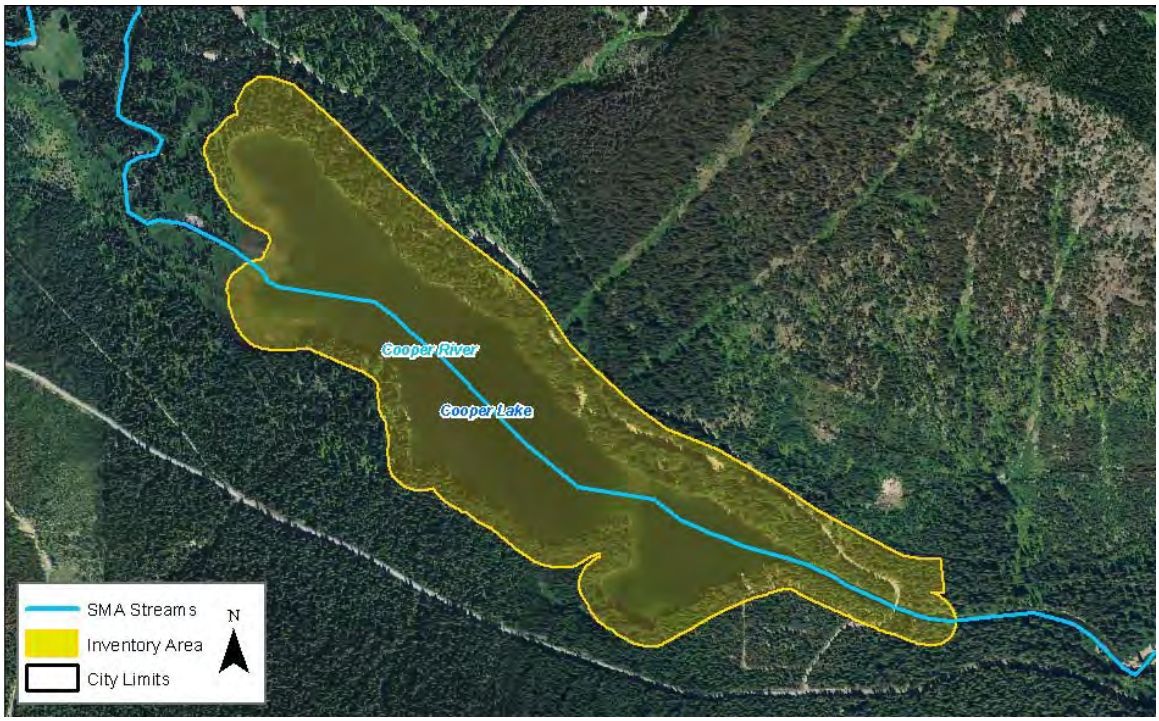
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

COOPER LAKE

SHORELINE LENGTH:
6.3 Miles

WATERBODY AREA: 121.1 Acres
REACH INVENTORY AREA: 242.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

The lake shoreline is mostly undeveloped and is oriented northwest to southeast. The lake inlet is located to the northwest; it drains to the southeast. A large stream delta/wetland complex is located on the western lake shoreline.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is largely open water (47%), conifer-dominated forest (43%), with some riparian vegetation (9%) and other (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (61%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of kokanee salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat within the reach. The presence of sockeye salmon is now likely within the reach.

Wetland habitat is mapped primarily at the northwest shoreline of the lake (7% of reach total). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are mapped within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The Cooper River Trail provides public access to the northern shoreline of the lake, as does the Owhi Campground and associated boat launch.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 6% private and 94% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (69%) and other (31%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is connected to a large area of contiguous forest habitat, contains a significant wetland complex, and is relatively unaltered.
VEGETATION FUNCTIONS **High:** The majority of the reach area consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **High:** The lakeshore is relatively unaltered and the lake helps maintain Cooper River base flows.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Privately-owned forest lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect riparian functions and protect structures from flooding.
- Protect the high value wetland complex at the northwest end of the lake.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

3.15 Teanaway River and Tributaries

The Teanaway River is a left-bank tributary to the Yakima River at RM 176.1 (Haring 2001). Tributaries to the Teanaway River with mean annual flows greater than 20 cfs are the North, Middle, and West Forks of the Teanaway, and Stafford Creek. The mainstem Teanaway and its forks generally flow from the northwest to south. The mainstem, downstream of the forks, is identified as a "shoreline of statewide significance."

3.15.1 Physical Characterization

The reach flows along the southern portion of a broad valley, with low topographic relief. The river is generally confined within a single, wide channel. The channel is confined at several locations by bridges, including the Highway 10 crossing, and by Highway 970 in places.

Active landslide hazard areas are mapped at a several locations in the upper watershed, adjacent to portions of the North and Middle Forks (WDNR 2010). In addition, steep slopes are mapped in the upper reaches of all river forks, as the river traverses through the eastern slopes of the Cascade Mountain Range (Kittitas County 2012). The FEMA 100-year floodplain is mapped in much of the mainstem and North Fork inventory areas, notably extending outside of this area where Highway 970 travels east away from the mainstem. The downstream halves of the West Fork and Middle Fork inventory areas also have mapped floodplain with their boundaries, but to a lesser extent. Near the confluence with the North Fork reach, Stafford Creek has mapped FEMA 100-year floodplain in its inventory area (FEMA 1996).

The mainstem Teanaway and its three forks are mapped as having potential for channel migration. There is substantial residential and agricultural development located within the channel migration zones, particularly along the mainstem river. In recent years, the migrating river has threatened Highway 970 in multiple locations, which has necessitated the installation of rock barbs, large woody debris, and bank armoring by WSDOT to protect the road (WSDOT, 2012).

The mainstem, Middle Fork, and West Fork of the Teanaway experience low flows and associated high water temperatures during the summer and fall, partially the result of multiple stream diversions. Several diversions have been converted to pump and pipeline irrigation systems, which have allowed more flow to remain in the river (Haring 2001).

This stretch of the river has been largely disconnected from its floodplain since the late 1800s. Human alterations have impacted river system processes: ponds and wetlands have been drained and side channels filled; the river has been straightened; and channels have been confined and consolidated. Beaver populations have been reduced so there are fewer dams to retain and disperse flows. Logging and splash damming in the upper watershed have increased the rate of runoff and reduced channel complexity. Downstream of the confluence of the three forks, the river has been moved to the edge of the valley, channelized, and armored to facilitate agricultural activities (Haring 2001).

3.15.2 Habitats and Species

3.15.2.1 Fish Use

The Teanaway River system provides rearing and spawning habitat for bull trout, summer steelhead, and spring Chinook. Other salmonids present in this river system include coho salmon, rainbow trout, westslope trout, eastern brook trout, and mountain whitefish (StreamNet 2010).

Approximately 51 miles of the Teanaway River and its tributaries are accessible to steelhead trout. Steelhead have been observed spawning in the mainstem Teanaway and in the lower West Fork (YSFWPB 2004).

It is unclear whether bull trout were ever abundant in Yakima River tributaries. The North Fork Teanaway River supports a bull trout population, but it is believed to be at risk of extinction due to limited habitat area and isolation from other populations (Haring 2001, USFWS 2002; YSFWPB 2004). Current legal fisheries in the basin are highly regulated to reduce negative impacts on steelhead and bull trout (Conley et al. 2009).

The Teanaway River system historically produced large numbers of spring Chinook salmon. Today small numbers of spring Chinook salmon spawn and rear in the mainstem Teanaway River and the North Fork as far as Stafford Creek (RM 8.3). In 1997 the Cle Elum Supplementation and Research Facility (CESRF) began a program to determine if introducing hatchery fish could increase the abundance of spring Chinook. Smolts have been released at the Jack Creek facility on the North Fork Teanaway River. Spawner returns and redds in the Teanaway River increased from near zero to 110 redds in 2002 and 31 redds in 2003. However, there are concerns that hatchery fish may compete with natural origin fish for space and food resources. (Conley et al. 2009).

Spawning conditions suitable for spring Chinook salmon, steelhead, and coho salmon are still present in much of the mainstem Teanaway River and the lower

portions of the forks. However, human changes to the river system have substantially altered fish habitats. Beginning in the late 19th century, the rivers were used to transport millions of board feet of timber downstream. The removal of large woody debris from the channel led to streambed scouring, channel incision, and lowering of the water table. As settlement continued, stream channels were consolidated or confined to protect homes and fields; while this reduced flooding, it also reduced the recharge of shallow aquifers by cold spring runoff and eliminated off-channel habitat. The lack of large wood in the Teanaway River reduced the number of pools and other important in-channel rearing habitats (Haring 2001, Conley et al. 2009).

Streamflows in the Teanaway River system continue to be a challenge for fisheries. Low flows can prevent salmon access to spawning areas, while excessive peak flows can scour the streambed and reduce the survival of incubating eggs and overwintering juveniles (Conley et al. 2009). The upper Teanaway River has not been subject to extensive water diversions, but below RM 9.6 there is significant diversion for irrigation, especially during the natural low-flow period of late July through mid-September (Reclamation 2002). Low flows and associated increased temperatures limit the availability of summer and early fall rearing habitat in affected tributary and lower mainstem reaches and create passage barriers for migrating and rearing steelhead (Conley et al. 2009). Irrigation systems have been modified to conserve water, reduce diversions, and increase streamflow in the Teanaway River. However, these gains may be partially offset by water used for residential development and drilling of permit exempt wells (Reclamation and Ecology 2011a).

Because the Teanaway watershed has a south-facing aspect, steep slopes, and is in the rain-on-snow zone, it is prone to increases in peak flows resulting from forest road networks and timber harvest. The Teanaway River is considered a high priority for identifying and reducing impacts from forest practices (Conley et al. 2009, YSFWPB 2004).

3.15.2.2 Water Quality

Ecology's 2008 303(d) list does not identify water quality issues in the Teanaway River or its tributaries. The Teanaway River watershed had past problems with high water temperatures. Development of a TMDL for temperature in 2003 (Ecology) resulted in removal of the basin's streams from the 303(d) list (Reclamation and Ecology 2011a).

The Teanaway River has elevated levels of sediment. This is due partly to natural sources such as landslides and partly to high road densities, agriculture, and recreational uses that remove vegetation and cause additional bank erosion. The

Teanaway is estimated to contribute a third of the total sediment load in the upper Yakima River (Haring 2001, YSFWPB 2004). A TMDL has been implemented for suspended sediment in the Teanaway River (Ecology, 2002).

3.15.2.3 Riparian Habitat Conditions (Land Cover)

The upper Teanaway River watershed is dominated by coniferous forest. Harvested forest, agriculture, and riparian vegetation are more common along the lower mainstem Teanaway. The growth of native riparian vegetation has been hampered by historic and ongoing human activities. For example, where roads have been located near stream channels the streambanks are reinforced with riprap, eliminating riparian vegetation. Historic use of streams to transport logs scoured the channels and lowered the groundwater table, making it more difficult for riparian species to grow (YSFWPB 2004).

3.15.2.4 Wetlands

The Teanaway River system historically had extensive riparian wetland habitats. In order to develop valley bottomland for agriculture, wet meadows were drained and side channels were filled. Removal of beavers, along with diking and channelization, further eliminated remaining wet meadows and wetlands (YSFWPB 2004).

A large wet meadow/wetland complex along the lower mainstem has been identified a priority for preservation. This complex has remnant off-channel backwaters and springs that provide important habitat for fish and wildlife (YSFWPB 2004, Haring 2001). Overall, mapped wetlands occupy less than a quarter of the shoreline inventory area along the Teanaway River and its forks. No wetlands are mapped along Stafford Creek.

3.15.2.1 Wildlife Habitats and Species

The upper Teanaway River watershed is mapped as critical habitat for northern spotted owl, a federally listed threatened species associated with structurally complex coniferous forest. Forests used by spotted owls in the lower and middle slopes of the eastern Cascade Range tend to be younger than forests used elsewhere in Washington. Owls in those areas nest in abandoned northern goshawk nests or clumps of branches infected by mistletoe (WDFW 2011c). The northern goshawk (a state candidate species and a federal species of concern) has been recorded throughout the upper Teanaway watershed, including in and near the shoreline inventory areas.

Despite conservation efforts, northern spotted owl populations continue to decline in Washington. Reasons for the decline include habitat loss and competition with barred owls. Habitat loss has resulted from forest conversion, timber harvest, fire, windthrow, insect outbreak and disease. In the Teanway River basin area, an ongoing spruce budworm outbreak has impacted large patches of spotted owl habitat (WDFW, 2011c).

The Teanaway River watershed is also used by elk as a calving area. Elk calving areas are considered a state priority habitat, along with elk migration corridors and wintering areas (WDFW 2008).

Another notable wildlife species that has recently been documented in the Teanaway River area is the gray wolf, a federally listed endangered species. The federal listing covers the western half of Washington, including the Yakima basin. Gray wolves were once common throughout the state but were eliminated during ranching and farming during the late 1800s and early 1900s. The species is a wide-ranging, top-level predator that affects the behavior of prey such as elk, in turn influencing vegetation patterns. In July 2011 a gray wolf pack was confirmed in the Teanaway region and appeared to be successfully breeding (WDFW, 2011a; Reclamation and Ecology 2011a).

3.15.3 Land Use

The mainstem Teanaway River is bordered by agricultural lands (primarily irrigated hayfields) and undeveloped forest land that is zoned for commercial forest and forest and range. Some moderate- and low-density residential subdivisions are also located along the downstream end of the river.

The lower approximately 7 miles of the West Fork Teanaway River is bordered primarily by undeveloped commercial forest-zoned lands, while the upper West Forks is located within National Forest lands. The lower approximately 3 miles of the Middle Fork is bordered by undeveloped forest and range-zoned land to the west, and low- to moderate-density residential development to the east. The remainder of the Middle Fork flows through undeveloped, commercial forest-zoned land and National Forest.

The lower approximately 2 miles of the North Fork Teanaway River is bordered by moderate-density residential development. The remainder of the North Fork flows through undeveloped commercial forest-zoned land and National Forest.

According to National Forest mapping data, there are three “special use” authorizations identified within the inventory area of the North Fork Teanaway River. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.15.4 Public Access

The mainstem Teanaway can be accessed off of Red Bridge Road, at the WDFW Masterson access area. In the upper watershed, the Teanaway River forks are crossed by a snowmobile trail/National Forest road and can also be accessed from numerous hiking/horse trails within the National Forest.

3.15.5 Reach Sheets

TEANAWAY RIVER (MAINSTEM)

SHORELINE LENGTH:	REACH INVENTORY AREA:
12.4 Miles	1,337.4 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows along the southern portion of a broad valley, with low topographic relief. The river is generally confined within a single, wide channel that allows flows though a significant number of gravel bars. The channel is confined at several locations highway infrastructure. The entire reach has migration potential.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

About three-quarters of the reach (73%) are located within the FEMA 100-year floodplain, and a few landslide hazard areas (1%) are mapped on the right bank of the river. Most of the reach (87%) has potential for channel migration.

WATER QUALITY

A TMDL has been implemented for temperature and suspended sediment in this reach.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily agriculture (37%), forest (27%), and riparian woodland/shrubland (19%), with patches of other (6%), harvested forest (4%), shrubland (3%), developed lands (3%), and grassland (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for spring Chinook and summer steelhead. The presence of coho salmon, bull trout, mountain whitefish, and rainbow trout, and westslope cutthroat is also mapped.

Patches of wetland habitat are mapped along the river throughout the reach (17% of the reach), and a large wetland complex near the Yakima River confluence is identified as priority wood duck nesting habitat. Priority elk calving habitat is also mapped within the reach along with a limited area of mule deer winter range.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Much of the channel within the reach is constrained by hydromodifications. In addition, SR 970 runs parallel to the lower 4 miles river, thus cutting it off from its natural floodplain.	**PUBLIC ACCESS (MAP FOLIO #4)** The River can be accessed off Red Bridge Road at the WDFW Masterson access area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) The primary land uses along the reach are rural (83%) and forestry (17%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for rural residential (36%), agriculture (24%), forest & range (17%), commercial forest (16%), and other (7%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** The historic irrigation ditch (circa 1885) is associated with early agriculture in the Teanaway and is potentially eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but low summer flows are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** There is significant development and agriculture usage along the river, but area of dense riparian cover and connections to large, relatively-undisturbed habitat areas exist
VEGETATION FUNCTIONS **Medium:** Areas of dense forest and shrub cover are present in the reach, but much of the area has been altered by agriculture and residential development.	**HYDROLOGIC FUNCTIONS** **Low:** The floodplain of the reach is highly altered by development, agriculture, and hydromodifications.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, some resource and agriculture land within the reach have been converted to more intensive uses (e.g., from agriculture to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- There is no public access within the reach.
- Low summer flows in the river are a limiting factor for salmon. Irrigation systems have been modified to conserve water, reduce diversions, and increase streamflow in the Teanaway River. However, these gains may be partially offset by water used for residential development and drilling of permit exempt wells.
- Encourage private irrigators and/or landowners to work with the Yakima Tributary Access & Habitat Program to install fish screen on irrigation diversions and correct fish passage barriers.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Protect the high value wetland complex at the downstream end of the reach (YSFWPB, 2004).
- Correct a fish passage barrier resulting from the January 2009 flood event that caused a headcut of the channel and required water right holders to create rock and gravel dams to direct water into their pump stations. The project will construct four channel spanning rock weirs to stabilize the streambed and return water flows to pump stations (YBFWRB, 2011).
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Protect high-quality forest and wildlife habitat in the upper reaches.

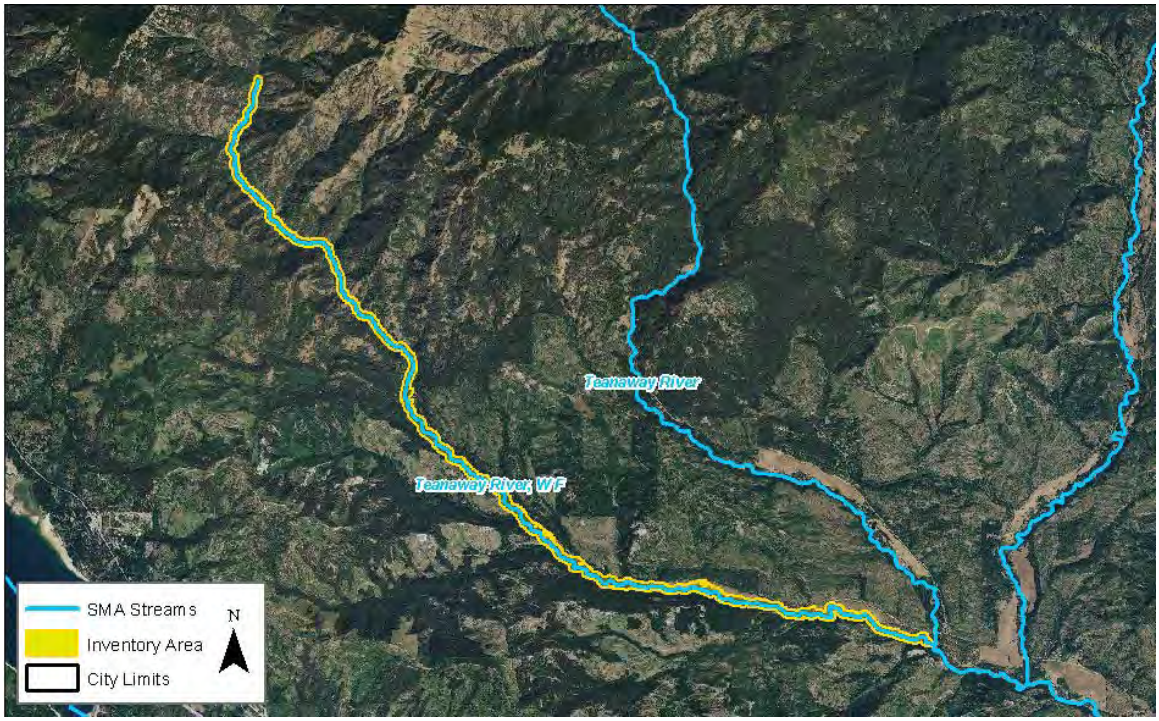
WEST FORK TEANAWAY RIVER

SHORELINE LENGTH:

11.1 Miles

REACH INVENTORY AREA:

559.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach flows through a valley with moderate topographic relief, while downstream, the ravine widens to a flat valley bottom. The river is generally confined within a single, wide channel that migrates within its banks. West Fork Teanaway Road parallels much of the left bank of the river.

LAND COVER (MAP FOLIO #3)

This reach is mostly forest (81%), with some riparian vegetation (9%), harvested forest (5%), agricultural lands (3%), and developed lands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 33% of the reach is located within the FEMA 100-year floodplain and multiple landslide hazard areas (3%) are mapped on the right bank of the reach. The majority of the reach area has potential for channel migration.

WATER QUALITY

A TMDL has been implemented for temperature in this reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides juvenile rearing habitat for spring Chinook. The presence of summer steelhead, rainbow trout, and westslope cutthroat is also mapped.

Limited wetland habitat is mapped along the river throughout the reach (5% of the reach). Priority elk winter range and calving habitat is mapped within the lower portion of the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Much of the reach is bordered by West Fork Teanaway Road.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/National Forest road crosses the middle portion of the reach; the West Fork Teanaway Trail provides access at several locations in the upstream section of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (92%) with rural lands along the downstream end (8%). Land ownership is 73% private and 27% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (96%), rural residential (2%), and other (2%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach is minimally altered and provides spawning and juvenile rearing habitat for priority fish species, but low summer flows are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The downstream end of the reach is in agricultural protection and a road bordered much of the stream, but a majority of the reach is covered with dense riparian forests and is connected to large, relatively-undisturbed habitat areas.
VEGETATION FUNCTIONS **Medium:** Most of the reach consists of dense forest cover, but vegetation is disturbed by agriculture at the downstream end and by West Fork Teanaway Road, which parallels much of the stream channel.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are altered by a road and agricultural development at the downstream end, but much of the floodplain is intact.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, some resource and agriculture lands along the Teanaway have been converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Low summer flows in the river are a limiting factor for salmon.
- Protect high-quality forest and wildlife habitat in the upper portion of the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.

MIDDLE FORK TEANAWAY RIVER

SHORELINE LENGTH:	REACH INVENTORY AREA:
12.5 Miles	639.6 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

Upstream, the river flows through a narrow valley with steep slopes as a single channel; a forest service road is mapped in the river channel for most of this section. Downstream, the river flows along the southern portion of a flat valley, through many gravel banks.

LAND COVER (MAP FOLIO #3)

The reach is dominated by forest (78%) and riparian vegetation (10%), with limited agricultural (7%), and harvested forest (5%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately one-quarter (25%) of the reach is located within the FEMA 100-year floodplain and numerous landslide hazard areas (10%) are mapped on both banks of the reach. The majority of the reach area has potential for channel migration.

WATER QUALITY

A TMDL has been implemented for temperature in this reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for summer steelhead. The presence of rainbow trout and westslope cutthroat is also mapped.

A small extent of wetland habitat is mapped along the river throughout the reach (4% of the reach). Priority elk calving habitat is also mapped within the lower portion of the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels and crosses the reach is several locations. Also, a linear hydromodification is located along the eastern bank at the downstream end of the river.	**PUBLIC ACCESS (MAP FOLIO #4)** The Middle Fork Teanaway Trail provides river access to the upstream half of the reach. A snowmobile trail/National Forest road crosses the reach downstream of the trail.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (73%) with rural lands along the downstream end (27%). Land ownership is 61% private and 39% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (73%), with forest & range (17%), rural residential (9%), and other (1%) areas at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

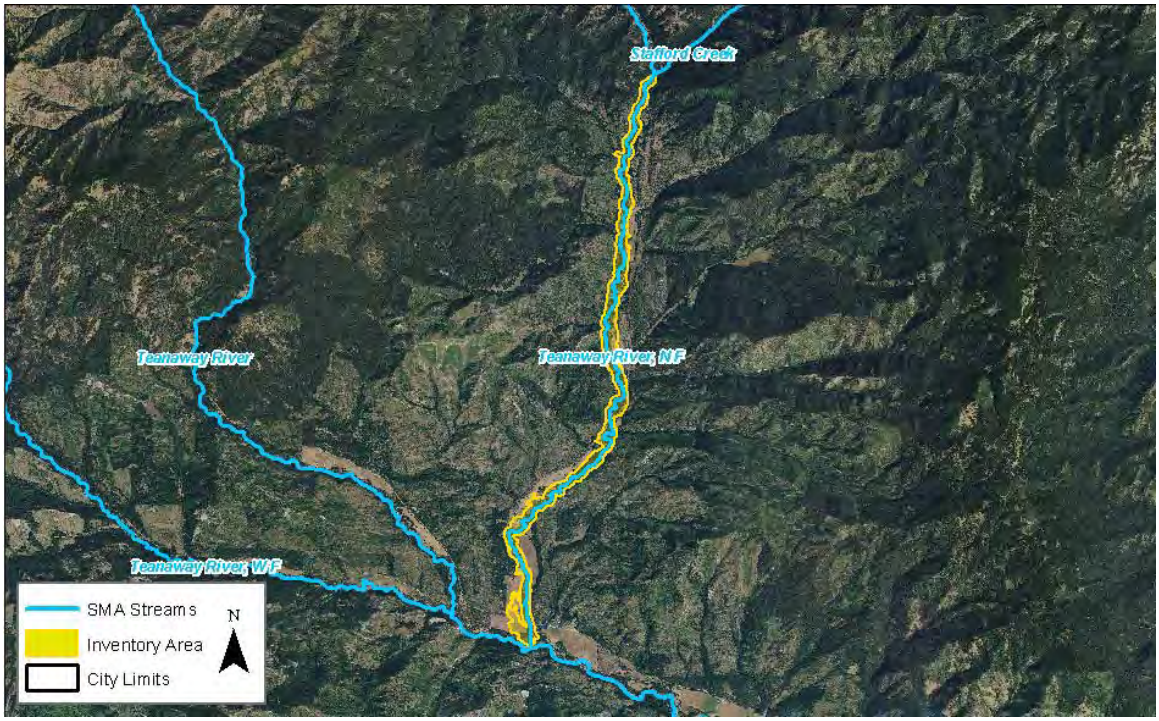
FISH HABITAT QUALITY **Medium:** The reach is minimally altered and provides habitat for priority fish species (including spawning habitat for spring Chinook), but low summer flows are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The downstream end of the reach is in agricultural protection and a road bordered much of the stream, but a majority of the reach is covered with dense riparian forests and is connected to large, relatively-undisturbed habitat areas.
VEGETATION FUNCTIONS **Medium:** Most of the reach consists of dense forest cover, but vegetation is disturbed by agriculture at the downstream end and by a Forest Service road, which parallels much of the stream channel.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are altered by a road and agricultural development at the downstream end, but much of the floodplain is intact.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, some resource lands within the reach have been converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and protect structures from flooding.
- Low summer flows in the river are a limiting factor for salmon.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Protect the high-quality forest and wildlife habitat in the upper portion of the reach.
- Educate shoreline property owners about measures to protect and restore riparian areas.

NORTH FORK TEANAWAY RIVER

SHORELINE LENGTH:	REACH INVENTORY AREA:
9.8 Miles	643.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

Much of the reach flows through a broad valley via multiple channels. The reach also contains many gravel bars. Steep topographic relief on either side of the valley bottom and a Forest Service road confine the channel in areas.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily forest (56%) and riparian vegetation (20%). Other cover types include: harvested forest (10%), agricultural lands (9%), other (4%), and developed lands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (71%) is located within the FEMA 100-year floodplain and a limited number of landslide hazard areas (1%) are mapped within the reach. Most of the reach (88%) has potential for channel migration.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for summer steelhead and bull trout. The presence of coho salmon, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped along the downstream half of the reach (12% of reach total). A significant amount of priority elk calving habitat is also mapped within the reach; mountain goat habitat is located at the upstream extent of the reach.

WATER QUALITY

A TMDL has been implemented for temperature in this reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is paralleled and crossed in several locations by North Fork Teanaway Road and Forest Service roads. Also, a linear hydromodification is located along the western bank at the downstream end of the river.	**PUBLIC ACCESS (MAP FOLIO #4)** The North Fork Teanaway Trail provides river access to the upstream half of the reach. A snowmobile trail/Forest Service road crosses the reach downstream of the trail.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily forestry (74%) with rural lands along the downstream end (26%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (74%), with rural residential (24%) and other (2%) along the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 7 recorded precontact sites, and 1 recorded historic site located within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The reach is minimally altered and provides habitat for priority fish species (including spawning habitat for spring Chinook).	**TERRESTRIAL HABITAT QUALITY** **Medium:** The downstream end of the reach is in agricultural protection and a road bordered much of the stream, but a majority of the reach is covered with dense riparian forests and is connected to large, relatively-undisturbed habitat areas.
VEGETATION FUNCTIONS **Medium:** Most of the reach consists of dense forest cover, but vegetation is disturbed by agriculture at the downstream end and by roads which parallel much of the stream channel.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are altered by a road and agricultural development at the downstream end, but much of the floodplain is intact.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- In the recent past, some resource lands within the reach have been converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Several important cultural and archaeological sites are located within the reach.
- Protect the high-quality forest and wildlife habitat in the upper portion of the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Identified restoration actions in the reach include:
    - Acquire a conservation easement on 5.8 miles of river and over 354 acres of floodplain, riparian forest, and meadow habitat along the river. Potential Phase I effort is to secure a conservation easement on the southern-most 96 acres of riparian area (YBFWRB, 2011).
    - Potential Phase II effort to fund a conservation easement on the middle two miles of stream and 100 acres of floodplain habitat between Dickey Creek and Jack Creek; this would be a continuation of Phase I (SRFB project 04-1672) efforts described above (YBFWRB, 2011).

NORTH FORK TEANAWAY RIVER, UPPER TRIBUTARY

SHORELINE LENGTH:	REACH INVENTORY AREA:
7.7 Miles	387.1 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach drops roughly 1,000 feet in elevation and flows to the southeast. The stream flows through an undeveloped, narrow valley.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A small amount (3%) of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Some portions of the reach (15%) has potential for channel migration.

WATER QUALITY

A TMDL has been implemented for temperature.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (96%), riparian vegetation (3%), and developed (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for bull trout. The presence of rainbow trout and westslope cutthroat is also identified.

No wetlands are mapped within the reach. Priority mountain goat range and elk calving area are mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the eastern shoreline.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking/horse trail crosses the upstream regulated stream area in two locations. The De Roux Campground is located adjacent to the reach, near the upstream extent. A cross country ski trail borders the entire northern regulated area and is shared with snowmobiles near the confluence with Stafford Creek/North Fork Teanaway River. A hiking/horse trail crosses the middle portion of the stream and is located upstream of the Beverly Campground.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 7% private and 93% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded precontact sites and 5 recorded historic sites located within the reach. Two of the historic sites are CCC campsites and were determined eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

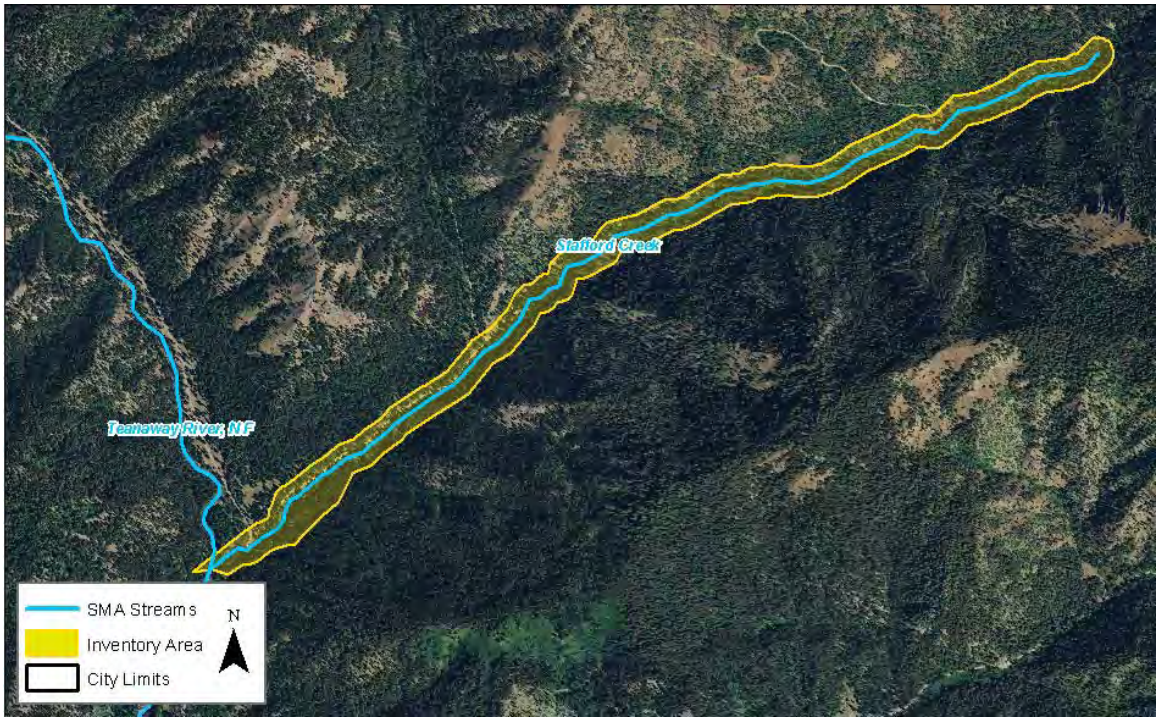
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

STAFFORD CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.7 Miles	133.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located within a narrow valley with steep topographic relief. The stream is generally confined within a single channel that migrates within its banks.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Only 12% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

A TMDL has been implemented for temperature in this reach.

LAND COVER (MAP FOLIO #3)

The reach is composed of confer-dominated forest (88%) and riparian vegetation (11%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for summer steelhead and juvenile rearing habitat for bull trout. The presence of rainbow trout, and westslope cutthroat is also documented.

No wetland habitat is mapped in the reach. The entire reach contains mapped priority elk calving habitat.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the entire reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road crosses the downstream portion of the reach and a cross country ski trail parallels the majority of the right bank.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is forestry (100%). Land ownership is 66% private and 34% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** The Stafford, or Standup Lookout, is a historic road that was built by the CCC during the 1930s. Additionally, there are 2 precontact sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The reach is minimally altered and provides habitat for priority fish species (including spawning and rearing habitat).	**TERRESTRIAL HABITAT QUALITY** **Medium:** A road borders much of the stream, but a majority of the reach is covered with dense riparian forests and is connected to large, relatively-undisturbed habitat areas.
VEGETATION FUNCTIONS **High:** Most of the reach consists of dense riparian forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are altered by a road, but there are generally minimal hydromodifications located within the reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect high-quality forest and wildlife habitat within the reach.

3.16 Swauk Creek

Swauk Creek enters the Yakima River at RM 169.9 as a left-bank tributary. The stream generally flows north to south.

3.16.1 Physical Characterization

Precipitation is limited in the Swauk Creek watershed, resulting in low streamflows during the dry season. During summer, flows become very low to intermittent downstream of RM 6, while flows typically become absent during the fall downstream of RM 4 to 6 (Haring 2001; Sullivan 2008). In addition to limited precipitation, low or absent flows are the result of irrigation diversions, which have cut off hyporheic connectivity between subsurface stream waters and floodplain waters (Sullivan 2008).

Seven roads and a railroad crossing are located over the stream, including Highways 970, 97 and 10, with the majority of crossings located in the upper watershed (WDFW 2010). In addition, two utility corridors cross the stream. Steeps slopes are also mapped over most of the upper watershed and adjacent to the lower portion of the stream (Kittitas County 2012). The FEMA 100-year floodplain is mapped in the downstream half of the river's inventory area, occupying most of the area (FEMA 1996). Much of the inventory area of Swauk Creek is located within a mapped channel migration zone, although the migration zone in several areas has been effectively disconnected from the active channel by state highways.

Swauk Creek has a naturally confined stream corridor and physical alterations have significantly modified the corridor's extent. Road construction and mining have straightened and steepened the channel, resulting in downstream bank erosion (Haring 2001). Along the lower reaches, the stream is confined in areas by an old railroad bed, while further up the canyon, State Route 97 and another abandoned railroad bed impair floodplain functions and reduce channel sinuosity. Undersized culverts result in debris blockages, fish passage barriers, and localized erosion during peak flows at several locations along the stream.

Much of the upper canyon, upstream of RM 8, is forested, while the lower portions of the stream, downstream of RM 3, flow through an arid canyon. Substantial recreational and commercial gold prospecting occurs upstream of RM 11 (Haring 2001). Limited residential development is located adjacent to the stream in the lower portion of the upper watershed.

3.16.2 Habitats and Species

3.16.2.1 Fish Use

Swauk Creek supports bull trout and steelhead (Middle Columbia River Distinct Population Segment), both federally listed as threatened. This stream is considered a major steelhead producer in the upper Yakima basin (Conley et al. 2009). Other salmonid species in this stream include eastern brook trout, rainbow trout, and westslope cutthroat (StreamNet 2010).

Swauk Creek was historically a substantial producer of coho salmon. Coho were witnessed spawning in Swauk Creek in the early 1960s, but are now largely extirpated due to impairment of side channels and loss of meandering stream courses (StreamNet 2010, Haring 2001). Recently, coho salmon have recently been introduced to the creek.

Swauk Creek provides a stable rearing environment for spring Chinook salmon in the summer, when irrigation water is released from upstream reservoirs. Juvenile Chinook enter can Swauk Creek to escape high flows (Nason 2004).

Spawning habitat in much of Swauk Creek is fair to poor. Fish habitat has been impacted by sedimentation and a lack of large woody debris. Mining for gold has likely increased sedimentation and decreased successful incubation and emergence of salmonid eggs. Toxic chemicals such as arsenic may still be present as a remnant of historic gold mining and processing in the watershed. (Haring 2001, YSFWPB 2004)

Roads in the Swauk Creek watershed have also contributed to an increase in sediment and a loss of complexity in the stream system. Sediment loading from extreme rain and snowmelt events on Highway 97 can be disastrous to fish populations if it occurs during spawning times (Nason 2004).

Summer and early fall streamflows in lower Swauk Creek are very low or intermittent as far upstream as RM 6. The lack of flow prevents adult salmonids from reaching the upper watershed until fall rains occur. Low flows may result from a combination of natural conditions plus a loss of floodplain water storage, floodplain confinement, impaired riparian function, and water withdrawals (Haring 2001). Some diversions on Swauk and First Creeks have been dedicated to instream flow purposes through acquisition from the Mountain Star Resort (Reclamation and Ecology 2011a).

Other impacts to fisheries include undersized culverts that cause debris blockages, fish passage barriers, and localized erosion during peak flows (Haring 2001).

The Yakama Nation and Kittitas Conservation Trust are currently working to improve riparian conditions and floodplain connectivity within Swauk Creek. Specific projects include riparian plantings, engineered log jams, and grade controls which will increase bank retention of spring runoff.

3.16.2.2 Water Quality

Ecology's 2008 303(d) list identifies high temperature problems on the mainstem Swauk Creek, and a TMDL for temperature has been implemented (Ecology, 2005). However, some of its tributaries are listed for high water temperatures. Instream habitat has been degraded by sedimentation as discussed above.

3.16.2.3 Riparian Habitat Conditions (Land Cover)

The lower three miles of the Swauk Creek watershed are located in a steep, arid canyon. Deciduous trees and shrubs increase along the middle reach of the stream. The upper watershed is mainly coniferous forest. Upstream of RM 8 the riparian condition is generally good. Lower riparian areas have largely been modified by human activities. For example, a study along middle Swauk Creek found that the extent and density of riparian vegetation had been substantially reduced from historic levels. Riparian vegetation had been removed for crop production and by intensive livestock grazing (Sullivan 2008). Some high-quality riparian habitat remains in lower parts of the watershed that are protected by conservation easements (Nason 2004, YSFWPB 2004).

3.16.2.4 Wetlands

Today less than 10 percent of the Swauk Creek shoreline inventory area is mapped as scattered riparian wetlands. Wet meadows, beaver dams, and ponds were historically more abundant in the Swauk Creek basin. The elimination of beavers and intensive mining disconnected the stream from its floodplain. Adjacent wetlands were lost, along with their capacity to store spring runoff. The lack of water storage may contribute to low streamflow through the dry summer months. (Haring 2001, YSFWPB 2004)

3.16.2.1 Wildlife Habitats and Species

The Swauk Creek watershed provides mule deer winter range and both wintering and calving habitat for elk. The upper part of the watershed is mapped as northern spotted owl critical habitat (federally listed threatened species). Another federally listed threatened species, grizzly bear, has also been observed in the Swauk Creek watershed. The grizzly bear population in the North Cascades has been estimated at

less than 20 individuals. Factors affecting grizzly bear recovery in the North Cascades recovery zone include very small population size, human disturbance, and population fragmentation resulting in genetic isolation (WDFW 2011b).

The banks of lower Swauk Creek, upstream from the confluence with the Yakima River, contain small, disjunct stands of Oregon white oak (a state priority habitat). This represents the northernmost known extent of this species in eastern Washington (Nelson 2004).

3.16.3 Land Use

The land bordering the lower approximately 4 miles of Swauk Creek is primarily undeveloped forest and shrub land, zoned for agriculture. An electric power line corridor crosses the creek within the segment. Upstream of the agriculture-zoned area, the creek is bordered by low- to moderate-density residential development, agriculture, and some undeveloped forest land that is zoned for rural residential development. The upper creek flows through National Forest land.

According to National Forest mapping data, there is one “special use” authorization identified within the inventory area. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

3.16.4 Public Access

The lower approximately 8 miles of Swauk Creek is bordered by private lands, and no public access is available. Upper Swauk Creek, within the National Forest, can be accessed from various hiking, snowmobile, and snowshoe/ski trails.

3.16.5 Reach Sheet

SWAUK CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
16.8 Miles	855.1 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

Upstream, the stream is located within a moderately narrow valley with steep topographic relief, and is generally confined within a single channel with multiple gravel bars. Downstream, terrain flattens and the channel is relatively unconfined.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Almost half of the reach (47%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Almost the entire reach (91%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily forest (35%), riparian vegetation (34%), and developed lands (20%). Other cover types located within the reach include: agricultural lands (5%), shrublands (5%), and unvegetated (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for summer steelhead and rearing habitat for spring Chinook. The presence of coho salmon, bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

Several patches of wetland habitat are mapped along the river throughout the reach (6% of the reach). Priority habitat and species include: cliff/bluffs and oak woodland, and elk winter area and calving habitat, mule deer winter range, and rocky mountain elk habitat.

The Swauk Creek shoreline inventory area supports one rare plant species mapped by the Washington Natural Heritage Program.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

Seven roads and a railroad cross the reach, with the majority of crossings in the upper watershed. In the lower reach, the channel is confined in areas by a railroad bed, while Highway 97 and another railroad bed confine the channel upstream.

PUBLIC ACCESS (MAP FOLIO #4)

Upper Swauk Creek, upstream of approximately RM 8, can be accessed from hiking, ATV, and snowmobile trails at various locations.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use along the reach is primarily rural (73%) with forestry lands along the upstream end. Land ownership is 68% private and 32% public (Forest Service).

CONTAMINATED SITES

A voluntary toxics cleanup site is located at the downstream end of the reach and a previous enforcement action occurred mid-reach, north of Liberty Road.

ZONING (MAP #5)

Lands within the reach are zoned for commercial forestry at the upstream end (25%); agriculture at the downstream end (34%); and forest & range (12%), rural residential (13%), mixed use (9%), and other (9%) [right-if-way] in the middle region.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

A total of 33 recorded precontact and historic sites are located within the reach. The sites are primarily historic and related to early mining infrastructure built during the late 1800s and early 1900s.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The reach provides habitat for priority fish species (including spawning and rearing habitat), but low summer flows are a limiting factor for fish use.

TERRESTRIAL HABITAT QUALITY

Medium: Vegetation is disturbed in some areas by development, agriculture, and roads, but a majority of the reach is covered with dense riparian forests and is connected to large, relatively-undisturbed habitat areas.

VEGETATION FUNCTIONS

Medium: Most of the reach consists of dense forest cover, but vegetation is disturbed in areas by agriculture and development at the downstream end, and Highway 97 which parallels the creek.

HYDROLOGIC FUNCTIONS

Medium: Much of the river's floodplain is altered by Highway 97 and agriculture and other development at the downstream end, but significant portions of the floodplain is intact.

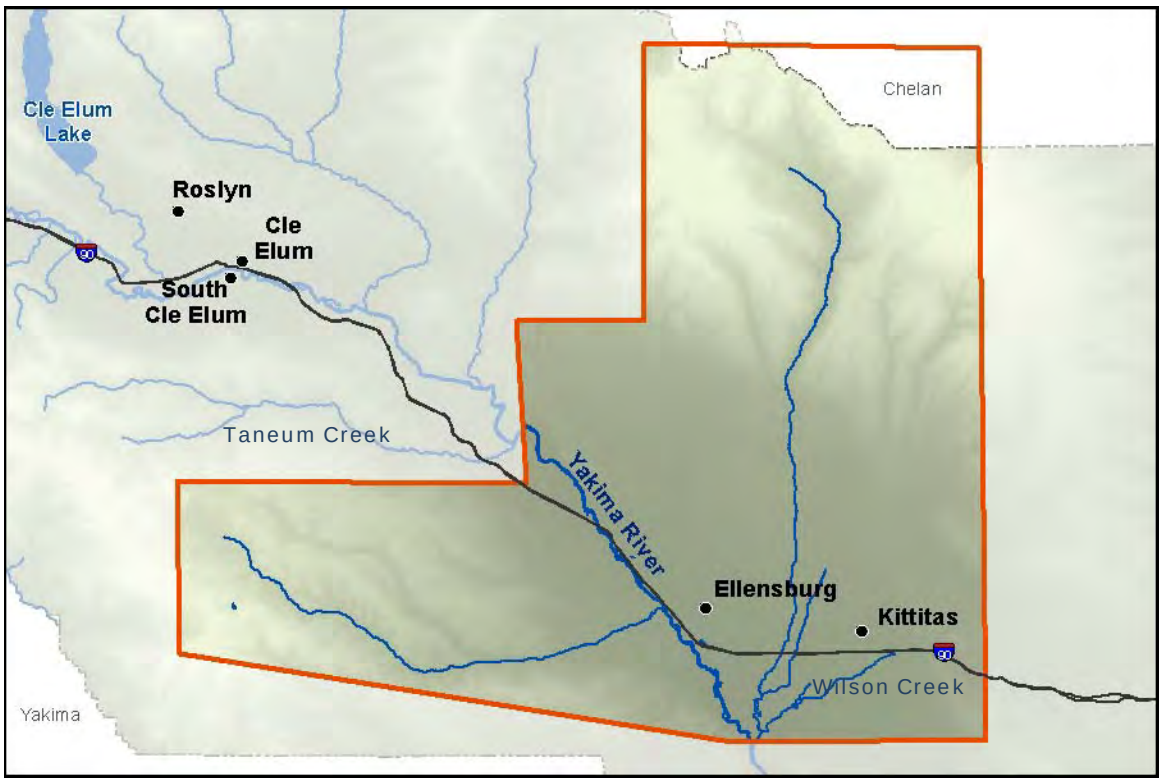
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect the high-quality forest and wildlife habitat within the reach.
- Low summer flows in the river are a limiting factor for salmon.
- Many important cultural and archaeological sites are located within the reach.
- Restoration actions identified within the reach include:
    - Grants are used to identify and design restoration alternatives for a 1.5-mile reach of Swauk Creek (RM 17.3-18.8). Alternatives will be designed to enhance groundwater storage, increase in-stream habitat complexity, and improve conditions of riparian habitat. Feasibility reports have been prepared and one alternative has been funded (SRFB 08-2001) (YBFWRB, 2011).
    - Fish screen projects have been completed over the last decade; stream restoration work is ongoing downstream of the US 97/Lauderdale Lane junction (Anna Lael, pers. comm.)
- Culverts within the reach are a barrier to fish passage.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Protect the Oregon white oak habitat in lower portion of the reach.
- The reach contains a rare plant specie, mapped by the Washington Natural Heritage Program.

CHAPTER 4. KITTITAS VALLEY

This chapter describes the conditions within the shoreline inventory area of the Kittitas Valley (including the City of Ellensburg). Kittitas Valley shorelines include the Yakima River and its tributaries between the Taneum Creek confluence and the Wilson Creek confluence (Figure 4-1). The 12 streams and 7 lakes and ponds within the Kittitas Valley are described in terms of their physical characteristics, ecological conditions, and human environment/land use characteristics. Readers are encouraged to review Chapter 2 and the maps in Appendix A for additional context on the information presented here.

Figure 4-1. "Kittitas Valley" shorelines.



Characteristics for the shoreline reaches are detailed on "reach sheets" included in this chapter. The information on the reach sheet is based upon available county-wide data sources that describe key physical, ecological, and land use characteristics. A description of the available data sources, including data limitations, is presented in Appendix B.

4.1 Yakima River: Kittitas Valley Reaches

This section describes the portion of the Yakima River that flows through the Kittitas Valley, from the Taneum Creek confluence to the Wilson Creek confluence, a distance of approximately 20 miles. For this analysis, the Kittitas Valley reaches of the Yakima River were divided into 2 reaches: Reach 3 (8.4 miles) extends from the Wilson Creek confluence to the Manastash Creek confluence and Reach 4 (11.2 miles) extends from the Manastash Creek confluence to the Taneum Creek confluence.

The Yakima River is designated as a "shoreline of statewide significance" because its mean annual flow exceeds 200 cubic feet per second. Major right-bank tributaries located within this portion of the river are Taneum Creek and Manastash Creek, and the major left-bank tributary is Wilson Creek.

The Yakima River flows past the City of Ellensburg; the river shoreline within the city is described below.

4.1.1 Physical Characterization

This portion of the Yakima River watershed is drier than the upper Yakima River because the lower elevation areas receive less precipitation (rain and snow). Most of the native shrub-steppe habitat here has been converted to agricultural land which has resulted in considerable alteration and hydrologic change to the landscape.

The Kittitas Valley reaches of the Yakima River are crossed by two railroads, the John Wayne Heritage Trail, I-90, and three other roads. A large irrigation diversion structure/dam is located on the west bank at approximately river mile (RM) 161. Highway 10 and I-90, located on the left bank of the river, constrain channel movement, and other hydromodifications are present along the river. The City of Ellensburg's wastewater treatment plant outfall is located within this segment of the river (approximately RM 152) and has extensive bank armoring associated with it to help prevent erosion (Akers 2012). Upstream from the confluence with Wilson Creek, the river has multiple braided channel complexes with associated side channels (Haring 2001). The forested riparian corridor is relatively continuous along both banks of the river, but it becomes patchy to non-existent in places where residential and industrial development or more extensive agricultural land uses have encroached into the corridor.

The FEMA 100-year floodplain occupies the majority of the valley bottom and is well over a mile wide in some areas of reaches 3 and 4 (FEMA 1996). The Kittitas Valley reaches of the Yakima River have a relatively wide channel migration zone that extends into residential and agricultural areas, as well as the City of Ellensburg.

However, in several areas, the identified migration zone has been effectively disconnected from the active channel by I-90, railroads, and other public infrastructure.

Unnamed Waterbody 03 (Gladmar Pond) is located on the right bank of the Yakima River at approximately RM 161, while Unnamed Waterbodies 02 and 01 along with Unnamed Pond 04 are located on the left bank, between RMs 156 and 159 . Gladmar Pond now has a permanent connection to the Yakima River. All of these aquatic features are old gravel pits located in the Yakima River floodplain, which is the most heavily mined floodplain in the state (Haring 2001). Gravel mining impacts both the structure and function of floodplains. Prior to gravel mining, peripheral floodplains stored seasonal overbank flows and often supported dense and diverse riparian habitat. Yakima River floodplains are typically located at points where the river shifts from a high-gradient stream course to a sinuous river system, resulting in slower stream velocity where sediments and gravels suspended in the water column tend to settle (Kosters 2010).

Gladmar Pond (Unnamed Waterbody 03) measures approximately 0.2 mile long and 0.15 mile wide. The Yakima River courses around the northern and eastern boundaries of the pond, while agricultural land use, a diversion channel, a road, and the Iron Horse Trail are located along the western and southern boundaries. Currently, a single channel located to the north allows flow into the pond and two channels drain the pond to the south. One building is located near the southeast boundary of the pond. A Yakima River irrigation diversion is located adjacent to the eastern bank of Gladmar Pond (approximately RM 161), carrying water to the east. The FEMA 100-year floodplain is mapped within the entire shoreline inventory area of the waterbody (FEMA 1996).

Unnamed Waterbody 02 is approximately 0.3 mile long and 0.2 mile wide. The Yakima River and associated side channels flank the western and southern boundaries of the waterbody. Several smaller gravel pits, located to the north, feed water to Unnamed Waterbody 02. I-90 is adjacent to the waterbody's eastern boundary. The FEMA 100-year floodplain is mapped within the majority of the shoreline inventory area of the waterbody (FEMA 1996).

Unnamed Pond 04 is located at about the same latitude as Unnamed Waterbody 02, but on the east side of I-90. The pond is about 0.4 mile long and 0.1 mile wide and is generally oriented west-east. An active gravel processing facility is located adjacent to the southern boundary of the pond; agricultural land occupies the area north of the pond. The FEMA 100-year floodplain is mapped within the western and southwestern portions of the shoreline inventory area (FEMA 1996).

Unnamed Waterbody 01 is located approximately 1 mile downstream from Unnamed Waterbody 02 and exhibits similar physical characteristics. The Yakima

River and associated side channels flank the western shoreline of the waterbody; several smaller gravel pits, located to the north, drain to the waterbody; and I-90 forms the eastern boundary. The waterbody drains back to the Yakima River at its southern extent. Unnamed Waterbody 01 is about 0.3 mile long and 0.1 mile wide. The FEMA 100-year floodplain is mapped within the northern, western, and a portion of the southern shoreline inventory area (FEMA 1996).

4.1.1.1 City of Ellensburg

Portions of the regulated extent of Yakima River Reach 3 are located within the western and southern city boundaries. The upstream extent of this area contains a short stretch of the Yakima River and a large pond that was created by gravel mining in the river's floodplain. The pond is divided by a narrow, man-made berm that allows flow to pass between the two halves. The pond is separated from the river by a larger berm. Land south of the pond is primarily forested. The City of Ellensburg water treatment plant is located in the southern portion of this regulated area.

The regulated downstream extent of Yakima River Reach 4 is located within the western city limits. The area contains three ponds that were the result of gravel mining in the river's floodplain and a portion of outlet channel that carries flow for these ponds to the Yakima River. The land adjacent to the ponds is developed industrial, while that next to the outlet channel is vegetated.

The FEMA 100-year floodplain encompasses a substantial area land between the river and Canyon Road within the city limits, including the area adjacent to the water treatment plant (FEMA 1996). The identified Yakima River channel migration zone extends throughout most of the inventory area, including Irene Rinehart Park.

4.1.2 Habitats and Species

4.1.2.1 Fish Use

This portion of the Yakima River supports spawning and rearing of spring Chinook and summer steelhead. Middle Columbia River steelhead were federally listed as threatened in 1999. Other fish species present in this part of the river include coho salmon, bull trout, mountain whitefish, rainbow trout, westslope cutthroat, and eastern brook trout (an introduced species) (StreamNet 2010). The presence of sockeye salmon is also likely, due to the recent re-introduction of the species to Lake Cle Elum.

Fish habitat along this part of the river has been degraded by removal of riparian vegetation in many areas, lack of large wood, altered hydrologic regimes, and isolation of side channel habitats from the main channel (Haring 2001).

Table 4-1 lists fish species documented in the four unnamed waterbodies (ponds) located along this reach.

Table 4-1. Fish Use in Unnamed Waterbodies along Middle Yakima River (Source: StreamNet 2010)

Species	Unnamed Waterbody 01	Unnamed Waterbody 02	Unnamed Waterbody 03	Unnamed Pond 04
Bull Trout	P		P	
Rainbow Trout	P		P	
Westslope Cutthroat	P		P	
Eastern Brook Trout				
Spring Chinook	P		P	
Summer Steelhead	P		P	
Coho salmon	P		P	
Mountain whitefish	P			

P/M = presence/migration; S = spawning; R= rearing

Many factors have caused the decline of Yakima basin fish populations, including the following (Reclamation and Ecology Integrated Plan DPEIS 2011):

- In the 1900s, crib dams on the four natural glacial lakes (Cle Elum, Kachess, Keechelus, and Bumping) extirpated sockeye.
- Construction of five storage dams eliminated access to productive spawning and rearing habitat for sockeye, spring Chinook, coho, steelhead salmon, and bull trout.
- Irrigation operations have altered streamflows, resulting in flows at certain times of the year that are too high in some reaches and too low in others to provide good fish habitat. This problem is worse during drought years.

- Land development (road construction, diking, gravel mining, and agriculture) has degraded riparian habitat in many areas and increased sediment in streams and rivers.
- Irrigation diversions have reduced flows and created fish passage barriers in tributary streams.
- The Columbia River dams and historic commercial fishing in the Columbia River and Pacific Ocean have also affected Yakima basin fisheries.

High summer flows in the Yakima River affect juvenile salmonid rearing habitat. The annual later summer "flipflop" operation disrupts salmonid habitat and impacts aquatic insect populations, while winter flows in the Yakima River are low, potentially impacting survival of overwintering juvenile salmonids (Reclamation and Ecology 2011a).

Mining in the Yakima River basin began in the early 1950s (Collins 2005). Gladmar Pond was created as a result of floodplain gravel mining from the 1960s through the 1980s (Kosters 2010). While the former gravel mine ponds along this part of the river provide habitat for some fish species, floodplain gravel mining in general has negative effects on habitat for native fish (YRFMIST 2004). Riverbanks may be armored to protect the gravel mine, constricting the floodplain and removing riparian vegetation and large wood. The river can avulse or suddenly change course into a gravel mine pit, creating a sink for sediments and increasing streamflow and erosion downstream. Avulsion into abandoned gravel pits occurred along the Yakima River at Parker, Selah Gap, and Gladmar Pond in 1996. Ponds located in abandoned gravel pits can warm adjacent river temperatures and act as reservoirs for introduced fish species that prey on or compete with native species. Roads are constructed to facilitate transport of the mined materials (Conley et al. 2009, Collins 1995, Kosters 2010, Reclamation 2004, Reclamation 2005).

Anadromous fisheries have improved in recent years as a result of better fisheries management, habitat and facility improvements, hatchery supplementation, and reintroduction efforts. Reintroduction of coho in the Yakima basin began in the mid-1980s. Summer Chinook reintroduction is currently being undertaken (Reclamation and Ecology 2011a). Efforts to restore coho salmon within the Yakima River basin rely largely upon releases of hatchery-produced fish. Natural reproduction of hatchery-reared coho salmon is now occurring in the Yakima River. The upper Yakima wild Chinook salmon population is supplemented with hatchery stock reared at the Cle Elum Supplementation and Research Facility (CESRF) and released from three acclimation sites (Reclamation 2011, Reclamation and Ecology 2011a). The CESRF has been operating since 1997 and is managed by WDFW and the Yakama Nation.

Additional major efforts to improve fish habitat and populations in the Yakima basin include the following (Reclamation and Ecology 2011a):

- The Yakima/Klickitat Fisheries Project is managed by WDFW and the Yakama Nation. Its goal is salmon reintroduction through supplementation along with habitat protection and restoration. Species currently being enhanced include spring, summer and fall Chinook salmon, coho salmon, sockeye salmon, and steelhead trout.

- The Yakima River Side Channels Project is managed by WDFW and the Yakama Nation through the Yakima/Klickitat Fisheries Project. It focuses on restoring habitat in the Easton, Ellensburg, Selah, and Union Gap reaches on the Yakima River and the Gleed reach in the lower Naches. Active habitat restoration actions include reconnecting structurally diverse alcoves and side channels, introducing large woody debris, fencing, and revegetating riparian areas.

- The Yakima Tributary Access and Habitat Program (YTAHP) is facilitated by the South Central Washington Resource Conservation and Development Council and is being implemented by several entities, including the Kittitas County Conservation District. YTAHP was developed to restore salmonid passage, protect fish from irrigation diversion entrainment, and to enhance riparian and instream habitat on Yakima River tributaries that historically supported salmonids. Landowners and irrigators participate and contribute voluntarily to the program.

- The U.S. Bureau of Reclamation is leading a cooperative investigation to study the feasibility of providing fish passage at the five large storage dams of the Yakima Project (Bumping Lake, Kachess, Keechelus, Cle Elum, and Tieton). Fish passage efforts at each dam are discussed in the relevant sections of this report.

Pacific lamprey is another native fish species that has recently become a focus of restoration efforts. The Columbia River basin historically supported abundant Pacific lamprey populations, but the population has steeply declined and is virtually non-existent in the upper Yakima watershed. Major factors in the species' decline include fish passage barriers, poor water quality, floodplain degradation, and highly altered stream hydrology (CRITFC 2011; USFWS 2011).

4.1.2.1 City of Ellensburg

This portion of the Yakima River supports spawning and rearing of spring Chinook and summer steelhead. Middle Columbia River steelhead were federally listed as threatened in 1999. Other fish species present in this part of the river include coho

salmon, bull trout, mountain whitefish, rainbow trout, westslope cutthroat, and eastern brook trout (an introduced species) (StreamNet 2010).

Fish habitat along this part of the river has been degraded by removal of riparian vegetation in many areas, lack of large wood, altered hydrologic regimes, and isolation of side channel habitats from the main channel (Haring 2001).

4.1.3 Water Quality

Several tributaries to the middle Yakima River are on Ecology's 303(d) list for pH, fecal coliform, low dissolved oxygen, and elevated temperatures. These tributaries are streams and irrigation canals with limited woody riparian cover that flow through agricultural and developed areas near Ellensburg. A TMDL for temperature has been implemented in the upper Yakima River basin (Ecology, 2005).

During spring and summer, levels of organochlorine pesticides, turbidity, and suspended sediments in the upper Yakima River basin sometimes exceed state water quality standards. In addition to concerns associated with turbidity in streams, suspended sediments also act as a transport mechanism for pesticides. Ecology completed an assessment of suspended sediment, turbidity, organochlorine pesticides, bacteria, and metals in the upper Yakima River basin in 1999, focusing on the mainstem river and major tributaries from Selah upstream to Cle Elum. A TMDL for suspended sediment, turbidity, and pesticides in the upper Yakima River and major tributaries was completed in 2002 (Ecology).

The Department of Ecology has recently undertaken the Yakima River Watershed Toxics Study to evaluate levels of toxic contaminants in streams, rivers, reservoirs, and lakes from the Yakima River’s headwaters near Snoqualmie Pass to its confluence with the Columbia River. Levels of toxic compounds in Yakima River fish were recognized as a concern in the 1990s. During 2006 - 2008, Ecology collected hundreds of samples of fish and water to evaluate current levels of toxic compounds such as DDT, PCBs, and several others, many of which were historically used in agriculture or utilities but have been banned in recent years. These compounds attach to soil particles which are then washed downstream by precipitation or irrigation. Although the compounds have not been applied in recent years, they can persist in the environment. Ecology's study found that fish in the upper Yakima River are currently meeting or close to meeting human health criteria for all toxic substances tested except PCBs. The level of toxics generally increases in downstream areas. The months of greatest concern for human-caused turbidity, suspended sediment loading, and pesticide transport are during the irrigation season, April through October. Sediments and pesticides can also be mobilized during storms or rain-on-snow events (Johnson et al. 2010; Ecology 2009; Joy 2002).

Ecology found that irrigation returns are the dominant cause of degraded water quality in the Yakima River and are the most important sources to control for reducing turbidity, pesticides, and PCBs. However, urban stormwater runoff from cities including Ellensburg also appears to be a significant source of these pollutants (Johnson et al. 2010).

4.1.3.1 City of Ellensburg

See Section 4.1.3.

4.1.4 Riparian Habitat Conditions (Land Cover)

Riparian vegetation along this part of the Yakima River is largely forested with some agricultural and rural residential areas and very limited industrial development. In a few locations, riparian vegetation is limited to a very narrow strip where the river abuts I-90 or local roads (e.g., between RM 157 and RM 158 and near the Manastash Creek confluence).

Sporadic tree cover occupies the northern, eastern, and southern shorelines of Gladmar Pond, while the western shoreline contains relatively continuous forest cover. The northern shoreline of Unnamed Waterbody 02 contains sporadic shrub/tree cover, while the western and southern boundaries have continuous shrub and tree cover. The shoreline of Unnamed Pond 04 contains a patchwork of dense to sparse shrub and tree cover.

4.1.4.1 City of Ellensburg

Riparian vegetation along the Yakima River within city limits is largely forested.

4.1.5 Wetlands

Nearly one-quarter of the shoreline inventory area of the middle Yakima River is mapped as wetlands. Large palustrine forested and scrub-shrub wetlands are mapped within the floodplain. Several ponds within the floodplain are mapped as open water wetlands (including the unnamed waterbodies/ponds within shoreline jurisdiction).

4.1.5.1 City of Ellensburg

The most extensive and least disturbed riverine wetlands in Ellensburg are associated with the Yakima River. These forested and scrub-shrub wetlands are dominated by black cottonwood and willows. Shrubs include rose, hawthorn,

snowberry, and dogwood. Aspen stands are also present. These riverine wetlands have a high level of functions (Adolfson 2005).

4.1.6 Wildlife Habitats and Species

The Yakima River floodplain provides an important wildlife movement corridor, along with feeding, breeding, and refuge habitat. Species such as bald eagle, great blue heron, and osprey are likely to use the Yakima River riparian area, along with a diversity of other species (Adolfson 2005)

The middle Yakima River valley is part of a mapped mule deer winter range area. A bald eagle communal roost is also mapped along the river. The Woodhouse Ponds wetland complex provides habitat for waterfowl, songbirds, and mammals.

Approximately one-quarter of the Yakima River shoreline inventory area is mapped as shrub-steppe habitat (USGS 1993). Shrub-steppe habitat is dominated by perennial bunchgrasses and shrubs such as sagebrush (WDFW 2008). Kittitas County has several types of shrub-steppe communities with different combinations of plant species, as described in Section 2.3.2 in Chapter 2. Shrub-steppe habitat supports numerous unique plant and wildlife species (Azerrad et al. 2011). While it was historically a common type of vegetation community in eastern Washington, shrub-steppe habitat has been largely converted to agriculture and is considered a priority habitat by WDFW (see Section 2.6.3.1).

4.1.6.1 City of Ellensburg

As described above, the Yakima River provides important wildlife habitat and connects riparian habitats in Ellensburg with other habitat areas in the county. The Irene Rinehart Park near the Manastash Creek confluence is a cottonwood riparian wetland area that includes a nature trail and wildlife habitat. The park is the largest contiguous tract of native habitat in Ellensburg (Adolfson 2005).

4.1.7 Land Use

From the Wilson Creek confluence upstream to near Thrall Road (approximately 1 mile), the Yakima River is bordered by undeveloped land zoned for forest and range to the west and Canyon Road to the east. North of Thrall Road, the river is bordered primarily by agricultural land and low-density rural residential uses. Land use intensifies near the City of Ellensburg, where the river is bordered by I-90 to the northeast and moderate-density residential development to the southwest.

From north of Ellensburg to approximately 4 miles upstream, the river is bordered by I-90 to the east and agricultural land to the west. A hay storage facility is located

near the river, between RMs 153 and 154. From the I-90 bridge to the Taneum Creek confluence, the river flows through agricultural lands.

4.1.7.1 City of Ellensburg

Within the City of Ellensburg, the Yakima River is bordered by Irene Rinehart Riverfront Park, located north of Umptanum Road and south of the Manastash Creek confluence.

4.1.8 Public Access

The "Kittitas Valley" reaches of the Yakima River can be accessed at the following locations:

- Irene Rinehart Riverfront Park in Ellensburg;
- The Thrall Access area off of Ringer Loop Road, which also contains a boat launch; and
- The John Wayne Heritage Trail, which crosses the river downstream of Gladmar Pond and upstream of the I-90 crossing.

Gladmar Pond (Unnamed Waterbody 03) can be accessed from Gladmar Road.

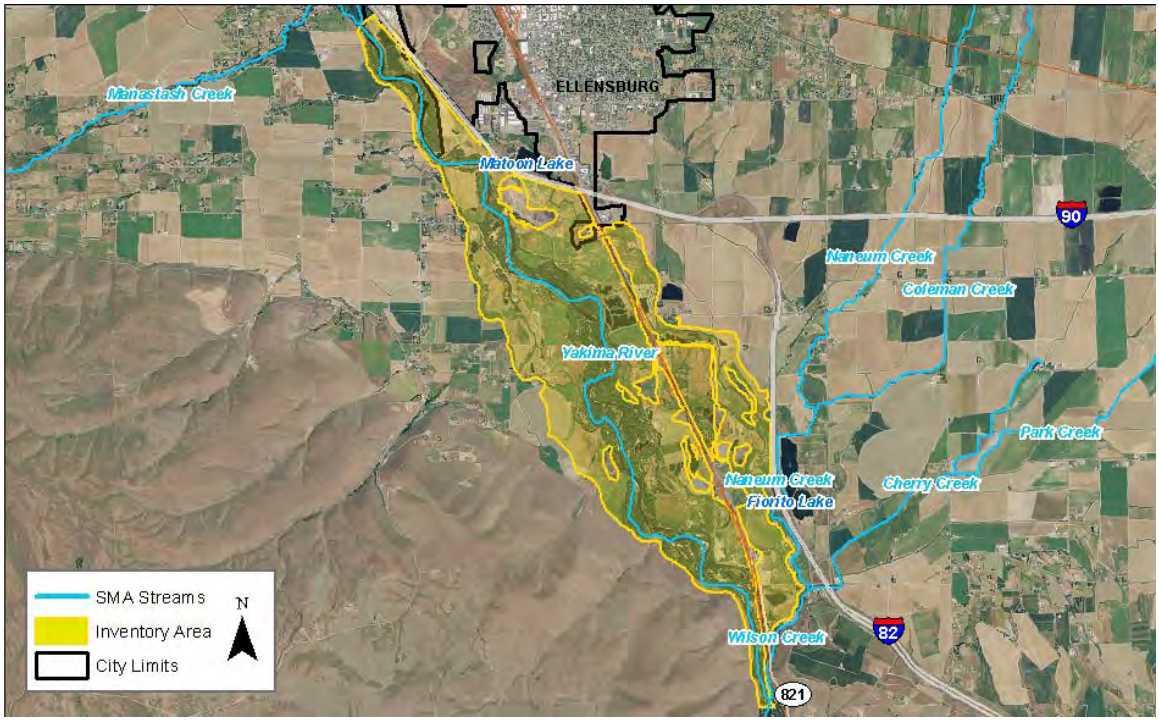
4.1.8.1 City of Ellensburg

Within the City of Ellensburg, the Yakima River can be accessed from Irene Rinehart Riverfront Park.

4.1.9 Reach Sheets

YAKIMA RIVER-REACH 3

SHORELINE LENGTH:	REACH INVENTORY AREA:
8.4 Miles	3,359.6 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach transitions between single and multiple channels several times and contains numerous gravel bars. The upstream portion of the channel is confined by I-90 on the left bank and by topographic relief downstream, on the right bank. Several gravel pits are located on the left bank of the river. The river flows through low topographic relief within this reach.

LAND COVER (MAP FOLIO #3)

This reach contains significant agricultural lands (63%) and forest (18%). A number of other land cover types are also present, including: developed lands (9%), riparian vegetation (6%), grassland (2%), and open water (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant area of the reach (98%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach (92%) has potential for channel migration.

WATER QUALITY

The reach is on the State's Water Quality Assessment list of 303 (d) Category 5 waters for pH, temperature, and fecal coliform. A TMDL has been implemented for temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows this reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of sockeye salmon, coho salmon, bull trout, mountain whitefish, rainbow trout, and westslope cutthroat is also identified.

Wetland habitat is mapped along the river at several locations (20% of the reach). Priority bald eagle habitat, mule deer winter range, and biodiversity areas and corridors are mapped along the downstream portion of the reach. Priority bighorn sheep, elk winter range, and great blue heron are also mapped .

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

Approximately one-third of the shoreline is constrained by linear hydromodifications, particularly at the upstream end of the reach.

PUBLIC ACCESS (MAP FOLIO #4)

The reach can be accessed from Irene Rinehart Riverfront Park off of W. Umptanum Road. A boat launch and access to BLM lands are located off of Ringer Loop Road. Helen McCabe Park, which provides access to a pond near the Yakima River, can be accessed from Canyon Road.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use within the reach is rural (61%) in the southern end of the reach and west of the river, agricultural areas (14%) in the southeast; and urban (20%), parks & open space (3%), industrial (1%), and other (1%) uses near the City of Ellensburg. Land ownership is 86% private, 8% public (State, WDFW, State Parks, and BLM), and 6% other.

CONTAMINATED SITES

One toxics cleanup site is located within the reach.

ZONING (MAP #5)

Lands within the reach are zoned primarily for agriculture (69%), with areas of industrial (11%), urban/suburban residential (9%), parks & open space (4%), mobile home park (1%), forest & range (1%), and other (6%) [right-of-way] zoning.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are 2 recorded National Register sites, and 1 recorded historic property within the reach. The National Register sites are barns that were built in the late 1800s and early 1900s and the historic site is irrigation ditches built around 1942.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but has some significant water quality impairments and hydromodification areas.

TERRESTRIAL HABITAT QUALITY

Medium: Areas directly adjacent to the river are generally well-vegetated, but surrounding areas are disturbed. However, the reach has an unaltered connection to a large area of relatively unaltered habitat to the south.

VEGETATION FUNCTIONS

Medium: Much of the area bordering the river contains dense forest and shrub habitat, but some areas have been altered by agriculture and development.

HYDROLOGIC FUNCTIONS

Medium: Portions of the river's floodplain are constrained by hydromodifications within the reach, but the river still has a connection to its floodplain in some areas.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- The reach has a wide floodplain; there is significant development and undeveloped land that lies within flood-prone areas.
- Investigate opportunities for floodplain reconnection and setting-back hydromodifications
- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding and channel migration hazards.
- Protect the remaining high-value, forested floodplain, shrub-steppe, and wildlife areas within the reach.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Support programs such as the Yakima/Klickitat Fisheries Project, Yakima River Side Channels Project, and Yakima Tributary Access and Habitat Program.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.

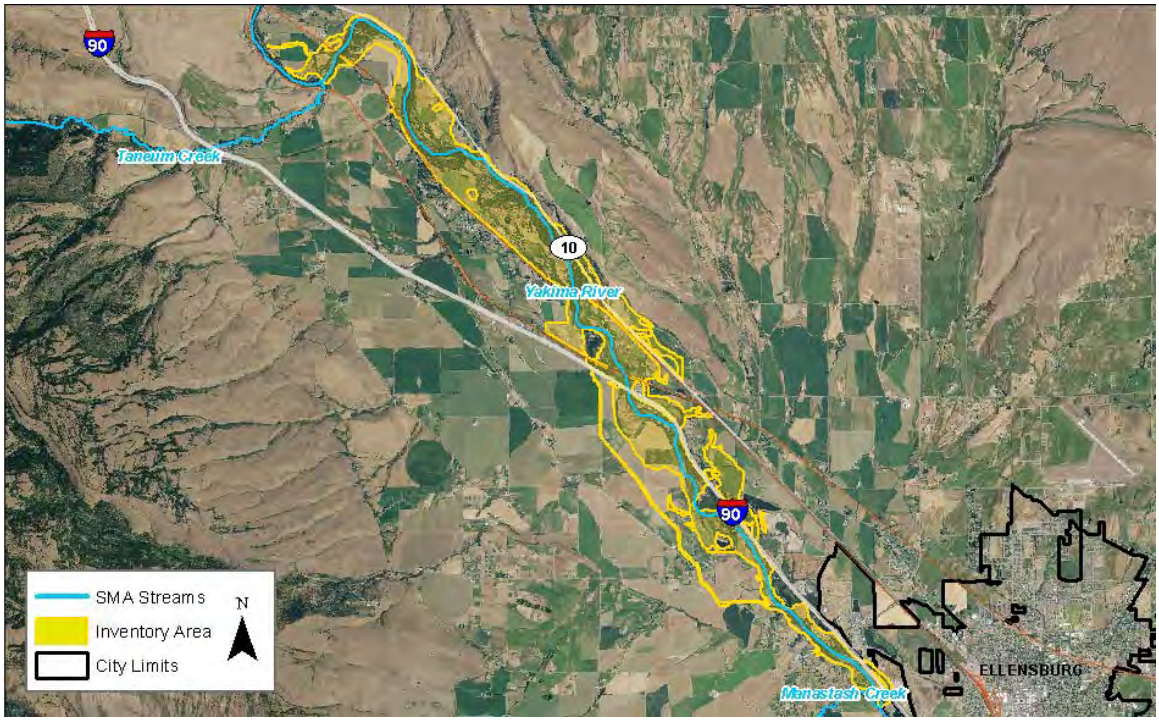
YAKIMA RIVER-REACH 4

SHORELINE LENGTH:

11.2 Miles

REACH INVENTORY AREA:

2,642.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach is primarily a single channel, with multiple gravel bars, while downstream the river flows through multiple channels over short stretches. Upstream, the channel is confined by Highway 10 on the left bank and a railway on the right bank. Further downstream, I-90 confines the left bank. Multiple roads, railways, I-90, and the John Wayne Trail cross the reach.

LAND COVER (MAP FOLIO #3)

This reach is primarily agricultural lands (40%), forest (35%), and developed (11%). Limited riparian vegetation (8%), grassland (2%), shrubland (2%), and open water (2%) are also present.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach (91%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach (88%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, fecal coliform, pH, and temperature. A TMDL has been implemented for temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of sockeye salmon, coho salmon, bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Patches of wetland habitat is mapped at several locations adjacent to the river (14% of the reach). Priority mule deer winter range habitat is mapped at the upstream end of the reach, on the left bank.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is constrained along most of its length by Highway 10, I-90, the John Wayne trail, and other hydromodifications areas.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses the reach downstream of Gladmar Pond (Unnamed Waterbody 03) and upstream of the I-90 crossing. The river can also be accessed at a WDFW area by the Thorp Highway bridge.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (91%), with some agricultural areas (6%) west of the river, and urban (2%) and commercial (1%) uses near the City of Ellensburg. Land ownership is 97% private and 3% public (State and WDFW).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for agriculture (85%), with areas of rural residential (2%), urban/suburban residential (2%), industrial (1%), and other (11%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** The Cabin Creek Diversion (circa 1930) is associated with early agriculture infrastructure and is potentially eligible for listing with the National Register.

SHORELINE FUNCTION ANALYSIS

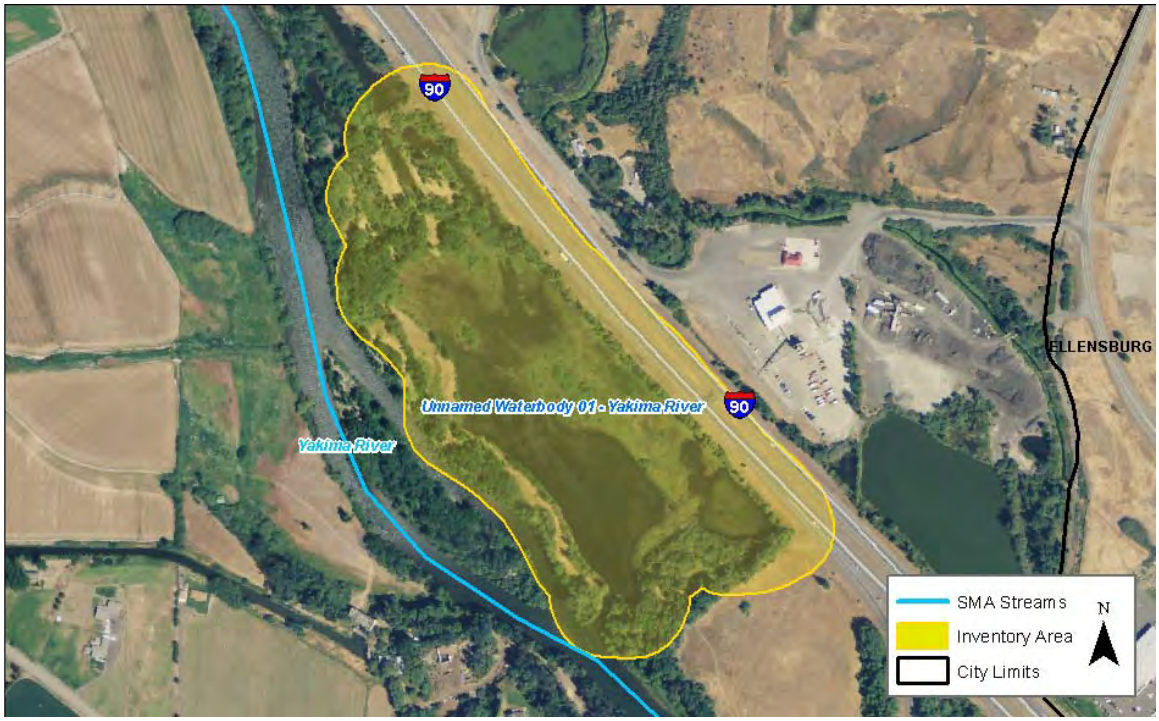
FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but has some significant water quality impairments and hydromodification areas.	**TERRESTRIAL HABITAT QUALITY** **Medium:** There is some remaining riparian vegetation along the river along and areas of wetland habitat, but connections to other habitat areas are largely altered.
VEGETATION FUNCTIONS **Medium:** Some areas bordering the river contain dense forest and shrub habitat, but large areas have been altered by agriculture, roads, and other development.	**HYDROLOGIC FUNCTIONS** **Medium:** Much of the river's outer floodplain is constrained by hydromodifications within the reach, but the river still has a connection to its floodplain in some areas.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There is significant development and undeveloped land that lies within flood-prone areas
- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding and channel migration hazards.
- Most of the floodplain areas within the reach have been historically altered; protect the remaining high-value, forested floodplain areas within the reach.
- Support programs such as the Yakima/Klickitat Fisheries Project, Yakima River Side Channels Project, and Yakima Tributary Access and Habitat Program.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.

UNNAMED WATERBODY 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.6 Miles	51.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The waterbody is located adjacent to I-90 and is separated from the Yakima River by a wide berm. The Yakima River connects to the waterbody at its southwest boundary. This feature is an artifact of gravel mining in the river's floodplain.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

More than half of the reach area (58%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The reach is within the channel migration zone of the Yakima River.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mainly developed lands (41%), forest (32%), and open water (19%), with patches of grassland (5%), riparian vegetation (3%), and agricultural lands (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

The presence of spring Chinook, summer steelhead, brown trout, coho salmon, bull trout, mountain whitefish, rainbow trout, and westslope cutthroat is mapped by WDFW.

Wetland habitat is mapped along the northern, eastern, and southern shorelines of the waterbody (20% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The eastern shoreline of the reach is constrained by I-90.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to the waterbody.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for agriculture (55%) and other (45%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake is a manmade artifact of gravel mining, but has mapped priority fish use and a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains some forested areas and is directly adjacent to the Yakima River, but is also disturbed by development (primarily I-90).
VEGETATION FUNCTIONS **Medium:** Much of the lakeshore is disturbed (primarily by I-90) but riparian forest areas are present, primarily near the Yakima River.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect riparian functions and protect structures from flooding hazards.
- Protect the remaining forest cover and high-value wetland areas within the reach.
- There is no public access to the waterbody.
- Explore restoration of former gravel pits to create more natural floodplain and riverine habitat.

UNNAMED WATERBODY 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.0 Mile	45.0 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The waterbody is located adjacent to I-90 and is separated from the Yakima River by a wide berm. This feature is an artifact of gravel mining in the river's floodplain.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by developed lands (39%), open water (27%), and forest (27%), with limited cover provided by riparian vegetation (3%), agricultural lands (2%), grassland (1%), and shrubland (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant portion of the reach (81%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The reach is within the channel migration zone of the Yakima River.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

No priority fish use is mapped by WDFW.

Wetland habitat is primarily mapped along the eastern and southern shorelines of the waterbody (20% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The eastern shoreline of the reach is constrained by I-90.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to the waterbody.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is rural (100%). Land ownership is 30% private and 70% public (WDFW).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for agriculture (55%) in the west and other (45%) [right-of-way] in the east.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

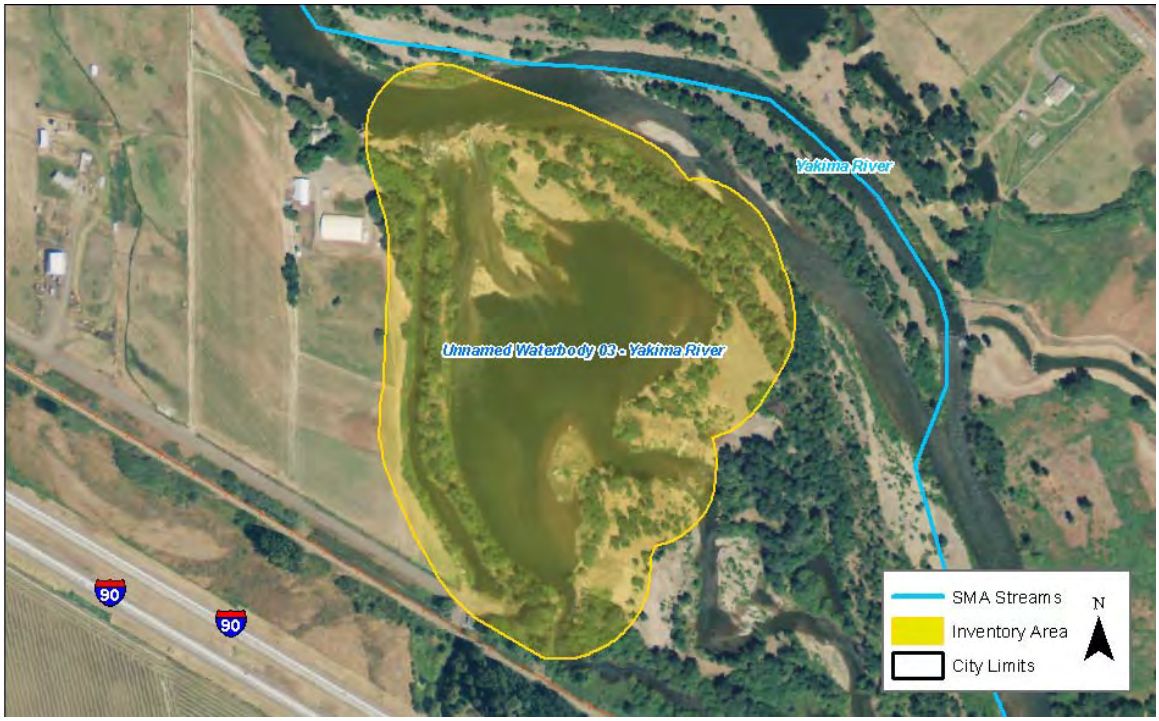
FISH HABITAT QUALITY **Low:** The lake is a manmade artifact of gravel mining with no surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains some forested areas and is directly adjacent to the Yakima River, but is also disturbed by development (primarily I-90).
VEGETATION FUNCTIONS **Medium:** Much of the lakeshore is disturbed (primarily by I-90) but riparian forest areas are present, primarily near the Yakima River.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect riparian functions and protect structures from flood hazards.
- Protect the remaining forest cover and high-value wetland areas within the reach.
- There is no public access to the waterbody.
- Explore restoration of former gravel pits to create more natural floodplain and riverine habitat.

UNNAMED WATERBODY 3 (GLADMAR POND)

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.7 Mile	36.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The waterbody (Gladmar Pond) is bordered by agricultural land use and an irrigation canal to the west and a road/John Wayne Trail to the south. The Yakima River flows through the waterbody north to south. This feature is an artifact of gravel mining in the river's floodplain.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The entire reach area (100%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The reach is within the channel migration zone of the Yakima River.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is largely forest (40%), open water (24%), and riparian vegetation (12%). The reach also contains the following land cover types: grassland (9%), shrubland (9%), and agricultural lands (6%).

HABITATS AND SPECIES (MAP FOLIO #1)

The presence of spring Chinook, summer steelhead, brown trout, coho salmon, bull trout, rainbow trout, and westslope cutthroat is mapped by WDFW.

Wetland habitat is mapped in small patches along the shoreline of the waterbody (17% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Linear hydromodifications are located at the northern and southern end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The reach can be accessed from the south end of Gladmar Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for agriculture (78%) and other (22%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

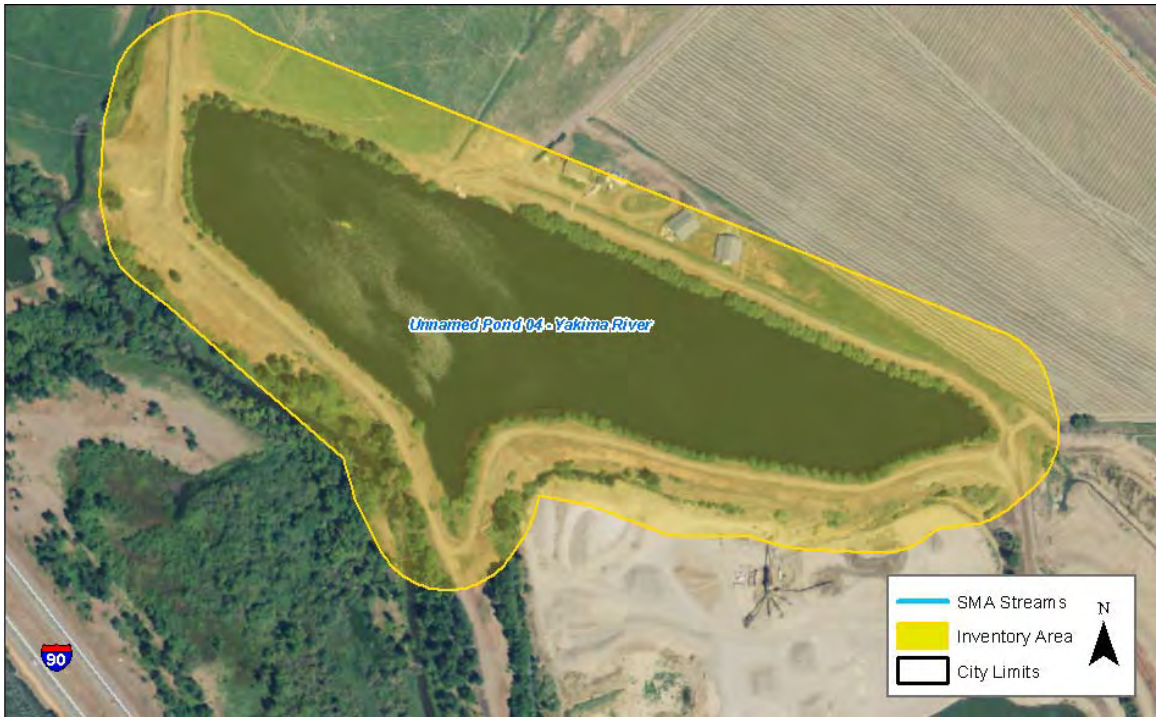
FISH HABITAT QUALITY **Medium:** The waterbody is a manmade artifact of gravel mining, but has mapped priority fish use and a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach contains some forested areas and is directly adjacent to the Yakima River, but contains some altered areas.
VEGETATION FUNCTIONS **Medium:** Much of the shoreline is disturbed from park development, adjacent development, and agriculture, but riparian forest areas are present, primarily near the Yakima River.	**HYDROLOGIC FUNCTIONS** **Low:** The waterbody is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- CWU is now managing Gladmar Pond and the surrounding County-owned shorelands for use as an outdoor research facility for university students.

UNNAMED POND 4

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.1 Miles	49.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The shoreline of the lake, which is oriented northwest to southeast, contains limited development and is separated by from the Yakima River by I-90. The lake does not drain to the Yakima River and was created by gravel mining.

LAND COVER (MAP FOLIO #3)

This reach contains significant amount of agricultural lands (46%) and open water (30%). A number of other land cover types are also present, including: shrubland (9%), grassland (8%), developed lands (5%), and forest (2%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A limited area of the reach (27%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

No priority fish use is identified by WDFW.

Wetland habitat is mapped along the southern shoreline of the waterbody (11% of the reach). No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is bordered by roads for the majority of its circumference.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to the waterbody.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for industrial uses (80%), with some agriculture zoning (20%) in the west.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

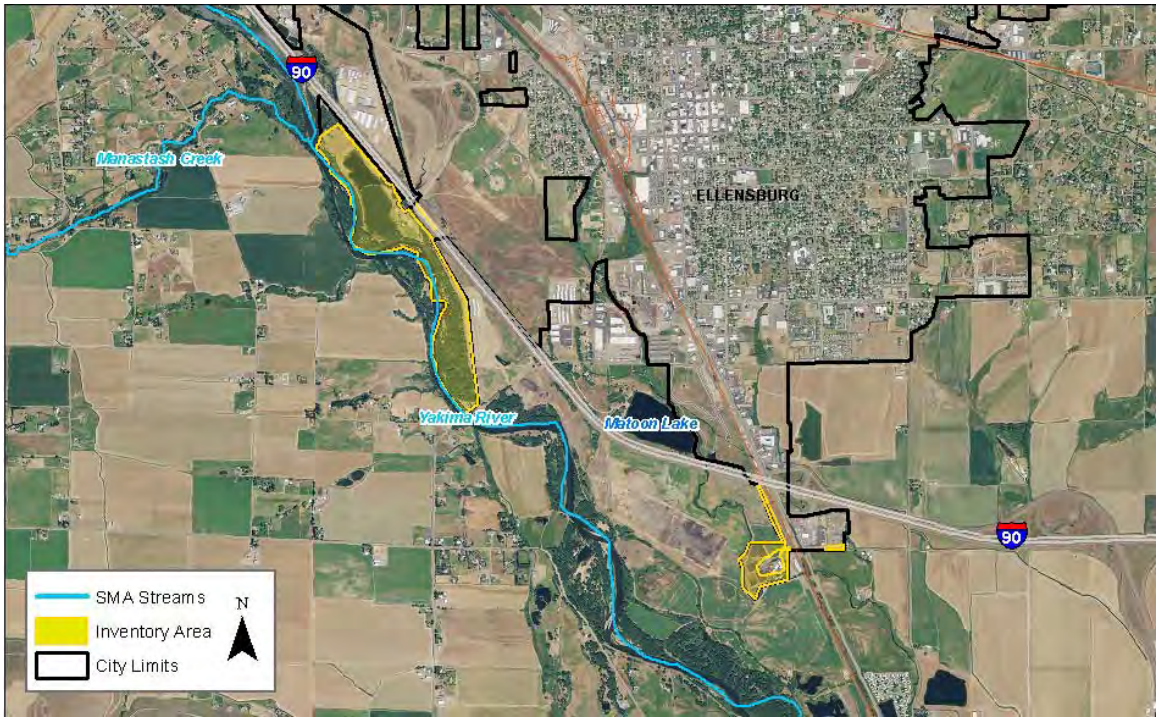
FISH HABITAT QUALITY **Low:** No priority fish use is mapped; the pond does not have a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Low:** The shoreline is highly altered, and riparian vegetation is generally absent.
VEGETATION FUNCTIONS **Low:** The shoreline is largely devoid of riparian vegetation.	**HYDROLOGIC FUNCTIONS** **Low:** The pond is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance to protect riparian functions.
- There is no public access to the waterbody.
- Educate shoreline property owners about measures to protect and restore riparian areas.

YAKIMA RIVER-CITY OF ELLENSBURG-REACH 3A

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.5 Miles	139.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is located in a low topographic relief valley and a large gravel pit pond is located on the left bank of the river. The water treatment site is approximately 0.5 mile from the Yakima River.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The entire reach (100%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The entire reach has potential for channel migration.

WATER QUALITY

The reach is on the State's Water Quality Assessment list of 303 (d) Category 5 waters for pH, temperature, and fecal coliform. A TMDL has been implemented for temperature.

LAND COVER (MAP FOLIO #3)

This reach contains significant forest (32%), agricultural lands (27%), developed lands (25%), and open water (10%). The two other land cover types present include: grassland (3%) and shrubland (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows this reach provides spawning and juvenile rearing habitat for spring Chinook and summer steelhead. The presence of sockeye salmon, brown trout, coho salmon, bull trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped along the river and at several locations adjacent to the river, ponds, and water treatment plant (27% of the reach). No priority habitat or species are mapped in this reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The northeastern end of the reach is constrained by I-90.	**PUBLIC ACCESS (MAP FOLIO #4)** The reach can be accessed from Irene Rinehart Riverfront Park off of W. Umptanum Road .
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily parks & open space (85%), with some areas of commercial (1%) and other (13%) [I-90] uses. Land ownership is 11% private and 89% public (City and Bureau of Reclamation).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for parks & open space (89%), commercial (2%), and other (9%) [I-90].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

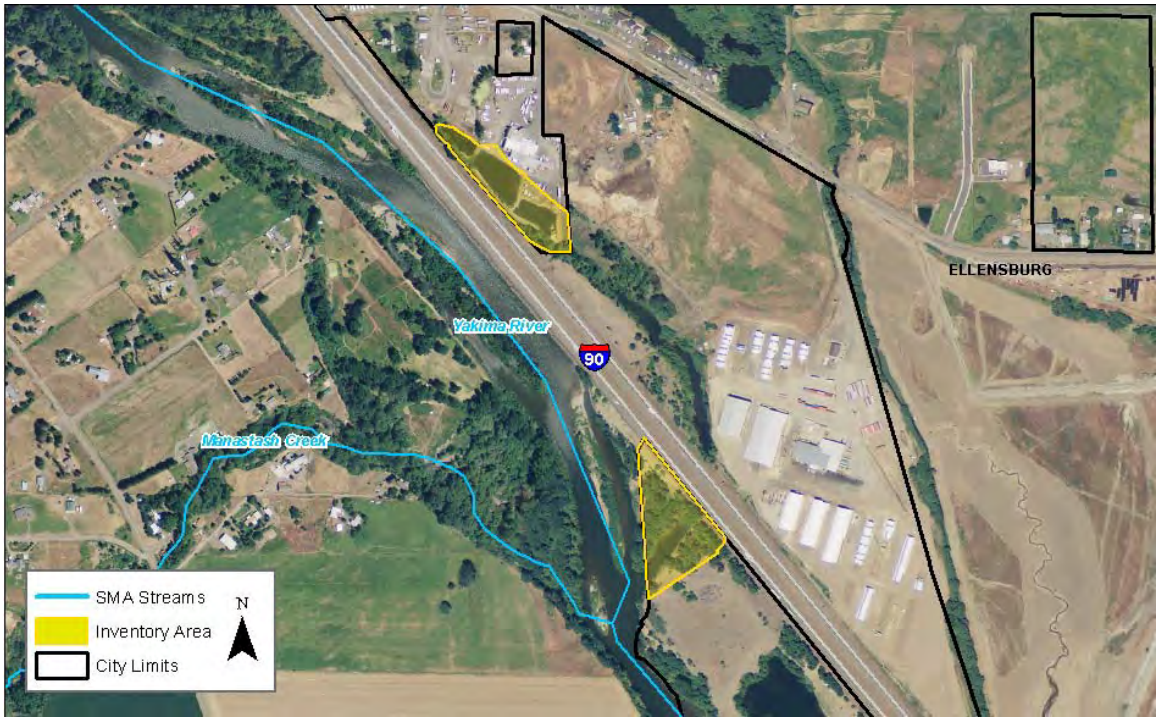
FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but has some significant water quality impairments and hydromodification areas.	**TERRESTRIAL HABITAT QUALITY** **Medium:** Areas directly adjacent to the river are generally well-vegetated, but surrounding areas are disturbed.
VEGETATION FUNCTIONS **Medium:** Much of the area bordering the river contains dense forest and shrub habitat, but some areas have been disturbed by park development and a manmade gravel pond.	**HYDROLOGIC FUNCTIONS** **Medium:** Portions of the river's floodplain are constrained by hydromodifications within the reach, but the river still has a connection to its floodplain in some areas.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New structures should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding.
- Educate property owners about measures to protect and restore riparian areas.
- Protect the high-value, forested floodplain areas within the reach.
- There is significant development (including Irene Rinehart Riverfront Park) that lies within flood-prone areas.
- Most of the reach is contained within Irene Rinehart Riverfront Park. The park is the largest contiguous tract of native habitat in the City of Ellensburg.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Educate public works and/or parks and recreation department about measures to protect and restore riparian areas.
- Identify city-owned properties where private mitigation and/or restoration grant funds may be utilized to improve riparian function.

YAKIMA RIVER-CITY OF ELLENSBURG-REACH 4A

SHORELINE LENGTH:	REACH INVENTORY AREA:
NA	9.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The northern reach segment is a manmade artifact of gravel mining, while the southern segment is a portion of Yakima River floodplain.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant area of the reach (86%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The southern portion of the reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, fecal coliform, pH, and temperature. A TMDL has been implemented for temperature.

LAND COVER (MAP FOLIO #3)

This reach primarily contains developed lands (72%), and forest (25%). Grassland (2%) and agricultural lands (1%) are also mapped.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW does not map any fish species in this reach.

Wetland habitat is mapped along the ponds and outlet channel (27% of the reach). No priority habitat or species are mapped in this reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The northern portion of the reach is constrained by I-90 to the west, and the southern portion by I-90 to the east.	**PUBLIC ACCESS (MAP FOLIO #4)** Irene Rinehart Riverfront Park provides public access to the downstream portion of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is commercial (52%) and parks & open space (48%). Land ownership is 54% private and 46% public (City).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for parks & open space (47%), commercial (10%), and other (43%) [I-90].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** There no mapped fish use within the reach.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach is adjacent to I-90 and industrial development.
VEGETATION FUNCTIONS **Medium:** The northern reach segment is largely devoid of vegetation, while the southern segment consists primarily of riparian forest.	**HYDROLOGIC FUNCTIONS** **Low:** The northern reach segment is surrounding by I-90 and industrial development, and the southern segment is constrained by I-90 to the east.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the remaining high value, forested floodplain area within the reach, located in the southern reach segment.
- Educate shoreline property owners about measures to protect and restore riparian areas.

4.2 Taneum Creek

Taneum Creek is a right-bank tributary to the Yakima River, flowing west to east and draining to the Yakima River at RM 166.1. The mainstem of Taneum Creek splits at RM 12.7 into the North and South Forks which are 12 and 9 miles long, respectively. For purposes of this inventory, there are 3 reaches: one for the mainstem and one for each of North and South forks.

4.2.1 Physical Characterization

Much of the Taneum Creek watershed is undeveloped, with the North and South Forks flowing through heavily forested areas, and the lower reach (below RM 1.5) of the mainstem traversing agricultural croplands. This lower reach also contains very limited residential development adjacent to the stream. The lower portions of the system have limited topographic relief (alluvial terraces), while higher in the drainage, steep-sided canyons and high ridges dominate the landscape.

Six road crossings, including I-90, are mapped over Taneum Creek. A Forest Service road borders much of the creek, but the road was significantly damaged during recent flood events (John Marvin, personal communication). Taneum Ditch and Bruton Ditch divert water from the stream for irrigation. The John Wayne Heritage Trail crosses the stream near its confluence with the Yakima River. Numerous landslide hazards are mapped on both banks of the North and South Forks (WDNR 2010). Steep slopes are mapped along most of the stream, particularly upstream of RM 1.5 (Kittitas County 2012). The FEMA 100-year floodplain is mapped in more than half of the downstream portion of the mainstem, but does not extend throughout the entire reach area (FEMA 1996). Taneum Creek has a large and unpredictable floodplain (Tetra Tech 2012), and the identified channel migration zone extends throughout much of the inventory area.

The lower 3.3 miles of the mainstem experiences low summer and fall flows due to major diversions, although a recent irrigation efficiencies projects and transfer of water rights to the state Trust Water Program have improved instream flow conditions. In addition, irrigation diversion fish barriers have recently been corrected (John Marvin, personal communication).

The channel length, wetted width, and depth of Taneum Creek have only slightly decreased over the last half of the twentieth century, indicating limited channel aggradation. However, the stream has been historically channelized within the large floodplain reach from Heart-K Ranch downstream to Springwood Ranch (Haring 2001). The Heart-K Ranch is now owned by the U.S. Bureau of Reclamation, and they

are allowing the stream to access its floodplain (Anna Lael, personal communication).

4.2.2 Habitats and Species

4.2.2.1 Fish Use

Taneum Creek provides rearing and spawning habitat for summer steelhead (federally listed threatened species). It also supports spawning of spring Chinook salmon. Other species present in Taneum Creek and its forks include eastern brook trout, rainbow trout and westslope cutthroat trout (StreamNet 2010). There are also reports of coho salmon spawning and rearing within the creek (John Marvin, personal communication).

Haring (2001) identified several constraints to salmonid production in Taneum Creek, including low summer and fall flows in the lower reaches (a result of irrigation diversions). Screens and fish ladders were installed on irrigation diversions in the 1990s. In 1994, state, federal, and local agencies and the Yakama Nation agreed to transfer flows from the Yakima River through the KRD Canal to enhance instream flow in the lower reaches of Taneum Creek. These changes improved fish passage (Haring 2001).

Fish habitat downstream of I-90 is impaired by low channel complexity and a lack of large wood. However, a recent project by the Yakima/Klickitat Fisheries Project has added over 1,200 pieces of woody debris to the stream. Habitat quality improves in the upstream, forested portions of the stream system. Past logging and road construction have impacted habitat in the upper reaches, and a historic railroad bed has confined the stream in many locations (Haring 2001; John Marvin, personal communication).

The Integrated Water Resource Management Plan for the Yakima River basin proposes modifications to laterals of the Kittitas Reclamation District (KRD) Main and South Branch canals to reduce seepage losses and allow greater flexibility in KRD supply management. The water saved or transferred would be used to enhance instream flows in tributaries to the Yakima River, including Taneum Creek (Reclamation and Ecology 2011a).

The Integrated Water Resource Management Plan for the Yakima River basin proposes targeted acquisition of lands at the headwaters of Taneum Creek to protect ecologically important areas. These areas are important in protecting water quality, cool stream temperatures, water supply, and current or potential spawning grounds (Reclamation and Ecology 2011a).

4.2.2.2 Water Quality

Several segments of the Taneum Creek stream system are on Ecology's 303(d) list for high water temperatures. Extensive logging roads in the upper watershed deliver fine sediment to stream reaches in the upper watershed. TMDLs has have implemented for temperature, turbidity, and suspended sediment (Ecology 2002 & 2005).

4.2.2.3 Riparian Habitat Conditions (Land Cover)

The upper part of Taneum Creek and the North and South Forks flow through commercial forestland in various stages of succession. Roads and recreational campsites have impacted riparian vegetation in some areas (Haring 2001). Lower Taneum Creek is located within agricultural lands and shrub-steppe habitats where woody riparian cover is narrow and intermittent.

4.2.2.4 Wetlands

Freshwater forested and scrub-shrub wetlands are mapped along approximately one-quarter of the Taneum Creek mainstem. Very little wetland area is mapped along the North and South Forks.

4.2.2.5 Wildlife Habitats and Species

Northern spotted owls (federally listed threatened species) have been documented near upper Taneum Creek and the North and South Forks. This area is mapped as spotted owl critical habitat.

The upper Taneum Creek valley is mapped as a migration corridor for elk and deer, and as a wintering and calving area for these species. The area around lower Taneum Creek is a mapped mule deer and elk winter range.

4.2.3 Land Use

The lower approximately 5 miles of Taneum Creek is bordered by agriculture and range lands, along with some moderate-density residential subdivisions. The Heart K ranch, owned by the U.S. Bureau of Reclamation, is managed for fish and wildlife conservation purposes. Upstream, the creek flows through the Washington Department of Fish and Wildlife (WDFW) L.T. Murray Wildlife Area, which extends to the National Forest boundary. The upstream end of mainstem Taneum Creek and its South Fork flow through National Forest lands. The North Fork flows through a “checkerboard” of National Forest lands and private timber lands.

4.2.4 Public Access

Near its confluence with the Yakima River, Taneum Creek is crossed by the John Wayne Heritage Trail. On the National Forest and WDFW land, Taneum Creek and its forks can be accessed from Taneum Road and a network of snowmobile and hiking/horse trails.

4.2.5 Reach Sheets

TANEUM CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
13.6 Miles	689.1 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is locally sinuous and flows from moderate (foothills) to low (valley) topographic relief west to east. No development is located in the upstream portion of the river, with limited development adjacent to the river in the valley. The channel is confined in several areas by the John Wayne HeritageTrail, I-90, and several other roads.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by forest (50%), riparian vegetation (26%), and agricultural lands (20%). Developed lands (2%), shrubland (1%), and other (1%) are also present in this reach.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Less than half of the reach area (42%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Almost the entire reach (97%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, fecal coliform, pH, and temperature; a TMDL has been implemented for temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides spawning and rearing habitat for summer steelhead and spring Chinook. The presence of coho salmon (reports of spawning and rearing), bull trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

Wetland habitat is mapped along both banks of the river at multiple locations (20% of the reach). Priority elk winter range and mule deer winter range habitat is mapped of the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

I-90 crosses the downstream end of the reach, and several other road crossings are mapped within the reach. A Forest Service road and a historic railroad borders much of the creek, and areas of linear hydromodifications are located upstream of I-90.

PUBLIC ACCESS (MAP FOLIO #4)

The stream is crossed by the John Wayne Heritage Trail near its confluence with the Yakima River. Snowmobile trails, in addition to the North Fork Taneum Trail and Icewater Loops Trail, provide access to the upstream portion of the stream.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use along the reach is rural (34%) and agriculture (3%) at the downstream end, and forestry (63%) along the upstream portion. Land ownership is 36% private and 64% public (Forest Service and WDFW).

CONTAMINATED SITES

No identified contaminated sites are located within this reach.

ZONING (MAP #5)

Lands within the reach are zoned for forest & range (26%), agriculture (10%), and other (1%) [right-of-way] at the downstream end, and commercial forestry (63%) upstream.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There are 4 recorded precontact and historic properties located within the reach. Historic properties include depression era (circa 1930s) camps and complexes associated with the CCC.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but low instream flows are a limiting factor for fish use.

TERRESTRIAL HABITAT QUALITY

Medium: The upper portion of the reach is well vegetated and is connected to large areas of relatively undisturbed habitat, but habitat along the lower reach has been disturbed.

VEGETATION FUNCTIONS

Medium: Vegetation along the lower creek has been altered by development and agriculture, but the upper creek is bordered by dense forest cover.

HYDROLOGIC FUNCTIONS

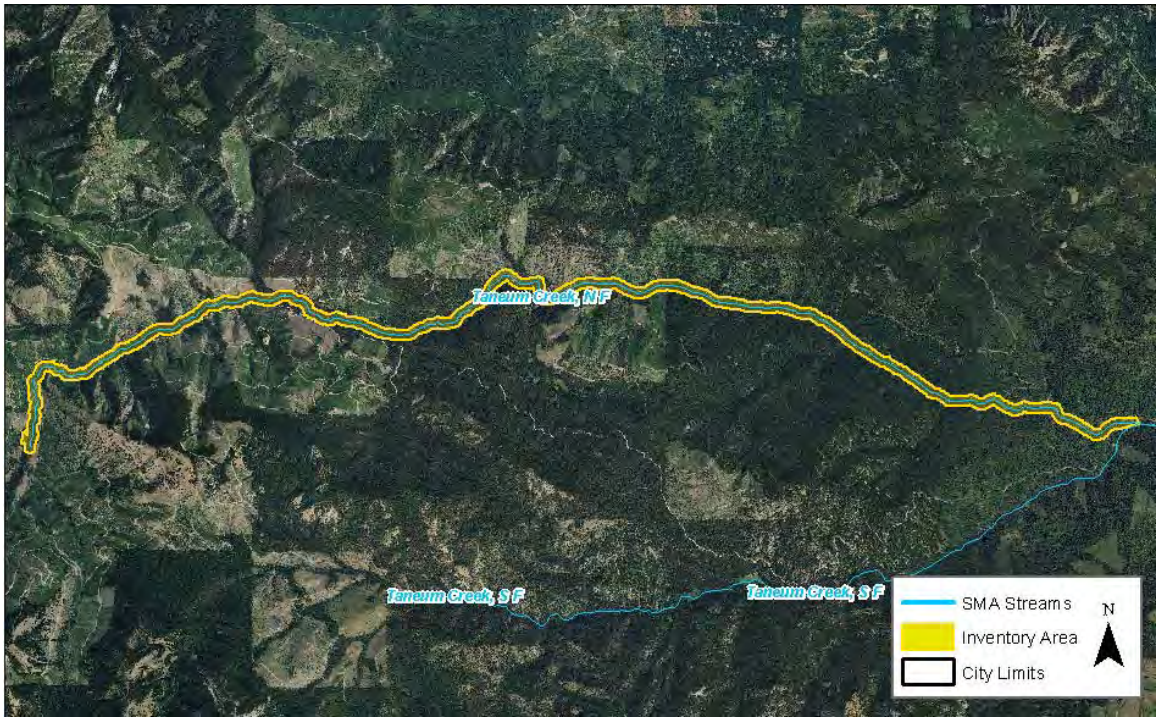
Medium: The hydrology of the upper creek is generally intact, but the lower portion experiences low flows because of water diversions. Much of the floodplain in the lower creek has been impacted by agriculture and development.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect stream functions, and protect structures from flooding and channel migration.
- Low instream flows are a limiting factor for salmonids in the lower creek.
- Decommission and revegetate any unused roads along the shoreline.
- Encourage water right holders/irrigation to work with the Kittitas County Conservation District to implement irrigation efficiencies improvements that result in water entered in the Trust Water Rights Program.
- Restoration opportunities include placing large woody debris in high priority areas in the Yakima Basin. Wood will be harvested from adjacent forests, decreasing fire potential and making riparian trees less susceptible to insect damage. Large wood replenishment on the river occurred in 2009 and environmental analysis is underway to treat additional acres (YBFWRB, 2011).
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Protect high-quality forested areas and wildlife habitat.
- Educate shoreline property owners about measures to protect and restore riparian areas.

NORTH FORK TANEUM CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
9.8 Miles	474.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows west to east through a ravine with moderate topographic relief. A Forest Service road parallels the river near the confluence of the forks, but the remainder of the reach is undeveloped.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain. Limited amount of landslide hazard areas (4%) are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

The majority of the reach is covered by forest (75%), harvested forest (13%), and riparian vegetation (11%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of eastern brook trout, rainbow trout, summer steelhead, and westslope cutthroat in this reach.

Very limited wetland habitat is mapped along the river (2% of the reach). Priority rocky mountain elk migration corridor is mapped in the central portion of the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The North Fork Taneum Trail parallels much of the reach. Snowmobile and dog sled trails provide access at multiple locations, primarily at the upstream and downstream segments of the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is forestry (100%). Land ownership is 50% private and 50% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A historic mine site and associated railroad that date from the late 1800s to early 1900s are recorded within the reach. Also, there is 1 recorded precontact site within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides habitat for priority fish species, but no spawning or rearing habitat have been identified.	**TERRESTRIAL HABITAT QUALITY** **High:** Riparian areas are generally intact and connected to large areas of relatively undisturbed habitat.
VEGETATION FUNCTIONS **High:** The reach is dominated by dense forest cover, with limited areas of significant alteration.	**HYDROLOGIC FUNCTIONS** **Medium:** There are limited hydromodifications within the reach, but past timber harvest and road construction have somewhat altered the hydrology of the creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Private resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect remaining high-quality forested areas and wildlife habitat.
- Decommission and revegetate any unused roads along the shoreline.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

SOUTH FORK TANEUM CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
6.0 Miles	289.5 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach generally flows west to east through a ravine with moderate to low topographic relief. A forest service road parallels the river near the confluence of the forks and upstream for several miles. A parking lot and associated car camping is also located near the confluence of the forks.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily forest (90%), with patches of riparian vegetation (9%) and other (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain. Limited amount of landslide hazard areas (4%) are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of eastern brook trout, rainbow trout, summer steelhead, and westslope cutthroat in this reach.

Limited wetland habitat is mapped along the river, primarily in the central portion of the reach (8% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** Taneum Ridge, Hoyt, Frost Creek, South Fork Taneum, and Frost Mountain trails provide reach access, in addition to a snowmobile trail/Forest Service road near the confluence with the North Fork.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is forestry (100%). Land ownership is 6% private and 94% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forestry (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded historic properties that include a mining complex, the remains of a mill operation, and a historic trail. There is 1 recorded precontact site located within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides habitat for priority fish species, but no spawning or rearing habitat have been identified.	**TERRESTRIAL HABITAT QUALITY** **High:** Riparian areas are generally intact and connected to large areas of relatively undisturbed habitat.
VEGETATION FUNCTIONS **High:** The reach is dominated by dense forest cover, with limited areas of significant alteration.	**HYDROLOGIC FUNCTIONS** **Medium:** There are limited hydromodifications within the reach, but past timber harvest and road construction have somewhat altered the hydrology of the creek.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Private resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect remaining high-quality forested areas and wildlife habitat.
- Decommission and revegetate any unused roads along the shoreline.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

4.3 Manastash Creek

Manastash Creek flows from west to east and is a right-bank tributary to the Yakima River, entering at RM 154.5. At RM 8.5, Manastash Creek branches into the 12-mile North Fork and 20-mile South Fork (Haring 2001). There are three inventory reaches; one each for the mainstem, the South Fork, and Manastash Lake.

4.3.1 Physical Characterization

In the lower portion of Manastash Creek are six active irrigation diversions. Natural runoff in Manastash Creek is fully appropriated for irrigation. In most years, between mid-July and October, there is no surface flow between RM 4.2 and approximately RM 1.5. Lack of flow is attributed to irrigation withdrawals and the porous substrate of the channel bed. Surface flows return at about RM 1.4, due primarily to groundwater return seepage (Haring 2001). In addition to irrigation dams, there are several road crossings and five mapped bridge crossings.

The lower 5 miles of mainstem flows through land that has experienced significant suburban growth, with many short plats established since the mid-1990s (Haring 2001). Residential development is currently located on both banks of the stream, with agricultural fields dominating the landscape.

Steeps slopes are nearly ubiquitous on both sides of Manastash Creek from RM 5 to the upstream extent of the stream's regulated shoreline, as the stream transitions from relatively flat agricultural land into forested canyons (Kittitas County, 2012). The FEMA 100-year floodplain is mapped the length of the mainstem and the lower one-third of the South Fork reach (FEMA 1996). The identified channel migration zone extends throughout much of the inventory area, and there is substantial residential development within the migration hazard area.

Significant flood, erosion, and sedimentation hazards are present along Manastash Creek, due to the volume of sediment moving through the system, development within the floodplain, lack of riparian vegetation, and confined channel reaches and roadway crossings (Herrera, 2012). The Kittitas County Conservation District, along with Kittitas County and local landowners, are currently developing a detailed study and analysis of the lower 13 miles of Manastash Creek to determine priority actions for alleviating flooding and erosion and improving salmonid productivity.

4.3.2 Habitats and Species

4.3.2.1 Fish Use

Manastash Creek provides spawning habitat for summer steelhead (federally listed threatened species) and spring Chinook salmon. Other species present in the Manastash Creek system include rainbow trout, eastern brook trout, and westslope cutthroat trout. Manastash Lake supports westslope cutthroat and eastern brook trout (StreamNet 2010). In addition, there are reports of coho rearing habitat at the downstream end of the creek (Anna Lael, personal communication).

The main factors limiting salmonid production in Manastash Creek are barriers to upstream fish passage, unscreened water diversions that entrain juvenile salmonids, and naturally low streamflows exacerbated by irrigation withdrawals. Miles of suitable spawning and rearing habitat are available upstream of the diversions (Haring 2001; BPA 2002). Through the Manastash Creek Restoration Project, efforts are underway to screen irrigation diversions and increase irrigation efficiencies in the watershed. Several of the project elements have already been completed (Anna Lael, personal communication).

The Integrated Water Resource Management Plan for the Yakima River basin proposes modifications to laterals of the Kittitas Reclamation District (KRD) Main and South Branch canals to reduce seepage losses and allow greater flexibility in KRD supply management. The water saved or transferred would be used to enhance instream flows in tributaries to the Yakima River, including Manastash Creek (Reclamation and Ecology 2011a).

The Integrated Plan for the Yakima River basin also proposes targeted acquisition of lands at the headwaters of Manastash Creek to protect ecologically important areas. These areas are important in protecting water quality, cool stream temperatures, water supply, and current or potential spawning grounds (Reclamation and Ecology 2011a).

4.3.2.2 Water Quality

Parts of Manastash Creek and the South Fork are on Ecology's 303(d) list for high water temperatures and low dissolved oxygen. TMDLs have been implemented for temperature, turbidity, and suspended sediment (Ecology 2002 & 2005). (

4.3.2.3 Riparian Habitat Conditions (Land Cover)

Riparian vegetation communities along Manastash Creek are largely intact, with the exception of the downstream end of the reach which is impacted by development

and agriculture. Riparian areas along the South Fork are a mixture of coniferous forest, shrub, and rocky bare areas within a steep-sided canyon.

4.3.2.4 Wetlands

A very small portion of the Manastash Creek shoreline inventory area is mapped as scattered wetlands. Most of this is scrub-shrub wetland mapped near the confluence with the Yakima River.

4.3.2.5 Wildlife Habitats and Species

Northern spotted owls (federally listed threatened species) have been documented near the upper part of the South Fork and Manastash Lake. The Manastash Creek corridor is mapped as mule deer winter range. Bighorn sheep summer range is mapped along the South Fork.

4.3.3 Land Use

Land use along the lower approximately 5 miles of Manastash Creek is primarily agriculture and low- to moderate-density residential development. Upstream, from the east end of Manastash Canyon to the point where the creek forks, the channel is bordered by agriculture lands and low- to moderate-density residential development.

The downstream approximately 5 miles of the South Fork of Manastash Creek is bordered by low- to moderate-density residential development and undeveloped land zoned as forest and range. The upstream two-thirds of the South Fork flows through National Forest land and private land zoned for commercial forestry.

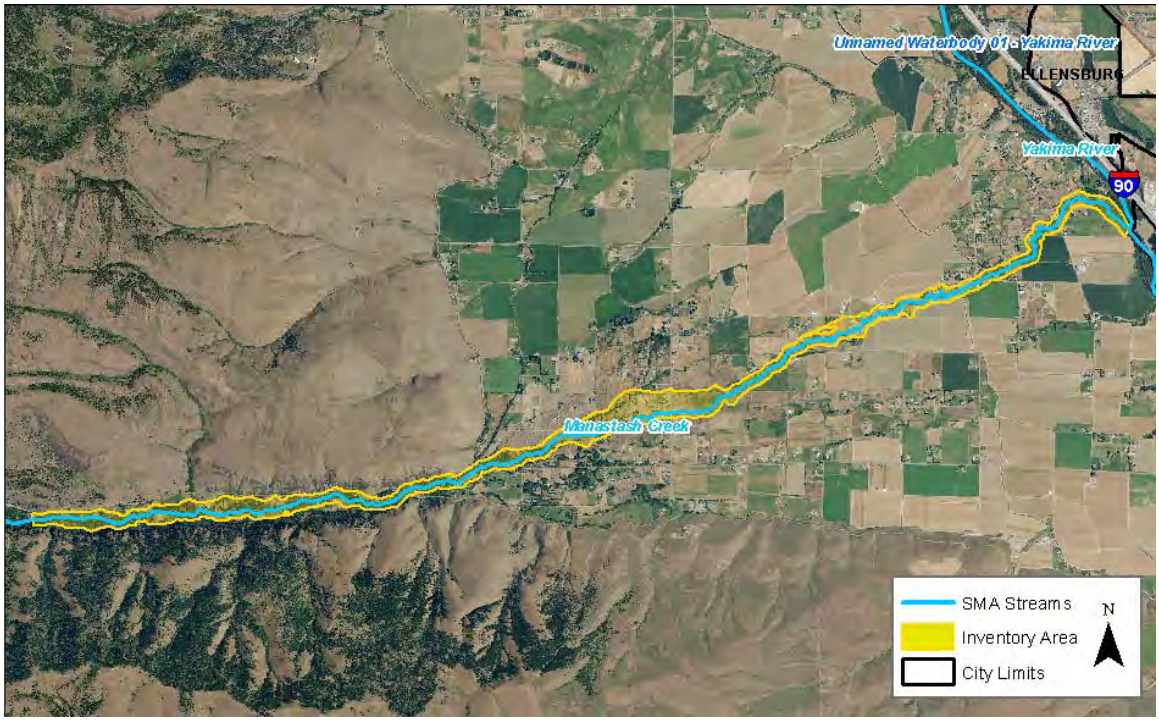
4.3.4 Public Access

The mainstem of Manastash Creek and the lower portion of its South Fork flow through private land with no public access opportunities. However, the stream can be viewed in several locations from Manastash Road, which borders the stream. The upper portion of the South Fork of Manastash Creek can be accessed from a network of snowmobile and hiking/horse trails.

4.3.5 Reach Sheets

MANASTASH CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
8.7 Miles	549.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream portion of the reach flows through a relatively narrow valley that gives way to flat agricultural land. The reach generally flows west to east, with several roads crossing and paralleling the river. Residential development is adjacent to the river at many locations.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The majority of the reach area (70%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The entire reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for dissolved oxygen, fecal coliform, pH, and temperature. A TMDL has been implemented for temperature.

LAND COVER (MAP FOLIO #3)

This reach contains significant agricultural lands (61%), forest (16%), and riparian vegetation (12%). A number of other land cover types are also present, including: developed lands (5%), shrubland (3%), and grassland (2%).

HABITATS AND SPECIES (MAP FOLIO #1)

The presence of eastern brook trout and westslope cutthroat trout is mapped. There are also reports of coho rearing habitat at the downstream end.

Very limited wetland habitat is mapped along, primarily near the confluence with the Yakima River (3% of the reach). Priority elk historic winter range and mule deer winter range are mapped along the majority of the reach. Priority cliffs/bluffs are also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Manastash Road parallels much of the reach, separating the creek from its natural floodplain. In addition, several road crossings, 2 irrigation dams which are partial barriers for fish passage, and several areas of linear hydromodifications are mapped.	**PUBLIC ACCESS (MAP FOLIO #4)** There are no public access opportunities in the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use in the reach is rural (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for primarily for agriculture (81%), with areas of forest & range (16%), and other (3%) [right-of-way] zoning.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 3 recorded historic and precontact sites located within the reach. The 2 recorded historic properties include agricultural irrigation diversions and irrigation systems.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but low instream flows and partial migration barriers are a limiting factor for fish use.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach has undergone significant vegetation removal and adjacent development, but habitat conditions improve somewhat upstream, where there is a connection to adjacent, high-quality habitat areas at the upstream end.
VEGETATION FUNCTIONS **Medium:** Vegetation along the lower creek has been significantly altered by roads, agriculture, and development, but riparian forest habitat and shrub remains in the upstream areas.	**HYDROLOGIC FUNCTIONS** **Low:** Adjacent roads and development separate the creek from much of its natural floodplain, and the flow is significantly reduced by irrigation diversions throughout much of the year.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Agricultural and resource lands within the reach have the potential to be converted to more intensive uses (e.g., from agriculture to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Low flows are a limiting factor for salmonids in the lower creek, as well as fish passage barriers (irrigation dams) and unscreened irrigation diversions.
- There is no public access to this reach of Manastash Creek.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Protect the remaining high-quality forested areas, shrub-steppe habitat, and wildlife habitat.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Flooding and alluvial fan hazards are prevalent within this reach; limit development within the floodplain and implement bioengineered measures, where practical, to avoid and minimize flood damage to existing structures.
- The Manastash Creek Restoration Project is currently working to improve fish passage and increase irrigation efficiency within the watershed. Several elements of the project have already been completed.

SOUTH FORK MANASTASH CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
13.4 Miles	667.8 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows northwest to southeast through a narrow ravine and is paralleled by a county/forest service road for most of its extent. Limited residential development is associated with the downstream portion of the reach.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A limited reach area (22%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach (79%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature; a TMDL has been implemented

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mostly forest (73%) and riparian vegetation (21%), with some developed lands (2%), shrublands (2%), agricultural lands (1%), unvegetated (1%), other (1%), and harvested forest (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of eastern brook trout, rainbow trout, and westslope cutthroat in this reach.

Small patches of wetland habitat is mapped along the river (3% of the reach). Priority mule deer winter range, bighorn sheep summer range, elk winter range, and cliffs/bluffs are mapped along the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Manastash Road parallels the downstream end of the reach, separating the creek from its natural floodplain	**PUBLIC ACCESS (MAP FOLIO #4)** The upstream half of the stream can be accessed by snowmobile trails/National Forest roads, and the Bucky, Buck Meadows, and Keenan Meadow trails.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is rural (28%) and agriculture (4%) at the downstream end, with forestry (67%) upstream. Land ownership is 66% private and 34% public (Forest Service and WDFW).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (67%), with areas of forest & range (27%), agriculture (5%), and other (1%) [right-of-way] at the downstream end.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 6 recorded precontact sites and 1 recorded historic site located within the reach. A stock bridge built over the Manastash was constructed in the late 1800s or early 1900s and appears to meet the requirements for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides habitat for priority fish species, but no specific spawning or rearing concentration areas have been identified.	**TERRESTRIAL HABITAT QUALITY** **Medium:** A road parallels the creek and portions of the downstream end have been altered by development, but much of the riparian corridor is forested and connections to high-quality habitat areas exist.
VEGETATION FUNCTIONS **High:** Some areas of alteration are present, but much of the riparian corridor (consisting of forest and shrub habitat) is largely intact.	**HYDROLOGIC FUNCTIONS** **Medium:** Adjacent roads and development separate the creek from much of its natural floodplain at the downstream end, but there are minimal hydromodifications at the upstream end.

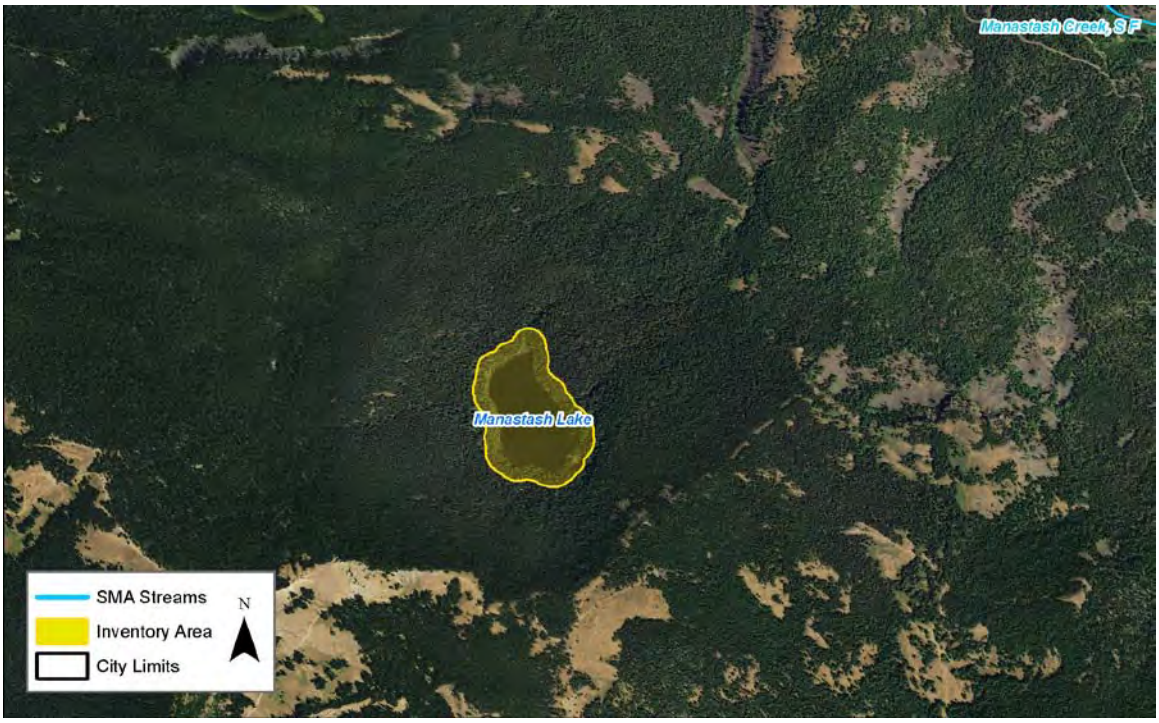
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Flooding and alluvial fan hazards are prevalent within this reach; limit development within the floodplain and implement bioengineered measures, where practical, to avoid and minimize flood damage to existing structures.
- Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forest/range lands to residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Protect the remaining high-quality forested areas, shrub-steppe habitat, and wildlife habitat.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Decommission and revegetate any unused roads along the shoreline.

MANASTASH LAKE

SHORELINE LENGTH:
0.9 Miles

WATERBODY AREA: 28.7 Acres
REACH INVENTORY AREA: 53.7 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach is undeveloped with a forested shoreline. The outlet to the lake is located at the north shore and drains to the South Fork Manastash Creek.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated by conifer-dominated forest (56%) and open water (44%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of eastern brook trout and westslope cutthroat within the reach.

No wetlands are mapped within the reach. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A hiking/horse trail accesses the regulated lake area.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The lake is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.	**TERRESTRIAL HABITAT QUALITY** **High:** The lakeshore is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The lake is bordered primarily by dense, unaltered forest habitat.	**HYDROLOGIC FUNCTIONS** **High:** The lakeshore is unaltered, and the lake has significant water storage potential.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

4.4 Matoon Lake

Matoon Lake is located north of I-90 and just outside of the southwest boundary of the City of Ellensburg. The northeastern shoreline of lake is located within city limits; the shoreline area within the city is described below.

4.4.1 Physical Characterization

Matoon Lake is approximately 0.3 mile long and 0.15 mile wide, occupying roughly 26 acres, and oriented northwest-southeast. The lake is a former gravel pit that is relatively shallow, with a mean depth of 3 meters and a maximum depth of 4 meters (Kittitas County Noxious Weed Board 2007). I-90 travels along the lake's southern boundary, and the combined segment of Wilson Creek and Bull Ditch flows near the northern and eastern boundaries.[1] The lake's shoreline is undeveloped, with one floating dock located in the northwest portion.

The FEMA 100-year floodplain, of the Yakima River and Wilson Creek, is mapped within a small portion of the waterbody's inventory area (FEMA 1996).

4.4.1.1 City of Ellensburg

The eastern regulated extent of Matoon Lake is located in the Ellensburg city limits. The eastern shoreline of the lake contains sparse vegetation and a gravel road. The land adjacent to the shoreline is undeveloped and contains a short stretch of Wilson Creek and an irrigation ditch; both have overwater structures located near their divergence.

The FEMA 100-year floodplain, of Wilson Creek, is mapped within a large portion of the waterbody's inventory area (FEMA 1996).

4.4.2 Habitats and Species

4.4.2.1 Fish Use

WDFW annually stocks Matoon Lake with rainbow and brown trout. Other warmwater fish in the lake include largemouth bass, pumpkinseed sunfish, and northern pikeminnow (KCNWCB 2007). Fish habitat in the lake has been degraded by non-native invasive vegetation (see below under Water Quality).

[1] This segment of Wilson Creek is not a shoreline of the state (see Section 4.5).

City of Ellensburg

See section 4.4.2.1

4.4.2.2 Water Quality

Mattoon Lake is considered a Category 4c waterbody on Ecology's 2008 303(d) list because of the presence of exotic invasive species. Category 4c waterbodies are impaired by causes that cannot be remedied by a TMDL and must be addressed through more complex solutions.

Non-native, invasive aquatic vegetation has degraded the quality of habitats within the lake. Four noxious aquatic weeds known to be present in Mattoon Lake: Eurasian watermilfoil, purple loosestrife, yellow-flag iris, and curly-leaf pondweed (KCNWCB 2007).

Eurasian watermilfoil is of particular concern to aquatic habitat. In just a few growing seasons, this invasive species can crowd out native aquatic vegetation, change predator-prey relationships among fish and other aquatic animals, reduce dissolved oxygen, and release excess nutrients when it decomposes (potentially increasing algal growth). Dense mats of Eurasian watermilfoil can increase water temperature by absorbing sunlight and raise the pH. An Integrated Aquatic Vegetation Management Plan (IAVMP) has been created to address this species along with other invasive plants in the lake such as purple loosestrife and curly-leaf pondweed (KCNWCB 2007).

City of Ellensburg

See Section 4.4.2.2.

4.4.2.3 Riparian Habitat Conditions (Land Cover)

The riparian zone of Matoon Lake has very little woody riparian cover. An unpaved road runs around most of the lakeshore, and I-90 is located on the south side.

City of Ellensburg

The combined segment of Wilson Creek and Bull Ditch runs along the eastern side of the lake within city limits. Woody riparian vegetation is sparse along both the lake and the stream. An unpaved access road runs close to the lake shoreline.

4.4.2.4 Wetlands

A small scrub-shrub wetland is located within the Matoon Lake shoreline inventory area. This wetland is located between unpaved access roads near the southwest corner of the lake.

City of Ellensburg

No wetlands are mapped along the lakeshore within city limits. Limited unmapped wetlands may be associated with Wilson Creek, east of the lake.

4.4.2.5 Wildlife Habitats and Species

No priority habitats or species are mapped near Matoon Lake. The lake is located in a developed area that is unlikely to provide high-quality wildlife habitat.

4.4.3 Land Use

Matoon Lake is bordered by I-90 to the south, undeveloped land (zoned for urban residential) to the west and north, and the City of Ellensburg to the east.

4.4.3.1 City of Ellensburg

To the northeast, within the City of Ellensburg, Matoon Lake is bordered by undeveloped land zoned for commercial development.

4.4.4 Public Access

Access to Matoon Lake is available off of West Umtanum Road.

4.4.5 Reach Sheets

MATOON LAKE

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.3 Miles	50.0 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The shoreline of the waterbody is oriented northwest to southeast and contains limited development, with the exception of I-90 that borders the waterbody to the south. The waterbody was created from gravel mining in the floodplain of the river. Wilson Creek (which is not a SMP-regulated stream at this location) flows within the inventory area along the east shore of the lake.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is dominated open water (43%), agricultural lands (39%), and developed lands (17%), with limited grasslands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Almost half of reach (46%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

There is no priority fish use mapped in the lake.

Wetland habitat is mapped along the southern shoreline of the waterbody (5% of the reach). No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

Mattoon Lake is listed as a Category 4c waterbody because of the presence of exotic invasive species

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) I-90 constrains the south end of the lake, and a gravel road is located along the western shore. An irrigation ditch is located along the eastern shore of the lake.	**PUBLIC ACCESS (MAP FOLIO #4)** Access to Matoon Lake is available via West Umtanum Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use around the lake is primarily urban (75%), with parks & open space (7%) and commercial (18%) land to the east. Land ownership is 11% private, 59% public (WDFW), and 30% other [I-90]	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for urban/suburban residential uses (62%), with area of commercial zoning (25%) to the east and other (13%) [right-of-way] to the south.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** No priority fish use is mapped; the pond does not have a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Low:** The shoreline is highly altered, and riparian vegetation is generally absent.
VEGETATION FUNCTIONS **Low:** The shoreline is largely devoid of natural riparian vegetation.	**HYDROLOGIC FUNCTIONS** **Low:** The pond is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Educate shoreline property owners about measures to protect and restore riparian areas.
- There are several species of noxious aquatic weeds identified within the lake.

MATOON LAKE-CITY OF ELLENSBURG REACH

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.02 Miles	6.0 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The shoreline of Matoon Lake is generally undeveloped. Wilson Creek (which is not a SMP-regulated stream at this location) flows within the inventory area along the east shore of the lake.

LAND COVER (MAP FOLIO #3)

This reach is entirely mapped as agricultural lands (100%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A significant area of the reach (84%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

There is no priority fish use mapped in the lake.

Wetland habitat is not mapped in this reach. No priority habitats or species are mapped in this reach.

WATER QUALITY

Mattoon Lake is listed as a Category 4c waterbody because of the presence of exotic invasive species

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) An irrigation ditch is located along the eastern shore of the lake.	**PUBLIC ACCESS (MAP FOLIO #4)** Access to the reach is available via West Umtanum Road and then a gravel trail.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily commercial (72%), with areas of parks & open space (27%) and urban (1%) uses. Land ownership is 42% private and 58% public (WDFW).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach; however, one hazardous waste generator is mapped near the center of the reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial uses (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** No priority fish use is mapped; the lake does not have a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Low:** The shoreline is highly altered, and riparian vegetation is generally absent.
VEGETATION FUNCTIONS **Low:** The shoreline is largely devoid of natural riparian vegetation.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There are several species of noxious aquatic weeds identified within the lake.
- Educate shoreline property owners about measures to protect and restore riparian areas.

4.5 Wilson, Naneum, and Coleman Creeks

Wilson Creek flows generally north to south and is a left-bank tributary to the Yakima River at RM 147.0. Naneum and Coleman Creeks converge just east of I-82 and join Wilson Creek approximately 2 miles upstream of the Yakima River confluence.

An Ecology "Shorelines of the State" GIS dataset (2009) shows the SMA-regulated extent of Wilson Creek extending far north, into the foothills of the Wenatchee Mountains. This mapping is in error, as documented in an ESA memorandum dated September 20, 2012. Ecology agreed with the findings of the memorandum in a letter to the County dated December 20, 2012. The Ecology letter states that the SMA-regulated extent of Wilson Creek begins at the juncture where the creek and Naneum Creek come together, south of Ellensburg city limits (Section 30, T17N, R19E). The ESA memo recommends that continuous flow monitoring be conducted on Wilson Creek to definitively determine its SMA jurisdictional status prior to the next required SMP update, currently scheduled to occur on or before June 30, 2012 (RCW 90.58.080).

4.5.1 Physical Characterization

Wilson Creek originates at Table Mountain north of Ellensburg. Wilson Creek combines with Naneum Creek where they flow out of their respective canyons and flow in a common channel for approximately 1.5 miles, where they are split at a concrete structure (Anna Lael, personal communication). Wilson Creek then continues to flow southward for approximately 0.5 mile and then splits into east and west branches. The west branch then splits into Whiskey and Mercer creeks across a large alluvial fan.

Near the northeastern Ellensburg city limits, Wilson Creek splits into two branches (west and east). The two branches flow south through the city and are composed of alternately exposed and piped sections. The west and east branches rejoin approximately 3 miles downstream of the city. Naneum Creek flows back into Wilson Creek approximately 2 miles upstream of Wilson Creek's confluence with the Yakima River. According to Ecology (1991), the only portion of Wilson Creek that is designated as a Shoreline of the State begins downstream (south) of Ellensburg city limits, in Sections 30 and 31, Township 17 North, Range 19 East.

Complete mapping of the Naneum Creek distributaries between Charlton Road and the Vantage Highway has not been completed (Anna Lael, personal communication), and the hydrology of Wilson Creek is complex and not well understood. Most of the creek's naturally occurring flow results primarily from melting of the upgradient

snowpack in the spring and summer months, as well as spring precipitation events (typically during the months of March through June) (Ecology 2005). To supply water for the annual agricultural growing season (April 15 through October 15), a substantial amount of supplemental water is diverted from the Yakima River and delivered to Wilson Creek via irrigation canals. Within the Wilson Creek subbasin, the amount of supplemental water is approximately 4.5 times the amount of water naturally supplied via local surface waters (Ecology 2002).

There are three road crossings (including I-90) and one railroad bridge over the lower, SMA-regulated portion Wilson Creek (WDFW 2010). Multiple bridges are mapped over both Naneum and Coleman Creeks and both streams flow under I-90 (Kittitas County 2012, WDFW 2010).

Steep slopes are mapped on the left bank of Wilson Creek near its confluence with the Yakima River and along both banks of Naneum Creek higher in the watershed, near the northern extent of the regulated shoreline of the stream (Kittitas County 2012). The FEMA 100-year floodplain is mapped the length of the Wilson Creek and Coleman Creek inventory areas, and the majority of the Naneum Creek inventory area (except for the upstream extent); however, the floodplain does not occupy the entire inventory area (FEMA 1996). The downstream portion of Wilson Creek is located within the mapped Yakima River channel migration zone.

Streams in the Kittitas Valley have been extensively altered to provide irrigation for crop production, resulting in channels being rerouted, channelized, and diked. The entirety of Wilson and Coleman Creeks, and approximately the lower half of Naneum Creek, flow through actively farmed lands. Some residential and commercial development, associated with farming activities, is located along the streams.

4.5.2 Habitats and Species

4.5.2.1 Fish Use

Table 4-2 summarizes known fish use in Wilson, Naneum, and Coleman Creeks. Summer steelhead, a federally listed threatened species, uses these streams as juvenile rearing habitat (StreamNet 2010). Numerous spring Chinook juveniles rear downstream of fish passage barriers in the lower part of Wilson, Naneum, and Coleman Creeks. Some spring Chinook and steelhead spawning also occurs in these reaches (Haring 2001). There are also reports of rainbow trout and coho salmon rearing within these streams (Anna Lael, personal communication).

Exactly how much of the Wilson Creek stream system was historically suitable for salmonids is unknown. Salmonid use in drier areas of the lower Wilson Creek

watershed likely varied substantially between dry and wet years (Haring 2001). Fish habitat in Wilson Creek and its tributaries has been heavily altered over the last century as the Kittitas Valley was developed for irrigation and agricultural uses, and lower Wilson Creek was channelized and its confluence with Naneum Creek was heavily modified when I-82 was constructed. In addition, Naneum and Coleman Creeks have been channelized and diverted into lower Wilson Creek. Riparian vegetation has been largely converted to cropland and pastures. Logging and extirpation of beavers also changed the character of the watershed. Downed wood is actively removed from channels in the lower part of the watershed to allow for irrigation flows, reducing the presence of woody debris for fish habitat (Haring 2001, Conley et al. 2009).

Streams in the Wilson Creek system have been largely rerouted, channelized, and diked for use as irrigation delivery systems. Fish habitat features such as pools, large wood, and riparian cover are lacking in many areas. Many stream channels have deeply incised or have been dredged to drain agricultural areas, increasing the draining of groundwater and irrigation return flows from surrounding lands (Haring 2001).

The hydrology of tributaries to Wilson Creek is still suitable for salmonids, but many areas are blocked by fish passage barriers including irrigation diversions lacking screens or fish ladders, irrigation canals, and road culverts. Naneum Creek intersects three large irrigation ditches: KRD Canal, Cascade Irrigation District Canal, and Ellensburg Water Company Canal, while Coleman Creek intersects the latter two. Control structures associated with these intersections may entrain fish in the irrigation canals (Haring 2001). Collaborative efforts to improve fish access within Wilson, Naneum, and Coleman Creeks have been underway for more than a decade. The Yakama Nation and Kittitas County Conservation District have worked with irrigation companies and individuals to remove fish passage barriers and install fish screens (Anna Lael, personal communication). Current work in these reaches is under the auspices of the Yakima Tributary Access and Habitat Program.

Table 4-2. Fish Use in Wilson, Naneum, and Coleman Creeks (Source: StreamNet 2010)[1]

Species	Wilson Creek	Naneum Creek	Coleman Creek
Bull Trout	P/M		
Rainbow Trout	R[2]	R[2]	R[2]
Westslope Cutthroat		P/M	
Eastern Brook Trout		P/M	

Species	Wilson Creek	Naneum Creek	Coleman Creek
Spring Chinook	R, S	R	R
Summer Steelhead	R	R	R
Coho salmon	R[2]	R[2]	R[2]

1. P/M = presence/migration; S = spawning; R= rearing
2. Source: Anna Lael, Kittitas County Conservation District

4.5.2.2 Water Quality

Water quality studies in the Wilson/Cherry Creek watershed over the past four decades have found elevated water temperature during summer months, elevated turbidity, suspended solids, and nutrients. Tributaries with agricultural irrigation return flows were found to have significantly higher nutrients, suspended sediment, and fecal coliform bacteria than the mainstem Yakima River. The Wilson/Cherry Creek system contributes approximately 20 percent of the annual fine sediment load to the Yakima River. In addition, little stormwater detention or water quality treatment is present in Ellensburg, and most storm drains discharge to one of the branches of Wilson Creek or its tributaries (Haring 2001). Wilson Creek is included in the 2002 TMDL for turbidity and suspended sediment in the upper Yakima River (Ecology). Wilson Creek is also included on Ecology's 303(d) list for pH.

A TMDL is being implemented to reduce fecal coliform contamination in the Wilson Creek system (2005). Sources of bacterial contamination in the Wilson Creek drainage basin include failing septic systems, livestock, wildlife, and pets (Ecology 2005, Creech 2006).

As part of the Yakima River Watershed Toxics Study, Ecology found that levels of toxaphene in Wilson Creek exceed state standards (see Section 4.1.2 for more information about this study). Toxaphene is a chlorinated pesticide that was banned in 1990. It is not included on the current 303(d) list but has been identified as a contaminant of potential concern in Yakima River fish (Johnson et al. 2010).

High water temperatures are an issue in segments of Wilson, Coleman and Naneum Creeks. TMDLs for temperature have been implemented for Wilson and Naneum creeks (Ecology, 2005). The mainstem of Naneum Creek has been subject to excessive fine sediments resulting from forest practices and road construction (Haring 2001).

4.5.2.3 Riparian Habitat Conditions (Land Cover)

Prior to irrigation, the Wilson Creek stream system likely flowed through dense stands of willow, cottonwood, and aspen within a surrounding shrub-steppe community. Riparian conditions are still relatively intact within the forested canyons along the upper portions of Wilson, Naneum, and Coleman Creeks. The lower portions of the streams flow through agricultural areas with limited and patchy woody cover. The upstream part of Naneum Creek crosses sagebrush and coniferous forest areas (Haring 2001).

4.5.2.4 Wetlands

A small fraction of the Wilson Creek shoreline inventory area is mapped as forested and scrub-shrub wetland. Numerous forested, scrub-shrub, and emergent wetlands are mapped along Naneum Creek. A large emergent wetland is mapped along upper Coleman Creek.

4.5.2.5 Wildlife Habitats and Species

Northern spotted owls (federally listed threatened species) are documented near upper Naneum Creek. This area is also mapped as mule deer winter range.

A small portion of the shoreline inventory area along these streams is mapped as shrub-steppe habitat (USGS 1993).

4.5.3 Land Use

Between its confluence with the Yakima River and the Naneum Creek confluence, Wilson Creek flows through agricultural lands and is paralleled by I-82 at the upstream end. The lower end of Naneum Creek is bordered by I-82 and Fiorito lake until just downstream of the Coleman Creek confluence. From this confluence upstream to near the Thomas Road crossing, Naneum Creek flows through agricultural and rural residential lands. Upstream of Thomas Road, the creek is bordered by undeveloped land zoned for agriculture and forest and range, with some areas of low-density residential development. The upper portion of Naneum Creek (within shoreline jurisdiction) flows through private, commercial forest-zoned land. The Ellensburg Water Company canal (i.e. Town Canal), the Cascade Irrigation District canal, and the KRD North Branch canal cross Naneum Creek.

Coleman Creek flows entirely through agricultural and low-density residential lands, with the exception of an industrial area located between Vantage Highway

and the Cascade Irrigation District canal. The creek also intersects the Ellensburg Water Company canal (i.e. Town Canal).

4.5.4 Public Access

The majority of Wilson, Naneum, and Coleman creeks flow through private property and are not accessible to the public. The John Wayne Heritage Trail crosses over the downstream portion of Naneum Creek and middle segment of Coleman Creek. Olmstead Place State Park is also located on the middle portion of Coleman Creek and can be accessed from North Ferguson Road. The downstream portion of Wilson Creek is accessible from Yakima Canyon State Park.

There is currently no established public access to Naneum Creek within Naneum Ridge State Forest; however, WDNR is currently undertaking a recreation plan for the area, which may include provisions for future access.

4.5.5 Reach Sheets

WILSON CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
2.0 Miles	122.5 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows north to south, flows under and is bordered by I-82/SR 97 along the reaches upstream extent and is crossed by two road roads and railway, which constrain channel movement downstream. The reach contains limited development.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mainly agricultural lands (40%), developed lands (26%), riparian vegetation (14%), and forest (12%), with limited shrubland (6%), grassland (1%), and unvegetated (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Over half of the reach area (64%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The lower portion of the reach (54%) is within the channel migration zone of the Yakima River.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides spawning and known juvenile rearing habitat for spring Chinook and known juvenile rearing habitat for summer steelhead. The presence of coho salmon, bull trout, and rainbow trout is also mapped.

Limited wetland habitat is mapped along both banks of the upstream portion of the river (2% of the reach). Priority biodiversity area and corridor is mapped at the downstream extent of the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for pH and temperature. TMDLs have been implemented for fecal coliform, suspended sediment, turbidity, and temperature.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The reach is constrained by I-82 at the upstream end and by Canyon Road at the downstream end, and the creek has been historically channelized. Most of the riparian corridor has been impact by development and agriculture.	**PUBLIC ACCESS (MAP FOLIO #4)** The downstream portion of Wilson Creek is accessible from Yakima Canyon State Park.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily agriculture (70%), with rural land (30%) at the downstream end. Land ownership is 89% private and 11% public (State Parks).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for agriculture (85%) with areas of other (15%) [right-of-way] zoning.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

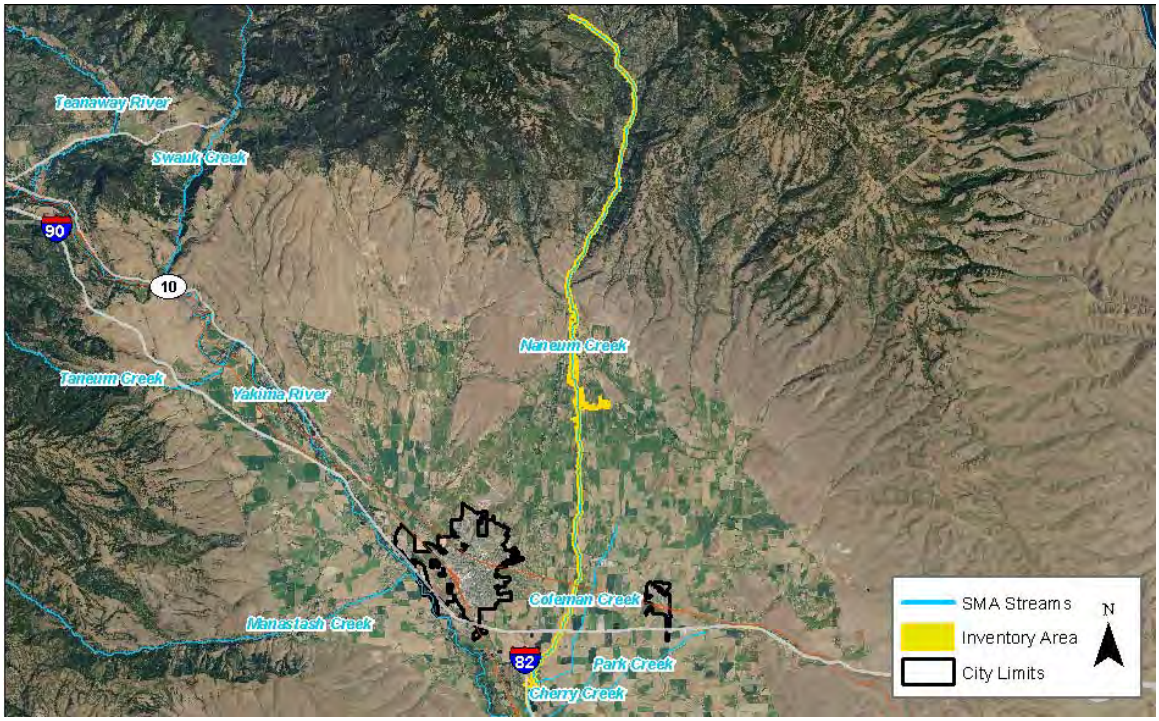
FISH HABITAT QUALITY **Low:** Priority fish use is mapped, but the creek has been historically channelized and the riparian corridor is largely devoid of riparian forest and shrub cover.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach and surrounding habitats have been highly altered by development and agricultural activities.
VEGETATION FUNCTIONS **Low:** There is very limited riparian cover within the reach.	**HYDROLOGIC FUNCTIONS** **Low:** The creek has been historically channelized, modified by the construction of I-82, and flows are highly altered by irrigation uses.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding and channel migration hazards.
- The stream channel and adjacent riparian areas have been highly altered by adjacent development, (including I-82) and agricultural activities (including irrigation uses).
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Study the feasibility of stormwater treatment retrofits to improve runoff water quality from urban areas.

NANEUM CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
25.3 Miles	1,454.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The upstream half of the reach flows through a canyon with moderate topographic relief, while downstream, the reach flows through flat agricultural lands in the valley. Residential development is associated with the downstream half of the reach, which flows under many roads, including I-90 and I-82/SR 97, in addition to the John Wayne Trail.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily agricultural lands (54%), forest (27%), riparian vegetation (14%), with limited developed lands (4%) and shrublands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A limited area of the reach (28%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the downstream half of the reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for pH and temperature. TMDLs have been implemented for fecal coliform and temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides rearing habitat for spring Chinook and summer steelhead. The presence of eastern brook trout, rainbow trout, coho salmon, and westslope cutthroat is also identified. Wetland habitat is mapped, primarily in the central and upstream portions of the reach (20% of the reach). Priority mule deer winter range and elk calving area are mapped along the central and upstream portions of the river, respectively. The Naneum Creek shoreline supports one rare plant species mapped by the Washington Natural Heritage Program.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Several bridges, including I-90, cross the creek. In the lower half of the reach, most of the riparian corridor has been impact by development and agriculture and the creek has been historically channelized. The creek also intersects several irrigation canals.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses over the downstream portion of Naneum Creek.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is agriculture (15%) at the downstream end, with rural land (52%) mid-reach and forestry (33%) at the upstream end. Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) From downstream to upstream, lands within the reach are zoned for agriculture (58%), other (3%) [right-of-way], forest & range (5%), and commercial forestry (33%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded precontact sites located within the reach.

SHORELINE FUNCTION ANALYSIS

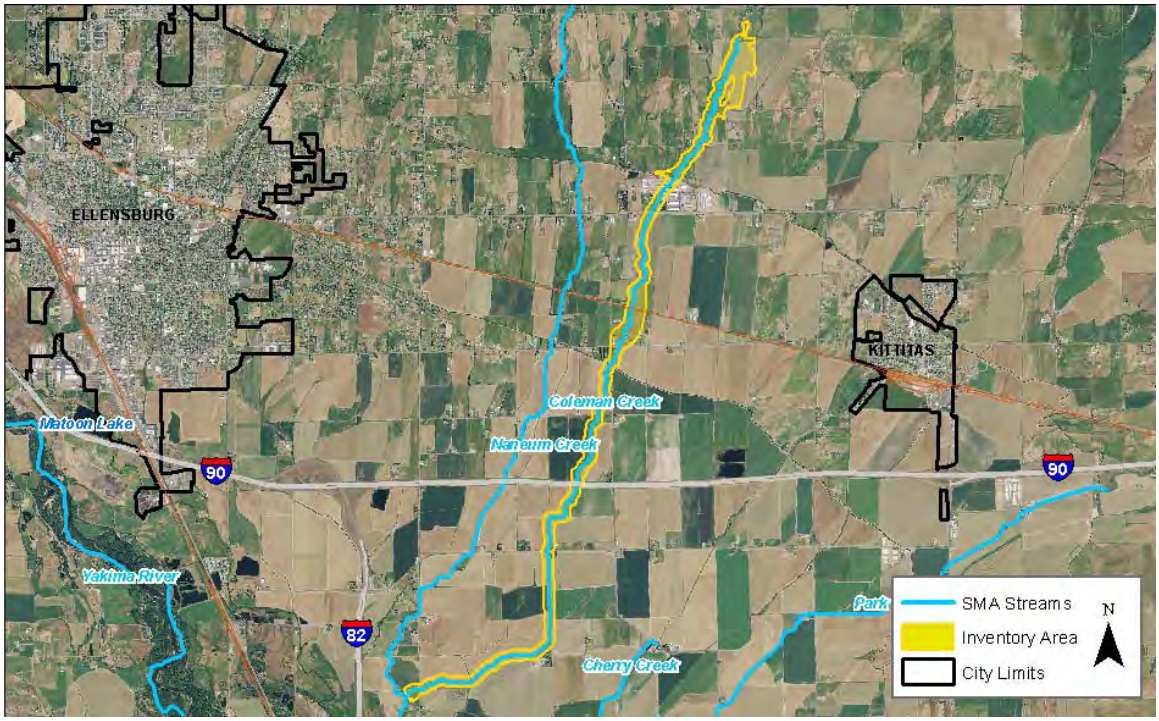
FISH HABITAT QUALITY **Medium:** The downstream portion of the creek has been historically channelized and cleared, but the upstream portion is more intact.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The downstream portion of the reach and surrounding habitats have been highly altered by development and agricultural activities, but habitat significantly improves upstream.
VEGETATION FUNCTIONS **Medium:** There is very limited riparian cover in the downstream portion of the reach, but dense forest and shrub cover bordered the upstream portion.	**HYDROLOGIC FUNCTIONS** **Medium:** The downstream portion of the creek has been historically channelized and flows are highly altered by irrigation uses. Hydrologic functions in the upper watershed are generally intact.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding and channel migration hazards.
- The downstream portions of the stream channel and adjacent riparian areas have been highly altered by adjacent development and agricultural activities (including irrigation uses).
- Encourage irrigation districts and private irrigators to work with the Yakima Tributary Access & Habitat Program to install fish screen on irrigation diversion, correct fish passage barriers and separate canals and creek to prevent entrainment of fish.
- Control structures associated with irrigation canal intersections may entrain fish within the canals.
- Decommission roads, where possible, to reduce sedimentation in the stream.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Protect intact habitat in the upper reaches.
- The reach contains a rare plant species, mapped by the Washington Natural Heritage Program.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.

COLEMAN CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
6.8 Miles	385.7 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach generally flows north to south through flat agricultural lands. Residential and commercial development is located adjacent to the river in places. The reach flows under multiple roads, including I-90, in addition to the John Wayne Trail.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is agricultural lands (94%) with limited developed lands (6%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Approximately 44 percent of the reach area is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The majority of the reach has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature. A TMDL has been implemented for fecal coliform.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides known juvenile rearing habitat for spring Chinook and summer steelhead. The presence of rainbow trout and coho salmon is also identified.

Wetland habitat is mapped along the river, mostly at the upstream extent of the reach (13% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Several bridges, including I-90, cross the creek. Within the reach, most of the riparian corridor has been impacted by development and agriculture and the creek has been historically channelized. The creek also intersects two irrigation canals.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses over the middle segment of Coleman Creek. Olmstead Place State Park is also located on the middle portion of Coleman Creek and can be accessed from North Ferguson Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily agriculture (99%), with a patch of rural land (1%) mid-reach. Land ownership is 86% private and 14% public (State Parks).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for agriculture (95%), with a few areas of other (5%) [right-of-way] zoning.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** Olmstead Place State Park, a historic site located in the reach, features original structures constructed in the late 1800s and early 1900s from early settlers of this area.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** Priority fish use is mapped, but the creek has been historically channelized and the riparian corridor is largely devoid of riparian forest and shrub cover.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach and surrounding habitats have been highly altered by agricultural activities.
VEGETATION FUNCTIONS **Low:** There is very limited riparian cover within the reach.	**HYDROLOGIC FUNCTIONS** **Low:** The creek has been historically channelized and flows are highly altered by irrigation uses.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding and channel migration hazards.
- Control structures associated with irrigation canal intersections may entrain fish within the canals.
- The stream channel and adjacent riparian areas have been highly altered by adjacent development, (including I-90) and agricultural activities (including irrigation uses).
- Encourage irrigation districts and private irrigators to work with the Yakima Tributary Access & Habitat Program to install fish screens on irrigation diversions, correct fish passage barriers and separate canals and creeks to prevent entrainment of fish.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

4.6 Fiorito Lake

Fiorito Lake is located upstream of the confluence of Wilson and Cherry Creeks, along the left bank of Naneum Creek and adjacent to I-82.

4.6.1 Physical Characterization

Fiorito Lake is oriented north-south and is approximately 0.7 mile long and about 0.1 mile in width, occupying roughly 54 acres. The lake is a former gravel pit. A berm separates the northern two-thirds of the lake from the southern part but allows flows to pass from north to south. The lake drains from its southeast corner back to Naneum Creek, passing under I-82, approximately 0.35 mile downstream of its southern extent.

The FEMA 100-year floodplain is mapped in much of the reach inventory area, particularly in the northern, western, and southern areas (FEMA 1996).

4.6.2 Habitats and Species

4.6.2.1 Fish Use

The lake is stocked with rainbow trout.

4.6.2.2 Water Quality

Fiorito Lake is considered a Category 4c waterbody on Ecology's 2008 303(d) list because of the presence of exotic invasive species (Eurasian watermilfoil). Category 4c waterbodies are impaired by causes that cannot be remedied by a TMDL and must be addressed through more complex solutions.

Eurasian watermilfoil can degrade water quality in just a few growing seasons by reducing dissolved oxygen, releasing excess nutrients when it decomposes (potentially increasing algal growth), increasing water temperature by absorbing sunlight, and raising the pH.

4.6.2.3 Riparian Habitat Conditions (Land Cover)

Fiorito Lake is located in an agricultural area and less than 200 feet east of I-82/U.S. 97. There is very little woody riparian cover along the lake's shoreline. An access road runs along the western side of the lake.

4.6.2.4 Wetlands

A small portion of the lake's shoreline inventory area is mapped as palustrine emergent wetland.

4.6.2.5 Wildlife Habitats and Species

No priority habitats or species are mapped along Fiorito Lake. The lake is located in an agricultural area near a major roadway and is unlikely to provide high-quality wildlife habitat.

Approximately 20 percent of the Fiorito Lake shoreline inventory area is mapped as shrub-steppe habitat (USGS 1993).

4.6.3 Land Use

Fiorito Lake is bordered by I-82 along its entire western shoreline. The lake is bordered by agricultural lands to the north, east, and south.

4.6.4 Public Access

The lake can be accessed from Number 6 Road.

4.6.5 Reach Sheet

FIORITO LAKE

SHORELINE LENGTH:
0.7 Mile

REACH INVENTORY AREA:
134.4 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The waterbody shoreline is oriented north to south and is bordered by I-82/SR 97 to the west. Limited development is associated with the shoreline, aside from the highway. A constructed berm splits the waterbody into two sections, but also flow to pass from north to south before the waterbody drains to Wilson Creek from its southeastern border.

LAND COVER (MAP FOLIO #3)

This reach contains significant agricultural lands (43%) and open water (39%). A number of other land cover types are also present, including: developed lands (9%), grasslands (4%), riparian vegetation (3%), shrublands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A large extent of the reach (70%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

Fiorito Lake is a Category 4c waterbody on the State's water quality list because of the presence of exotic invasive species

HABITATS AND SPECIES (MAP FOLIO #1)

No priority fish use is mapped by WDFW.

Wetland habitat is mapped along the shoreline of the waterbody at several locations (16% of the reach). No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The shoreline is constrained by I-90 to the west.	**PUBLIC ACCESS (MAP FOLIO #4)** The lake can be accessed from Number 6 Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use around the lake is primarily agriculture (78%), with rural (19%) land at the downstream end and parks & recreation land (2%) at the upstream end. Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned primarily for agriculture (73%), with commercial zoning (19%) to the south and other (9%) [right-of-way] zoning to the west.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** No priority fish use is mapped; the lake does not have a surface water connection to the Yakima River.	**TERRESTRIAL HABITAT QUALITY** **Low:** The shoreline is highly altered, and riparian vegetation is generally absent.
VEGETATION FUNCTIONS **Low:** The shoreline is largely devoid of natural riparian vegetation.	**HYDROLOGIC FUNCTIONS** **Low:** The lake is a manmade artifact of gravel mining.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Manage non-native invasive aquatic vegetation.
- Educate shoreline property owners about measures to protect and restore riparian areas.

4.7 Cherry Creek and Tributaries

Cherry Creek is a left-bank tributary to Wilson Creek, emptying at RM 0.5, downstream from the I-82/Thrall Road overpass. Parke and Cooke creeks join Cherry Creek near Moe Road. The streams generally flow from the northeast to the southwest.

4.7.1 Physical Characterization

Cherry, Parke, and Cooke creeks flow through agricultural lands and are crossed by several bridges. As discussed under Wilson Creek and Tributaries (Section 4.5.1), most of the streams in the area have been extensively altered to provide water for irrigation.

The FEMA 100-year floodplain is mapped along the lengths of the Cherry, Parke and Cooke inventory areas (FEMA 1996).

4.7.2 Habitats and Species

4.7.2.1 Fish Use

Cherry Creek and Cooke creeks provide rearing and spawning habitat for summer steelhead (federally listed threatened species) and spring Chinook (StreamNet 2010, Haring 2001). Rainbow trout are also present in Cherry, Parke, and Cooke creeks (StreamNet 2010), and there are reports of rainbow trout rearing within these streams (Anna Lael, personal communication).

Fish habitat in Cherry Creek and its tributaries has been heavily altered over the last century as the Kittitas Valley was developed for irrigation and agricultural uses. The stream has been channelized and riparian vegetation has been largely converted to cropland and pastures. Logging and extirpation of beavers also changed the character of the watershed. Downed wood is actively removed from channels in the lower part of the watershed to allow for irrigation flows, reducing the presence of woody debris for fish habitat (Haring 2001).

As described in Section 4.5.2, use of the Wilson Creek stream system for delivery of irrigation flows has resulted in greater streamflows during the dry season than would have occurred naturally. Some of the Cherry Creek tributaries that now flow year-round may not have been perennial before irrigation began (Haring 2001).

4.7.2.2 Water Quality

Water quality studies in the Wilson/Cherry Creek watershed over the past four decades have found elevated water temperature during summer months, elevated turbidity, suspended solids, and nutrients. Tributaries with agricultural irrigation return flows were found to have significantly higher nutrients, suspended sediment, and fecal coliform bacteria than the mainstem Yakima River. The Wilson/Cherry Creek system contributes approximately 20 percent of the annual fine sediment load to the Yakima River (Haring 2001). Tributaries to upper Cherry Creek are on the 303(d) list for high water temperatures. TMDLs for temperature, organic pesticides, and fecal coliform have been implemented for Cherry Creek and a TMDL for fecal coliform for Cooke Creek have been implemented (Ecology 2002 & 2005).

4.7.2.3 Riparian Habitat Conditions (Land Cover)

Prior to irrigation, the Kittitas Valley likely supported a shrub-steppe community with dense woody vegetation along lower tributary streams (Haring 2001). Today, woody vegetation is limited to narrow bands and patches of trees and shrubs, particularly along the lower mile of Cherry Creek. The upper part of Cherry Creek and all of Parke Creek flow through agricultural areas where woody riparian vegetation is lacking or sparse. Large wood is removed from streams used for irrigation deliveries in the lower watershed. Homogenous stands of reed canarygrass along tributaries to Cherry Creek suppress and compete with native woody vegetation (Haring 2001).

4.7.2.4 Wetlands

A very small portion of the Cherry Creek shoreline inventory area is mapped as freshwater emergent wetland. No wetlands are mapped along Parke Creek.

4.7.2.5 Wildlife Habitats and Species

No priority habitats or species are documented along Parke or Cherry Creek. These streams flow through agricultural areas and are unlikely to provide high-quality wildlife habitat.

4.7.3 Land Use

Cherry, Parke, and Cooke creeks flow through agricultural lands, and are bordered in several areas by low-density residential development.

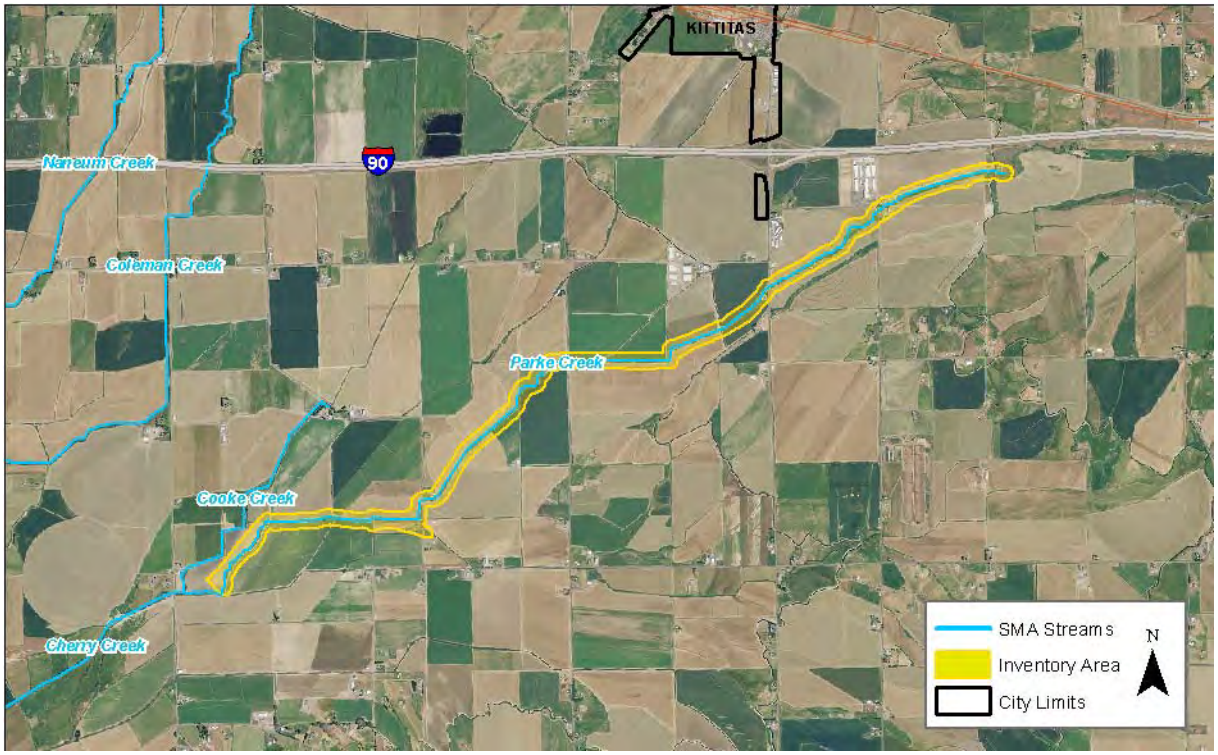
4.7.4 Public Access

The entirety of Cherry, Parke, and Cooke creeks flow through private property and are not accessible to the public, but can be viewed from several roads that cross over the streams, including: Thrall Road, Cleman Road, Denmark Road, Badger Pocket Road (Parke Creek only) and South Ferguson Road (Parke Creek only).

4.7.5 Reach Sheets

PARKE CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.2 Miles	268.5 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows through flat agricultural lands from the northeast to southwest, crossing under several roads. A few residences and agricultural associated buildings are located next to the reach.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is mostly agricultural lands (94%) with patches of developed lands (5%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

About 59 percent of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

A TMDL has been implemented in this reach for fecal coliform.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of rainbow trout in this reach, and there are reports of rearing habitat.

No wetland habitat is mapped along the river. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Most of the riparian corridor has been impacted by development and agriculture and the creek has been historically channelized. There are several road crossings within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The reach is not accessible to the public, but viewable at several road crossings.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily agriculture (86%) with rural land (14%) at the upstream end. Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for primarily for agriculture (99%) with areas of other (1%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

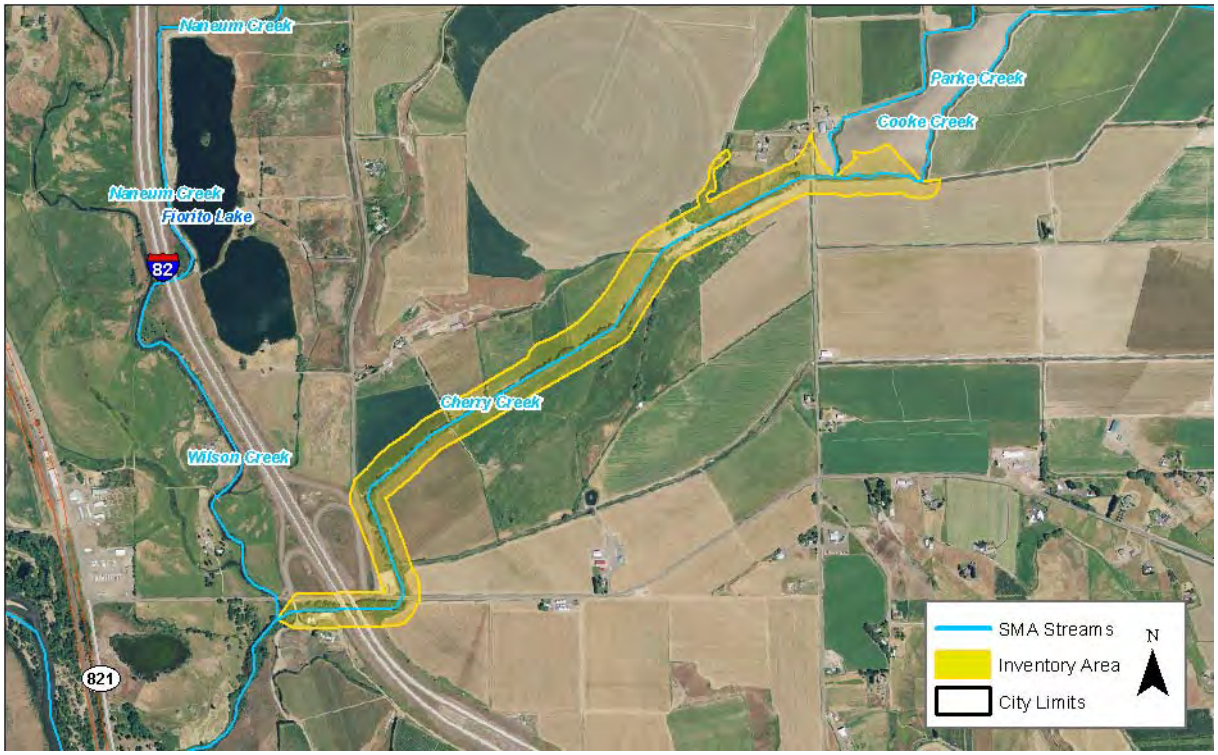
FISH HABITAT QUALITY **Low:** Priority fish use is mapped, but the creek has been historically channelized and the riparian corridor is largely devoid of riparian forest and shrub cover.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach and surrounding habitats have been highly altered by development and agricultural activities.
VEGETATION FUNCTIONS **Low:** There is very limited riparian cover within the reach.	**HYDROLOGIC FUNCTIONS** **Low:** The creek has been historically channelized and flows are highly altered by irrigation uses.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding.
- The stream channel and adjacent riparian areas have been highly altered by adjacent development, (including I-90) and agricultural activities (including irrigation uses).
- One of approximately 8 identified fish screen/passage projects has been completed on the stream (Anna Lael, personal communication).
- There is no public access to the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Encourage irrigation districts and private irrigators to work with the Yakima Tributary Access & Habitat Program to install fish screen on irrigation diversions and correct fish passage barriers.
- Educate shoreline property owners about measures to protect and restore riparian areas.

CHERRY CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.8 Miles	93.5 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows through flat agricultural lands from the northeast to southwest, crossing under Moe Road, Thrall Road, and I-82. Limited development is associated with the reach.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is primarily agricultural lands (78%) and developed lands (21%), with limited shrublands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Over half of the reach (59%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides known juvenile rearing habitat for spring Chinook and summer steelhead. The presence of rainbow trout is also mapped, and there are reports of rearing.

Limited wetland habitat is mapped along the river, primarily near the confluence with Wilson Creek (5% of the reach). No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

TMDLs have been implemented in this reach for 4,4'-DDE, DDT, dieldrin, and fecal coliform.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Most of the riparian corridor has been impacted by development and agriculture and the creek has been historically channelized. I-82 crosses the downstream end of the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The reach is not accessible to the public, but viewable from Moe Road and Thrall Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is agriculture (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for primarily for agriculture (86%) with areas of other (14%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

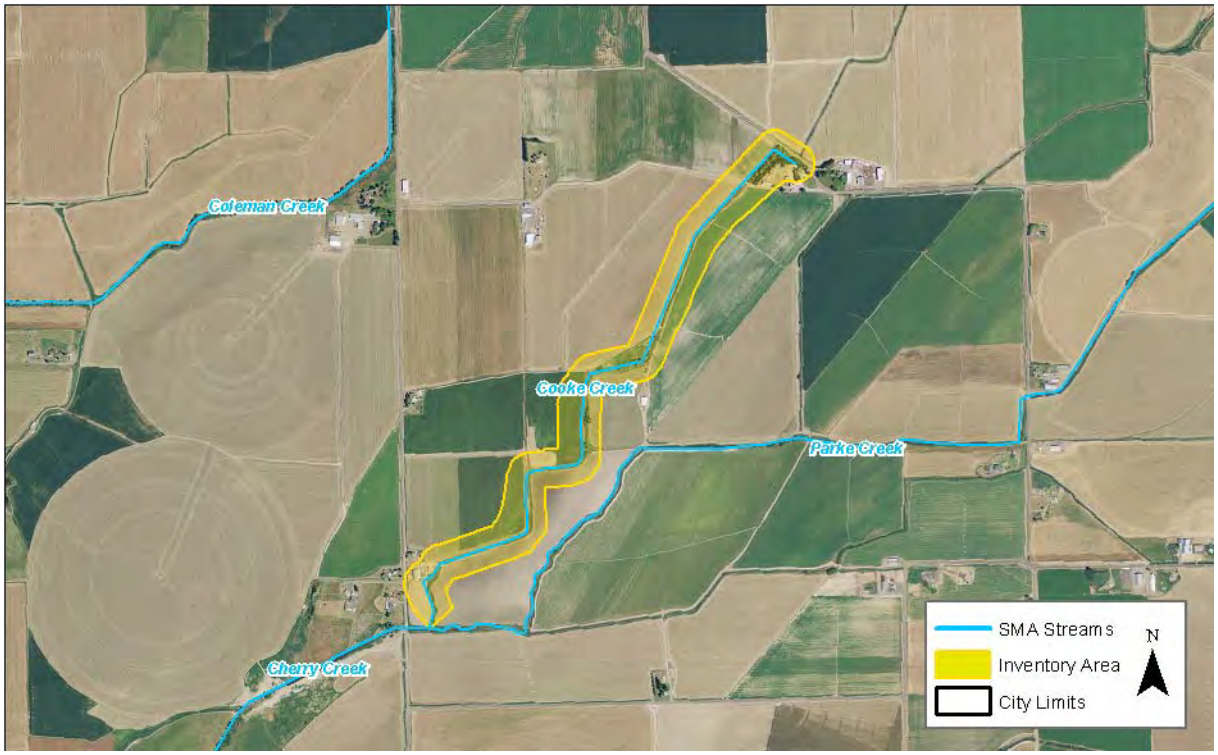
FISH HABITAT QUALITY **Low:** Priority fish use is mapped, but the creek has been historically channelized and the riparian corridor is largely devoid of riparian forest and shrub cover.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach and surrounding habitats have been highly altered by development and agricultural activities.
VEGETATION FUNCTIONS **Low:** There is very limited riparian cover within the reach.	**HYDROLOGIC FUNCTIONS** **Low:** The creek has been historically channelized and flows are highly altered by irrigation uses.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding.
- The stream channel and adjacent riparian areas have been highly altered by adjacent development, (including I-82) and agricultural activities (including irrigation uses).
- No fish passage barriers or unscreened irrigation diversions remain in this reach.
- There is no public access to the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Educate shoreline property owners about measures to protect and restore riparian areas.

COOKE CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.4 Miles	71.6 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows through flat agricultural lands from the northeast to southwest; limited development is associated with the reach.

LAND COVER (MAP FOLIO #3)

This reach contains significant agricultural lands (93%) with patches of developed lands (7%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

Over half of the reach (56%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and TMDLs have been implemented for fecal coliform and temperature

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides known juvenile rearing habitat for spring Chinook. There are also reports of rainbow trout rearing within the reach.

No wetland habitat is mapped along the river. No priority habitats or species are identified in this reach by WDFW.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Most of the riparian corridor has been impacted by development and agriculture and the creek has been historically channelized.	**PUBLIC ACCESS (MAP FOLIO #4)** The reach is not accessible to the public, but is viewable from S. Ferguson Road.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is agriculture (100%). Land ownership is 100% private.	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for primarily for agriculture (98%) with areas of other (2%) [right-of-way] zoning at the upstream and downstream ends.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Low:** Priority fish use is mapped, but the creek has been historically channelized and the riparian corridor is largely devoid of riparian forest and shrub cover.	**TERRESTRIAL HABITAT QUALITY** **Low:** The reach and surrounding habitats have been highly altered by development and agricultural activities.
VEGETATION FUNCTIONS **Low:** There is very limited riparian cover within the reach.	**HYDROLOGIC FUNCTIONS** **Low:** The creek has been historically channelized and flows are highly altered by irrigation uses.

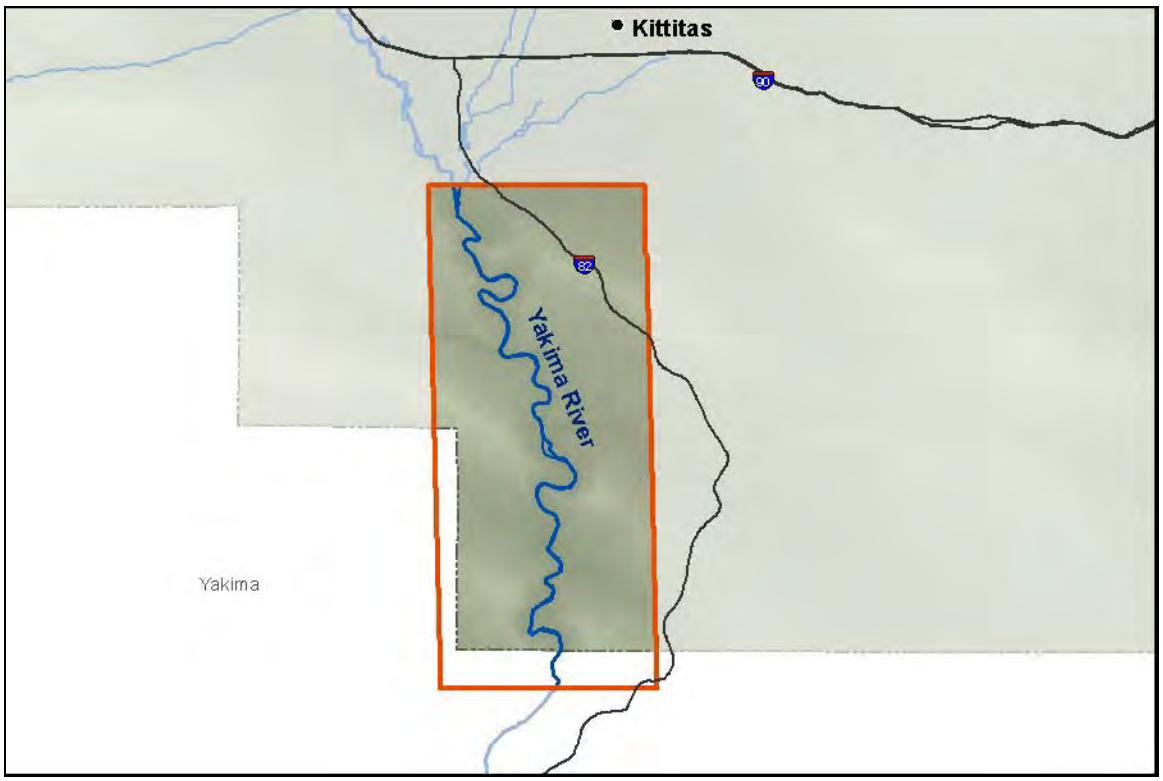
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- New development should be set back an adequate distance from the shoreline to protect riparian functions and protect structures from flooding.
- The stream channel and adjacent riparian areas have been highly altered by activities (including irrigation uses).
- There is no public access to the reach.
- Educate shoreline property owners about measures to protect and restore riparian areas.
- Encourage private irrigators to work with the Yakima Tributary Access & Habitat Program to install fish screens on irrigation diversions and correct fish passage barriers.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.

CHAPTER 5. YAKIMA CANYON AND LITTLE NACHES RIVER

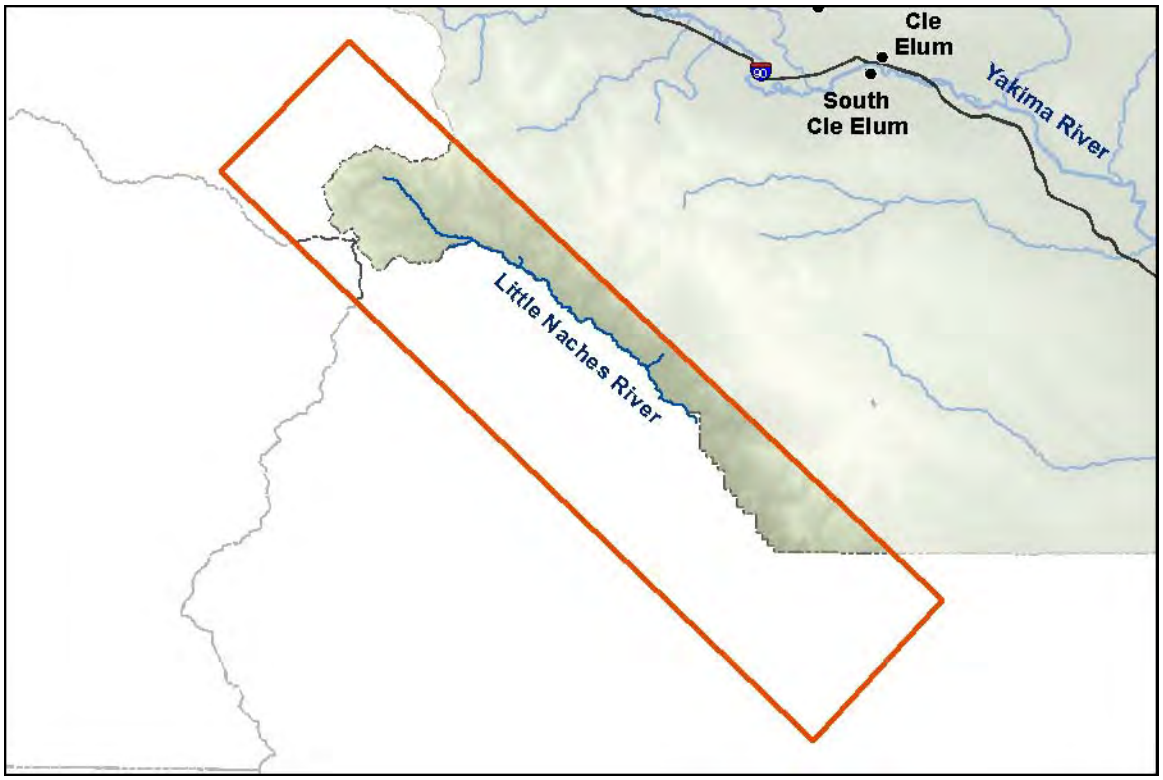
This chapter describes the conditions within the shoreline inventory areas of the portions of the Yakima Canyon (Figure 5-1) and Little Naches River (Figure 5-2) that lie within Kittitas County. These stream reaches are described in terms of their physical characteristics, ecological conditions, and human environment/land use characteristics. Readers are encouraged to review Chapter 2 and the maps in Appendix A for additional context on the information presented here.

Figure 5-1. "Yakima Canyon" shoreline.



Characteristics for the shoreline reaches are summarized on "reach sheets" included in this chapter. The information on the reach sheet is based upon available county-wide data sources that describe key physical, ecological, and land use characteristics. A description of the available data sources, including data limitations, is presented in Appendix B.

Figure 5-2. "Little Naches River" shorelines.



5.1 Yakima Canyon

This section describes the portion of the Yakima River that flows through the Yakima Canyon (approximately 21 miles), from the Wilson Creek confluence downstream to the Kittitas-Yakima County boundary (approximately 1.5 miles downstream from Roza Dam). For this analysis, the portion of the Yakima River that flows through the Yakima Canyon was divided into 2 reaches: Reach 1 (1.6 miles) extends from the County boundary to Rosa dam and Reach 2 (19.1 miles) extends from Rosa Dam to the Wilson Creek confluence.

The Yakima River is designated as a "shoreline of statewide significance" because it has a mean annual flow of more than 200 cubic feet per second.

5.1.1 Physical Characterization

The Yakima River flows generally from north to south through the canyon and is relatively sinuous compared to the upstream reaches of the river. The landscape in the Yakima Canyon is arid, with little agricultural land and the only appreciable tree cover located in the narrow riparian corridor of the river.

Only a few river crossings are located over this stretch of river, including two railroad bridges and the Umtanum pedestrian bridge. Limited residential development is located along the river; however, a railroad corridor and State Route 821 (Canyon Road) parallel the right and left river banks, respectively, along the canyon bottom. An irrigation canal borders the right bank of the river, extending downstream approximately 0.4 mile from Roza Dam. Several parking lots are located on the left bank of the river, providing access for campers, rafters, and boaters.

The steep, deep-walled canyon confines the river into a single channel, with no side-channel complexes and few islands or backwater areas. The canyon is a transport reach, with confinement limiting channel complexity (Haring 2001).

Much of the land adjacent to the river is mapped as steep slopes, which indicates the potential for erosion or landslide hazards. Although there are no formally mapped landslide hazard areas along these reaches (WDNR 2010; Kittitas County 2012), a significant rain event in 1998 resulted in over 30 landslides upstream of Roza Dam. Many of these landslides narrowed the river by up to half (Haring 2001).

Due to the moderate to steep canyon slopes and relatively narrow area between these slopes, the floodplain is confined within a portion of the inventory area for the majority of these reaches (FEMA 1996). At several locations, where tributary streams drain to the river, the floodplain extents out of the inventory area and upstream into the tributaries. Identified channel migration zones are present throughout much of the inventory area, although some areas are disconnected from the active channel by Canyon Road.

Roza Dam, which is located near the downstream end of this portion of the river, was built in 1941 to divert water from the Yakima River for irrigation purposes. The dam impounds approximately 100 acres of water behind a 67-foot-high concrete dam. The dam has a fish passage facility.

5.1.2 Habitats and Species

5.1.2.1 Fish Use

Table 2-14 in Chapter 2 shows the listing status of all fish species in Kittitas County. Within the Yakima Canyon, the river provides rearing habitat for summer steelhead (federally listed as threatened) and both spawning and rearing habitat for spring Chinook salmon. This part of the river is also used by coho salmon, bull trout (federally listed as threatened), fall Chinook, mountain whitefish, rainbow trout, and westslope cutthroat (StreamNet 2010). The presence of sockeye salmon is also likely, due to the recent re-introduction of the species to Lake Cle Elum.

The Yakima River steelhead recovery plan (Conley et al. 2009) describes Roza Dam as a potential bottleneck for outmigrating smolts during low runoff. Smolts that are delayed in the pool above the may experience mortality, residualization, or delayed arrival in the lower Yakima River until periods when low flow, high temperature, and increased predator activity reduce survival. However, the Roza Dam spillway was modified in 2011, which may have resolved the smolt bottleneck (Sean Gross, personal communication).

A new fish ladder installed at Roza Dam in 1989 allows fish passage at minimum pool and full pool levels. However, the Yakima River steelhead plan (Conley et al. 2009) indicates there is no passage at water levels between these extremes, which occur while the pool is being drained or filled (a period of days for a few times each year).

The diversion of flow at Roza Dam has substantially altered the hydrologic regime downstream, with lower winter flows and higher flows during the summer irrigation season. Water is diverted from the river into the canal at Roza Diversion Dam and flows about 11 miles to the Roza Powerplant near Yakima. Flows return to the river below the powerplant. When power is being generated at the Roza Powerplant, there is a minimum flow target of 400 cubic feet per second (cfs) below Roza Diversion Dam. Power generation is terminated when the flow target cannot be met with the plant operating (Haring 2001, Reclamation and Ecology 2011a).

One measure proposed in the Yakima Basin Integrated Water Resource Management Plan is to further subordinate water diversions for power generation at Roza Dam to support outmigration of juvenile steelhead, Chinook, sockeye, and coho. Additional subordination would be subject to an agreement on mitigation and approval by the U.S. Bureau of Reclamation, the Bonneville Power Administration, and the Roza Irrigation District (Reclamation and Ecology 2011a).

Many other historic and ongoing events have contributed to the decline of Yakima basin fish populations, including land development, construction of storage dams in the upper watershed and on the Columbia River, and commercial fishing (Reclamation and Ecology 2011a).

Anadromous fisheries have improved in recent years as a result of better fisheries management, habitat and facility improvements, hatchery supplementation, and reintroduction efforts. Reintroduction of coho in the Yakima basin began in the mid-1980s. Summer Chinook reintroduction is currently being undertaken (Reclamation and Ecology 2011a). Efforts to restore coho salmon within the Yakima River basin rely largely upon releases of hatchery-produced fish. Natural reproduction of hatchery-reared coho salmon is now occurring in the Yakima River. The upper Yakima wild Chinook salmon population is supplemented with hatchery stock reared at the Cle Elum Supplementation and Research Facility (CESRF) and released

from three acclimation sites (Reclamation 2011, Reclamation and Ecology 2011a). The CESRF has been operating since 1997 and is managed by WDFW and the Yakama Nation.

Pacific lamprey is another native fish species that has recently become a focus of restoration efforts. The Columbia River basin historically supported abundant Pacific lamprey populations, but the population has steeply declined and is virtually non-existent in the upper Yakima watershed. Major factors in the species' decline include fish passage barriers, poor water quality, floodplain degradation, and highly altered stream hydrology (CRITFC 2011; USFWS 2011).

The Yakima Basin Integrated Water Resource Management Plan (2011) recommends acquisition of 15,000 acres in the Yakima River Canyon, including the valley bottom and eastern slopes, from the Yakima River to I-82. This would provide an opportunity to protect a large swath of shrub-steppe habitat along with the Yakima Canyon riparian area. Additional efforts to improve fish habitat and populations in the Yakima basin include the following (Reclamation and Ecology 2011a):

- The Yakima/Klickitat Fisheries Project, managed by WDFW and the Yakama Nation, is aiming enhance salmon populations through supplementation along with habitat protection and restoration. Species currently being enhanced include spring, summer and fall Chinook salmon, coho salmon, sockeye salmon, and steelhead trout.

- The Yakima River Side Channels Project, also managed by WDFW and the Yakama Nation through the Yakima/Klickitat Fisheries Project, focuses on restoring habitat in the Easton, Ellensburg, Selah, and Union Gap reaches on the Yakima River and the Gleed reach in the lower Naches. Active habitat restoration actions include reconnecting structurally diverse alcoves and side channels, introducing large woody debris, fencing, and revegetating riparian areas.

- The Yakima Tributary Access and Habitat Program has numerous participants including the Kittitas County Conservation District. The program seeks to restore fish passage to Yakima River tributaries that historically supported salmon and to improve habitat through measures such as fish screening and fish passage improvements, riparian plantings, fencing, and irrigation system improvements.

As a component of the Yakima River Basin Water Storage Feasibility Study, the U.S Bureau of Reclamation (2007) is studying the Wymer Dam and Reservoir Project. The proposed project would pump water from the Yakima River and store it in a reservoir on Lmuma Creek, approximately 8 miles upstream of the Roza Diversion

Dam. The purpose of the project is to create additional storage in the Yakima River basin in order to:

- Improve anadromous fish habitat;
- Improve the water supply for irrigators; and
- Meet future municipal water supply

5.1.2.2 Water Quality

During spring and summer, levels of organochlorine pesticides, turbidity, and suspended sediments in the Yakima River basin sometimes exceed state water quality standards. In addition to concerns associated with turbidity in streams, suspended sediments also act as a transport mechanism for pesticides. Ecology completed an assessment of suspended sediment, turbidity, organochlorine pesticides, bacteria, and metals in the upper Yakima River basin in 1999, focusing on the mainstem river and major tributaries from Selah upstream to Cle Elum. A TMDL for suspended sediment, turbidity, and pesticides in the upper Yakima River and major tributaries was implemented in 2002 and a TMDL for temperature was implemented in 2005 (Ecology).

The Department of Ecology has recently undertaken the Yakima River Watershed Toxics Study to evaluate levels of toxic contaminants in streams, rivers, reservoirs, and lakes from the Yakima River's headwaters near Snoqualmie Pass to its confluence with the Columbia River. Levels of toxic compounds in Yakima River fish were recognized as a concern in the 1990s. During 2006 - 2008, Ecology collected hundreds of samples of fish and water to evaluate current levels of toxic compounds such as DDT, PCBs, and several others, many of which were historically used in agriculture or utilities but have been banned in recent years. These compounds attach to soil particles which are then washed downstream by precipitation or irrigation. Although the compounds have not been applied in recent years, they can persist in the environment. Ecology's study found that fish in the upper Yakima River are currently meeting or close to meeting human health criteria for all toxic substances tested except PCBs. The level of toxics generally increases in downstream areas. The months of greatest concern for human-caused turbidity, suspended sediment loading, and pesticide transport are during the irrigation season, April through October. Storms or rain-on-snow events can also mobilize sediments and pesticides at any time of the year (Johnson et al. 2010; Ecology 2009; Joy 2002).

Ecology found that irrigation returns are the dominant cause of degraded water quality in the Yakima River and are the most important sources to control for reducing turbidity, pesticides, and PCBs. However, urban stormwater runoff from

cities including Ellensburg also appears to be a significant source of these pollutants (Johnson et al. 2010).

The river within Yakima Canyon is on Ecology's 303(d) list for dioxin. However, dioxin was excluded from the Ecology 2006 water quality study due to budget constraints and because the fish tissue survey showed human health criteria were very close to being met (Johnson et al. 2010).

5.1.2.3 Riparian Habitat Conditions (Land Cover)

Riparian vegetation along the Yakima River within the canyon consists mainly of cottonwood and willow with scattered pine trees. Canyon Road and the railroad parallel the river leaving little space for natural riparian vegetation in some areas. The steep canyon walls support sparse plant cover, with sagebrush and various grasses amid rock outcrops. Shrubs are the dominant land cover in this part of the Yakima River corridor.

5.1.2.4 Wetlands

Less than 1 percent of the Yakima River shoreline inventory area in the canyon is mapped as wetland along the river. The small amount of wetland area is due to the relatively arid conditions within the steep, confined canyon.

5.1.2.5 Wildlife Habitats and Species

Priority wildlife species mapped in the Yakima River Canyon include bighorn sheep, elk, golden eagle, and mule deer. The canyon provides cliff/bluff habitats and serves as a migratory corridor for many species of birds, reptiles, amphibian and mammals.

Shrub-steppe habitat is a dominant vegetation community in the Yakima River canyon (USGS 1993). This habitat type is dominated by perennial bunchgrasses and shrubs such as sagebrush (WDFW 2008). Kittitas County has several types of shrub-steppe communities with different combinations of plant species, as described in Section 2.3.2 in Chapter 2.

Shrub-steppe habitat supports numerous unique plant and wildlife species (Azerrad et al. 2011). In the Yakima River canyon, two plant species associated with shrub-steppe communities have been mapped by the Washington Natural Heritage Program: Hoover's desert parsley and pauper milk vetch. While it was historically a common type of vegetation community in eastern Washington, shrub-steppe habitat has been largely converted to agriculture and is considered a priority habitat by WDFW (see Section 2.6.3.1).

5.1.3 Land Use

From the Wilson Creek confluence downstream to Roza Dam, the Yakima River is bordered by Canyon Road along the east bank and a railroad along the west bank. The railroad crosses the river near the dam and borders its east bank, between the river and Canyon Road. Outside of the transportation corridors, the surrounding shorelands are undeveloped and zoned for agriculture and forest/range. Over half of the land area bordering the river is state and federal lands (WDFW and BLM, respectively).

5.1.4 Public Access

The Yakima River Canyon supports a premier trout fishery and is a significant tourist attraction. Three sites, which include boat launches, provide access to the Yakima Canyon: Lmuma Creek, Big Pines, and Roza Recreation areas (Kittitas County 2011). In addition to these facilities, boat launch facilities are located at mileposts 8 and 10, and at the Umtanum Recreation Area. In addition, SR 821 parallels the majority of the reaches, providing informal access and views of the river.

5.1.5 Reach Sheets

YAKIMA RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.6 Miles	121.7 Acres

PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows as a single channel through a canyon with moderate topographic relief. The upstream portion of the reach is confined by the Roza Dam, bordered by an irrigation canal and is crossed by a railroad. Downstream, the railroad and Canyon Road parallel the channel.

LAND COVER (MAP FOLIO #3)

This reach contains shrubland (41%), open water (19%), grassland (15%), and riparian vegetation (13%). A number of other land cover types are also present, including: forest (9%), developed lands (2%), and unvegetated lands (1%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

About half the reach area (49%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach, although landslides have occurred on steep slopes bordering the canyon.

WATER QUALITY

The reach is not listed on the State Water Quality Assessment list of 303(d) waters.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides spawning and known juvenile rearing habitat for summer steelhead and known spawning habitat for spring Chinook. The presence of sockeye salmon, coho salmon, bull trout, fall Chinook, mountain whitefish, rainbow trout, and westslope cutthroat is also identified.

Limited wetland habitat is mapped along the river (<1% of the reach). Priority mule deer winter range, bighorn sheep winter range, elk winter range, cliffs/bluffs, and biodiversity areas and corridor are mapped along the reach. In addition, golden eagle is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) Roza Dam is located at the upstream end of the reach, and a railroad borders much of the east shoreline of the river. An irrigation canal, originating at Roza Dam, is located along the western shoreline at the upstream end.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no public access to the reach, but SR 821 parallels the majority of the reach, providing views of the river.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (80%), with agricultural land (20%) at the upstream end of the reach. Land ownership is 56% private and 44% public (BLM).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for forest & range (57%), agriculture (20%), and other (23%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

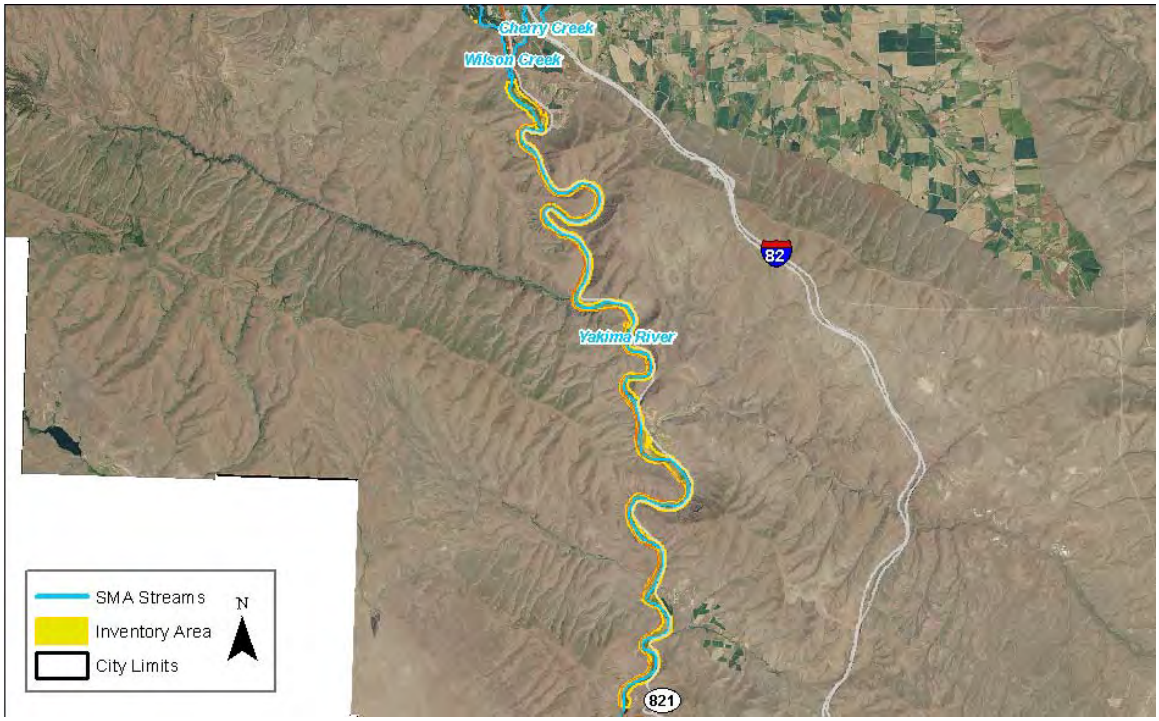
FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but habitat is altered upstream by Roza Dam.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The eastern shoreline of the river is generally unaltered and connects to high-value habitat areas, but the western shoreline is altered by a railroad.
VEGETATION FUNCTIONS **Medium:** The river is bordered by dense shrub cover, but vegetation has been altered along the eastern bank by a railroad.	**HYDROLOGIC FUNCTIONS** **Low:** The Yakima Canyon functions primarily as a transport reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Upstream fish passage at Roza Dam is periodically impaired during high and low water levels.
- There is no formal public access to this reach.
- New development should be set back an adequate distance to protect stream functions and protect structures from flooding.
- Protect the high-quality wildlife habitat within the reach.
- The Integrated Plan for the Yakima Basin proposes acquisition of 15,000 acres in the Yakima River Canyon, including the valley bottom and eastern slopes, from the Yakima River to I-82. This area is a wildlife corridor and contains shrub-steppe habitat, a community type that is becoming increasingly rare.

YAKIMA RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
19.1 Miles	1,650.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach primarily flows as a single channel through a confined canyon with moderate topographic relief, generally flowing north to south. Low floodplain terraces have limited distribution within the reach.

LAND COVER (MAP FOLIO #3)

This reach is dominated by shrubland (25%), riparian vegetation (18%), grassland (15%), open water (15%), and developed lands (10%). Agricultural lands (8%), forest (7%), other (1%), and unvegetated lands (1%) are also mapped.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

A large extent of the reach area (60%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach, although steep slopes bordering the river may occasionally slide. Approximately one-third of the reach (38%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State Water Quality Assessment list of 303 (d) Category 5 waters for chlordane, dioxin, PCB, and temperature. TMDLs have been implemented for: 4,4'-DDE, 4, DDT, dieldrin and temperature.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps show this reach provides spawning habitat for spring Chinook and rearing habitat for Chinook and summer steelhead. The presence of coho salmon, sockeye salmon, bull trout, fall Chinook, mountain whitefish, rainbow trout, and westslope cutthroat is also identified.

Wetland habitat is mapped along the banks of the river and at multiple locations (9% of the reach). Priority mule deer winter range, bighorn sheep winter range, elk winter range, cliffs/bluffs, and biodiversity areas and corridor are mapped along the reach. In addition, golden eagle is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A railroad parallels much of the right bank of the river within the reach and a Canyon Road parallels the left bank	**PUBLIC ACCESS (MAP FOLIO #4)** Three sites, which include boat launches, provide access to the Yakima Canyon: Lmuma Creek, Big Pines, and Roza Recreation areas (Kittitas County, 2011). In addition to these facilities, boat launch facilities are located at milesposts 8 and 9, and at the Umtanum Recreation Area. In addition, SR 821 parallels the majority of the reaches, providing informal access and views of the river.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is rural (55%) and agricultural (45%). Land ownership is 40% private and 60% public (State, BLM, and WDFW).	**CONTAMINATED SITES** One leaking underground storage tank is mapped mid-reach.
ZONING (MAP #5) Lands within the reach are zoned for agriculture (60%), forest & range (23%), and other (17%) [right-of-way].	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 9 recorded precontact sites and 3 recorded historic sites are located within the reach. The recorded precontact sites feature lithic debitage in addition to talus pits.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), but has several listed water quality impairments and adjacent hydromodifications.	**TERRESTRIAL HABITAT QUALITY** **Medium:** Portions of generally unaltered habitat remain along the river, but the river is separated from adjacent habitat areas by transportation corridors (Canyon Road and a railroad).
VEGETATION FUNCTIONS **Medium:** The river is bordered by dense shrub cover, but vegetation has been altered in many areas by Canyon Road and a railroad.	**HYDROLOGIC FUNCTIONS** **Low:** The Yakima Canyon functions primarily as a transport reach.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There is generally limited development potential within the reach. Potential new development should be set back an adequate distance from the shoreline to protect shoreline functions.
- Several important archaeological sites are present within the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Protect the shrub-steppe and wildlife habitat within the reach.
- The Yakima Canyon is a highly-used recreational area. Recreational activities should be managed to reduce impacts on vegetation and subsequent erosion. There may be opportunities to restore riparian vegetation when recreational facilities are improved or redeveloped in the future.

5.2 Little Naches River and Tributaries

The Little Naches River flows from northwest to southeast in southwestern Kittitas County, forming the boundary between Kittitas and Yakima Counties. The Little Naches River is a right-bank tributary to the Naches River (in Yakima County). Tributaries within Kittitas County with mean annual flows greater than 20 cfs are the Middle and North Forks of the Little Naches River, Bear Creek, and Quartz Creek. Downstream of the Bear Creek confluence, the Little Naches River is identified as a "shoreline of statewide significance" because the mean annual flow exceeds 200 cubic feet per second. The Little Naches River and its tributaries are located almost entirely on National Forest lands, and are briefly described below.

5.2.1 Physical Characterization

The Little Naches River is located in the southwestern portion of the county and flows from the northwest to southeast. The river traverses the Kittitas County border with Yakima County, crossing the county lines multiple times. The river reach is largely undeveloped aside from forest service roads, camping, and logging activities that are located adjacent to the river. The majority of the riparian area contains evergreen forest that contributes substantial woody material to the system. Topography is low to moderate with the single channel dominating the system. Forest Service roads cross the river eight times and the downstream extent of the river is paralleled by a Forest Service road. The Yakima Klickitat Fisheries Project, in conjunction with the Forest Service, is proposing to re-route a portion of Forest Service Road 1900 out of the floodplain of the little Naches River.

The North Fork Naches River branches with the Middle Fork Naches River at approximately RM 19 of the Little Naches River. The topography and habitat along the north and middle forks are similar to that of the mainstem with little development and forested riparian corridors. Bear and Quartz creeks are left bank tributaries to the Little Naches River and both are crossed by a forest service road near their confluence with the Little Naches River. Bear and Quartz creeks have similar physical characteristics as the Little Naches River.

Much of the northern and southern extents of the river are flanked by mapped steep slopes, and the majority of the inventory area of the Little Naches River and its tributaries is located within identified channel migration zones.

5.2.2 Habitats and Species

5.2.2.1 Fish Use

Fish use within the Little Naches River and its tributaries is summarized in Table 5-1. Road development and timber harvest in the watershed have had a number of negative impacts on the quality of river habitat. Large quantities of fine sediment and a lack of riparian tree cover have resulted in increased embeddedness, lack of deep pools and habitat complexity, and high water temperatures. Timber harvest has reduced the available of large wood that can be recruited to the river along lower Bear Creek. Large wood was removed from the lower 10 miles of the river as part of "channel cleaning" efforts following floods in the 1970s. The lower part of the Little Naches below Salmon Falls has been degraded by road building and channelization (Haring 2001).

Despite these alterations, the upper part of the Little Naches (upstream of Salmon Falls) is considered to provide good fish habitat, with abundant spawning gravel, excellent riparian condition, adequate summer flows, and plentiful large wood and instream cover. Many forest roads have been repaired or decommissioned and fine sediment in spawning gravels has been reduced (Haring 2001).

Table 5-1. Fish Use in Little Naches River and Tributaries (Source: StreamNet 2010)

Species	Little Naches River	NF Little Naches	MF Little Naches	Bear Creek	Quartz Creek
Bull Trout	P/M				P/M
Rainbow Trout	P/M	P/M	P/M	P/M	P/M
Westslope Cutthroat	P/M	P/M	P/M	P/M	P/M
Eastern Brook Trout	P/M				P/M
Spring Chinook	R, S	S		R	R
Summer Steelhead	S	S	S	S	P/M

P/M = presence/migration; S = spawning; R= rearing

Installation of fish passage facilities at Salmon Falls (RM 4.4) in 1988 allowed anadromous fish to access approximately 18 miles of upstream habitat on the Little Naches River. There are no constructed barriers to migrating fish along any of the forks of the Little Naches River or the mouths of most tributary streams. A dewatered reach

along the North Fork, resulting from sediment loading, may inhibit access by spring Chinook (Haring 2001).

The Yakima Basin Integrated Water Resource Management Plan (Reclamation and Ecology 2011s) recommends acquisition of lands at the headwaters of the Little Naches River. Preservation of the upper reach is viewed as important maintaining for water quality, particularly cool temperatures for bull trout, as well as current or potential salmon and steelhead spawning grounds.

5.2.2.2 Water Quality

The North Fork Little Naches River is currently on Ecology's 303(d) list for high water temperatures. Removal of riparian vegetation and the subsequent lack of shade are likely the major reasons for high summer temperatures. A TMDL has been developed to address temperatures in the upper Naches River watershed (Ecology, 2004).

As described above, excess sediment is also an issue for water quality in the Little Naches River. Erosion has resulted from timber harvest, road building, wildfires, debris flows, and recreational use (Haring 2001).

5.2.2.3 Riparian Habitat Conditions (Land Cover)

Riparian vegetation along the Little Naches River and its tributaries is mainly coniferous forest in various stages of succession and harvest. Upstream of Salmon Falls, riparian vegetation is in excellent condition with the exception of areas along forest roads and camping areas. Riparian vegetation has been severely degraded downstream of the falls to the river mouth as a result of highway construction and channelization of the stream. Natural meadows along Bear Creek limit potential shade levels (Haring 2001).

5.2.2.4 Wetlands

Approximately one-third of the Little Naches River and North Fork shoreline inventory areas are mapped as wetland. Less than a third of the Quartz Creek shoreline is mapped as wetland, and a very small amount of the Bear Creek shoreline contains wetland areas. Mapped wetlands are mainly forested and scrub-shrub communities.

5.2.2.5 Wildlife Habitats and Species

Priority habitats and species mapped along the Little Naches River and its tributaries include elk calving areas, northern spotted owl (federally listed threatened species), talus slopes, and harlequin duck.

5.2.3 Land Use

With the exception of a private inholding at its upstream end, the Little Naches River flows through National Forest land. The North and Middle Forks of the river flow through a checkerboard of private and National Forest lands. Bear and Quartz Creeks flow through National Forest land. The private inholdings are zoned for commercial forestry and are inaccessible from public roads.

According to National Forest mapping data, there are two "special use" authorizations identified within the inventory area of the mainstem Little Naches River. A National Forest special use authorization allows for non-federal and temporary occupancy, use, rights, or privileges of National Forest lands.

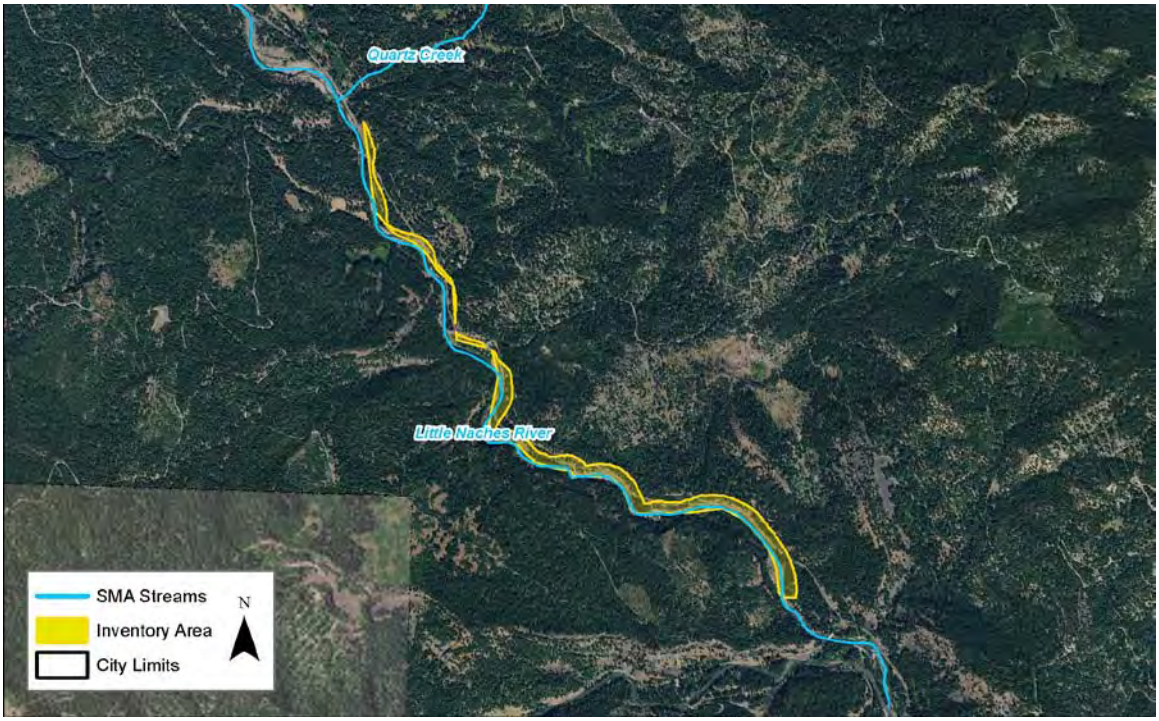
5.2.4 Public Access

The middle portion of the Little Naches River within Kittitas County is accessible from a snowmobile trail/Forest Service road that parallels much of its length. The snowmobile trail/Forest Service road also crosses Quartz Creek near its confluence with the Little Naches River.

5.2.5 Reach Sheets

LITTLE NACHES RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
1.6 Miles	66.5 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows to the southeast and is largely undeveloped.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. The majority of the reach (77%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (100%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

A small area (5%) of the reach is mapped as wetland. Priority elk calving area is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the eastern bank of the stream.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road traverses through the upstream portion of the regulated stream area. The Sawmill Flat Campground is located adjacent to the eastern reach boundary.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 6 recorded precontact sites, and 2 recorded historic sites located within the reach. The precontact sites feature rockshelters that were determined eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

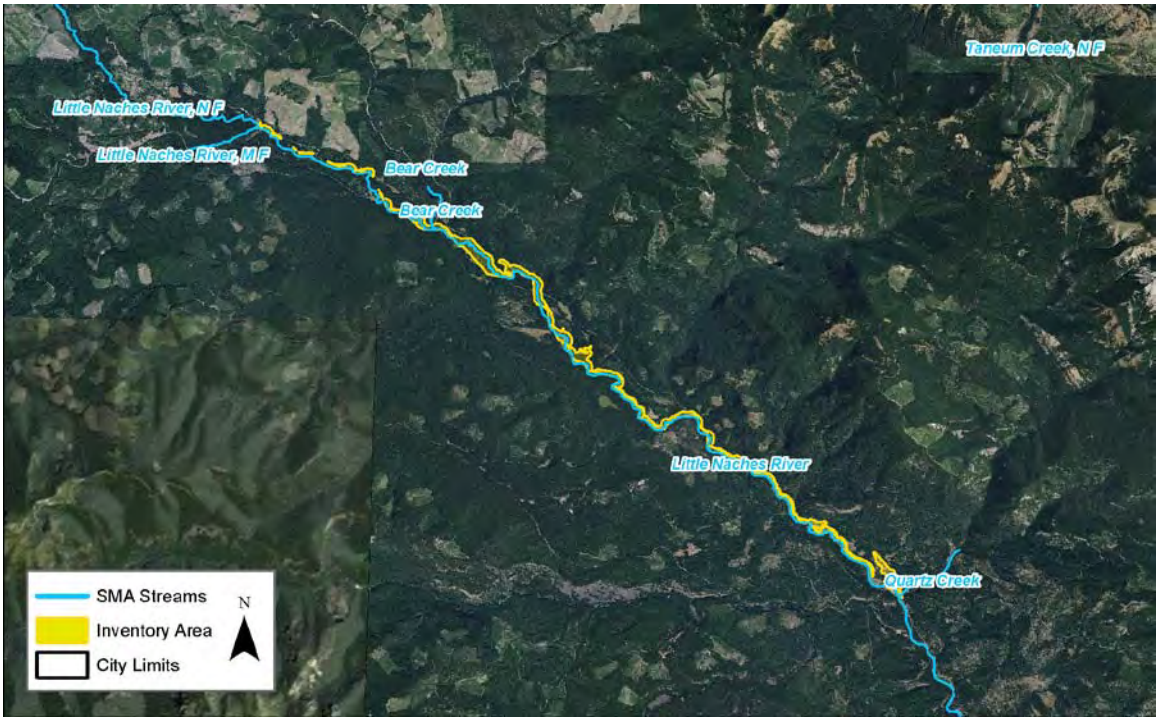
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

LITTLE NACHES RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
4.4 Miles	271.7 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows to the southeast, and is generally undeveloped.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. The majority of the reach (79%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated (73%), riparian vegetation (8%), harvested forest (1%), shrubland (1%), and other (18%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning and rearing habitat for spring Chinook and spawning habitat for summer steelhead. The presence of bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

Over one-third (37%) of the reach is mapped as wetland. Priority Harlequin duck, Rocky Mountain elk, and elk calving area are mapped within the reach.

The Washington Natural Heritage Program maps the Little Naches River: Reach 2 shoreline inventory area as habitat for Oregon golden aster.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road parallels the stream, and crosses in the stream in several locations.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road traverses through portions of the downstream regulated stream area and crosses the stream approximately mid-reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 2% private and 98% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are primarily zoned for commercial forest (86%); some areas are not zoned (14%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 7 recorded precontact sites, 3 historic sites, and 1 precontact and historic site located within the reach. The Naches Trail historic site was determined eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

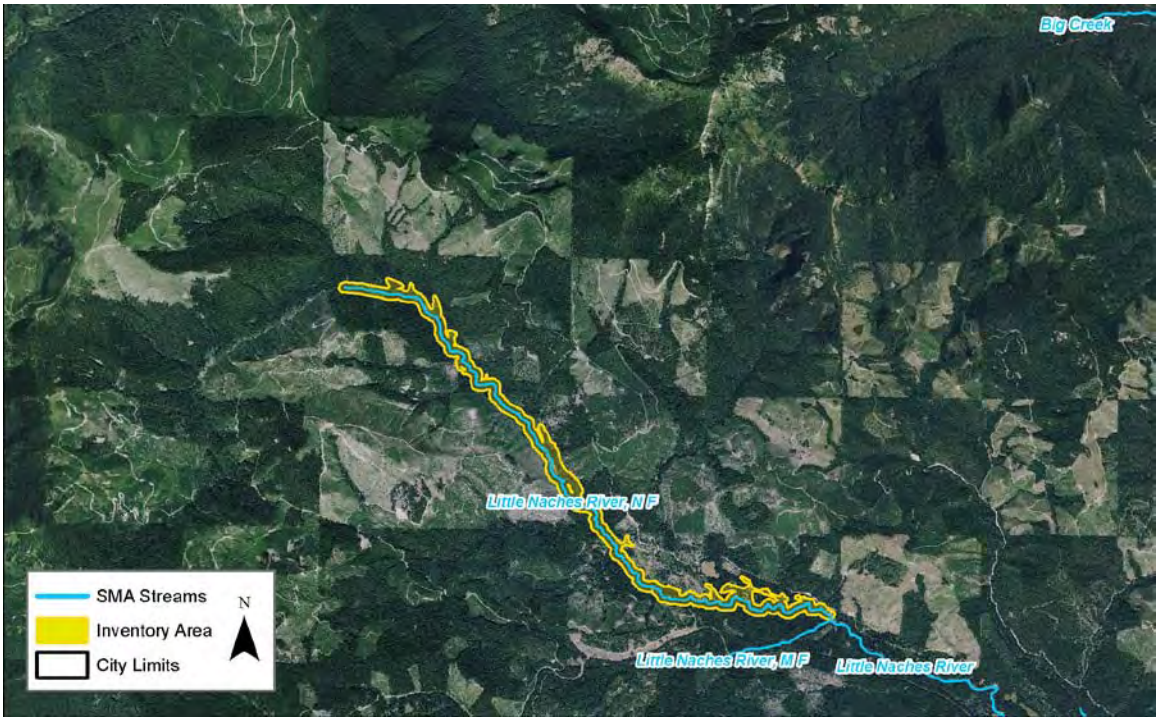
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest and wetland habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Decommission and revegetate any unused roads along the shoreline.

NORTH FORK LITTLE NACHES RIVER

SHORELINE LENGTH:	REACH INVENTORY AREA:
5.4 Miles	314.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach generally flows to the southeast within an undeveloped corridor. Clear-cut logging practices have occurred on the southern bank of the reach at several locations. The downstream bank topography is flatter than upstream.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (82%), riparian vegetation (15%), and harvested forest (3%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. Almost the entire reach (96%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

Approximately 29% of the reach is mapped as wetland. Priority elk calving areas are mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no known public access to the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 37% private and 63% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are no recorded sites within the reach.

SHORELINE FUNCTION ANALYSIS

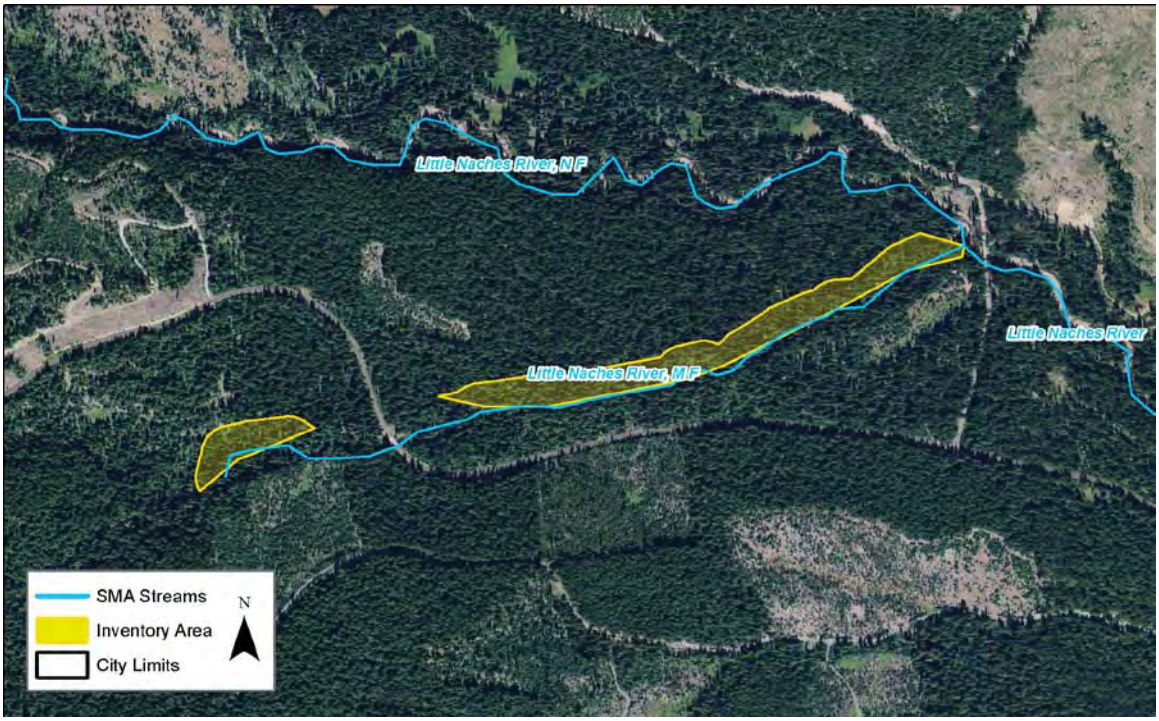
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality wetland and forest habitat within the reach.
- There is no identified public access within the reach.
- Decommission and revegetate any unused roads along the shoreline.
- New development should be set back an adequate distance to protect stream functions.

MIDDLE FORK LITTLE NACHES RIVER

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.3 Miles	19.8 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach roughly flows west to east. The stream is undeveloped and flows through a heavily forested corridor.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (90%) and riparian vegetation (10%).

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. Over half of the reach (55%) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature, and a TMDL is required, but has not been implemented.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides spawning habitat for summer steelhead. The presence of bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

No wetlands are mapped within the reach. Priority elk calving area is mapped within the entire reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no known public access to the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 12% private and 88% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded precontact sites and 1 recorded precontact and historic site located within the reach. The Naches Pass Wagon Road is a historic trail that was determined eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

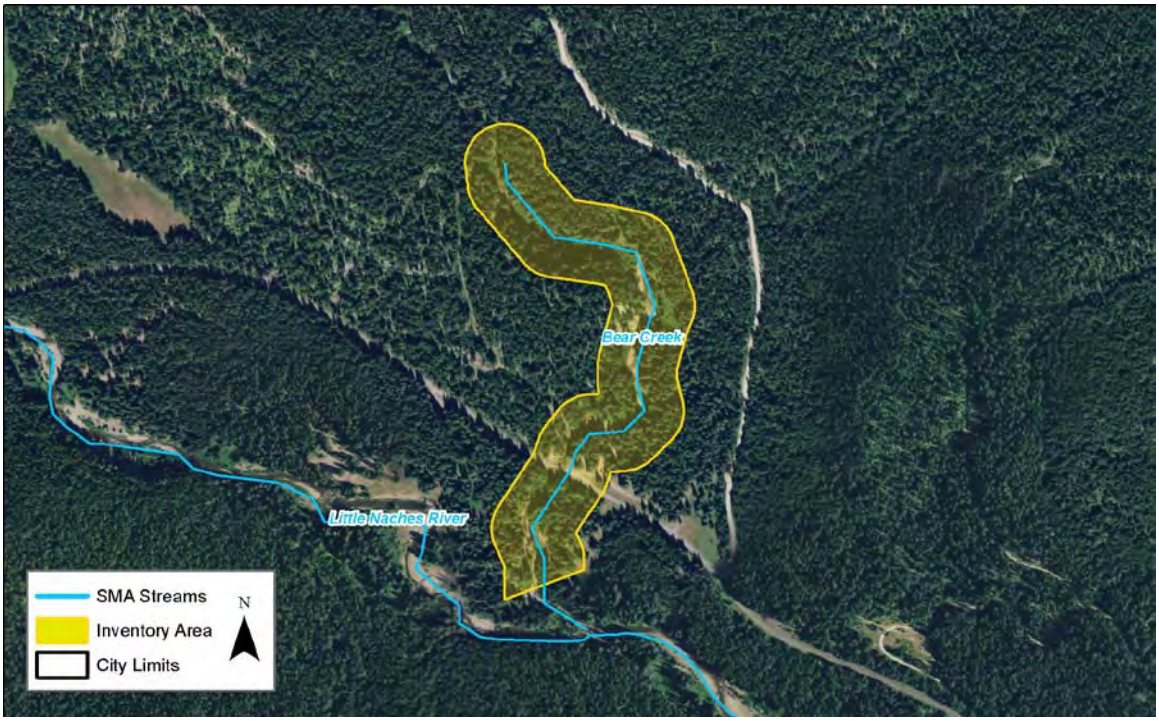
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access within the reach.
- Decommission and revegetate any unused roads along the shoreline.
- New development should be set back an adequate distance to protect stream functions.

BEAR CREEK

SHORELINE LENGTH:
0.6 Miles

REACH INVENTORY AREA:
28.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows north to south within an undeveloped, forested corridor.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. Almost the entire reach (87%) has potential for channel migration.

WATER QUALITY

Temperature data are not sufficient for listing the reach, but raise concern about water quality, per the State's Water Quality Assessment.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (94%) and riparian vegetation (6%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides rearing habitat for spring Chinook and spawning habitat for summer steelhead. The presence of bull trout, eastern brook trout, rainbow trout, and westslope cutthroat is also identified.

A limited extent (3%) of the reach is mapped as wetland. Priority elk calving habitat is mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) A Forest Service road crosses the stream approximately mid-reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There is no known public access to the reach.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are primarily zoned for commercial forest (98%); a limited area is not zoned (2%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A single recorded historic site is located within the reach. The site consists of ceramic insulators and probably was a fire communication line built in the 1930s.

SHORELINE FUNCTION ANALYSIS

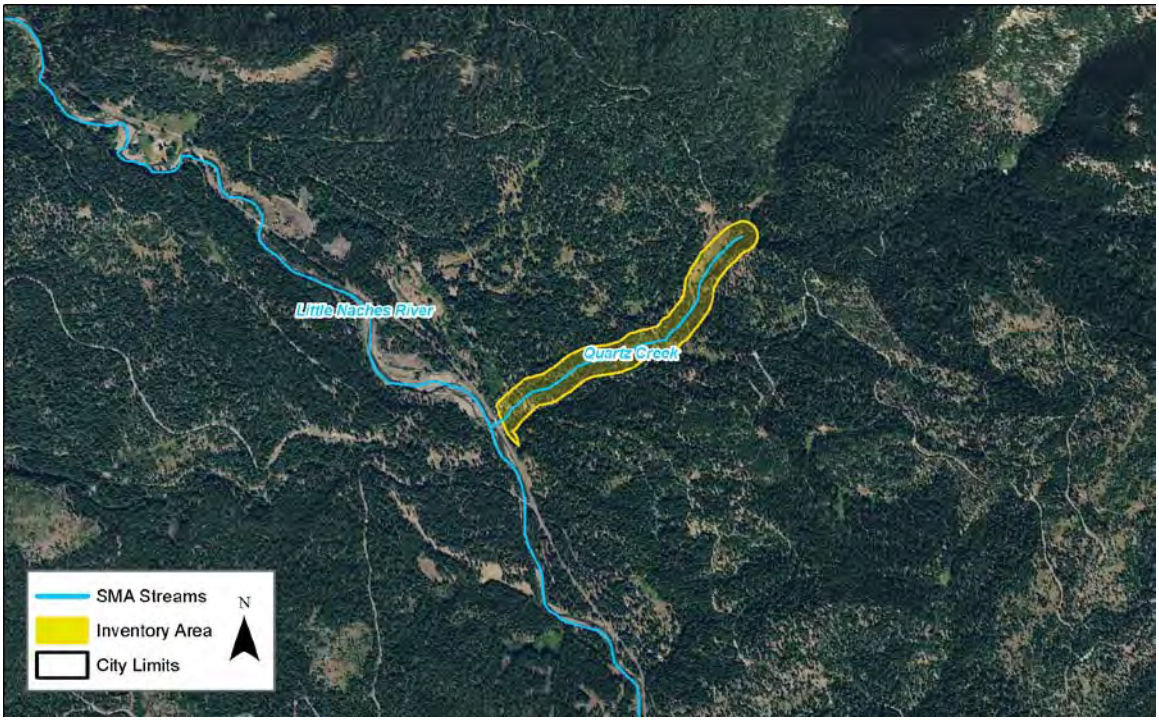
FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality forest habitat within the reach.
- There is no identified public access within the reach.

QUARTZ CREEK

SHORELINE LENGTH:	REACH INVENTORY AREA:
0.8 Miles	42.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The reach flows to the southwest within an undeveloped, forested corridor.

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

The reach is not located within the FEMA 100-year floodplain and no landslide hazard areas are mapped. The lower portion of the reach (28%) is within the channel migration zone of the Little Naches River.

WATER QUALITY

The reach is not listed on the State's Water Quality Assessment list of 303 (d) waters.

LAND COVER (MAP FOLIO #3)

Land cover within the reach is conifer-dominated forest (93%) and riparian vegetation (7%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the reach provides rearing habitat for spring Chinook. The presence of bull trout, eastern brook trout, rainbow trout, summer steelhead, and westslope cutthroat is also identified.

A small area (18%) of wetland is mapped within the reach. Priority elk calving area and Harlequin duck, are mapped within the reach. Talus slopes, a priority habitat, is also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) There are no shoreline modifications identified within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** A snowmobile trail/Forest Service road crosses the stream near the confluence with Little Naches River. A dog sled trail is located within the regulated stream area, near the stream mouth.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use within the reach is forestry (100%). Land ownership is 100% public (Forest Service).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for commercial forest (100%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are 2 recorded precontact sites located within the reach that feature lithic material.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **High:** The stream is largely unaltered and provides habitat for several priority fish species, including spawning and rearing habitat.	**TERRESTRIAL HABITAT QUALITY** **High:** The reach is generally well-forested and is connected to a large area of contiguous forest habitat.
VEGETATION FUNCTIONS **High:** The reach area generally consists of dense, mature forest cover.	**HYDROLOGIC FUNCTIONS** **Medium:** The stream is largely unaltered, but is located within a relatively narrow floodplain.

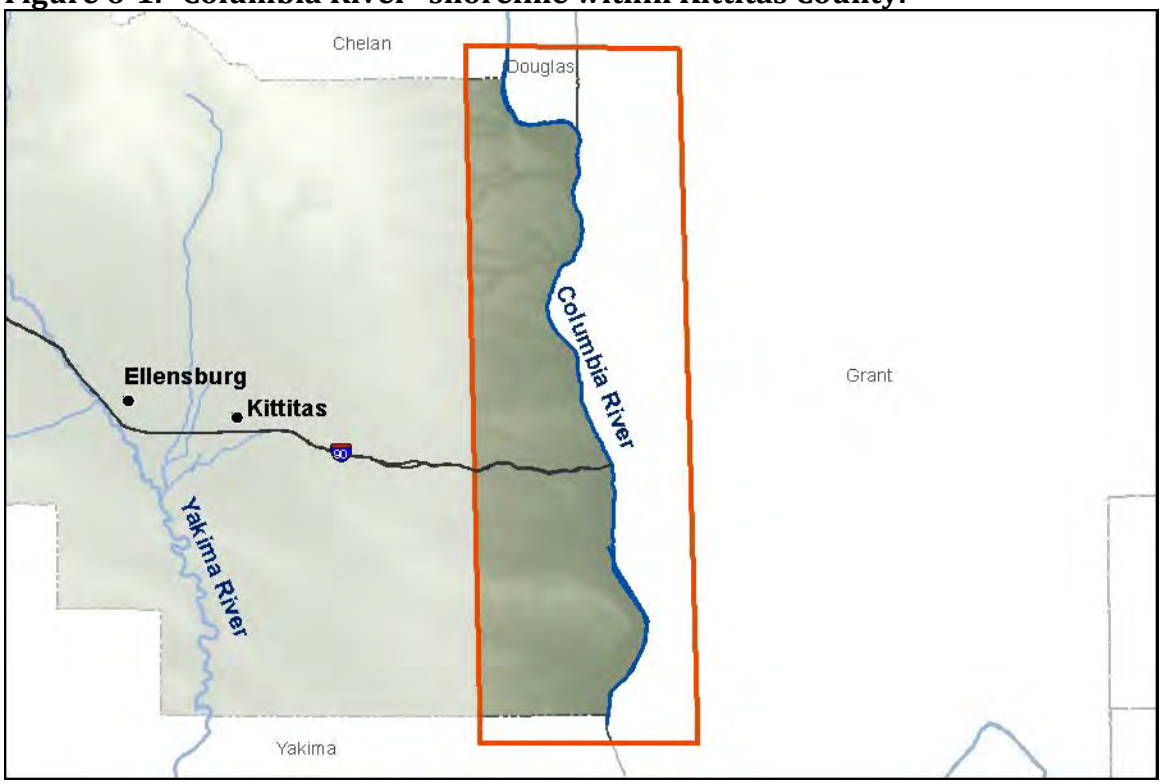
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-quality wetland and forest habitat within the reach.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

CHAPTER 6. COLUMBIA RIVER

This chapter describes the conditions within the shoreline inventory area of the portion of the Columbia River that lies within Kittitas County (Figure 6-1). These Columbia River reaches are described in terms of their physical characteristics, ecological conditions, and human environment/land use characteristics. Readers are encouraged to review Chapter 2 and the maps in Appendix A for additional context on the information presented here.

Figure 6-1. "Columbia River" shoreline within Kittitas County.



Characteristics for the three Columbia River reaches within the County are summarized on "reach sheets" included in this chapter. The information on the reach sheet is based upon available county-wide data sources that describe key physical, ecological, and land use characteristics. Appendix B describes the available data sources, including data limitations.

6.1 Columbia River

The headwaters of the Columbia River are located in the Rocky Mountains of British Columbia. The river flows, via a relatively steep gradient, approximately 1,243 miles to the Pacific Ocean at Astoria, Washington, after passing through 14 hydroelectric dams located on the mainstem. The Columbia River forms the eastern border of Kittitas County, flowing in a north to south direction from approximately river mile (RM) 448 to RM 405, a distance of approximately 43 miles. The river is designated as a "shoreline of statewide significance" because its mean annual flow exceeds 200 cubic feet per second.

For this analysis, the portion of the Columbia River that borders Kittitas County was divided into 3 reaches: Reach 1 (11.0 miles) extends from the southern County border to Wanapum Dam, Reach 2 extends from the Wanapum Dam to 8.9 miles upstream, and Reach 3 (22.9 miles) extends from 8.9 miles upstream of the Wanapum Dam to the northern County border.

6.1.1 Physical Characterization

The Priest Rapids Project on the Columbia River is owned and operated by Public Utility District No. 2 of Grant County (Grant PUD). The Priest Rapids Project includes two hydroelectric developments, Wanapum and Priest Rapids Dams. Wanapum Dam is located at RM 415 in Kittitas County, while Priest Rapids Dam is downstream. Wanapum Dam is 8,637 feet long and 187 feet high and is capable of generating over 4 million megawatt-hours per year. Wanapum Reservoir extends 38 miles upstream to the tailwater of Rock Island Dam. The reservoir impounds 693,600 acre-feet of water during normal maximum elevation (Grant PUD 2010a; (Grant PUD 2011; Ecology Order No. 4219; FERC 2006).

Wanapum Dam began power generation in 1963. The Federal Energy Regulatory Commission (FERC) issued a new license for the Priest Rapids Project (including both dams) in 2008. The license will be valid until 2052. As part of the relicensing requirements, Grant PUD is required to prepare more than 50 management plans that document how the dam will be upgraded and operated while protecting natural, cultural, and recreational resources. Table 7-1 lists the major management plans and their status as of fall 2011. Many of the plans require ongoing monitoring and preparation of annual reports.

Table 6-1. Summary of Management Plans for Priest Rapids Project FERC Relicensing

Management Plan	Status (October 2011)
Aquatic Invasive Species Control & Prevention Plan	Approved by FERC in 2010.
Artificial Propagation Plans/Hatchery and Genetic Management Plans	Coho and Okanogan summer Chinook plans approved by FERC in 2011; other plans pending approval.
Avian Predation Control Plan	Approved by FERC in 2008.
Bald Eagle Perch/Roosting Protection	Approved by FERC in 2010.
Bull Trout Hydrologic Water Quality Study Plan	Approved by FERC in 2010.
Bull Trout Monitoring & Evaluation Plan	Approved by FERC in 2009.
Downstream Passage Alternatives Action Plan	Approved by FERC in 2009
Fish Ladder Water Supply Monitoring Study Plan	Approved by FERC in 2010.
Fisheries and Aquatic Resource Habitat Plan	Over $17 million contributed toward projects to restore habitat for federally listed and non-listed anadromous fish in drainages affected by the Priest Rapids Project.
Gas Abatement Plan	Approved by FERC in 2011.
Hanford Reach Follow-up Monitoring Program Plan	FERC approval pending.
Hanford Reach Study Plan	Approved by FERC in 2011.
Implementation Feasibility Study Plan	FERC approval pending.
Memorandum of Agreement between Grant PUD and Wanapum Indians	Pending.

Management Plan	Status (October 2011)
Native Resident Fish Management Plan	Approved by FERC in 2009.
Northern Pikeminnow Removal Program	Approved by FERC in 2008.
Northern Wormwood Conservation	Approved by FERC in 2010.
Pacific Lamprey Management Plan	
Pollution and Erosion Control Plan	Approved by FERC in 2011.
Priest Rapids Dam Bypass Facility Total Dissolved Gas Study Plan	FERC approval pending.
Priest Rapids Fish Bypass	Fish bypass at Priest Rapids Dam to be completed by 2014.
Programmatic Agreement/Historic Properties Management Plan	Archaeological surveys and determinations of eligibility underway.
Quality Assurance Project Plans	Approved by FERC in 2009.
Rare, Threatened & Endangered Plant Monitoring	Baseline survey completed in 2011.
Recreation Resource Management Plan	FERC License approved 23 specific recreation projects. Amendment to plan submitted to FERC in 2010.
Shoreline Management Plan	FERC released environmental assessment in 2011.
Short-term monitoring in shallow Reservoir Habitat Plan	Approved by FERC in 2010.
Transmission Line Avian Collision Protection Plan	Measures to be installed at Wanapum in 2013 and 2014.
Wanapum Dam Turbine Installation Total Dissolved Gas Study Plan	FERC approval pending.
Wanapum Future Unit #11 Total Dissolved Gas Study Plan	FERC approval pending.

Management Plan	Status (October 2011)
Wanapum Interim Spill Regime Evaluation Plan	Approved by FERC in 2009.
White Sturgeon Management Plan	Approved by FERC in 2009.
Wildlife Habitat Management Plan	
Wildlife Habitat Monitoring & Information & Education	Approved by FERC in 2010.

Source: Grant PUD 2011b.

The Wanapum Reservoir has a lake-like or lacustrine component and a river-like or riverine component. The riverine section extends from about RM 434 to Rock Island Dam at RM 453. Water levels in the riverine section are dependent on flow and there is a prominent current. Water surface gradients of 10 to 15 feet may occur between the upper and lower reaches of the riverine section at high river flows (greater than 500,000 cfs). The lacustrine section extends downstream of the riverine section to Wanapum Dam. This area has a relatively flat water surface during most flow conditions (FERC 2006).

The town of Vantage and the I-90 crossing of the Columbia River are located on Wanapum Reservoir. The west side bridge abutment of Interstate-90 (I-90) extends from the shoreline to approximately the midpoint of the river, at which point the roadway transitions from being supported by fill material to bridge piers. The John Wayne Heritage Trail bridge is an abandoned railroad trestle supported by piers. In addition to the I-90 and trail bridges that span the river, a small bridge located parallel to the river crosses a shoreline inlet that is associated with the Gingko Petrified Forest State Park campground/boat launch at about RM 416. This bridge is a short expanse, approximately 100 feet long, but is supported by relatively long abutment fills (the north abutment is about 510 feet long; the south abutment is roughly 275 feet long).

Steep slopes are mapped at many locations along the western shoreline of the Columbia River, primarily between the mouth of Tekison Creek (RM 437) and Vantage (RM 421), and in the vicinity of Wanapum Dam (RM 415). The FEMA 100-year floodplain is mapped sporadically along much of the three Columbia River reaches. While the floodplain covers much of the reach inventory area lengths, it primarily occupies a small portion of this area. The shoreline south of the I-90 crossing exhibits the greatest extent of floodplain coverage (FEMA 1996). Only the upstream extent of the reach (at the Douglas and Grant County boundaries) has potential for channel migration (Ecology 2011).

No major tributaries empty to the river from the western shoreline; however, many smaller streams drain to the river.

Climatic conditions in the vicinity of this portion of the river, which are typically warm and dry, dictate vegetation communities adapted to desert-like conditions (e.g., sagebrush). Columbia River riparian conditions support more temperate tree and shrub vegetation communities along this stretch of the river, particularly at the mouths of the many small tributaries to the river.

6.1.2 Habitats and Species

6.1.2.1 Fish Use

The Columbia River in the vicinity of Kittitas County supports several native fish species, including bull trout; rainbow trout; cutthroat trout; spring, summer, and fall Chinook; summer steelhead; coho salmon; sockeye salmon; kokanee salmon; Pacific lamprey; mountain and lake whitefish; white sturgeon; and others such as sculpin, suckers, and dace. Three of these species are listed under the federal Endangered Species Act: bull trout (threatened), upper Columbia River spring Chinook (endangered), and upper Columbia River summer steelhead (endangered); others have special status at the state level (see Table 2-14 in Chapter 2). Only fall Chinook salmon are known to both spawn and rear within the Priest Rapids Project area, while the other salmon species migrate through the area (StreamNet 2010, FERC 2006).

Columbia River Summer Chinook, fall Chinook, and sockeye populations are relatively stable. Coho salmon were historically present, but the endemic stock was extirpated by the 1940s. Coho have been reintroduced through hatchery programs (Ecology Order No. 4219, FERC 2006).

In 2010, 14 bull trout were observed passing the fish ladder count stations at Priest Rapids and Wanapum Dams between April 15 and November 15 (Grant PUD 2011c).

This part of the river also supports numerous nonnative fish species, including American shad, largemouth and smallmouth bass, black bullhead, northern pikeminnow, black and white crappie, pumpkinseed, bluegill, brown trout, tench, channel catfish, walleye, common carp, and yellow perch, and others. American shad are currently restricted to the Columbia River below Priest Rapids Dam (Grant PUD 2010b; StreamNet 2010, FERC 2006).

Hydroelectric projects on the Columbia River have had major impacts on salmonid species. As required by the FERC license for the Priest Rapids Project, as well as the

401 Water Quality Certification and Endangered Species Act Biological Opinion, Grant PUD is undertaking numerous measures to protect fish and water quality. Major programs include the following:

- Construction and operation of juvenile fish bypasses at Wanapum Dam (completed in 2008) and Priest Rapids Dam;
- Installation and testing of advanced turbines and alternative spill measures;
- Control of northern pikeminnow and bird species that prey on juvenile fish;
- Measures to reduce total dissolved gas, which can injure fish;
- Prevention and control of aquatic invasive species; and
- A hatchery supplementation program for white sturgeon;
- A habitat management plan for Pacific lamprey.

Two organizations, the Priest Rapids Coordinating Committee and the Priest Rapids Fish Forum, are working with Grant PUD to achieve fish passage performance standards and meet state and federal requirements for the Priest Rapids Project. A fish bypass was completed at Wanapum Dam in 2008. In addition, turbines used to generate hydroelectric power are operated in specific modes to protect fish during the juvenile salmonid out-migration season (typically April through August) (Grant PUD 2010a).

Hydroelectric power facilities in the Columbia River basin have had negative impacts on white sturgeon. White sturgeon populations in the middle and upper Columbia River now reside in reservoirs between dams. These populations are subject to river regulation, flooding of historical critical spawning and rearing habitats, increases in predators due to habitat alteration, introduction of exotic species, and pollution. (Grant PUD 2009)

Grant PUD has performed surveys for white sturgeon in the Priest Rapids Project area. Resident white sturgeon populations are present in both Wanapum and Priest Rapids Reservoirs. Between 2000 and 2002, white sturgeon spawning was documented in the tailrace areas of Wanapum Dam (upper boundary of the Priest Rapids reservoir) and Rock Island Dam (upper boundary of Wanapum reservoir) (Grant PUD 2009).

As part of its FERC license for the Priest Rapids Project, Grant PUD is required to develop and implement a White Sturgeon Management Plan in consultation with the Priest Rapids Fish Forum. The plan includes a regional hatchery supplementation

program for the middle Columbia River. White sturgeon brood stock holding, gamete collection, fertilization, egg incubation, and juvenile rearing is expected to occur at the Yakama Nation's Marion Drain Facility (Priest Rapids Fish Forum 2011).

Pacific lamprey populations in the Columbia River basin have declined over the past four decades (FERC 2006). Mainstem passage is an urgent problem for lamprey in the basin. The *Tribal Pacific Lamprey Restoration Plan for the Columbia River Basin* (CRITFC 2011) includes several objectives and actions for Pacific lamprey, including Mainstem Passage and Habitat, Tributary Passage and Habitat, Supplementation/ Augmentation, Contaminants and Water Quality, Public Outreach and Education, and Research, Monitoring and Evaluation.

Studies have suggested that predation by northern pikeminnow might account for most of the 10 to 20 percent mortality of juvenile salmonids in the Columbia River and Snake River reservoirs. Efforts to control northern pikeminnow in the Columbia River basin have been underway for over two decades. The basinwide pikeminnow control program is coordinated by the Pacific States Marine Fisheries Commission, Oregon Department of Fish and Wildlife, and Washington Department of Fish and Wildlife. One aspect of the program is providing a bounty to anglers for catching northern pikeminnow. In 2011, anglers harvested over 155,000 northern pikeminnow through the program (Porter 2011).

6.1.2.2 Water Quality

Priest Rapids Lake and Wanapum Lake are on Ecology's 303(d) list for water temperature. In 1991, EPA published a TMDL for dioxin in the Columbia River. Chlorine bleaching pulp mills are the major source of dioxin; because several of these mills are located between the river mouth and the Canadian border, they have the potential to affect water quality in the entire river. Other sources of dioxin are thought to include wood treating industries that use pentachlorophenol, wastewater treatment plants, agriculture, industry, urban areas, and release from bottom sediments (EPA 1991).

The EPA and Ecology established a TMDL for total dissolved gas (TDG) in the mainstem of the Columbia River, from the Canadian border to the confluence of the Snake River. Water spilling from dams can elevate TDG levels, causing injury to fish (Pickett et al. 2004). Examples of measures being taken to reduce TDG at the Priest Rapids project include construction of spillway deflectors at Wanapum Dam (completed in 2000), construction of the Wanapum fish bypass (completed in 2008), construction of the Priest Rapids fish bypass (to be completed by 2016), and installation of new turbines at Wanapum Dam (scheduled for completion in 2012).

Grant PUD will also conduct biological monitoring for gas bubble trauma in fish (Ecology Order No. 4219; Keeler 2011a, 2011b).

Two species of aquatic invasive vegetation are currently known to occur within the Priest Rapids Project area: Eurasian watermilfoil and curly-leaf pondweed. When invasive aquatic plants form dense infestations, then can degrade aquatic habitat as well as interfering with recreation. The aquatic invasive species management plan for the Priest Rapids Project includes education, monitoring, and response elements to reduce the potential for new invasive species to be introduced into the area. Grant PUD is monitoring not only for invasive plants in aquatic and shoreline areas, but also for zebra/quagga mussels and New Zealand mudsnails (Grant PUD 2010b).

In 2004, the EPA analyzed sediment samples taken from Wanapum Dam downstream to McNary Dam (just downstream of the Kittitas County boundary). While the study did not identify any obvious hot spots or sinks for sediment contaminants, it did find cadmium and zinc at elevated concentrations relative to other areas within the basin. Several pesticides were also identified (generally at low levels). EPA states that the detection of the pesticides Ethyl chlorpyrifos and Malathion in a few of the samples "raises a concern about the potential impacts of currently used agricultural chemicals on the health of the Columbia Basin aquatic ecosystem." EPA also recommended additional investigation of polybrominated diphenyl ethers (PBDEs), which were found in over half of the samples. PBDEs are chemical flame retardants that are persistent, bioaccumulative, and toxic to humans and the environment (Watson et al. 2008; EPA 2012).

6.1.2.3 Riparian Habitat Conditions (Land Cover)

This portion of the Columbia River flows through a vast canyon of steep basalt cliffs where riparian vegetation is sparse. Tree and shrub cover is concentrated near stream mouths and in a few developed areas such as Vantage and the agricultural area south of the bridge crossing near Beverly. Based on GAP mapping data, less than 10 percent of the river's shoreline inventory area is forested and less than 10 percent is shrubland.

6.1.2.4 Wetlands

A very small portion of the shoreline inventory area is mapped as freshwater emergent wetland. West Bar, near the northern edge of Kittitas County, contains a shallow, semi-permanently flooded emergent wetland known as West Bar Slough (FERC 2006).

6.1.2.5 Wildlife Habitats and Species

The Columbia River shoreline inventory area provides habitat for bighorn sheep, Rocky Mountain elk, and mule deer. The river supports common loon and waterfowl concentrations. Other common bird species in the area include mergansers, geese, cormorants, great blue heron, chukar, California quail, red-tailed hawks, golden eagles, and great horned owls (FERC 2006).

West Bar, near the northern edge of Kittitas County, contains an extensive area of sand shrub-steppe habitat fringed by high cliffs (FERC 2006).

Approximately half of the shoreline inventory area along the Columbia River is mapped as shrub-steppe habitat (USGS 1993). Shrub-steppe habitat is dominated by perennial bunchgrasses and shrubs such as sagebrush (WDFW 2008). Kittitas County has several types of shrub-steppe communities with different combinations of plant species, as described in Section 2.3.2 in Chapter 2.

Shrub-steppe habitat supports numerous unique plant and wildlife species (Azerrad et al. 2011). For example, WDFW has mapped long-billed curlew, a bird species associated with shrub-steppe, near the Columbia River. The plant species Columbia milk vetch, Hoover's desert parsley, and Wormskiold's northern wormwood are shrub-steppe species also mapped near the river by the Washington Natural Heritage Program. While it was historically a common type of vegetation community in eastern Washington, shrub-steppe habitat has been largely converted to agriculture and is considered a priority habitat by WDFW (see Section 2.6.3.1).

6.1.3 Land Use

Limited development is associated with the western shoreline of the Columbia River within Kittitas County. The downstream end of the river shoreline is undeveloped and located within the Yakima Training Center (Department of Defense). Just to the north, across from the town of Beverly, the west bank of the river is used for agriculture. In addition, the John Wayne Heritage Trail crosses the river in this area.

From approximately 2.5 miles north of Wanapum Dam to the Vantage Airport near I-90, the river is bordered by generally undeveloped land zoned for forest and range, with the exception of Wanapum State Park and Getty’s Cove (a day-use recreation area co-managed by Grant County PUD and Washington State Parks). Huntzinger Road directly parallels the shoreline between Wanapum Dam and Wanapum State Park.

The community of Vantage is located north of I-90, and Gingko Petrified Forest State Park is located north of Vantage. North (upstream) of Gingko State Park to the

County boundary, the west bank of the river is generally undeveloped and lies within a "checkerboard" of public (primarily WDFW) and private lands. This area is zoned for agriculture and forest and range.

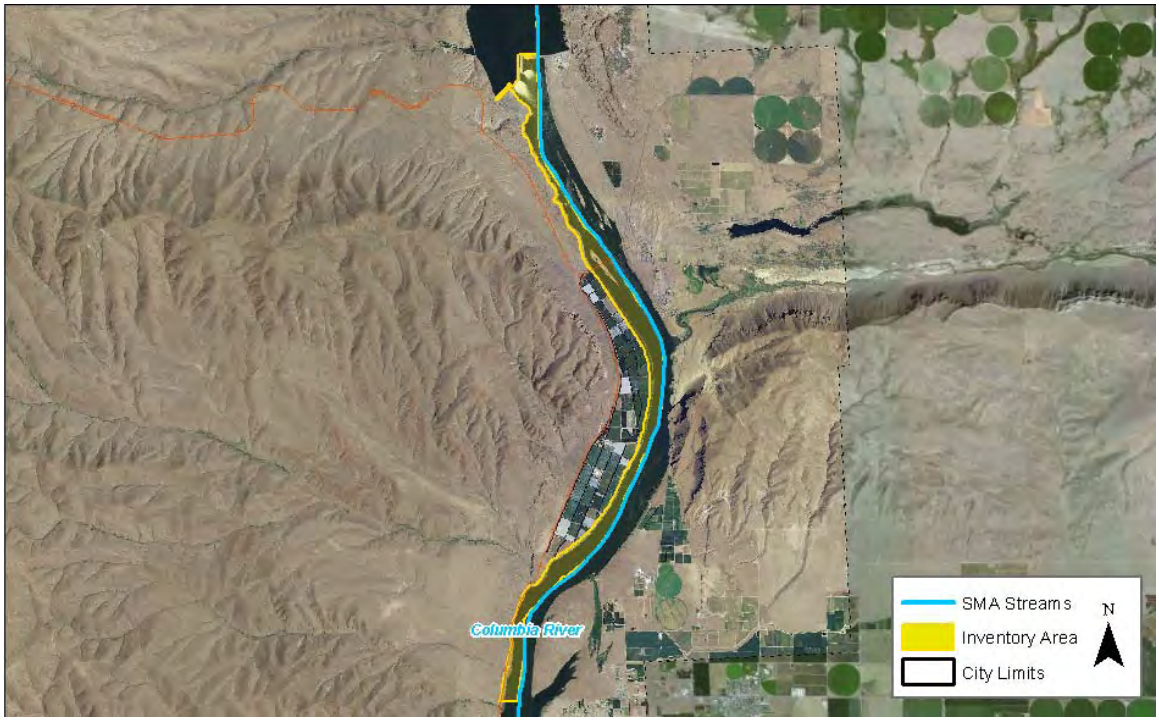
6.1.4 Public Access

Two mapped boat launches are located on Columbia River Reach 2. The Vantage boat launch provides river access at Boat Ramp Road adjacent to the I-90 crossing of the river, and the Wanapum Recreation Area boat launch, located approximately 2.5 miles downstream of the Vantage boat launch, also provides river access to the public. North of the Vantage boat launch and located in the Ginko Petrified Forest State Park, Recreation Drive provides access to the river. In addition, there are a number of unimproved roads that provide access to Yakima River Reach 3 and the upstream extent of Yakima River Reach 2. Huntzinger Road parallels the downstream portion of Reach 2 and Getty's Cover Road, and associated boat launch, is also located here. The John Wayne Heritage Trail crosses the Columbia River across from the town of Beverly.

6.1.5 Reach Sheets

COLUMBIA RIVER-REACH 1

SHORELINE LENGTH:	REACH INVENTORY AREA:
11.0 Miles	1,625.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The single channel is located in a canyon with moderate to steep topographic relief. Wanapum Dam is located at the upstream end of the reach and the John Wayne Heritage Trail crosses the river further downstream. An agricultural area is located on a right bank floodplain terrace downstream of the trail crossing.

LAND COVER (MAP FOLIO #3)

The majority of this reach contains open water (72%); other land cover types include: shrubland (8%), forest (6%), other (6%), agricultural lands (4%), and developed lands (3%).

HAZARD AREAS (MAP FOLIO #2)

A limited area of the reach (20%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for 4,4'-DDD, 4,4'-DDE, PCB, pH, and temperature. A TMDL has been implemented for total dissolved gas in this reach.

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps the presence of the following fish species in the reach: brown trout, coho salmon, bull trout, fall Chinook, largemouth bass, mountain whitefish, rainbow trout, smallmouth bass, sockeye salmon, spring Chinook, summer steelhead, walleye, and white sturgeon.

No wetland habitat is mapped in the reach. Priority common loon, long-billed curlew, and waterfowl concentrations are located along the downstream portion of the reach, in addition to mule deer.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) The Wanapum Dam is located at the upstream end of the reach, and the John Wayne Heritage Trail bridge is located mid-reach.	**PUBLIC ACCESS (MAP FOLIO #4)** The John Wayne Heritage Trail crosses the Columbia River across from the town of Beverly. The Huntzinger Boat Launch is located below the dam.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (61%) to the east and agriculture (39%) to the west. Land ownership is 89% private and 11% public (BL M).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for forest & range (58%) to the north and south and agriculture (42%) mid-reach.	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** There are a total of 25 recorded precontact sites, 6 recorded historic sites, and 9 recorded sites that feature both precontact and historic components located within the reach. Several of the precontact sites are among the oldest recorded sites in the county and include rockshelters, burials, and petroglyphs.

SHORELINE FUNCTION ANALYSIS

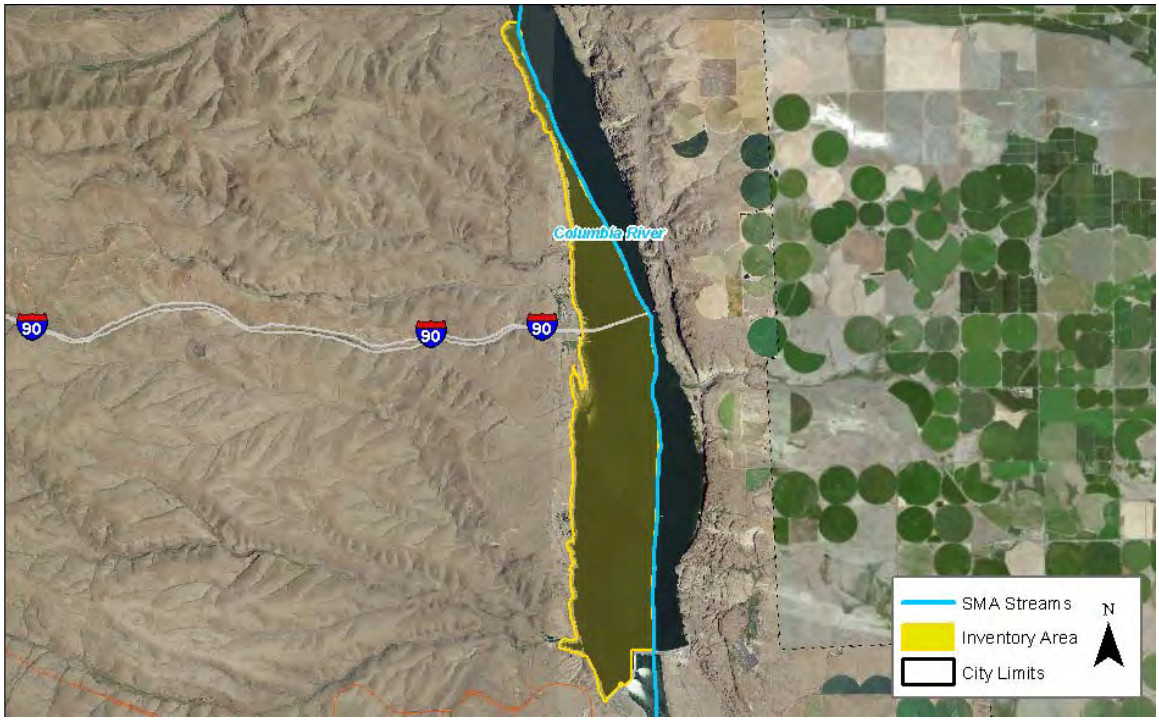
FISH HABITAT QUALITY **Medium:** The reach provides habitat for a variety of priority fish species, but the river has several water quality impairments and is highly influenced by dam operations.	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach is connected to significant areas of undisturbed habitat, but a large portion of the shoreline is in agricultural production.
VEGETATION FUNCTIONS **Low:** Much of the shoreline is in agricultural production, and dense vegetation is generally absent from the shoreline.	**HYDROLOGIC FUNCTIONS** **Medium:** The reach but provides important hyporheic flow functions, but is highly influenced by dam operations

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There are many important archaeological resources located within the reach.
- Encourage use of agricultural best management practices to reduce erosion and transport of legacy pesticides.
- Project the high-quality wildlife habitat within the reach.
- The Wanapum Dam significantly alters the hydrology and fish habitat quality of the reach. Grant PUD is undertaking numerous management plans and studies to address fish, wildlife, and water quality issues related to management of the dam.

COLUMBIA RIVER-REACH 2

SHORELINE LENGTH:	REACH INVENTORY AREA:
8.9 Miles	4,228.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The single channel is located in a canyon with moderate to steep topographic relief. I-90 crosses the approximate mid-point of the reach and is supported by fill for roughly half of the crossing. Wanapum Dam forms the downstream extent of the reach.

HAZARD AREAS (MAP FOLIO #2)

Less than half the reach area (41%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature. A TMDL has been implemented for total dissolved gas in this reach.

LAND COVER (MAP FOLIO #3)

This reach contains primarily open water (92%). A number of other land cover types are also present, including: shrubland (3%), other (1%), agricultural lands (1%), forest (1%), developed lands (1%), and unvegetated lands (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps known juvenile rearing habitat for summer steelhead in the reach. The presence of the following fish species is also mapped: coho salmon, bull trout, fall Chinook, Kokanee salmon, largemouth bass, mountain whitefish, rainbow trout, smallmouth bass, sockeye salmon, spring Chinook, summer steelhead, walleye, and white sturgeon.

Very limited wetland habitat is mapped along the river (2% of the reach). Priority mule deer winter range, bighorn sheep, elk winter range, and cliffs/bluffs are mapped along the reach; common loon and waterfowl concentrations are also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

The Wanapum Dam is located at the downstream end of the reach, and I-90 crosses the river mid-reach.

PUBLIC ACCESS (MAP FOLIO #4)

The Vantage boat launch provides river access at Boat Ramp Road adjacent to the I-90 crossing of the river, and the Wanapum Recreation Area boat launch, located approximately 2.5 miles downstream of the Vantage boat launch. North of the Vantage boat launch and located in the Ginko Petrified Forest State Park, Recreation Drive provides access to the river. In addition, there are a number of unimproved roads that provide access to the upstream extent of Yakima River Reach 2. Huntzinger Road parallels the downstream portion of Reach 2 and Getty's Cove Road, and associated boat launch, is also located here. There is also a fishing pier located above the dam.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use along the reach is primarily rural (92%), with agricultural land (1%) at the upstream end and other (7%) [Vantage] near I-90. Land ownership is 63% private and 37% public (BLM, WDFW, and State Parks).

CONTAMINATED SITES

No identified contaminated sites are located within this reach.

ZONING (MAP #5)

Lands within the reach are zoned primarily for forest & range (82%), with areas of agriculture (1%), commercial (1%) urban/suburban residential (4%) and other (12%) [Vantage] zoning.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

A total of 39 recorded precontact sites, 2 recorded historic sites, and 1 recorded site that features both precontact and historic features are located within the reach. Several recorded precontact sites include rockshelters, burials, and petroglyphs.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The reach provides habitat for a variety of priority fish species, but the river has several water quality impairments and is highly influenced by dam operations.

TERRESTRIAL HABITAT QUALITY

Medium: The reach is connected to significant areas of undisturbed habitat, and the majority of the reach is unaltered.

VEGETATION FUNCTIONS

Low: Most of the shoreline is unaltered, but vegetation coverage is naturally sparse.

HYDROLOGIC FUNCTIONS

Medium: The reach but provides important hyporheic flow functions, but is highly influenced by dam operations

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There are many important archaeological resources located within the reach.
- The Wanapum Dam significantly alters the hydrology and fish habitat quality of the reach (see Reach 1).
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Protect the high-quality wildlife and shrub-steppe habitat within the reach.
- Preventing and controlling invasive species infestations is a key management issue at boat launches.

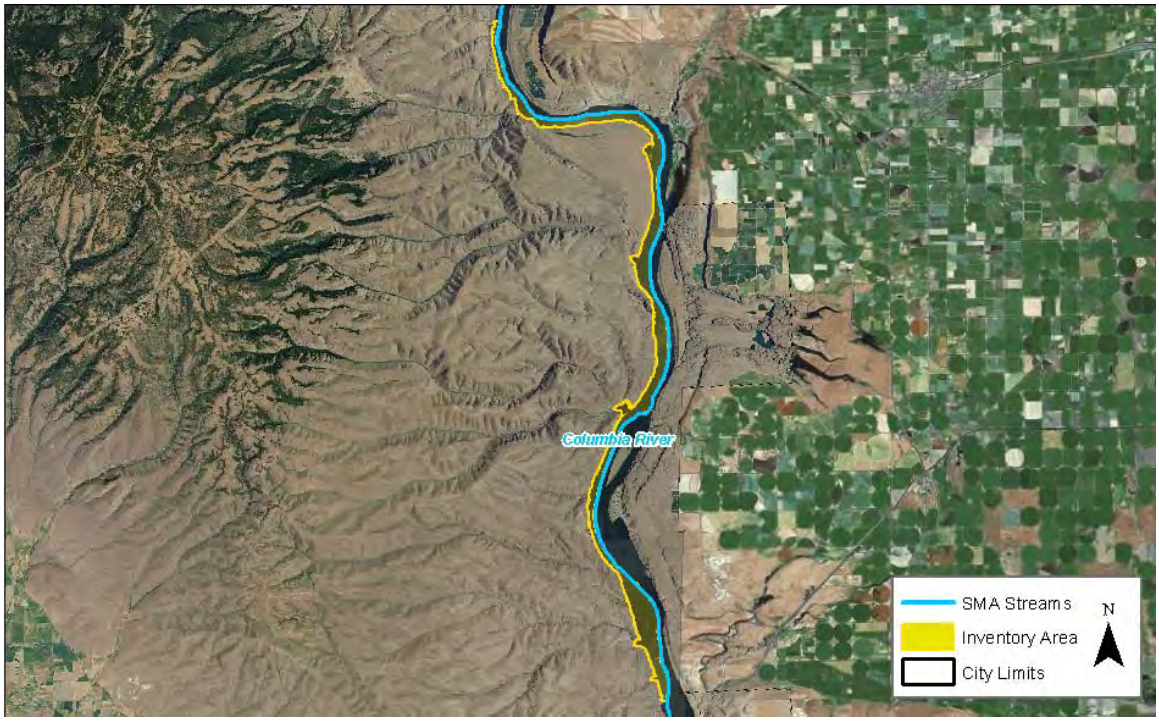
COLUMBIA RIVER-REACH 3

SHORELINE LENGTH:

22.9 Miles

REACH INVENTORY AREA:

3,723.0 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

The single channel is located in a canyon with moderate to steep topographic relief. Two, wide floodplain terraces are located on the right bank of the river.

HAZARD AREAS (MAP FOLIO #2)

25 percent of the reach area is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. Only the upstream extent of the reach (at the Douglas and Grant County boundaries) has potential for channel migration.

WATER QUALITY

The reach is listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters for temperature.

LAND COVER (MAP FOLIO #3)

This reach contains significant open water cover (84%). A number of other land cover types are also present, including: shrubland (6%), other (5%), unvegetated lands (3%), forest (1%), and grassland (1%).

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW maps record known spawning and known juvenile rearing habitat for summer steelhead. The presence of the following fish species is also mapped: coho salmon, bull trout, fall Chinook, Kokanee salmon, largemouth bass, mountain whitefish, rainbow trout, smallmouth bass, sockeye salmon, spring Chinook, summer steelhead, walleye, and white sturgeon.

Very limited wetland habitat is mapped along the river (1% of the reach). Priority mule deer winter range, bighorn sheep, elk winter range, and cliffs/bluffs are mapped along the reach; common loon and waterfowl concentrations are also mapped within the reach.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1) No shoreline modifications are mapped within the reach.	**PUBLIC ACCESS (MAP FOLIO #4)** There are a number of unimproved roads that provide access to Yakima River Reach 3.
EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily agriculture (75%), with rural land (27%) at the upstream and downstream ends. Land ownership is 31% private and 69% public (BLM and WDFW).	**CONTAMINATED SITES** No identified contaminated sites are located within this reach.
ZONING (MAP #5) Lands within the reach are zoned for agriculture (63%) and forest & range (37%).	**CULTURAL AND ARCHAEOLOGICAL RESOURCES** A total of 153 recorded precontact sites, 10 recorded historic sites, and 18 recorded sites that feature both precontact and historic features are located within the reach. The precontact sites predominantly feature rockshelters, burials, and petroglyphs.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY **Medium:** The reach provides habitat for a variety of priority fish species, but the river has several water quality impairments and is highly influenced by dam operations (upstream and downstream).	**TERRESTRIAL HABITAT QUALITY** **Medium:** The reach is connected to significant areas of undisturbed habitat, and the majority of the reach is unaltered.
VEGETATION FUNCTIONS **Low:** Most of the shoreline is unaltered, but vegetation coverage is naturally sparse.	**HYDROLOGIC FUNCTIONS** **Medium:** The reach but provides important hyporheic flow functions, but is highly influenced by dam operations

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- There are many important archaeological resources located within the reach.
- The Wanapum and Priest Rapids dams significantly alter the hydrology and fish habitat quality of the reach (see Reach 1).
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.
- Protect the high-quality wildlife and shrub-steppe habitat within the reach.
- This reach contains an area of sand shrub-steppe, a unique habitat type.

CHAPTER 7. REGULATORY PROGRAMS THAT COMPLEMENT THE SHORELINE MASTER PROGRAM

Shoreline Master Programs (SMPs) are one of several regulatory programs that determine, influence, and affect the type, intensity, and impact of development along and adjacent to shoreline environments. The adopted codes of Kittitas County (the Kittitas County Code [KCC]), Cle Elum (the Cle Elum Municipal Code [CEMC]), Ellensburg (the Ellensburg Municipal Code [EMC]), and South Cle Elum (the South Cle Elum Municipal Code [SCEMC]) include several additional provisions that work along with the respective SMPs, as well as state and federal programs, to protect shorelines and accommodate appropriate shoreline use and development. This Chapter summarizes some of the key regulatory programs for the County and the three partnering municipalities that support the overall goals and policies of the respective SMPs.

7.1 Local Regulations and Plans

7.1.1 Existing Shoreline Plans, Comprehensive Plans, and Zoning

7.1.1.1 Kittitas County (KCC Title 17: Zoning)

The County's SMP has not been comprehensively updated since 1975. The current shoreline master program is being updated to address current conditions, consider new science, and become better aligned with state laws pertinent local laws.

The County adopted its first comprehensive plan in 1996 and has made several updates to the plan to identify long-range planning goals and policies that address countywide issues. The comprehensive plan utilized for this inventory and characterization study is dated December 2011(Kittitas County 2011); this version

of the plan is updated from the County's 2006 comprehensive plan[1]. The comprehensive plan sets a series of goals and policies to manage all unincorporated lands throughout Kittitas County, totaling almost 1.5 million acres (and including all areas of the County's shoreline jurisdiction).

Management areas addressed by the 2011 Comprehensive Plan include housing, transportation, capital facilities, utilities, economic development, and recreation and parks (Kittitas County 2011). The comprehensive plan also includes elements to manage land use, including broad land use goals and policies, and specific criteria for managing master planned resorts, major industrial developments, and rural lands. The plan fulfills the County's responsibilities to manage growth as mandated by the Growth Management Act (GMA).

Collectively, the plan's goals and policies provide guidance for development within the unincorporated areas of Kittitas County, including areas subject to the shoreline master program, as well as those lands held by the state.

KCC Title 17 establishes zoning districts in the county. The zoning districts that implement the 2011 Comprehensive Plan include the zones shown in Table 7-1 and depicted on Map 5 in Appendix A (Zoning). Zoning designations are in addition to any shoreline environment designations established via the SMP. The SMP environment designations and zoning designations must be consistent with one another.

7.1.1.1 Cle Elum (CEMC Title 17: Zoning)

Cle Elum currently does not have a separate SMP; the City relies on the Kittitas County SMP adopted in 1975 for shoreline regulations. The SMP update provides the City with an opportunity to develop a set of policies and regulations for shorelines that are tailored to the City's needs.

The Cle Elum comprehensive plan, adopted in 2007, includes references to planning policies established by the County. Title 17 of the Cle Elum Municipal Code details zoning requirements that apply throughout the city, including areas within the jurisdictional shorelines of the City (Map 5, Appendix A).

[1] The County is currently underway on the Kittitas County Comprehensive Plan Compliance 2012 project, an effort to revise its comprehensive plan to meet state Growth Management Act requirements. After the plan update occurred in 2006, some aspects of the plan were rejected by the Eastern Washington Growth Hearings Board. Since that time, the County has been working to address consistency issues. See the Compliance 2012 project webpage for more information: http://www.co.kittitas.wa.us/cds/compliance-2012/.

Table 7-1. Zoning Designations in Kittitas County Established by KCC Title 17

Residential Zones		Rural Zones	
R	Residential	R-3	Rural 3
R-2	Residential II	R-5	Rural 5
RR	Rural Residential	**Resource Zones**	
UR	Urban Residential	A-3	Agricultural 3
Commercial Zones		A-5	Agricultural 5
CF	Commercial Forest	A-20	Agricultural 20
C-L	Limited Commercial	CA	Commercial Agriculture
C-G	General Commercial	CF	Commercial Forest
C-H	Highway Commercial	F-R	Forest and Range
Industry Zones		**Other Zones**	
I-L	Light Industry	PUD	Planned Unit Development
I-G	General Industry	HT-C	Historic Trailer Court
		L-H	Liberty Historic Zone
		A	Airport Zone
		MPR	Master Planned Resort

7.1.1.2 Ellensburg (EMC Title 13: Zoning)

Ellensburg currently does not have a separate SMP; the City relies on the 1975 Kittitas County SMP for shoreline regulations. The SMP update provides the City with an opportunity to develop a set of policies and regulations for shorelines that are tailored to the City's needs.

The Ellensburg Comprehensive Plan was adopted in 2006. The plan establishes local goals and policies for a variety of management areas, including land use, and includes references to and integration with planning policies established by the County's comprehensive plan. Title 13 of the Ellensburg Municipal Code outlines zoning requirements that apply throughout the city, including areas within the City's jurisdictional shorelines (Map 5, Appendix A).

Ellensburg is currently completing a comprehensive update of the City's land development code regulations in order to create consistency with the comprehensive plan, make the code more user friendly, incorporate current best practices, and provide for future development that is more energy efficient and

improves walkability in the community. A first draft version of the new land development code was released for public review and comment in September 2011. A second and final draft will be released in June 2013 which will begin the formal review and process. It is anticipated that formal adoption will occur in late 2013 (Mike Smith, personal communication).

7.1.1.3 South Cle Elum

The Town of South Cle Elum currently does not have a separate SMP but relies on the Kittitas County SMP for shoreline regulations. Like the other municipalities in the County, the SMP update process gives the Town a chance to develop an SMP that is tailored to its specific needs.

The South Cle Elum Comprehensive Plan was originally adopted in 1995 and revised in 2007 and 2011. The plan establishes goals and policies for a variety of management areas, including land use, housing, and transportation. Chapter 17 of the South Cle Elum Municipal Code outlines zoning requirements that apply throughout the city, including areas within the Town's jurisdictional shorelines (Map 5, Appendix A).

7.1.2 Critical Areas Regulations

7.1.2.1 Kittitas County (KCC Title 17A)

The GMA defines the following types of areas as "critical areas": critical aquifer recharge areas, flood hazard areas, geologic hazard areas, habitat conservation areas, and wetlands. Kittitas County critical area regulations apply to all those unincorporated lands not within city, town, or national parks / forest lands. Developed in 1994, the code provides protection for critical areas through the use of buffers, land use restrictions, and building standards.

Concurrent with the SMP update, the County is undertaking a comprehensive review and update of critical areas regulations. As an initial step, the County is completing a review of best available science to identify necessary protections for critical areas, including streams, other waters, and wetlands. Based on the results of the best available science review, KCC Title 17A will be revised. It is anticipated that KCC Title 17A will occur in 2014 after Ecology approval of the County's updated SMP.

7.1.2.2 Cle Elum (CEMC Title 18)

The Cle Elum critical areas regulations are adopted as CEMC Title 18. The City's critical areas regulations were extensively updated in 2010 by Ordinance 1335. Like the County, the critical areas standards in Cle Elum were developed consistent with GMA requirements to provide protection for critical aquifer recharge areas, flood hazard areas, geologic hazard areas, habitat conservation areas, and wetlands.

Cle Elum's critical areas regulations include general performance standards for all critical areas (CEMC 18.01.070.A), as well as specific performance standards pertaining to each type of critical area (CEMC 18.01.070. A through F). Wetlands are provided with protective buffers ranging in width from 40 feet (for all Category IV wetlands) to 190 feet (Category I wetlands as determined by meeting 'bog' or 'Natural Heritage Wetland' criteria). Impacts to wetlands, where allowed and where avoidance is not feasible, require mitigation. The ratios of impact area to mitigation area are established by wetland type for a variety of mitigation options.

Many streams are regulated by CEMC Title 18 as fish and wildlife habitat conservation areas when they support federally listed fish species or when designated as waters of the state. Standards for stream protection do not require designation of riparian buffers of specific width. Section CEMC 18.01.07.D requires protection of flora and fauna identified as "protected" within fish and wildlife habitat conservation areas, as well as use of best management practices to shelter these areas from construction activities.

7.1.2.3 Ellensburg (EMC Title 13, Chapter 13.39)

Ellensburg critical areas regulations are adopted as EMC Chapter 13.39, integrated into Title 13 (Zoning). The City's critical areas regulations were extensively updated in 2009 and 2010 by Ordinances 4545 and 4565, respectively. Like the County and other cities, the critical areas standards in Ellensburg were developed consistent with GMA requirements to provide protection for critical aquifer recharge areas, flood hazard areas, geologic hazard areas, habitat conservation areas, and wetlands.

Ellensburg's critical areas regulations include specific performance standards pertaining to each type of critical area (EMC Article III pertains to wetlands, Article IV frequently flooded areas, and Article VI fish and wildlife habitat conservation areas). Wetlands are provided with protective buffers ranging in width from 25 feet (for all Category IV wetlands) to 150 feet (for all Category I wetlands). Impacts to wetlands, where allowed and where avoidance is not feasible, require mitigation. The ratios of impact area to mitigation area are established by wetland type for a variety of mitigation options.

Streams are regulated by EMC Title 13.39 as fish and wildlife habitat conservation areas. Standards for stream protection require designation of riparian buffers of specific width, ranging from 250 feet for the Yakima River (Type 1 stream), 85 feet for Type 2 streams, and 50 feet for Type 3 and 4 streams.

7.1.2.4 South Cle Elum

The South Cle Elum critical areas regulations (SCEMC Chapter 16.10) were adopted in 1995. The critical areas regulations Cle Elum were developed consistent with GMA requirements to provide protection for critical aquifer recharge areas, flood hazard areas, geologic hazard areas, habitat conservation areas, and wetlands.

South Cle Elum's critical areas regulations include specific performance standards pertaining to each type of critical area (Section 150 pertains to wetlands, Section 250 to frequently flooded areas, Section 280 to geologically hazardous areas, Section 340 to fish and wildlife habitat conservation areas, and Section 410 to aquifer recharge areas). Wetlands require protective buffers ranging in width from 25 to feet for Category IV wetlands to 100 to 200 feet for Category I wetlands, depending upon the overall intensity of the proposed use and other factors. Impacts to wetlands require mitigation. The ratios of impact area to mitigation area are established by wetland type for a variety of mitigation options.

Riparian habitats (i.e. the Yakima River) are regulated by SCEMC 16.10.350 as fish and wildlife habitat conservation areas. Riparian habitats require protective buffers ranging in width from 100 to 325 feet, depending on the overall intensity of the proposed use and other factors.

7.1.2.5 Integration of Critical Areas Regulations into Shoreline Programs

State law requires that SMPs provide protection for critical areas within shoreline jurisdiction. This was clarified most recently in Engrossed House Bill 1653 (Washington State 2010), which amended the GMA to declare that shoreline master programs must provide a level of protection to critical areas located within shorelines of the state that "assures no net loss of shoreline ecological functions necessary to sustain shoreline natural resources as defined by Ecology guidelines adopted pursuant to RCW 90.58.060." Ecology has directed local jurisdictions to incorporate their critical area ordinances into their SMPs according to one of two options:

1. Adopt by reference the critical areas ordinance, citing the ordinance number and date of adoption; or

2. Incorporate the critical areas ordinance into the SMP as either an appendix or part of the body of the SMP.

Ecology's SMP guidelines state that local governments that plan to integrate critical area regulations into SMPs must review the existing critical area regulations to ensure they meet SMA requirements for critical area protection. Jurisdictions must use *"the most current, accurate and complete scientific and technical information available"* (WAC 173-26-201(2)(a)).

7.1.3 Other Relevant Local Provisions

In addition to comprehensive plan policies and zoning regulations, Kittitas County and the partnering jurisdictions administer other plans and programs that influence shoreline development, and as such need to be considered and integrated into the SMP updates (Table 7-2).

Table 7-2. Other Relevent Local Plans and Programs

Plan / Program	Description	Code Citations
State Environmental Policy Act(SEPA) / Environmental Policy Regulations	Establishes procedures and policies to implement SEPA. All non-exempt County / City actions require environmental review under SEPA.	County: KCC Title 15 Cle Elum: CEMC 15.28 Ellensburg: Chapter 1.42 South Cle Elum: SCEMC Chapter 16.05
Floodplain Regulations	Establish policies, regulations, and land use controls to promote public health, safety, and general welfare; reduce the annual cost of flood insurance; and minimize public and private losses due to flood conditions in specific areas. In addition to codified floodplain regulations (typically developed to meet consistency with federal and state minimum floodplain management standards), all jurisdictions planning under GMA are required to manage floodplains as critical areas.	County: KCC Chapter 14.08 Cle Elum: CEMC 15.24 Ellensburg: EMC 13.34, Article IV (incorporated into Critical Areas Code) South Cle Elum: SCEMC 16.10.260
Historic Preservation	The purpose of historic preservation standards is to provide for the identification, evaluation, and protection of designated historic and prehistoric resources.	County: KCC Title 15 Cle Elum: CEMC 15.22 Ellensburg: Chapter 1.45 South Cle Elum: (none)
Stormwater / Surface Water Management	Stormwater management plans provide for comprehensive management of surface and stormwater for land use proposals and development projects that could have impacts related to water quality, erosion, clearing and grading activities, flood hazard zones, or critical areas. The City of Ellensburg has established stormwater / surface water utilities.	Ellensburg: EMC Chapter 9.100 (establishes Utility)

7.1.4 Other Regional Plans

7.1.4.1 Yakima Basin Integrated Water Resource Management Plan

In 2009, Ecology and the U.S. Bureau of Reclamation convened representatives from the Yakama Nation, irrigation districts, environmental organizations, and federal, state, county, and city governments to form the Yakima River Basin Water Enhancement Project to help develop a consensus-based solution to the basin's water problems. The project resulted in an Integrated Water Resource Management Plan, released in 2011, that will allow for authorization and funding (both federal and state) to begin implementing projects outlined in the integrated plan.

The Integrated Plan has seven elements, all framed around development and allocation of water sources to support a variety of uses and functions. The elements include reservoir fish passage; structural and operational changes to existing facilities; surface water storage; groundwater storage; habitat/watershed protection and enhancement; enhanced water conservation; and market reallocation of water. The Final Programmatic Environmental Impact Statement was recently published for the Integrated Plan. More information is available at the Ecology project site: http://www.ecy.wa.gov/programs/wr/cwp/YBIP.html.

7.1.4.2 Fish & Wildlife Recovery Planning

The Yakima Basin Fish & Wildlife Recovery Board has led development of a recovery plan for steelhead (2009) and an action plan for bull trout (2012). The Yakima Subbasin Plan (2005) guides investment in fish and wildlife mitigation projects by the Bonneville Power Administration.

These recovery planning efforts meet requirements specified by the Endangered Species Act for federally listed populations, identifying the causes for decline, setting specific goals for recovery, and identifying actions that will be needed to achieve goals. More information is available at the Yakima Basin Fish & Wildlife Recovery Board website (http://www.ybfwrb.org/).

7.2 State and Federal Regulations and Plans

Numerous state and federal agencies have regulatory jurisdiction over resources in the County's shoreline planning area. State and federal regulations apply throughout Kittitas County and sometimes overlap with existing County regulations and with each other. Among the most important of these regulations are the federal

Endangered Species Act, the federal Clean Water Act, the federal National Flood Insurance Program, the federal Rivers and Harbors Act, the state Forest Practices Act, and state Hydraulic Code. Other relevant federal laws include the National Environmental Policy Act, Anadromous Fish Conservation Act, Clean Air Act, and Migratory Bird Treaty Act. Other state laws that address shoreline issues include the State Environmental Policy Act, Salmon Recovery Act, and Water Quality Protection Act.

A variety of agencies (e.g., U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Departments of Natural Resources and Fish and Wildlife) are involved in implementing these regulations. These agencies typically only review shoreline permits that involve in-water or overwater work, discharges of fill or pollutants into the water, or substantial land clearing. Depending on the nature of the proposed development, state and federal regulations can have a major effect on the design and implementation of a shoreline project, and on the timing and complexity of the permit review process.

7.2.1 Clean Water Act Sections 401 and 404

The federal Clean Water Act (CWA) requires states to set standards for the protection of water quality. It also regulates excavation and dredging in waters of the U.S., including lakes, streams, and wetlands. Certain activities affecting shorelines, including all in-water work, require a permit from the U.S. Army Corps of Engineers (Corps) and/or Washington State Department of Ecology under Section 404 and Section 401 of the CWA, respectively. Construction of bulkheads and other shoreline revetments, docks, launching ramps, recreational swim beaches, and shoreline restoration projects all have the potential to require permits under Section 404 and Section 401. The Corps and Ecology review all projects and require mitigation for adverse impacts.

7.2.2 Rivers and Harbors Act Section 10

The federal Rivers and Harbors Act requires any project that creates an obstruction or alteration in, over, or under navigable U.S. waters to obtain a permit. Permits are issued by the Corps for construction and maintenance of in-water crossings (road or utility), docks, piers, revetments, and certain other in-water and overwater structures. Corps standards for Section 10 approval will dictate construction techniques, materials, and size and bulk allowed for construction of docks, piers, shoreline armoring, and other in-water or overwater structures. The Corps also requires mitigation for adverse effects caused by these construction activities.

7.2.3 Endangered Species Act

The federal Endangered Species Act addresses the protection and recovery of federally listed species. Depending on the listed species, the Act is administered by either the National Oceanic and Atmospheric Administration - National Marine Fisheries Service or the U.S. Fish and Wildlife Service (collectively called "the Services"). Many of Kittitas County's shoreline waterbodies provide critical migration, spawning, and rearing habitat for threatened salmon species. Any project that requires a federal permit, occurs on federal land, or uses federal funding must be reviewed to ensure that effects of the project will not result in a "take" of listed species. The Services require projects to implement specific conservation measures to ensure that listed species are not jeopardized.

7.2.4 State Hydraulic Code

The Washington Department of Fish and Wildlife regulates activities that use, divert, obstruct, or change the natural flow of the beds or banks of waters of the state and may affect fish habitat. Projects in the shoreline jurisdiction requiring construction below the ordinary high water mark could require a Hydraulic Project Approval (HPA). These projects would include construction of docks, revetments, culverts, and other in-water structures. Projects creating new impervious surfaces that could substantially increase stormwater runoff to waters of the state may also require approval.

7.2.5 Forest Practices Act

The Washington Forest Practices Act of 1974 (RCW 76.09) regulates activities that relate to growing, harvesting, or processing timber. The Forest Practices Board is an independent state agency that defines rules and regulations for forest practices. The rules are designed to protect public and natural resources such as water quality and fish habitat. By requiring harvesters to implement a reforestation plan, natural resources are protected while maintaining a viable timber industry. The Washington Department of Natural Resources (WDNR) administers the publication of the Forest Practices Board rules, along with guidance and other technical information. Specific rules involving water quality protection must be approved by Ecology prior to Forest Practices Board adoption.

Operators of lands covered under the Forest Practices Act must file a notice of intent to convert to a non-forestry use with WDNR. The notice is then forwarded to the local jurisdiction, which has the authority to approve or deny associated

development permits based on compliance with the provisions of the original application for forest practices.

The Forest Practices Act directs counties that are planning under the Growth Management Act to adopt and enforce ordinances and regulations for forest practices within their jurisdiction. The Shoreline Management Act defers management of forest lands to the Forest Practices Act in that harvest activities are not subject to SMP regulations. Regulations for forest practices within the shoreline jurisdiction may not be more restrictive than those provided by the Forest Practices Act, except for the proposed conversion to non-forest land uses (RCW 90.58.030(2)(d)(ii)).

CHAPTER 8. SHORELINE USES

One of the primary policy goals of the Shoreline Management Act is to ensure utilization of shorelines for economically productive uses that are particularly dependent on shoreline location or use. Such so-called "water-dependent" uses cannot exist or be viable unless they are located adjacent to shoreline waterbodies. "Water–related" uses are similar to water-dependent uses in that they have a functional requirement for a waterfront location or they provide a necessary service supportive of the water-dependent activities and the proximity of the use to its customers makes its services less expensive and/or more convenient. Water-depended and water-related uses are collectively referred to as water-oriented uses. Examples of water-oriented uses include marinas, fish hatcheries, hydroelectric generation plans, wastewater treatment plant outfalls, and some recreational facilities such as boat launches and campgrounds. Potential, new water-oriented uses that may occur on shorelines within Kittitas County are briefly described in Table 8-1 below.

Table 8-1. Description of Shoreline Uses

Uses	Description
Fish Hatcheries	Fishing is an important recreational use on the Yakima River and its tributaries, and there are efforts underway to restore anadromous salmon runs within the Yakima River basin. As such, there could be future demand for new fish hatcheries within the basin.
Campgrounds/Shoreline Recreation Access	Kittitas County shorelines attract thousands of visitors every year, and recreation is an important component to the economy of the area. As demand for shoreline recreational access continues to grow, there is significant potential for the development of new access facilities such as campgrounds, trails, boat launches and the like, particularly on Yakima basin shorelines.
Marinas	In general, there are limited suitable locations for new marinas on Kittitas County shorelines, with the exception of the larger lakes/reservoirs. There has been a steady increase in residential development on Kachess Lake and Cle Elum Lake, which could lead to future demand for new marinas on these shorelines.
Aquaculture	There are currently no aquaculture facilities located within Kittitas County waterbodies. However, there may be potential for new aquaculture within the County, such as rainbow trout farms.
Hydropower	The development of new large-scale hydropower dams on Kittitas County shorelines is unlikely. However, there is potential for new small-scale hydroelectric power projects on river and stream shorelines. Typical small-scale hydroelectric facilities are “run-of-the river” systems, in which a portion of the river’s water is diverted to a water conveyance, which then delivers the water to a power-generating turbine. The diverted water is then fed back into the stream at a downstream location.

CHAPTER 9. REFERENCES

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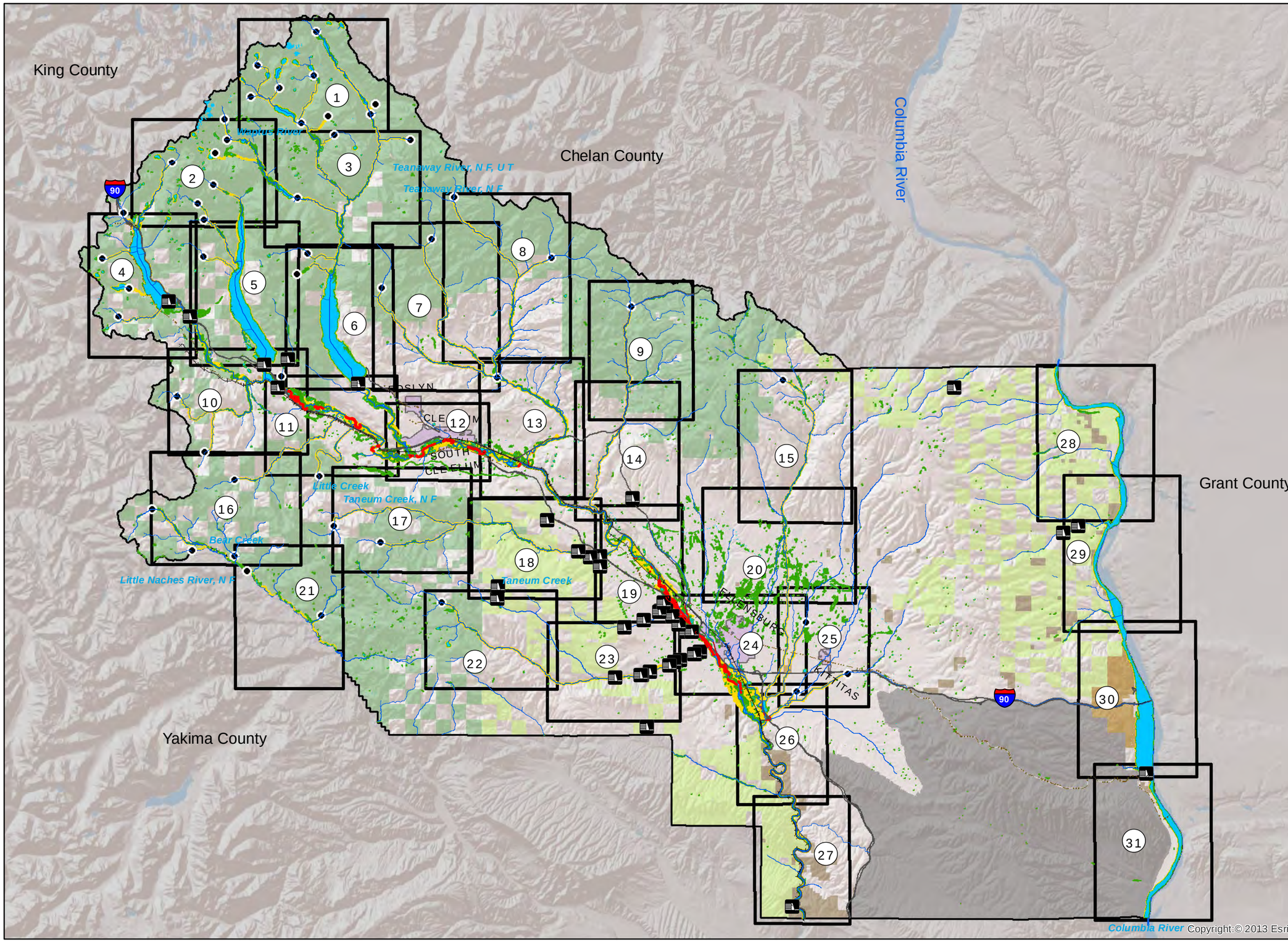
APPENDIX A MAP FOLIO



Map Folio #1: Habitats and Shoreline Modifications Map Index

Kittitas County Regional SMP Update Inventory and Characterization

0 5 10 Miles

N

- Map Index (Map # of 31)
- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Overwater Structures selection
- Hydromodifications
- Dams
- Inventory Waterbodies
- Inventory Streams
- Upstream Limits (20 cfs)
- Trails
- Railroads
- Major Roads
- Cities

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- County Boundary

Priority Fish Distribution

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Dolly Varden/Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon
	Shoreline Inventory Area

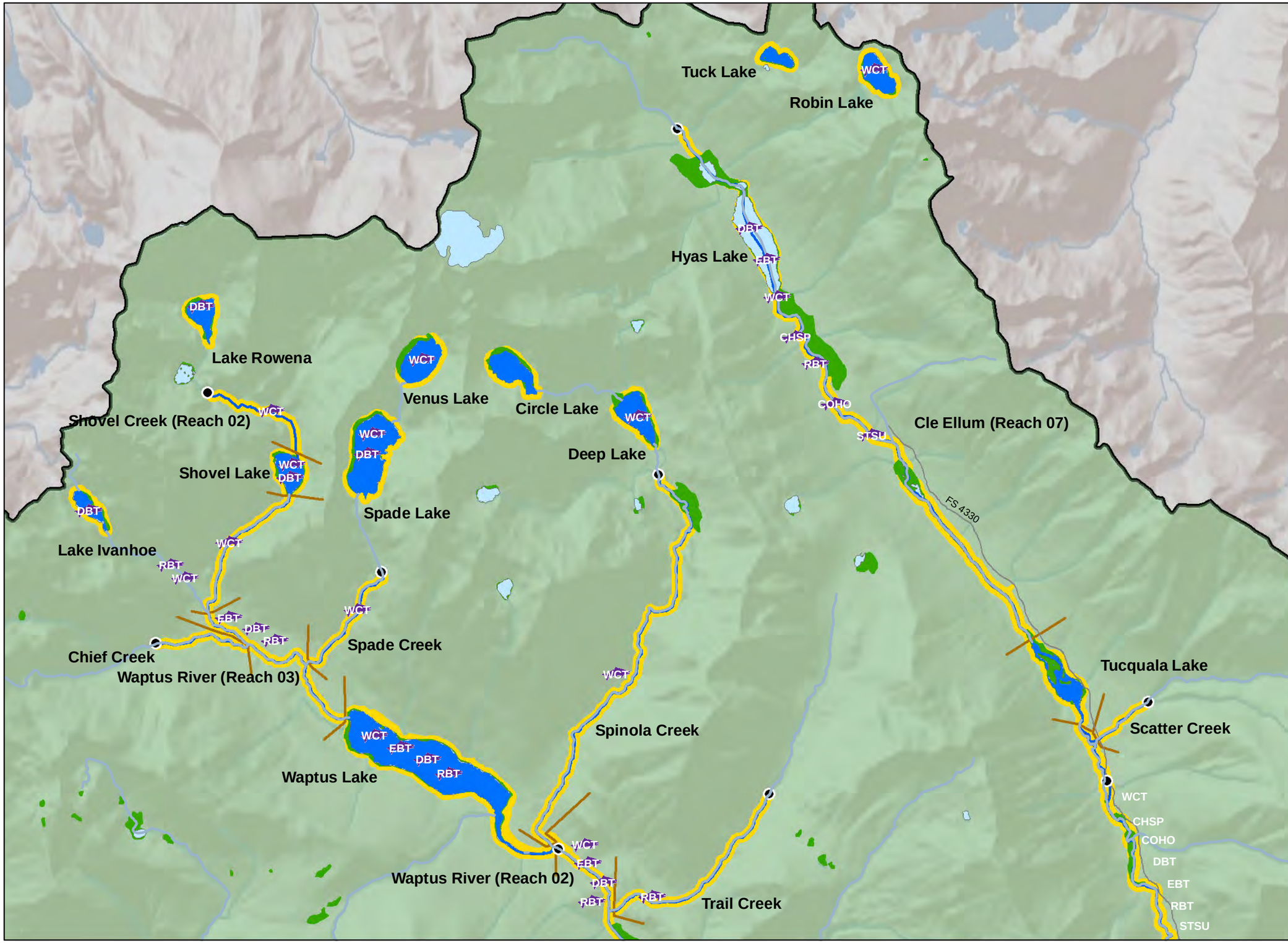
City and Town Shoreline Inventory Areas:

- 12 Map 12: City of Cle Ellum and Town of South Cle Ellum
- 24 Map 24: City of Ellensburg

ESA

3/14/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 1

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

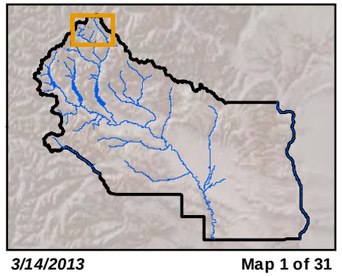
Shoreline Inventory Area
Hydromodifications
Wetlands (USFWS NWI)
Overwater Structures
Culverts
Dams
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Trails
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

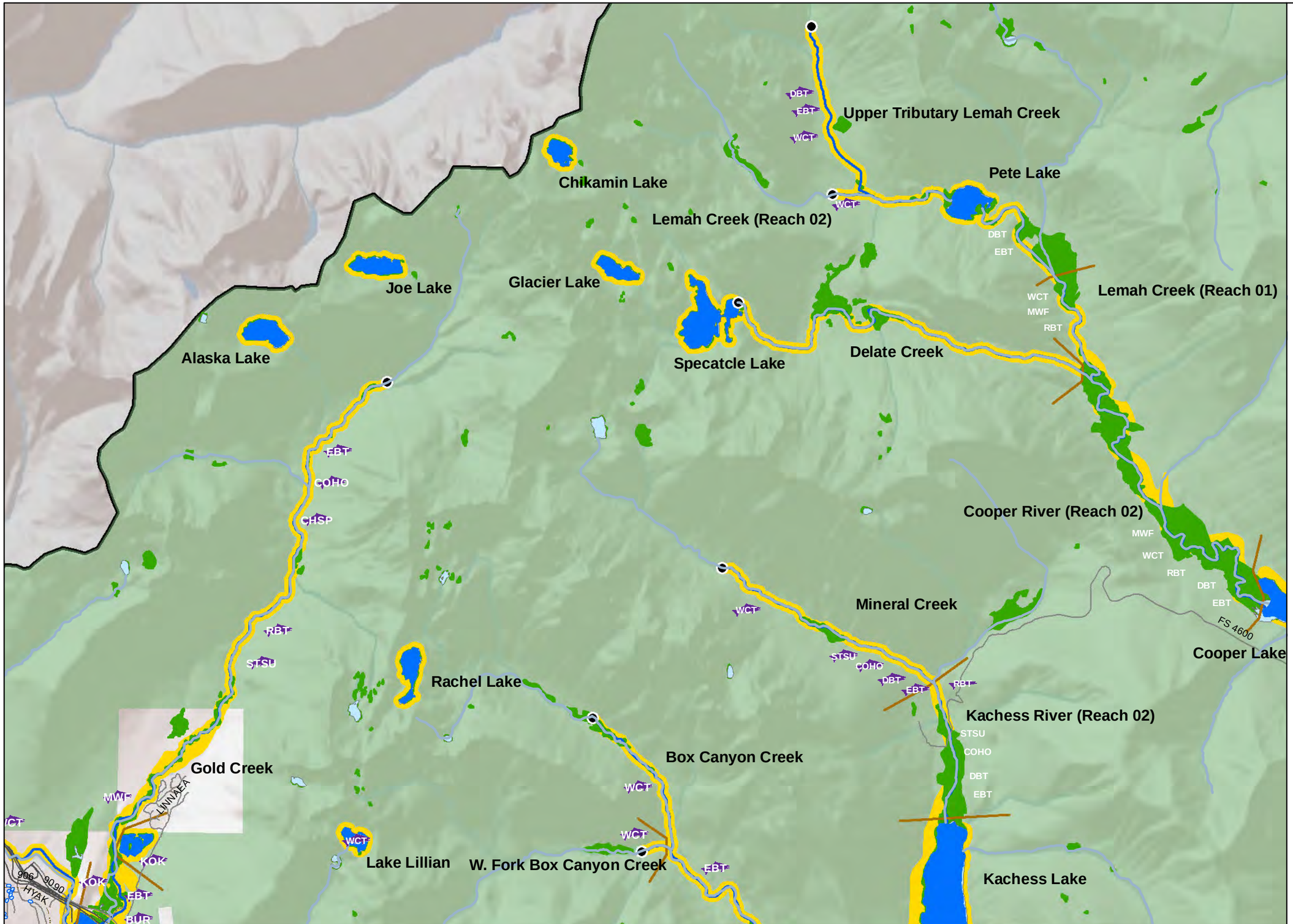
Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



3/14/2013 **Map 1 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 2

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

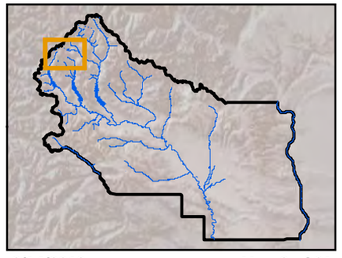
Shoreline Inventory Area
Hydromodifications
Wetlands (USFWS NWI)
Overwater Structures
Culverts
Dams
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Trails
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Priority Fish Distribution (see codes below)

Species Code

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 2 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #1: Habitats and Shoreline Modifications Map 3

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

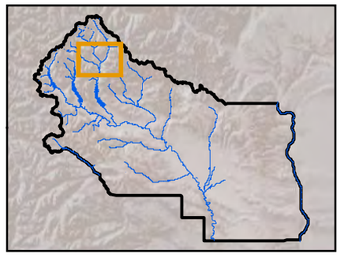
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

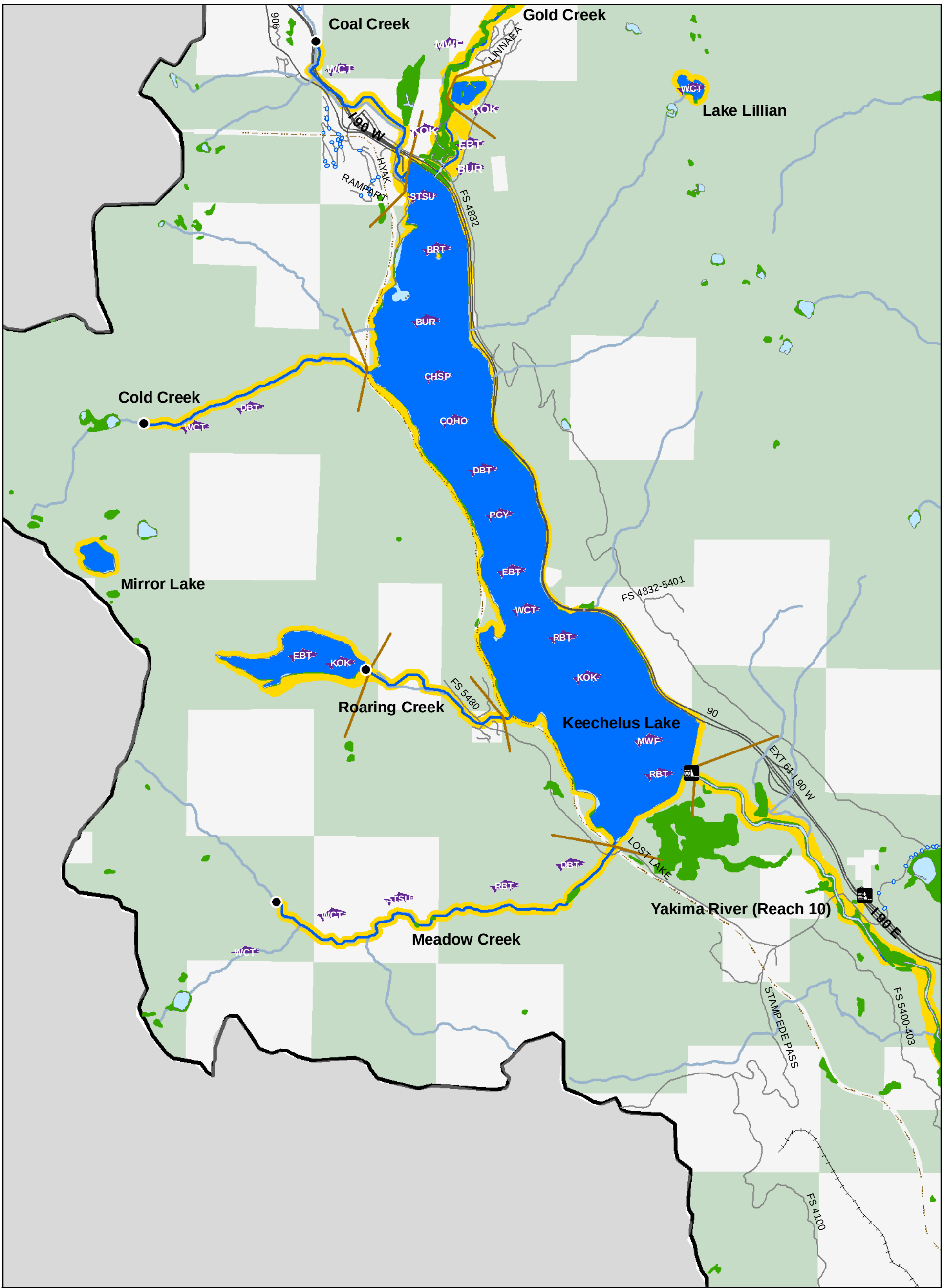
Species Code, Species Name

- BRT, Brown Trout
- BUR, Burbot
- CCT, Resident Cutthroat
- CHFA, Fall Chinook
- CHSP, Spring Chinook
- CHSU, Summer Chinook
- COHO, Coho Salmon
- DBT, Bull Trout
- EBT, Eastern Brook Trout
- KOK, Kokanee Salmon
- LMB, Largemouth Bass
- MWF, Mountain Whitefish
- PGY, Pygmy Whitefish
- RBT, Rainbow Trout
- SMB, Smallmouth Bass
- SOCK, Sockeye Salmon
- STSU, Summer Steelhead
- WAL, Walleye
- WCT, Westslope Cutthroat
- WHST, White Sturgeon



3/14/2013 **Map 3 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 4

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
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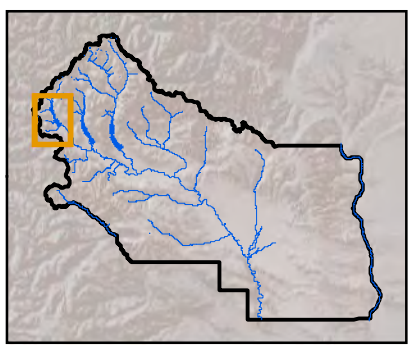
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



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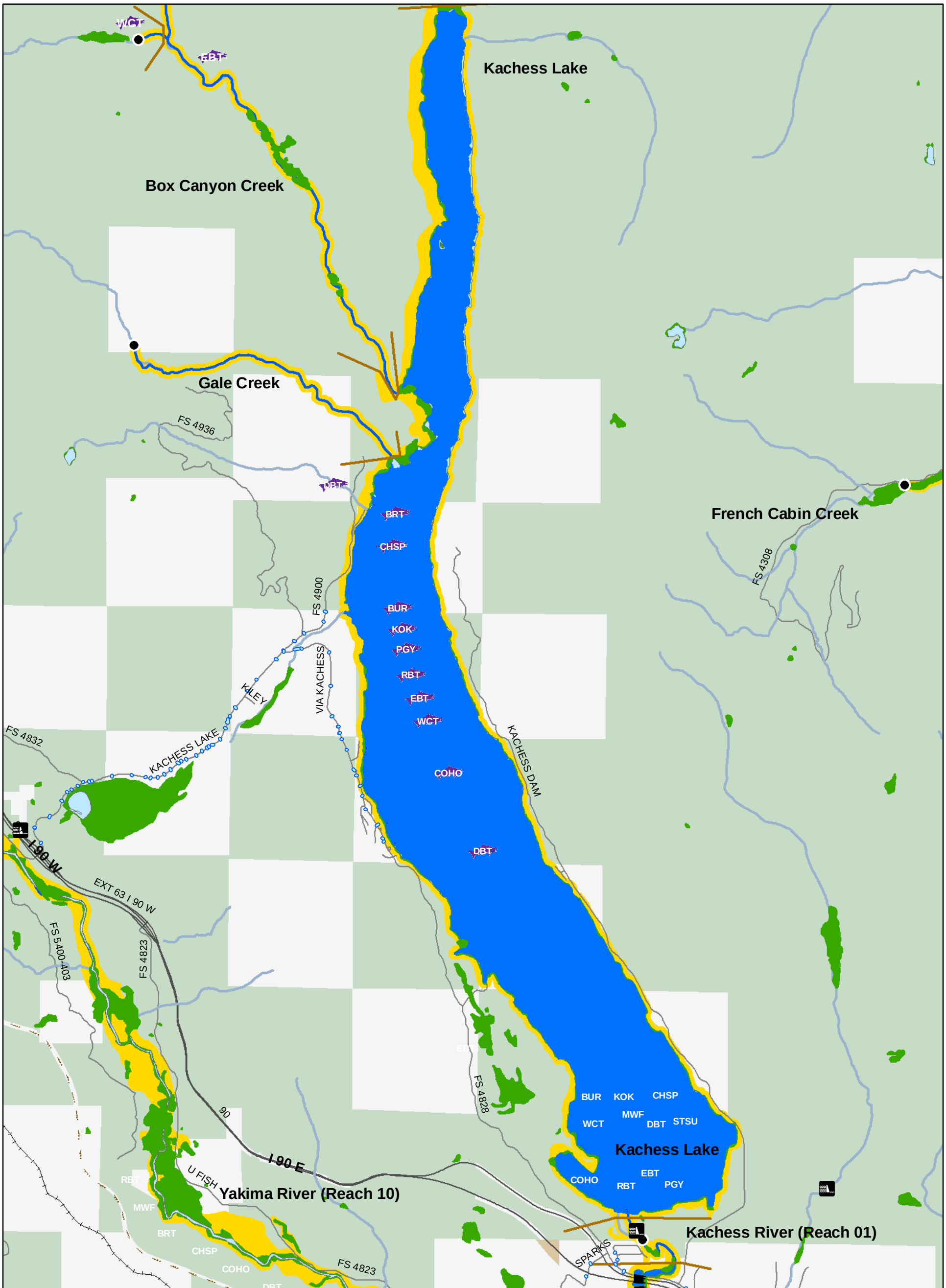
Map 4 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 5

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)

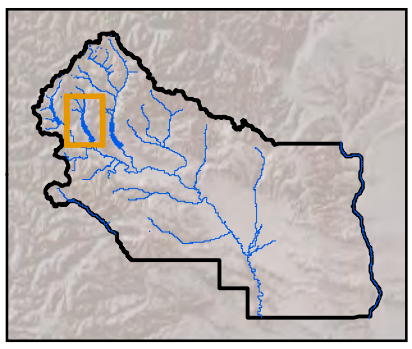
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



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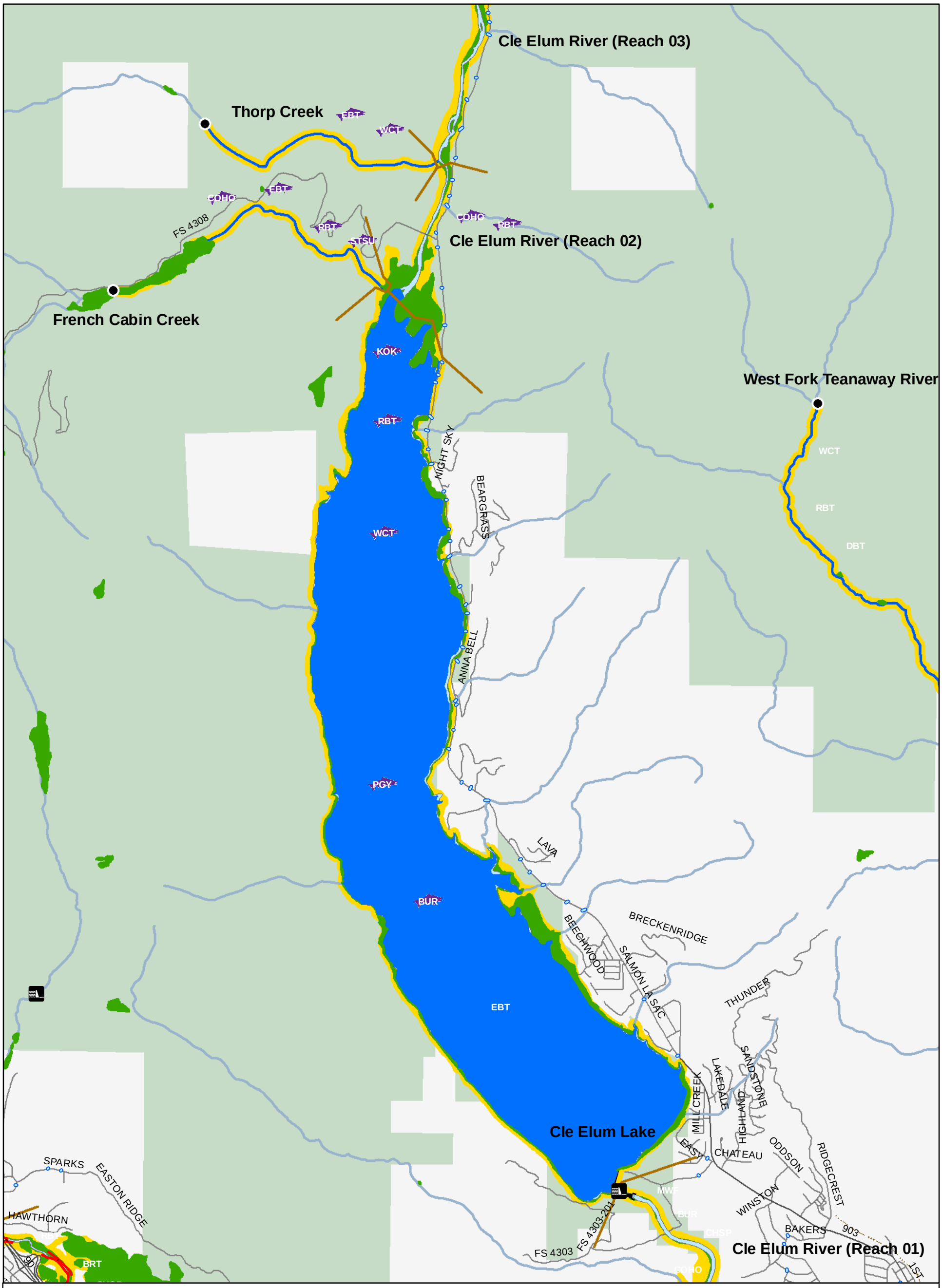
Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 6

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)

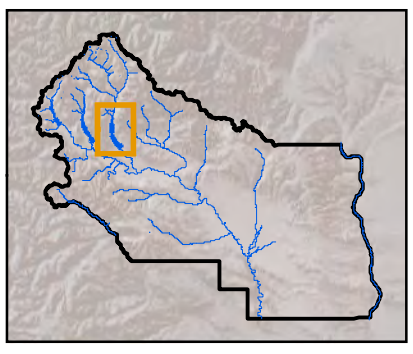
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



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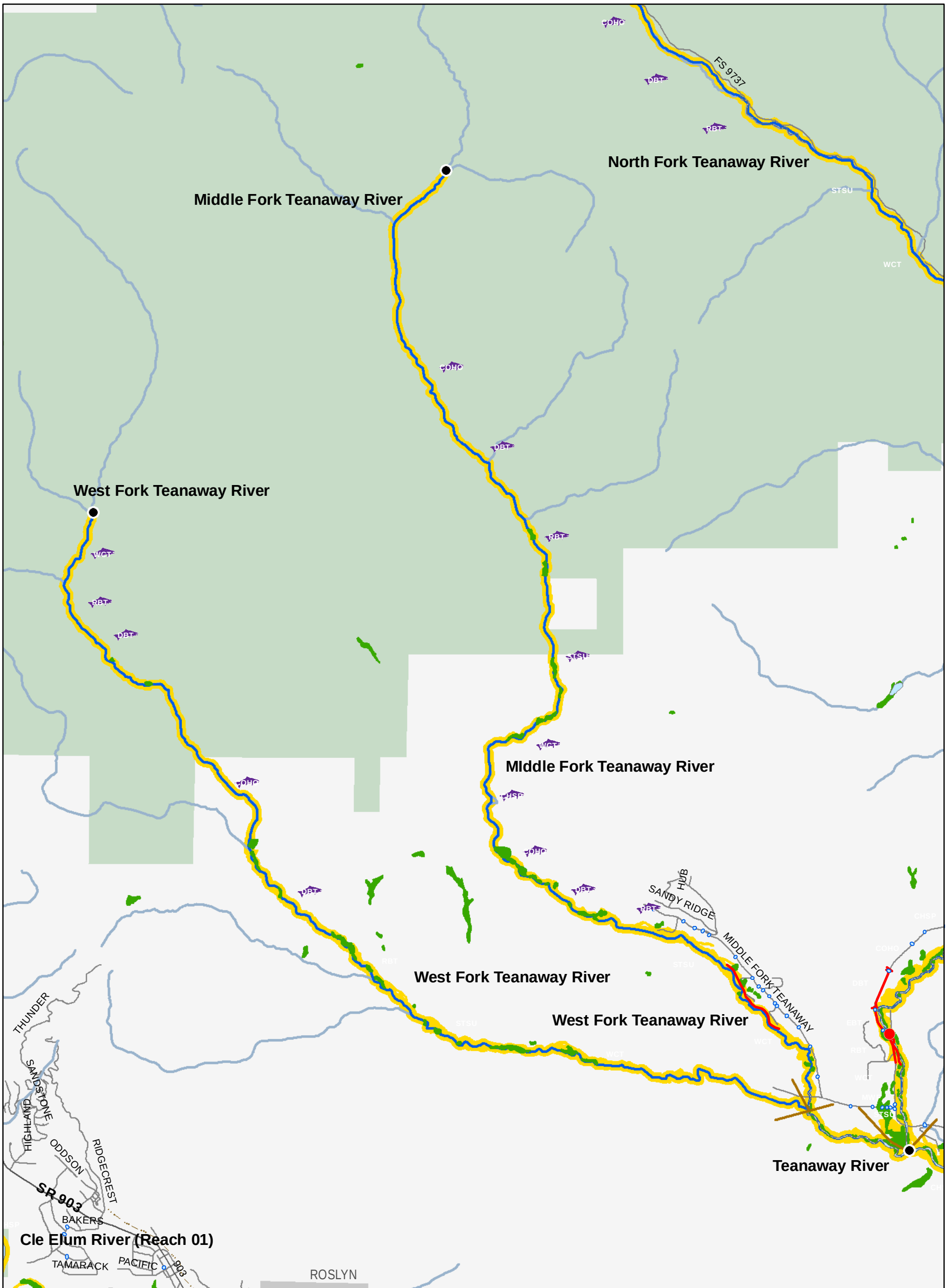
Map 6 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 7

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
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Species Code — Priority Fish Distribution (see codes below)

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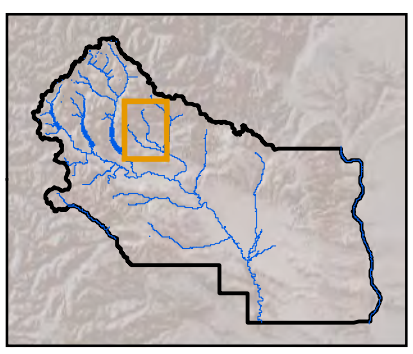
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Map 7 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #1: Habitats and Shoreline Modifications

Map 8

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
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SMA Streams
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Waterbodies

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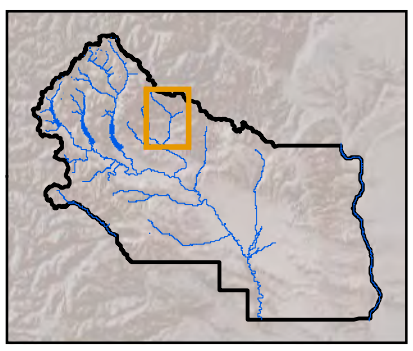
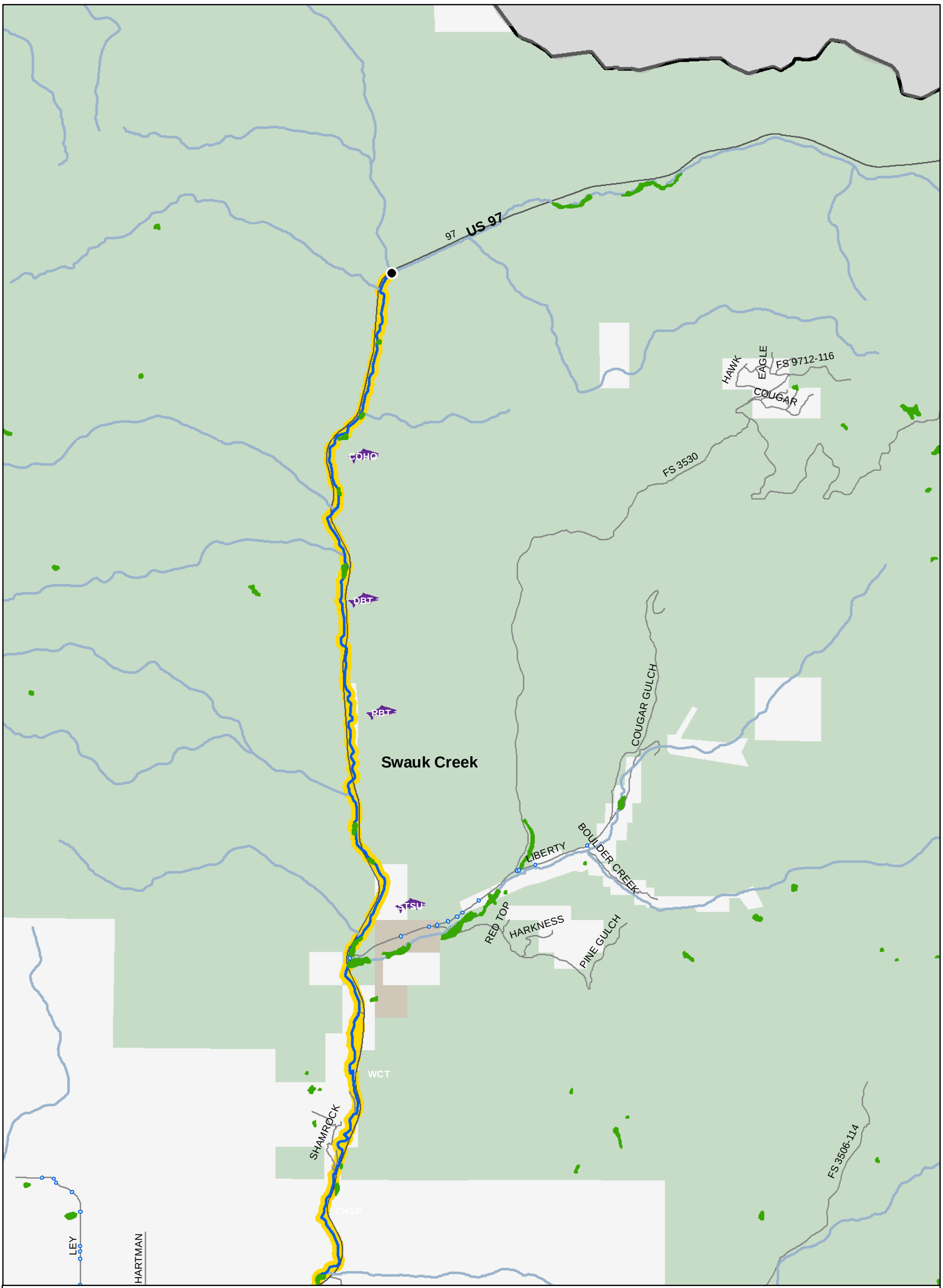
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Map 8 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 9

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)

SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code — Priority Fish Distribution (see codes below)

Species Code, Species Name	
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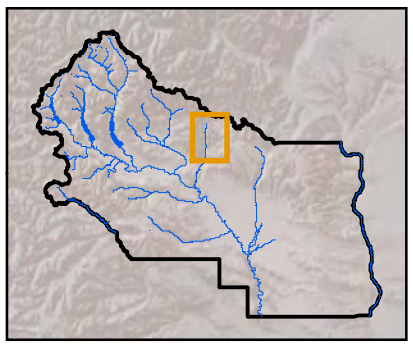
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



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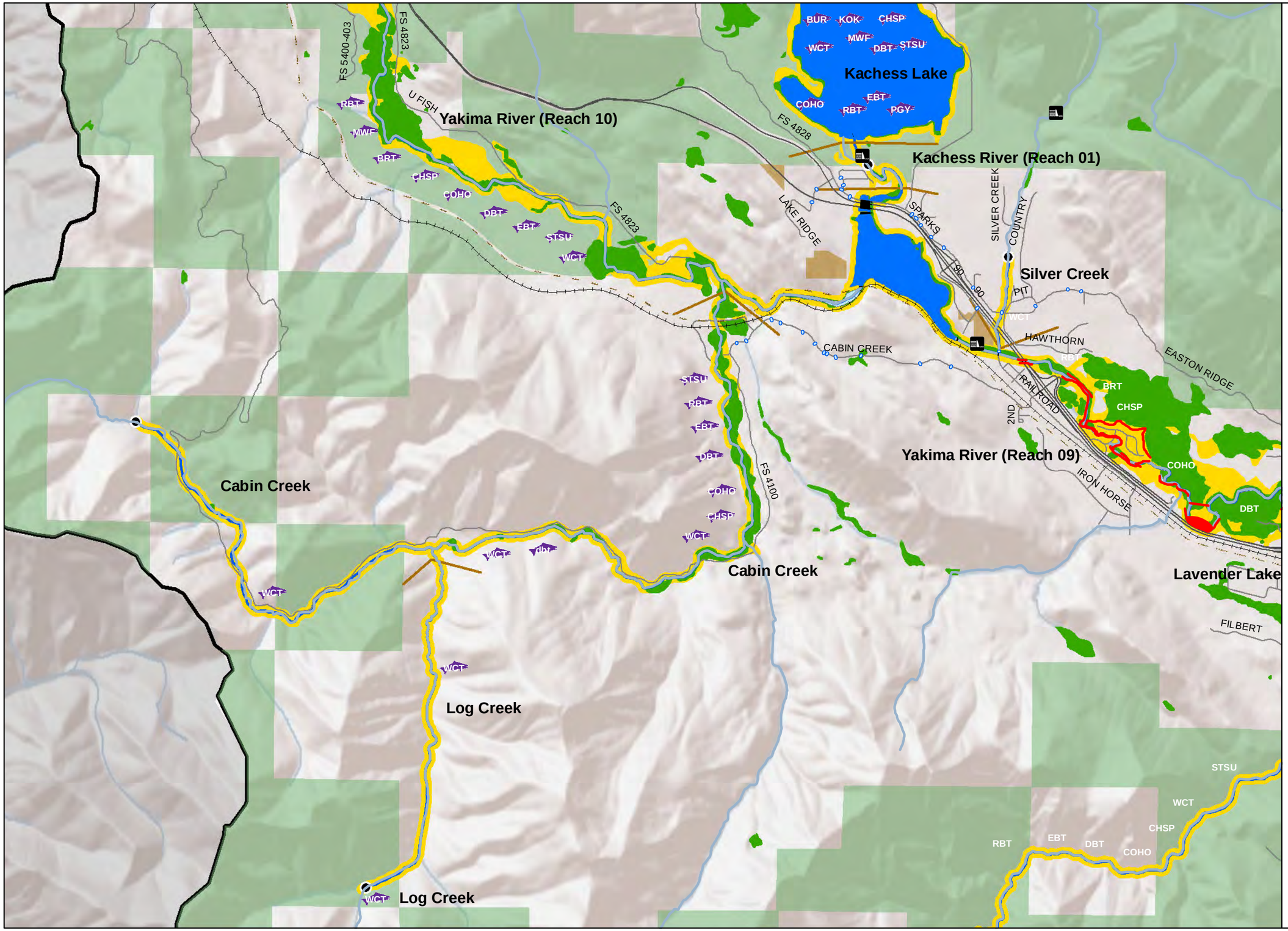
Map 9 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 10

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

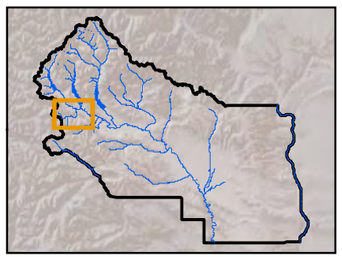
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

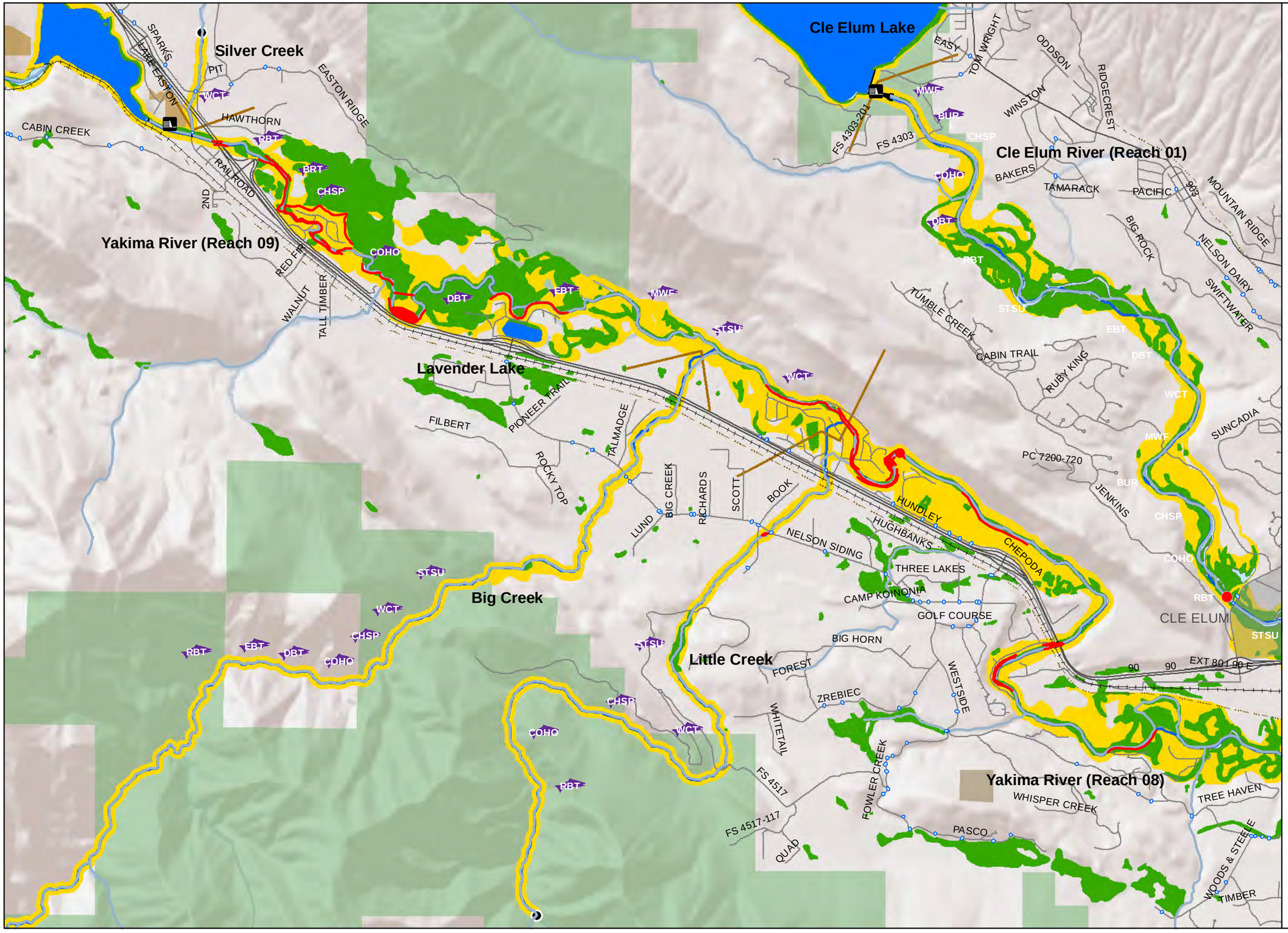
Species Code

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 10 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1:
Habitats and
Shoreline Modifications
Map 11

Kittitas County Regional SMP Update
Inventory and Characterization

0 0.5 1
Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

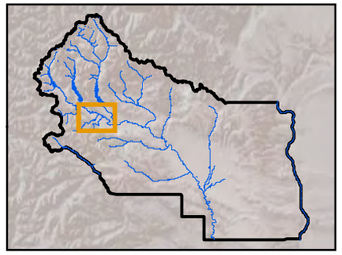
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code

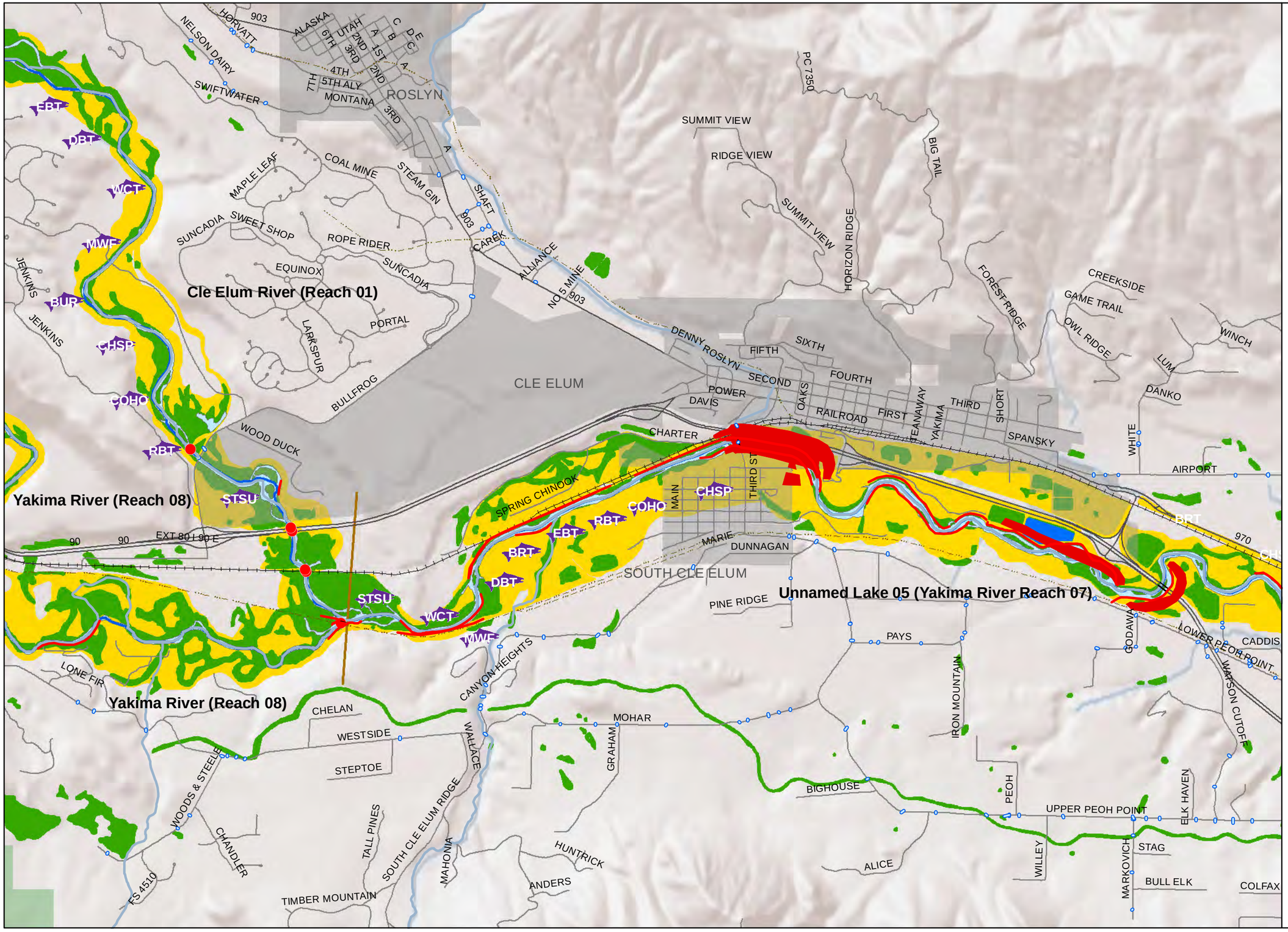
Priority Fish Distribution (see codes below)

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 11 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 12

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

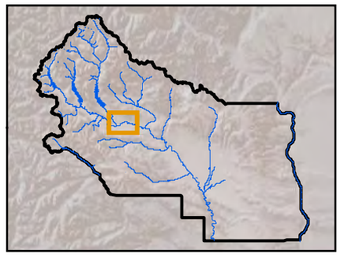
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

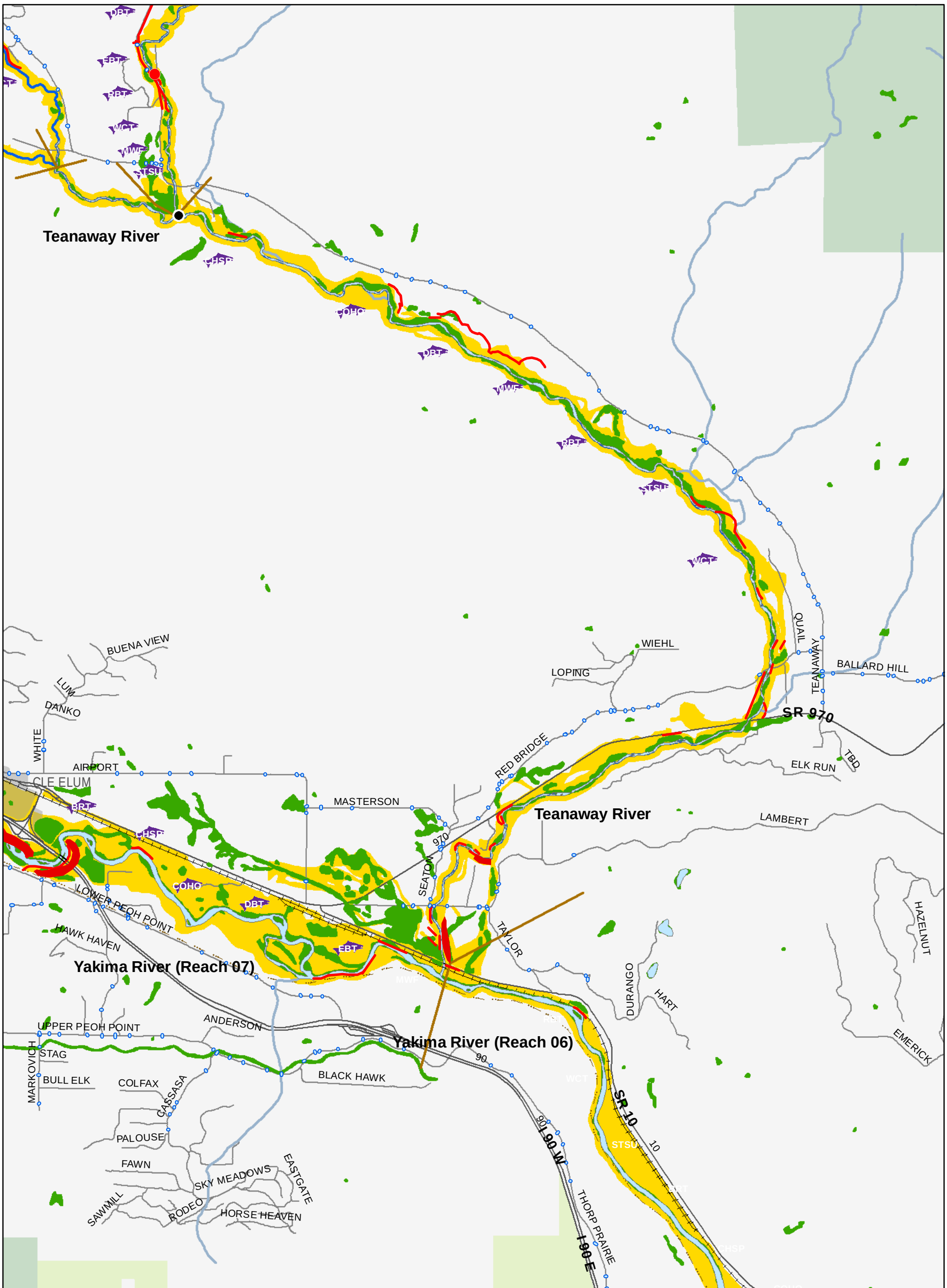
Species Code

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 12 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 13

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

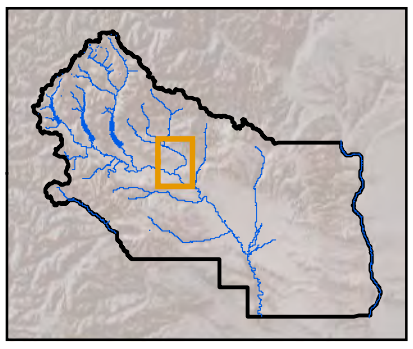
Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

Priority Fish Distribution (see codes below)

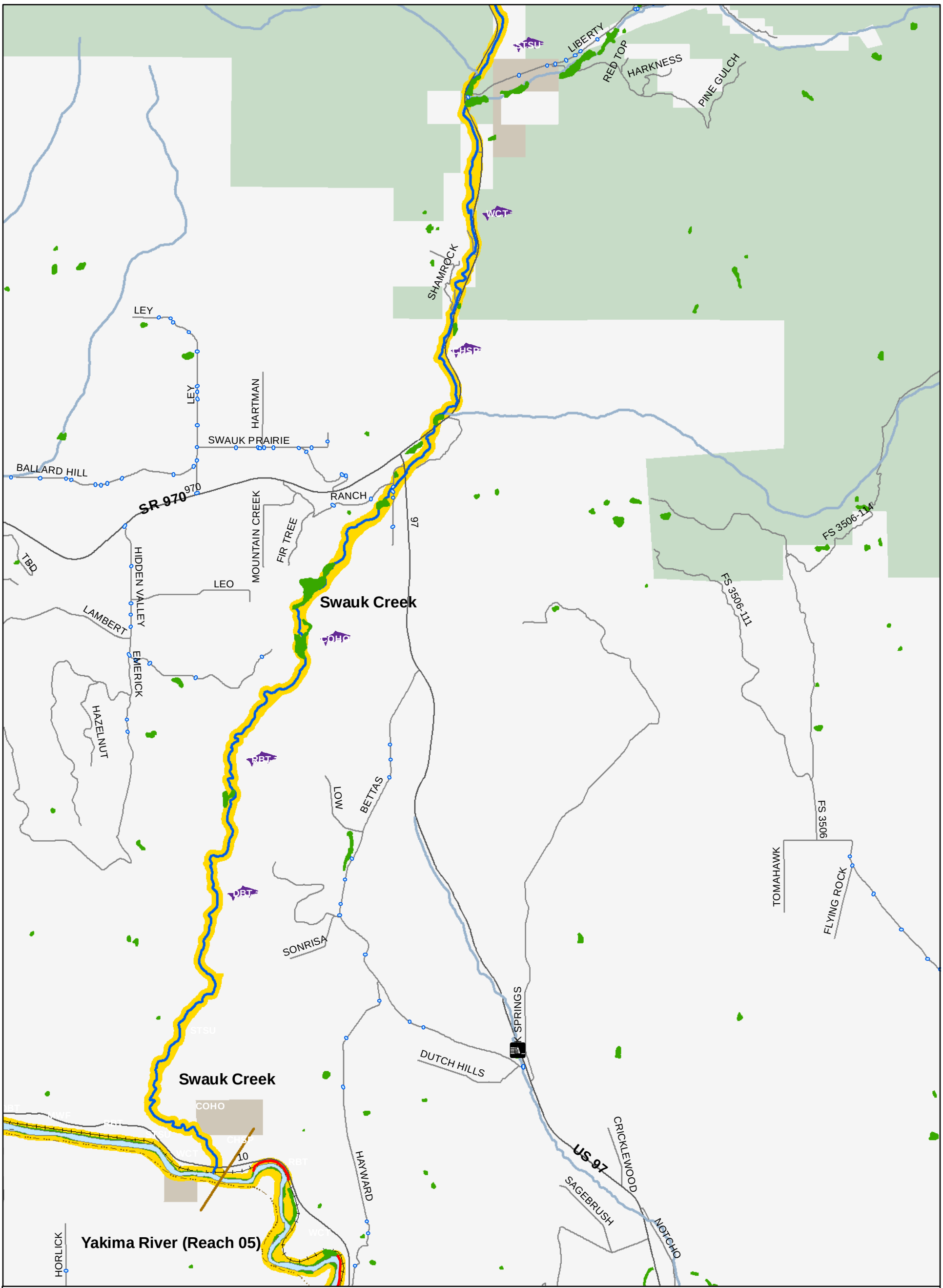
Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Map 13 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 14

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

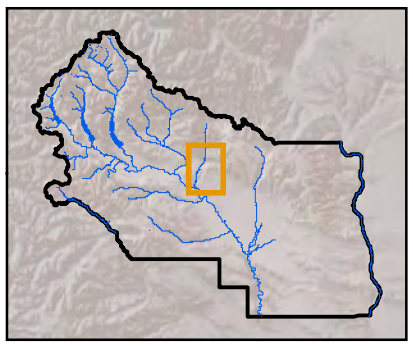
- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code

Priority Fish Distribution (see codes below)

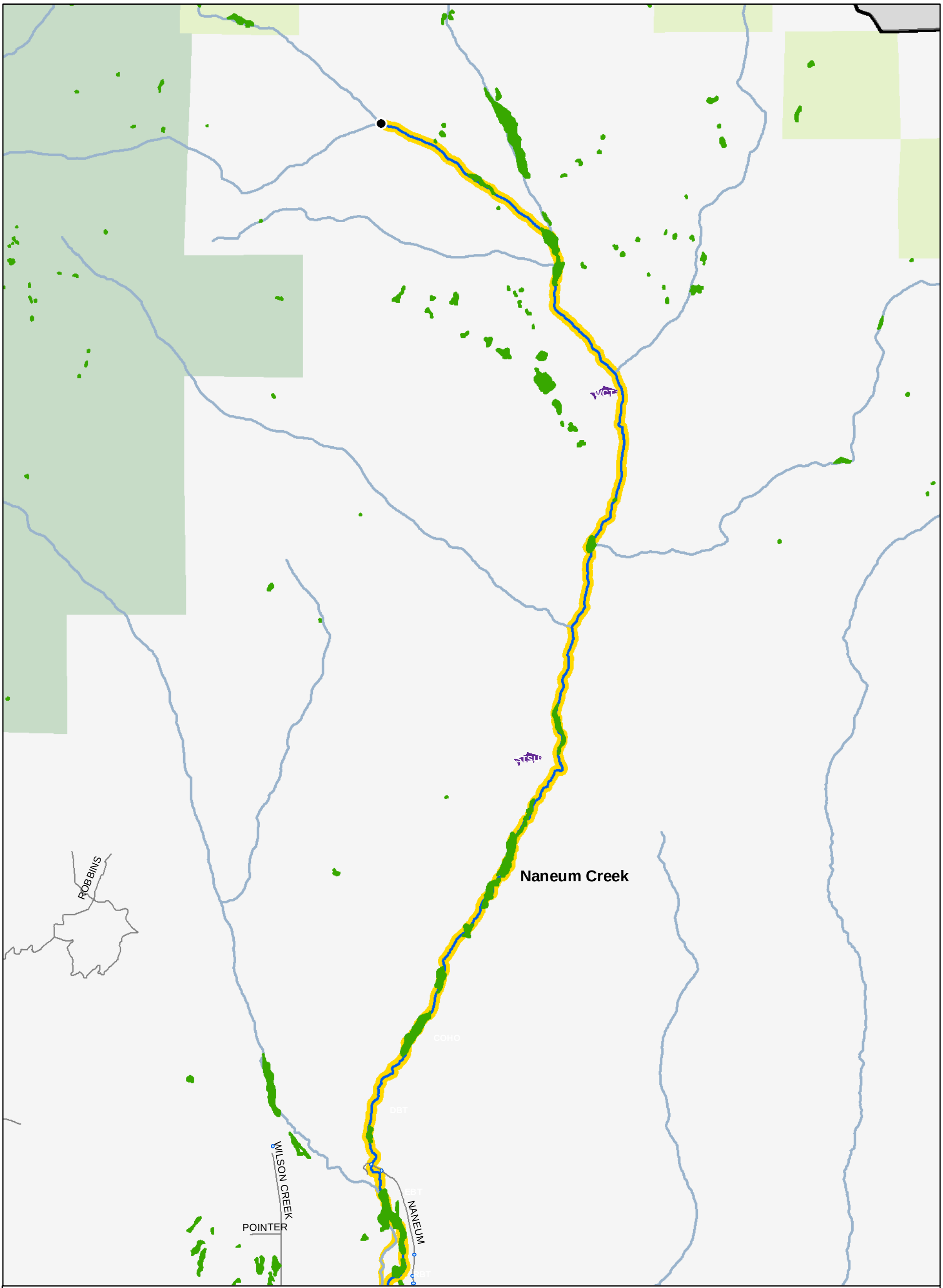
Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Map 14 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 15

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)

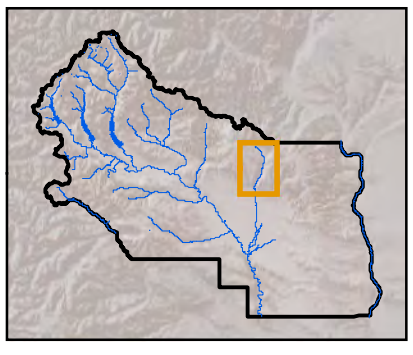
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

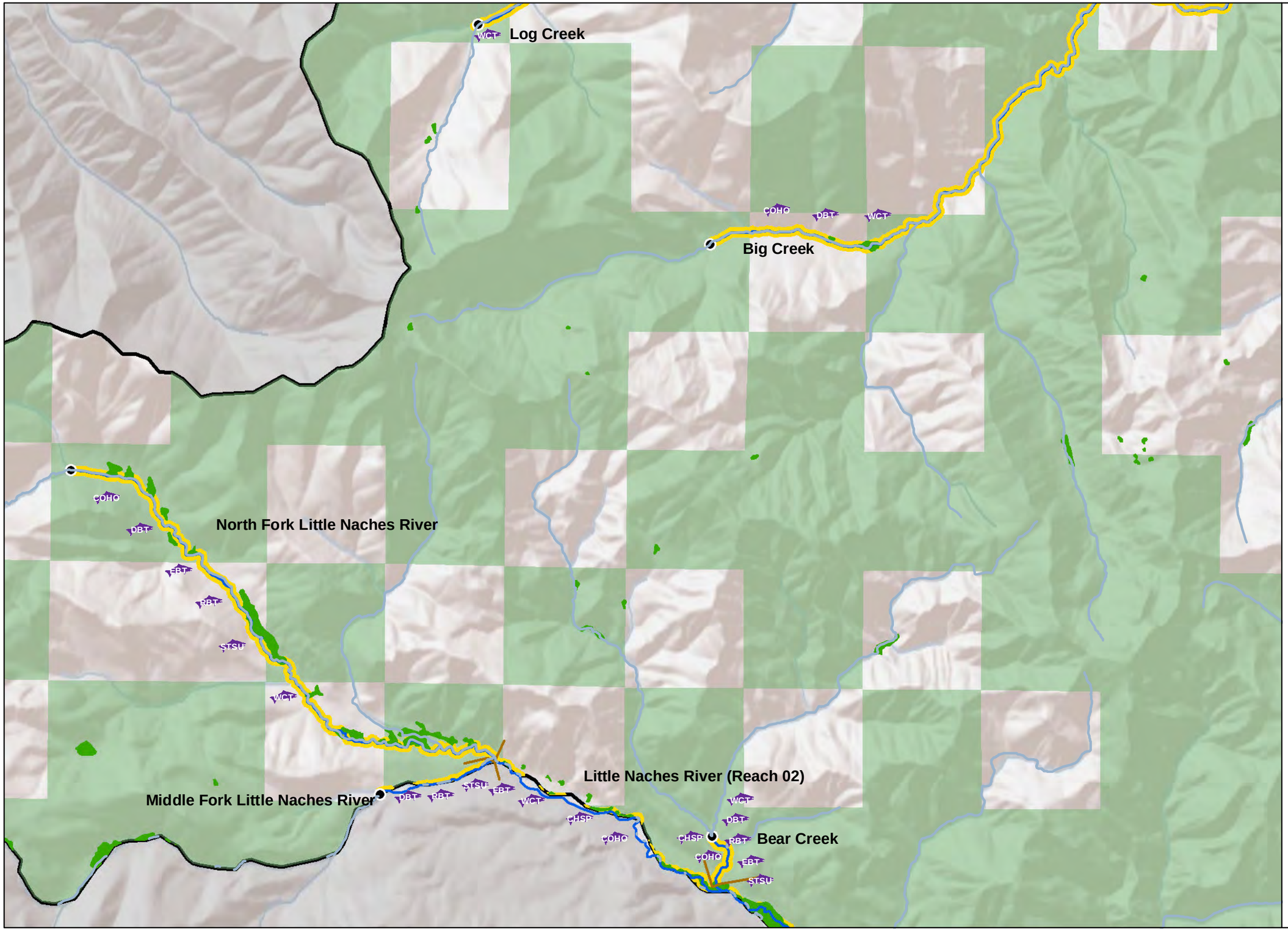
Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



3/13/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 16

Kittitas County Regional SMP Update
Inventory and Characterization

0 0.5 1
Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

Species Code, Species Name

BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
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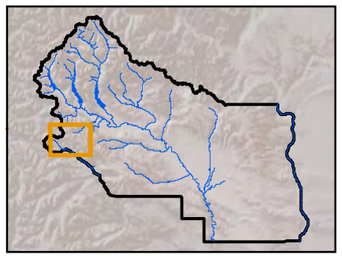
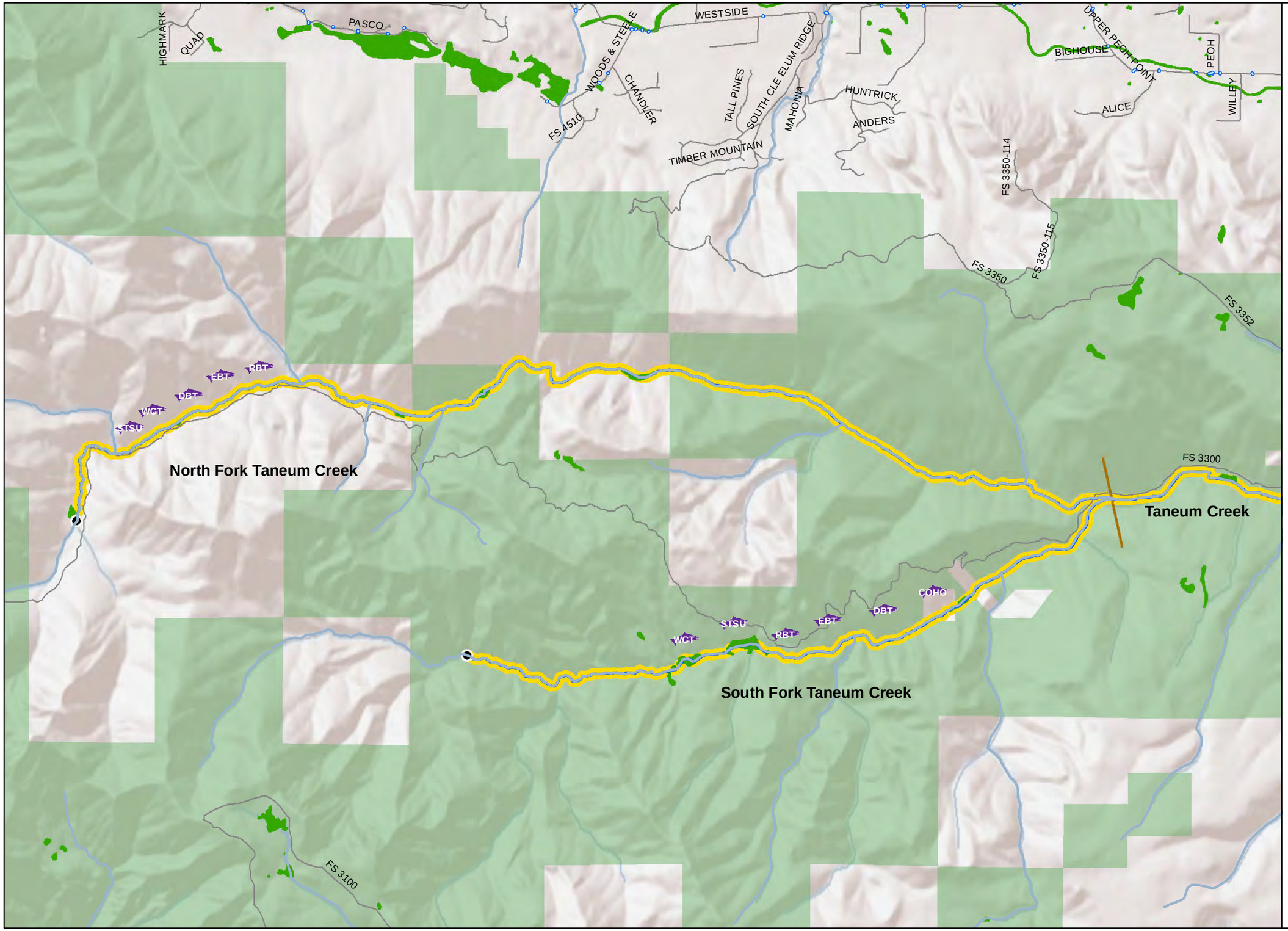
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 16 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications Map 17

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

Species Code

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
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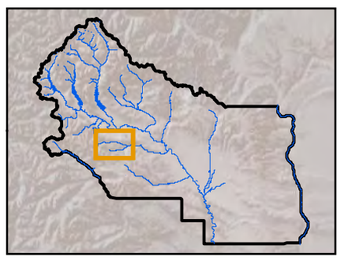
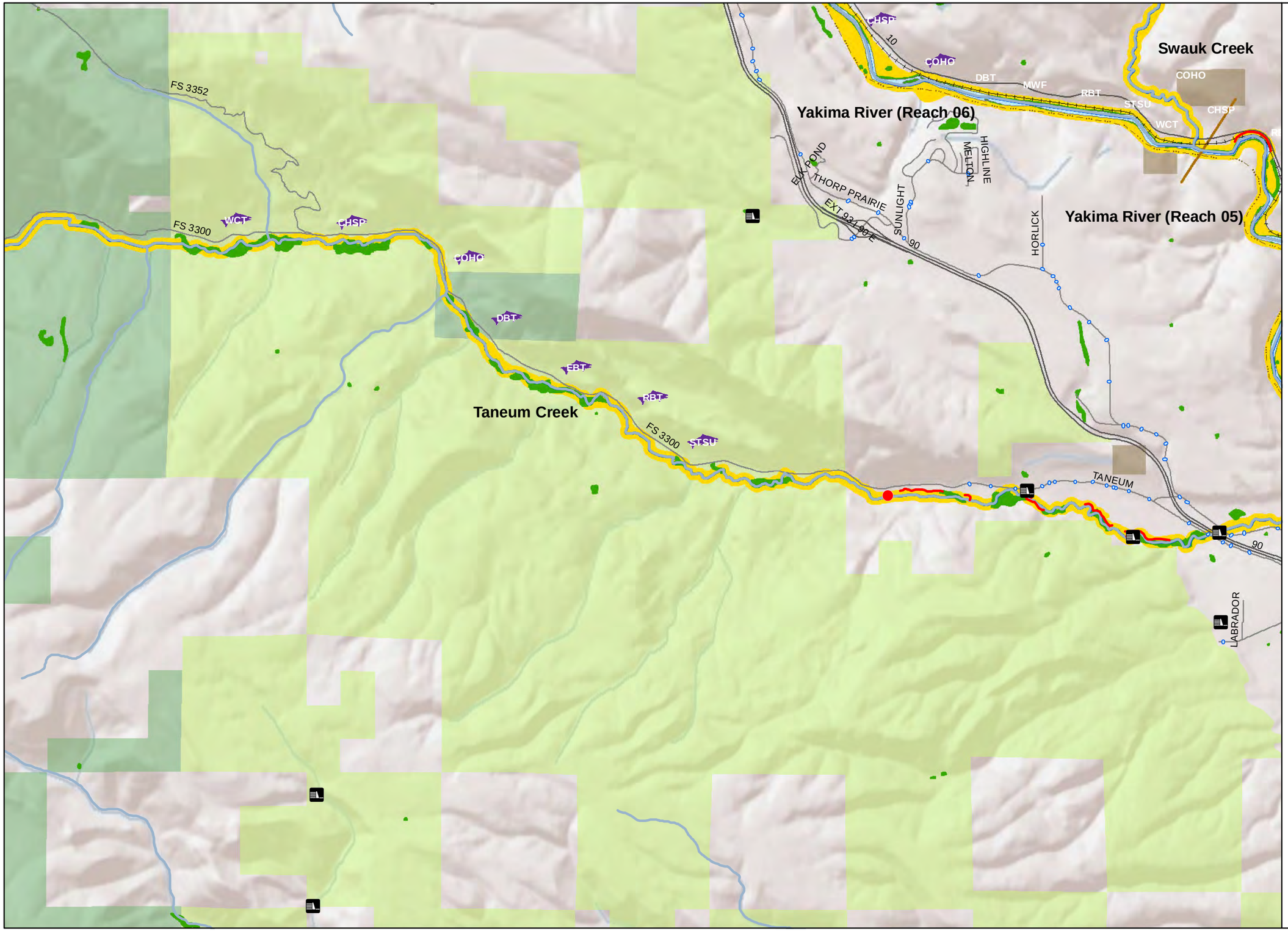
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 17 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1:
Habitats and
Shoreline Modifications
Map 18

Kittitas County Regional SMP Update
Inventory and Characterization

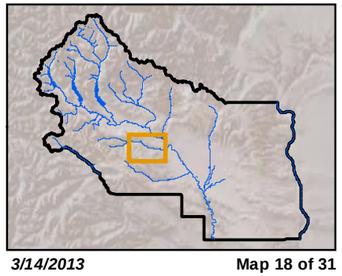
0 0.5 1
Miles

N

Shoreline Inventory Area
Hydromodifications
Wetlands (USFWS NWI)
Overwater Structures
Culverts
Dams
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Trails
Railroads
Major Roads
Minor Roads
Cities
Waterbodies
Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

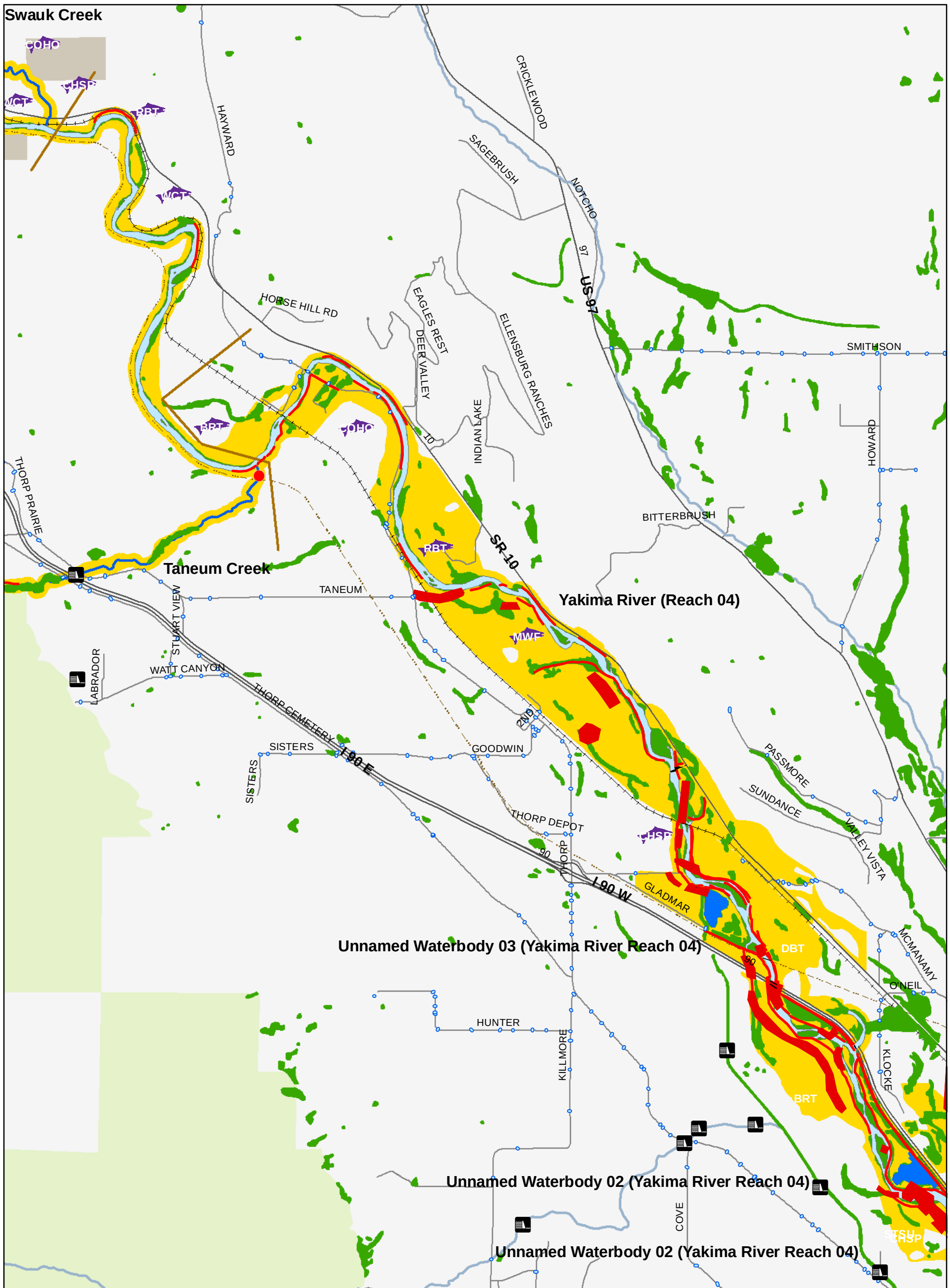
Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



3/14/2013 **Map 18 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 19

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
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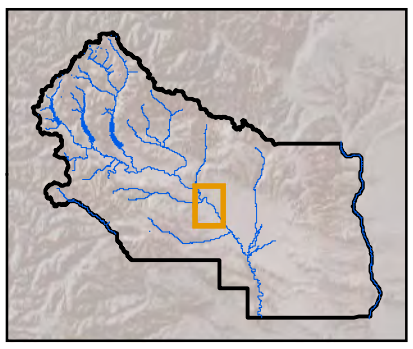
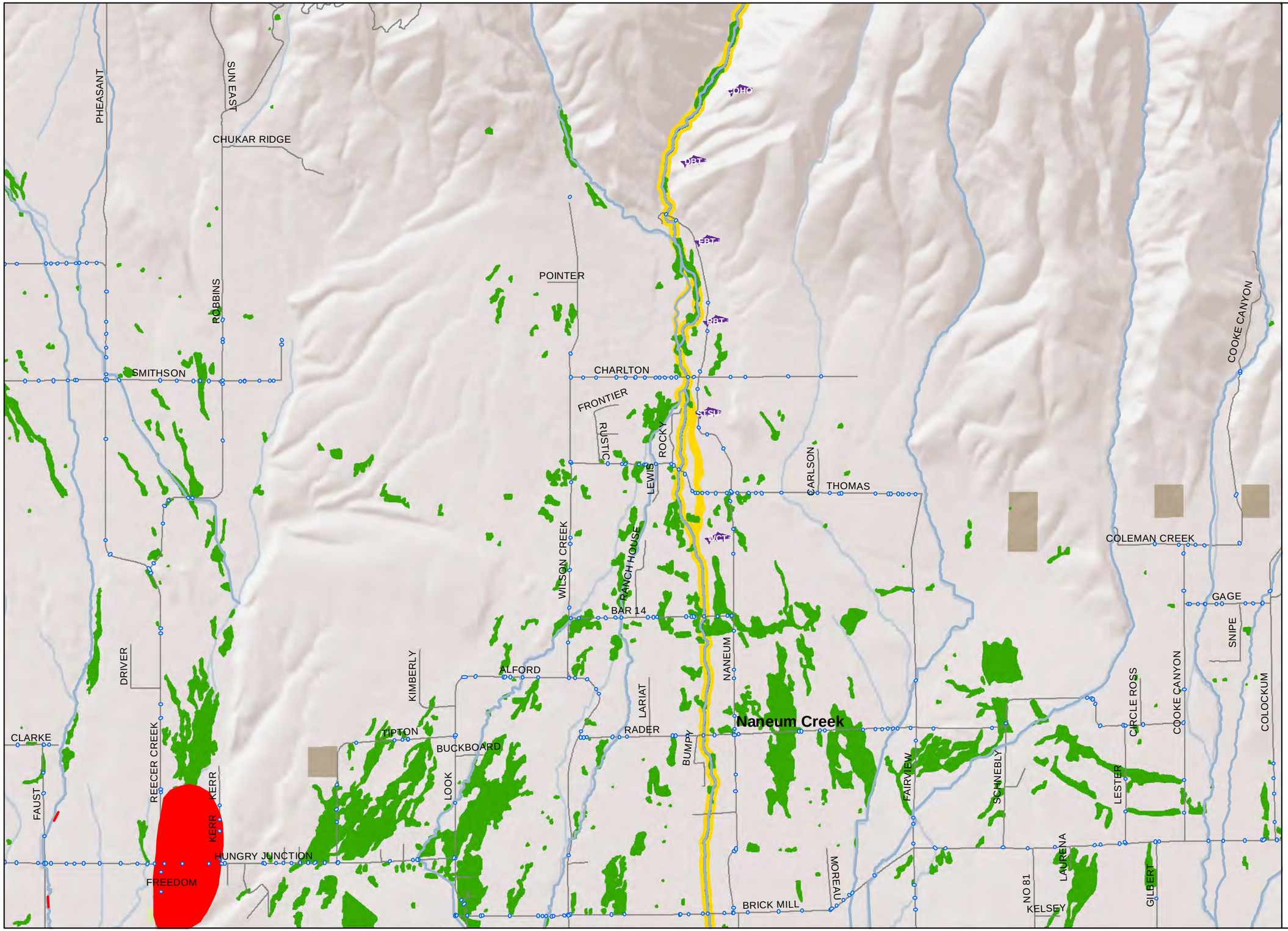
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications Map 20

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

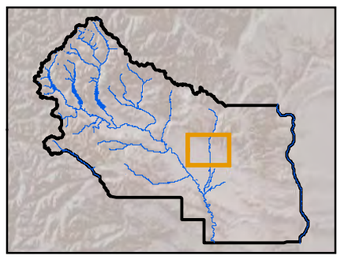
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

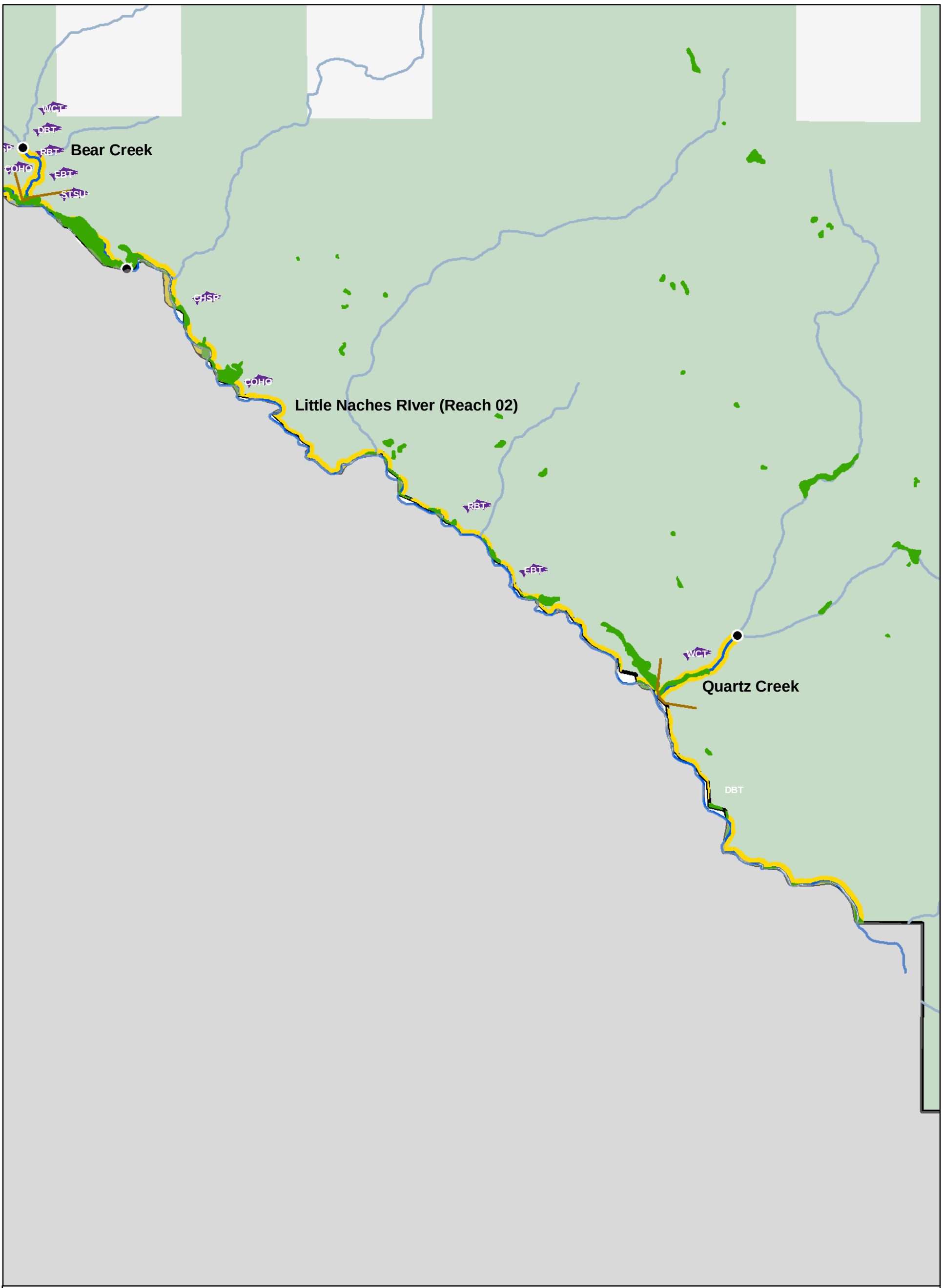
Species Code

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013 **Map 20 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 21

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

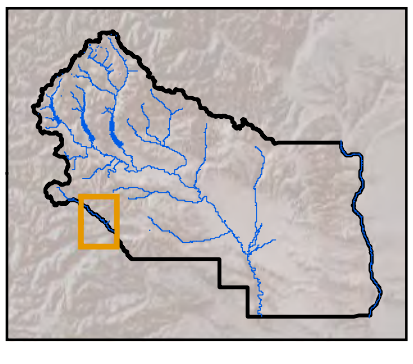
N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code — Priority Fish Distribution (see codes below)

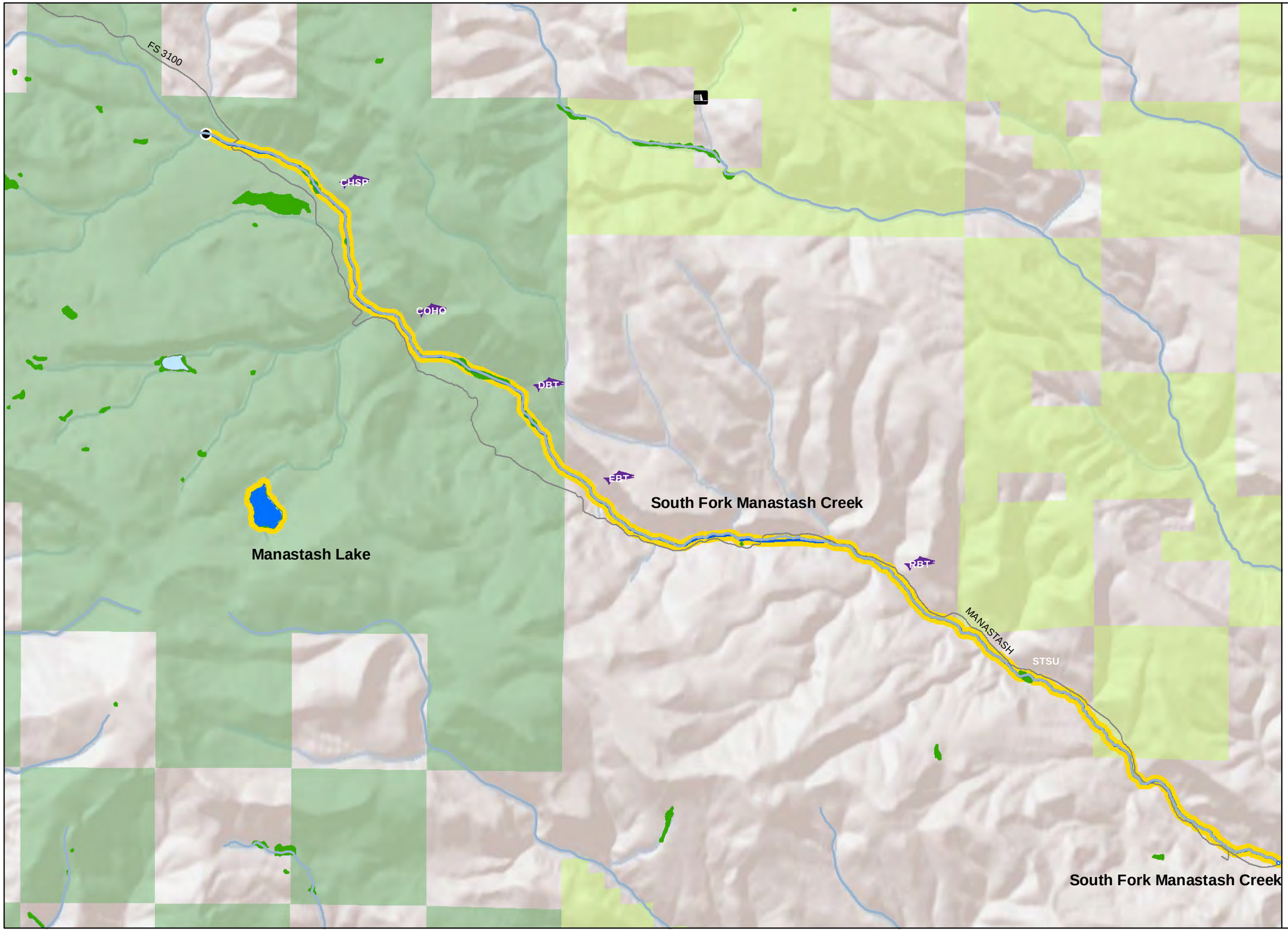
Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
CHSP, Spring Chinook
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



3/13/2013

Map 21 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications Map 22

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Hydromodifications
- Wetlands (USFWS NWI)
- Overwater Structures
- Culverts
- Dams
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

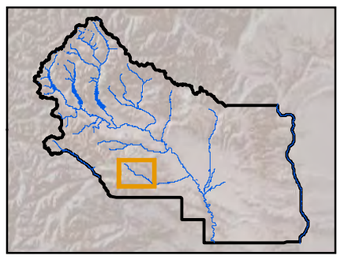
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code **Priority Fish Distribution (see codes below)**

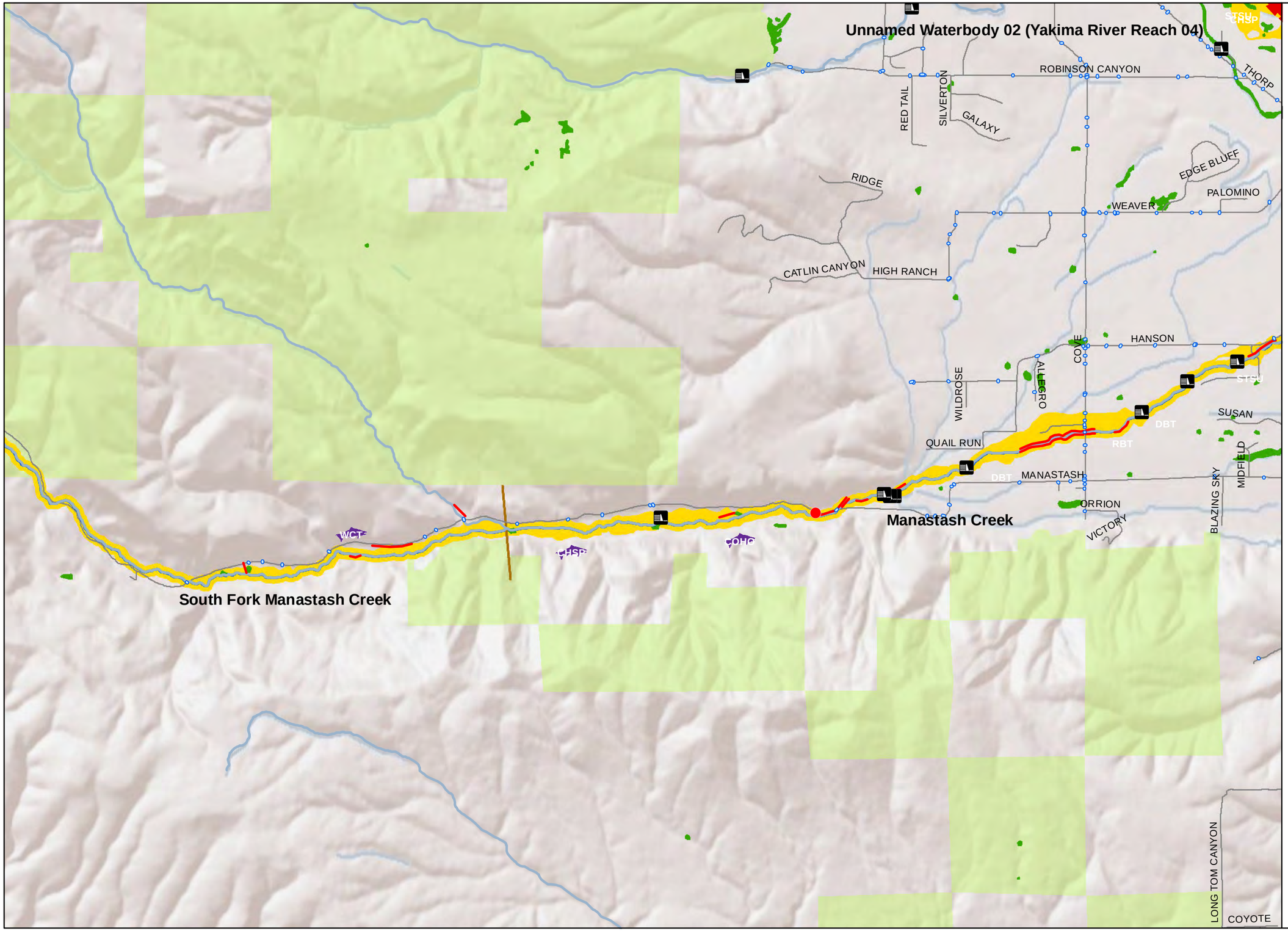
Species Code, Species Name

- BRT, Brown Trout
- BUR, Burbot
- CCT, Resident Cutthroat
- CHFA, Fall Chinook
- CHSP, Spring Chinook
- CHSU, Summer Chinook
- COHO, Coho Salmon
- DBT, Bull Trout
- EBT, Eastern Brook Trout
- KOK, Kokanee Salmon
- LMB, Largemouth Bass
- MWF, Mountain Whitefish
- PGY, Pygmy Whitefish
- RBT, Rainbow Trout
- SMB, Smallmouth Bass
- SOCK, Sockeye Salmon
- STSU, Summer Steelhead
- WAL, Walleye
- WCT, Westslope Cutthroat
- WHST, White Sturgeon



3/14/2013 **Map 22 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 23

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Hydromodifications
Wetlands (USFWS NWI)
Overwater Structures
Culverts
Dams
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Trails
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Priority Fish Distribution (see codes below)

Species Code, Species Name
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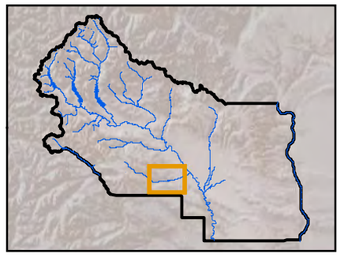
- PGY, Pygmy Whitefish
- RBT, Rainbow Trout
- SMB, Smallmouth Bass
- SOCK, Sockeye Salmon
- STSU, Summer Steelhead
- WAL, Walleye
- WCT, Westslope Cutthroat
- WHST, White Sturgeon



3/14/2013 **Map 23 of 31**

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #1: Habitats and Shoreline Modifications

Map 24

Kittitas County Regional SMP Update
Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Hydromodifications
Wetlands (USFWS NWI)
Overwater Structures
Culverts
Dams
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Trails
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code **Priority Fish Distribution (see codes below)**

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BUR, Burbot	MWF, Mountain Whitefish
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CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon

Unnamed Pond 04 (Yakima River Reach 04)

Naneum Creek

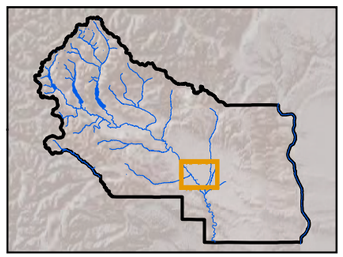
Coleman Creek

Yakima River (Reach 03)

Cooke Creek

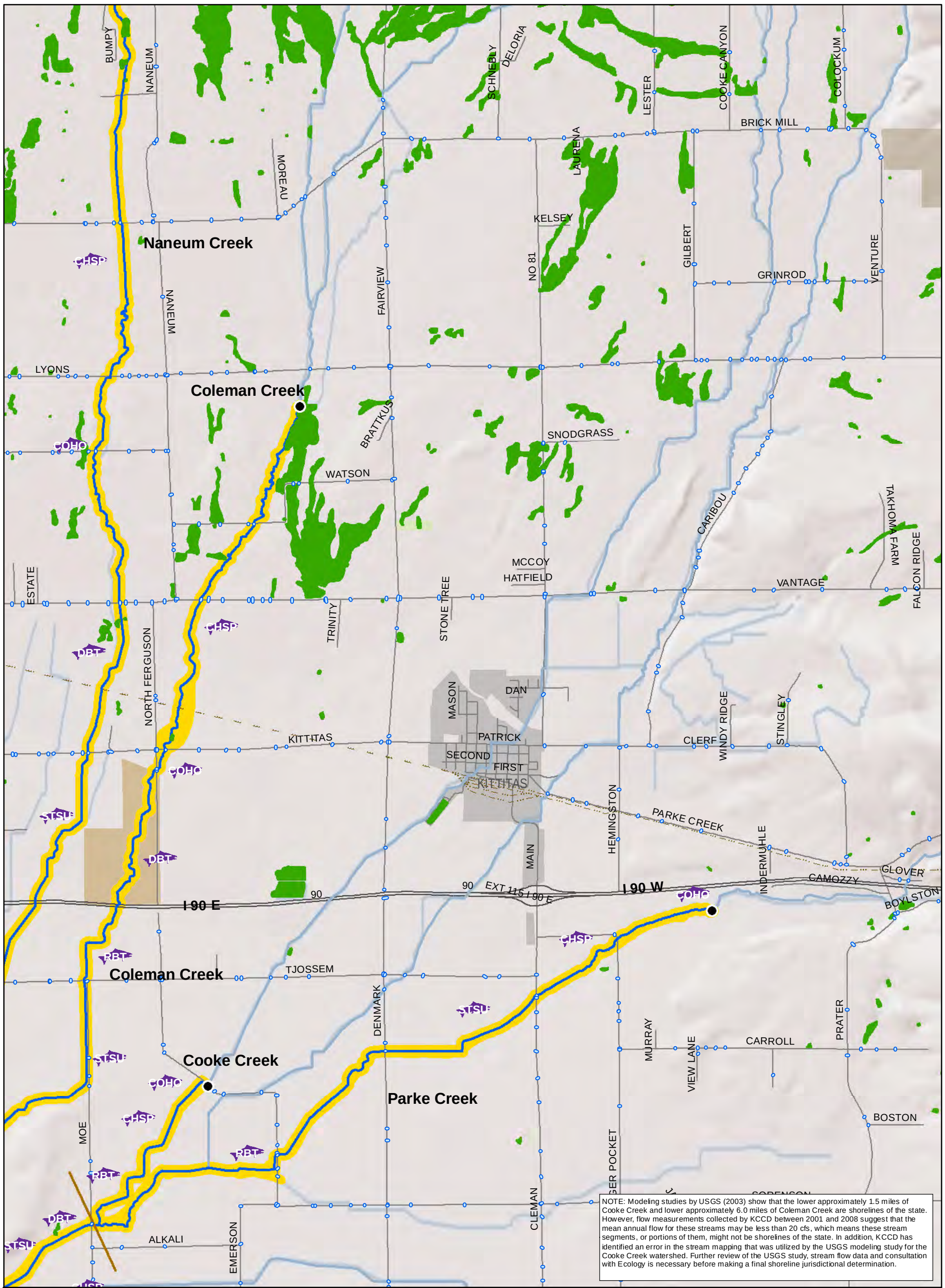
ELLENSBURG

NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.



3/14/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #1: Habitats and Shoreline Modifications

Map 25

Kittitas County Regional SMP Update
Inventory and Characterization

0 0.5 1 Miles

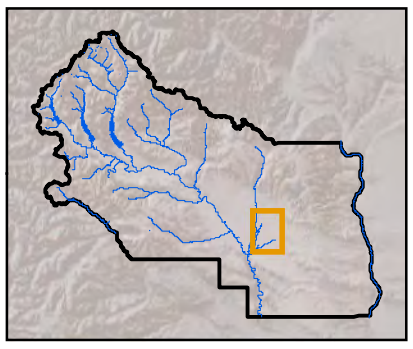
N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code — Priority Fish Distribution (see codes below)

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
CCT, Resident Cutthroat	PGY, Pygmy Whitefish
CHFA, Fall Chinook	RBT, Rainbow Trout
CHSP, Spring Chinook	SMB, Smallmouth Bass
CHSU, Summer Chinook	SOCK, Sockeye Salmon
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/14/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

Coleman Creek
TJOSSEM
NO 6
Naneum Creek
Cooke Creek
Parke Creek
WCT
CANYON
82 82
STSU
COHO
CHSP
RBT
MOE
DBT
Fiorito Lake
SORENSON
ALKALI
RINGER
EMERSON
DENMARK
Cherry Creek
THRALL
ORCHARD
Yakima Creek
TOZER
STONE GATE
Wilson Creek
PAYNE
DODGE
CHERRY HILL
PERRY
SKYVIEW
CANYON RANCH
I 82 W I 82 E
RYAN RAVINE
VANDERBILT
MCDOWELL
821
BRT
82 WB SCENIC VIEW
I 82 SCENIC VIEW S
Yakima Creek
MWF
Yakima River (Reach 02)

NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #1: Habitats and Shoreline Modifications Map 26

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code — Priority Fish Distribution (see codes below)

Species Code, Species Name
- BRT, Brown Trout
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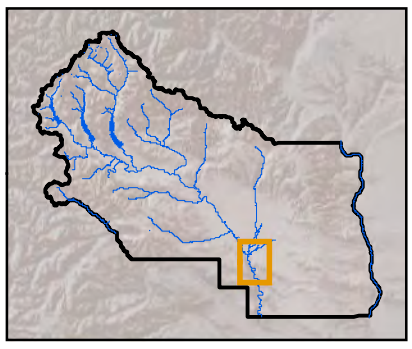
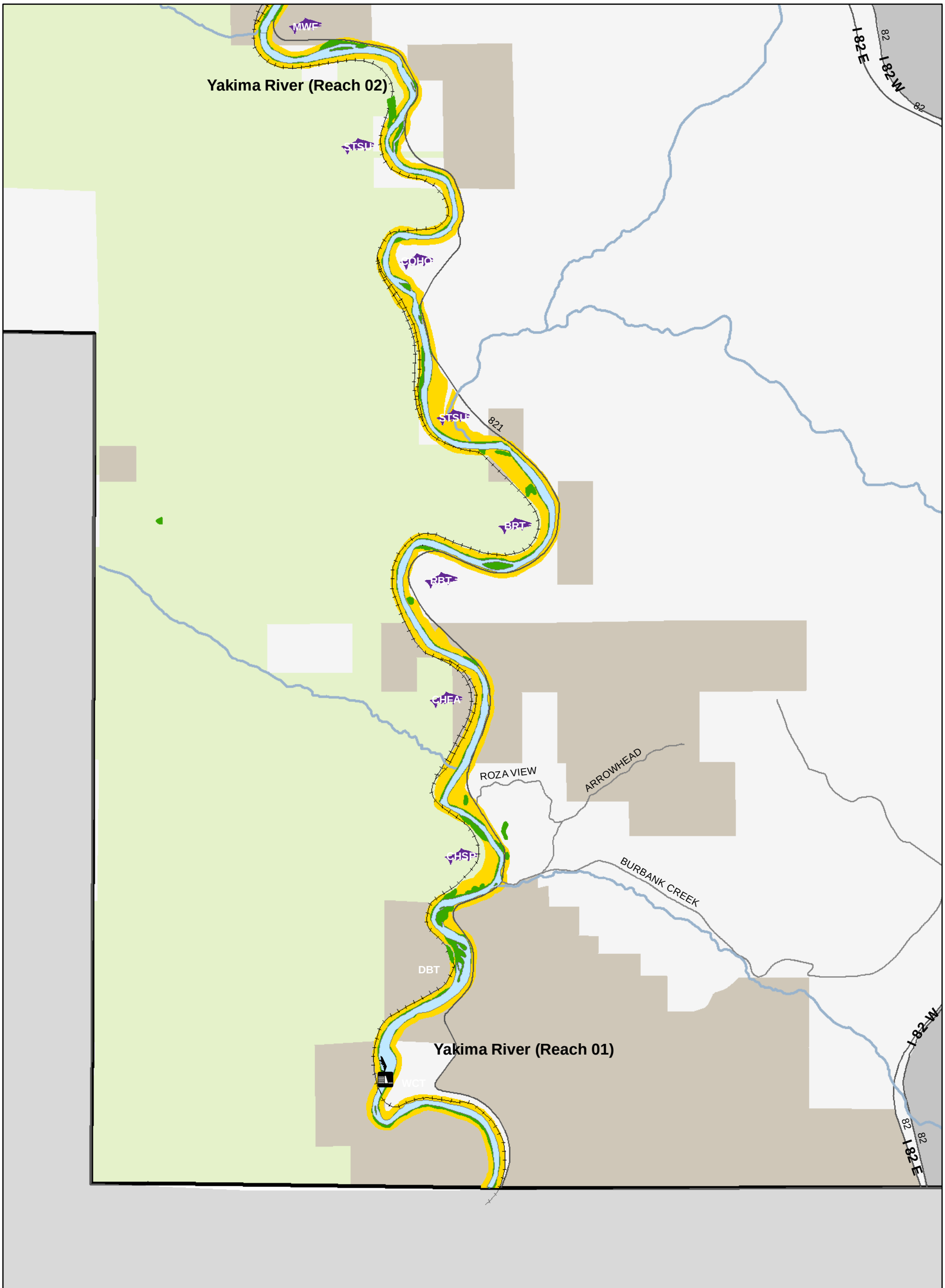
- EBT, Eastern Brook Trout
- KOK, Kokanee Salmon
- LMB, Largemouth Bass
- MWF, Mountain Whitefish
- PGY, Pygmy Whitefish
- RBT, Rainbow Trout
- SMB, Smallmouth Bass
- SOCK, Sockeye Salmon
- STSU, Summer Steelhead
- WAL, Walleye
- WCT, Westslope Cutthroat
- WHST, White Sturgeon



3/14/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 27

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code — Priority Fish Distribution (see codes below)

Species Code, Species Name	
BRT, Brown Trout	LMB, Largemouth Bass
BUR, Burbot	MWF, Mountain Whitefish
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CHSP, Spring Chinook	SMB, Smallmouth Bass
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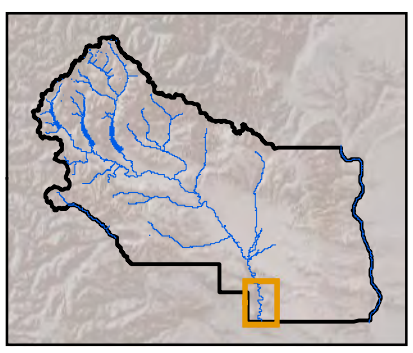
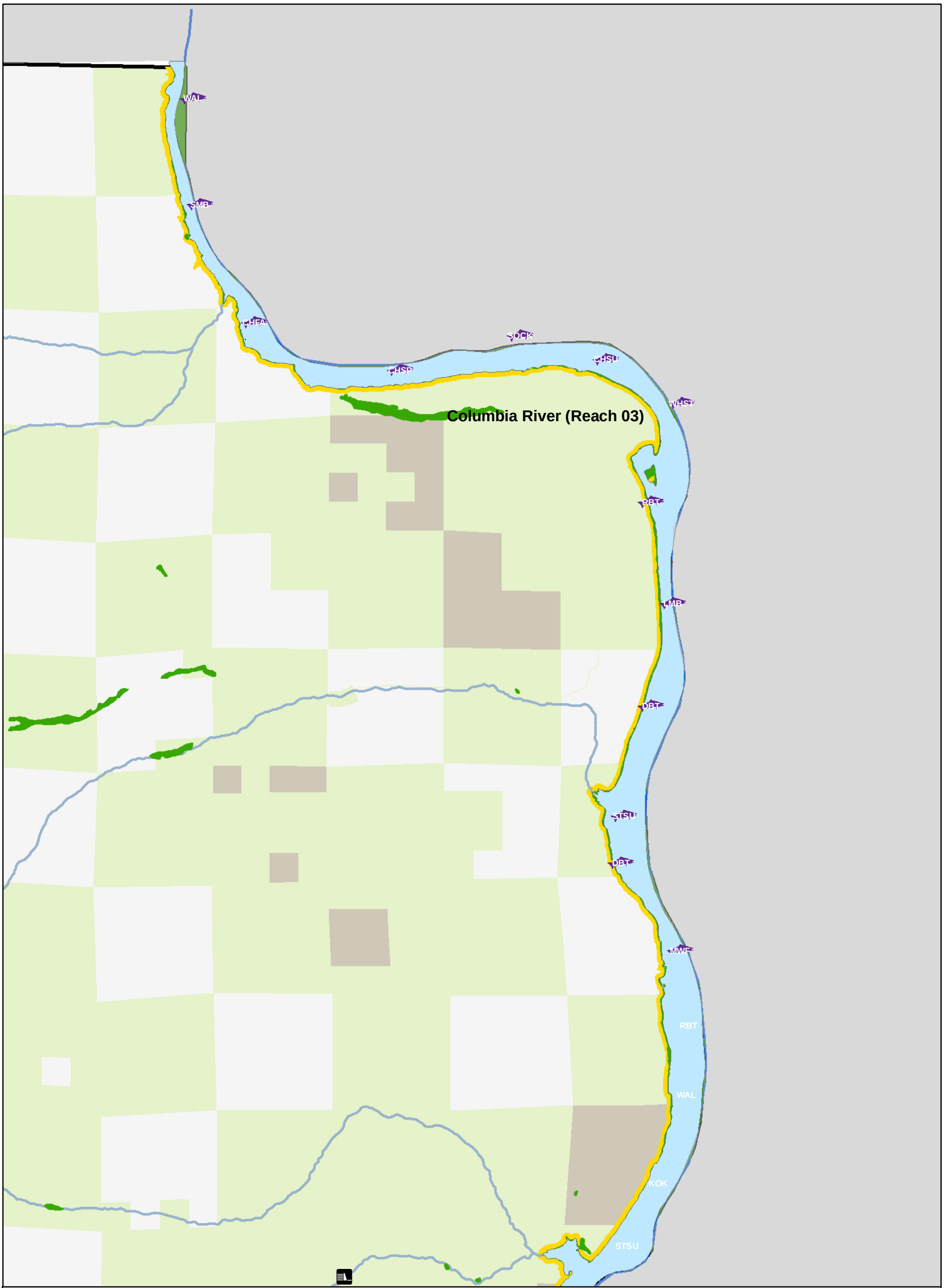
COHO, Coho Salmon	STSU, Summer Steelhead
DBT, Bull Trout	WAL, Walleye
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 28

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name
BRT, Brown Trout
BUR, Burbot
CCT, Resident Cutthroat
CHFA, Fall Chinook
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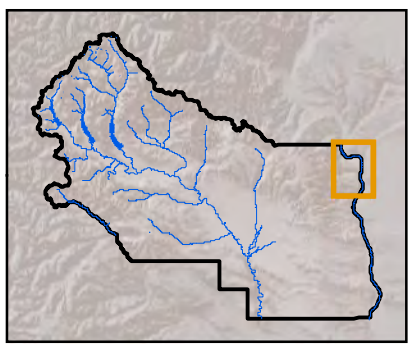
CHSU, Summer Chinook
COHO, Coho Salmon
DBT, Bull Trout
EBT, Eastern Brook Trout
KOK, Kokanee Salmon
LMB, Largemouth Bass
MWF, Mountain Whitefish
PGY, Pygmy Whitefish
RBT, Rainbow Trout
SMB, Smallmouth Bass
SOCK, Sockeye Salmon
STSU, Summer Steelhead
WAL, Walleye
WCT, Westslope Cutthroat
WHST, White Sturgeon



3/13/2013

Map 28 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #1: Habitats and Shoreline Modifications

Map 29

Kittitas County Regional SMP Update
Inventory and Characterization

0 0.5 1
Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
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Public Lands
- US Bureau of Land Management
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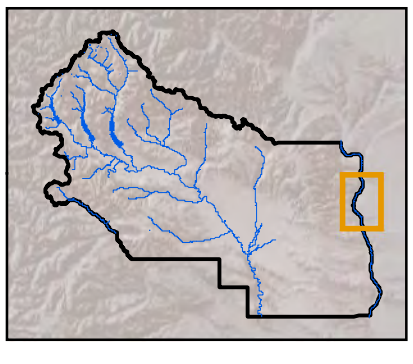
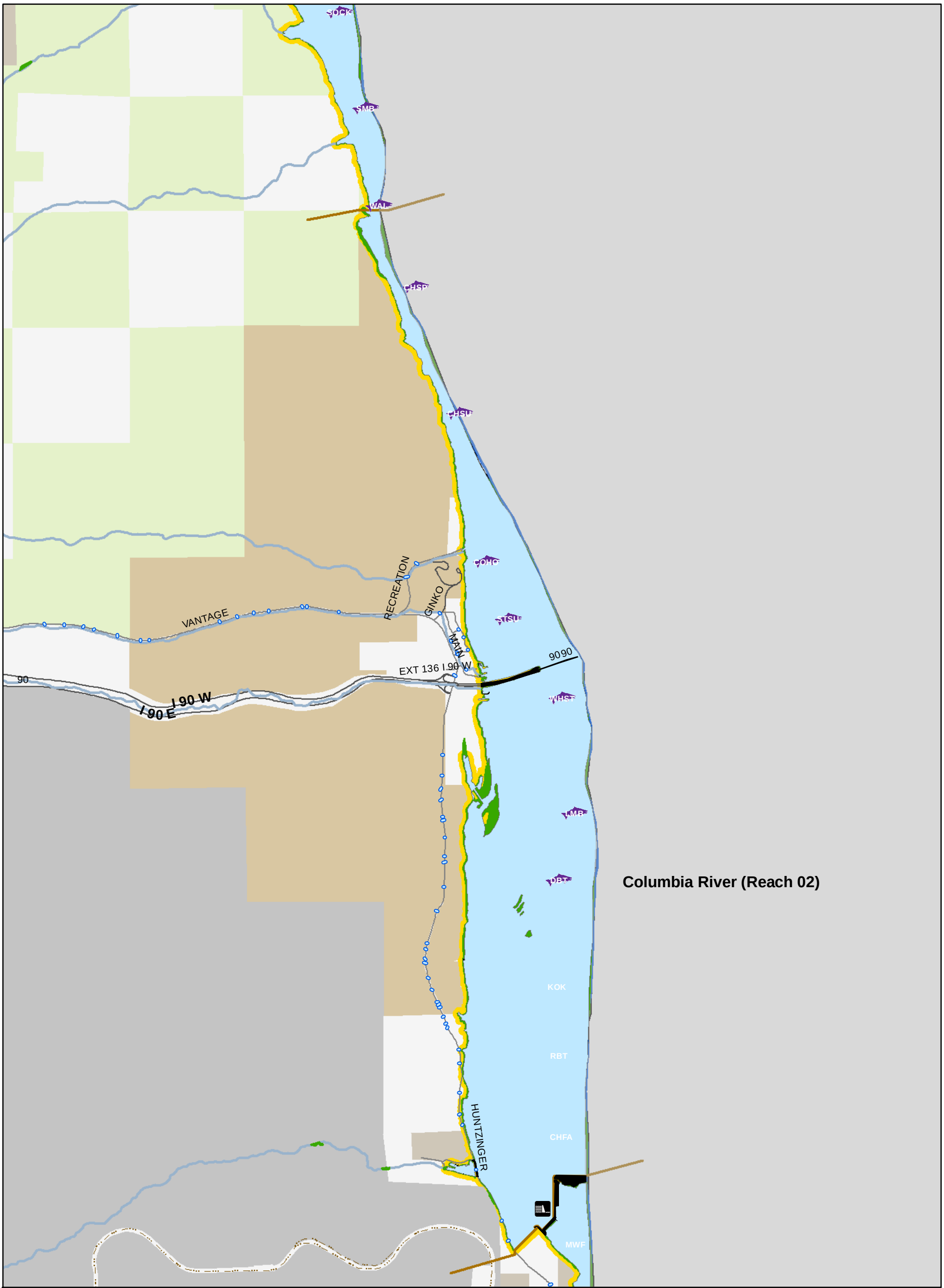


3/13/2013

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 30

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
Wetlands (USFWS NWI)
Hydromodifications
Overwater Structures
Dams
Culverts
SMP Reach Breaks
Upstream Limits (20 cfs)
SMA Waterbodies
SMA Streams
Non-SMA Streams
Railroads
Major Roads
Minor Roads
Cities
Waterbodies

Public Lands
US Bureau of Land Management
US Dept. of Defense
US Forest Service
Washington Department of Fish and Wildlife
State Parks

Species Code

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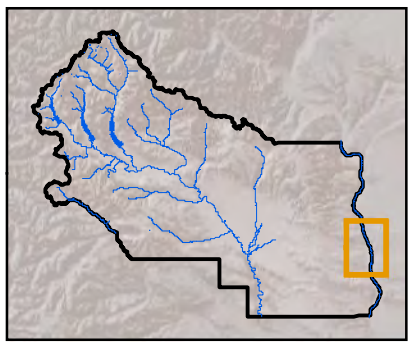
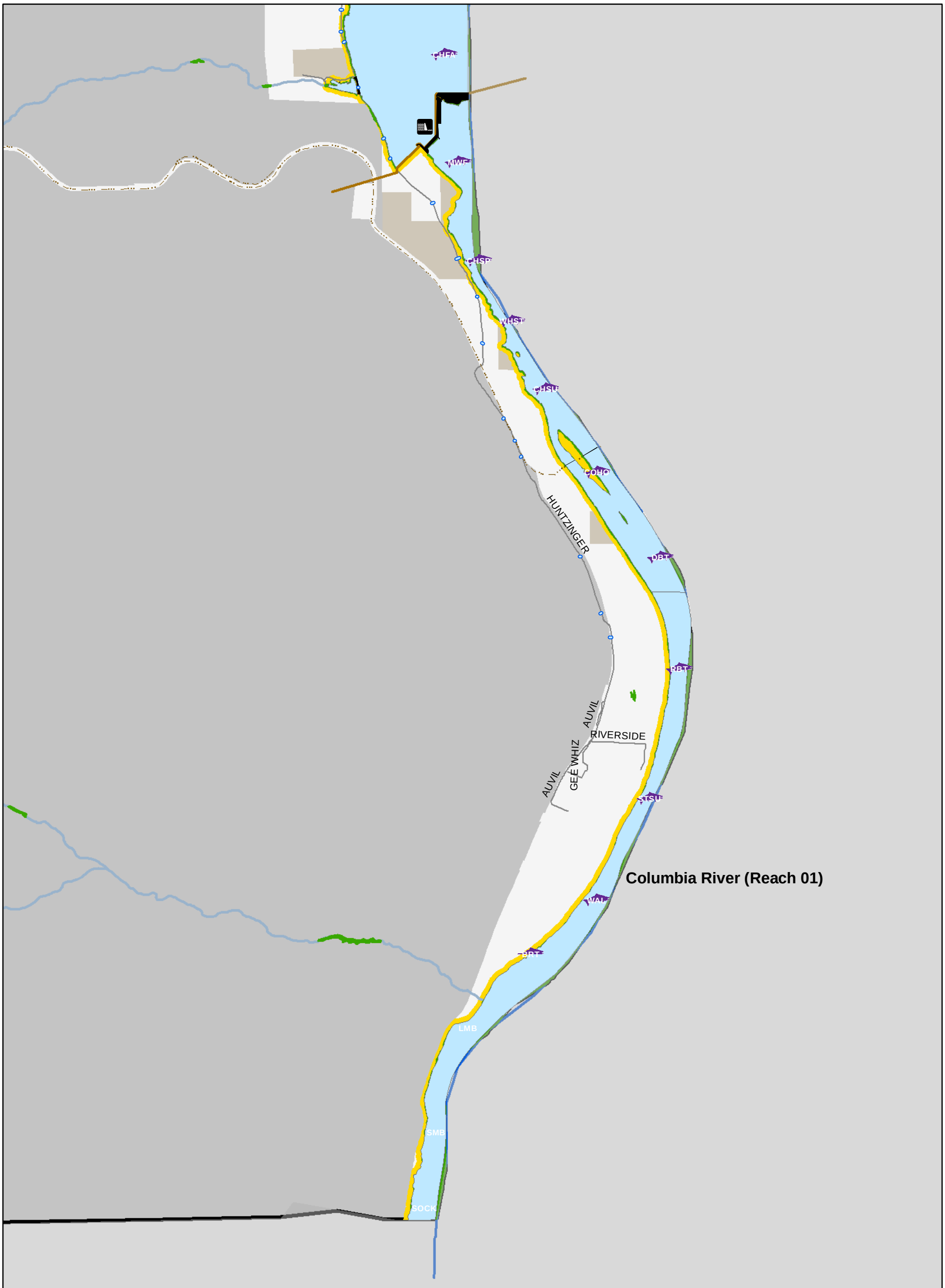


3/13/2013

Map 30 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #1: Habitats and Shoreline Modifications

Map 31

Kittitas County Regional SMP Update Inventory and Characterization

0 0.5 1 Miles

N

- Shoreline Inventory Area
- Wetlands (USFWS NWI)
- Hydromodifications
- Overwater Structures
- Dams
- Culverts
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks

Species Code

Priority Fish Distribution (see codes below)

Species Code, Species Name	
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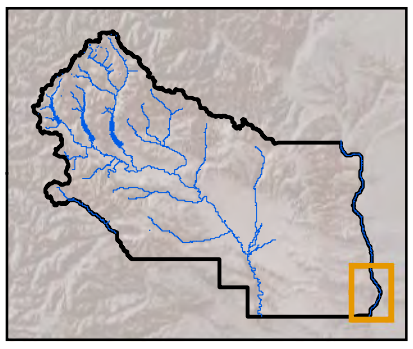
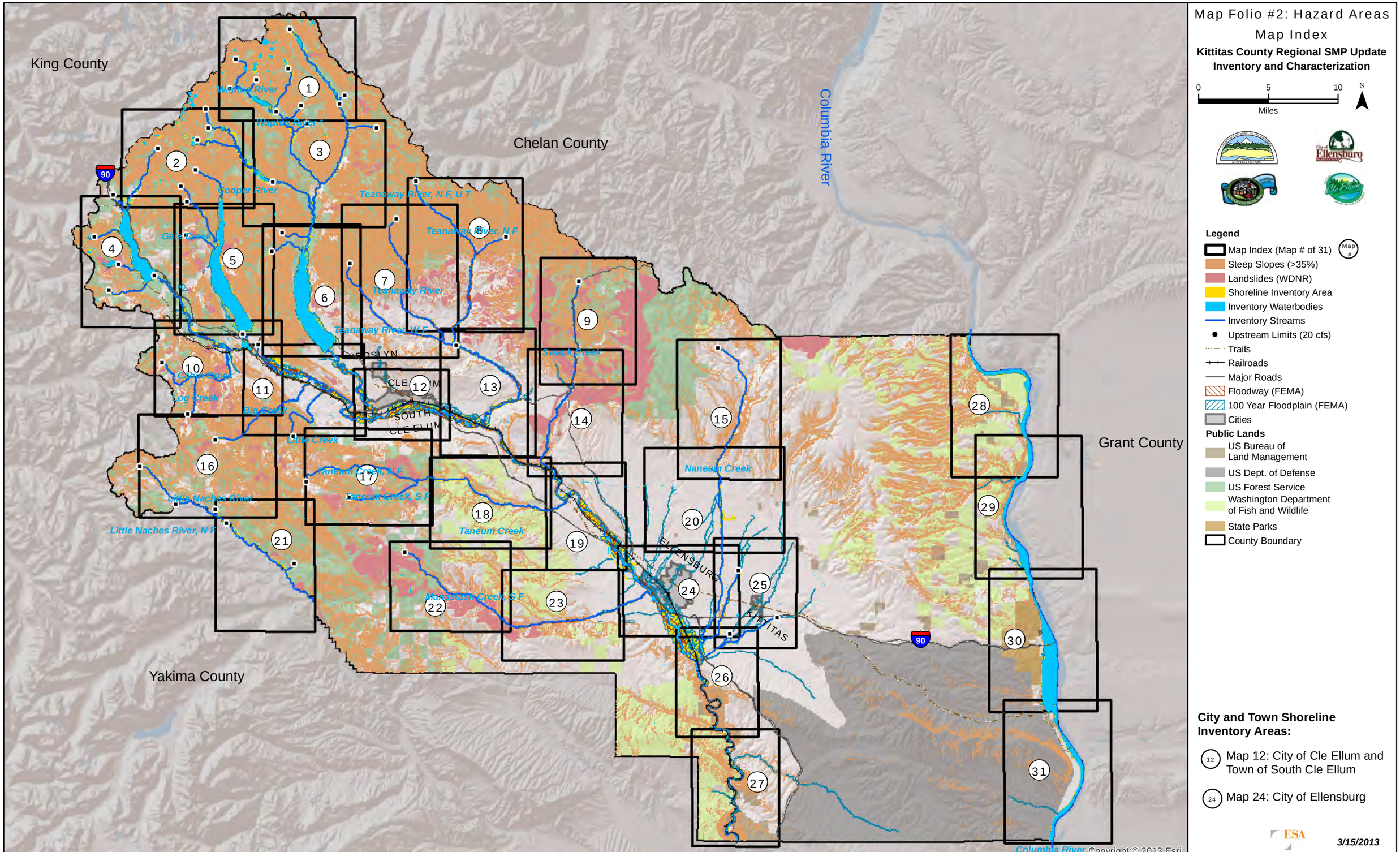
EBT, Eastern Brook Trout	WCT, Westslope Cutthroat
KOK, Kokanee Salmon	WHST, White Sturgeon



3/13/2013

Map 31 of 31

Data Sources: USFWS (NWI), 2011; CWU, 1999; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

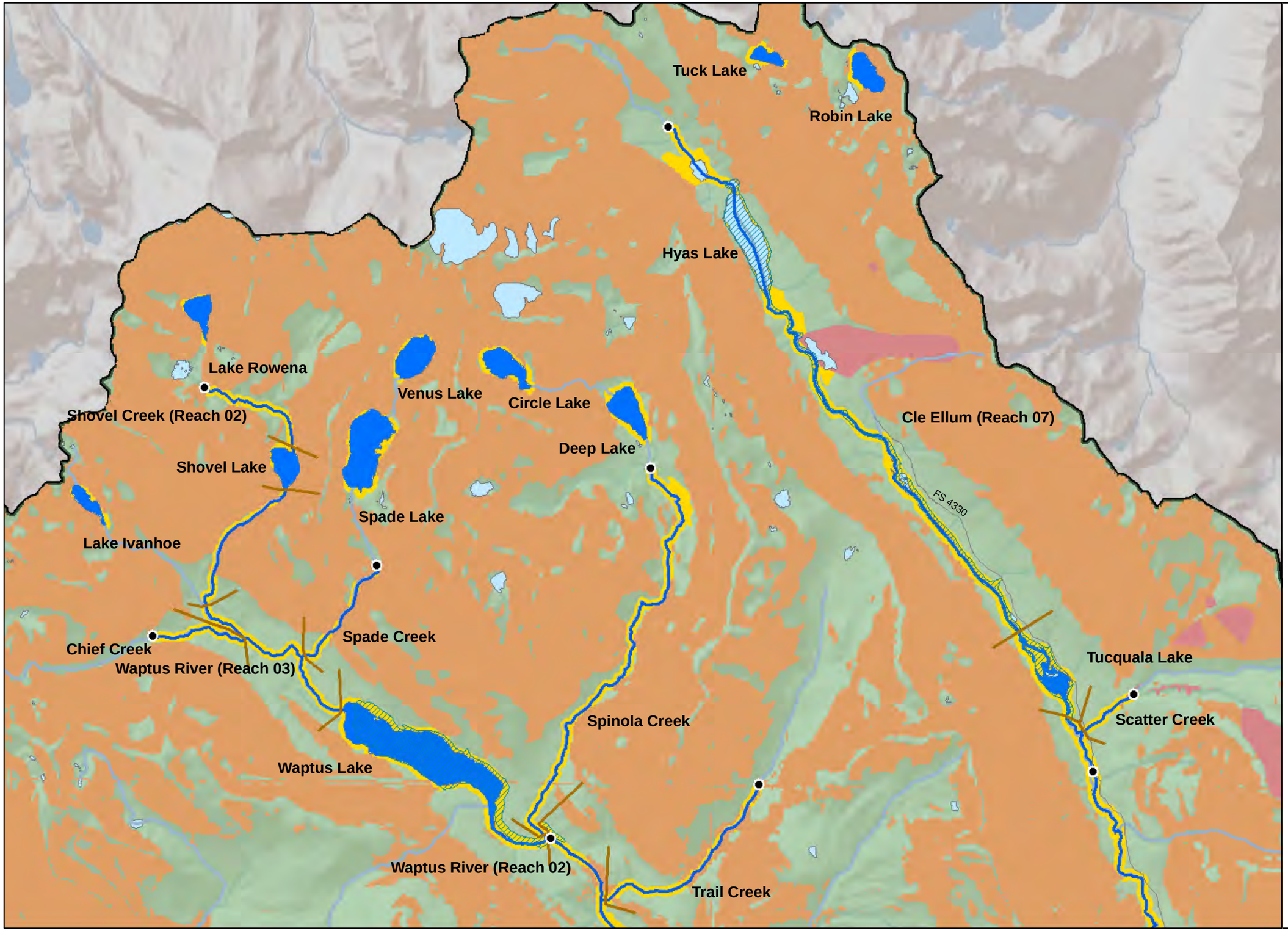


Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 1

Kittitas County Inventory and Characterization



0 0.5 1
Miles

N

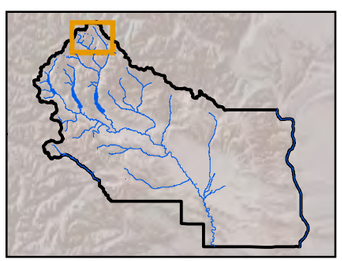
ESA

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

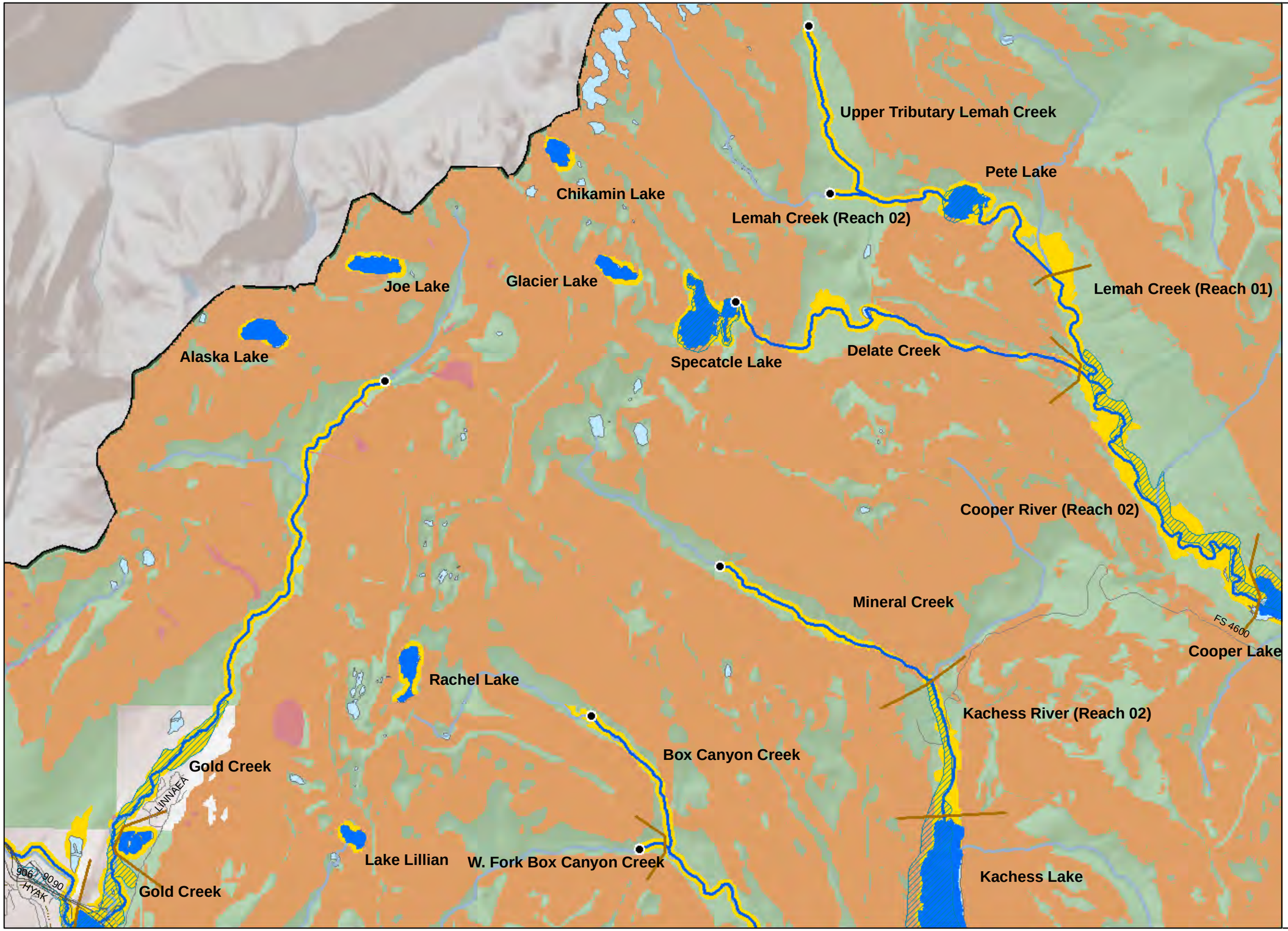
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 2

Kittitas County Inventory and Characterization

0 0.5 1
Miles

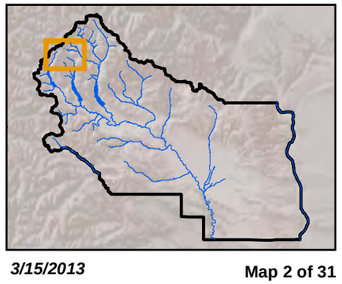
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

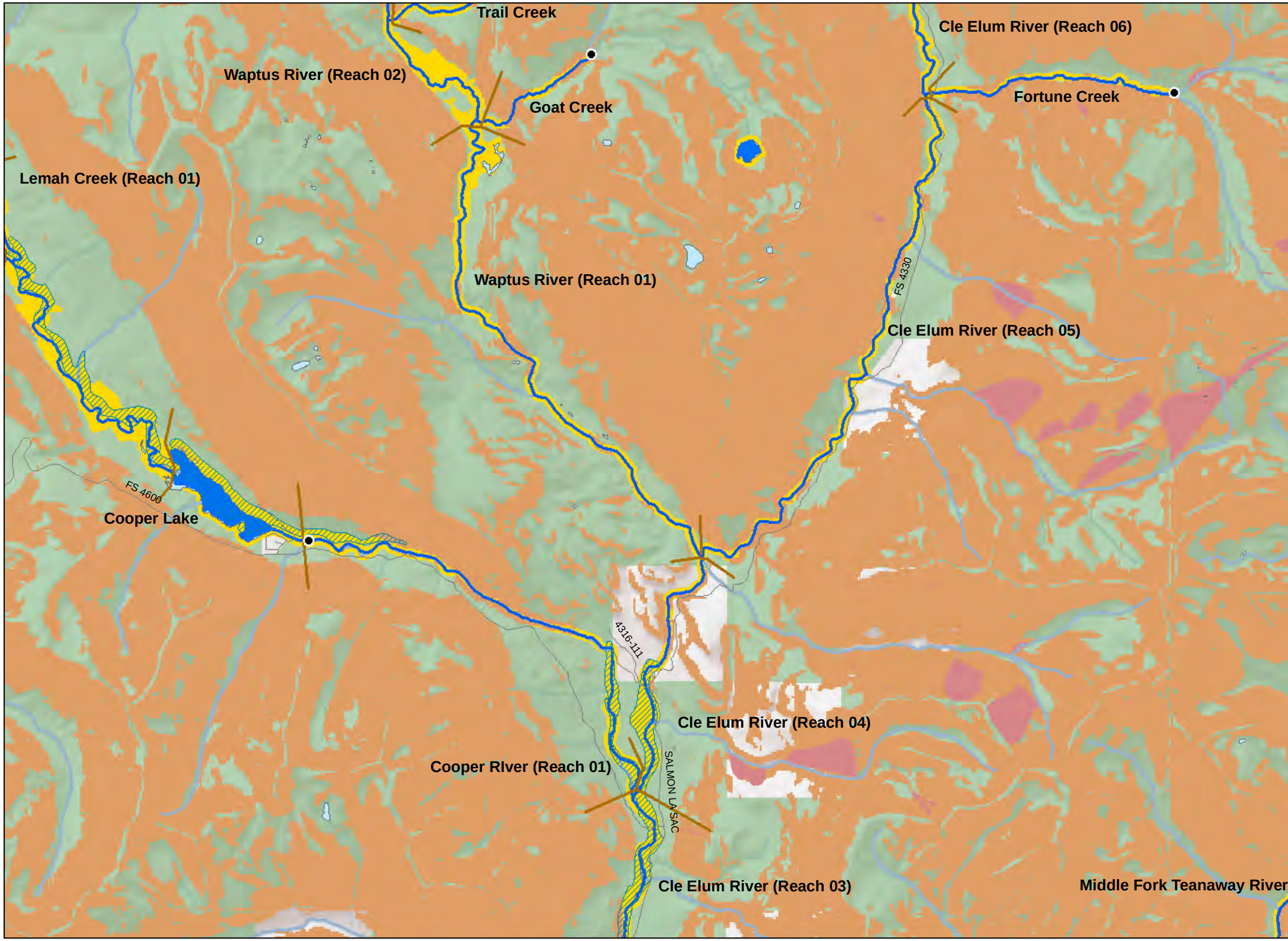
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 2 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 3

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

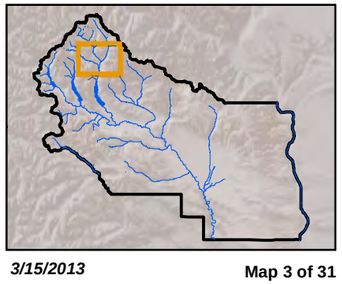
ESA

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

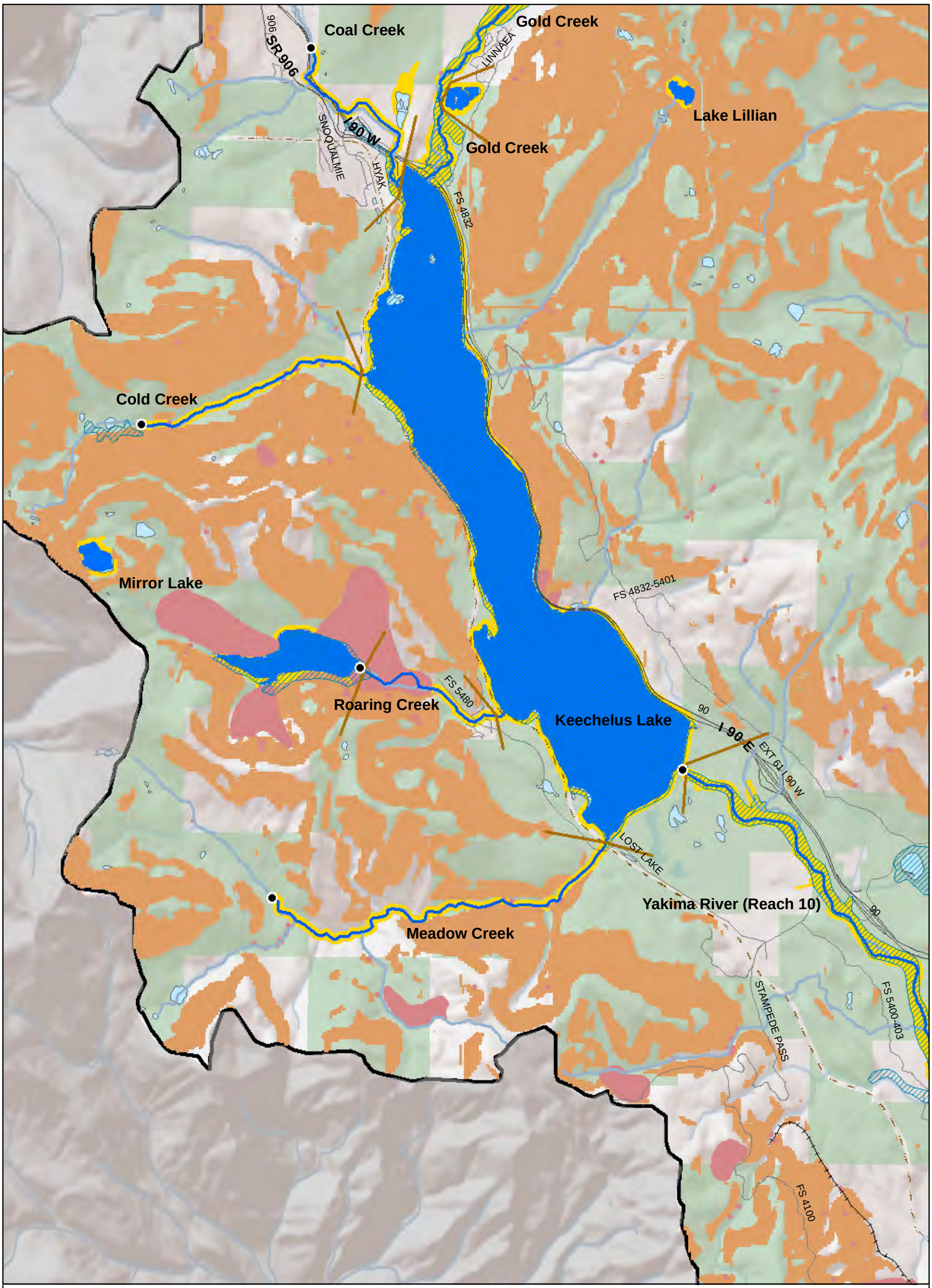
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 4

Kittitas County Inventory and Characterization

0 0.5 1
Miles

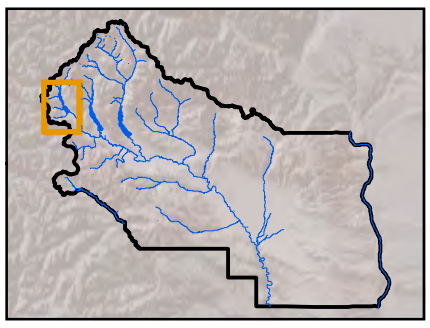
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 4 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Kachess Lake
Box Canyon Creek
Gale Creek
FS 4936
FS 4900
French Cabin Creek
FS 4308
VIA KACHESS
KILEY
FS 4832
KACHESS LAKE
KACHESS DAM
90
EXT 63 I 90 W
FS 5400-403
FS 4823
FS 4828
90
Kachess Lake
I-90 W
Yakima River (Reach 10)
I-90 E
SPARKS
Kachess River (Reach 01)

Map Folio #2: Hazard Areas

Map 5

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

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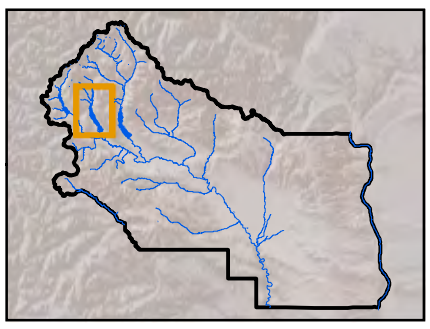
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 5 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 6

Kittitas County Inventory and Characterization

0 0.5 1 Miles

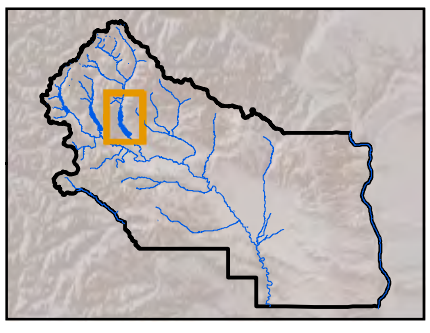
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 6 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 7

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

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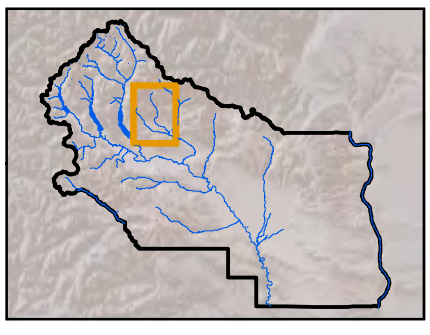
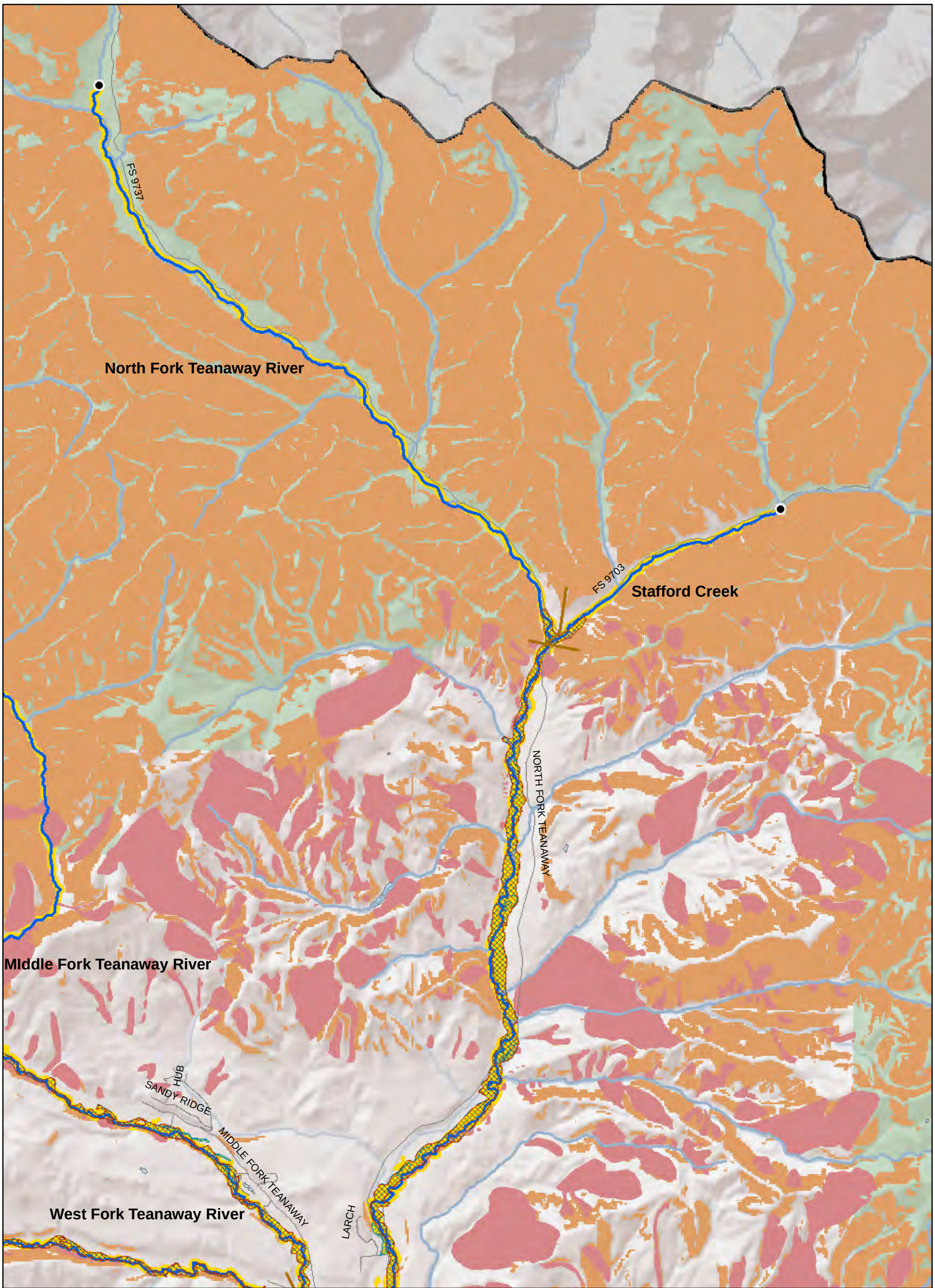
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 7 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 8

Kittitas County Inventory and Characterization

0 0.5 1
Miles

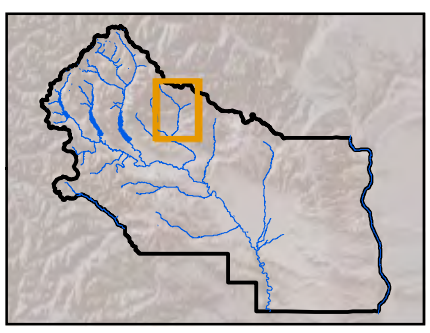
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

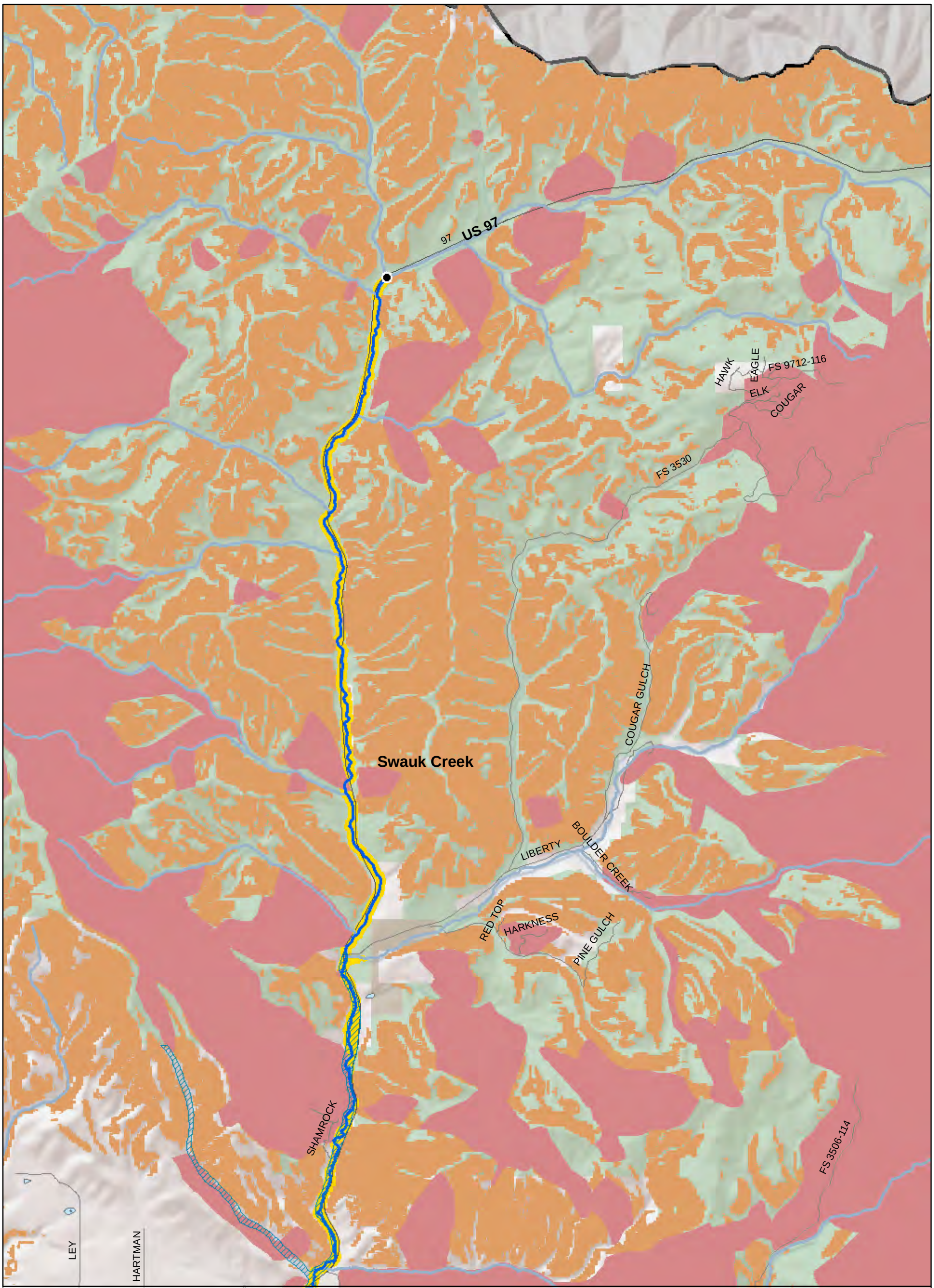
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 8 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 9

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
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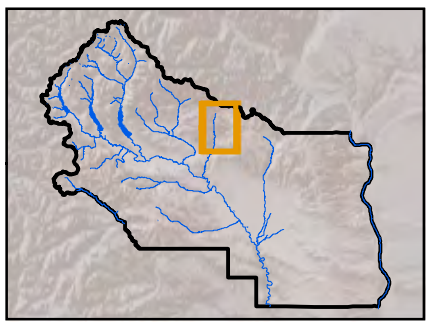
- Minor Roads
- Cities
- Waterbodies

Public Lands

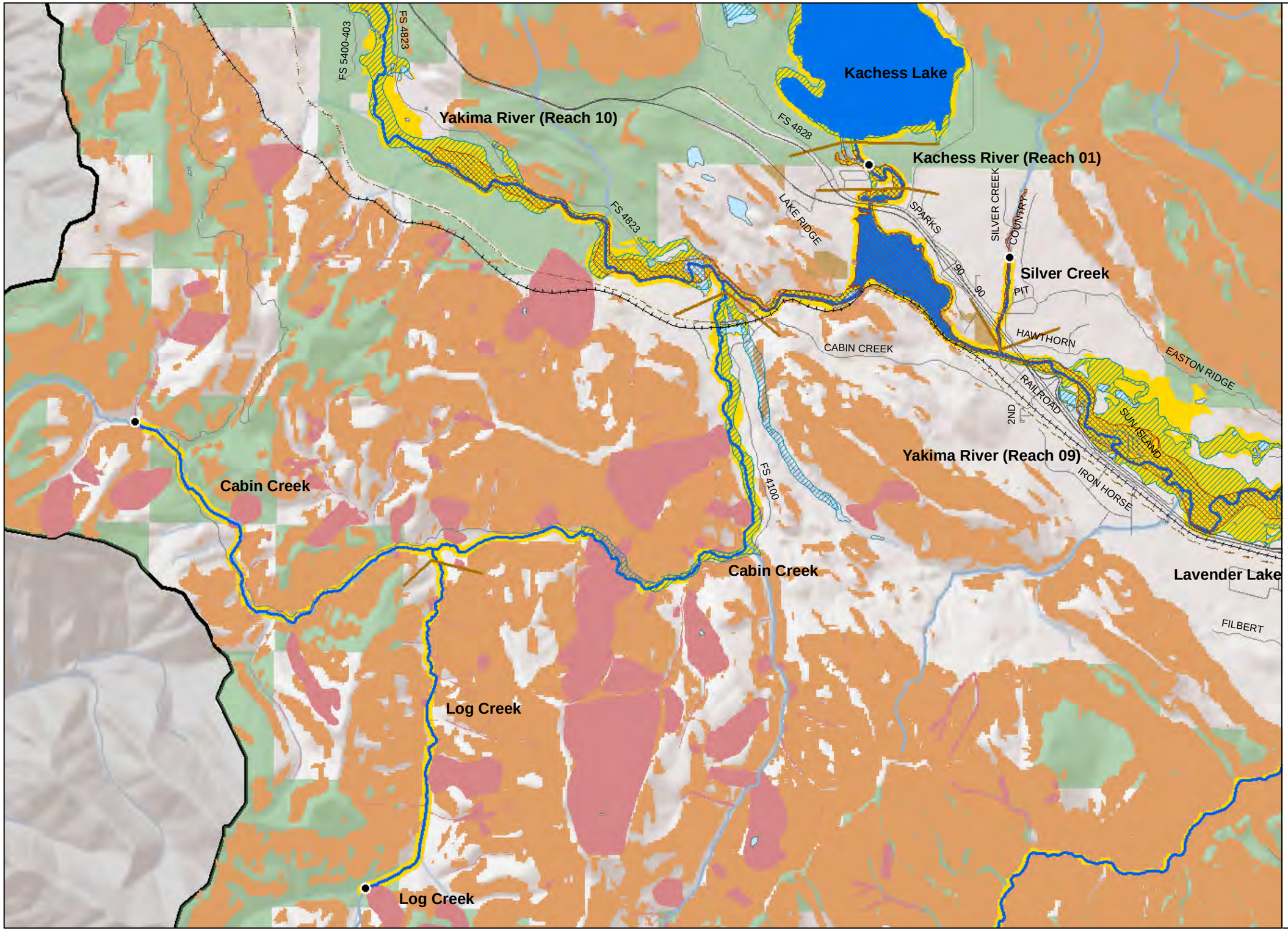
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 9 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 10

Kittitas County Inventory and Characterization

0 0.5 1
Miles

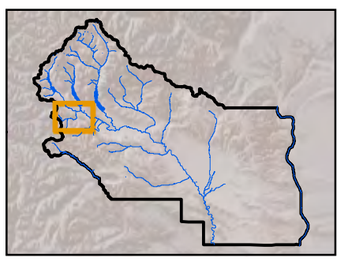
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

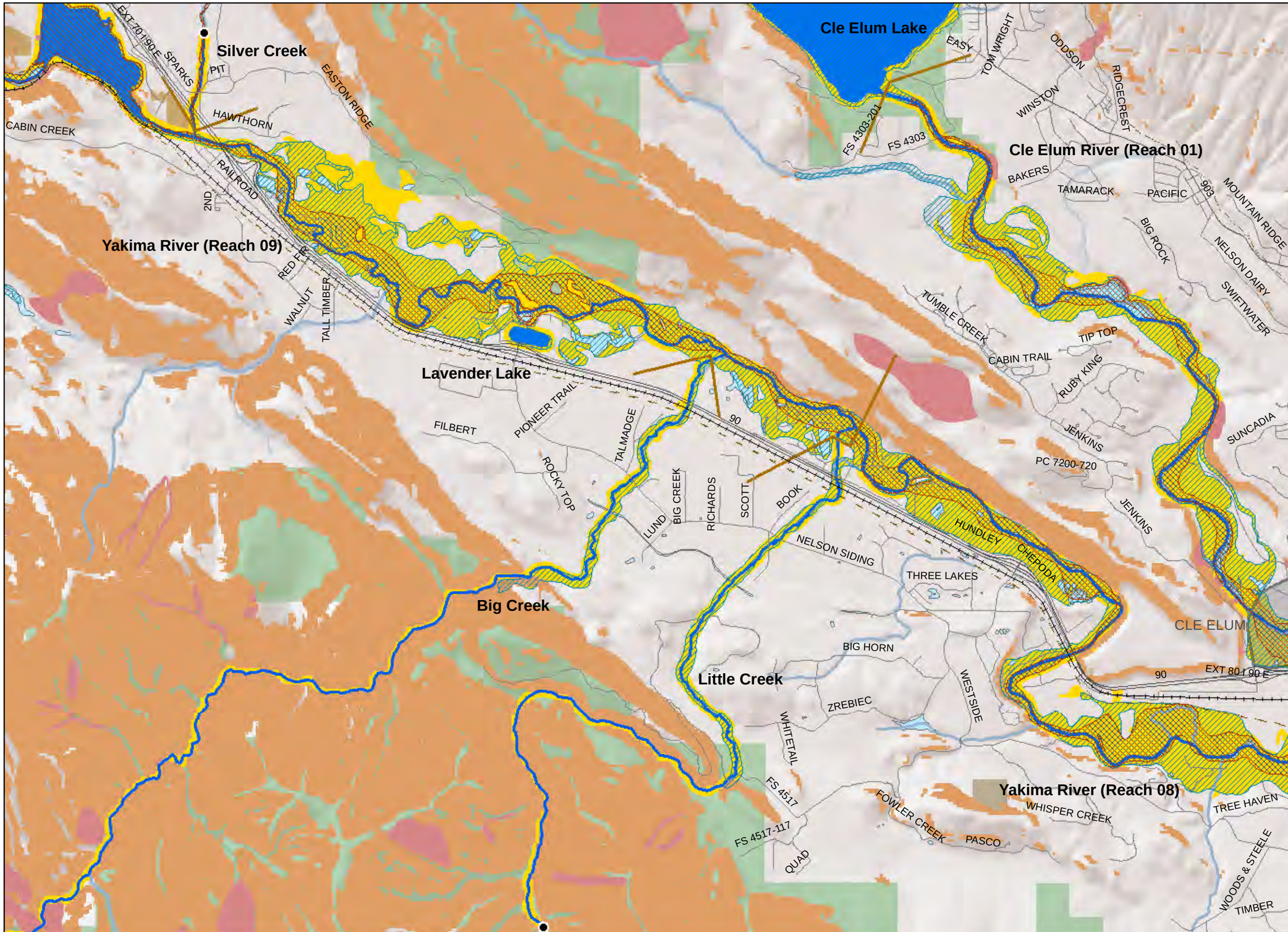
Map 10 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 11

Kittitas County Inventory and Characterization



0 0.5 1 Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
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- Waterbodies (DNR, 2010)

Public Lands

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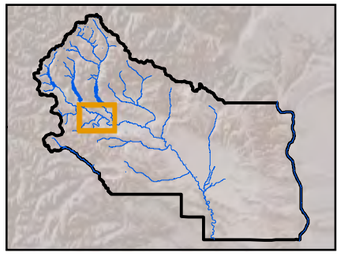
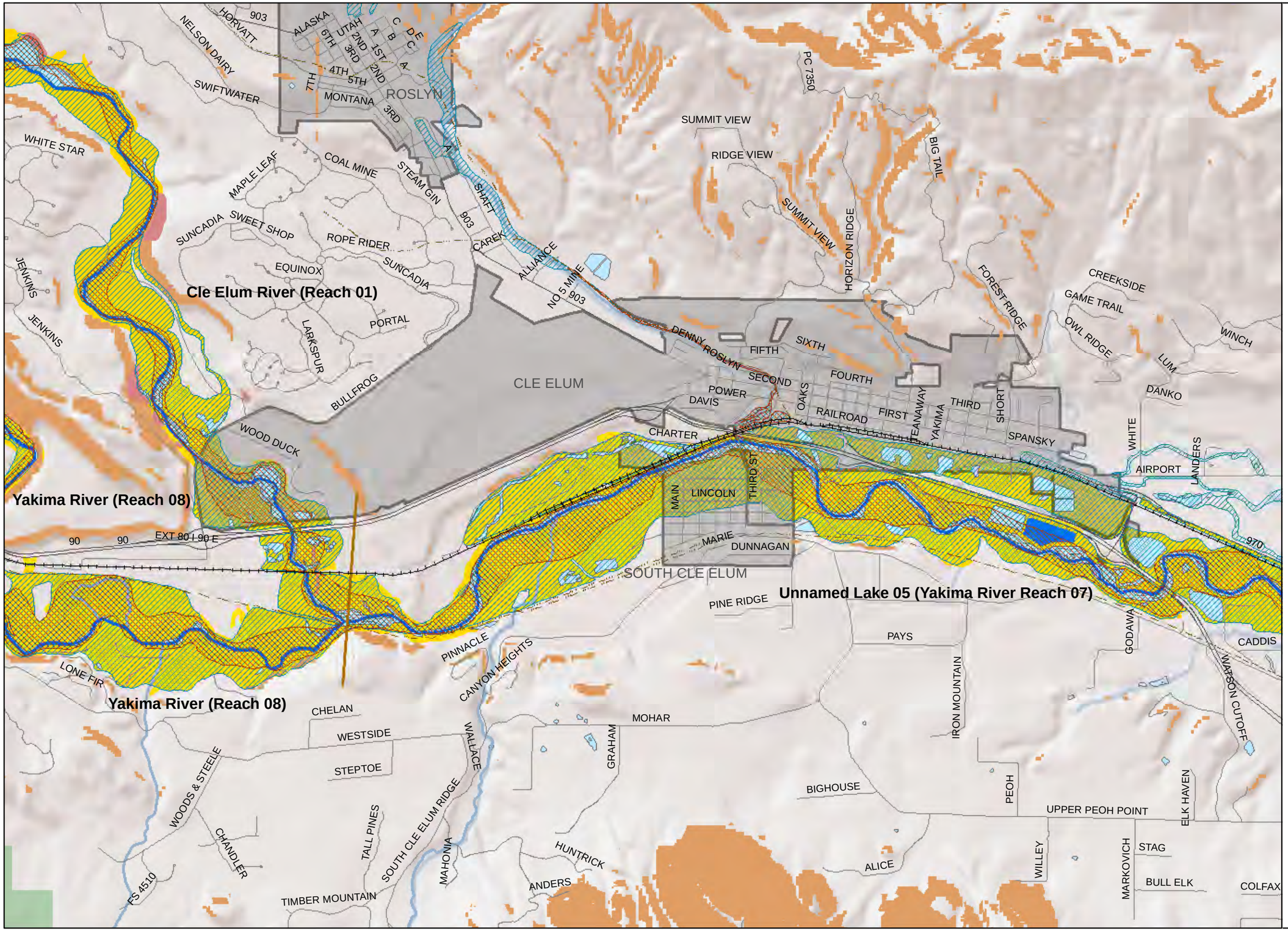
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 11 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 12

Kittitas County Inventory and Characterization

0 0.5 1 Miles

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

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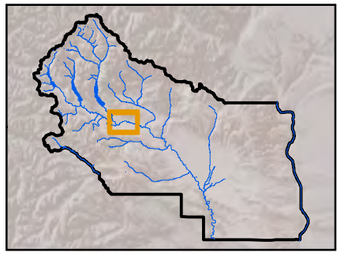
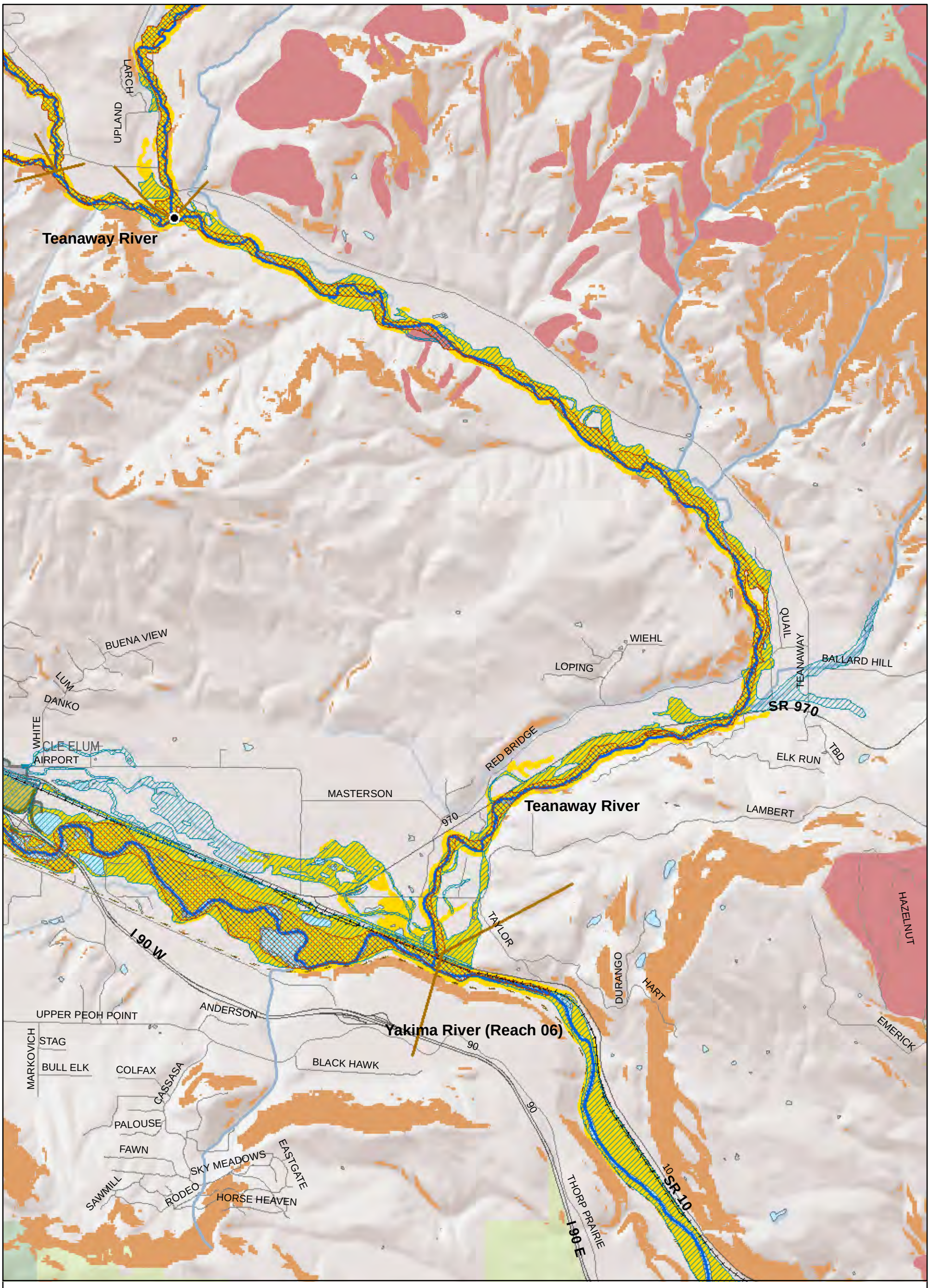
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 13

Kittitas County Inventory and Characterization

0 0.5 1 Miles

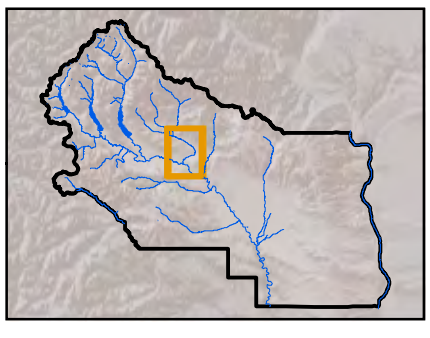
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 13 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 14

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

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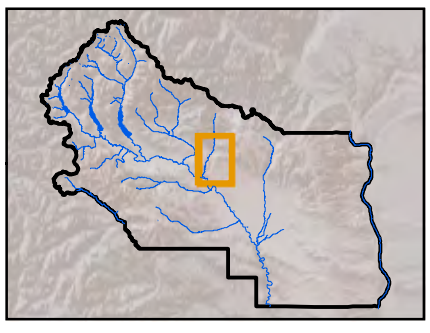
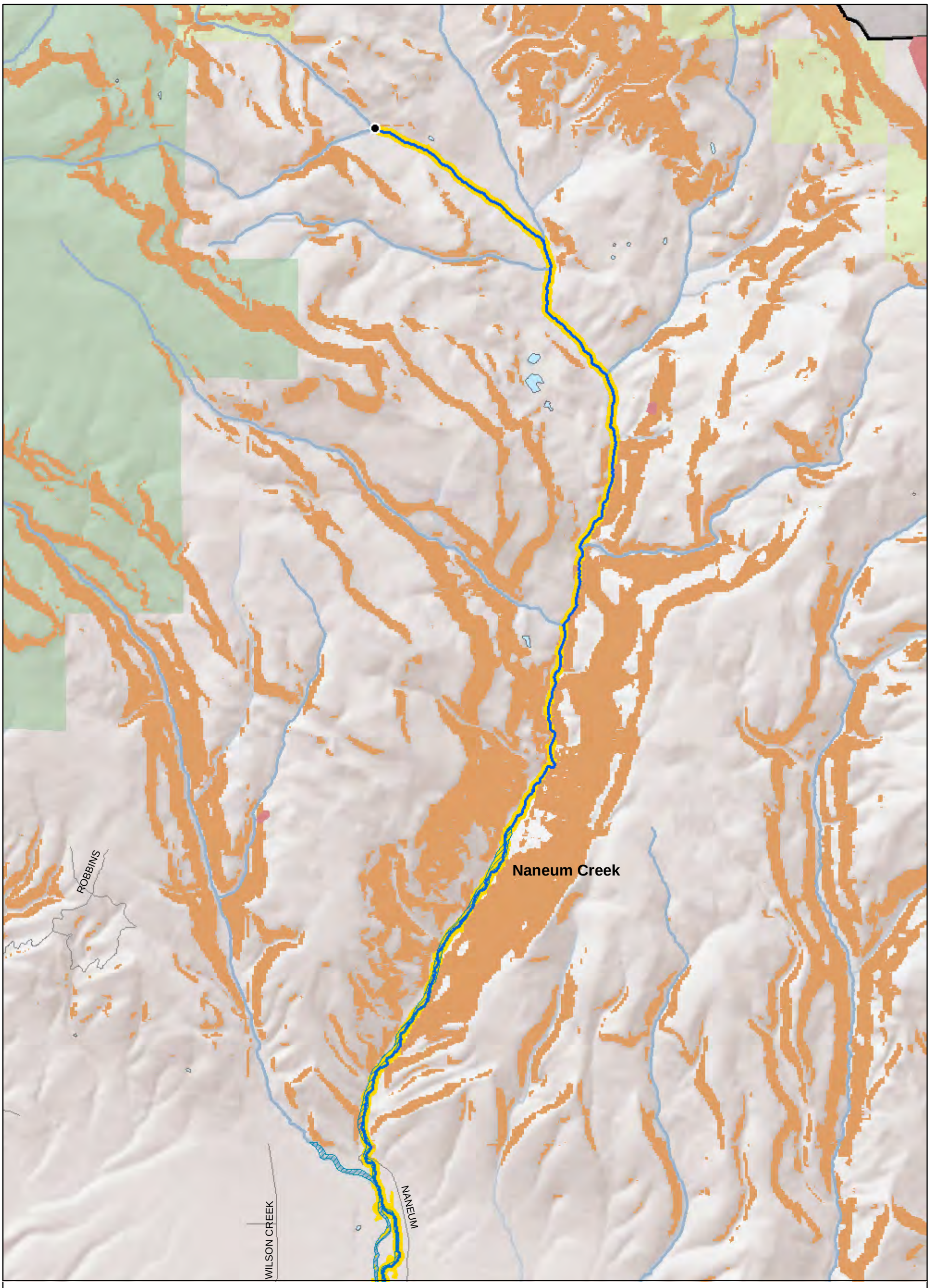
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 14 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 15

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
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Public Lands

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- US Forest Service
- Washington Department of Fish and Wildlife
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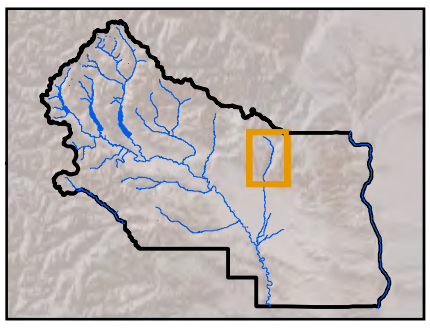
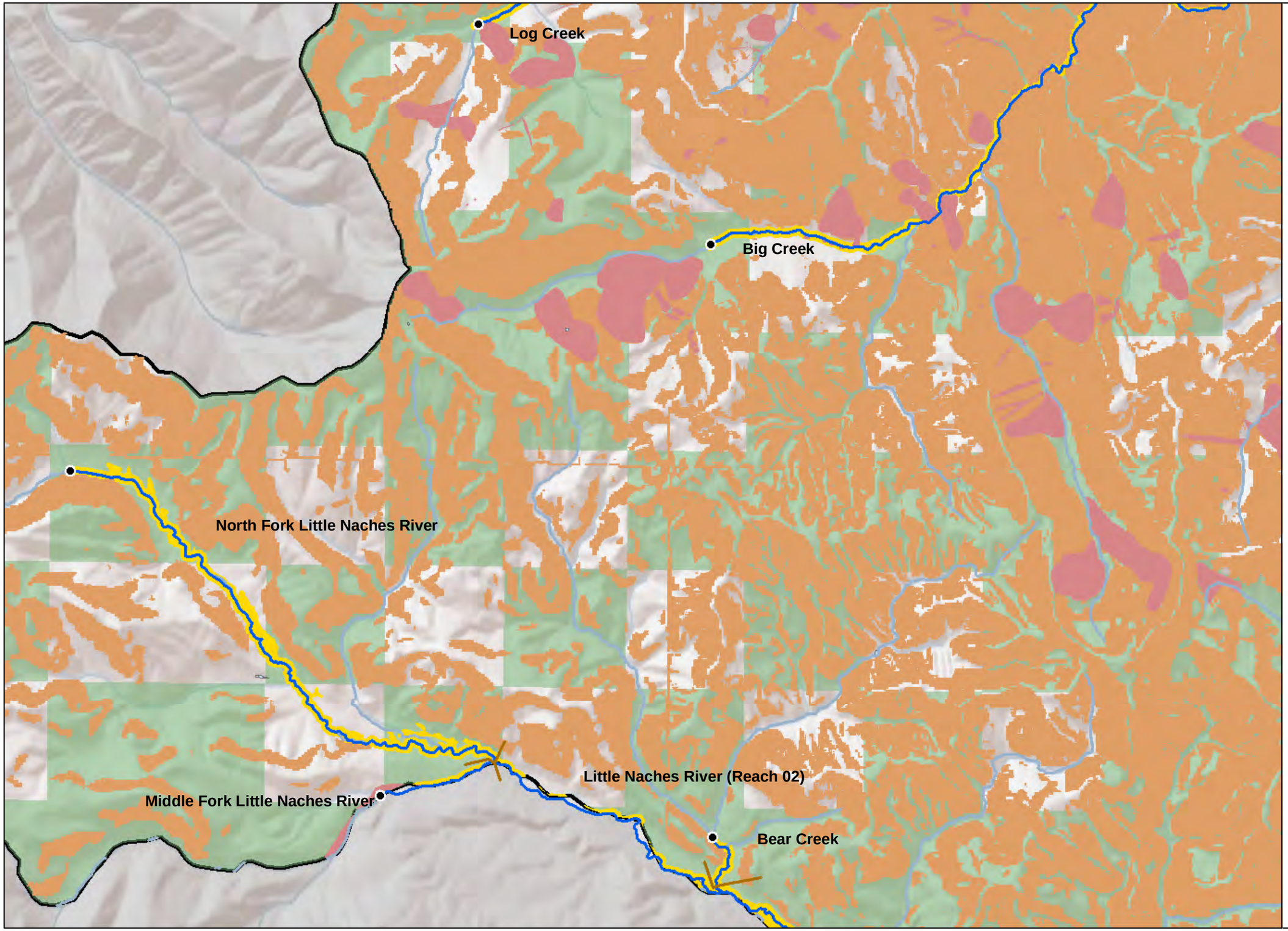
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 15 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 16

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
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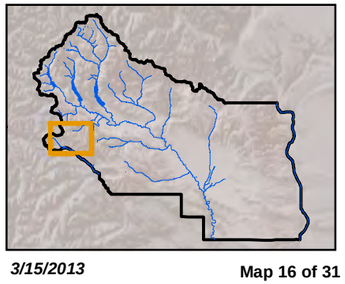
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

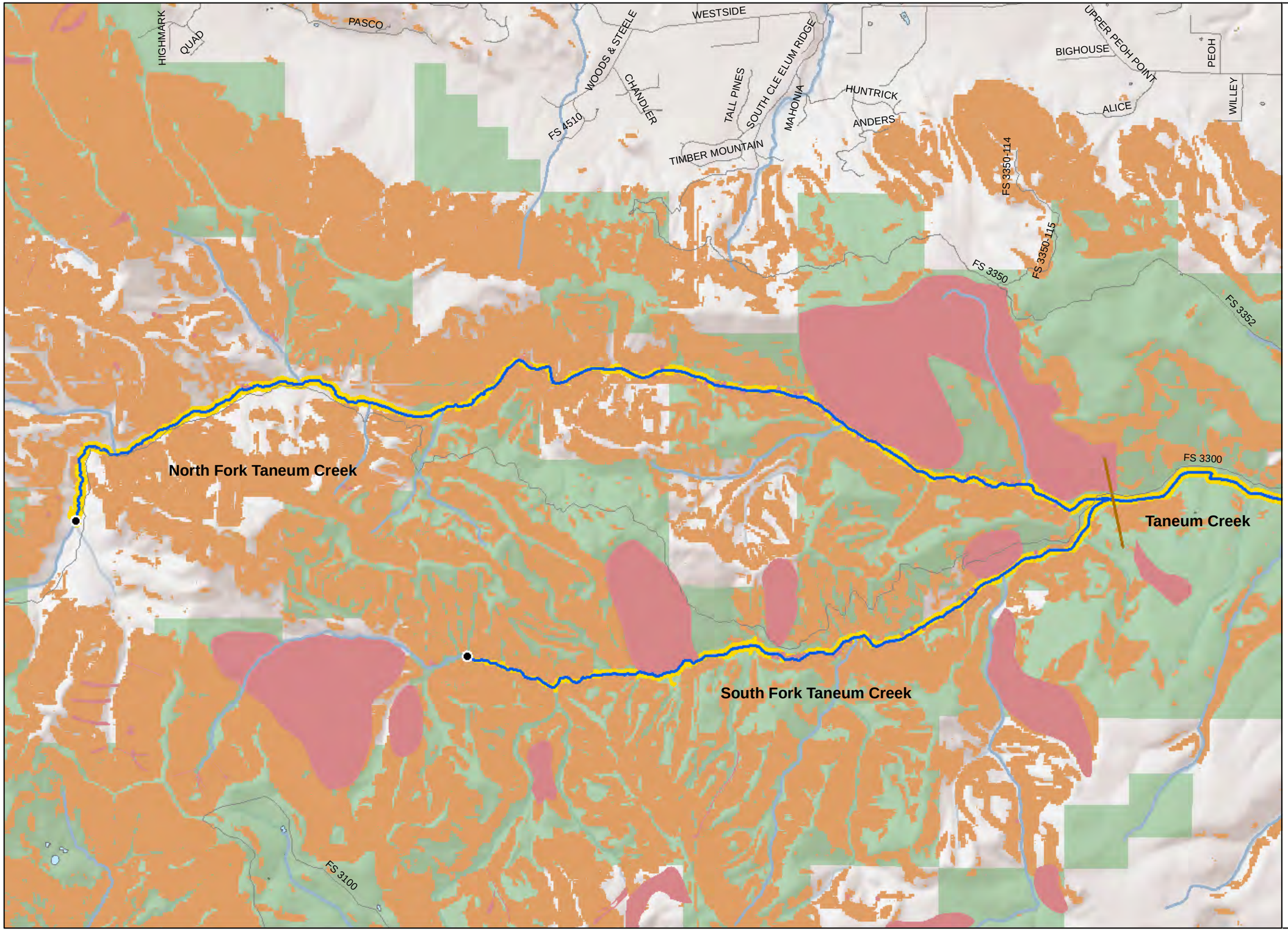
Map 16 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 17

Kittitas County Inventory and Characterization



0 0.5 1
Miles

N

ESA

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
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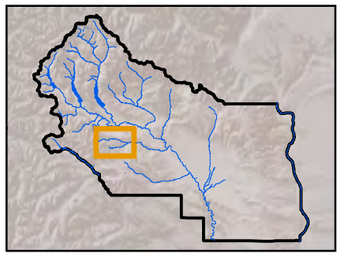
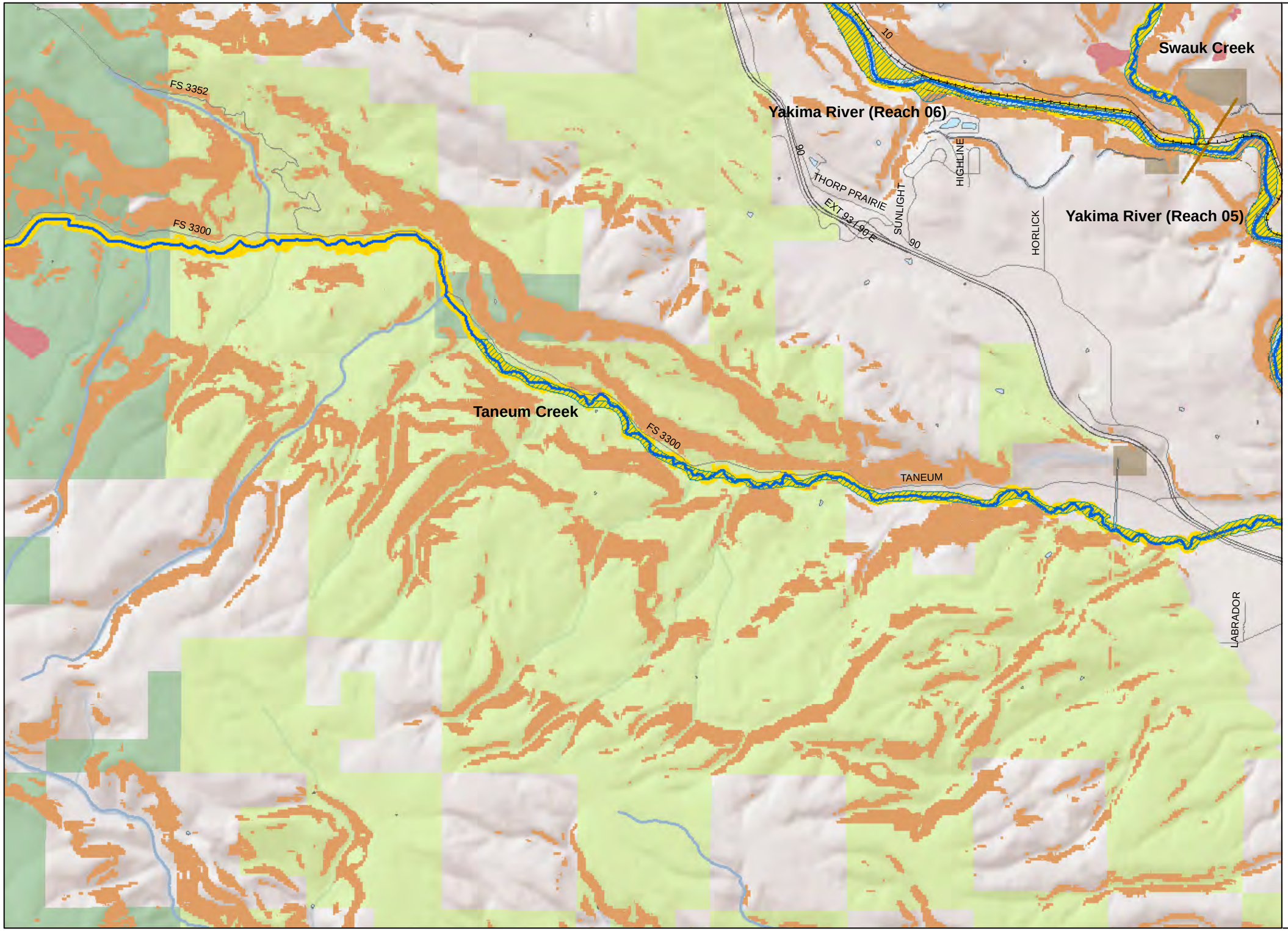


3/15/2013

Map 17 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 18

Kittitas County Inventory and Characterization

0 0.5 1
Miles

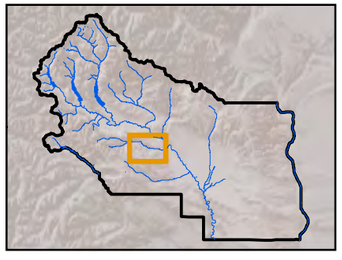
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

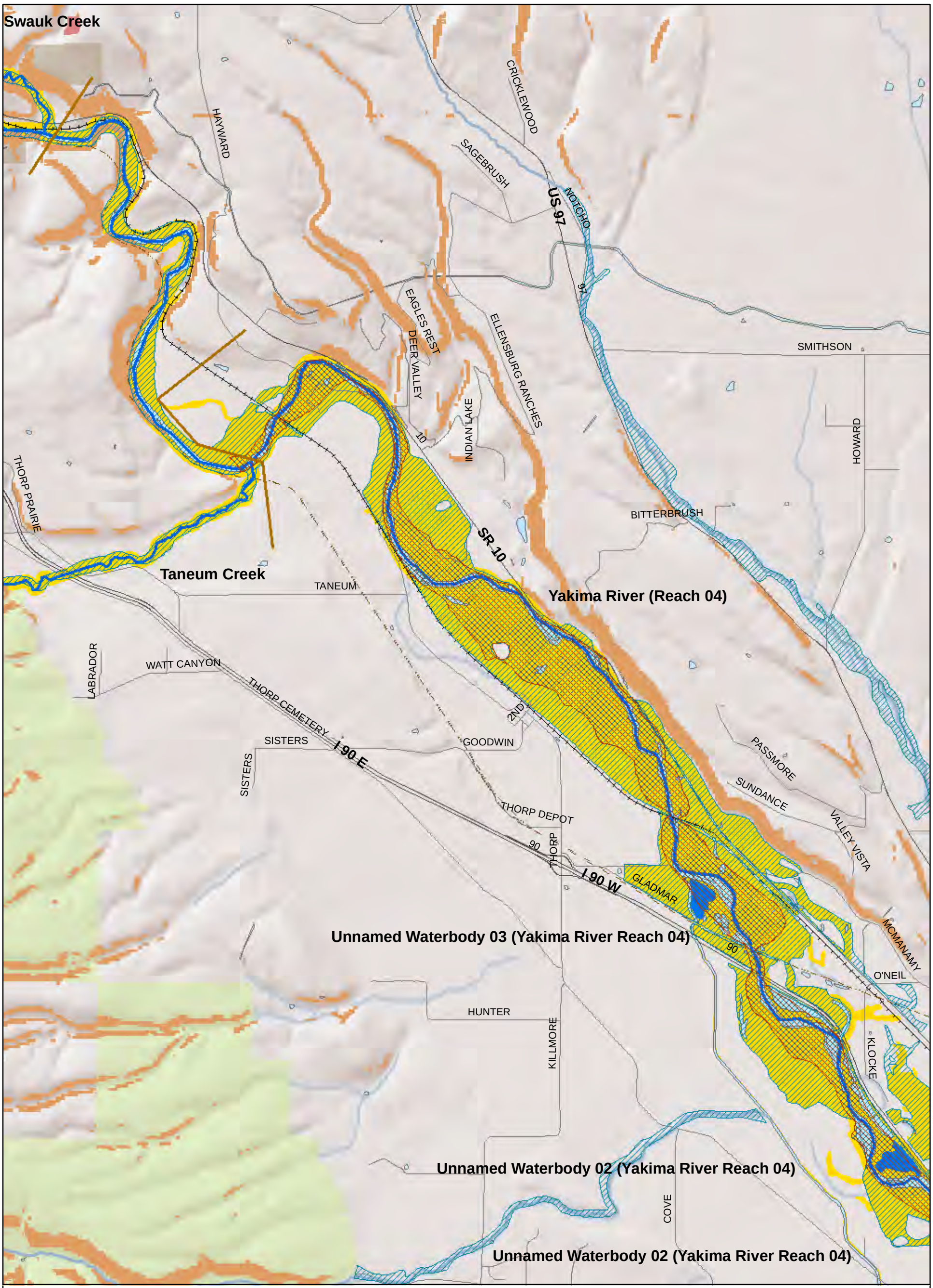
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 19

Kittitas County Inventory and Characterization

0 0.5 1 Miles

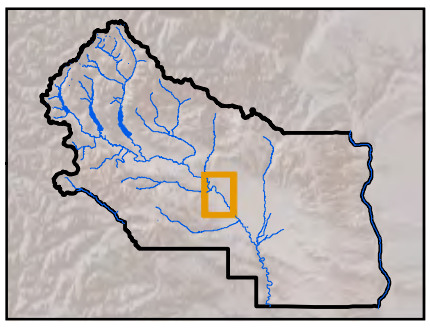
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

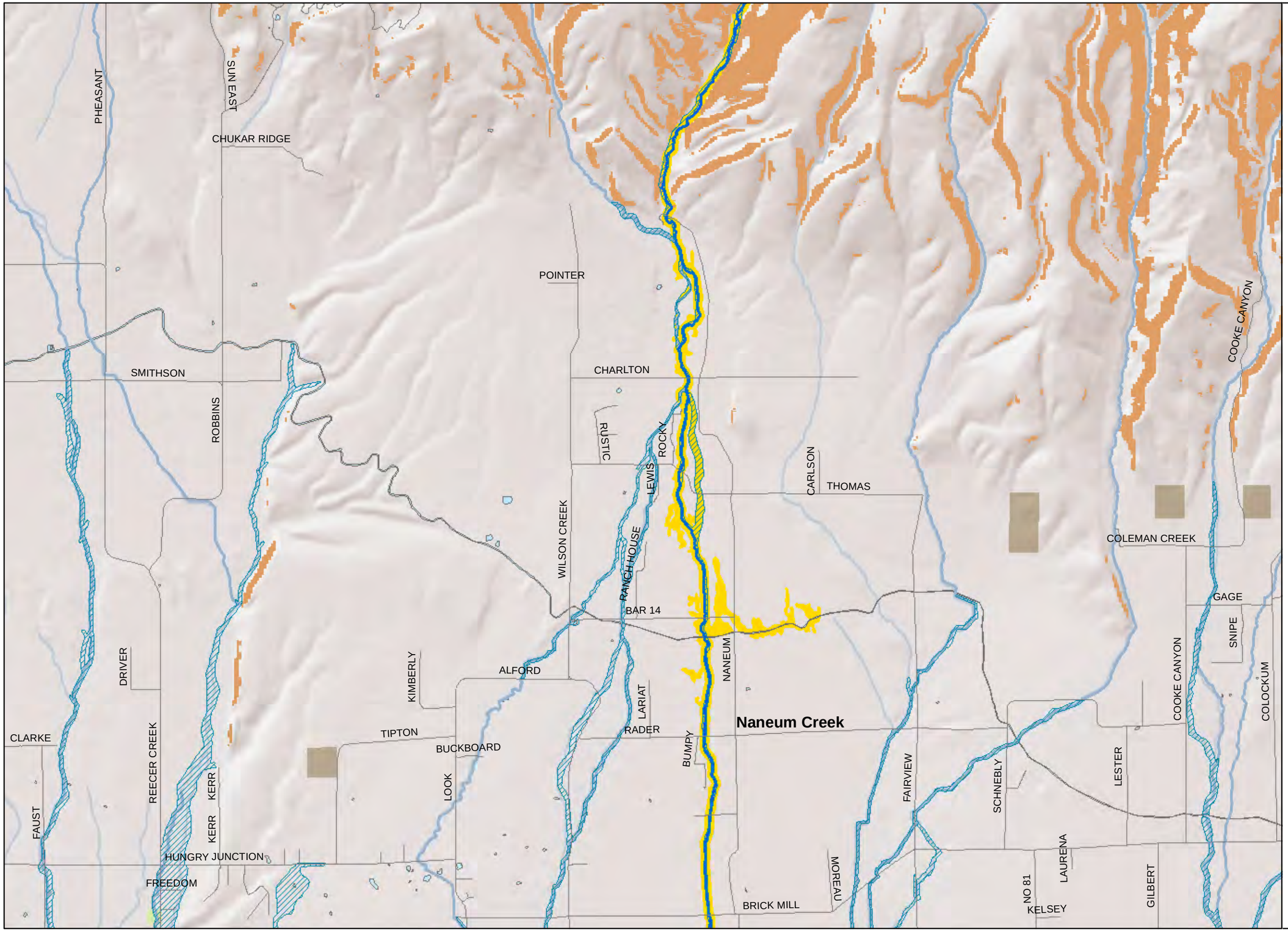
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 20

Kittitas County Inventory and Characterization

0 0.5 1
Miles

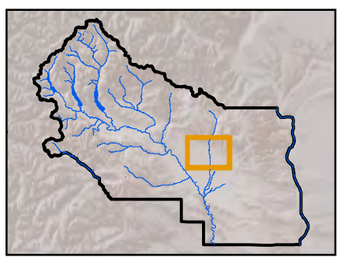
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 20 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 21

Kittitas County Inventory and Characterization

0 0.5 1
Miles

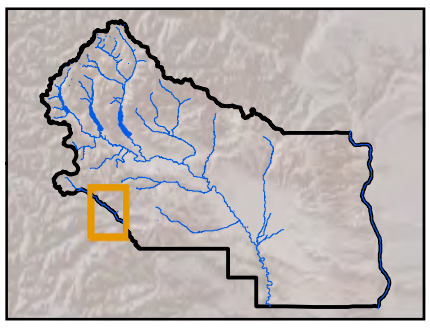
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

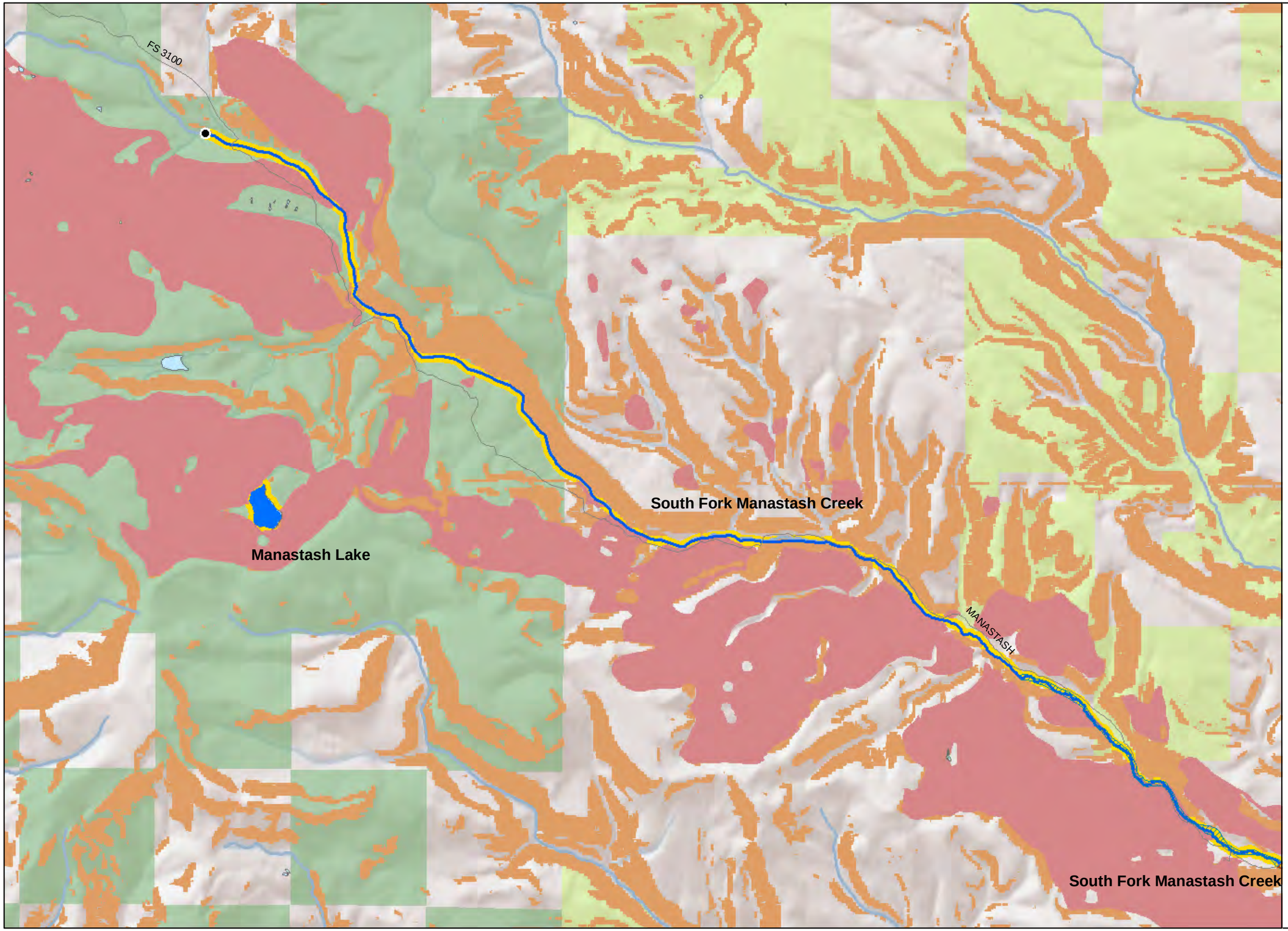
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 21 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 22

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

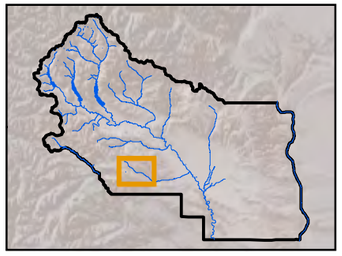
ESA

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

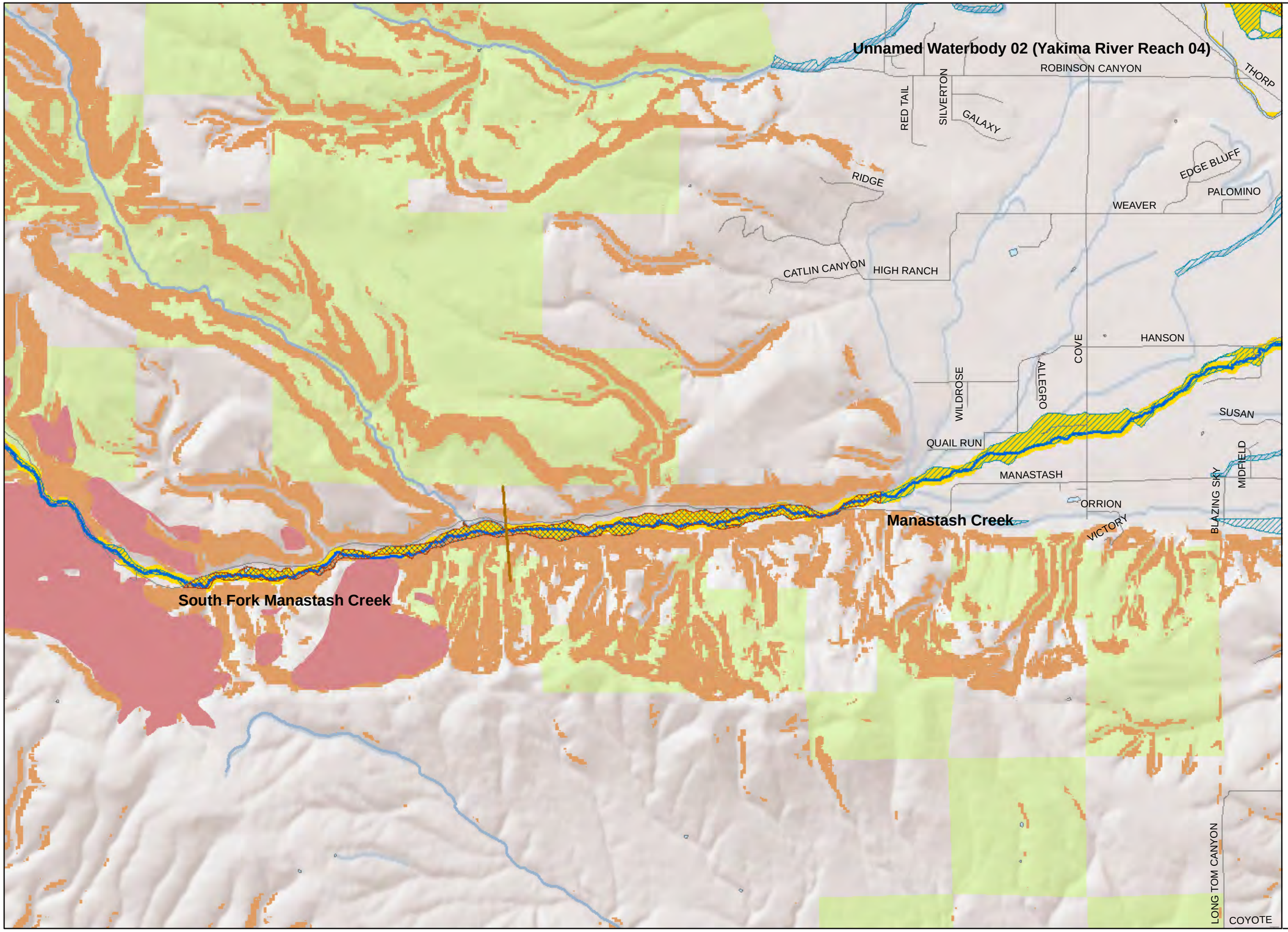
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 23

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

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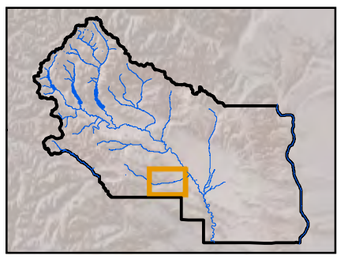
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 23 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 24

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies (DNR, 2010)

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Hazardous Facilities (Ecology, 2011)
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)

Unnamed Pond 04 (Yakima River Reach 04)

Naneum Creek

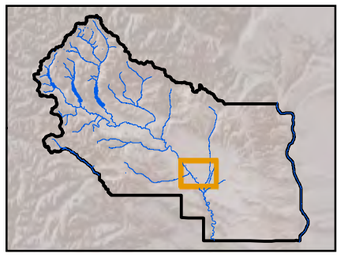
Coleman Creek

Yakima River (Reach 03)

Cooke Creek

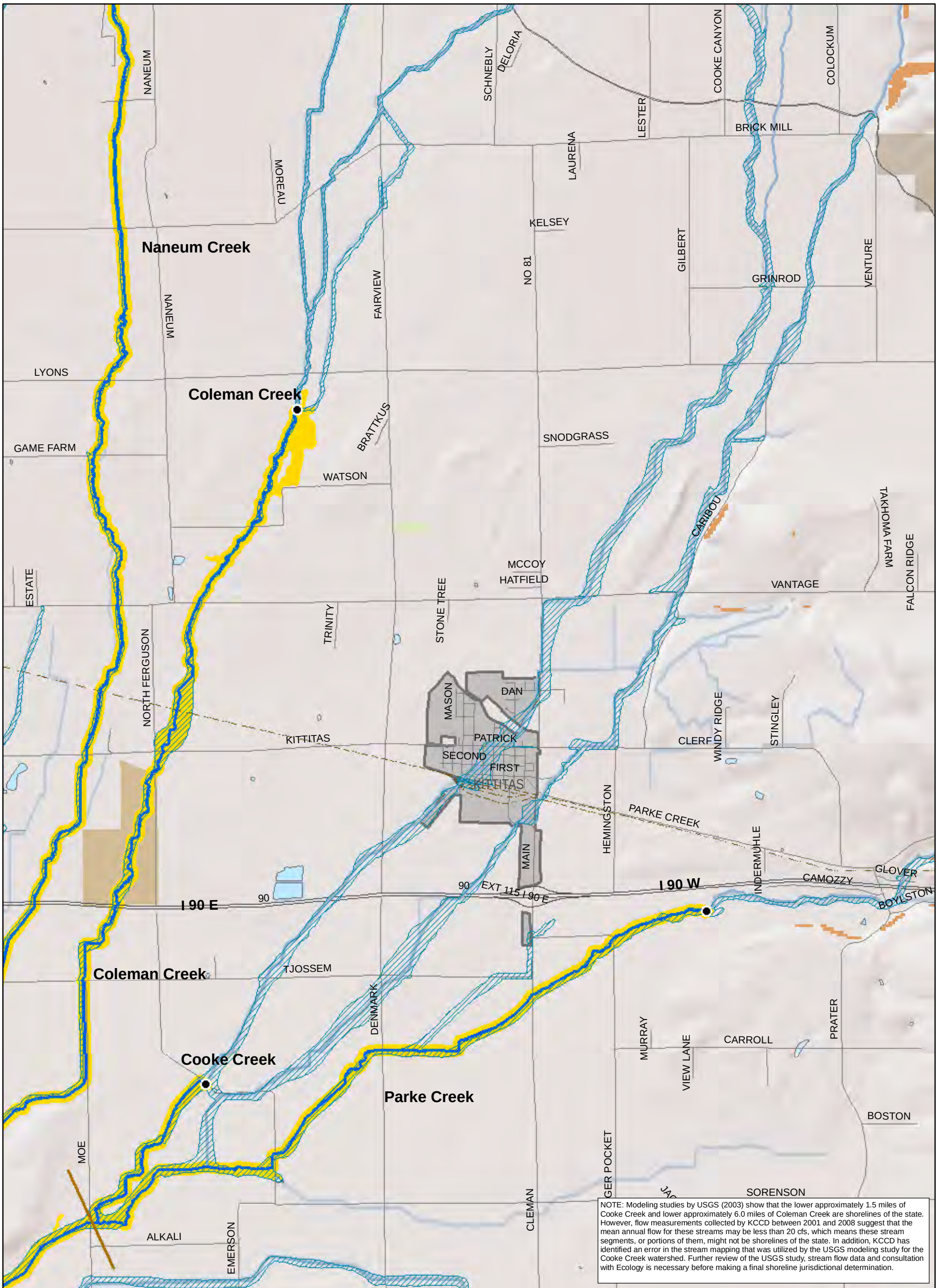
ELLENSBURG

NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #2: Hazard Areas

Map 25

Kittitas County Inventory and Characterization

0 0.5 1 Miles

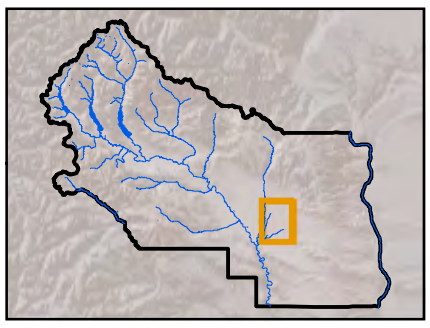
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

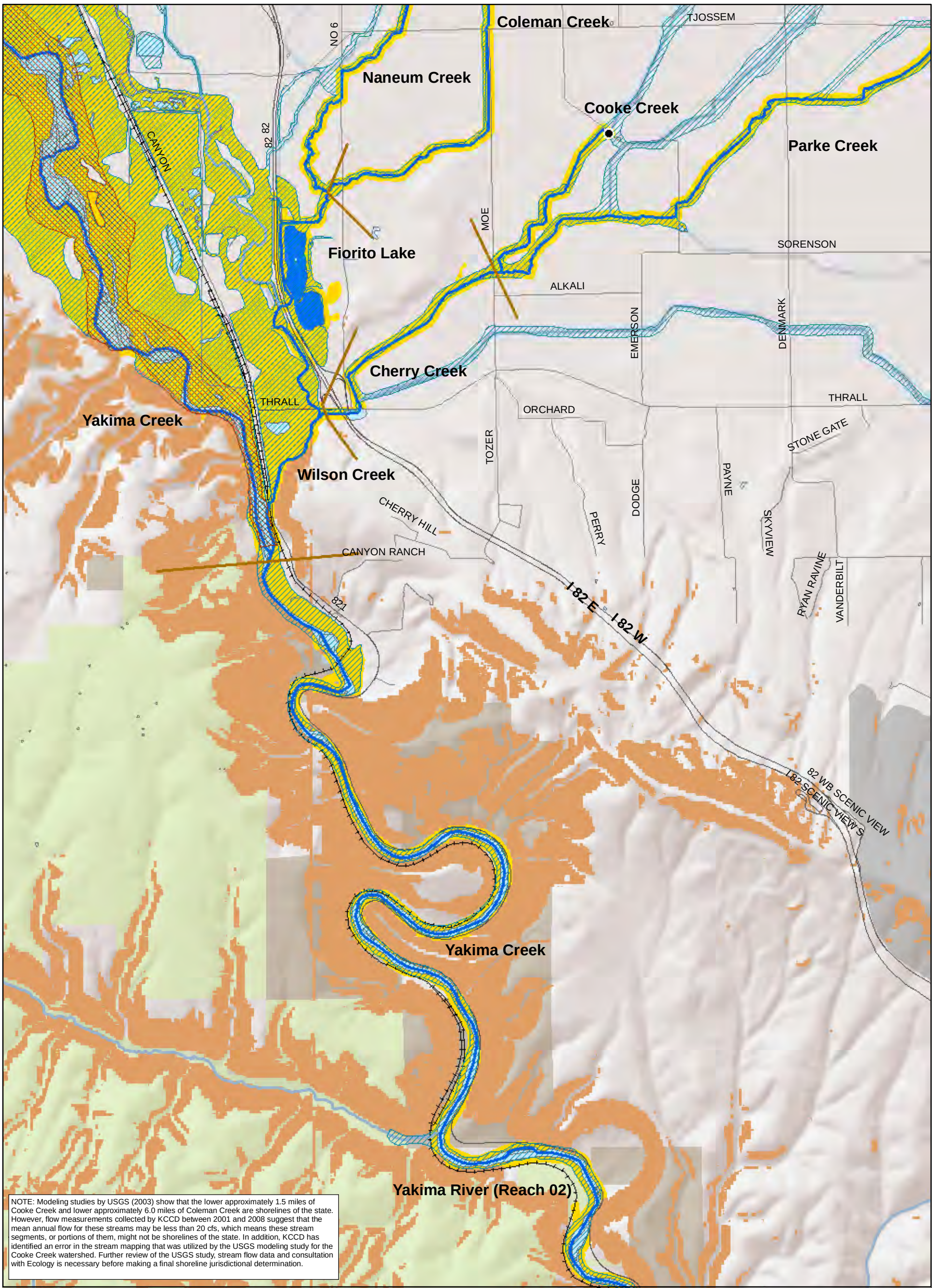
- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 25 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #2: Hazard Areas

Map 26

Kittitas County Inventory and Characterization

0 0.5 1 Miles

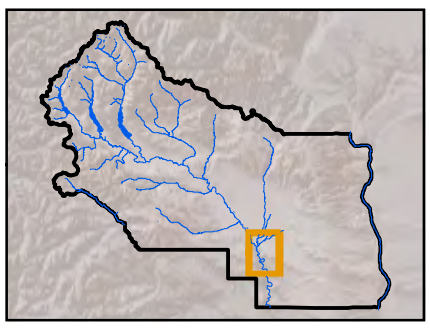
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

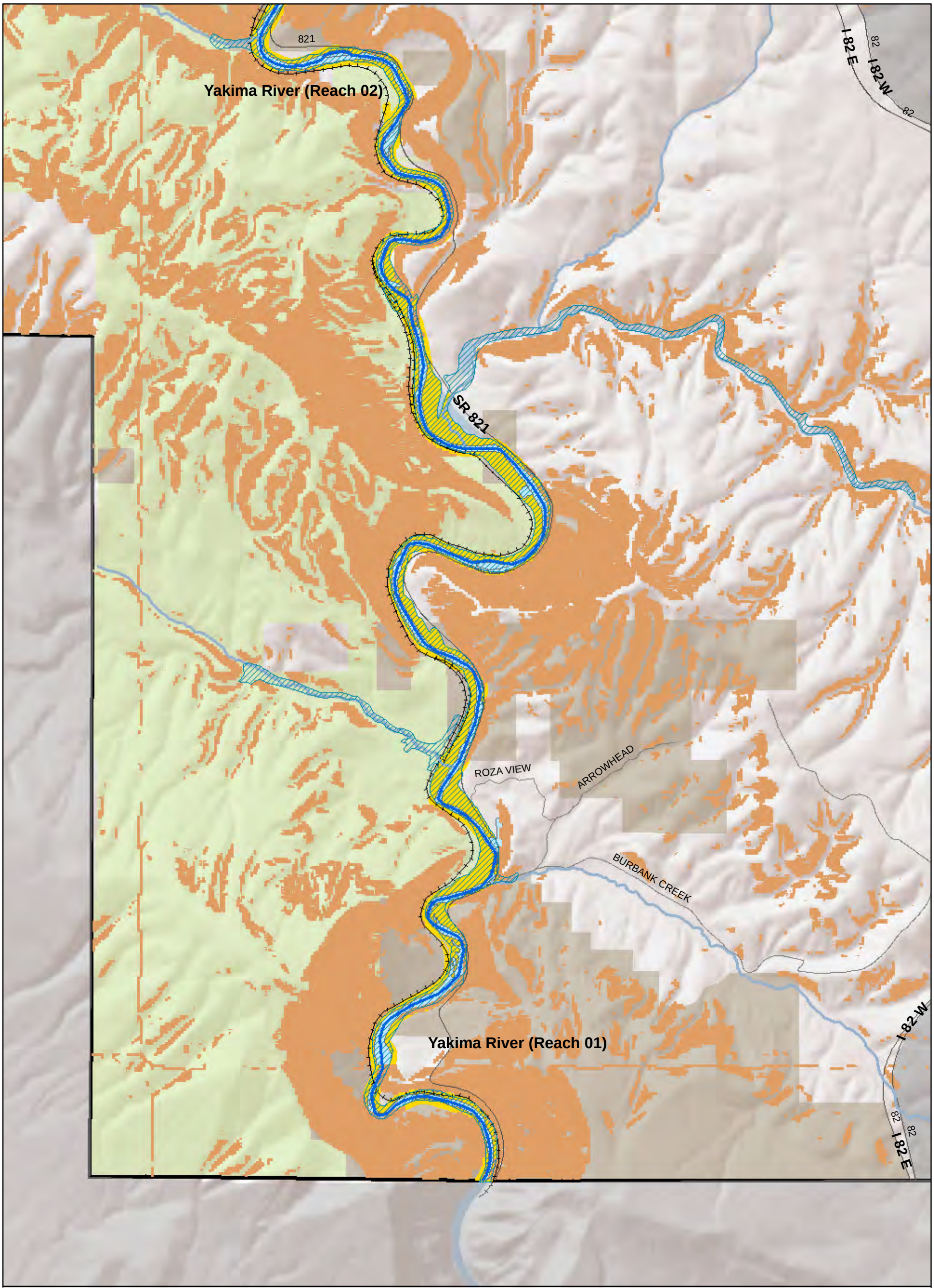
Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 27

Kittitas County Inventory and Characterization

0 0.5 1 Miles

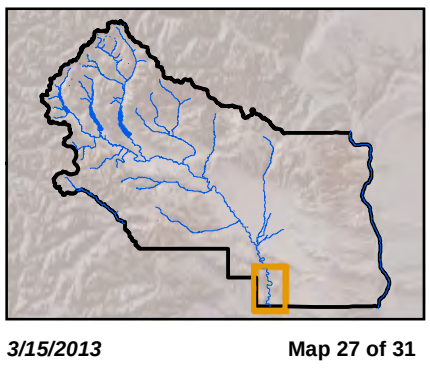
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 27 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 28

Kittitas County Inventory and Characterization

0 0.5 1
Miles

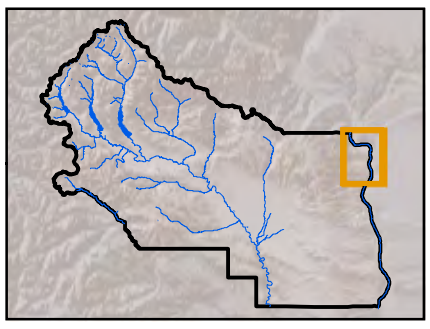
N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

- US Bureau of Land Management
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 28 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

Map Folio #2: Hazard Areas

Map 29

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

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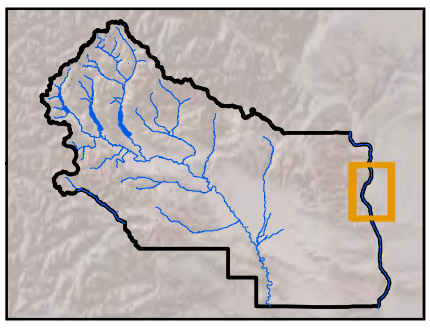
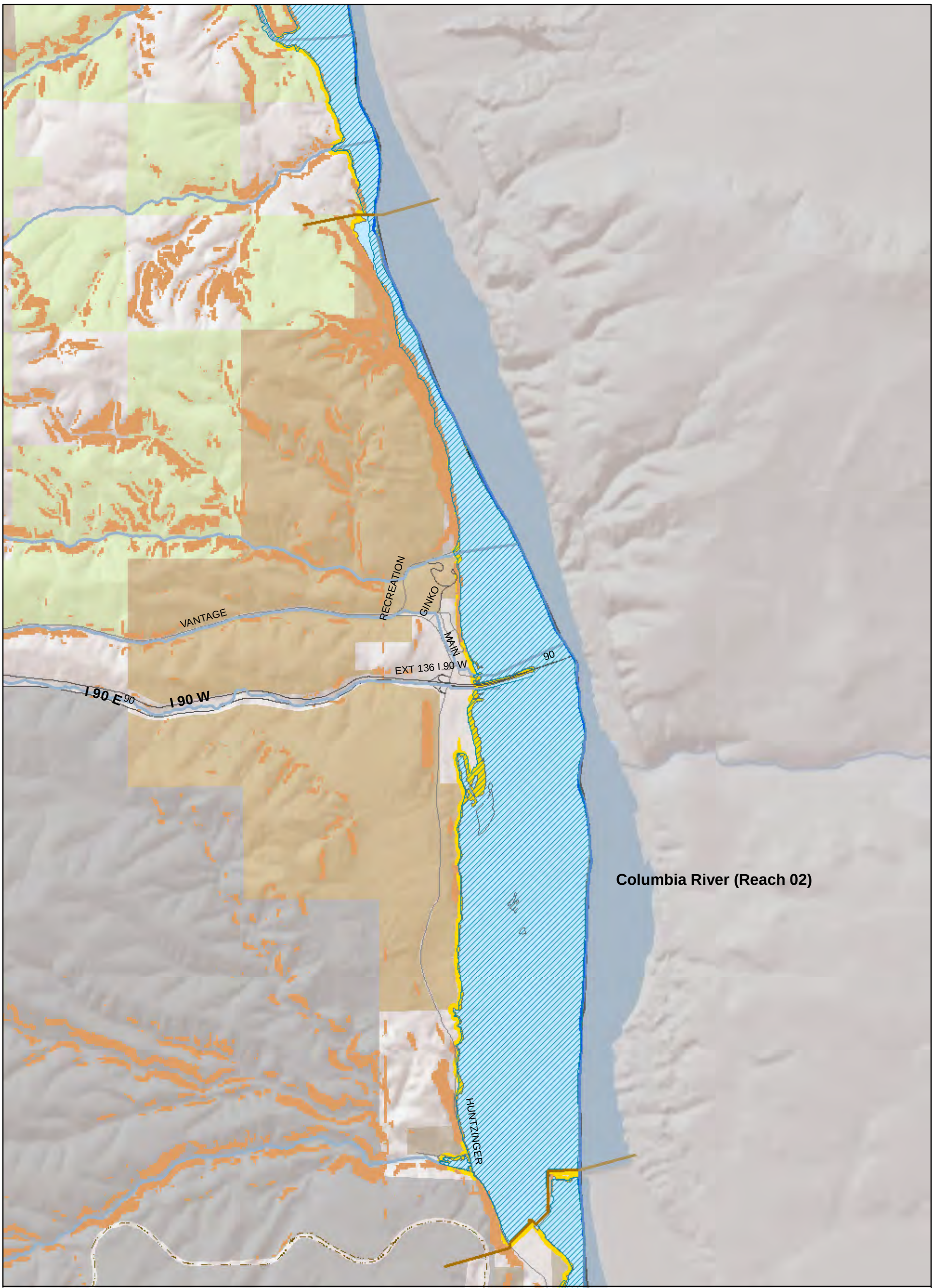
- US Dept. of Defense
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 29 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 30

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
- SMA Streams
- Non-SMA Streams
- Trails
- Railroads
- Major Roads
- Minor Roads
- Cities
- Waterbodies

Public Lands

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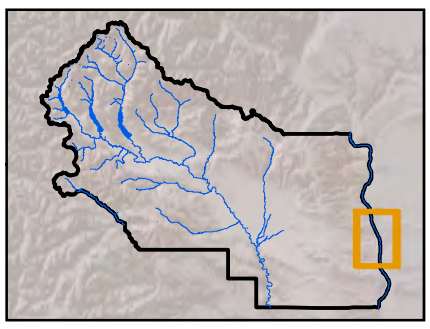
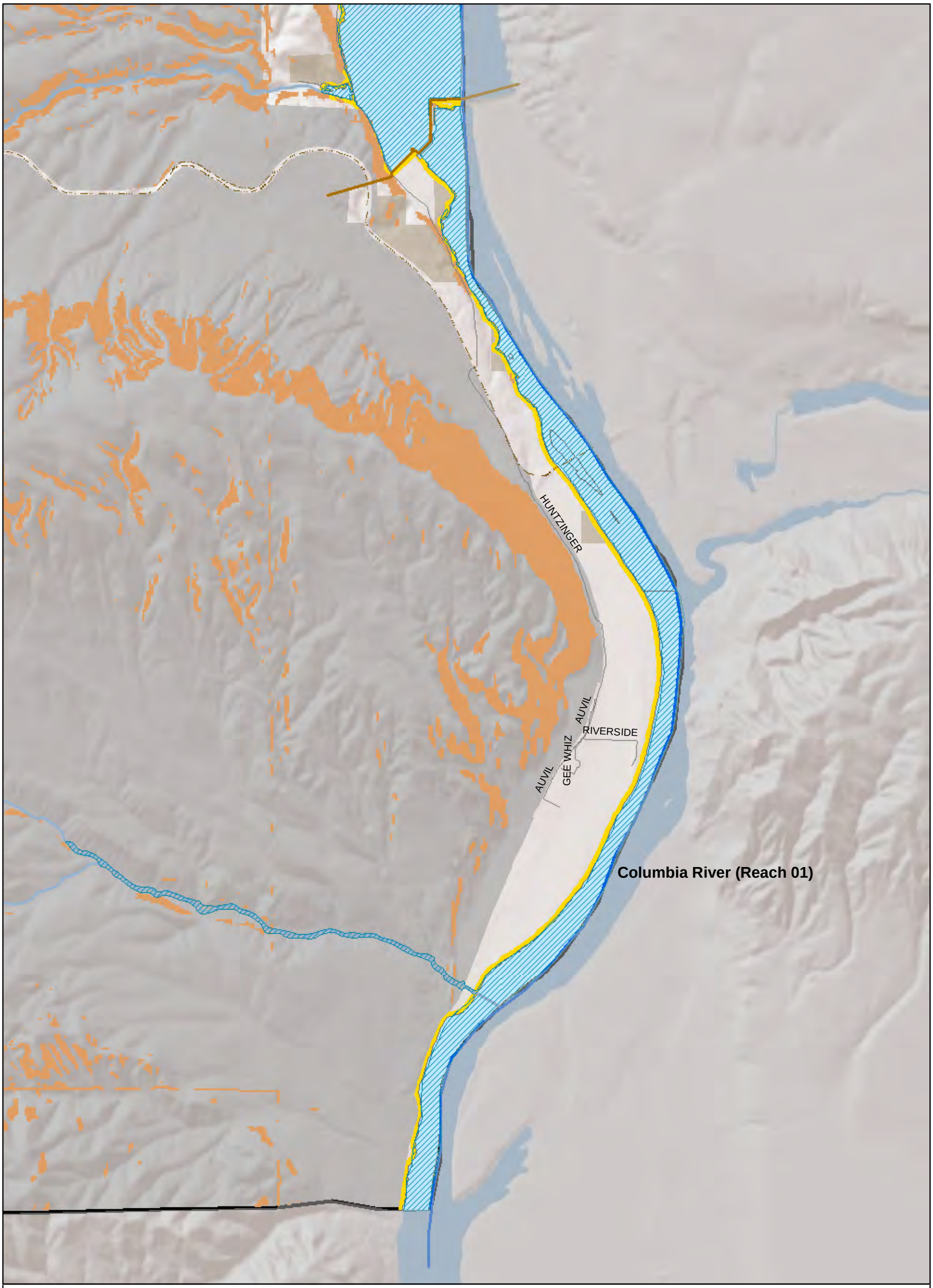
- US Forest Service
- Washington Department of Fish and Wildlife
- State Parks
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 30 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.



Map Folio #2: Hazard Areas

Map 31

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Legend

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- SMA Waterbodies
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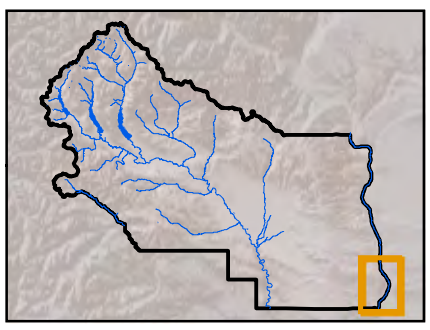
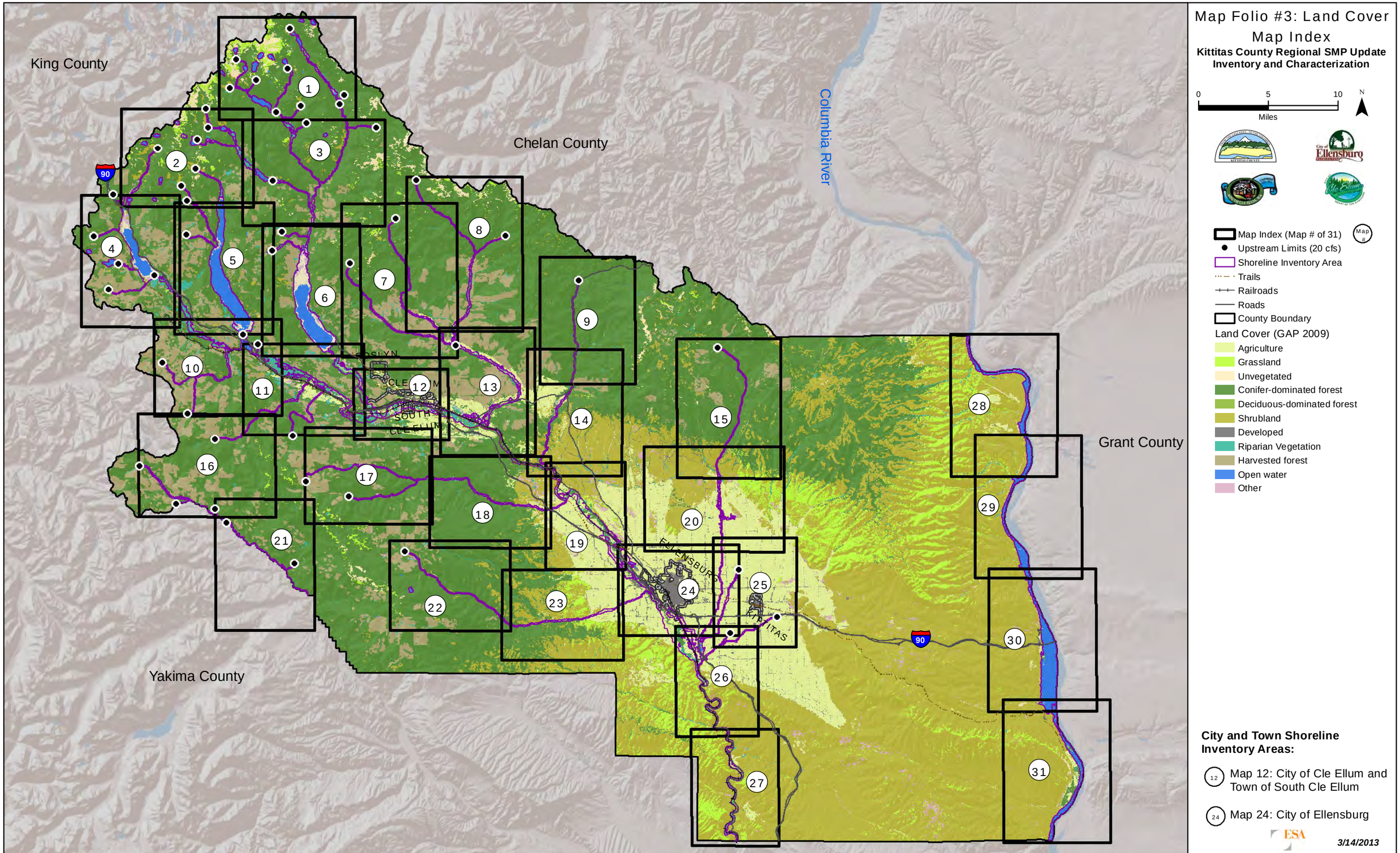
- Steep Slopes (>35%)
- Landslides (WDNR)
- Floodway (FEMA)
- 100 Year Floodplain (FEMA)



3/15/2013

Map 31 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; ESRI, 2010.

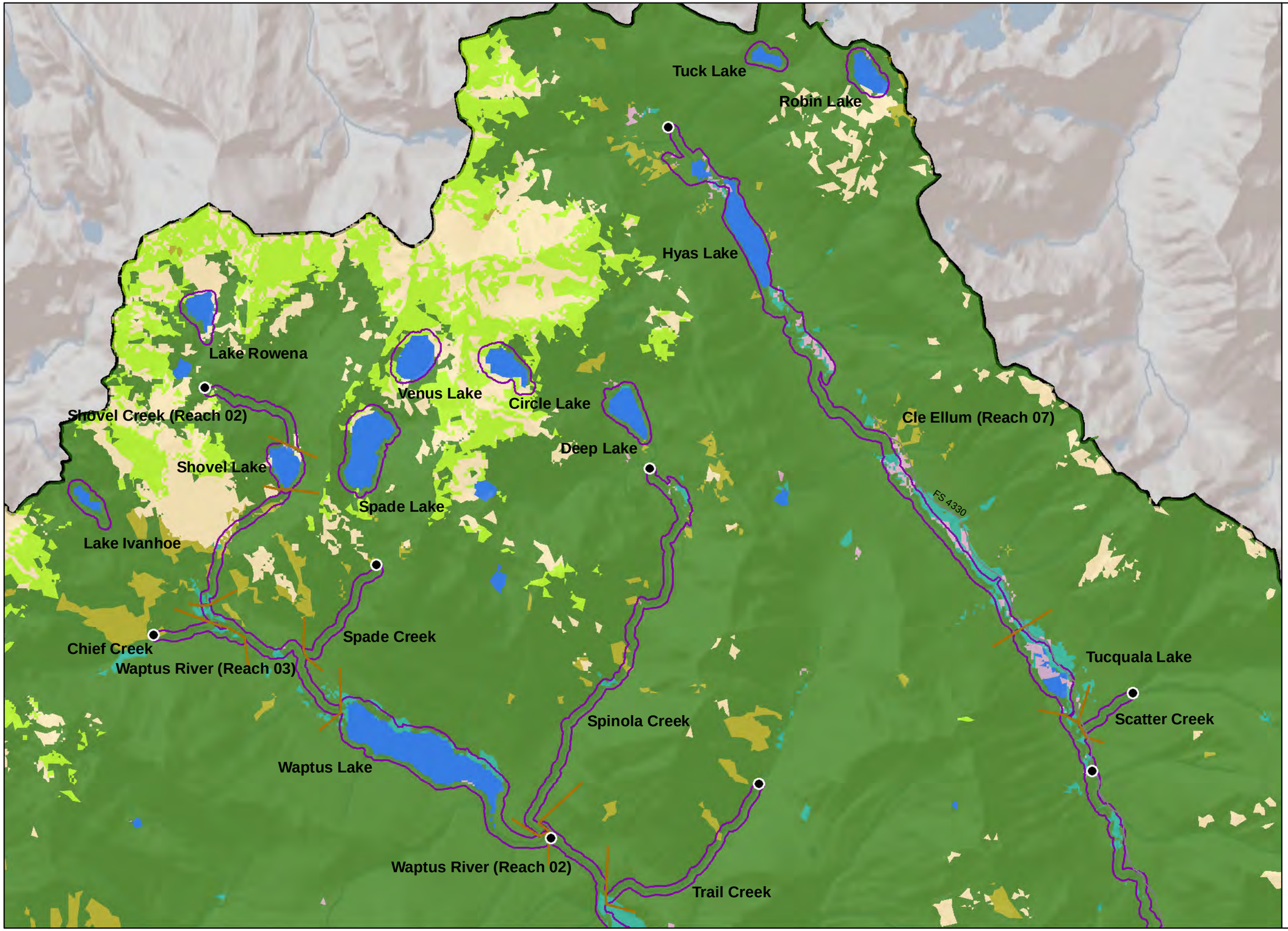


Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 1

Kittitas County Inventory and Characterization

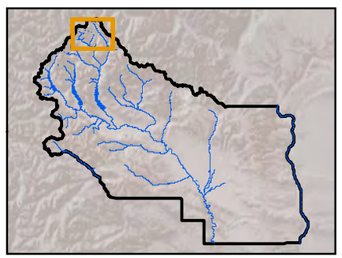


0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 1 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 2

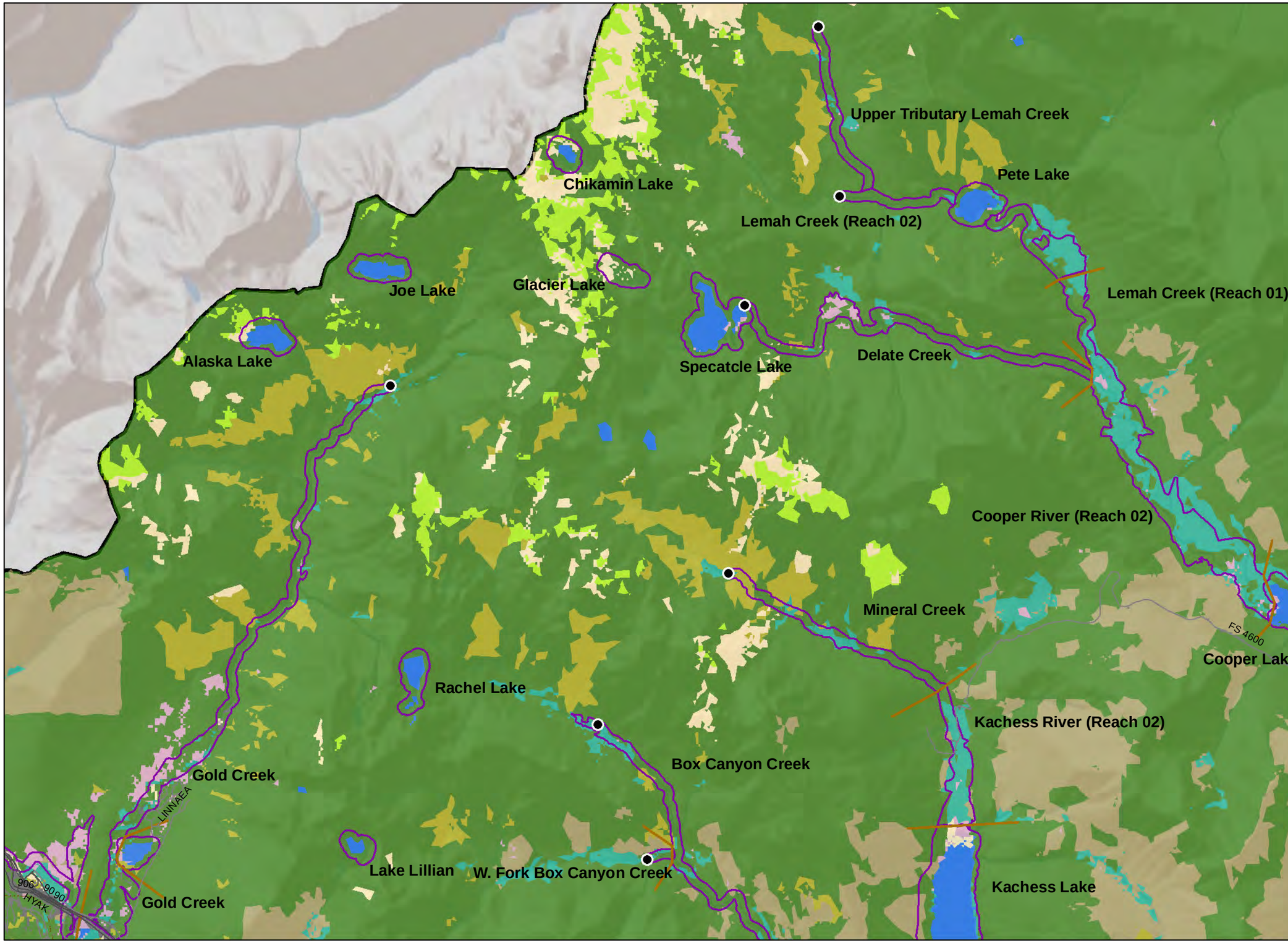
Kittitas County Inventory and Characterization

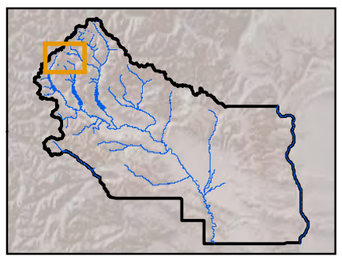
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other





3/14/2013

Map 2 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 3

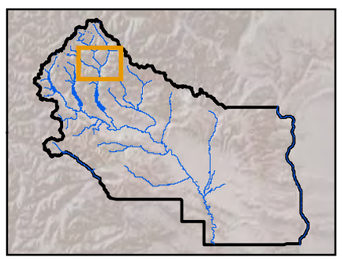
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 3 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 4

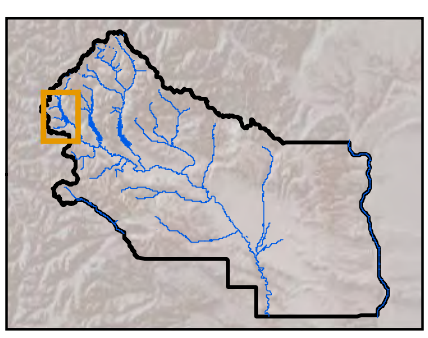
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 4 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 5

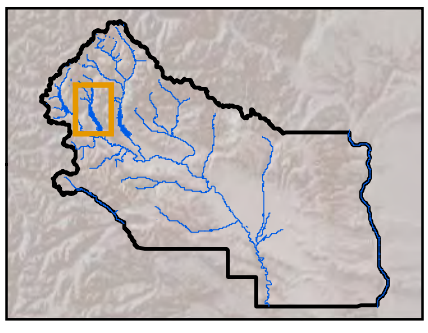
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

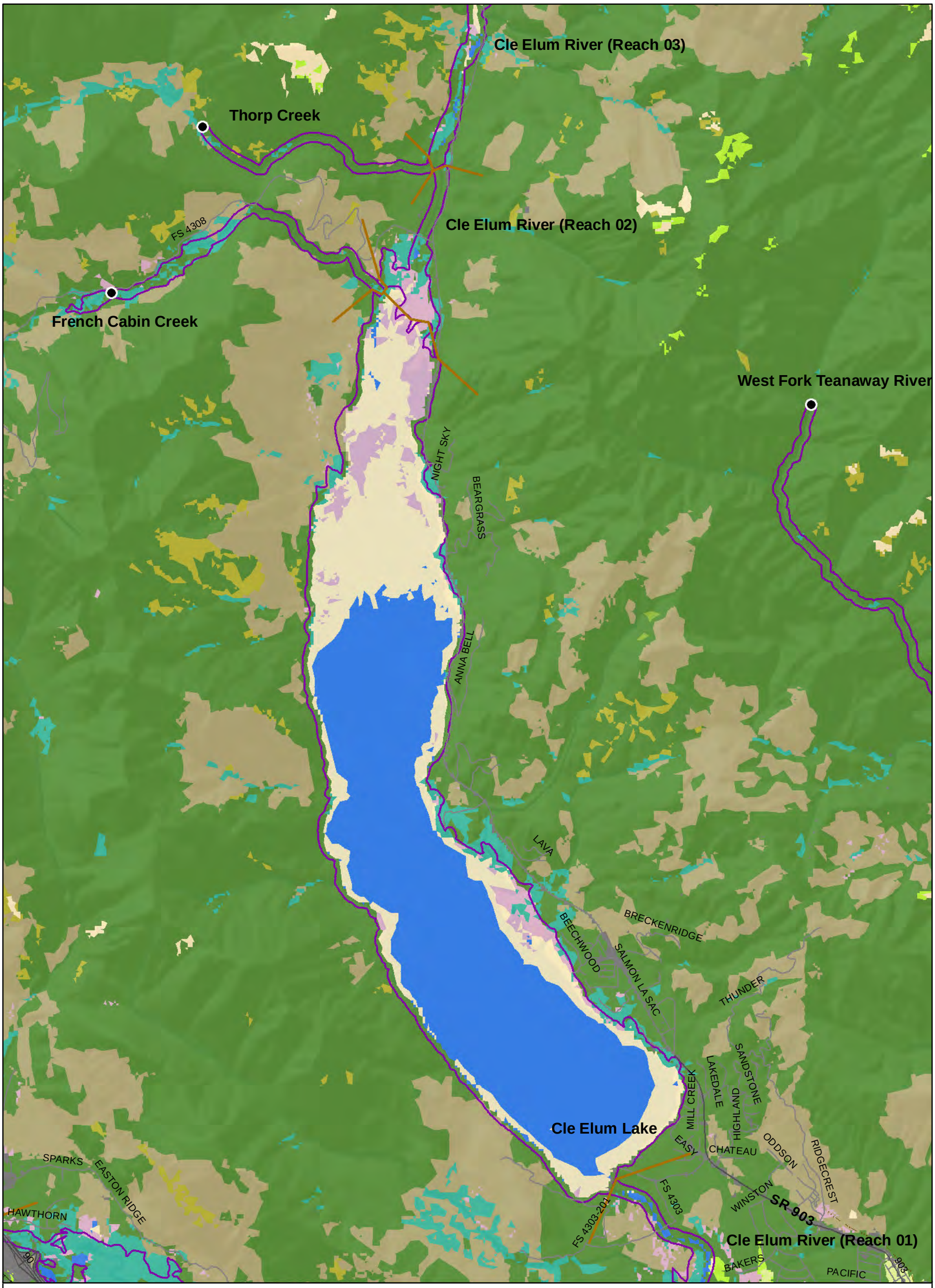
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 5 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 6

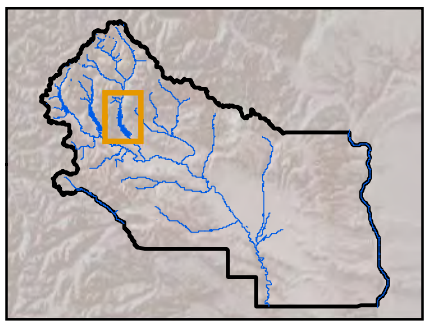
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

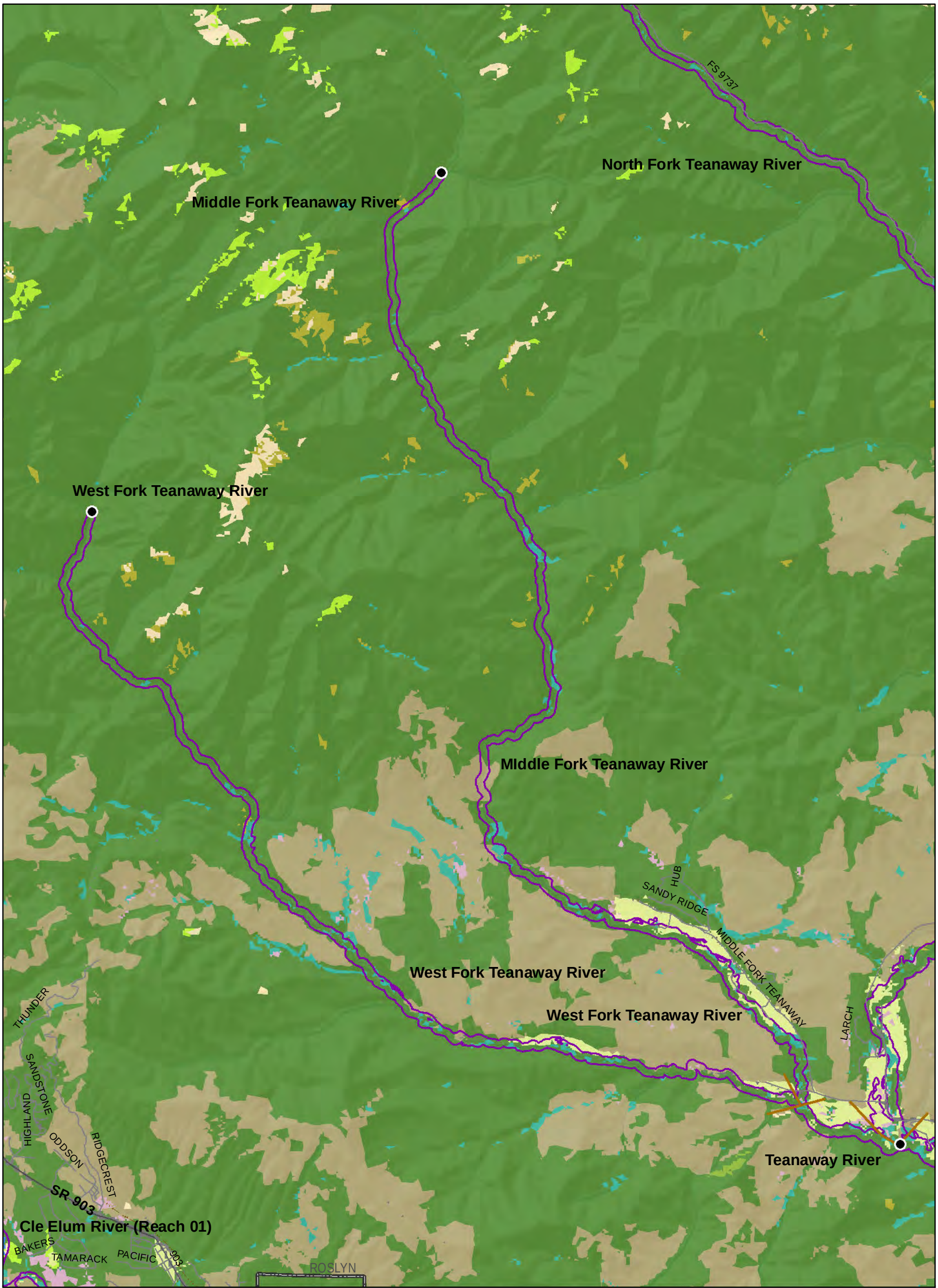
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 6 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 7

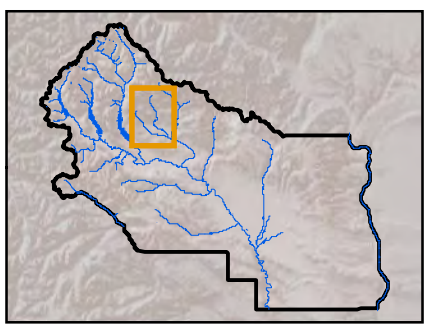
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

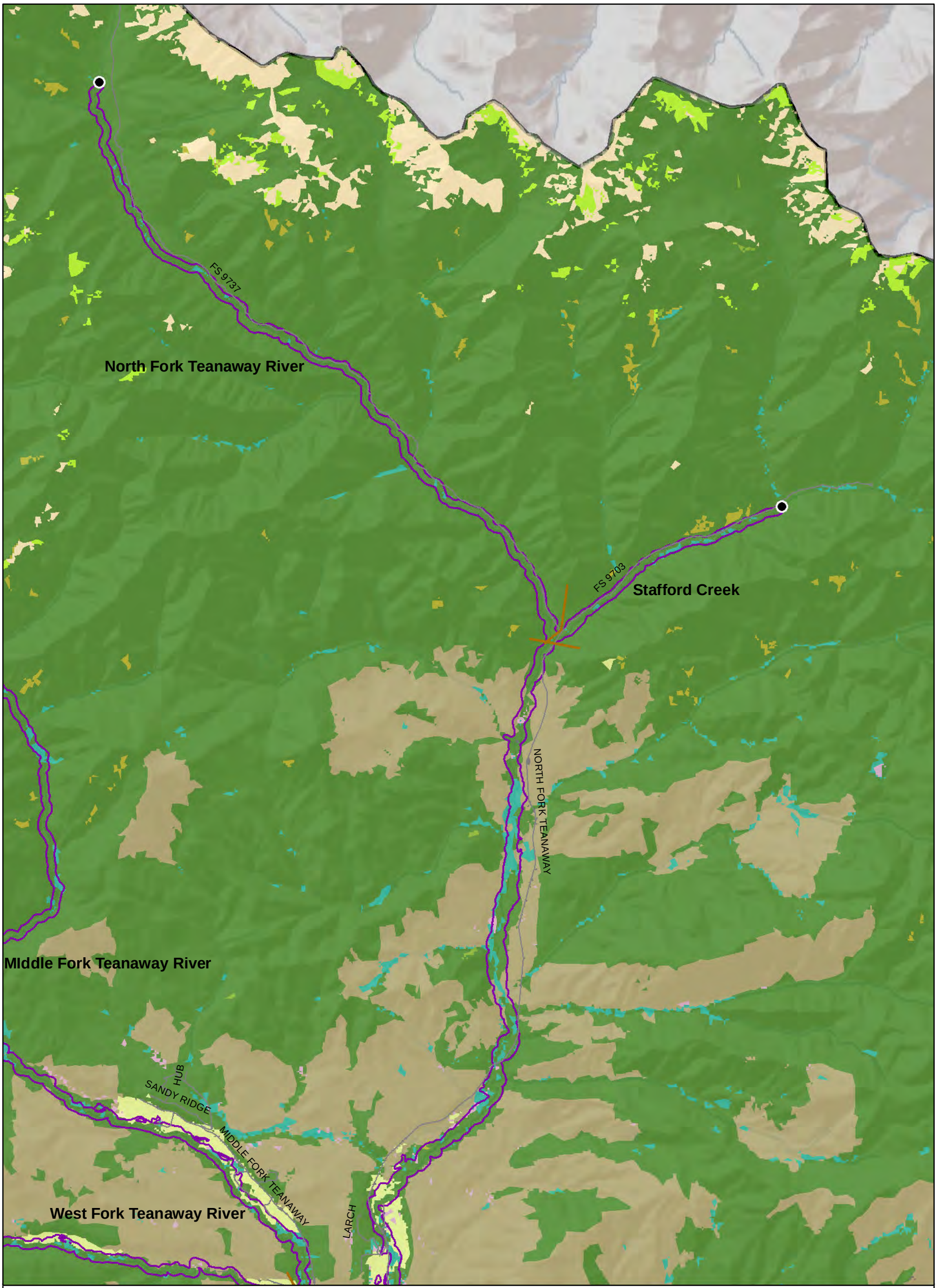
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 7 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 8

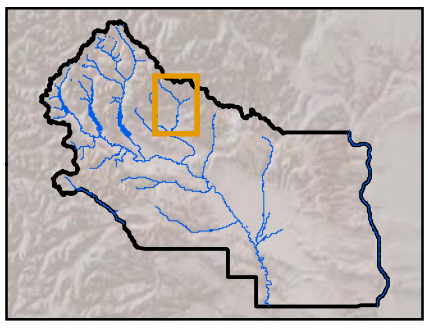
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 8 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 9

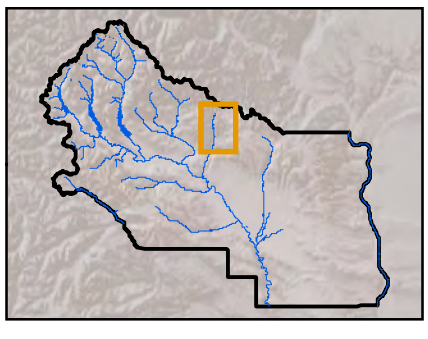
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

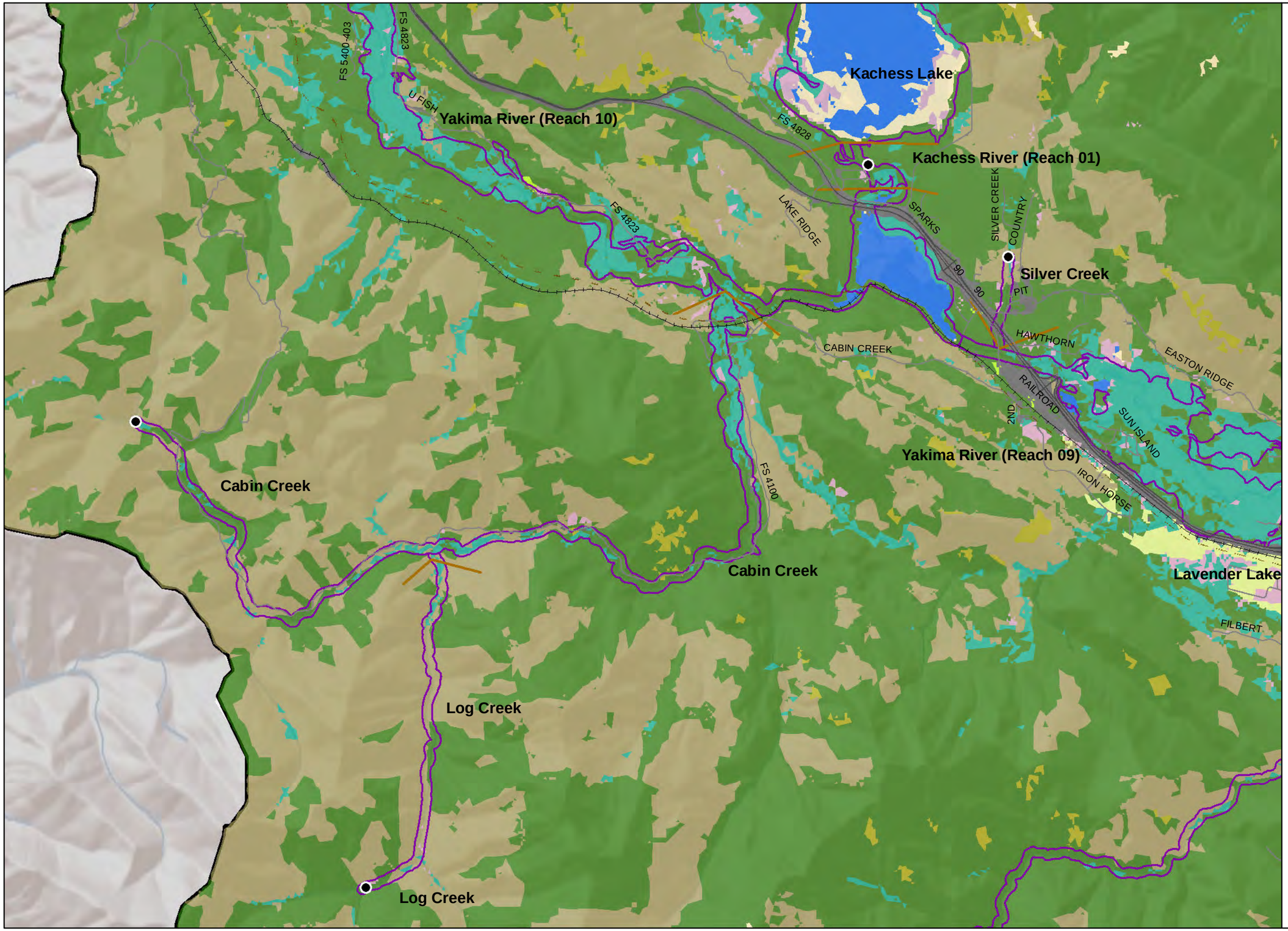
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 9 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 10

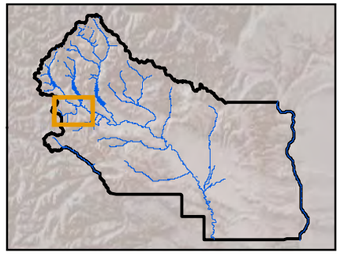
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

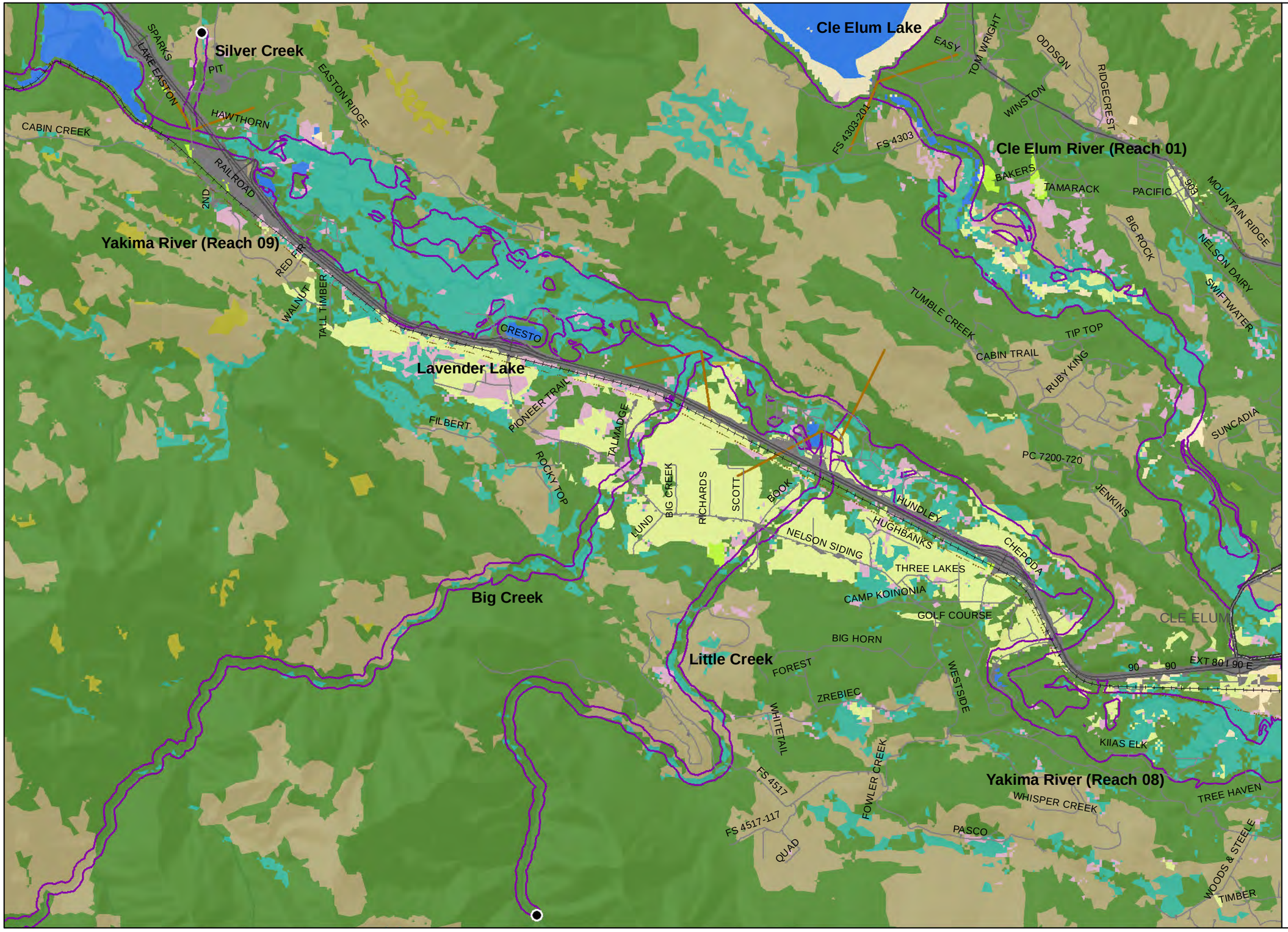
Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 10 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

Map 11

Kittitas County Inventory and Characterization

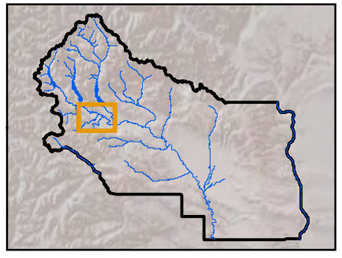
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)

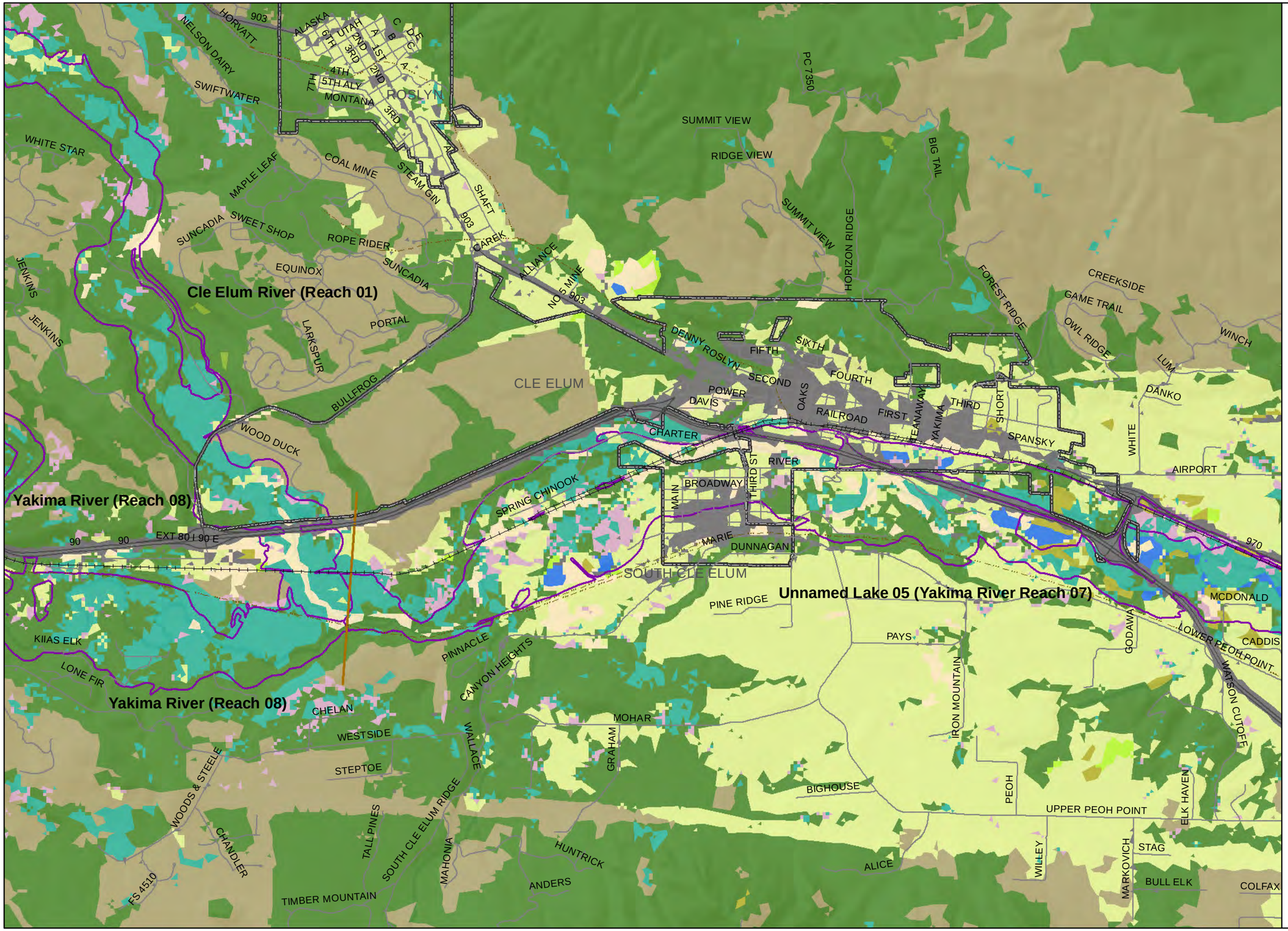
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 11 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

Map 12

Kittitas County Inventory and Characterization

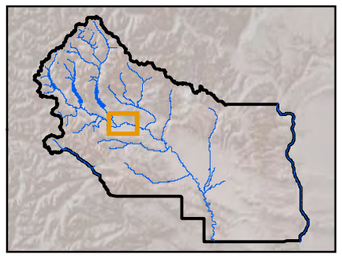
0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)

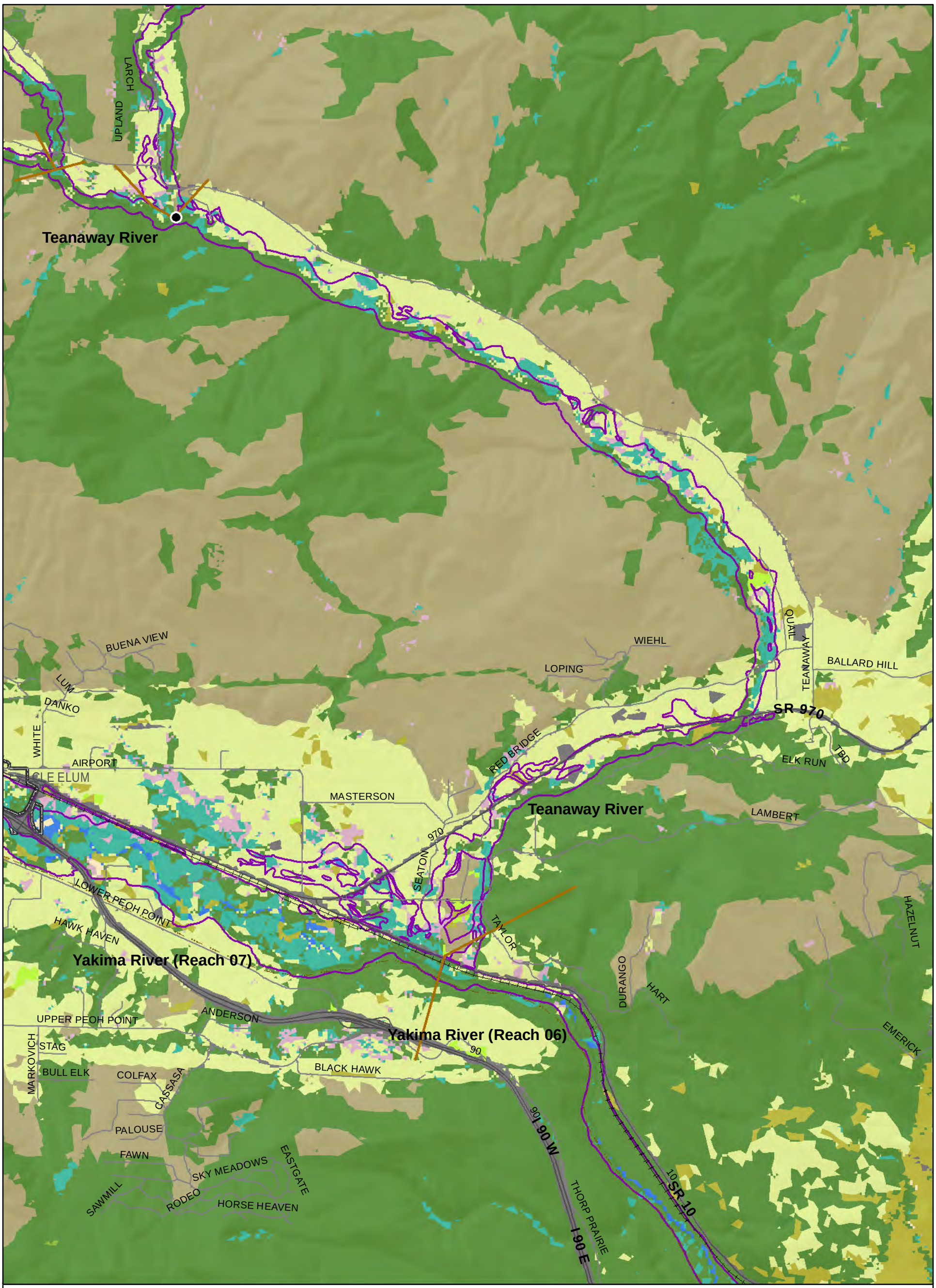
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 12 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

Map 13

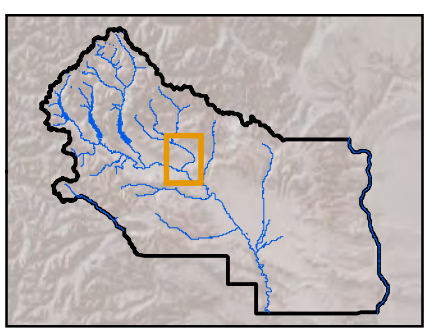
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

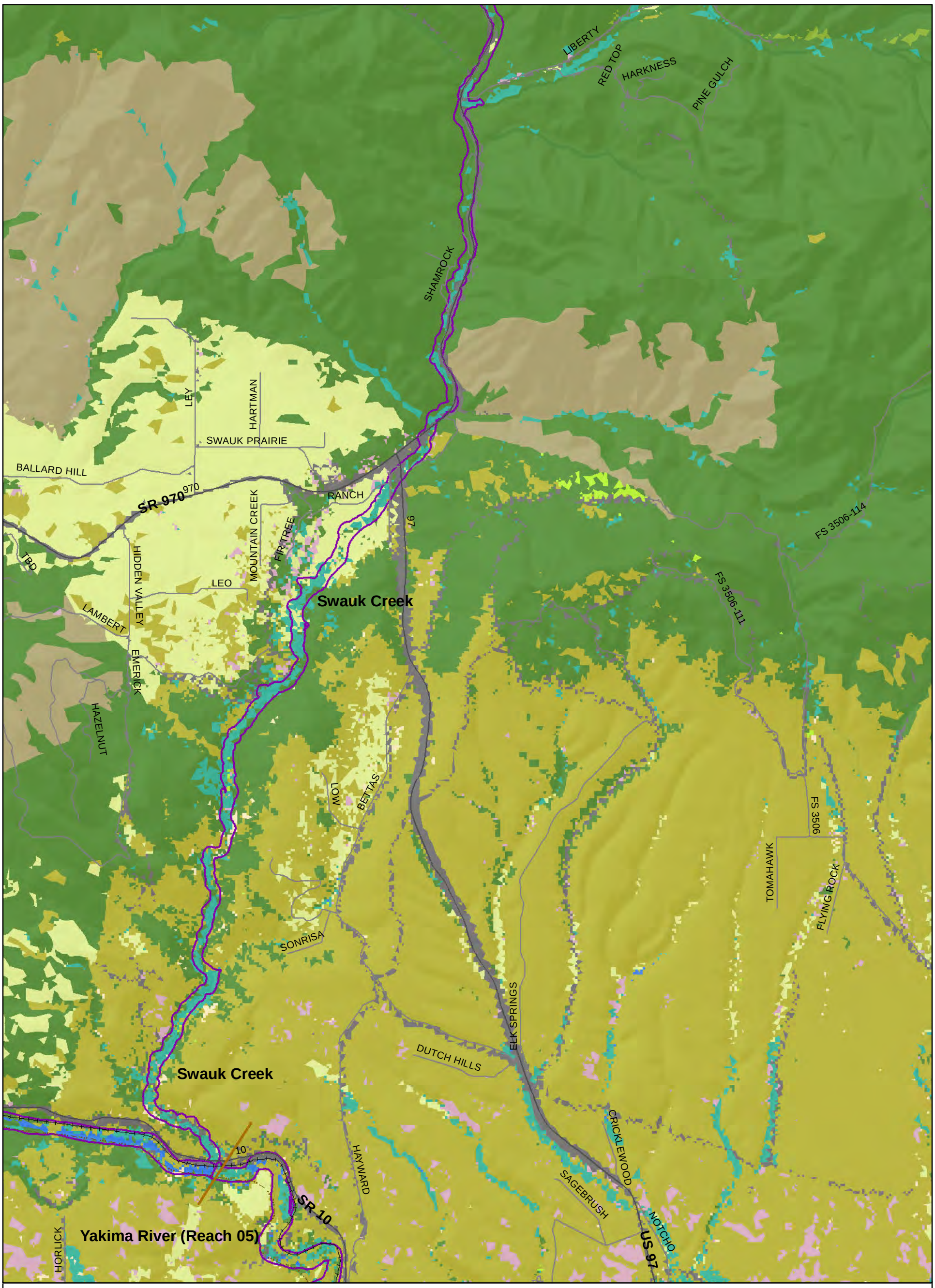
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 13 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 14

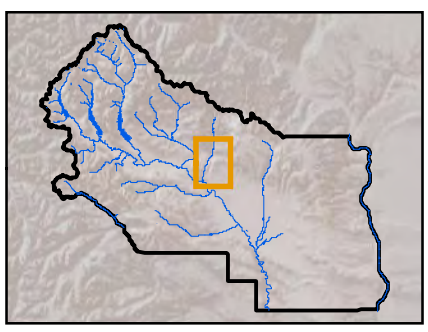
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

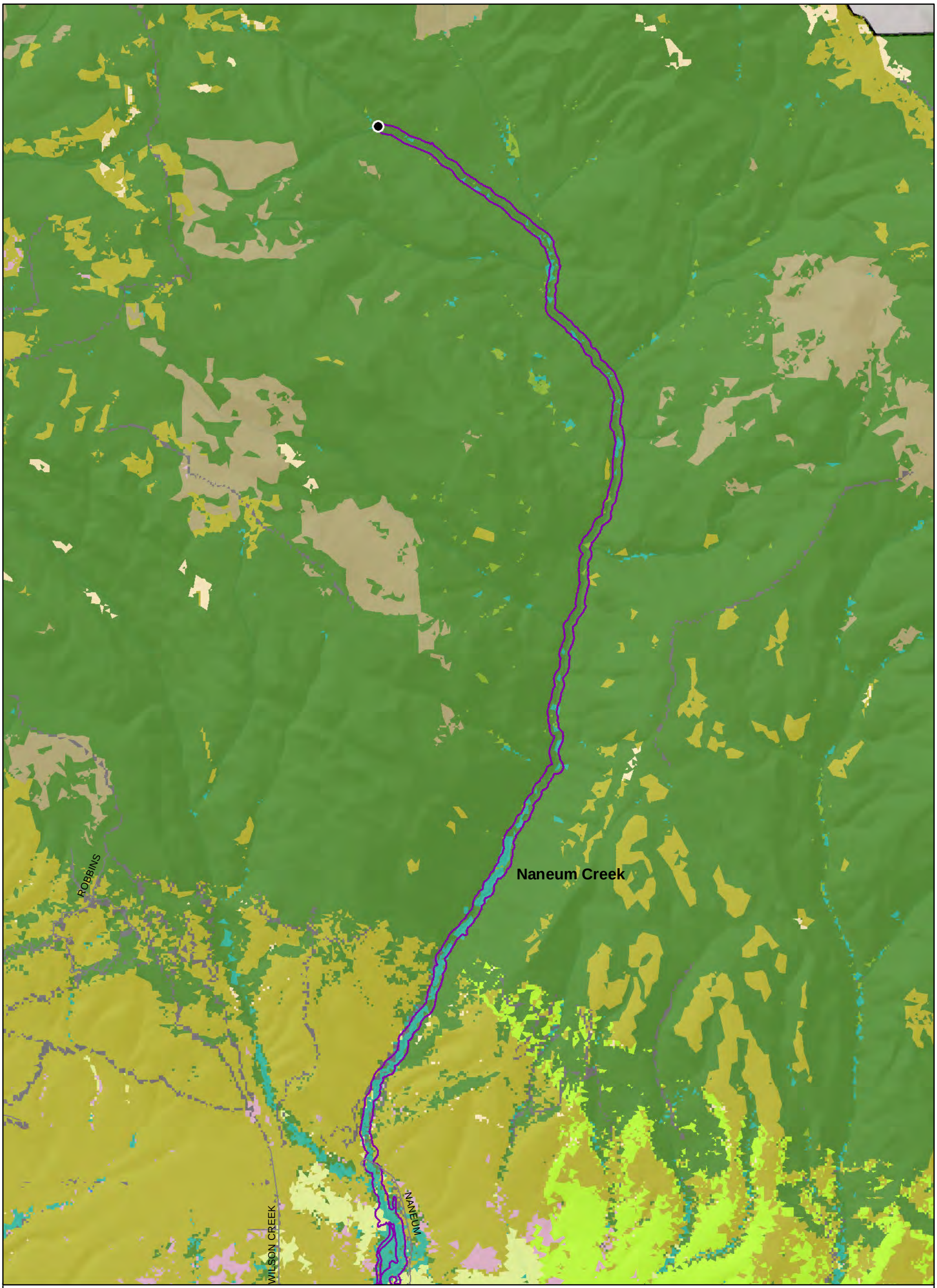
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 14 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 15

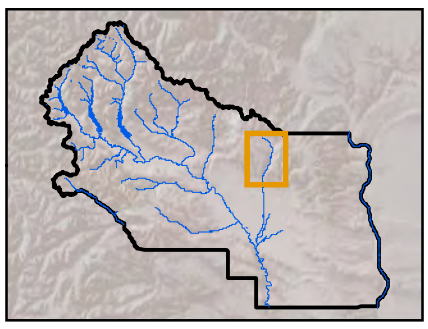
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

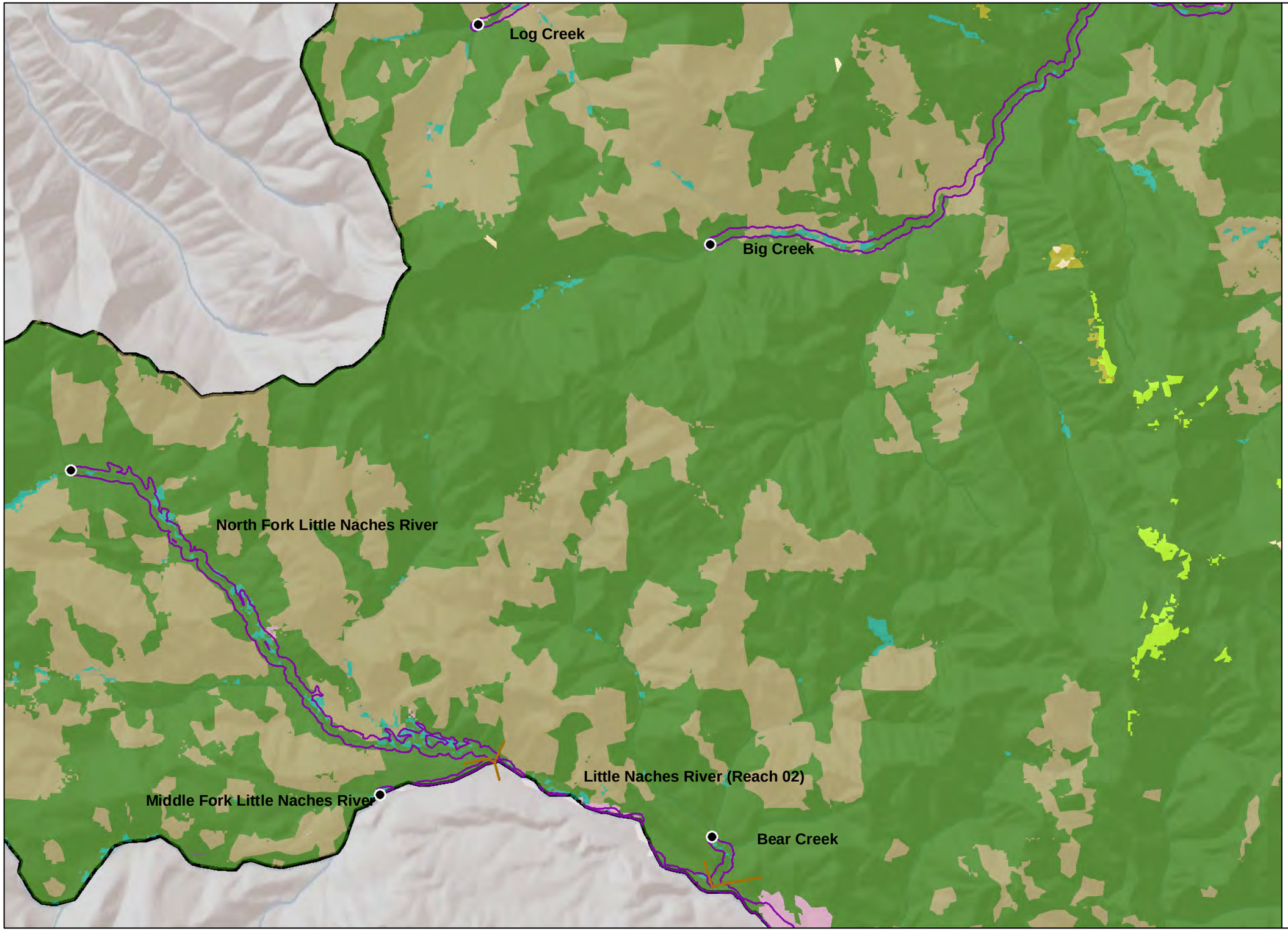
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 15 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 16

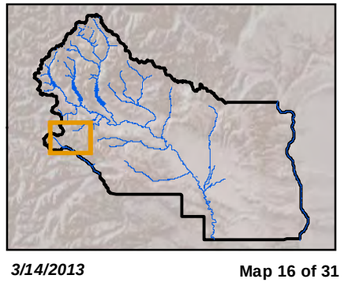
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

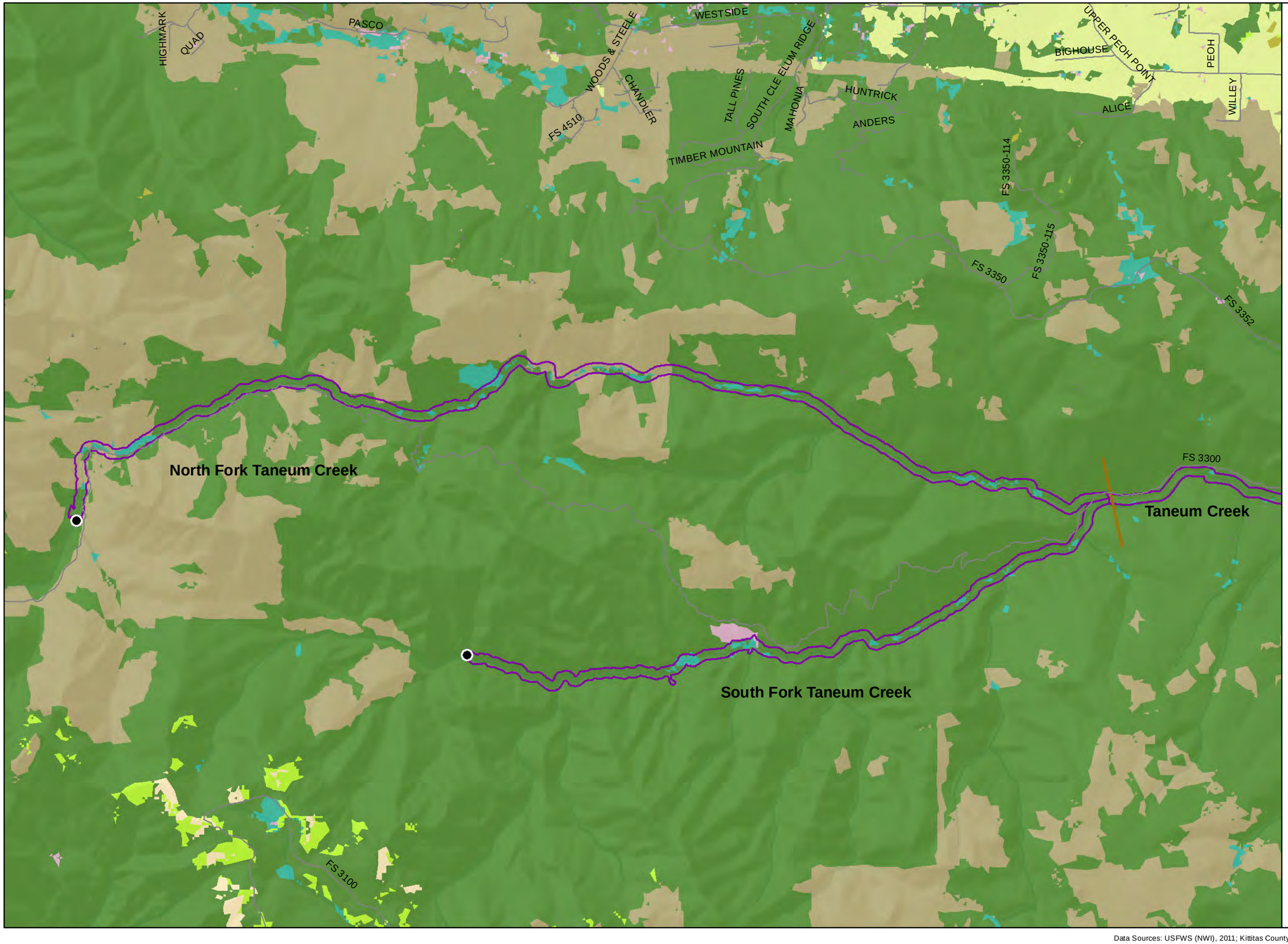
Map 16 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 17

Kittitas County Inventory and Characterization



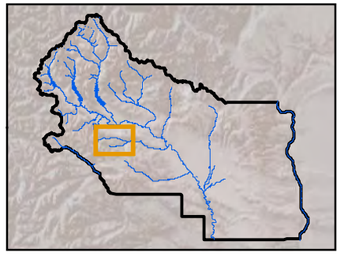
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)

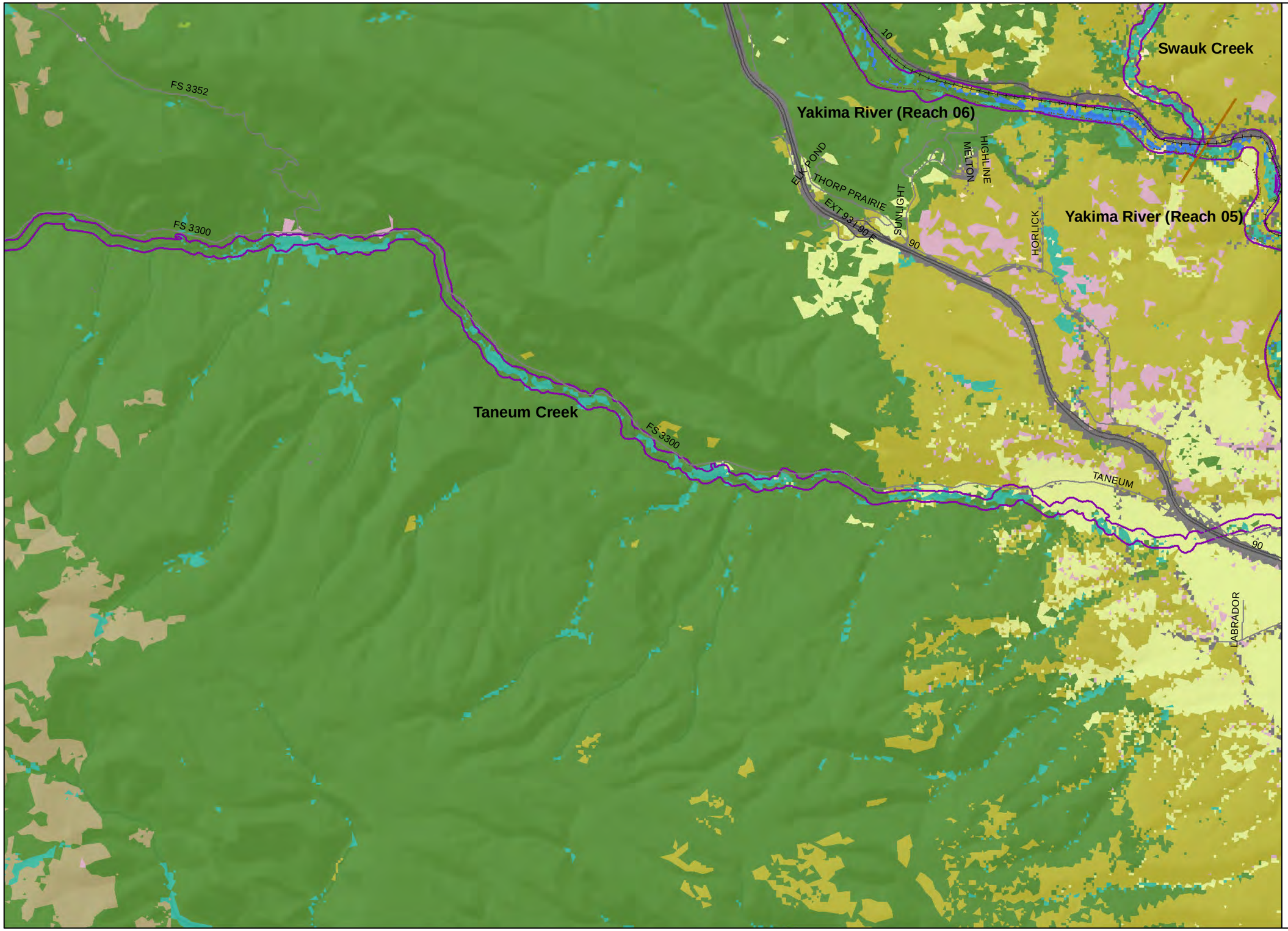
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 17 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

Map 18

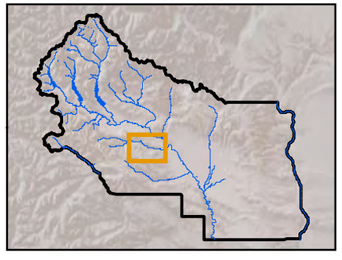
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

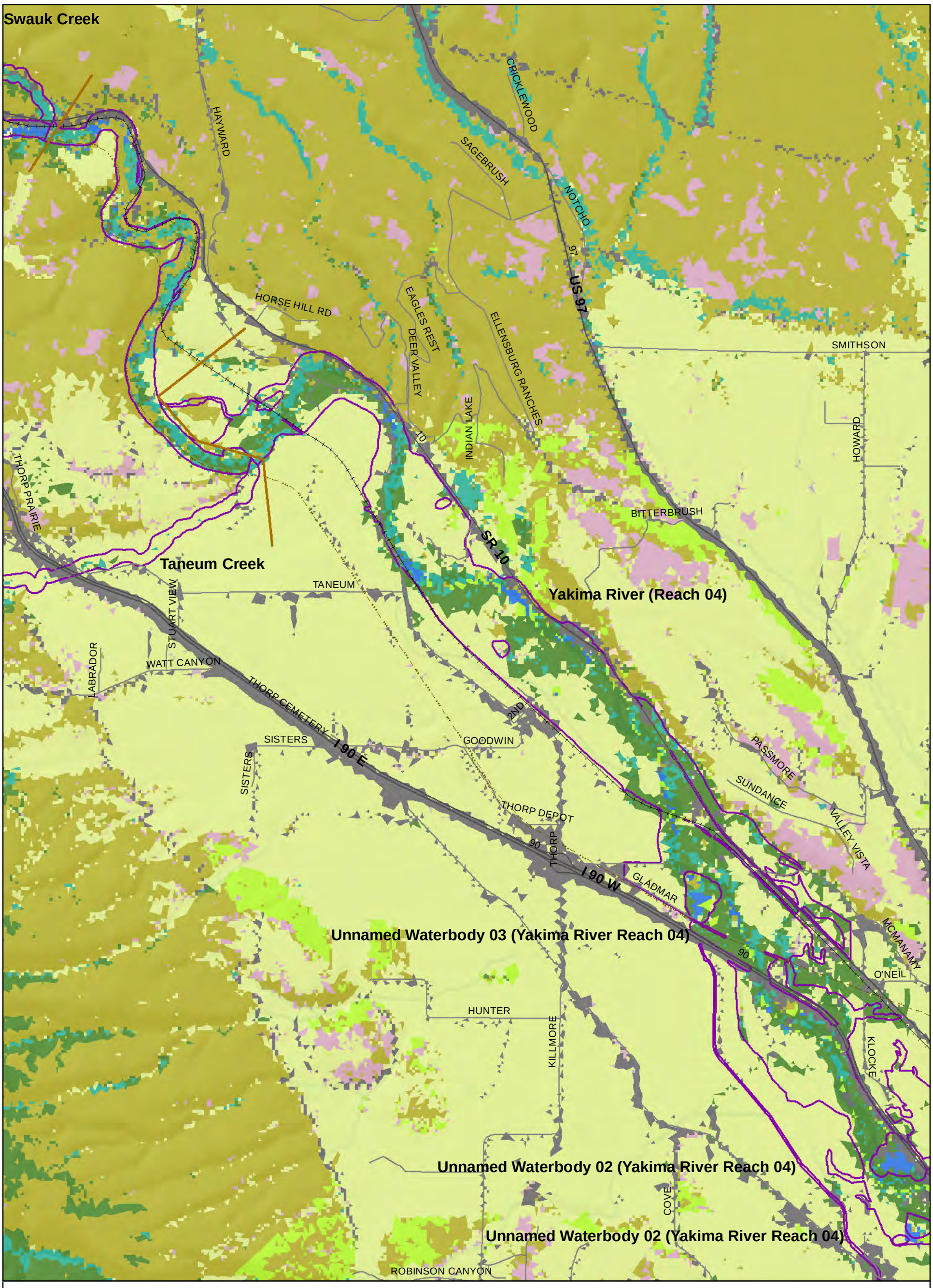
Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 18 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

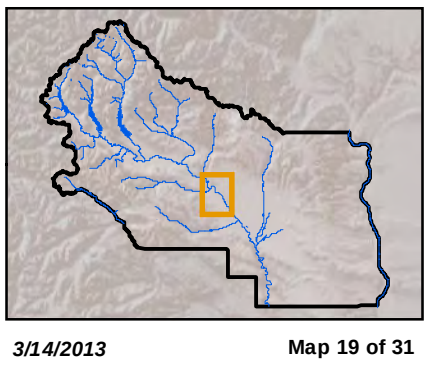
Map 19

Kittitas County Inventory and Characterization

0 0.5 1 Miles

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

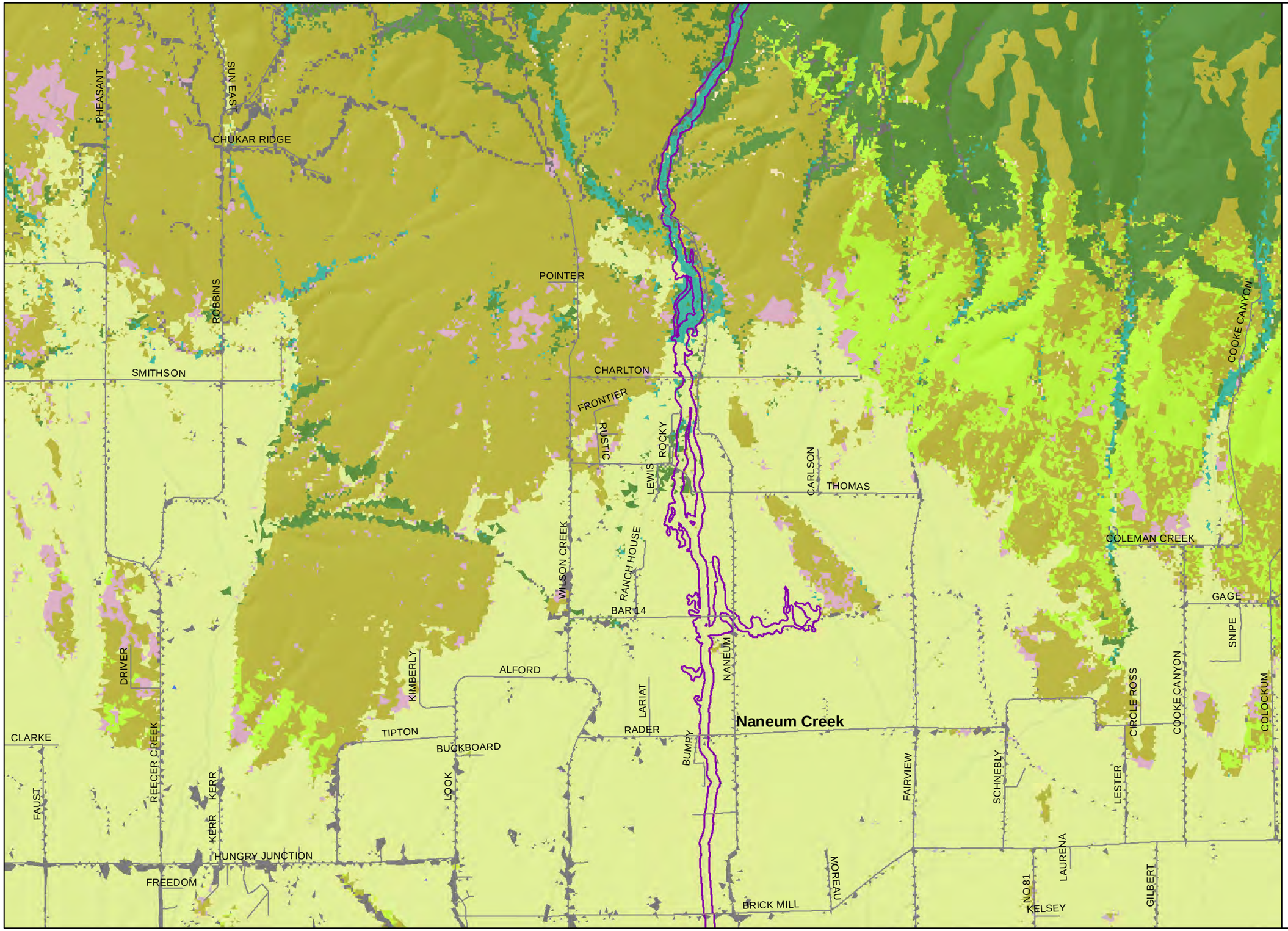
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 19 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 20

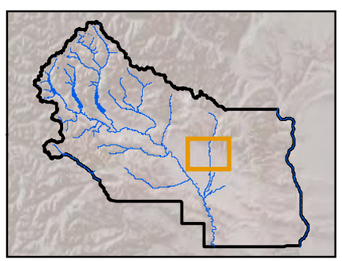
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



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Map 20 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Bear Creek

Little Naches RIver (Reach 02)

Quartz Creek

Map Folio #3: Land Cover

Map 21

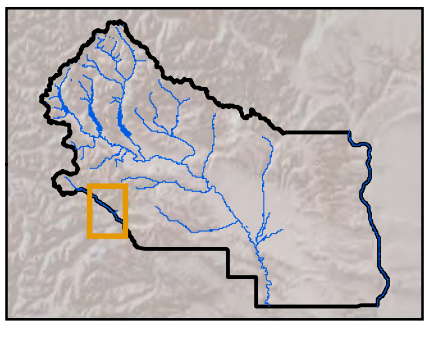
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 21 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 22

Kittitas County Inventory and Characterization

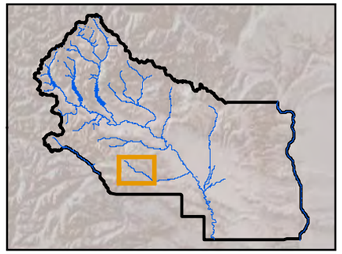
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)

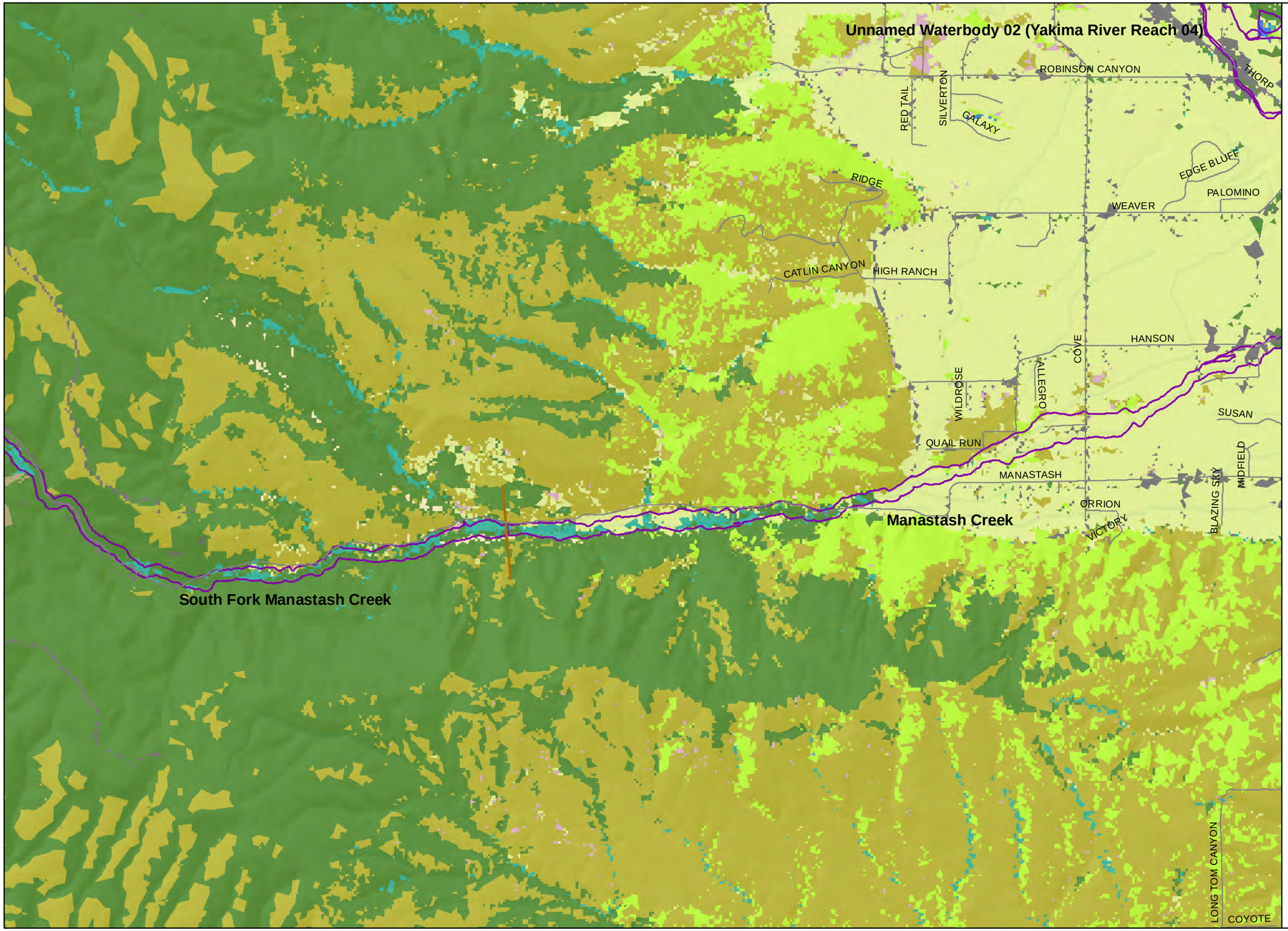
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 22 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #3: Land Cover

Map 23

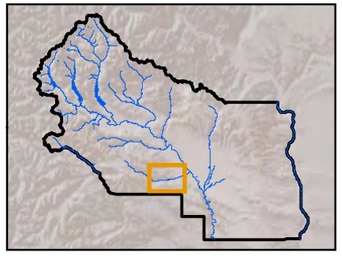
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

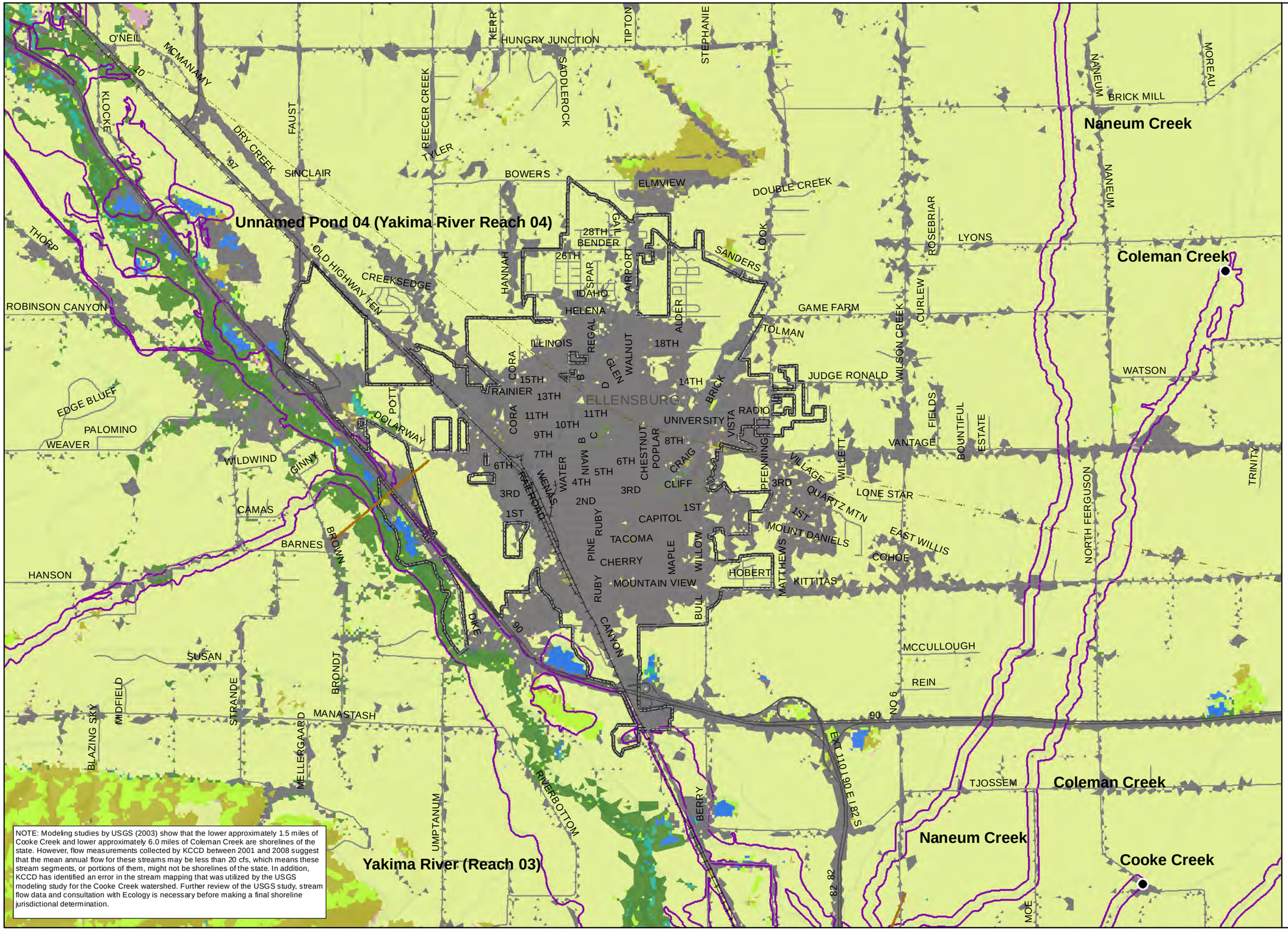
Map 23 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #3: Land Cover

Map 24

Kittitas County Inventory and Characterization



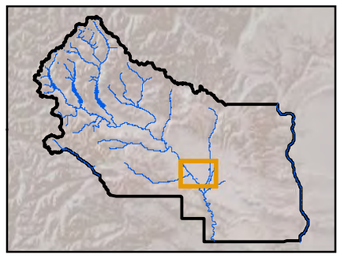
NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

0 0.5 1
Miles

N

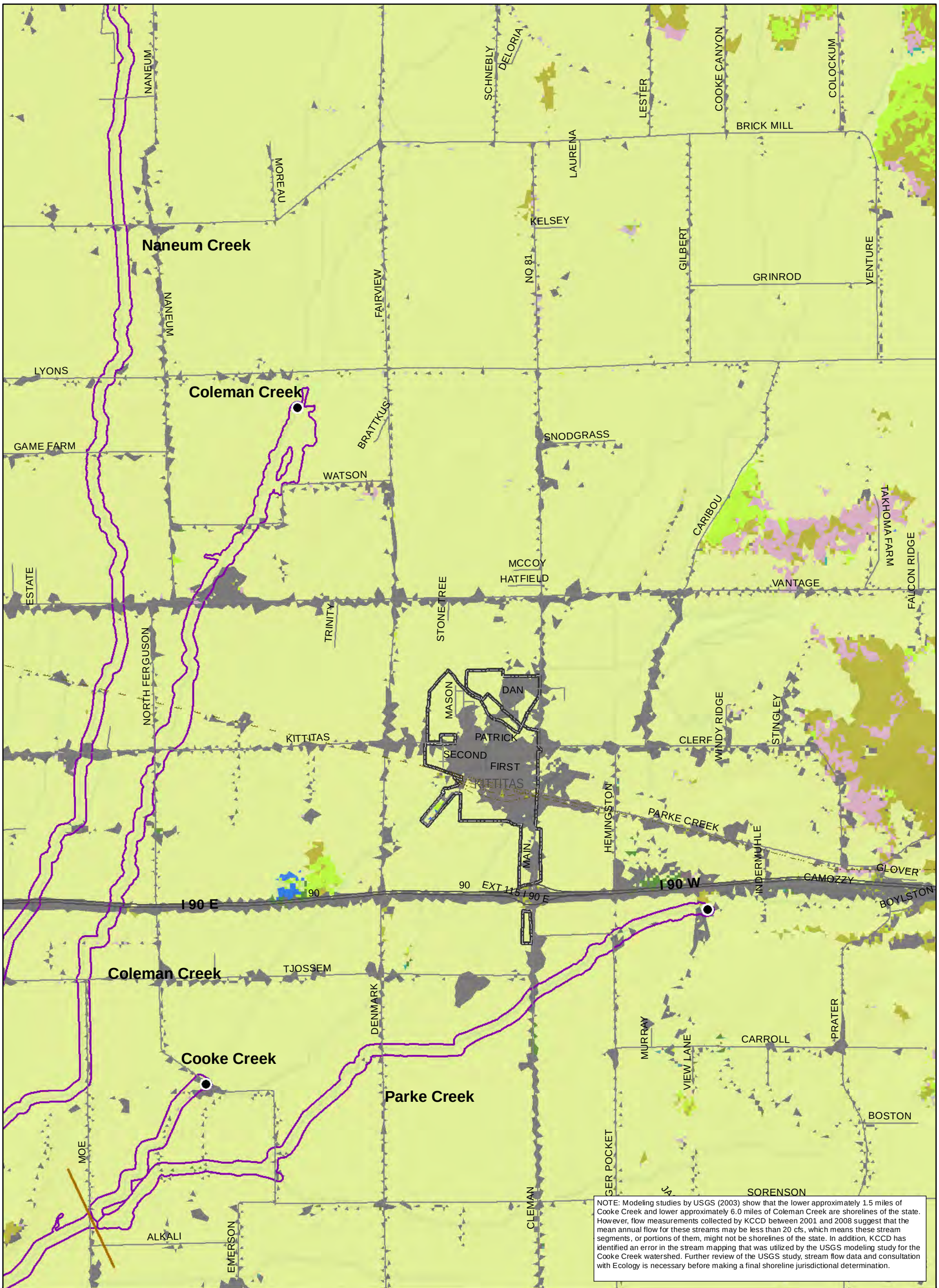
Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



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Map Folio #3: Land Cover

Map 25

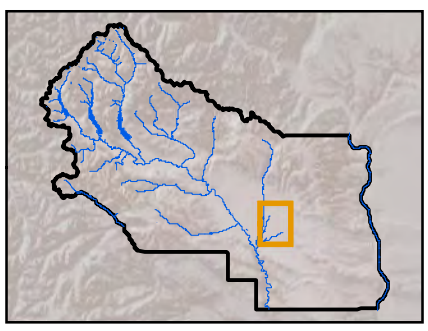
Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

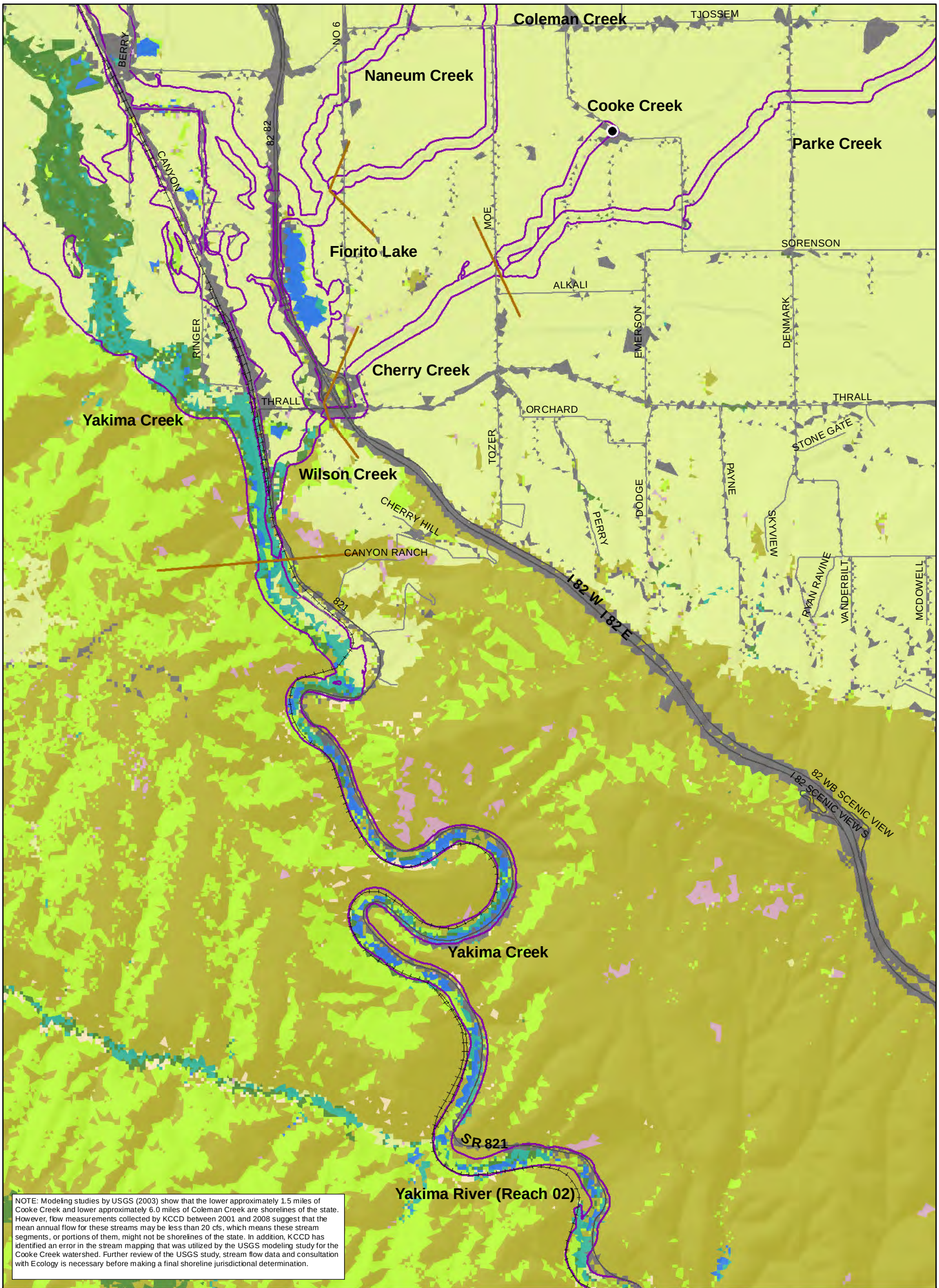
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 25 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #3: Land Cover

Map 26

Kittitas County Inventory and Characterization

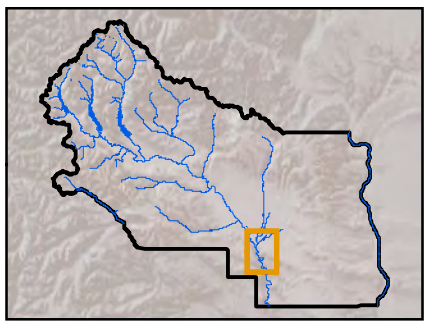
0 0.5 1 Miles

N

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- Trails
- Railroads
- Roads
- Cities

Land Cover (GAP 2009)

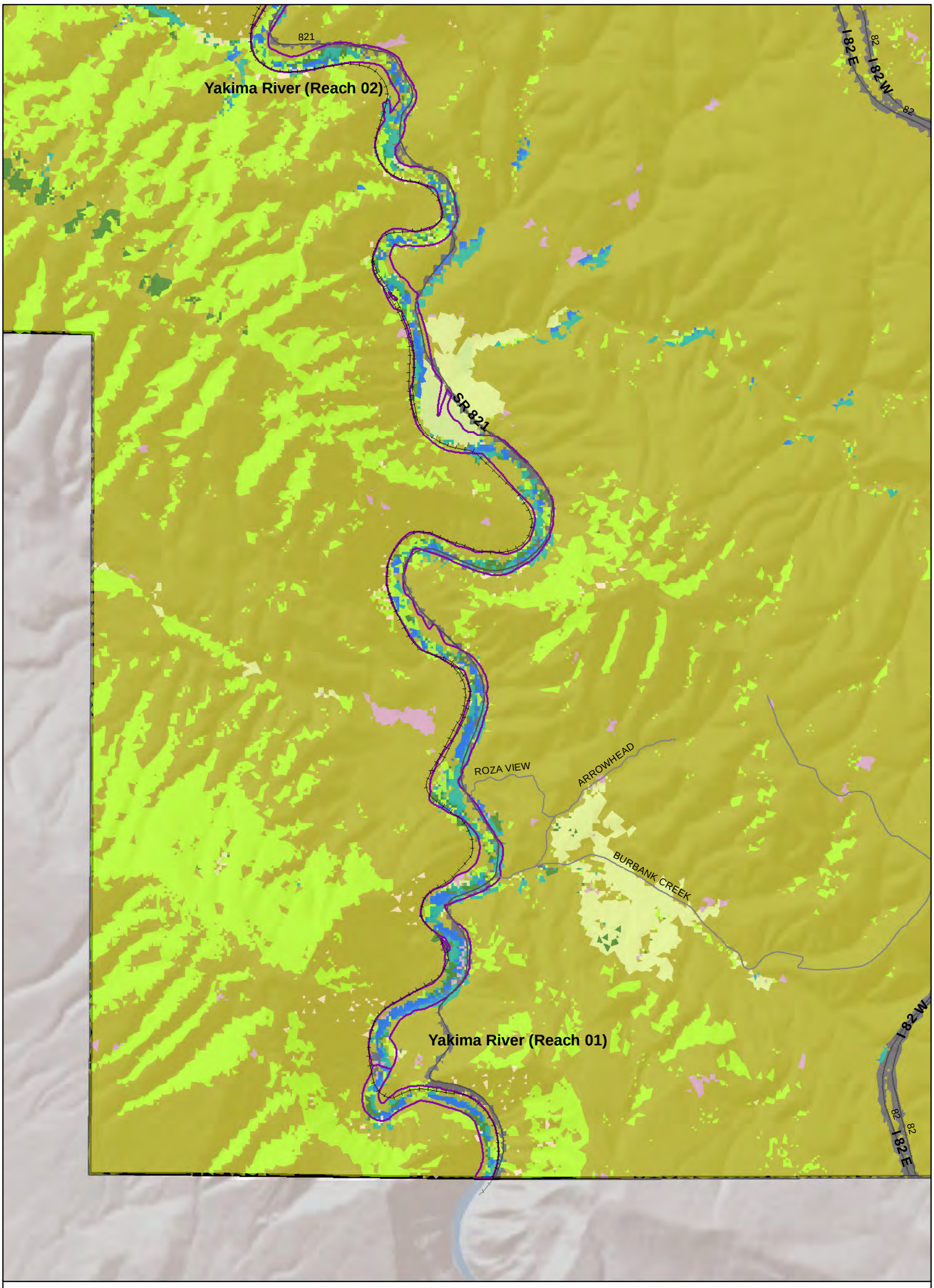
- Agriculture
- Grassland
- Unvegetated
- Conifer-dominated forest
- Deciduous-dominated forest
- Shrubland
- Developed
- Riparian Vegetation
- Harvested forest
- Open water
- Other



3/14/2013

Map 26 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

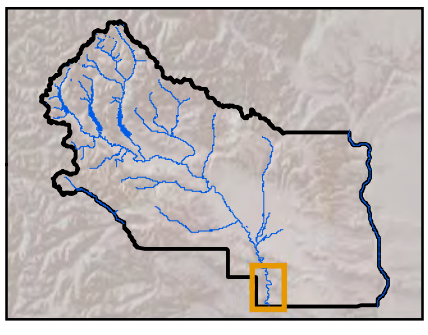
Map 27

Kittitas County Inventory and Characterization

0 0.5 1 Miles N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 27 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 28

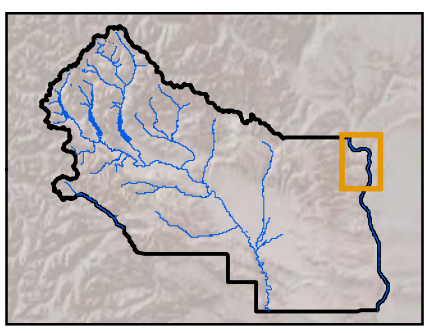
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 28 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 29

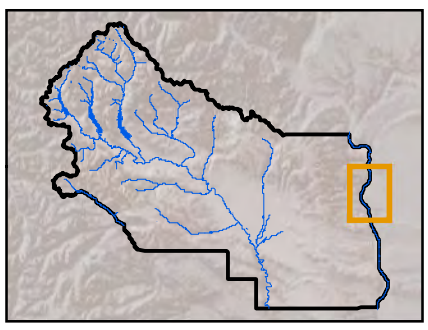
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 29 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #3: Land Cover

Map 30

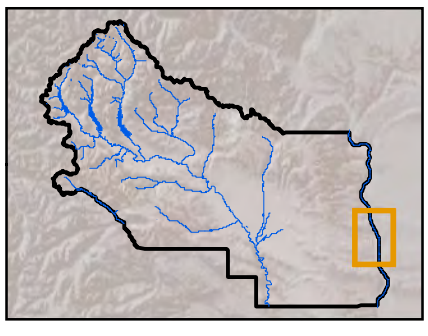
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

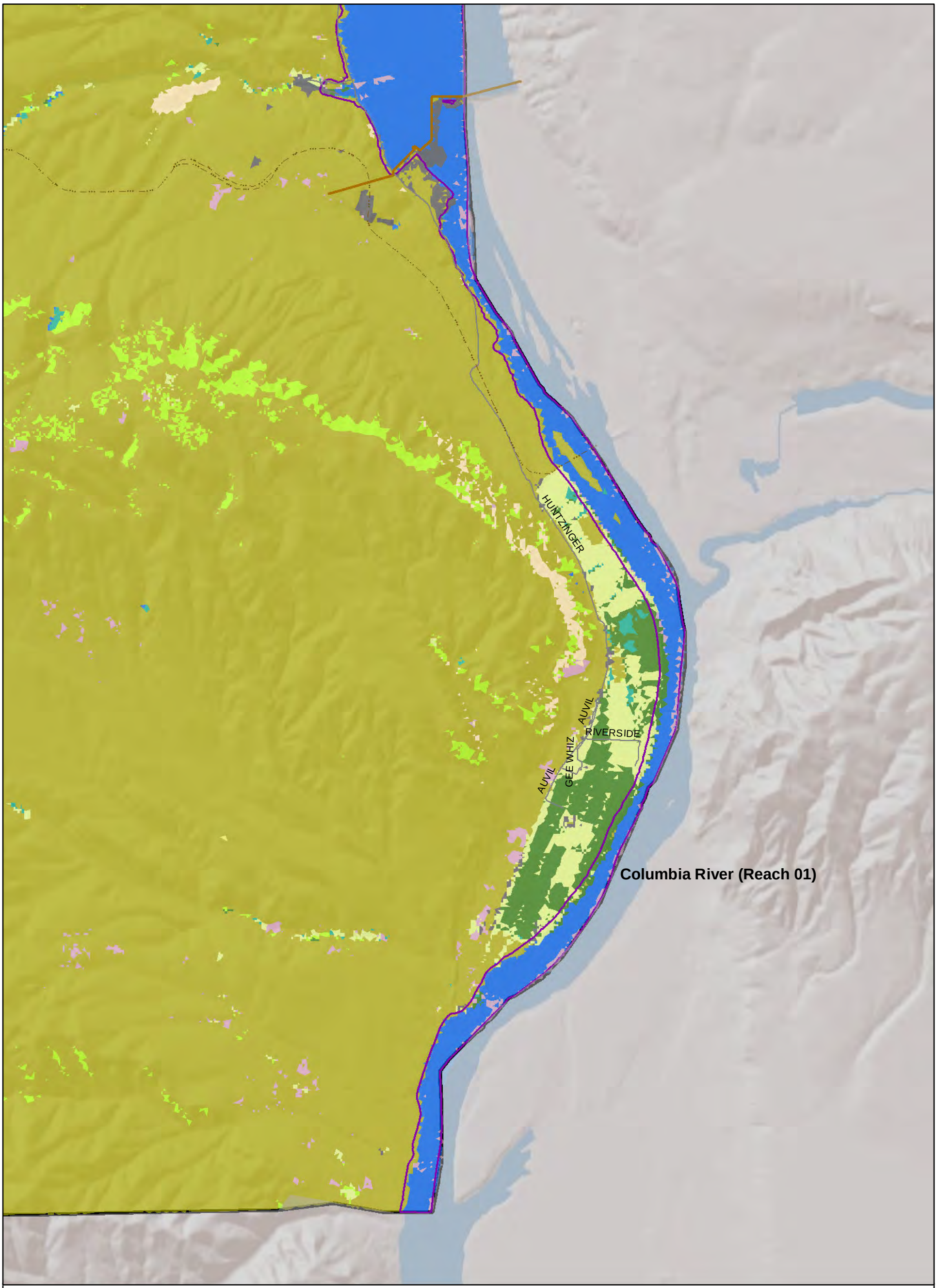
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 30 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #3: Land Cover

Map 31

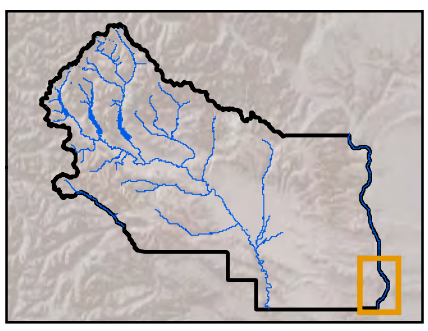
Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Trails
Railroads
Roads
Cities

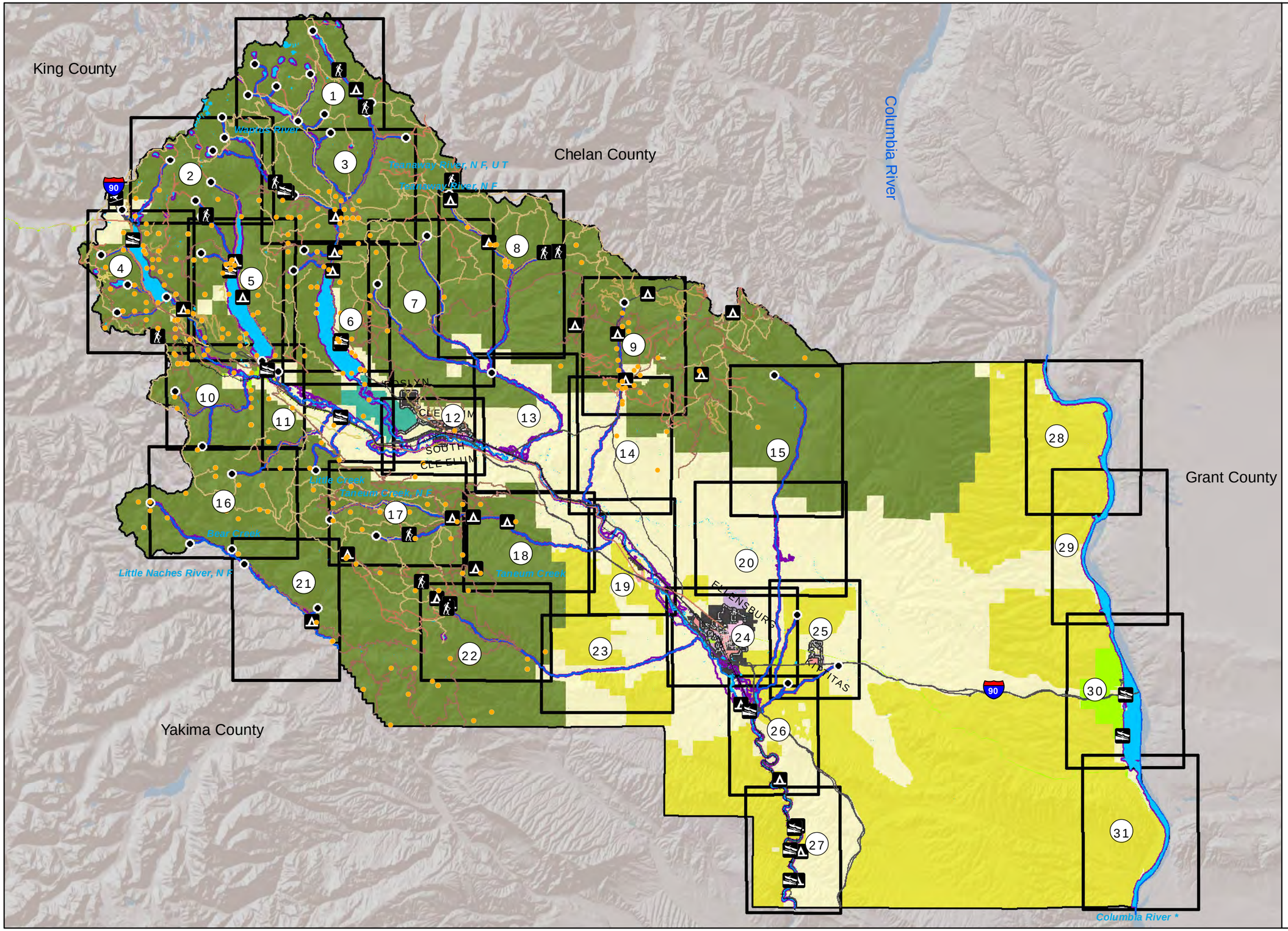
Land Cover (GAP 2009)
Agriculture
Grassland
Unvegetated
Conifer-dominated forest
Deciduous-dominated forest
Shrubland
Developed
Riparian Vegetation
Harvested forest
Open water
Other



3/14/2013

Map 31 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map Index

Kittitas County Regional SMP Update Inventory and Characterization

0 5 10 Miles

N

Map Index (Map # of 31)

Inventory Waterbodies

Inventory Streams

Upstream Limits (20 cfs)

Shoreline Inventory Area

Railroads

Roads

Cities

County Boundary

Forest Service Special Uses

Boat Launches

Campground/site

Ski Area

Trailhead

Landuse

- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

Trails

- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile

City and Town Shoreline Inventory Areas:

12 Map 12: City of Cle Ellum and Town of South Cle Ellum

24 Map 24: City of Ellensburg

ESA

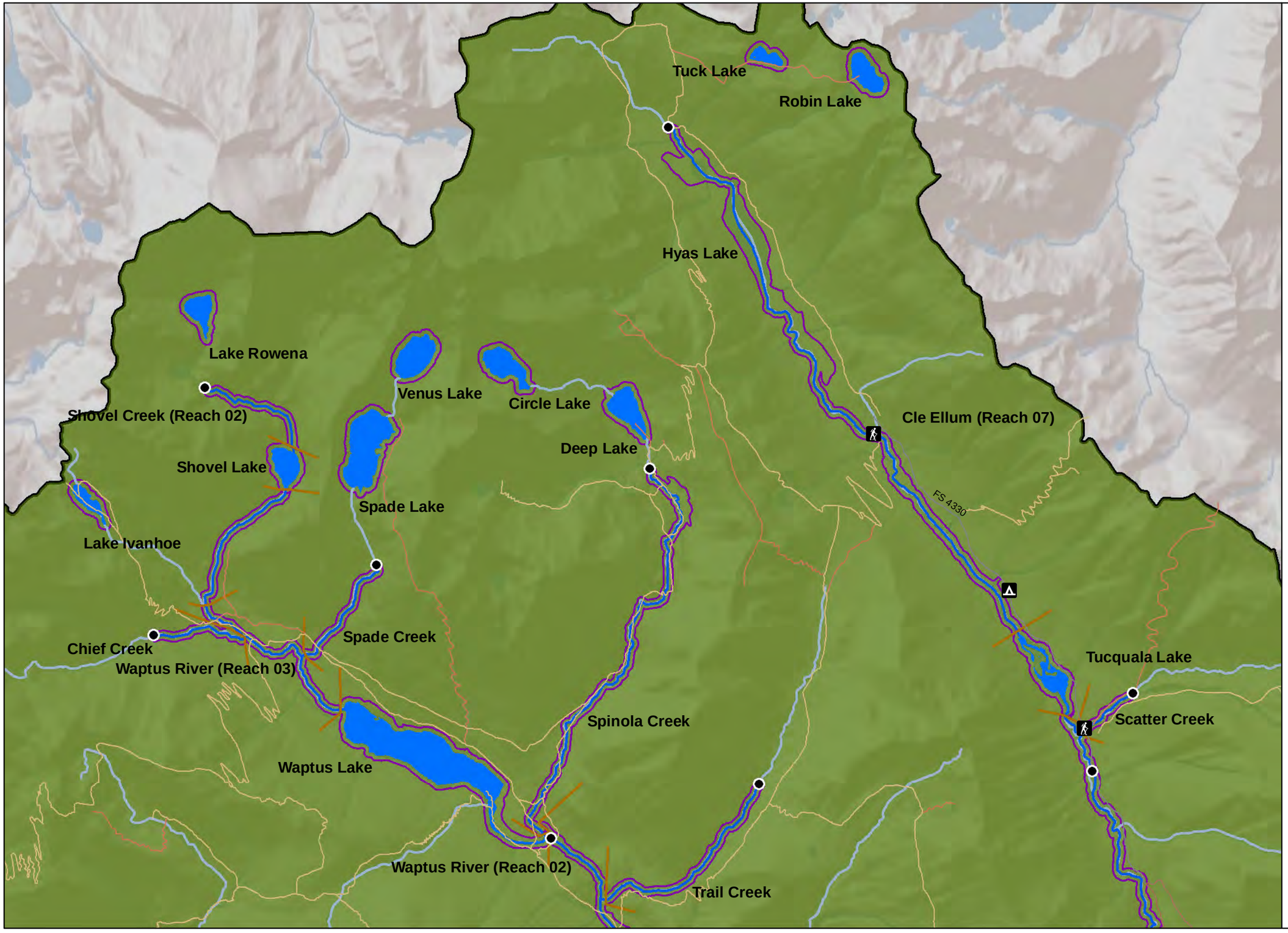
3/14/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 1

Kittitas County Inventory and Characterization



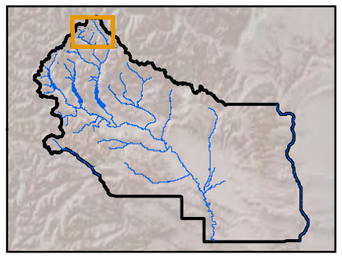
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 1 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 2

Kittitas County Inventory and Characterization

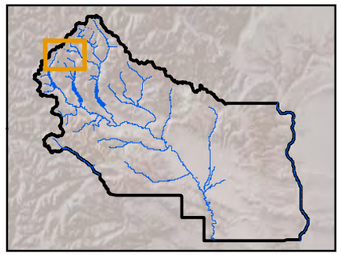
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 2 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 3

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
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Cities
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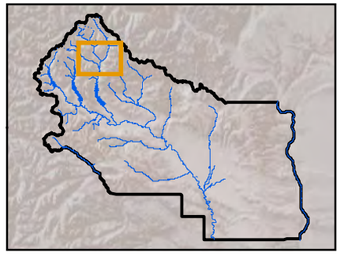
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access Map 4

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
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Cities
Forest Service Special Uses

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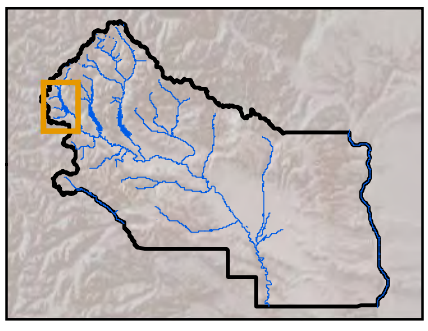
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 4 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #4: Land Use and Public Access

Map 5

Kittitas County Inventory and Characterization

0 0.5 1
Miles

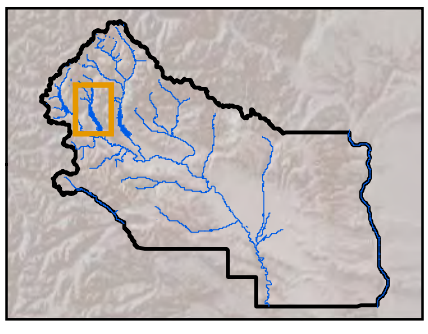
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 5 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #4: Land Use and Public Access

Map 6

Kittitas County Inventory and Characterization

0 0.5 1
Miles

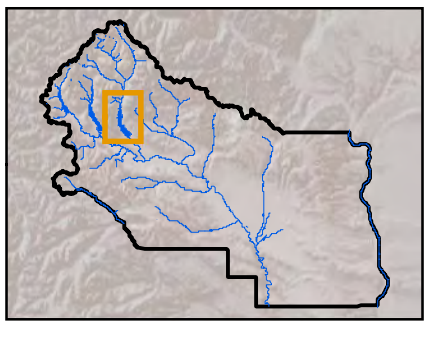
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

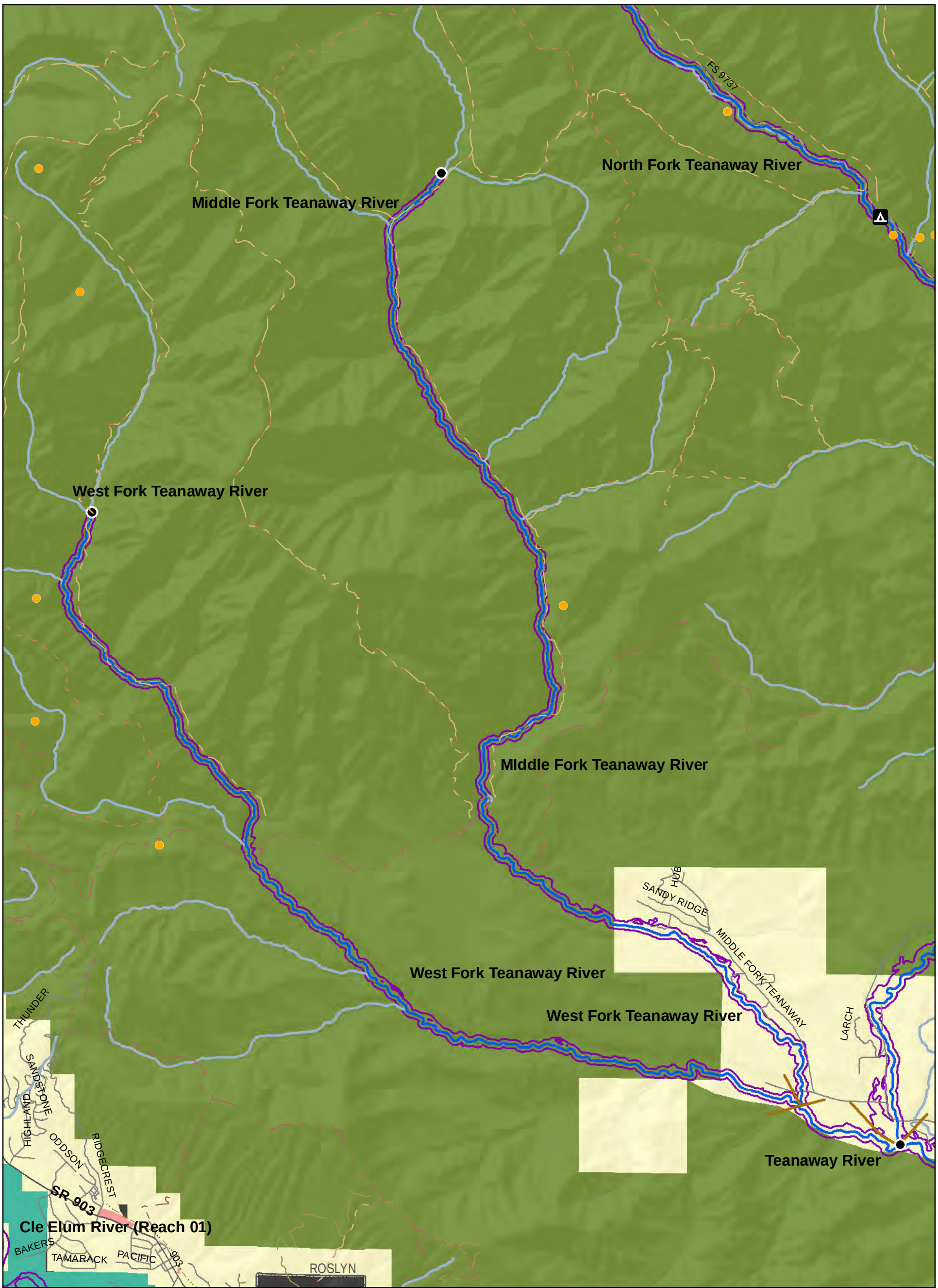
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 6 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 7

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
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Roads
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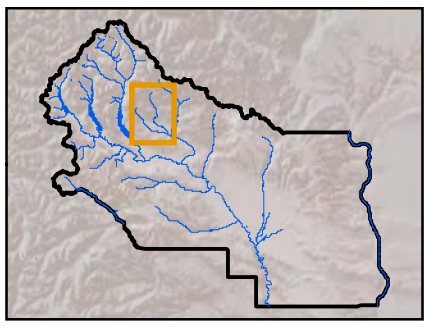
Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

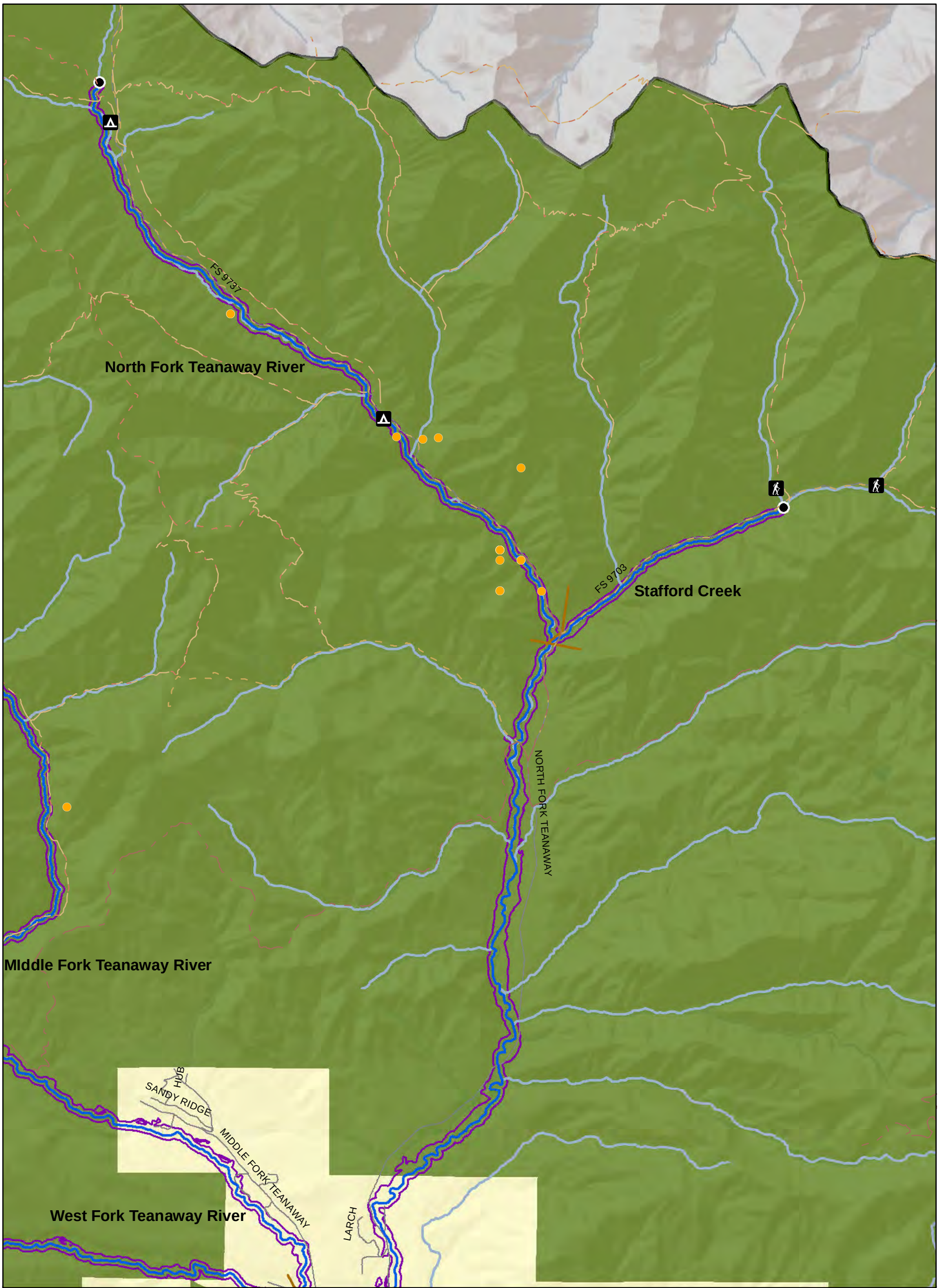
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 7 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 8

Kittitas County Inventory and Characterization

0 0.5 1
Miles

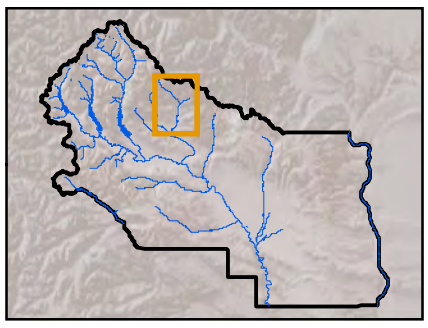
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

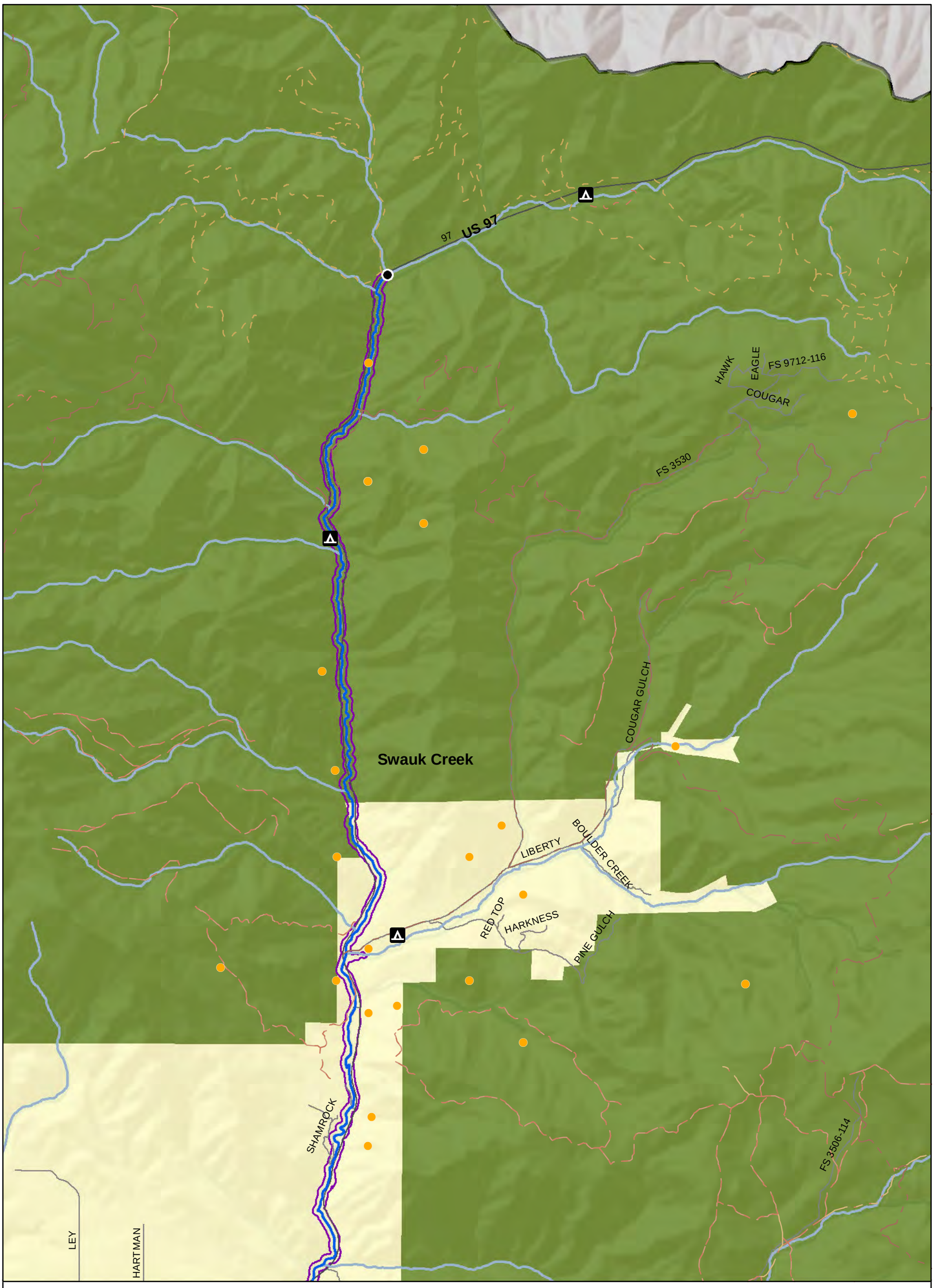
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 8 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 9

Kittitas County Inventory and Characterization

0 0.5 1
Miles

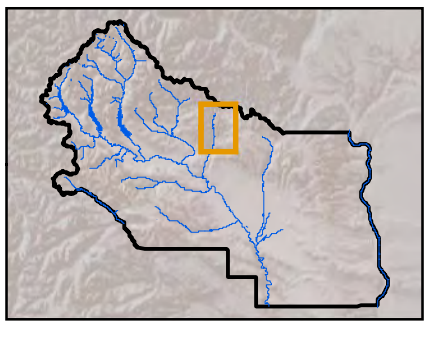
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

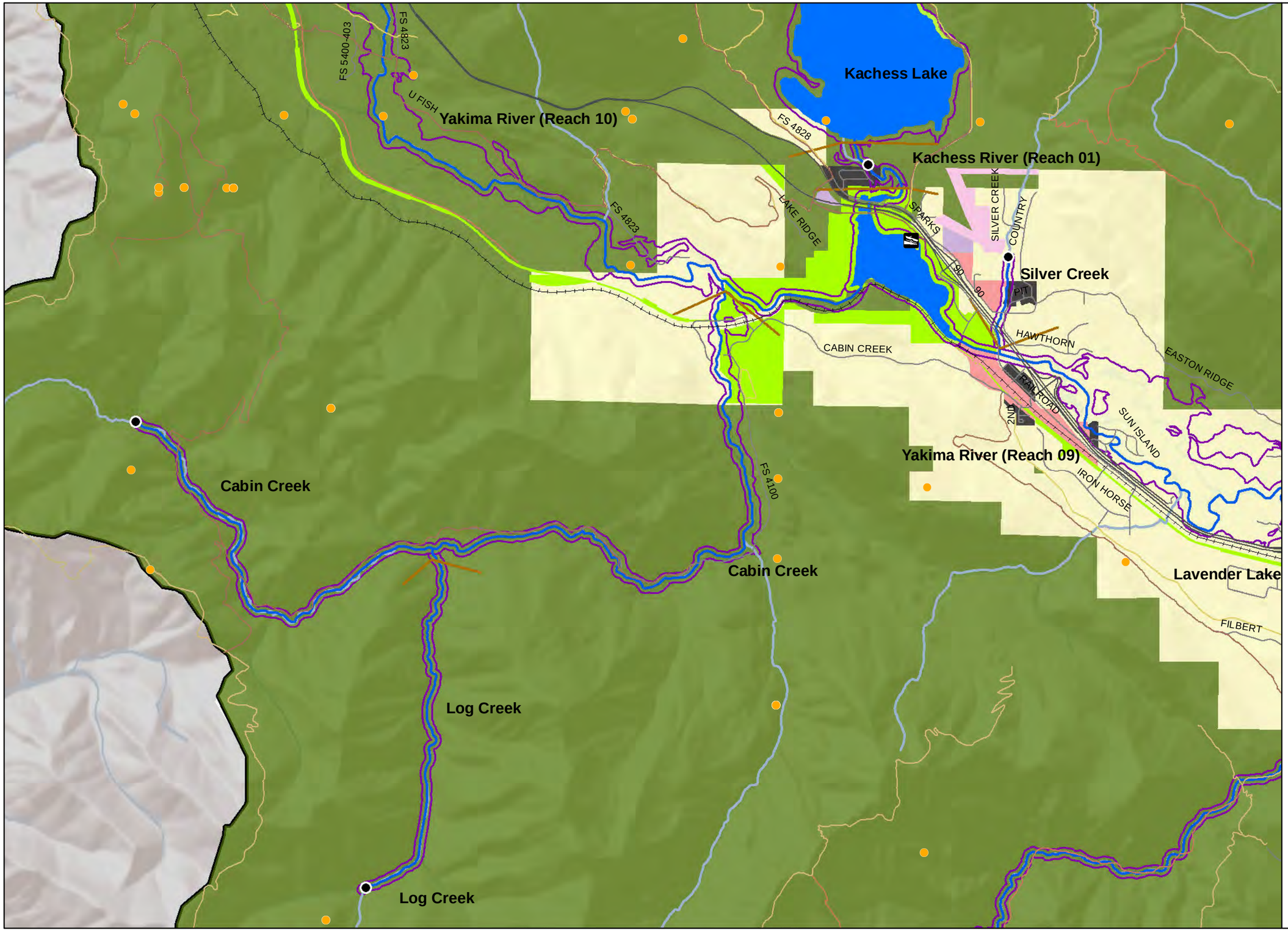
Map 9 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #4: Land Use and Public Access

Map 10

Kittitas County Inventory and Characterization



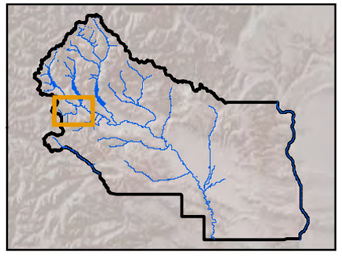
0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



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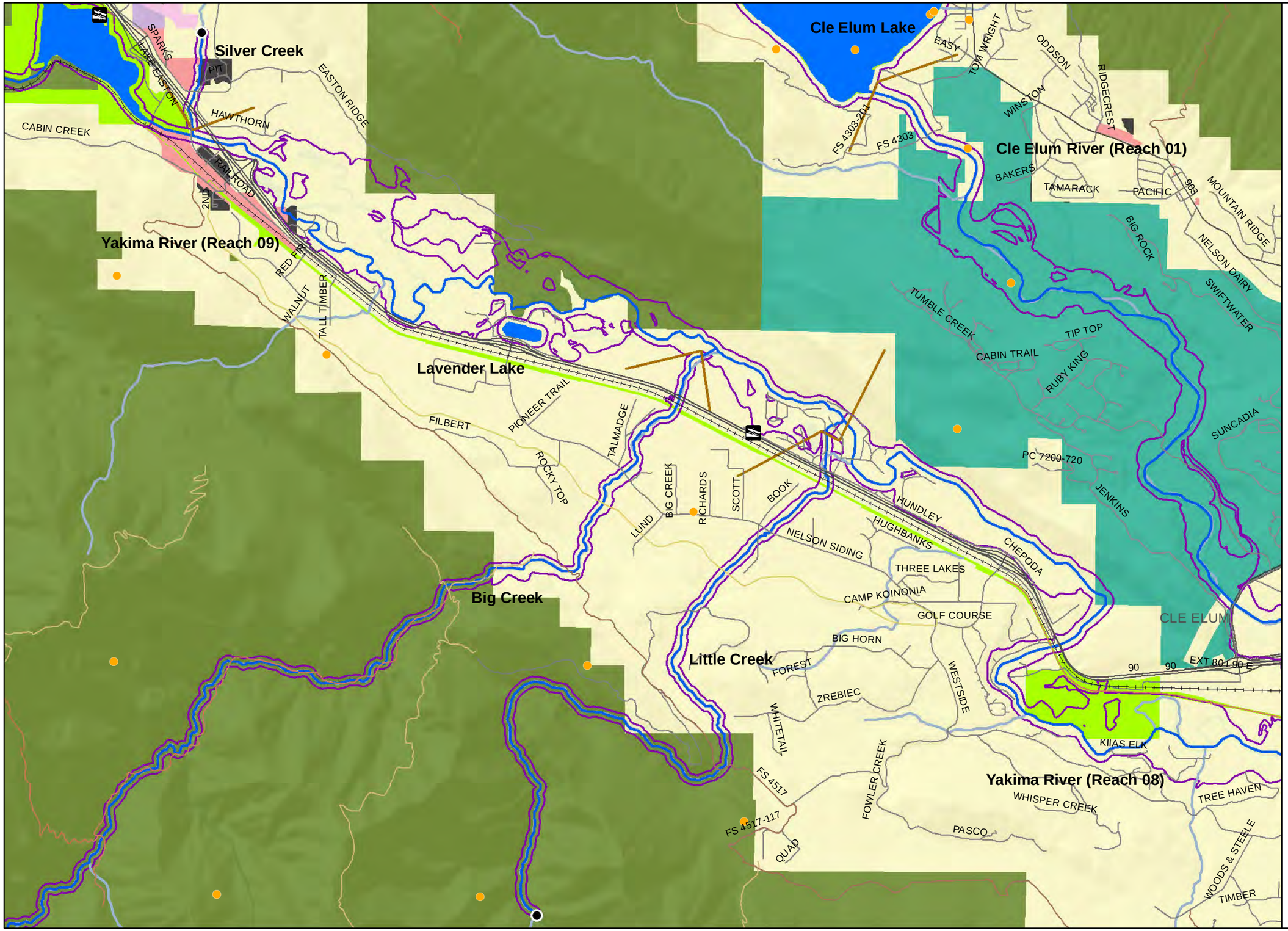
Map 10 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 11

Kittitas County Inventory and Characterization



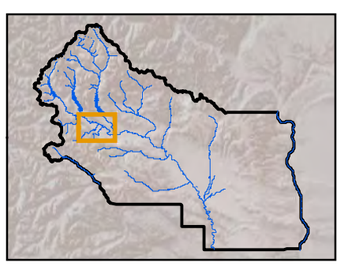
0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

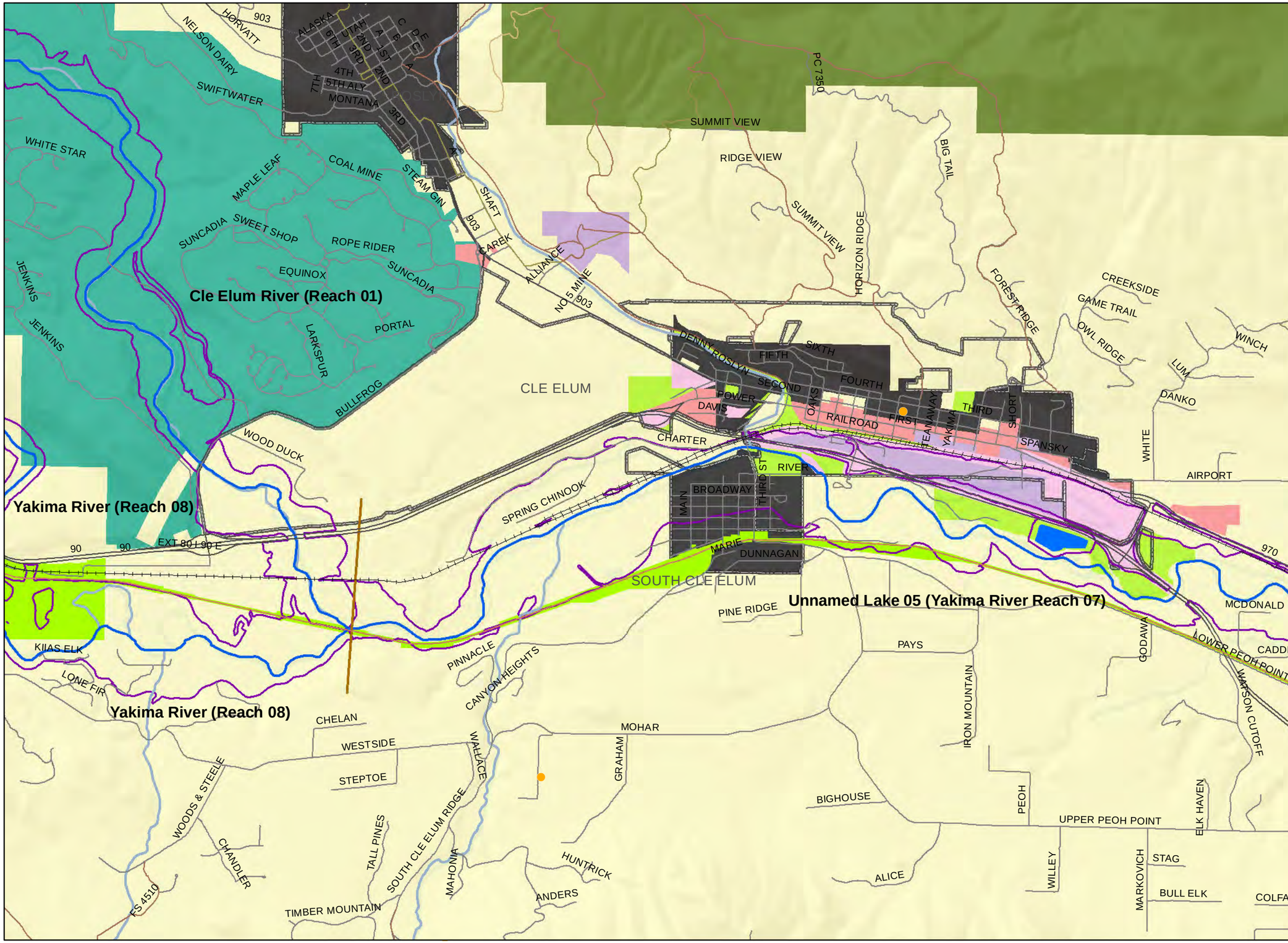
Map 11 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 12

Kittitas County Inventory and Characterization



0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
- Urban
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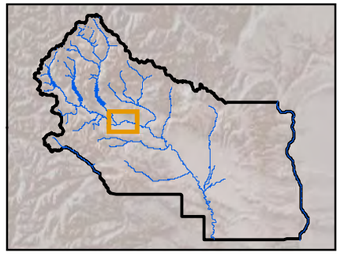
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

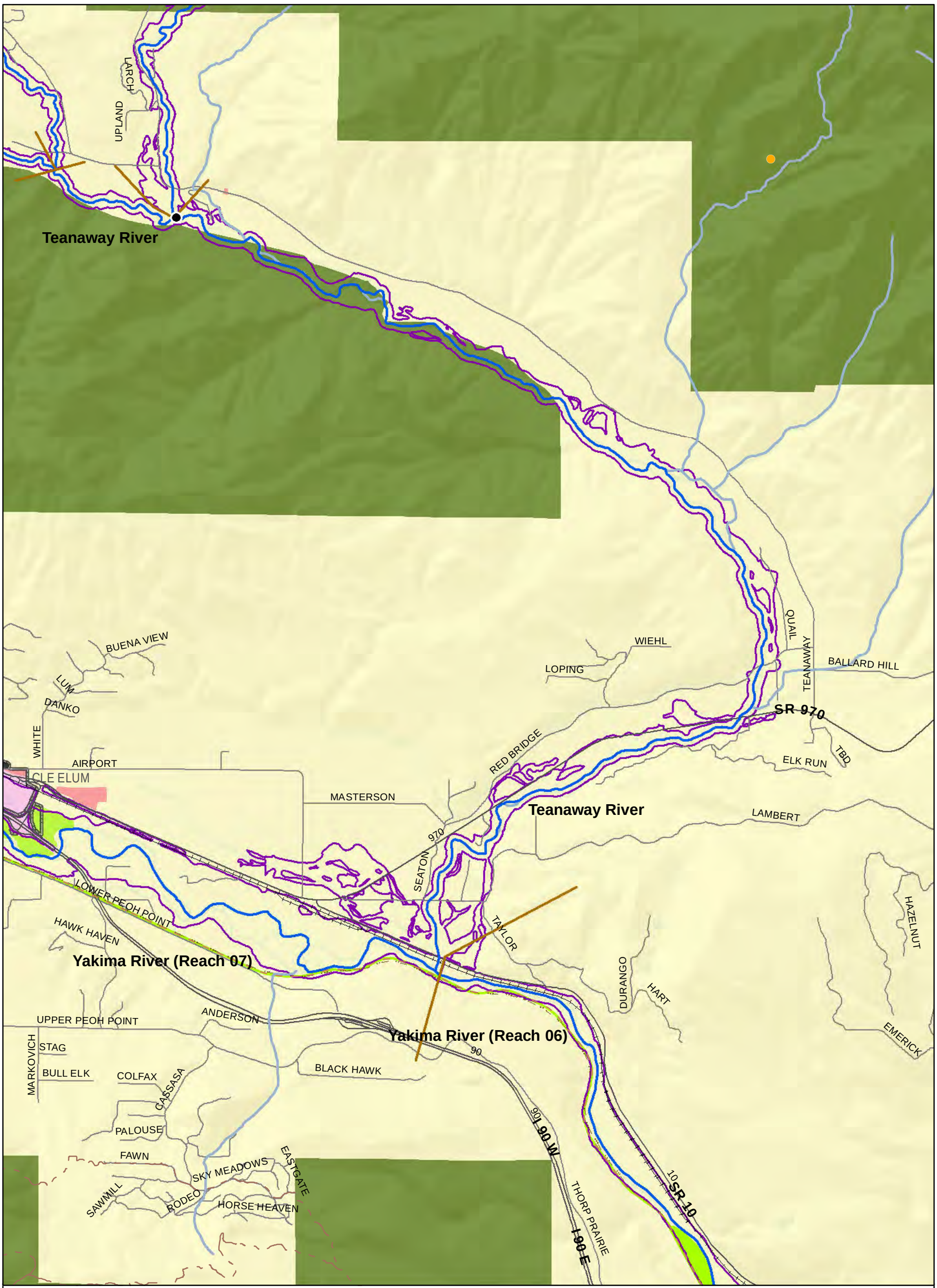
Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 12 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #4: Land Use and Public Access

Map 13

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
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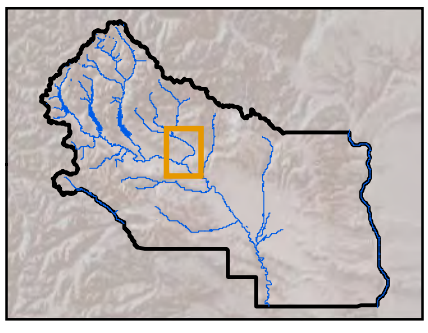
Multiple
Snowmobile



3/15/2013

Map 13 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.

Map Folio #4: Land Use and Public Access

Map 14

Kittitas County Inventory and Characterization

0 0.5 1 Miles

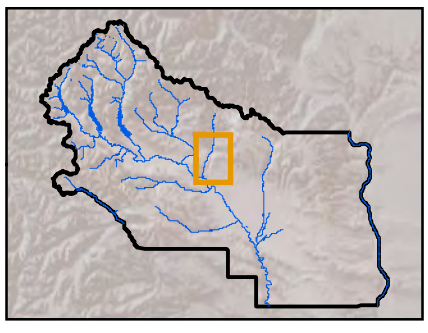
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

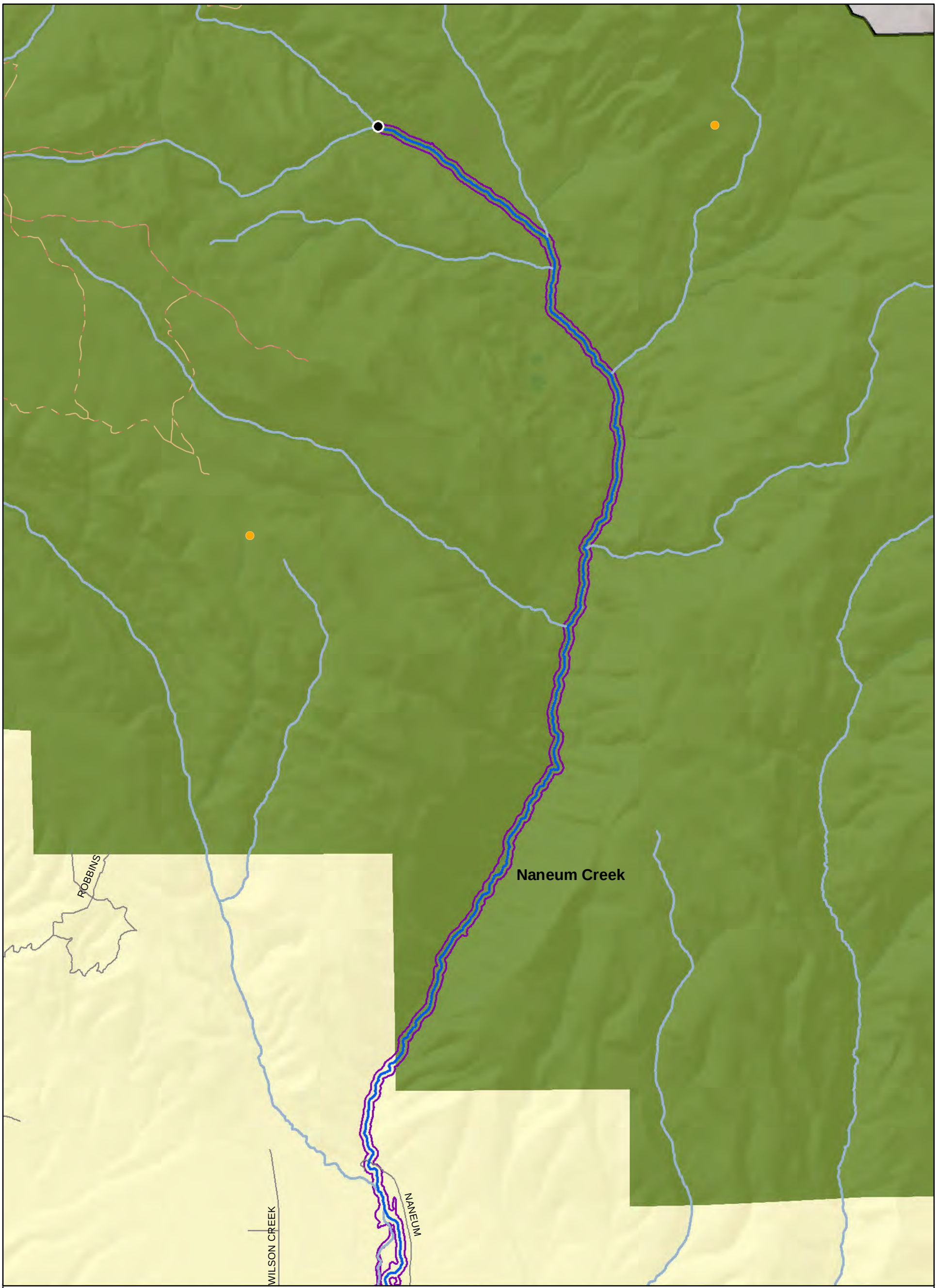
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 14 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 15

Kittitas County Inventory and Characterization

0 0.5 1
Miles

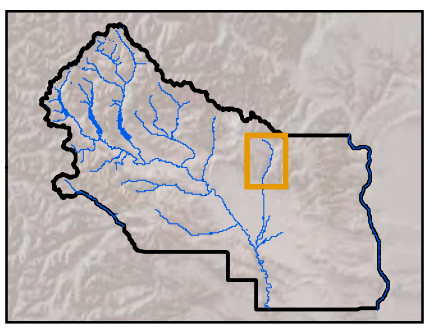
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

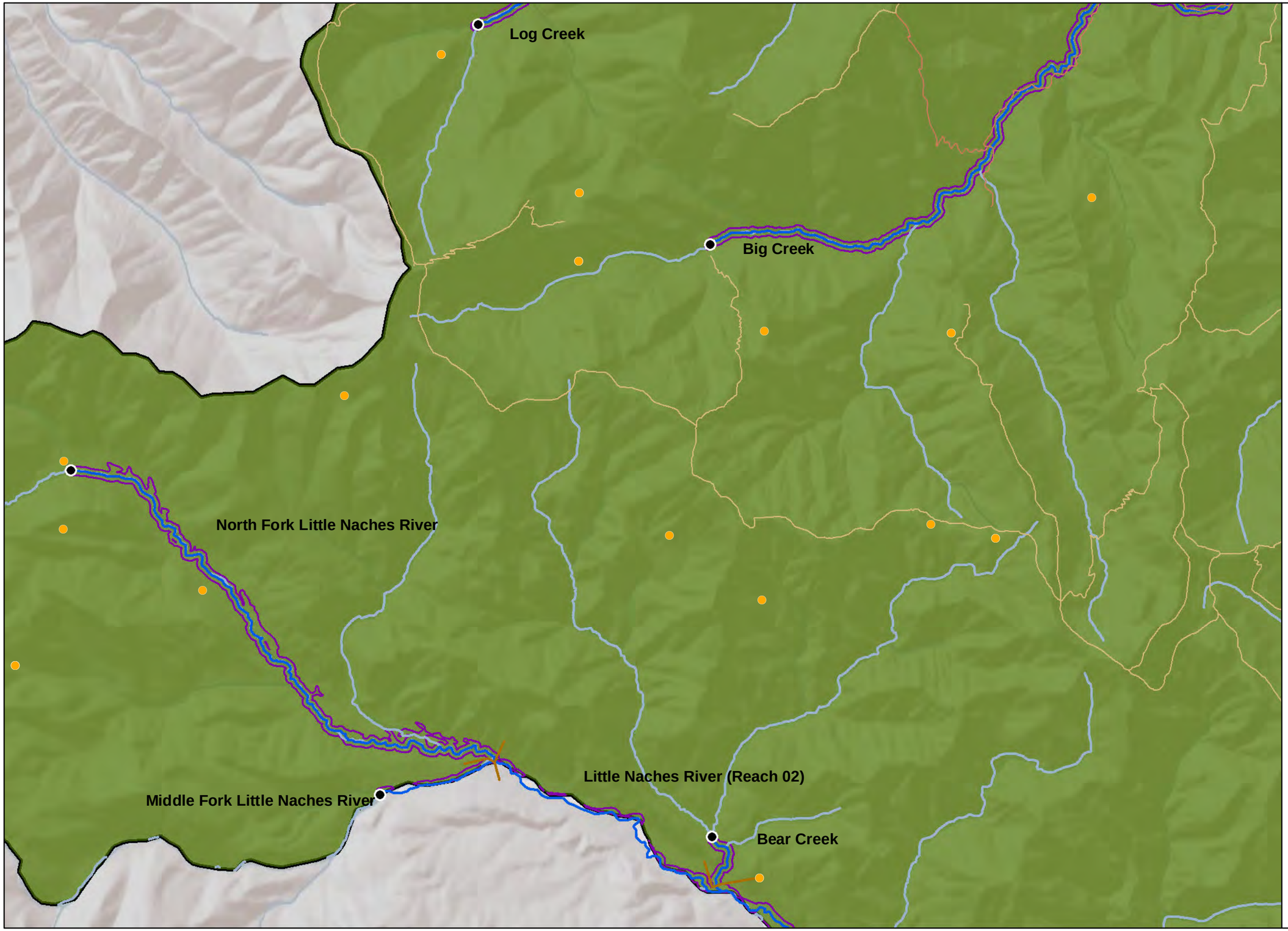
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 15 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 16

Kittitas County Inventory and Characterization

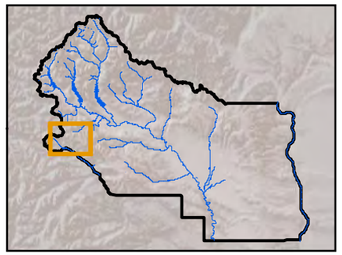
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

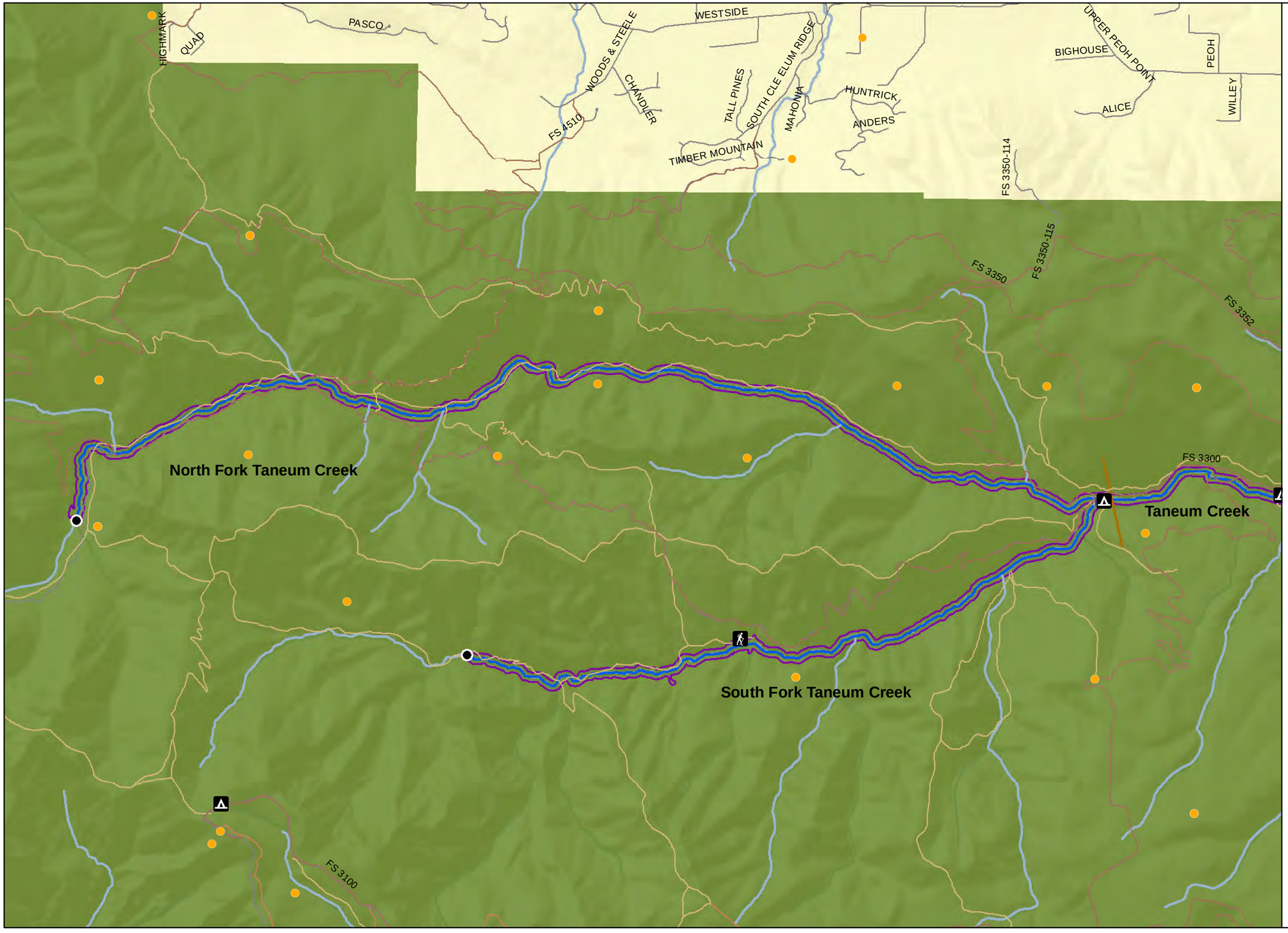
Map 16 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 17

Kittitas County Inventory and Characterization



0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
Urban
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Parks and Open Space
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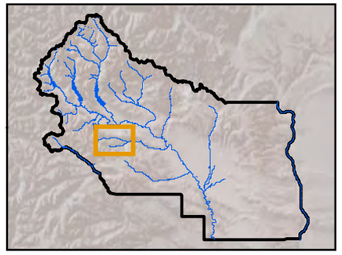
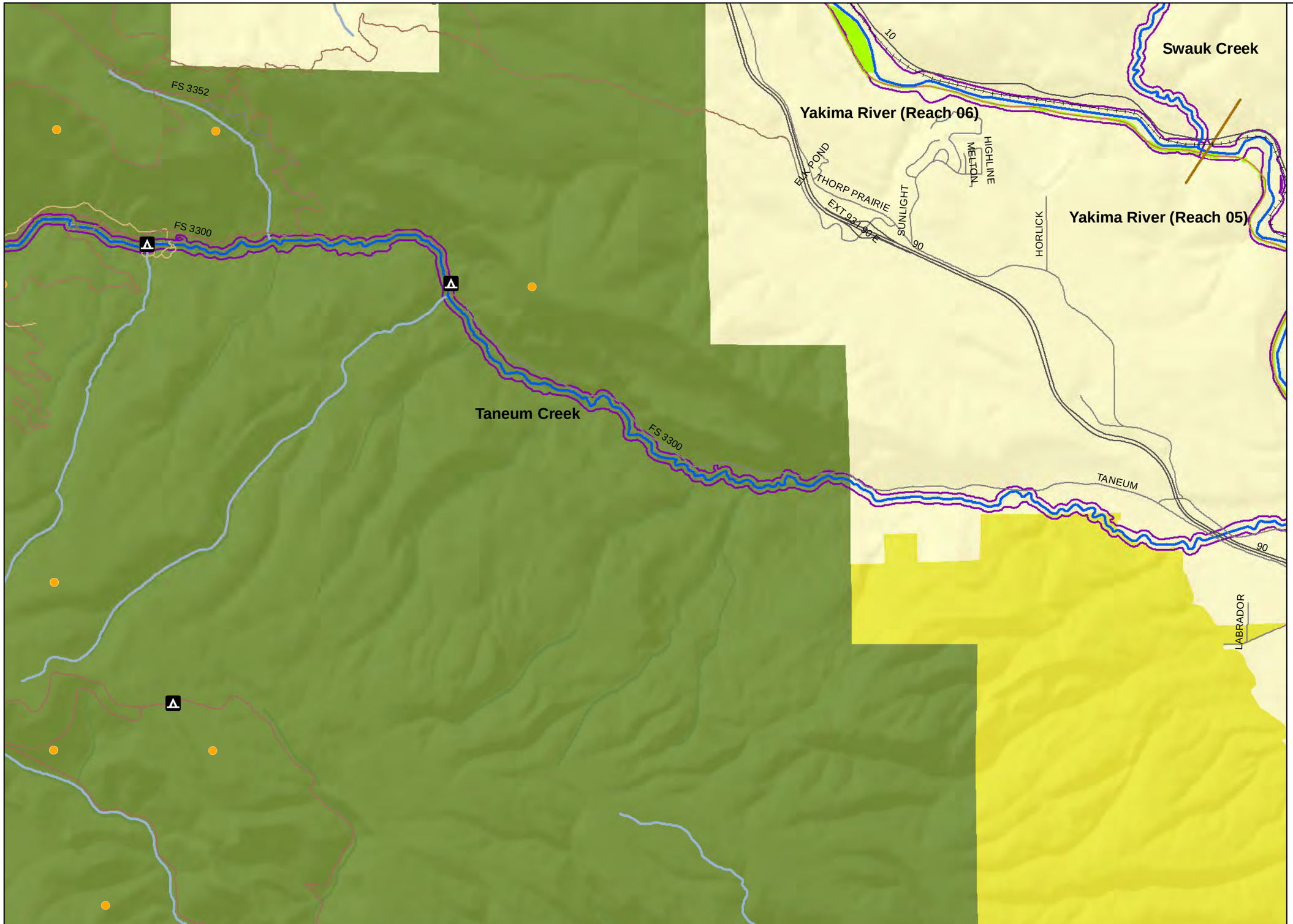
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #4: Land Use and Public Access

Map 18

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
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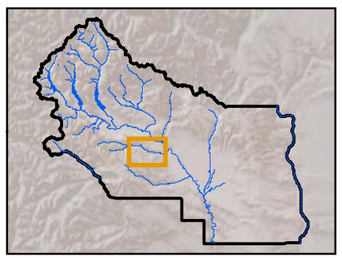
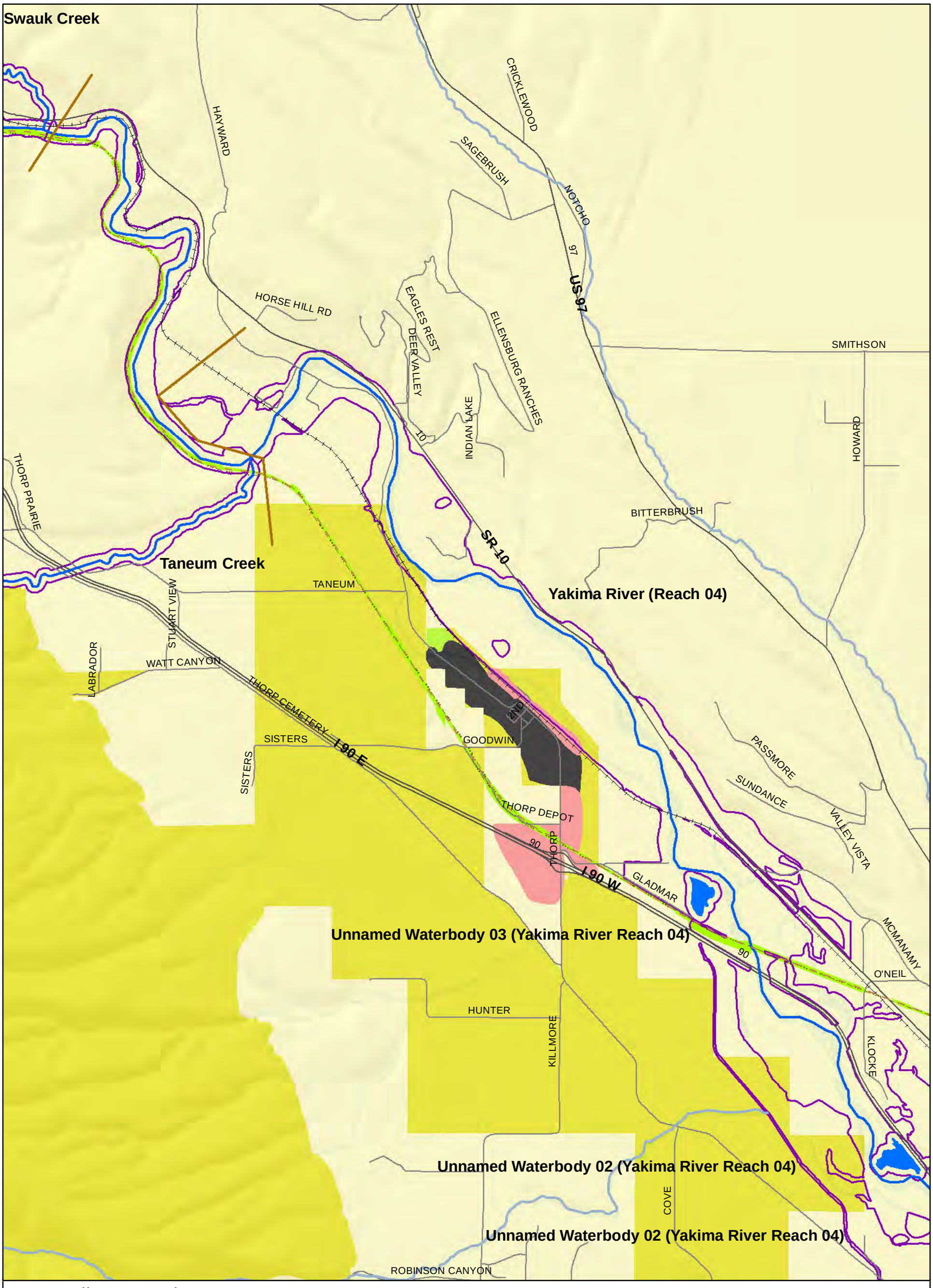
Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 18 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #4: Land Use and Public Access

Map 19

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

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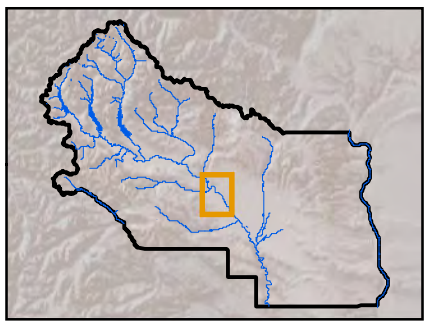
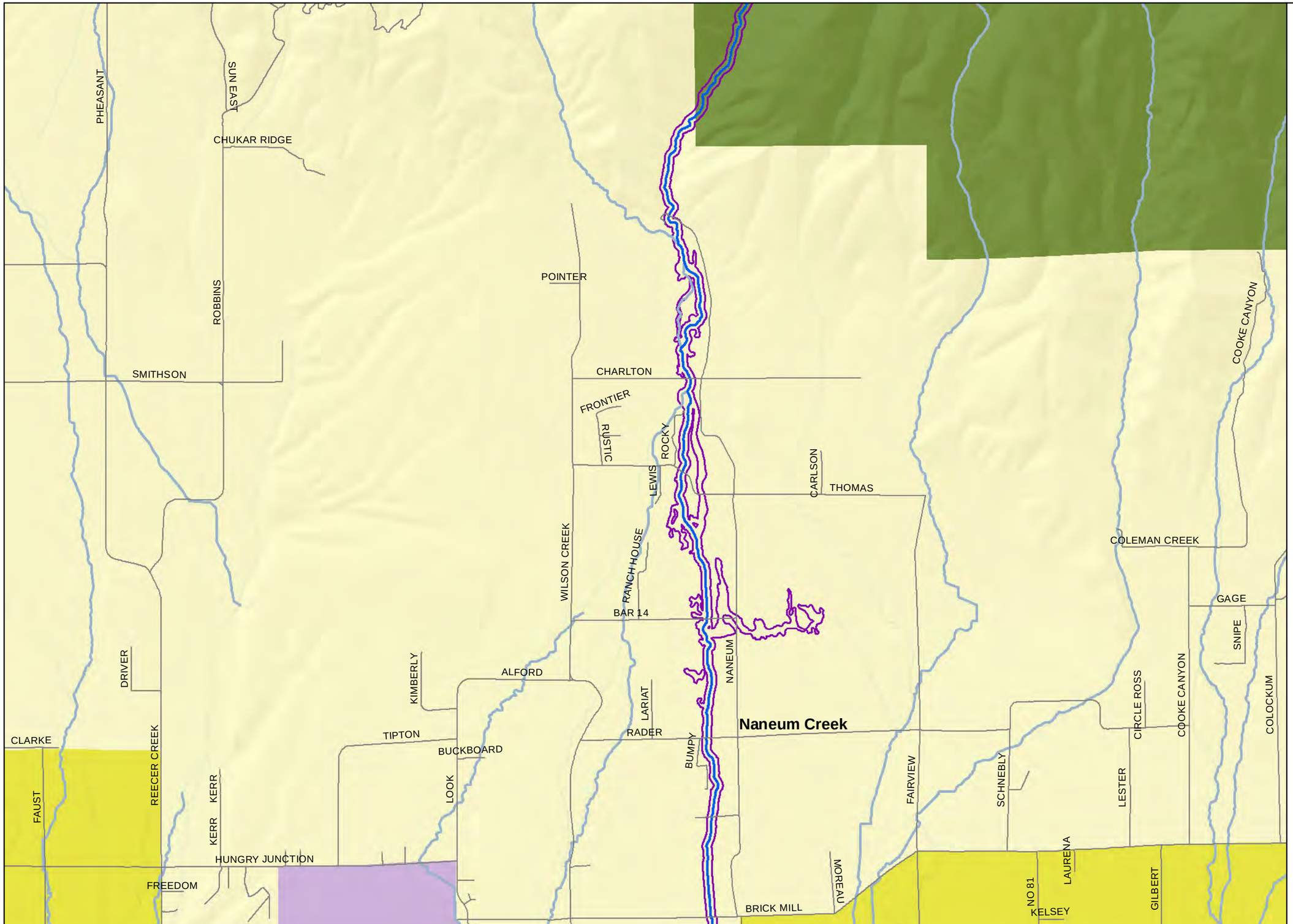
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 19 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 20

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
- Urban
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- Commercial
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- Resort
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- Rural
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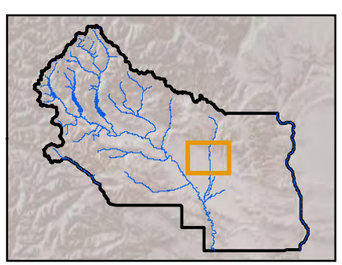
Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



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Map 20 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 21

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
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Campground/site
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ATV or 4WD
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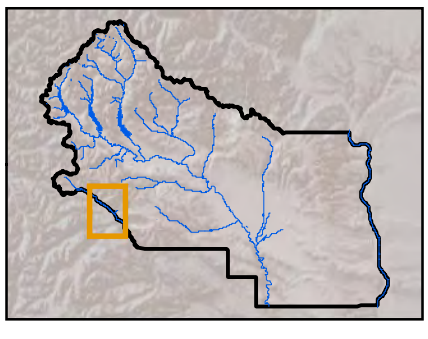
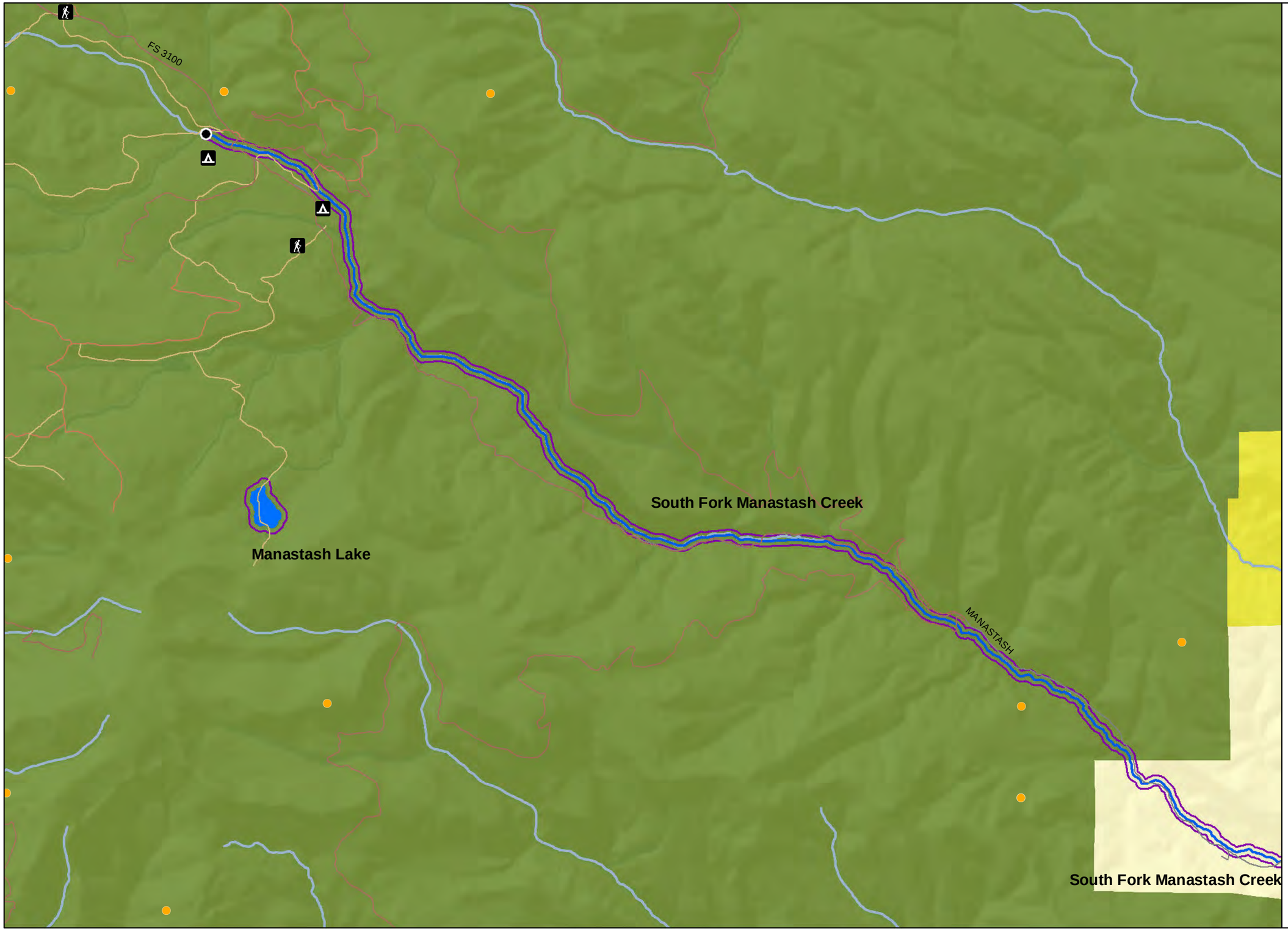
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 21 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 22

Kittitas County Inventory and Characterization

0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
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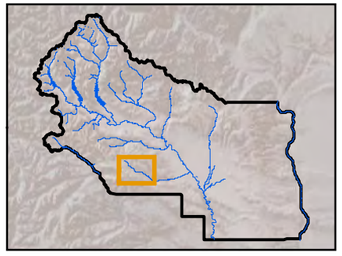
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



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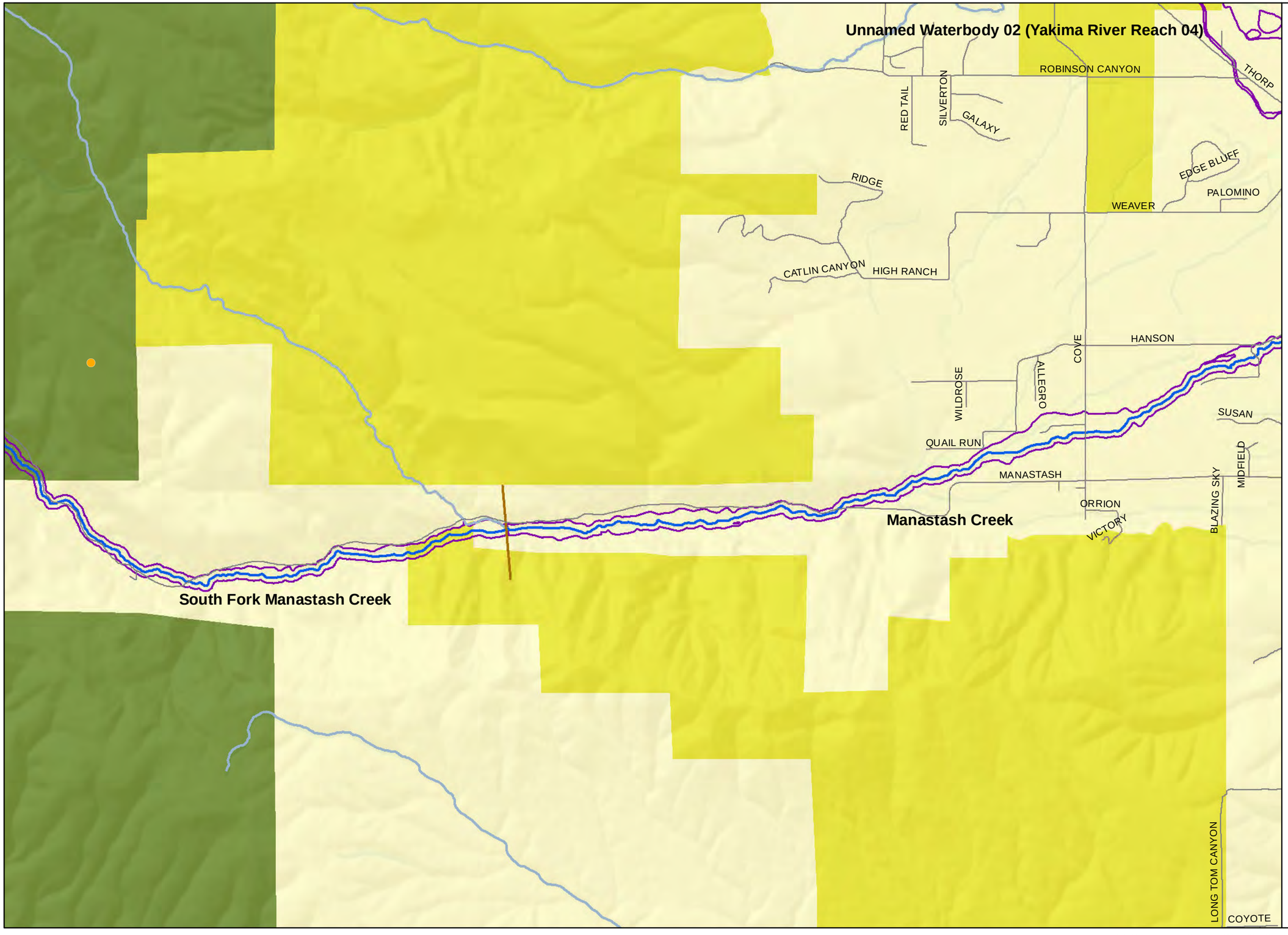
Map 22 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,



Map Folio #4: Land Use and Public Access

Map 23

Kittitas County Inventory and Characterization

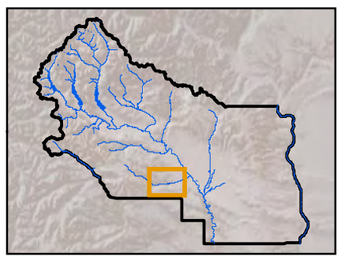
0 0.5 1
Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Non-SMA Streams
Railroads
Roads
Cities
Campground/site
Ski Area
Trailhead
Boat Launches
Forest Service Special Uses

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

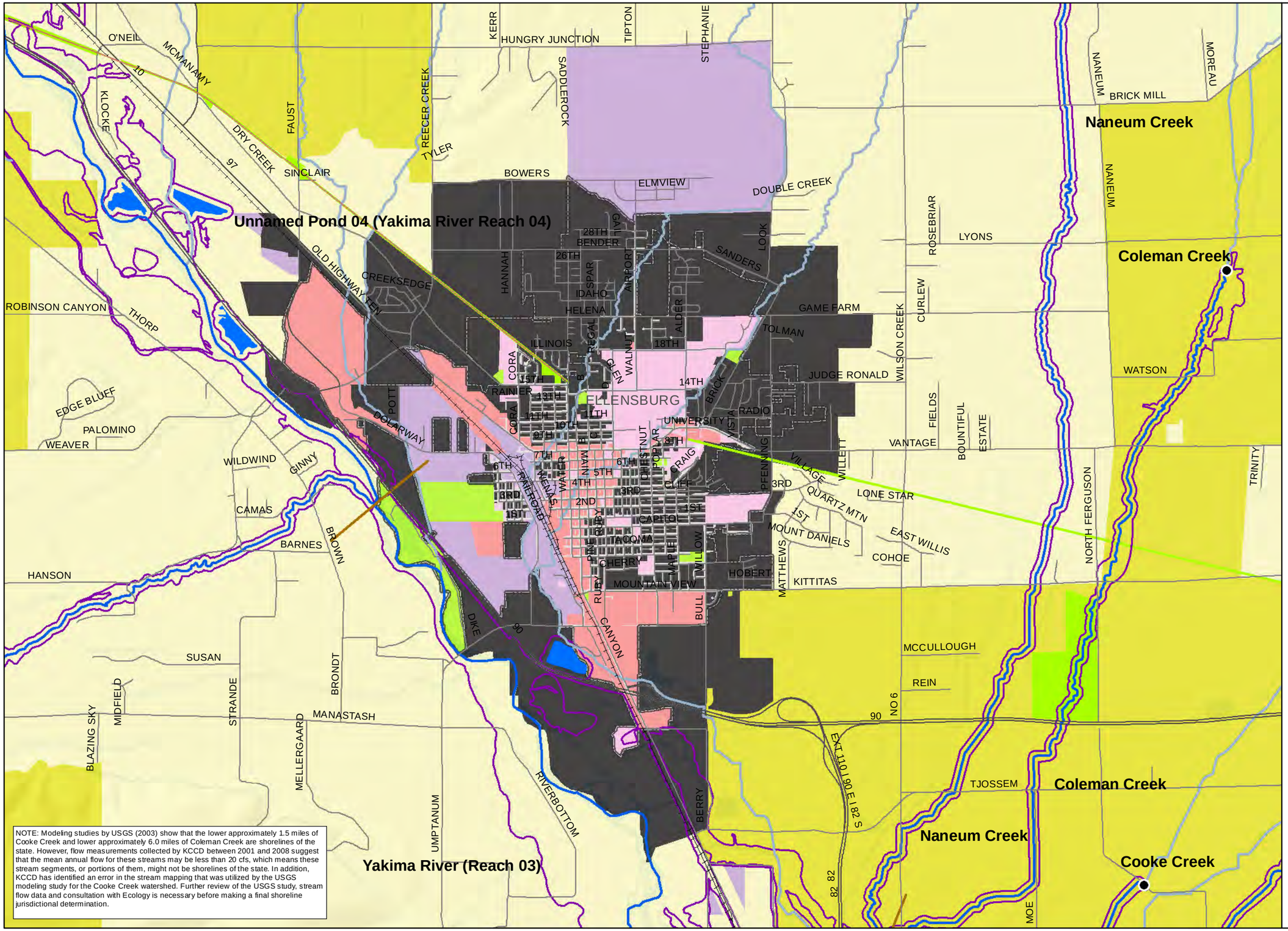
Map 23 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI,

Map Folio #4: Land Use and Public Access

Map 24

Kittitas County Inventory and Characterization



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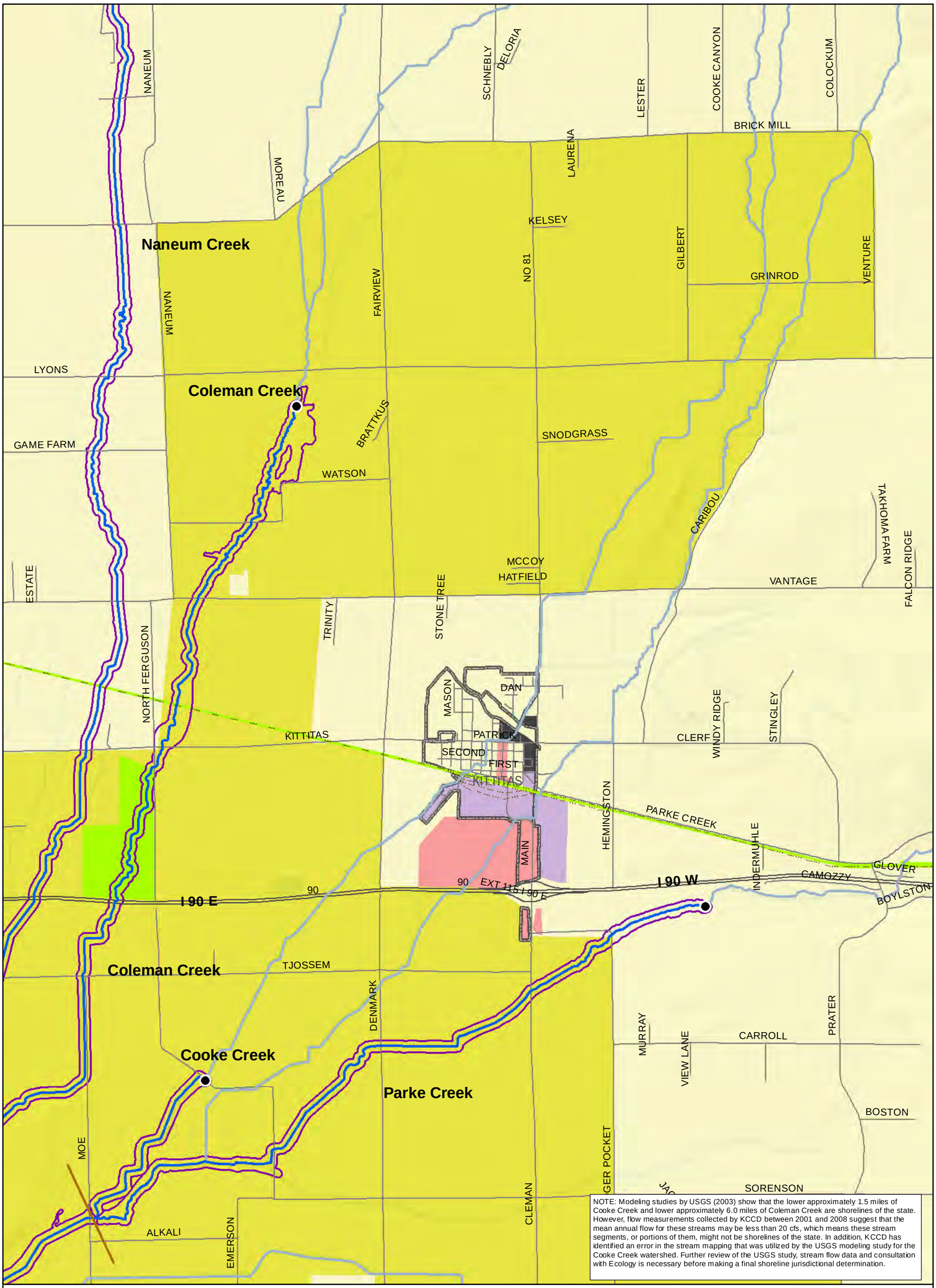


Map Folio #4: Land Use and Public Access

Map 25

Kittitas County Inventory and Characterization

0 0.5 1
Miles

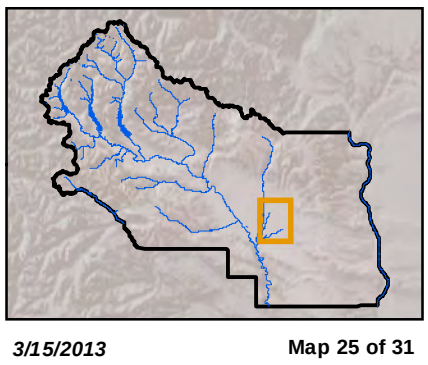
N

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- Inventory Waterbodies
- Inventory Streams
- Railroads
- Roads
- Cities
- Forest Service Special Uses

- Campground/site
- Ski Area
- Trailhead
- Boat Launches

Landuse
- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

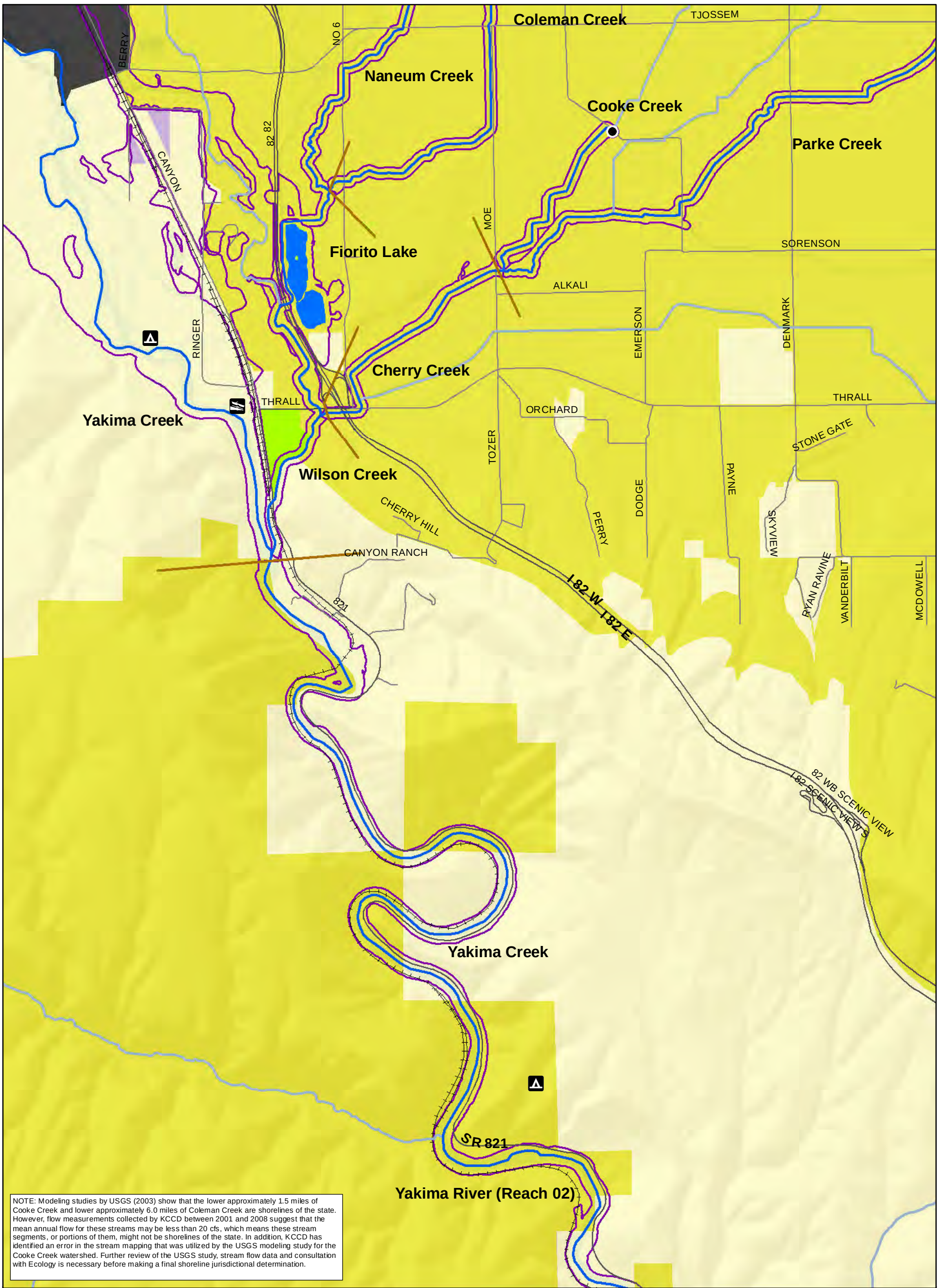
Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 25 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



NOTE: Modeling studies by USGS (2003) show that the lower approximately 1.5 miles of Cooke Creek and lower approximately 6.0 miles of Coleman Creek are shorelines of the state. However, flow measurements collected by KCCD between 2001 and 2008 suggest that the mean annual flow for these streams may be less than 20 cfs, which means these stream segments, or portions of them, might not be shorelines of the state. In addition, KCCD has identified an error in the stream mapping that was utilized by the USGS modeling study for the Cooke Creek watershed. Further review of the USGS study, stream flow data and consultation with Ecology is necessary before making a final shoreline jurisdictional determination.

Map Folio #4: Land Use and Public Access

Map 26

Kittitas County Inventory and Characterization

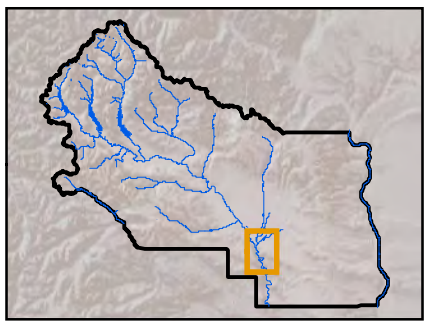
0 0.5 1
Miles

N

- Shoreline Inventory Area
- SMP Reach Breaks
- Upstream Limits (20 cfs)
- Inventory Waterbodies
- Inventory Streams
- Railroads
- Roads
- Cities
- Forest Service Special Uses
- Campground/site
- Ski Area
- Trailhead
- Boat Launches

Landuse
- Urban
- Agriculture
- Commercial
- Industrial
- Resort
- Parks and Open Space
- Rural
- Forest and Range
- Forestry
- Other
- State Parks

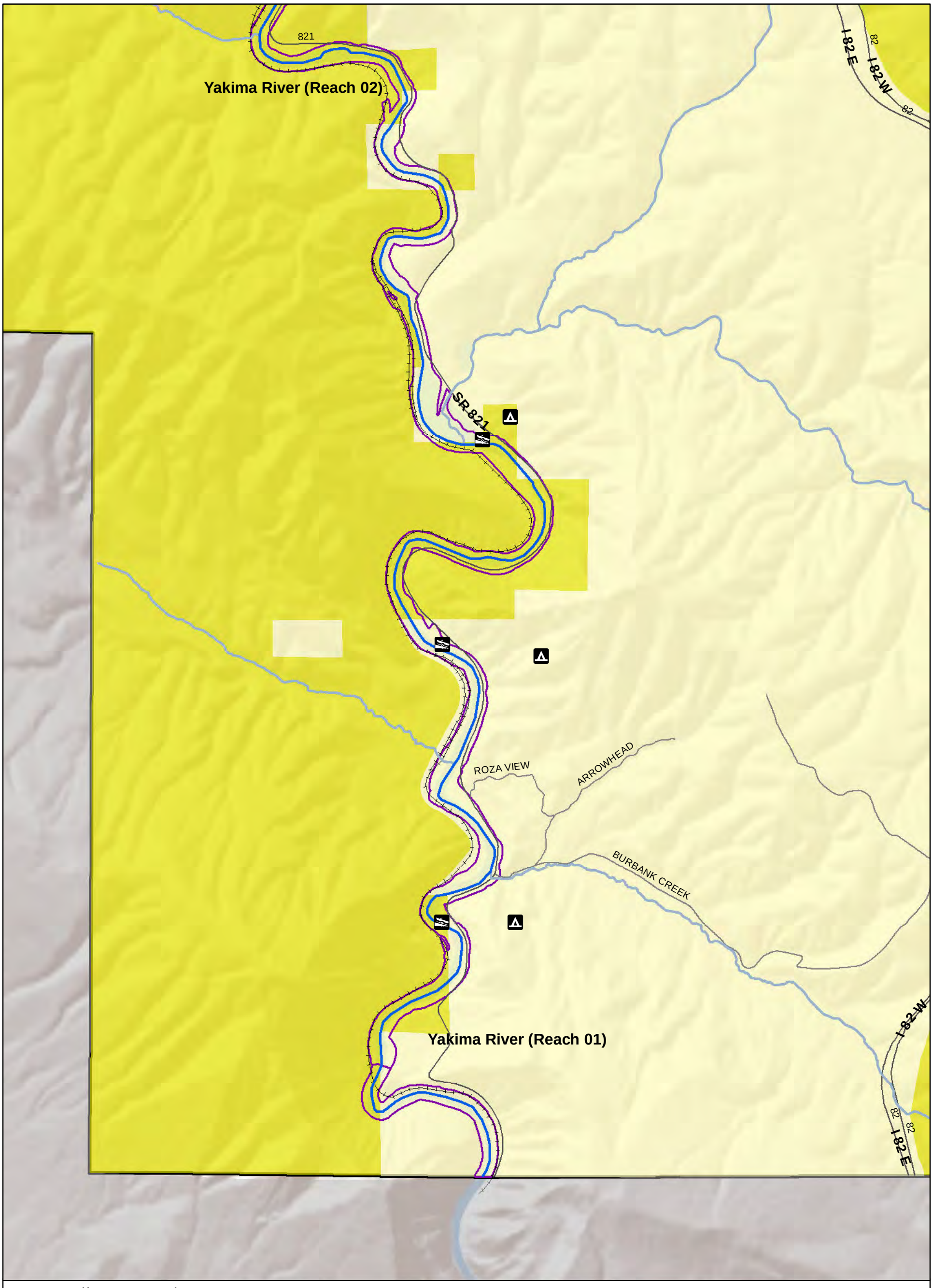
Trails
- ATV or 4WD
- City
- Cross Country
- Dog Sled
- Hiking
- Horse
- Mountain Bike
- Multiple
- Snowmobile



3/15/2013

Map 26 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 27

Kittitas County Inventory and Characterization

0 0.5 1 Miles

N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

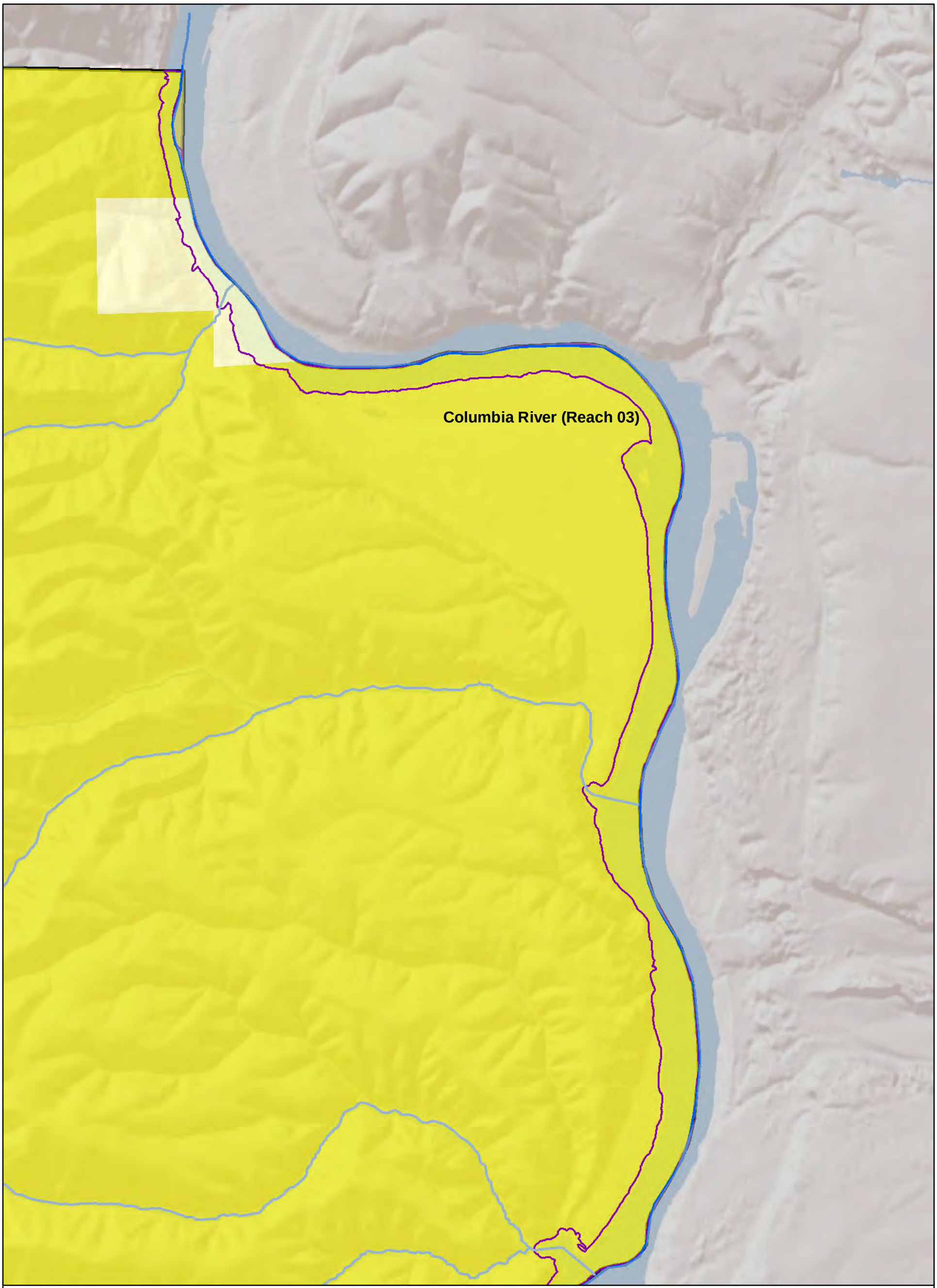
Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile

3/15/2013

Map 27 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 28

Kittitas County Inventory and Characterization

0 0.5 1
Miles

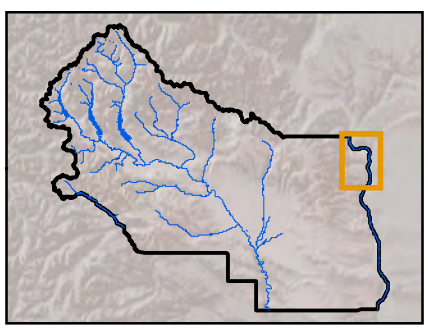
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

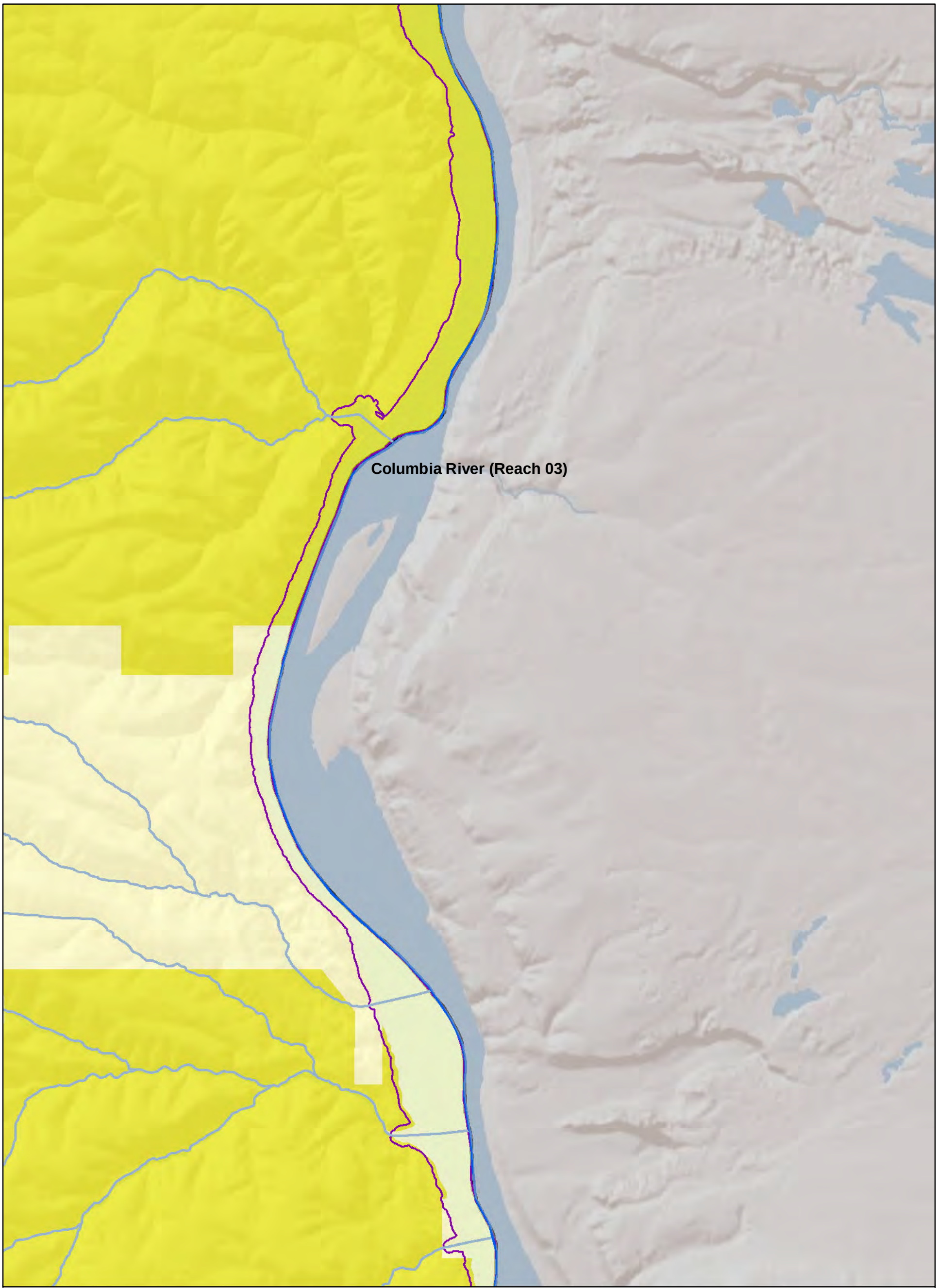
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 28 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 29

Kittitas County Inventory and Characterization

0 0.5 1
Miles

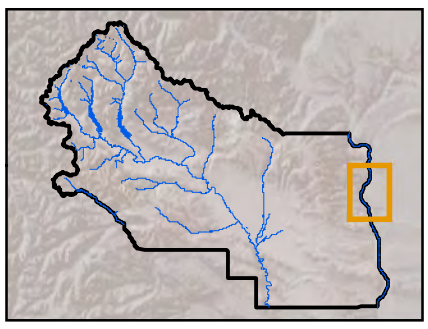
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

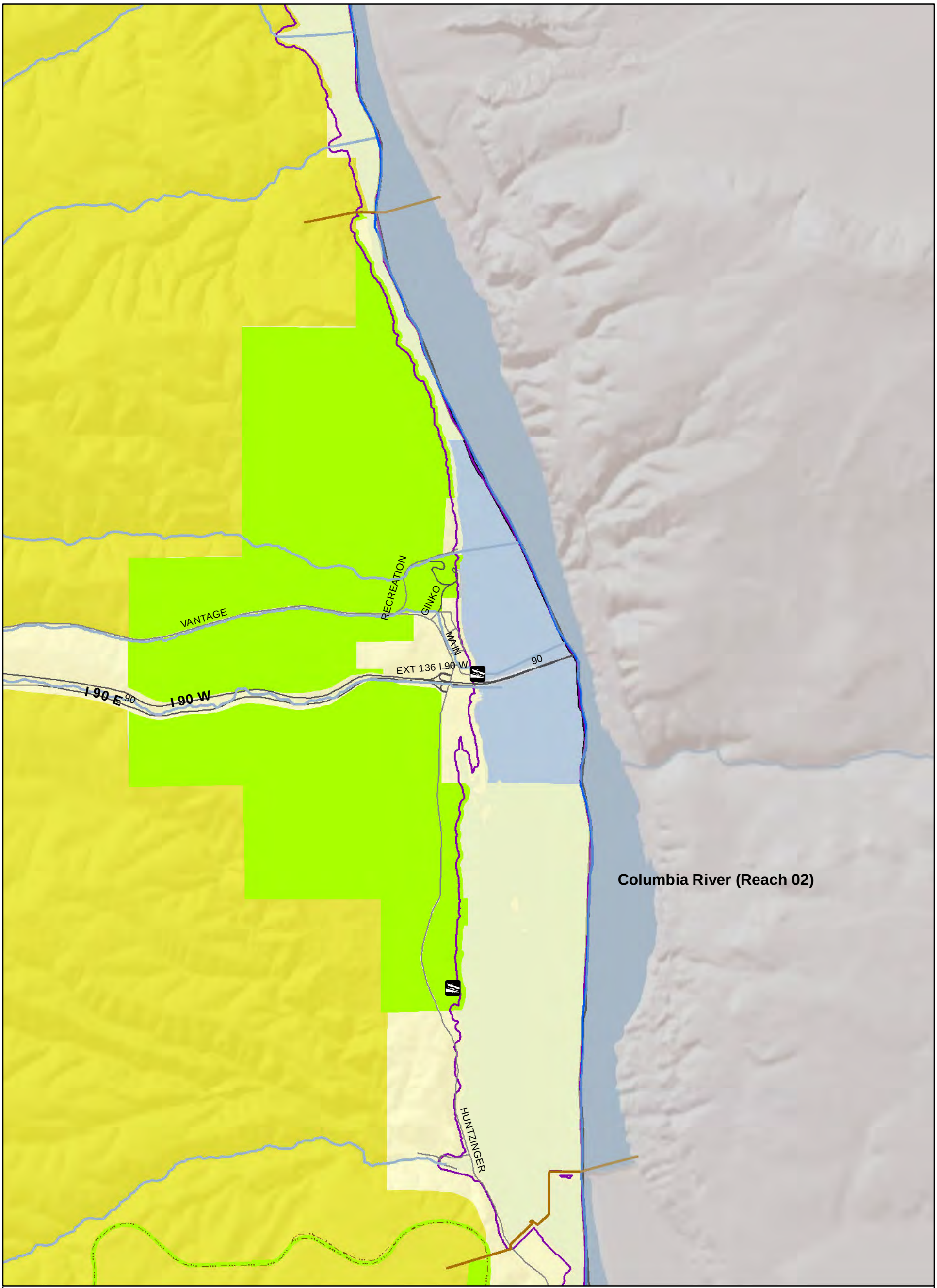
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 29 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 30

Kittitas County Inventory and Characterization

0 0.5 1
Miles

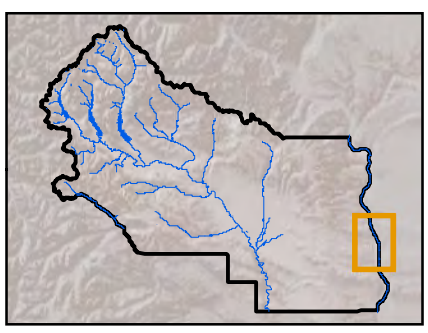
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

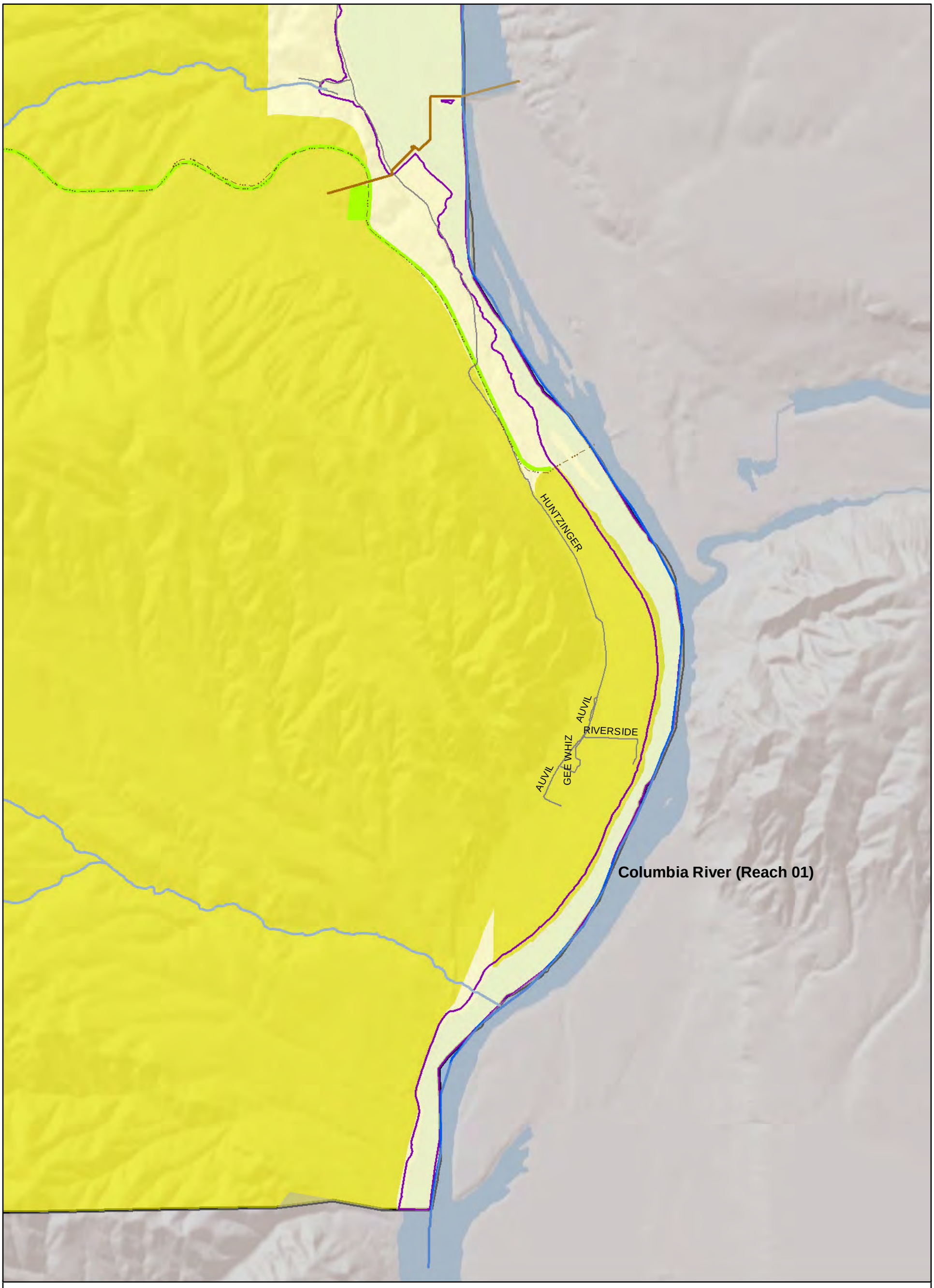
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 30 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map Folio #4: Land Use and Public Access

Map 31

Kittitas County Inventory and Characterization

0 0.5 1
Miles

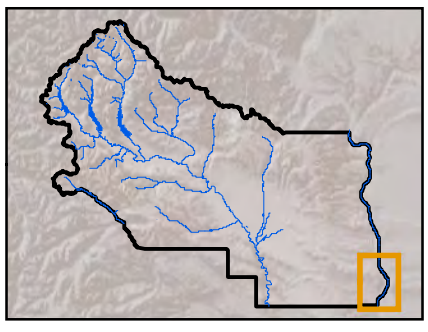
N

Shoreline Inventory Area
SMP Reach Breaks
Upstream Limits (20 cfs)
Inventory Waterbodies
Inventory Streams
Railroads
Roads
Cities
Forest Service Special Uses

Campground/site
Ski Area
Trailhead
Boat Launches

Landuse
Urban
Agriculture
Commercial
Industrial
Resort
Parks and Open Space
Rural
Forest and Range
Forestry
Other
State Parks

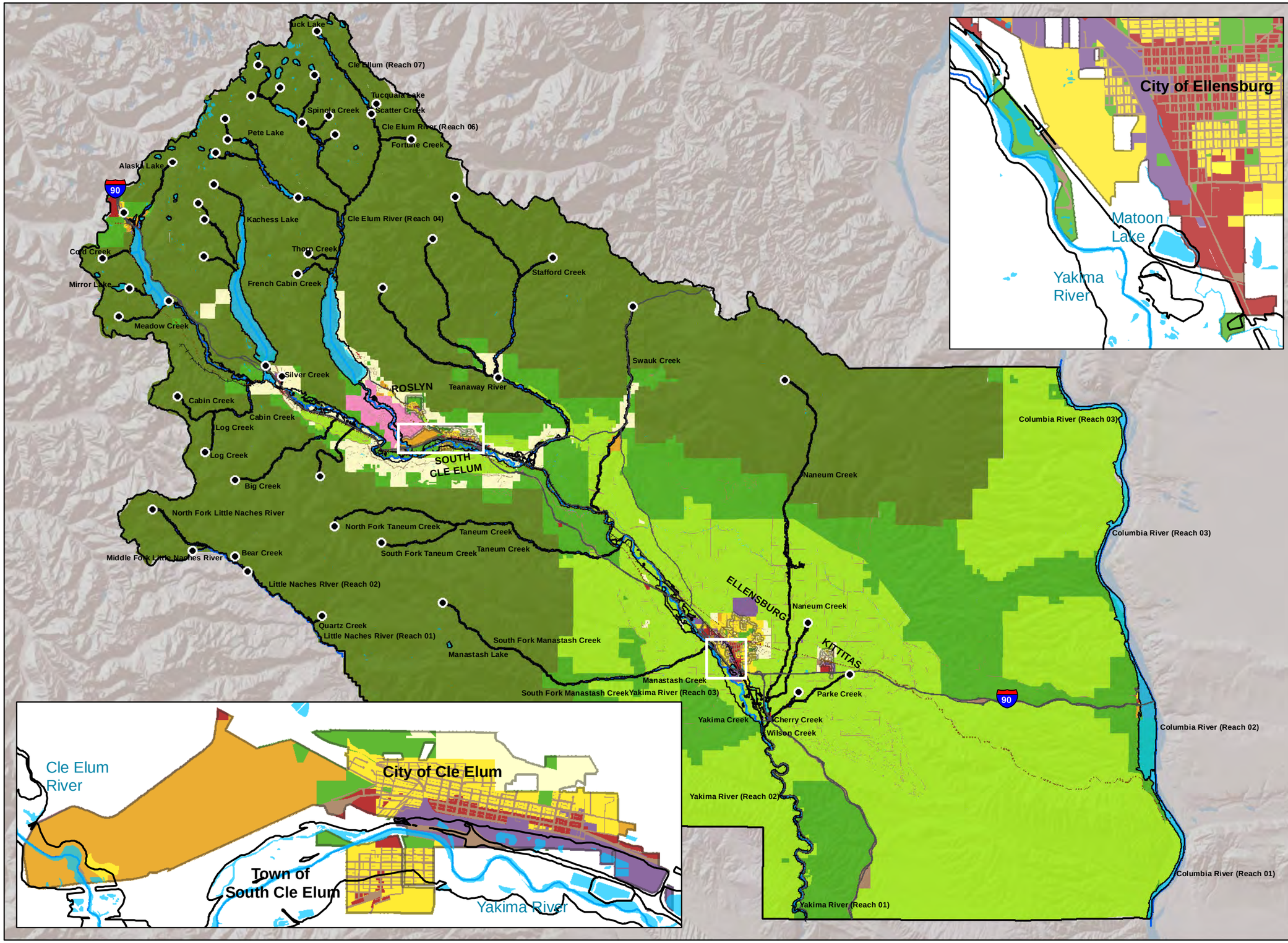
Trails
ATV or 4WD
City
Cross Country
Dog Sled
Hiking
Horse
Mountain Bike
Multiple
Snowmobile



3/15/2013

Map 31 of 31

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011; Ecology, 2010; DNR, 2007; USGS GAP 2009; ESRI, 2010.



Map #5: Zoning

Kittitas County Inventory and Characterization

0 5 10 Miles

N

Inventory Waterbodies
Inventory Streams
Upstream Limits (20 cfs)
Shoreline Inventory Area
Trails
Railroads
Roads
County Boundary

Zoning
- Urban/Suburban Residential
- Mixed Use
- Commercial
- Industrial
- Parks and Open Space
- Rural Residential
- Master Planned Resort
- Mobile Home Park
- Agriculture
- Forest & Range
- Commercial Forest
- Wind Farm
- Other

3/14/2013

Data Sources: USFWS (NWI), 2011; Kittitas County, 2011, 2012; Ecology, 2010; DNR, 2007; ESRI, 2010.

APPENDIX B REACH SHEET DATA SOURCES

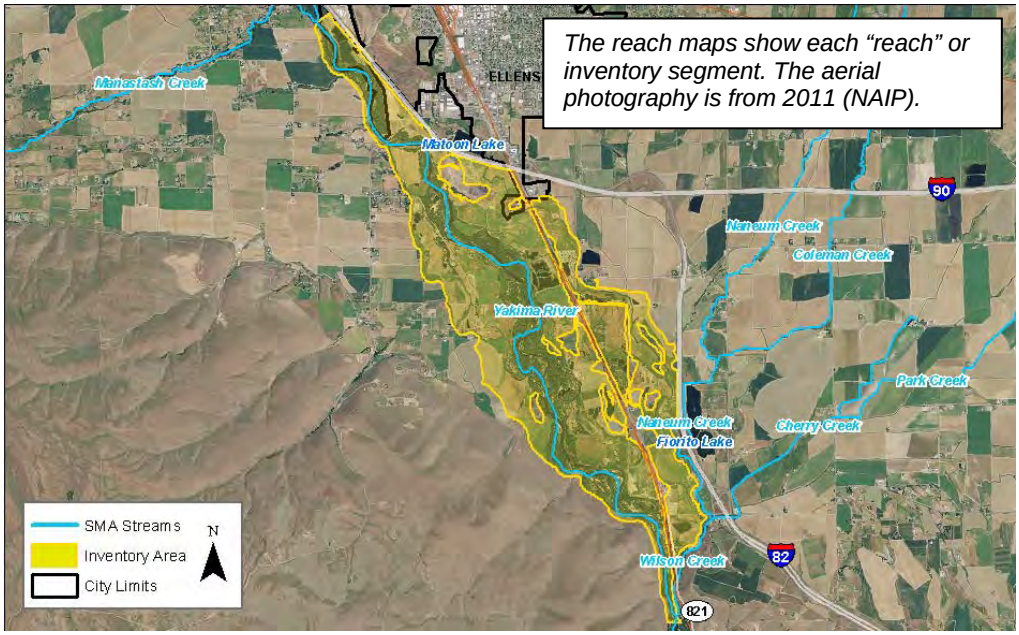
REACH SHEET EXPLANATION AND DATA SOURCES

SHORELINE LENGTH:

Shows the calculated length of the stream reach, or the lake perimeter within the shoreline inventory area.

REACH INVENTORY AREA:

Shows the total area of land and water subject to the inventory.



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

Configuration of the stream channel or lake is described based primarily upon information available in Haring, 2001. If channel/lakeshore data was not available, configuration was described based upon air photo interpretation.

LAND COVER (MAP FOLIO #3)

This information describes the land cover types within the reach based upon remote sensing data (GAP Analysis-Level II Land Cover, 2009).

HAZARD AREAS (MAP FOLIO #2)

This dataset contains information about potentially hazardous areas, which include: landslide hazard areas, frequently flooded areas (i.e. the FEMA 100-year floodplain), and channel migration zones (Data sources: WDNR, 2010; FEMA; Ecology, 2012; ESA, 2013). These data show where hazards are likely to occur or where they are known to have occurred. Hazards may be present in areas where none are mapped.

HABITATS AND SPECIES (MAP FOLIO #1)

This describes the location of state-designated priority habitat and species, as reported by the WDFW Priority Habitats and Species Program. Priority habitat data are based upon field biologist observations, where available; not all species or habitat locations are represented in the data. The fish data is augmented by information collected from the TAC.

Information on the approximate location and extent of known wetlands and streams is based on data from USFWS and WDNR wetland and waterbody inventories. Wetland data are course-scale, and often do not depict small wetlands, slope wetlands, or wetlands in dense forest stands. A field investigation would be required to accurately determine the presence or absence of wetland habitat in a particular area.

PHYSICAL AND ECOLOGICAL FEATURES (CONTINUED)

WATER QUALITY

This dataset comes from the State of Washington's Water Quality assessment (WQA) and list of impaired waterbodies (2008). The State's WQA categorizes water quality into five categories, ranging from Category I waterbodies which meet federal clean water standards to Category 5 waterbodies that are polluted and put on the EPA's impaired waterbodies (303(d)) list. Only waterbodies that have an approved and implemented pollution control program [i.e., a Total Maximum Daily Load or TMDL (i.e., Category 4a and 5 waterbodies) are shown in the reach sheets.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

This dataset identifies locations of modifications to the shoreline environment, including docks, dams, stream crossings, fish passage barriers, streambank armoring. Data are from a variety of sources: WDFW, 2010; WDNR, 2009; CWU, 2009; and TAC, 2012.

PUBLIC ACCESS (MAP FOLIO #4)

These data identify locations where members of the public have access to shoreline streams and lakes (Data sources: WSP, 2012, Kittitas County, 2011 & 2012, BLM, 2010, TAC 2012). Some locally known, unpublished, or unofficial public access areas may be missing from the maps.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

These data describes the use and ownership (i.e., public and private) of lands immediately adjacent to shorelines based on available public records (Data source: Kittitas County, 2011).

CONTAMINATED SITES

This dataset contains the locations of regulated hazardous materials facilities, spill sites, and cleanup projects. The list of regulated facilities as well as past and on-going cleanup projects is maintained and updated by Ecology (2011).

ZONING (MAP FOLIO #5)

These data depict Kittitas County zoning categories of lands immediately adjacent to shorelines (2011).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

This dataset contains recorded and prehistoric cultural and archaeological sites (Source: Washington State Department of Archaeology and Historic Preservation, 2010). Due to federal and state laws which preclude the release of site location information, only the number and type of cultural resource sites recorded within a reach are shown on the reach sheets.

SHORELINE FUNCTION ANALYSIS

This box presents an assessment of shoreline functions. The existing level of aquatic habitat quality, terrestrial habitat quality, vegetation functions, and hydrologic functions were assessed qualitatively into 3 categories (high, medium, and low functioning) based on the indicators described below. The function analyses represent an average of functional quality within the inventory reaches. For example, there may be high-functioning areas present within a reach that scored an overall low rating.

FISH HABITAT QUALITY

Indicators of high-quality fish habitat include:

- *Presence of fish spawning and rearing habitat*
- *Anadromous fish access*
- *Generally non-impaired water quality and adequate water flow regime*
- *Absence of shoreline modifications*
- *Presence of relatively undisturbed, natural riparian vegetation*

TERRESTRIAL HABITAT QUALITY

Indicators of high-quality terrestrial habitat include:

- *Presence of wetland habitat*
- *Presence of relatively undisturbed, natural vegetation*
- *Connectivity to large areas of undisturbed habitat*
- *Minimal existing land development*

SHORELINE FUNCTION ANALYSIS (CONTINUED)

VEGETATION FUNCTIONS	HYDROLOGIC FUNCTIONS
(e.g., water quality buffering, temperature maintenance, woody debris/organic matter inputs) *Indicator of high-quality vegetation functions includes:* • *Presence of dense, natural, and relatively undisturbed riparian forest and shrub*	*(e.g., flood water storage, movement of water, hyporheic connectivity)* *Indicators of quality hydrologic functions include:* • *Presence of undeveloped/unaltered floodplain* • *Absence of shoreline hydromodifications* • *Unaltered flow regime (e.g., minimal irrigation withdrawals/diversions)*

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

This box describes key management issues and opportunities for the reach based upon an analysis of the data presented above, potential future land use changes, and a review of existing studies and other information conducted during the shoreline inventory and characterization. The box is limited to issues and opportunities that are reach-specific; waterbody and watershed-scale issues are presented in the text. A list of initial restoration opportunities within the reach is also presented.

APPENDIX C CHANNEL MIGRATION ZONE METHODS, DATA TABLES, AND MAP FOLIO

C.1 Delineation Methodology

The goal of the channel migration zone (CMZ) mapping effort in Kittitas County was to meet the requirements of the State Shoreline Management Act Guidelines (WAC 73-26-201.3.c.vii) which require local jurisdictions to identify the "general location of channel migration zones." ESA mapped the CMZs of the subset of streams under SMA jurisdiction with the potential to migrate, as identified by Ecology. ESA's assumption is that channel migration potential for each of these streams exists throughout the entire alluvial valley bottom and in some cases could extend to erodible valley walls. Where sufficient data were available, ESA refined the mapping within the alluvial valley to more defensively identify portions of the valley that, because of inherent geomorphological conditions, are not subject to channel migration and therefore outside the potential channel migration zone.

ESA undertook two levels of effort for the mapping with the greatest level of effort devoted to areas of the County where we have data to provide more accurate mapping. For streams (defined here as Tier 1) with more resolved LiDAR topographic data, we implemented the draft methodology[1] being developed by Ecology, GeoEngineers, and Cardno Entrix (Ecology et al., 2011). This method generally consists of identifying an 'active channel corridor' (ACC) where the channel could easily occupy, then using the width of that corridor as an indication of potential lateral extent of meandering or erosion hazard area (EHA). ESA also identified relict features on the valley floor that could provide overflow routes and avulsion hazards. Geotechnical setback areas were defined where the CMZ intersects a high bank that could be undermined by channel movement. Ecology (Dr. Patricia Olson) reviewed the initial mapping results and provided comments, which have been incorporated into the final maps.

For the remaining streams ESA implemented a less detailed mapping approach that typically resulted in a broad delineation of the CMZ. These Tier 2 streams are in areas where there is no detailed LiDAR and only 10-meter Digital Elevation Model (DEM) topographic data are available. For Tier 2 streams, available data was used to identify the approximate lateral extents of migration, which often included the entire valley bottom. A brief summary of the two levels of effort is included in Table C-1 below.

[1] Ecology (Washington State Department of Ecology), CardnoEntrix, and GeoEngineers. 2011. *Planning Level Channel Migration Zone Assessment and Delineation Methodology* (DRAFT). Olympia, WA.

Table C-1. Tiers of effort for Kittitas County CMZ mapping

Tier	Definition	Example Locations
1	Streams with more resolved topographic information (LiDAR)	Mainstem Yakima, Teanaway to the forks, lower Swauk, lower Taneum
2	Streams with less resolved topographic information (10-meter DEM)	NF Teanaway, Little Naches River, Upper Taneum, Gold Creek

The CMZ mapping also identified areas that could be considered Disconnected Migration Areas (DMAs) within the overall CMZ. Potential DMAs were identified where essential public infrastructure exists and is actively protected (from migration) by public entities. Infrastructure that was considered for identification for DMAs consisted of state highways, sole source county roads, and levees surrounding critical infrastructure (e.g., wastewater treatment plants). DMAs did not include all levees, revetments, or other alterations that may alter migration rates, but are not formally certified or maintained.

The Yakima and lower Cle Elum rivers were determined to have relatively wide CMZs using the draft methodology being developed Ecology et al. (2011). The overall width of the mapped CMZ for both systems was highly influenced by the presence of geomorphic alluvial features (e.g., abandoned channels, oxbows, depressions on valley alluvium) that occur outside the active channel corridor and erosion hazard buffer. The CMZ delineation was typically expanded to include these features. The hydrographs of both rivers have been highly altered by the installation of the storage system (via dams), which has generally reduced the frequency and magnitude of peak flows. The changes in hydrograph may have reduced or eliminated the ability of both streams to occupy historical portions of their channel migration zones. Therefore, the CMZ identified for the Yakima and lower Cle Elum Rivers may be conservatively large as the methods rely on landscape and geomorphic indicators that may be relict under the current hydrologic regime. This CMZ analysis did not include any specific modeling or quantitative assessment of current hydrologic regime, hydraulics, or stream power.

Results of the CMZ delineation are summarized in the tables and maps that follow. The tables organize the information according to key elements of the CMZ for each reach or subunit as follows. Subunits are 'reaches' as defined in the Ecology et al. (2011) methods, but are termed subunits here to avoid confusion with SMP reaches.

C.2 CMZ Delineation Data Tables

C.2.1 Big Creek

Big Creek-TIER 2 (Map Folio Pages 57-59)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	No subunits identified.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	No DMAs identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.2 Cabin Creek

Cabin Creek-TIER 2 (Map Folio Pages 60-61)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Two subunits were identified in the Tier 2 section of the creek: break identified based upon change in valley width and stream sinuosity.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	No DMAs identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ was determined based primarily by topography and mapped extent of alluvium.

C.2.3 Cle Elum River and Scatter Creek

Cle Elum River-TIER 1 (Map Folio Pages 18, 55-56)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Two subunits were identified along the Tier 1 section of the Cle Elum River, primarily based on sinuosity, (anastomosing versus single channel).
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included bars and secondary channels judged to be frequently activated. This included secondary channels judged to be routinely activated during high flow events.
Alluvial Fans	Sketched over geologic and topographic data sources.	None identified.
Erosion Hazard Buffer – from the Active Channel	Buffer from active channel, calculated by stream subunit.	Based on width measurements, the active channel meander amplitude was used as an initial buffer from the ACC.
Erosion Hazard Buffer – Avulsion hazard areas	Avulsion hazard areas typically identified using the relative water surface elevations data.	The Cle Elum River included a number of anastomosing reaches, indicating that the primary channel could easily migrate over the majority of the alluvial valley. These areas were typically included within the ACC if channels could engage at relatively low discharge levels. Avulsion hazards typically included channels that would engage at higher discharge levels.
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel and avulsion hazard zones) described above.	In almost all cases along the Cle Elum River, the EHA extended beyond the valley walls. The overall CMZ was mapped as including the valley walls with geotechnical hazard zones where applicable.

Cle Elum River-TIER 1 (Map Folio Pages 18, 55-56)		
Element	**Source/development**	**Notes**
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways)	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with taller terrace composed of landslide, sedimentary rock, or glacial outwash materials or where past erosion of the valley margin (e.g., scalloping) is evident. These areas would require more detailed analysis to determine appropriate management measures.

Cle Elum River and Scatter Creek-TIER 2 (Map Folio Pages 62-64)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Three subunits were identified in the Tier 2 section of the river: lower break identified based upon change in channel sinuosity (upstream of the river's outlet into Lake Cle Elum), and upper break identified by confluence with major tributary (Cooper River).
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	Lower Salmon La Sac Road is a sole-source county road; assumed that the road would be maintained in the event of channel migration. Upper Salmon La Sac Road, which is located entirely within National Forest land, was not identified as a DMA feature.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.4 Coal Creek

Coal Creek-TIER 2 (Map Folio Page 67)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	I-90 borders the creek; assumed that the interstate would be maintained in the event of channel migration.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	None identified.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography.

C.2.5 Cooper River

Cooper River-TIER 2 (Map Folio Pages 65-66)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Two subunits were identified within the analysis area: break identified based upon change in channel sinuosity (upstream of the river's outline into Cooper Lake).
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	None identified.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and evidence of relic channel observed on air photos.

C.2.6 Gold Creek

Gold Creek-TIER 2 (Map Folio Page 67)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	None identified.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.7 Little Naches River and tributaries

Little Naches River and tributaries-TIER 2 (Map Folio Pages 68-73)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Four subunits were identified in the analysis length of the river. Breaks based primarily on large changes in valley width and confluences with major tributaries.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	No DMAs identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped mass-wasting deposits. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium. A portion of the Little Naches River forms the boundary between Kittitas and Yakima counties. CMZ areas within Yakima County were not delineated.

C.2.8 Log Creek

Log Creek-TIER 2 (Map Folio Page 61)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	None identified.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.9 Manastash Creek

Manastash Creek-TIER 1 (Map Folio Pages 26-28)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 1 section, as the analysis length is relatively short and conditions are similar.
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included main and distributary channels judged to be frequently activated. This included distributary channels occurring within the alluvial fan.
Avulsion Hazard Areas	Taken from existing meander bend apex downstream if there is a relict channel or swale judged to be within the inundation area shown by the relative water surface elevations.	Extensive avulsion hazard areas were identified on the alluvial fan.
Alluvial Fans	Sketched over geologic and topographic data sources.	The Manastash alluvial fan was mapped based on topography and aerial photographs, representing the majority of the overall CMZ in this instance.
Erosion Hazard Buffer – from the Active Channel	Buffer from active channel, calculated by stream subunit.	The EHA buffer was not used within the alluvial fan portion of the Manastash CMZ. The ACC width was used to approximate the overall CMZ in the two main channels extending downstream from the alluvial valley to the mainstem Yakima River.
Erosion Hazard Buffer – Avulsion hazard areas	Typically from aerial photo evidence or relative water surface elevations or LiDAR information.	Subsumed within the overall alluvial fan mapping. Agricultural land conversion is assumed to limit avulsion potential in the downstream segments.

Manastash Creek-TIER 1 (Map Folio Pages 26-28)		
Element	**Source/development**	**Notes**
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel, alluvial fan, and avulsion hazard zones) described above.	The lower subunit was based primarily on an EHA buffer from the relatively incised primary channels. The upper portion of the Tier 1 CMZ encompasses the entire alluvial fan. The CMZ delineation was terminated to the north, as the flow potential in this direction is unknown; therefore the CMZ hazard are may extend past this area.
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways)	No DMAs were identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	The Tier 1 area occurs on a terrace that does not extend to the valley margin, so no geotechnical hazard flags were mapped here.

Manastash Creek-TIER 2 (Map Folio Pages 28-29)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped mass-wasting deposits. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.10 Manastash Creek, S. Fork

Manastash Creek, S. Fork-TIER 2 (Map Folio Pages 29-33)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Three subunits were identified along the creek length: breaks identified based upon relatively short stretches of stream that do not have migration potential.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mass-wasting deposits. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.11 Swauk Creek

Swauk Creek-TIER 1 (Map Folio Pages 13, 38-39)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Seven subunits were identified in the Tier 1 section, with breaks typically occurring at geologic constrictions of the valley, or distinct changes in channel form.
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included bars and secondary channels judged to be frequently activated. This included secondary channels connected to the mainstem with evidence of engagement in recent high flow events.
Alluvial Fans	Sketched over geologic and topographic data sources.	Alluvial fans from tributaries were identified adjacent to the CMZ as channel change is often rapid in these areas, and these areas have the potential for significant sediment input to the main channel.
Erosion Hazard Buffer – from the Active Channel	250 to 400 foot buffer from active channel, calculated by stream subunit.	Based on width measurements, the active channel meander amplitude typically ranged from 180 to 340 feet. This initial EHA width was rarely noted as the extent of the CMZ along Swauk.
Erosion Hazard Buffer – Avulsion hazard areas	Typically from aerial photo evidence or relative water surface elevations or LiDAR information.	Avulsion hazards extended well beyond the ACC and initial EHA width in the broad alluvial portions of Swauk Creek. These features are typically swales or channels mapped within 5 vertical feet of the active channel in the relative water surface elevations dataset.

Swauk Creek-TIER 1 (Map Folio Pages 13, 38-39)		
Element	**Source/development**	**Notes**
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel and avulsion hazard zones) described above.	The overall CMZ along Swauk typically included the entire alluvial valley in broader reaches based on the presence of avulsion hazards throughout the valley. In more confined portions of the valley, the initial EHA often extended past the valley walls, so the CMZ delineation was extended to the top of the wall.
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways).	A disconnected area was noted at the upstream extent of the Tier 1 mapping near HWYs 970 and 97
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Several identified in sedimentary and glacial rock deposits.

Swauk Creek-TIER 2 (Map Folio Pages 39-42)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	US 97 borders the creek; many DMAs are present. It is assumed that the highway would be maintained in the event of channel migration.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	None identified.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.12 Taneum Creek

Taneum Creek-TIER 1 (Map Folio Pages 12, 34)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Six subunits were identified in the Tier 1 section of the creek: breaks identified based on change in valley width and channel plan form
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included bars and secondary channels judged to be frequently activated.
Alluvial Fans	Sketched over geologic and topographic data sources.	Alluvial fans from tributaries were identified adjacent to the CMZ as channel change is often rapid in these areas, and these areas have the potential for significant sediment input to the main channel.
Erosion Hazard Buffer – from the Active Channel	Buffer from active channel, calculated by stream subunit.	Based on width measurements, the active channel meander amplitude typically ranged from 140 to 320 feet. These calculations were performed by geomorphic subunit, then used as an initial buffer from the ACC.
Erosion Hazard Buffer – Avulsion hazard areas	Identified in aerials or relative water surface elevations data.	Extensive avulsion hazard areas were identified on the alluvial valley, with most extending outside the ACC plus an EHA based on the meander amplitude. Avulsion potential was identified in a broad alluvial valley upstream of I90, but the LiDAR data did not cover the entire valley to the wall in this location. This mapping was conservatively placed at the valley wall based on the tight meander bend at the upstream portion of the reach. Avulsion hazards were considered to be significant in this reach given evidence of significant landsliding and therefore sediment source in the upper watershed, as well as the

Taneum Creek-TIER 1 (Map Folio Pages 12, 34)		
Element	**Source/development**	**Notes**
		significant watershed area.
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel and avulsion hazard zones) described above.	In the lower subunits, the initial EHA intersected the valley wall, which also exhibited some scalloping, so the overall CMZ was extended to include the entire valley below I-90. The upper reach was extended to the valley margins based on avulsion hazards and lack of topographic information at the valley margin.
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways)	DMAs were identified in the lower subunit, associated with I-90. It is assumed that I-90 would be protected against channel migration.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with taller terrace composed of landslide, sedimentary rock, or glacial outwash materials or where past erosion of the valley margin is evident. These areas would require more detailed analysis to determine appropriate management measures.

Taneum Creek-TIER 2 (Map Folio Pages 34-37)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were not identified in the Tier 2 section, as the analysis length is relatively short and conditions are similar.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock, glacial deposits, or mass-wasting deposits. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography.

C.2.13 Teanaway River

Teanaway River-TIER 1 (Map Folio Pages 15, 43-46)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Five subunits were identified along the Tier 1 section of the mainstem Teanaway River, primarily based on sinuosity, and presence/absence of active gravel bars.
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included bars and secondary channels judged to be frequently activated. This included secondary channels connected to the mainstem with evidence of engagement in recent high flow events.
Avulsion Hazard Areas	Included locations from 1950s aerials showing main channel outside existing active channel. Taken from existing meander bend apex downstream if there is a relict channel or swale judged to be within the inundation area shown by the relative water surface elevations	Extensive avulsion hazard areas were identified on the alluvial valley, with most extending outside the ACC plus an EHA based on the meander amplitude.
Alluvial Fans	Sketched over geologic and topographic data sources.	Alluvial fans from tributaries were identified adjacent to the CMZ as channel change is often rapid in these areas, and these areas have the potential for significant sediment input to the main channel.
Erosion Hazard Buffer – from the Active Channel	250 to 400 foot buffer from active channel, calculated by stream subunit.	Based on width measurements, the active channel meander amplitude typically ranged from 150 to 400 feet. These calculations were performed by geomorphic subunit, then used as an initial buffer from the ACC.
Erosion Hazard Buffer – Avulsion hazard areas	Variable buffer from Avulsion Hazard Areas.	Incorporated on the outside (away from active channel) edge of avulsion hazard areas.

Teanaway River-TIER 1 (Map Folio Pages 15, 43-46)		
Element	**Source/development**	**Notes**
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel and avulsion hazard zones) described above.	Typically, a 300 foot erosion hazard buffer was applied to the river left bank, and 150 feet were applied to the river right bank to capture the greater potential for migration into the alluvial valley. The 300 foot buffer was then inspected against geomorphic features such as relict channels and low areas on the floodplain that present avulsion hazard risks, and the
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways)	DMAs were identified in the lower subunits. The largest area was delineated on the landward side of Red Bridge Road. Smaller DMAs were identified along Teanaway Road. A potential DMA exists north of SR 970, but the channel appears to have the potential to avulse into the floodplain in the section between Red Bridge Road and SR 970, which would engage this area.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with taller terrace composed of landslide, sedimentary rock, or glacial outwash materials or where past erosion of the valley margin is evident. These areas would require more detailed analysis to determine appropriate management measures.

C.2.14 Teanaway River, Middle Fork

Teanaway River, Middle Fork-TIER 2 (Map Folio Pages 46, 51-53)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were typically not identified in the Tier 2 sections, as the width of the CMZ closely resembles the valley bottom, rather than relying on meander amplitude widths.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.15 Teanaway River, N. Fork and N. Fork U.T.

Teanaway River, N. Fork and N. Fork U.T.-TIER 2 (Map Folio Pages 46-49)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were typically not identified in the Tier 2 sections, as the width of the CMZ closely resembles the valley bottom, rather than relying on meander amplitude widths.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	NF Teanaway Road is a sole-source county road; assumed that the road would be maintained in the event of channel migration.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.16 Teanaway River, W. Fork

Teanaway River, W. TIER 2 (Map Folio Pages 46, 50, 54)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were typically not identified in the Tier 2 sections, as the width of the CMZ closely resembles the valley bottom, rather than relying on meander amplitude widths.
Disconnected Migration Areas	Sketched along inside edge of road, using air photo.	None identified.
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with steep slopes and mapped sedimentary rock. These areas would require more detailed analysis to determine appropriate management measures.
Tier 2 Channel Migration Zone	Sketched edge of valley bottom, using air photo, 10-m DEM, DNR 1:100,000 geology mapping, and 7.5 minute USGS topo map (10 foot contours).	CMZ determined based primarily by topography and mapped extent of alluvium.

C.2.17 Yakima River

Yakima River-TIER 1 (Map Folio Pages 1-25)		
Element	**Source/development**	**Notes**
Subunits	Identified along the active channel based on geomorphic channel characteristics such as sinuosity, channel type, overall valley confinement, and gradient.	Subunits were identified along the Tier 1 section of the mainstem Yakima River, primarily based on sinuosity, and overall channel plan form. These delineations were intended to be generally equivalent to previous geomorphic investigations performed by CWU in the 'Reaches' project (CITE).
Active Channel Corridor	Digitized from 2011 aerial photo and relative water surface elevations	Active channel included bars and secondary channels judged to be frequently activated. This included secondary channels connected to the mainstem with evidence of engagement in recent high flow events.
Alluvial Fans	Sketched over geologic and topographic data sources.	Alluvial fans from tributaries were identified adjacent to the CMZ as channel change is often rapid in these areas, and these areas have the potential for significant sediment input to the main channel.
Erosion Hazard Buffer – from the Active Channel	Initial buffer from active channel, calculated by stream subunit.	These calculations were performed by geomorphic subunit, then used as an initial buffer from the ACC.
Erosion Hazard Buffer – Avulsion hazard areas	Identified using aerial photographs and the relative water surface elevations or LiDAR information.	Extensive avulsion hazard areas were identified in portions of the alluvial valley, with most extending outside the ACC plus an EHA based on the meander amplitude.

Yakima River-TIER 1 (Map Folio Pages 1-25)		
Element	**Source/development**	**Notes**
Tier 1 Channel Migration Zone	Sketched along outside edge of the full EHA (from both the active channel and avulsion hazard zones) described above.	The overall CMZ for the mainstem Yakima displayed three general patterns: 1. For much of the mainstem Yakima, avulsion hazard areas extend beyond the initial EHA area, representing by swales and secondary channels within 5 vertical feet of the mainstem as represented in the relative water surface elevations dataset. 2. In a number of confined reaches, the overall CMZ extends beyond the valley walls based on the initial EHA. This includes the reaches confined in canyons. 3. In reaches where the present channel has created an inset floodplain in glacial or other deposits, as near the confluence with the Manastash, the CMZ is limited to the inset floodplain. An additional erosion buffer is included where the terrace can be eroded, generally equivalent to half the EHA.
Disconnected Migration Area	Areas within the overall CMZ that are separated from the existing main channel by a linear feature that is likely to be maintained in the future (e.g., sole-source county roads and state highways)	Significant areas of DMA were along the I-90 corridor, I-82, SR 10, SR 970, BNSF railroad, and Canyon Road. A potential DMA exists in the City of Ellensburg, but the channel appears to have the potential to avulse to the north side of the highway upstream of the town (near Gladmar Rd bridge), so this area was not included in a DMA.

Yakima River-TIER 1 (Map Folio Pages 1-25)		
Element	**Source/development**	**Notes**
Geotechnical Hazard Flag	Sketched in locations where the CMZ intersects the valley wall.	Identified for locations with taller terrace composed of landslide, sedimentary rock, or glacial materials or where past erosion of the valley margin is evident. These areas would require more detailed analysis to determine appropriate management measures.

GLOSSARY

- A -

Accretion means the process of growing or increasing by the gradual accumulation of additional layers, such as layers of sediment.

Adverse Impact means an impact that can be measured or is tangible and has a reasonable likelihood of causing moderate or greater harm to ecological functions or processes or other elements of the shoreline environment.

Aeolian means produced by the wind.

Agriculture is the cultivation of animals, plants, fungi and other life forms for food, fiber, and other products used to sustain life**.**

Alluvial Fan means a fan-shaped deposit of sediment and organic debris formed where a stream flows or has flowed out of a mountainous upland onto a level plain or valley floor. Sediment is deposited because of a sudden change in sediment transport capacity (e.g., significant change in slope or confinement).

Alluvium is a general term for clay, silt, sand, gravel, or similar other unconsolidated materials, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi-sorted sediment in the bed of the stream or on its floodplain or delta.

Alteration means any human-induced change in an existing condition. Alterations include, but are not limited to, grading, filling, channelizing, dredging, clearing (vegetation), draining, construction, compaction, excavation, or any other activity that changes the character of the area.

AMSL means above mean sea level.

Anadromous Fish means fish species that spend most of their life cycle in salt water, but return to fresh water to reproduce.

Anticlinal means occurring at right angles.

Armoring means the addition of structures or material along the shoreline to decrease the impact of waves and currents or to prevent the erosion of banks or bluffs.

Associated Wetlands means wetlands that are in proximity to and either influence or are influenced by a shoreline stream, lake or tidal water. This influence includes, but is not limited to, one or more of the following: periodic inundation, location within a floodplain, or hydraulic continuity (WAC 173-22-040).

Avulsion means a sudden cutting off or separation of land by a flood breaking through a meander or by a sudden change in current whereby the stream deserts its old channel for a new one.

- B -

Bank is the terrain alongside the bed of a river, creek, or stream.

Base Flow is the portion of streamflow that comes from "the sum of deep subsurface flow and delayed shallow subsurface flow."

Basin means the area drained by a river and its tributaries or a depressed area with no surface outlet.

Benthic is the ecological region at the lowest level of a body of water such as an ocean or a lake, including the sediment surface and some sub-surface layers.

Biota is the plant and animal life of a region.

Boat Ramp means an inclined slab, set of pads, rails, planks, or graded slope used for launching boats with trailers or occasionally by hand.

BPA means Bonneville Power Administration.

Buffer means the area adjacent to a shoreline and/or critical area that separates and protects the area from adverse impacts associated with adjacent land uses.

Bulkhead means a wall-like shoreline structure, such as a revetment, that is placed parallel to the shoreline (at or near the OHWM) primarily for stabilizing shorelines, retaining uplands and fills prone to sliding or sheet erosion, and protecting uplands and fills from erosion by waves or currents.

- C -

Candidate means a species considered for listing as threatened or endangered under the Endangered Species Act, indicating that there is a possibility that the species has potential to be at risk of becoming threatened or endangered in the foreseeable future.

CESRF means Cle Elum Supplementation and Research Facility.

cfs means cubic feet per second.

Channel Migration Zone means the area along a river or stream within which the channel can reasonably be expected to migrate over time as a result of normally occurring processes. It encompasses the area of current and historic lateral stream channel movement that is subject to erosion, bank destabilization, rapid stream incision, and/or channel shifting, as well as adjacent areas that are susceptible to channel erosion.

Channelization means the straightening, relocation, deepening or lining of stream channels, including construction of continuous revetments or levees, for the purpose of preventing gradual, natural stream meander and progression.

Climate encompasses the statistics of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elemental measurements in a given region over long periods of time.

CMZ means Channel Migration Zone.

Comprehensive Plan means the guiding policy document for all land use and development regulations in a defined area and for regional services throughout the area including transit, parks, trails, utilities, environment and natural resources protection, cultural resource protection, and providing open space.

Confined Aquifer means an aquifer that has an overlying layer of impermeable material such as rock or clay, that prevents water from infiltrating to the aquifer directly through surface soils.

Confluence means a place of meeting of two or more streams; the point where a tributary joins the main stream.

Conifer cone-bearing seed plants with vascular tissue; all extant conifers are woody plants, the great majority being trees.

Conservation means the prudent management of rivers, streams, wetlands, wildlife and other environmental resources in order to preserve and protect them. This includes the careful use of natural resources to prevent depletion or harm to the environment.

Contaminant means any chemical, physical, biological, or radiological substance that does not occur naturally in groundwater, air, or soil or that occurs at concentrations greater than natural levels.

County means Kittitas County, Washington.

CRBG means Columbia River Basalt Group.

Critical Aquifer Recharge Area or CARA means an area with a critical recharging effect on aquifers used for potable water, including areas where an aquifer that is a source of drinking is vulnerable to contamination that would affect the potability of the water, or is susceptible to reduced recharge (WAC 365-190-030(3)).

Critical Areas includes the following areas and ecosystems: (a) wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas; (d) frequently flooded areas; and (e) geologically hazardous areas. “Fish and wildlife habitat conservation areas” does not include such artificial features or constructs as irrigation delivery systems, irrigation infrastructure, irrigation canals, or drainage ditches that lie within the

boundaries of and are maintained by a port district or an irrigation district or company.

Critical Habitat means habitat areas with which endangered, threatened, sensitive or monitored plant, fish, or wildlife species have a primary association (e.g., feeding, breeding, rearing of young, migrating). Such areas are identified herein with reference to lists, categories, and definitions promulgated by the Washington Department of Fish and Wildlife as identified in WAC 232-12-011 or 232-12-014; in the Priority Habitats and Species (PHS) program of the Department of Fish and Wildlife; or by rules and regulations adopted by the U.S. Fish and Wildlife Service, National Marine Fisheries Service, or other agency with jurisdiction for such designations.

CSIR means Central Washington University's Center for Spatial Information and Research.

Culvert is a device used to channel water.

- D -

Dam means a barrier or controlling and appurtenant works across a stream or river that does or can confine, impound, or regulate flow or raise water levels for purposes such as flood or irrigation water storage, erosion control, power generation, or collection of sediment or debris.

DDD means dichloro-diphenyl-dichloroethane.

DDE means dichloro-diphenyldichloro-ethylene.

DDT means dichloro-diphenyl-trichloroethane.

Degradation means to lower, or make inferior, the function(s) of the shoreline or natural resources. As it pertains to riverine morphology, "degredation" means the lowering of a streambed due to such factors as increased scouring.

Denitrification means the conversion of nitrate (NO_3^-) to gaseous nitrogen (N_2) by bacteria. In wetlands and riparian zones, denitrification can remove excess nitrogen resulting from agricultural runoff and residential fertilizers.

Deposition means the laying, placing, or accumulation of any material.

Delta means the landform at the mouth of a river.

Detrital as it pertains to geology is the adjective form of "detritus," which is loose rock or mineral material that is worn off or removed by mechanical means; especially fragmented material such as sand, silt, and clay that is derived from older rocks and moved from its place of origin.

Development means a use consisting of the construction or exterior alteration of structures, dredging, drilling, dumping, filling; removal of any sand, gravel or minerals; bulkheading; driving of pilings; placing of obstructions; or any project of a permanent or temporary nature that interferes with the normal public use of the surface of the waters overlying lands subject to the Shoreline Management Act at any stage of water level.

Dike or **Diking** means an artificial wall, embankment, ridge, or mound, usually of earth or rock fill, built around a relatively flat, low lying area to protect it from flooding.

Dissolved Oxygen means the amount of oxygen, in parts per million by weight, dissolved in water, generally expressed in milligrams per liter (mg/L).

Distinct Population Segment or **DPS** means a subgroup of a vertebrate species that is treated as a species for purposes of listing under the Endangered Species Act. It is required that the subgroup be separable from the remainder of and significant to the species to which it belongs.

Dock means all platform structures or anchored devices in or floating upon waterbodies to provide moorage for pleasure crafts or landing for water-dependent recreation, including but not limited to floats, swim floats, floatplane moorages, and water ski jumps. Launch ramps are excluded.

Dredging is the removal or excavation of bottom sediments and is carried out at least partly underwater.

- E -

Ecological Functions or **Shoreline Functions** means the work performed or role played by the physical, chemical, and biological processes that contribute to the maintenance of the aquatic and terrestrial environments that constitute the shoreline's natural ecosystem. See WAC 173-26-201 (2)(c). Functions include, but are not limited to, habitat diversity and food chain support for fish and wildlife, groundwater recharge and discharge, high primary productivity, low flow stream water contribution, sediment stabilization and erosion control, storm and floodwater attenuation and flood peak desynchronization, and water quality enhancement through biofiltration and retention of sediments, nutrients, and toxicants. These beneficial roles are not listed in order of priority.

Ecology means Washington State Department of Ecology.

Ecoregion is a large area of land or water containing geographically distinct assemblage of species and communities.

Ecosystem is a biological environment consisting of all the organisms living in a particular area, as well as all the nonliving, physical components of the environment with which the organisms interact, such as air, soil, water and sunlight.

Ecosystem Processes or **Ecosystem-wide Processes** means the suite of naturally occurring physical and geologic processes of erosion, transport, and deposition; they can include specific chemical processes that shape landforms within a specific shoreline ecosystem and determine both the types of habitat and the associated ecological functions.

Ecotone is a transitional area between different ecosystems.

Embankment means a linear structure, usually of earth or gravel, constructed to extend above the natural ground surface and designed to prevent water from overflowing a level tract of land.

Emergent means non-woody, erect wetland plant species that typically grow emerging from flooded areas and shallow marshes.

Emergent Wetland means a wetland with at least 30 percent of the surface area covered by erect, rooted, herbaceous vegetation as the uppermost vegetative strata.

Endangered as it relates to species or habitats means listed and protected under the Endangered Species Act, indicating that the described species is in danger of extinction throughout all or a significant portion of its range.

Enhancement means actions performed within an existing degraded shoreline, critical area and/or buffer to intentionally increase or augment one or more functions or values of the existing area. Enhancement actions include, but are not limited to, increasing plant diversity and cover, increasing wildlife habitat and structural complexity (snags, woody debris), installing environmentally compatible erosion controls, or removing non-indigenous plant or animal species.

Environment Designation means a categorical classification of a land parcel that reflects the biological and physical character of the shoreline, as well as the type of development that has or should take place in a given area.

Erosion means a process whereby wind, rain, water and other natural agents mobilize, transport, and deposit soil particles.

ESA means Environmental Science Associates.

Escapement means that portion of an anadromous fish population that escapes the commercial and recreational fisheries and reaches the freshwater spawning grounds.

Evapotranspiration is a term used to describe the sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.

Evolutionarily Significant Unit or ESU means a population of organisms that is considered distinct for purposes of conservation. Delineating ESUs is important when considering conservation actions. This term can apply to any species, subspecies, geographic race, or population.

- F -

FC or Fecal Coliform means a group of bacteria that are commonly associated with feces produced by humans, mammals and birds and that can be found in untreated sewage water.

FEMA means Federal Emergency Management Agency.

FERC means Federal Energy Regulatory Commission.

Fill means any solid or semi-solid material that when placed, changes the grade or elevation of the receiving site, including the addition of soil, sand, rock, gravel, sediment, earth retaining structure, or other material to an area waterward of the OHWM, in wetlands, or on shorelands in a manner that raises the elevation or creates dry land.

Fish and Wildlife Habitat Conservation Areas (FWHCA) are areas that serve a critical role in sustaining needed habitats and species for the functional integrity of the ecosystem, and which, if altered, may reduce the likelihood that the species will persist over the long term. These areas may include, but are not limited to, rare or vulnerable ecological systems, communities, and habitat or habitat elements including seasonal ranges, breeding habitat, winter range, and movement corridors; and areas with high relative population density or species richness. Counties and cities may also designate locally important habitats and species.

Float means a floating platform similar to a dock that is anchored or attached to pilings.

Flood or **Flooding** means a general and temporary condition of partial or complete inundation of normally dry land areas due to the overflow of inland waters and/or the unusual and rapid accumulation of runoff of surface waters from any source.

Floodplain or **FEMA Floodplain** means all federally-designated lands along a river or stream that may be inundated by the base flood of a river or stream.

Floodway means the area, as identified in a master program, that either:

1. has been established in federal emergency management agency flood insurance rate maps or floodway maps, or
2. those portions of a river valley lying streamward from the outer limits of a watercourse upon which flood waters are carried during periods of flooding that occur with reasonable regularity, although not necessarily annually

Flow Regime encompasses the following characteristics of stream flow and their interactions: magnitude, timing, frequency, duration, and rate of change.

Fluvial means of or pertaining to a river; a system that is influenced by a river or rivers.

Food Web is a map that depicts who eats whom in an ecological community.

Forest Land means all land that is capable of supporting a merchantable stand of timber and is not being actively used, developed, or converted in a manner that is incompatible with timber production.

Forested Wetland means a wetland that supports a forested canopy over more than 30 percent of the habitat area as defined by the U.S. Fish and Wildlife Service Classification System for wetlands.

Frequently Flooded Areas means lands in the floodplain subject to a one percent or greater chance of flooding in any given year, or within areas subject to flooding due to high groundwater, and those lands that provide important flood storage, conveyance and attenuation functions. These areas include, but are not limited to, streams, rivers, lakes, wetlands, and areas where high groundwater forms ponds on the ground surface, as designated and classified by a local government in accordance with WAC 365-190-110. Classifications of frequently flooded areas include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program.

- G -

GDE means groundwater dependent ecosystems.

Geologically Hazardous Areas means areas that, because of their susceptibility to erosion, sliding, earthquake, or other geological events, pose unacceptable risks to public health and safety and may not be suited for commercial, residential, or industrial development.

Glacial Outwash means the stratified detritus (chiefly sand and gravel) removed from a glacier by meltwater streams and deposited in front of or beyond the terminal moraine or along the margin of an active glacier.

Glacial Plain is an extensive flat plain of glacial till that forms when a sheet of ice becomes detached from the main body of a glacier and melts in place depositing the sediments it carried.

Glacial Till is unsorted glacial sediment.

Glaciation means having been covered with a glacier or subject to glacial epochs in the past.

Gradient means the degree of inclination, or rate of ascent or descent, of an inclined part of the earth's surface with respect to the horizontal; it is the steepness of a slope. It is expressed as a ratio (vertical to horizontal), a fraction (such as meters/ kilometers or feet/miles), a percentage (of horizontal distance), or an angle (in degrees).

Groundwater means all the water that exists beneath the land surface or beneath the bed of any stream, lake or reservoir, or other body of surface water, whatever may be the geological formation or structure in which such water stands or flows, percolates, or otherwise moves.

- H -

Habitat means the natural environment in which an organism normally lives or occurs.

Hazardous Area means any shoreline area which is hazardous for intensive human use or structural development due to inherent and/or predictable physical conditions such as, but not limited to, geologically hazardous areas, frequently flooded areas, and coastal high hazard areas.

Headwater means the source and upper part of a stream, especially of a large stream or river, including the upper drainage basin.

Historic Site means those sites that are eligible or listed on the Washington Heritage Register, National Register of Historic Places or any developed historic registry formally adopted by a local government.

Hydraulics is a topic in applied science and engineering dealing with the mechanical properties of liquids.

Hydric Soil means a soil that is saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part. The presence of hydric soil shall be determined following the methods described in the approved federal wetland delineation manual and applicable regional supplements, pursuant to WAC 173-22-035.

Hydrology means of or pertaining to the movement, distribution or quality of water on the earth.

Hydromodification means a human-made alteration to a streambank that changes or affects the natural flow of water through the channel/stream corridor. Bank armoring, levees, revetments and channelization are examples of hydromodifications.

Hyporheic refers to the saturated soil environment around a stream or river that exchanges water, nutrients, and organisms with surface waters.

- I -

ICR means Shoreline Inventory and Characterization Report.

Impairment means damage that compromises or reduces the strength or quality of the item. It is commonly used as a classification of water under the Clean Water Act

meaning poor water quality.

Impervious Surface means a hard surface area that either prevents or retards the entry of water into the soil mantle. Common impervious surfaces may include, but are not limited to, rooftops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam or other surfaces which similarly impede the natural infiltration of stormwater. Impervious surfaces do not include surfaces created through proven low impact development techniques.

Industrial refers to the production of an economic good (either material or a service) within an economy.

Intermittent refers to streams that flow during only part of the year (i.e., seasonal streams).

Inundation means spreading of water over land that is not normally submerged.

Invasive Species means a species that is (1) non-native (or alien) to a specific geographic area; and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

Invertebrate is an animal without a backbone.

- J -

Juvenile Salmon are immature salmon; fry.

- K -

KRD means Kittitas Reclamation District.

- L -

Lacustrine means pertaining to lakes.

Lake means a body of standing water in a depression of land or expanded part of a stream, of 20 acres or greater in total surface area, including reservoirs. A lake is bounded by the OHWM, or where a stream enters the lake, the extension of the lake's OHWM within the stream.

Landslide is a general term covering a wide variety of mass movement landforms and processes involving the downslope transport, under gravitational influence, of soil and rock material en masse; it includes debris flows, debris avalanches, earthflows, mudflows, slumps, mudslides, rockslides, and rock falls.

Landslide Hazard Areas means areas that, due to a combination of site conditions like slope inclination and relative soil permeability, are susceptible to mass wasting.

Large Woody Debris or **LWD** means the large trees, sticks and branches that fall into streams and rivers. They can divert water and provide microhabitats for organisms.

Limnetic means relating to the pelagic or open part of a body of fresh water.

Liquefaction means a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading.

Littoral means relating to or located on a shoreline.

Loess means wind-blown soil deposits.

- M -

MAF means million acre-feet.

Mean Annual Flow means the average flow of a river or stream (measured in cubic feet per second) from measurements taken throughout the year. If available, flow data for the previous 10 years should be used in determining mean annual flow.

Mesic refers to a moderately moist area.

Microclimate is a local atmospheric zone where the climate differs from the surrounding area.

Migration (salmonid) means the systematic movement of a salmon population from their natal freshwater streams, out to the open ocean, and back to the same stream where they hatched.

Mitigation means individual actions that may include a combination of the following measures, listed in order of preference:

- Avoiding an impact altogether by not taking a certain action or parts of actions;
- Minimizing impacts by limiting the degree or magnitude of an action and its implementation;
- Rectifying impacts by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time by preservation and maintenance operations during the life of the action;
- Compensating for an impact by replacing or providing substitute resources or environments; and
- Monitoring the mitigation and taking remedial action when necessary.

Mooring means the location where a vessel can fasten to a fixed object such as a pier or quay, or to a floating object such as an anchor buoy.

Moraine is any glacially formed accumulation of unconsolidated glacial debris (soil and rock) which can occur in currently glaciated and formerly glaciated regions, such as those areas acted upon by a past glacial maximum.

Mouth is a part of a stream where it pours into another stream, river, lake, reservoir, sea, or ocean.

- N -

Natal means relating to the time or place of birth.

Native Vegetation means plant species that are indigenous and historically found in the local area.

NFIP means National Flood Insurance Program.

Non-point Source means a diffuse source of contaminants, without a single point of origin, introduced into a receiving stream.

Nutrient Cycling is a pathway by which a chemical element or molecule moves through both biotic (biosphere) and abiotic (lithosphere, atmosphere, and hydrosphere) compartments of Earth.

Nutrient Loading is the increased nutrient (nitrogen and phosphorus) loading to waterbodies that leads to degraded water quality and ecosystem health**.**

- O -

OCPs means organochlorine pesticides.

Oligotrophic means low in nutrients.

Open Space means any parcel or area of land or water not covered by structures, hard surfacing, parking areas and other impervious surfaces except for pedestrian or bicycle pathways, or sites dedicated for active or passive recreation, visual enjoyment or critical area development buffers.

Ordinary High Water Mark or **OHWM** means that mark that will be found by examining the bed and banks of a lake or stream and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland, in respect to vegetation as that condition exists on June 1, 1971, as it may naturally change thereafter, or as it may change thereafter in accordance with approved development. In any area where the OHWM cannot be found, the OHWM adjoining fresh water shall be the line of mean high water. For braided streams, the OHWM is found on the banks forming the outer limits of the depression within which the braiding occurs.

ORV means off-road vehicle.

Overwater Structure means any manmade structure that hangs over a surface water body such as a dock, deck, bridge, or building.

- P -

Palustrine means wetlands that include inland marshes and swamps as well as bogs, fens, tundra and floodplains. Palustrine systems include any inland wetland which lacks flowing water, contains ocean-derived salts in concentrations of less than 0.05%, and is non-tidal.

Pathogen is a microbe or microorganism such as a virus, bacterium, prion, or fungus that causes disease in its animal or plant host.

PBDEs means polybrominated diphenyl ethers.

PCBs means polychlorinated biphenyls.

Perennial refers to a stream or river that flows year-round.

Physiography is one of the two major subfields of geography.

Pilings means either wood, reinforced concrete or steel cylinders that are driven deep and embedded into the ground to serve as an intrinsic part of a deep foundation for a structure.

Point Source means a stationary location or fixed facility from which contaminants are discharged; it is a single identifiable source of contamination.

Pool / riffle means an area of stream or river habitat, which is seemingly stagnant at the surface but in reality, water is flowing downstream. A riffle is an area where the water flows through the channel at a higher velocity due to a moderate gradient.

Precipitation is rain, sleet, hail, snow and other forms of water falling from the sky.

Pre-contact Materials means archeological items that originated prior to European contact.

Preservation means actions taken to ensure the permanent protection of existing, ecologically, culturally, or historically important areas, structures, or species that a local government has deemed worthy of long-term protection.

Primary Production is the production of organic compounds from atmospheric or aquatic carbon dioxide, principally through the process of photosynthesis.

Priority Habitat means a habitat type with a unique or significant value to one or more species. An area classified and mapped as priority habitat must have one or more of the following attributes: comparatively high fish or wildlife densities; comparatively high fish or wildlife species diversity; fish spawning habitat; important wildlife habitat; important fish or wildlife seasonal range; important fish

or wildlife movement corridors; rearing and foraging habitat; refuge; limited availability; high vulnerability to habitat alteration; unique or dependent species; or shellfish beds. A priority habitat may be described by its unique vegetation type or by a dominant plant species that is of primary importance to fish and wildlife (such as oak woodlands or eelgrass meadows). A priority habitat may also be described by a successional stage (such as old growth and mature forests). Alternatively, a priority habitat may consist of a specific habitat element (such as talus slopes, caves, snags) of key value to fish and wildlife. A priority habitat may contain priority and/or non-priority fish and wildlife (WAC 173-26-020(28).

Priority Species means species requiring protective measures and/or management guidelines to ensure their persistence at genetically viable population levels. Priority species are those that meet any of the criteria listed in WAC 173-26-020.

Protection means the practice of conserving and guarding valued resources in order to preserve and ensure their existence in the future.

Public Access means the public's right to get to and use the State's public waters, the water/land interface and associated shoreline area. It includes physical access that is either lateral (areas paralleling the shore) or perpendicular (an easement or public corridor to the shore), and/or visual access facilitated by scenic roads and overlooks, viewing towers and other public sites or facilities.

- R -

Ravine means a small, narrow, deep depression, smaller than a gorge or a canyon but larger than a gully; it is usually carved by running water.

Reach means a segment of shoreline and associated planning area that is mapped and described as a unit (for purposes of inventorying conditions) due to homogenous (similar) characteristics that include land use and/or natural environment characteristics.

Recharge means the process involved in the absorption and addition of water from the unsaturated zone to groundwater.

Reclamation means U.S. Bureau of Reclamation.

Recreation means an experience or activity in which an individual engages for personal enjoyment and health. Most shore-based recreation is outdoor recreation such as: fishing, hunting, clamming, beach combing, and rock climbing; various forms of boating, swimming, hiking, bicycling, horseback riding, camping, picnicking, watching or recording activities such as photography, painting, bird watching or viewing of water or shorelines, nature study and related activities.

Reestablishment as it pertains to natural resources means measures taken to intentionally restore an altered or damaged natural feature or process including:

- Active steps taken to restore damaged wetlands, streams, protected habitat, and/or their buffers to the functioning condition that existed prior to an unauthorized alteration;
- Actions performed to reestablish structural and functional characteristics of the critical area that have been lost by alteration, past management activities, or other events; and
- Restoration of wetland functions and values on a site where wetlands previous existed, but are no longer present due to lack of water or hydric soils.

Refuge means a place that provides shelter or protection from danger or distress.

Resident Fish means a fish species that completes all stages of its life cycle within fresh water and frequently within a local area.

Residential Development means buildings, earth modifications, subdivision and use of land primarily for human residence including, but not limited to, single-family and multifamily dwellings, mobile homes and mobile home parks, boarding homes, family daycare homes, adult family homes, retirement and convalescent homes, together with accessory uses common to normal residential use. Camping sites or clubs, recreational vehicle parks, motels, hotels and other transient housing are not included in this definition.

Restore, **Restoration** or **Ecological Restoration** means the reestablishment or upgrading of impaired ecological processes or functions. This may be accomplished through measures including, but not limited to, revegetation, removal of intrusive structures and removal or treatment of toxic materials. Restoration does not imply a requirement for returning ecological processes, functions or areas to aboriginal or pre-European settlement conditions.

Retention means the portion of rainfall that does not escape a drainage basin as surface runoff; some of the water is retained in local soils and aquifers.

Riprap means dense, hard, angular rock that can be used for revetments or other flood control works.

Riparian Corridor or **Riparian Zone** means the area adjacent to a waterbody (stream or lake) that contains vegetation that influences the aquatic ecosystem, nearshore area and/or fish and wildlife habitat by providing shade, fine or large woody material, nutrients, organic debris, sediment filtration, and terrestrial insects (prey production). Riparian areas include those portions of terrestrial ecosystems that significantly influence exchanges of energy and matter with aquatic ecosystems (i.e., zone of influence). Riparian zones provide important wildlife habitat. They provide sites for foraging, breeding and nesting; cover to escape predators or weather; and corridors that connect different parts of a watershed for dispersal and migration.

Riparian Vegetation means vegetation that tolerates and/or requires moist conditions and periodic free flowing water, thus creating a transitional zone between aquatic and terrestrial habitats which provides cover, shade and food sources for aquatic and terrestrial insects for fish species. Riparian vegetation and root systems stabilize streambanks, attenuate high water flows, provide wildlife habitat and travel corridors, and provide a source of limbs and other woody debris to terrestrial and aquatic ecosystems, which, in turn, stabilize streambeds.

RM or River Mile means the distance measured from the mouth of a river, traveling upstream.

Rootwad is the lower trunk and root fan of a large tree.

Runoff means surface waters that flow overland during rain events and storms.

- S -

Salmon or **Salmonid** is the common name for several species of fish of the family *Salmonidae*. The family includes salmon, trout, and char. Pacific salmon species are anadromous; they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce. Some species of sockeye and rainbow and cutthroat trout have nonanadromous populations.

Scrub-shrub Wetland means a class of wetland that is in a transition to becoming a forested wetland. It can have a variety of water regimes and is typified by a mix of woody and shrublike vegetation less than 20 feet tall.

Sediment Transport is the movement and carrying away of sediment by natural agents, especially the conveyance by stream.

Serpentine Soils are an uncommon type of soil found in mountainous areas. They are rocky soils with unique chemical concentrations that are not conducive to the growth of most plants. Certain plants are specially adapted to grow in serpentine areas.

Shoreline Environment Designation is a mechanism identifying specific shoreline areas for regulatory purposes as specified in WAC 173-26-211. Examples of designations include: Shoreline Residential, Rural Conservancy, Urban Conservancy, Natural, and Aquatic.

Shoreline Modification means any human activity that changes the structure, hydrology, habitat, and/or functions of a shoreline. Bulkheads, piers, docks, shoreline stabilization systems, berms, and dikes are all examples of shoreline modifications. Shoreline modifications can also include other actions, such as clearing, grading, or application of chemicals.

Shoreline Planning means to integrate the land use patterns, physical and biological characterizations, and relevant regulations and policies to help managers delineate and categorize development opportunities for a shoreline.

Shoreline Stabilization is structural or non-structural modifications to the existing shoreline intended to reduce or prevent erosion of uplands or beaches. They are generally located parallel to the shoreline at or near the OHWM.

Shorelands or Shoreland Areas mean those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the OHWM; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams, lakes and tidal waters which are subject to the provisions of Chapter 90.58 RCW.

Shorelines are all of the water areas of the state as defined in RCW 90.58.030, including reservoirs and their associated shorelands, together with the lands underlying them except:

- Shorelines of statewide significance;
- Shorelines on segments of streams upstream of a point where the mean annual flow is 20 cubic feet per second (cfs) or less and the wetlands associated with such upstream segments; and
- Shorelines on lakes less than 20 acres in size and wetlands associated with such small lakes.

Shoreline Jurisdiction means all shorelines of the state and shorelands.

Shorelines of Statewide Significance means the shorelines identified in RCW 90.58.030 which because of their elevated status require the optimum implementation of the Shoreline Management Act's policies. East of the Cascade crest, this includes all rivers with a mean annual flow of greater than 200 cfs and lakes with surface areas of 1,000 acres or more.

Shorelines of the State means the total of all "shorelines" and "shorelines of statewide significance" within the state subject to the Shoreline Management Act and its implementing mechanism, the Shoreline Master Program.

Sinuosity is a measure of deviation of a path between two points from the shortest possible path.

Site means a defined area that can include a parcel or combination of contiguous parcels, or right-of-way under the applicant's ownership.

Slope means the inclined surface of any part of the earth's surface, delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.

SMA means Shoreline Management Act.

Smolt means a young salmon or sea trout, about two years old, that is at the stage of development where it assumes the silvery color of the adult and is ready to migrate to the sea.

SMP means Shoreline Master Program

Spalling means breaking off in fragments.

Spatial is the boundless, three-dimensional extent in which objects and events occur and have relative position and direction.

Spawn is the eggs of aquatic animals.

Spring means a place where groundwater flows naturally from a rock or the soil onto the land surface or into a surface waterbody.

State Priority Habitat and Species are habitats and species considered to be priorities for conservation and management. Priority habitats are habitat types or elements with unique or significant value to a diverse assemblage of species. Priority species require protective measures for their survival due to their population status, sensitivity to habitat alteration, and/or recreational, commercial, or tribal importance.

Stormwater means water that accumulates on land as a result of storms and can include runoff from urban areas such as roads and roofs.

Streams are those areas where surface waters produce a defined channel or bed. A defined channel or bed is an area that demonstrates clear evidence of the annual passage of water and includes, but is not limited to, bedrock channels, gravel beds, sand and silt beds, and defined channel swales. The channel or bed need not contain water year-round. This definition includes drainage ditches or other artificial watercourses where natural streams existed prior to human alteration, and/or the waterway is used by anadromous or resident salmonid or other fish populations.

Structural Complexity is considered to be a measure of the number of different attributes present and the relative abundance of each of these attributes.

Structural Downfold means a folded geologic structure that is concave upward formed by tectonic processes. Also known as a syncline.

Substrate means the underlying bed layer that makes up the bottom of a lake or stream, frequently composed of rock, gravel, sand, organic material, or a combination of these materials.

- T -

Terminus is an extreme point or element**.**

Terrestrial refers to things related to land or the planet Earth.

Threatened means listed and protected under the federal Endangered Species Act, indicating that the described species is likely to become endangered in the foreseeable future.

TMDL means Total Maximum Daily Load.

303(d) list comprises those waters that are in the polluted water category, for which beneficial uses– such as drinking, recreation, aquatic habitat, and industrial use – are impaired by pollution.

Top means the top of a slope; or the highest point of contact above a landslide hazard area.

Topography is the study of Earth's surface shape and features.

Total Maximum Daily Load or **TMDL** is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet established water quality standards, and an allocation of that amount to the pollutant's sources. Water quality standards are set by States, Territories, and Tribes. They identify the uses for each waterbody, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing), and the scientific criteria to support that use. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources.

Tributary means a stream feeding, joining, or flowing into a larger stream or into a lake.

TWSA means Total Water Supply Available.

- U -

UGA means urban growth area.

Unconfined Aquifer means an aquifer that receives infiltration directly through the overlying soil.

Unconsolidated Material means loosely arranged, not stratified.

Upland means dry lands landward of OHWM.

Urban Growth Area (UGA) means a local government’s regulatory measure for delineating an area for urban growth over a period of time. Land within UGA boundaries is made available for urban levels of development, while land outside the UGA remains primarily for rural farming, forestry, or low-density residential development.

Utilities means all lines and facilities used to distribute, collect, transmit, or control electrical power, natural gas, petroleum products, information (telecommunications), water, and sewage.

- V -

VHG means vertical hydraulic gradient.

- W -

WAC means Washington Administrative Code.

Water-Dependent Use means a use that requires direct access to the water to accomplish its primary function. In other words, a use or portion of a use, which cannot exist in a location that is not adjacent to the water and which is dependent on the water by reason of the intrinsic nature of its operations. Examples include commercial fishing, marinas, aquaculture, shipbuilding yard, ferry terminal.

Water-Enjoyment Use means a use that does not require access to the water, but is enhanced by a waterfront location, such as a restaurant or aquarium. This includes uses that facilitate public access to the shoreline as a primary characteristic of the use; or uses that provide for recreational use or aesthetic enjoyment of the shoreline for a substantial number of people. The use must be open to the general public and the shoreline-oriented space within the project must be devoted to the specific aspects of the use that foster shoreline enjoyment.

Water-Related Use means a use that does not require direct access to the water, but provides goods or services associated with water-dependent uses (e.g., boater supply, kayak rental). In other words, a use or portion of a use which is not intrinsically dependent on a waterfront location but whose economic viability is dependent upon a waterfront location because:

> (a) The use has a functional requirement for a waterfront location such as the arrival or shipment of materials by water or the need for large quantities of water; or
> (b) The use provides a necessary service supportive of the water-dependent uses and the proximity of the use to its customers makes its services less expensive and/or more convenient.

Waterbody means a body of still or flowing water, identified at its outer limits by the OHWM.

Water Quality means the characteristics of water, including flow or amount and related physical, chemical, aesthetic, recreation-related, and biological characteristics.

Watershed means a geographic region within which water drains into a particular river, stream or body of water.

Watershed Processes are the movement of water, sediment, nutrients, pathogens, toxic, compounds, and wood through the landscape.

WDFW means Washington Department of Fish and Wildlife.

Wetlands means areas that are inundated or saturated by surface water or groundwater 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 non-wetland 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 non-wetland areas to mitigate the conversion of wetlands.

Windthrow means a natural process by which trees are uprooted or sustain severe trunk damage by the wind.

WRIA means Water Resource Inventory Area and refers to watersheds within the State of Washington.

WSDOT means Washington State Department of Transportation.

- Y -

YRBWEP means Yakima River Basin Water Enhancement Project.