

## CHAPTER 4. 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 Swauk Creek confluence (Figure 4-1). The X streams and X lakes within the upper county are described in terms of their physical characteristics, ecological conditions, and human environment/land use characteristics. Maps are provided in Appendix A.

### Insert Upper County figure

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, key physical, ecological, and land use. A description of the available data sources, including data limitations, is presented in Appendix B. Shoreline reaches that are located entirely on federal lands (e.g., National Forest lands) and therefore mostly not subject to shoreline jurisdiction do not have reach sheets and are only briefly described below.

### 4.1 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.

#### 4.1.1 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 4.2.

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).

## 4.1.2 Habitats and Species

### *Fish Use*

Keechelus Lake supports spawning of Dolly Varden/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 I-90 FEIS 2008, DEIS 2005). 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 I-90 DEIS 2005; FEIS 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 (Steelhead Recovery Plan 2009):

- Alteration of stream flows 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 (YRBS Vol 1 Reclamation and Ecology 2011).

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 (YRBS Vol 1 Reclamation and Ecology 2011).

### *Water Quality*

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

### *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. 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 I-90 DEIS 2005).

### *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 I-90 DEIS 2005).

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

### *Priority 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 I-90 DEIS 2005).

### 4.1.3 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.

### 4.1.4 Shoreline Function Analysis

*in progress*

### 4.1.5 Public Access

*public access analysis still in progress*

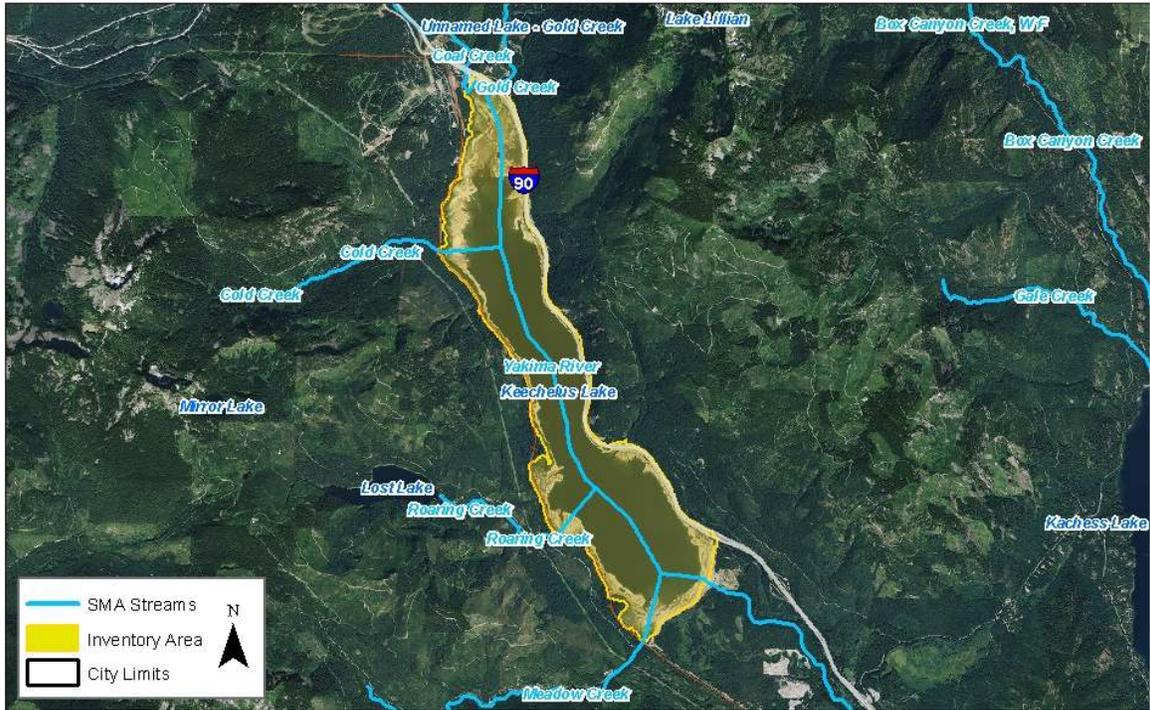
The John Wayne Pioneer Trail borders the western shore of the lake. A boat launch is also located on the western shore of the lake, which can be accessed from Forest Service Road 9070.

### 4.1.6 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 2,425 feet.

### LAND COVER (MAP X)

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.

### HAZARD AREAS (MAP X)

Roughly a 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.

### HABITATS AND SPECIES (MAP X)

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

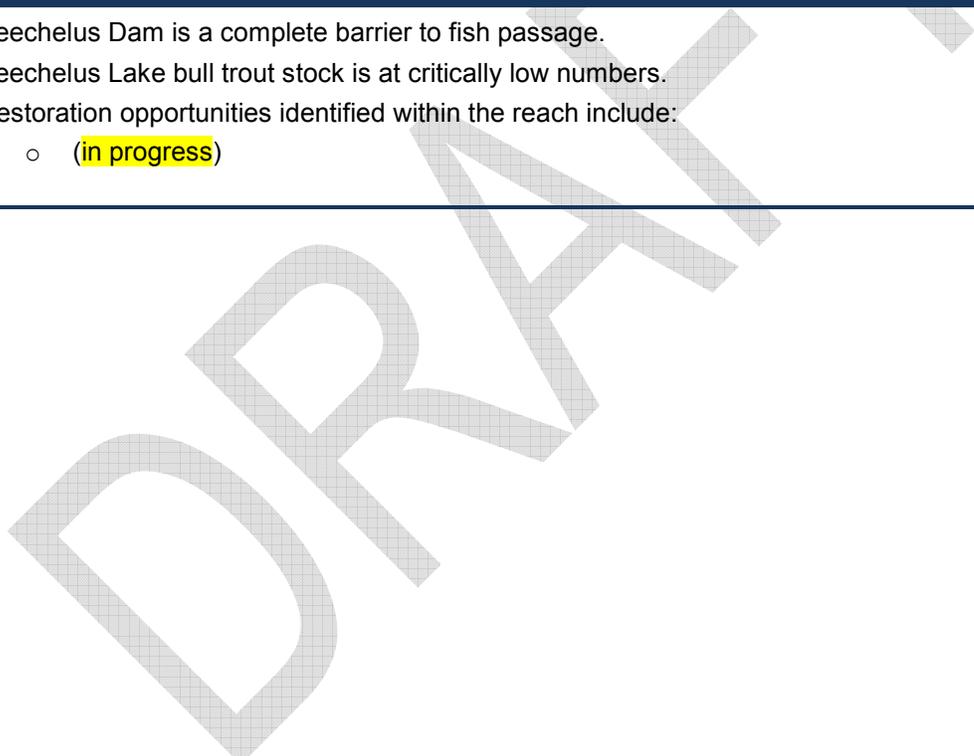
### WATER QUALITY

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

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.

<b>BUILT ENVIRONMENT AND LAND USE</b>	
<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The lake level is controlled by a dam (barrier to fish passage), and I-90 borders the eastern shore.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>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).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>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.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

<b>KEY MANAGEMENT ISSUES AND OPPORTUNITIES</b>
<ul style="list-style-type: none"> <li>• Keechelus Dam is a complete barrier to fish passage.</li> <li>• Keechelus Lake bull trout stock is at critically low numbers.</li> <li>• Restoration opportunities identified within the reach include:                             <ul style="list-style-type: none"> <li>○ (in progress)</li> </ul> </li> </ul>



## 4.2 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. Several of these water bodies are located on National Forest lands, including Meadow Creek, Cold Creek, Lost Lake, Mirror Lake, Alaska Lake, Joe Lake, and Lake Lillian.

### 4.2.1 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).

### 4.2.2 Habitats and Species

#### *Fish Use*

Table 4-1 summarizes mapped fish use in tributaries to Keechelus Lake. As discussed in Section 4.1.2, 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 (BOR, 2000; Harding, 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 I-90 DEIS 2005; WSDOT I-90 FEIS 2008).

As shown in Table 4-1, 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 I-90 DEIS 2005).

DRAFT

**Table 4-1. Fish Use in Keechelus Lake Tributaries (Source: StreamNet 2010)**

Species	Meadow Creek	Lost Lake	Cold Creek	Coal Creek	Gold Creek	Unnamed Lake - Gold Creek	Alaska Lake	Joe Lake	Lake Lillian
Dolly Varden/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



## *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 I-90 DEIS 2005)

## *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 4.2.3).

## *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 I-90 DEIS 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 I-90 DEIS 2005).

## *Priority Habitats and Species*

One marbled murrelet sighting has been recorded in the Gold Creek Valley (WSDOT I-90 DEIS 2005). This species is federally listed as threatened.

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 I-90 DEIS 2005).

### 4.2.3 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.

### 4.2.4 Shoreline Function Analysis

*in progress*

### 4.2.5 Public Access

*public access analysis still in progress*

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.

### 4.2.6 Reach Sheets

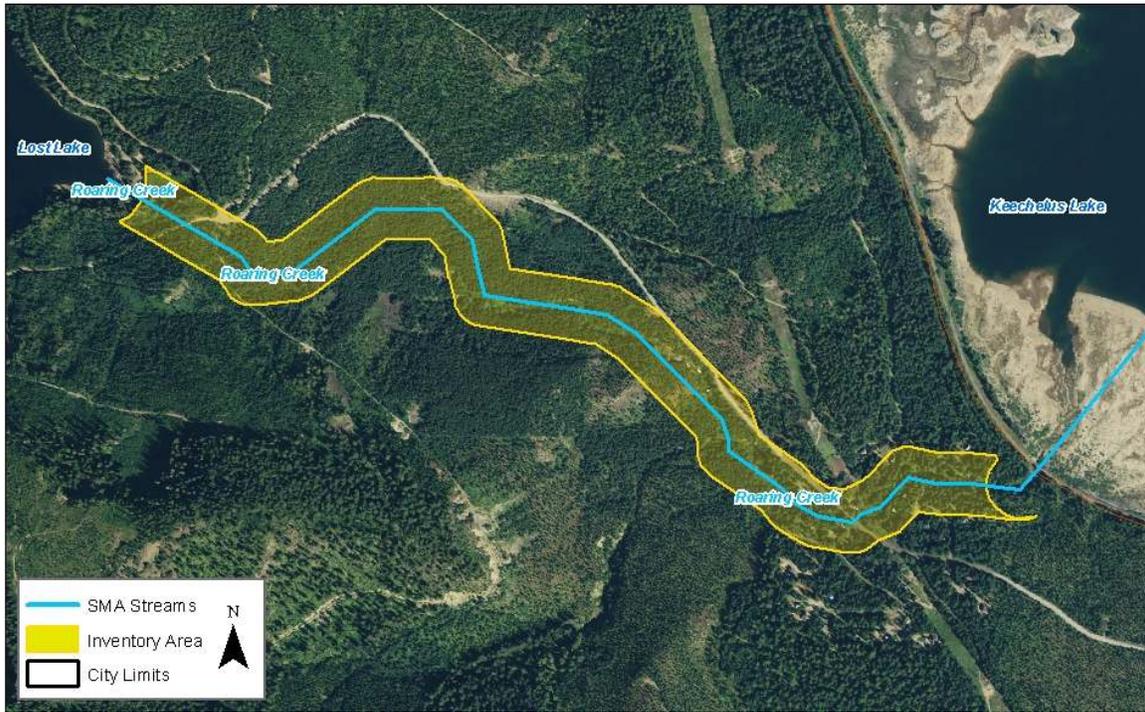
# ROARING CREEK

**SHORELINE LENGTH:**

1.3 Miles

**REACH INVENTORY AREA:**

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 X)**

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) Category 5 waters.

**LAND COVER (MAP X)**

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 X)**

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

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>There are no shoreline modifications identified within the reach.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>Land use within the reach is forestry (100%). Land ownership is 68% public and 32% public (Forest Service).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned for commercial forestry (97%) and other (3%).</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

## 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.
- Restoration opportunities identified within the reach include:
  - (in progress)

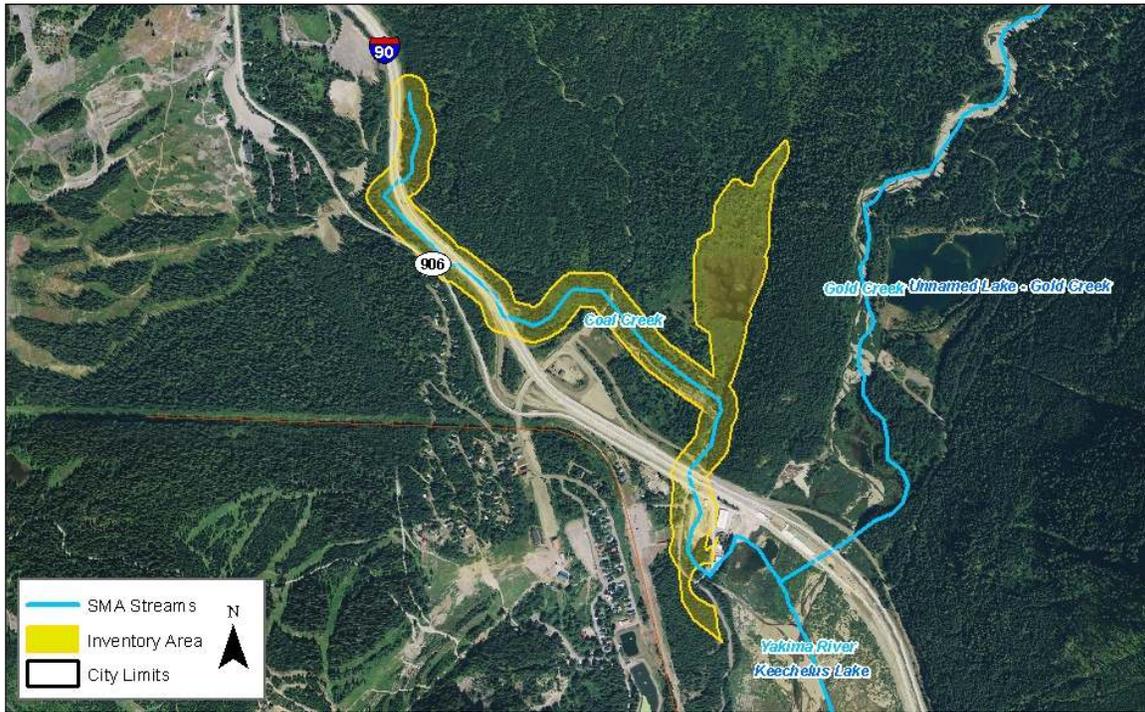
## COAL CREEK

**SHORELINE LENGTH:**

1.7 Miles

**REACH INVENTORY AREA:**

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.

**LAND COVER (MAP X)**

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%).

**HAZARD AREAS (MAP X)**

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. The reach has potential for channel migration.

**HABITATS AND SPECIES (MAP X)**

WDFW mapping shoes that the reach provides spawning habitat for Kokanee salmon. The presence of Dolly Varden/bull trout and westslope cutthroat is also mapped.

**WATER QUALITY**

The reach is not listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters.

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.

## BUILT ENVIRONMENT AND LAND USE

### SHORELINE MODIFICATIONS (MAP X)

Portions of the reach are constrained by I-90, and two culverts act as fish passage barriers.

### PUBLIC ACCESS (MAP X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

Land use within the reach is rural (100%). Land ownership is 88% private and 12% public (State and Forest Service).

### CONTAMINATED SITES (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## 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.
- Restoration opportunities identified within the reach include:
  - (in progress)

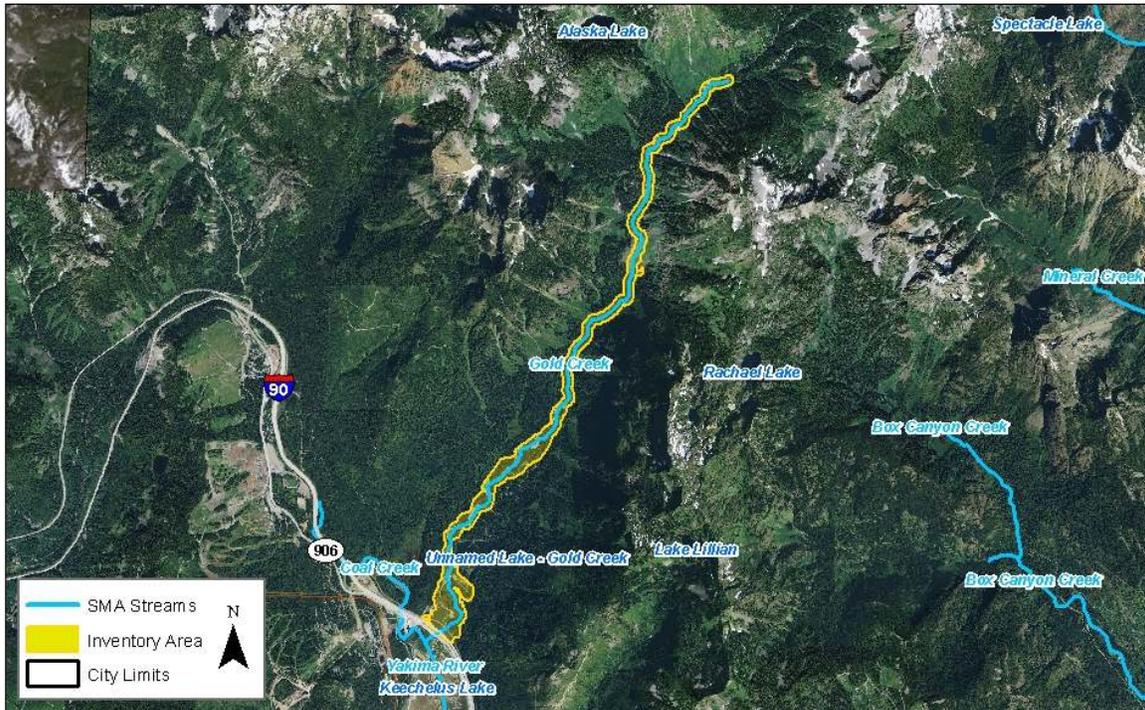
## GOLD CREEK

**SHORELINE LENGTH:**

5.8 Miles

**REACH INVENTORY AREA:**

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.

**LAND COVER (MAP X)**

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%).

**HAZARD AREAS (MAP X)**

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. The reach has potential for channel migration.

**HABITATS AND SPECIES (MAP X)**

WDFW mapping shows that the reach provides spawning habitat for Dolly Varden/bull trout and Kokanee salmon. The presence of burbot, coho salmon, eastern brook trout, mountain whitefish, rainbow trout, summer steelhead, 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.

**WATER QUALITY**

The reach meets water quality criteria, per the State's Water Quality Assessment (2008).

## BUILT ENVIRONMENT AND LAND USE

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>There are no shoreline modifications identified within the reach.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>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).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned primarily for commercial forestry (59%), with some areas of forest &amp; range (20%), mixed use (13%), and other (7%) at the downstream end.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

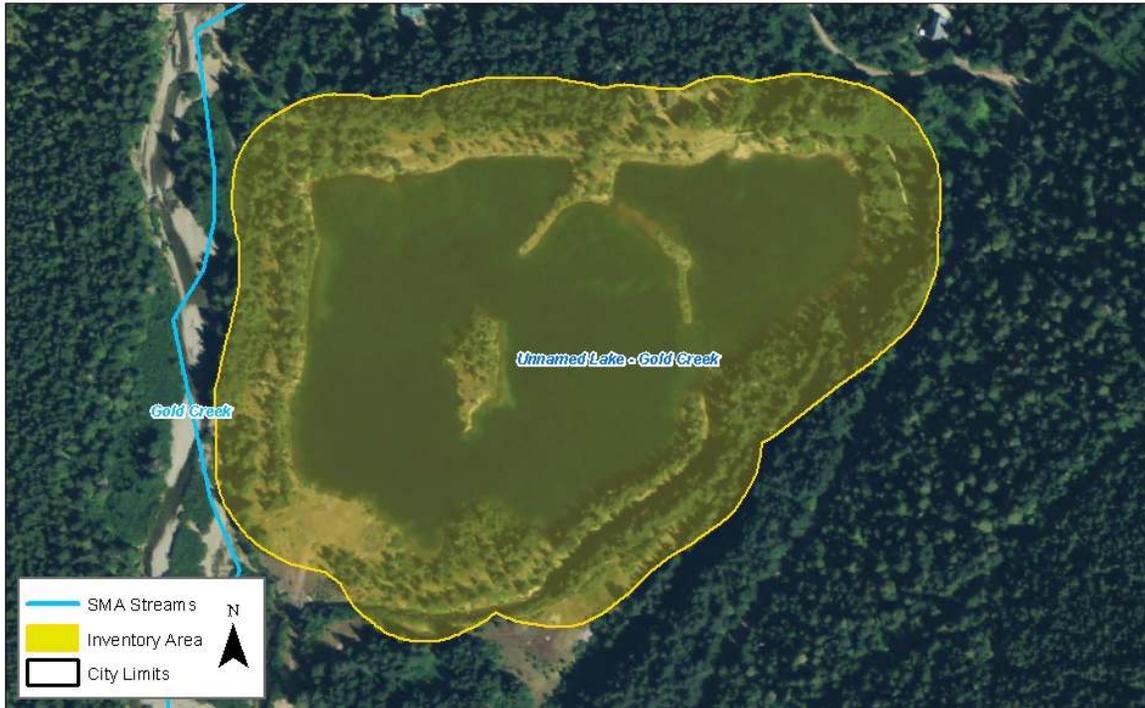
## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- 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.
- Low summer flows in the river are a limiting factor for salmon.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 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.

**LAND COVER (MAP X)**

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.

**HAZARD AREAS (MAP X)**

Approximately 11% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach.

**HABITATS AND SPECIES (MAP X)**

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

**WATER QUALITY**

The reach is not listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters.

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

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>There are no shoreline modifications identified within the reach.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>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).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned primarily for commercial forestry (79%), with mixed use (21%) along the northern lake shore.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>There are no recorded sites within the reach.</p>

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Potential new development should be set back an adequate distance to protect riparian functions.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.3 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 44 miles. The 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.

### 4.3.1 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).

From Keechelus Dam to Easton Dam, the Yakima River floodplain function is excellent, with a braided, meandering channel and numerous side channels (WDFW, 1998; Harding, 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 (BOR, 2000; Harding, 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 (Harding, 2001). Low levels of residential development occur along the banks of the river, with a few exceptions.

Unnamed Lake 5 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 (YSSS, 2001; Harding, 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, then enter a channel separated from the river by a structure, reentering the river approximately 0.5 mile downstream.

### *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 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.

### *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 confines the left bank of the river in this area.

## 4.3.2 Habitats and Species

### *Fish Use*

The mainstem upper Yakima River supports spawning and rearing of spring Chinook, summer steelhead, and Dolly Varden/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).

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 I-90 DEIS 2005; FEIS 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 Integrated Plan DPEIS 2011; WSDOT I-90 DEIS 2005).

Many factors have caused the decline of upper 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) contributed to the extirpation of sockeye.
- Construction of five storage dams eliminated access to productive spawning and rearing habitat for sockeye, spring 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 “flipflop” 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 Integrated Plan DPEIS 2011).

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 Integrated Plan DPEIS 2011).

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 Integrated Plan DPEIS 2011).

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 Fish Passage FPR 2011, Reclamation and Ecology Integrated Plan DPEIS 2011). 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 Integrated Plan DPEIS 2011):

- 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 Glead 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 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 (CRIT 2011; USFWS 2011).

### *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.

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 (Ecology 2007 data report; Ecology 2009 Toxics study focus sheet; Ecology 2002 upper Yakima sediment TMDL).

### *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.

### *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.

### *Priority 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).

### **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.

## 4.3.3 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.

### *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.

### *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.

## 4.3.4 Shoreline Function Analysis

*in progress*

### *City of Cle Elum*

*in progress*

### *Town of South Cle Elum*

*in progress*

## 4.3.5 Public Access

*public access analysis still in progress*

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;
- Undeveloped Washington State Parks land, located approximately 1 mile west of the City of Cle Elum;
- Easton Ponds;
- Lake Easton State Park;
- Crystal Springs Campground (National Forest); and
- A network of hiking, snowmobiling, and cross-country ski trails on National Forest land.

### *City of Cle Elum*

*in progress*

### *Town of South Cle Elum*

*in progress*

## 4.3.6 Reach Sheets

Reach sheets specific to Cle Elum and South Cle Elum are in progress



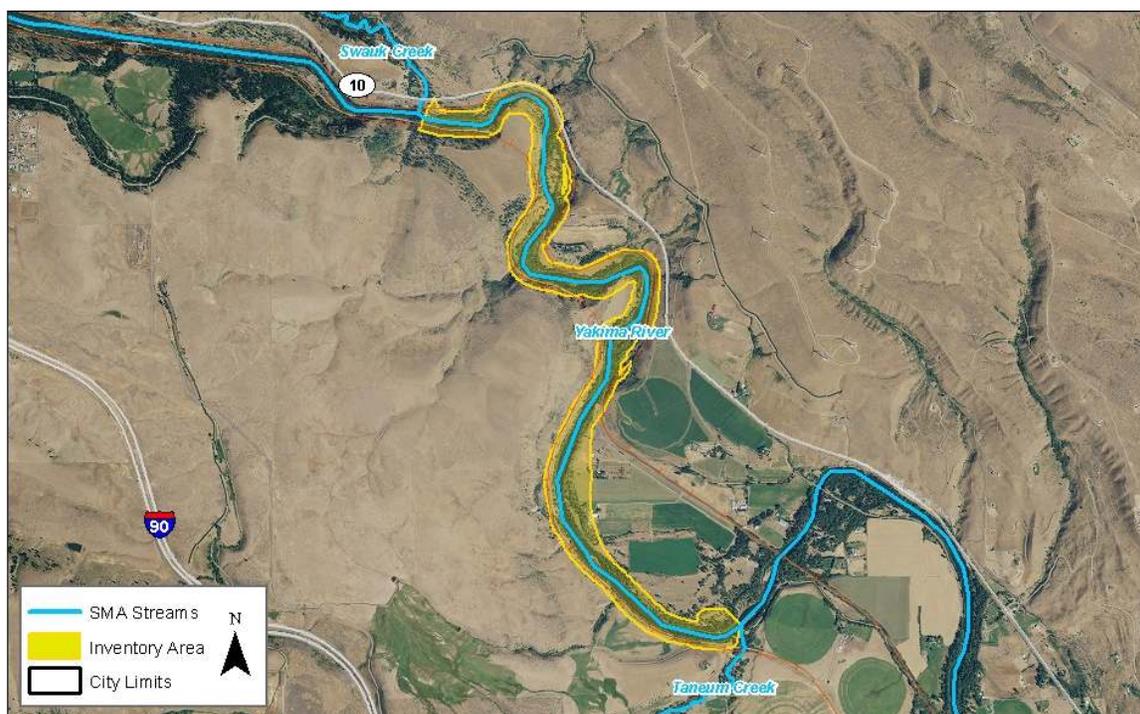
## YAKIMA RIVER-REACH 5

### SHORELINE LENGTH:

4.0 Miles

### REACH INVENTORY AREA:

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 X)

The majority of the reach (70%) is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. The lower approximately one-third 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, and pH.

### LAND COVER (MAP X)

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

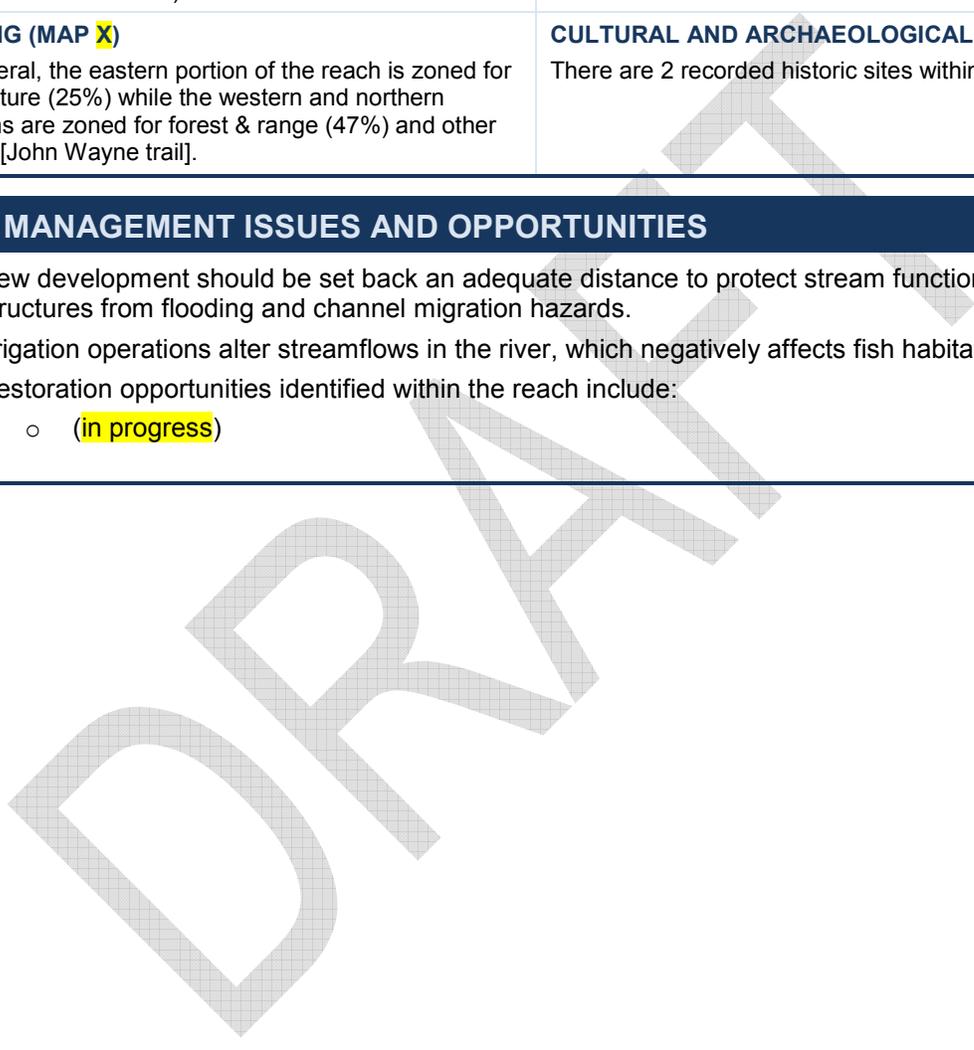
### HABITATS AND SPECIES (MAP X)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of brown trout, coho salmon, Dolly Varden/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.

<b>BUILT ENVIRONMENT AND LAND USE</b>	
<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The reach is constrained along most of its length by Highway 10 and the John Wayne Trail.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>Land use along the reach is rural (100%). Land ownership is 78% private and 22% public (State and Bureau of Reclamation).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>In general, the eastern portion of the reach is zoned for agriculture (25%) while the western and northern portions are zoned for forest &amp; range (47%) and other (28%) [John Wayne trail].</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>There are 2 recorded historic sites within the reach.</p>

<b>KEY MANAGEMENT ISSUES AND OPPORTUNITIES</b>
<ul style="list-style-type: none"> <li>• New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.</li> <li>• Irrigation operations alter streamflows in the river, which negatively affects fish habitat.</li> <li>• Restoration opportunities identified within the reach include:                         <ul style="list-style-type: none"> <li>○ (in progress)</li> </ul> </li> </ul>



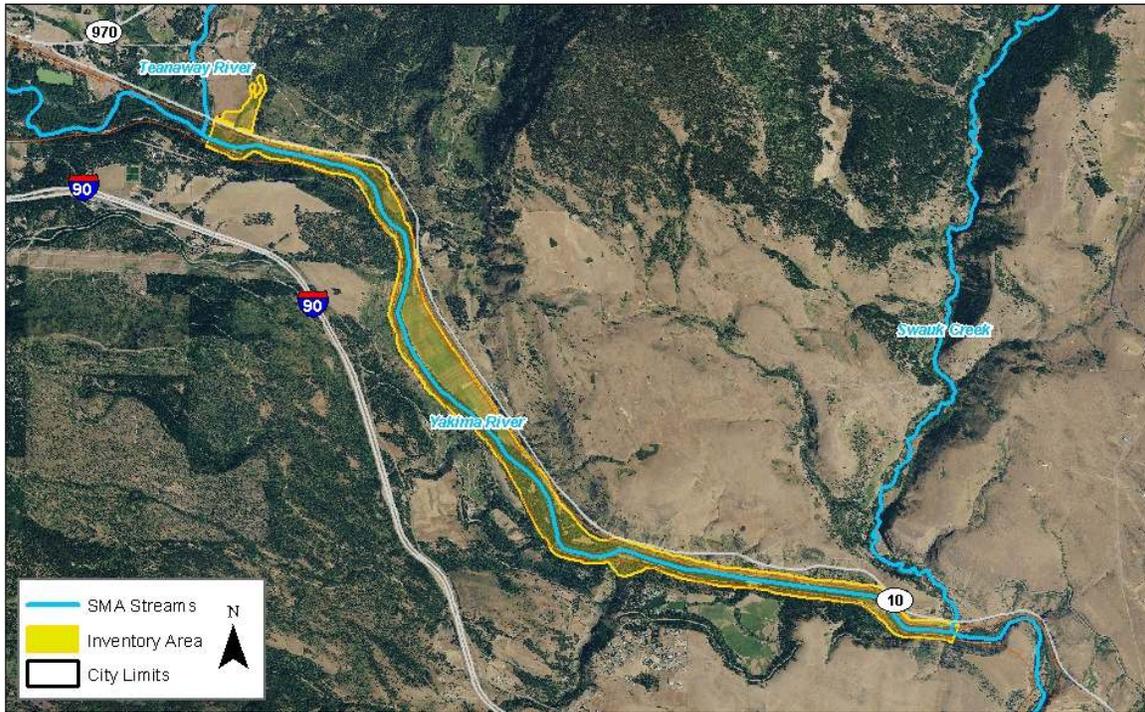
## YAKIMA RIVER-REACH 6

**SHORELINE LENGTH:**

6.3 Miles

**REACH INVENTORY AREA:**

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.

**LAND COVER (MAP X)**

Land cover within the reach is primarily conifer-dominated 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%).

**HAZARD AREAS (MAP X)**

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

**HABITATS AND SPECIES (MAP X)**

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

**WATER QUALITY**

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

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.

<b>BUILT ENVIRONMENT AND LAND USE</b>	
<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The reach is constrained along most of its length by Highway 10 and the John Wayne Trail.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>Land use along the reach is rural (100%). Land ownership is 87% private and 13% public (State).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned primarily for forest &amp; range (67%), with rural residential (11%) at the upstream end and other (21%) [primarily John Wayne trail] extending along the reach.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

<b>KEY MANAGEMENT ISSUES AND OPPORTUNITIES</b>
<ul style="list-style-type: none"> <li>• New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration hazards.</li> <li>• Irrigation operations alter streamflows in the river, which negatively affects fish habitat.</li> <li>• Restoration opportunities identified within the reach include:             <ul style="list-style-type: none"> <li>○ (in progress)</li> </ul> </li> </ul>

DRAFT

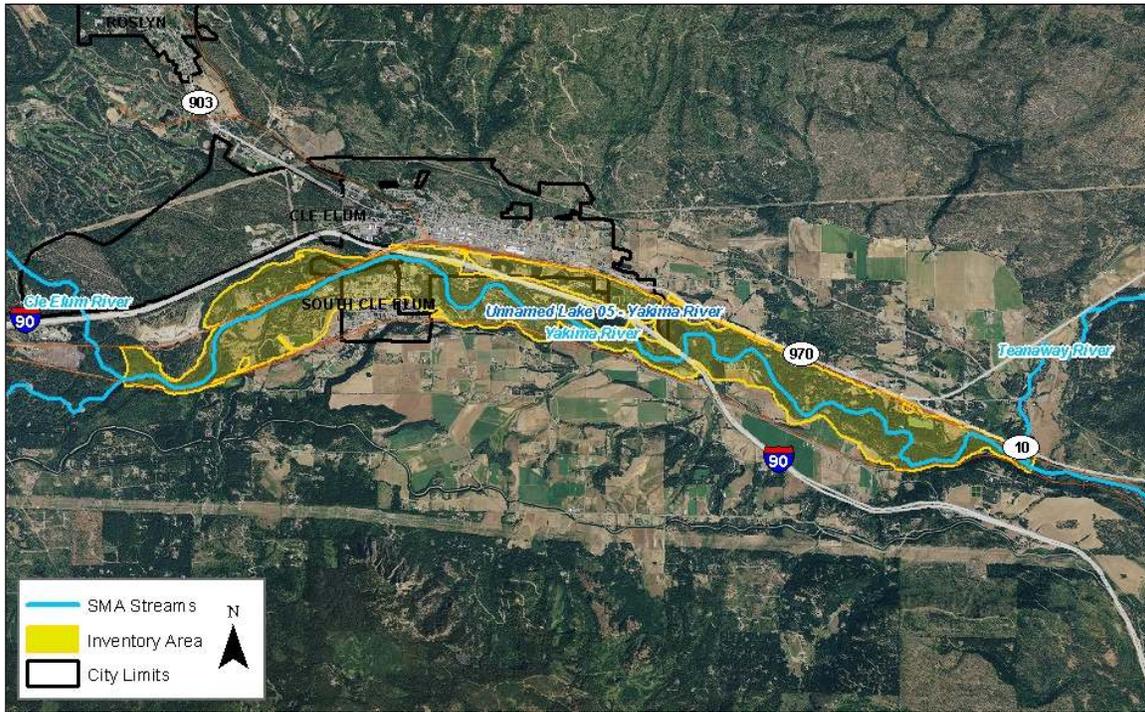
## YAKIMA RIVER-REACH 7

**SHORELINE LENGTH:**

10.4 Miles

**REACH INVENTORY AREA:**

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. The channel is confined in several areas by the John Wayne trail, I-90, and Highway 10. Several gravel pits are located on the left bank of the river.

**LAND COVER (MAP X)**

This reach contains significant riparian vegetation (37%), conifer-dominated 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%).

**HAZARD AREAS (MAP X)**

A significant area of the reach (96%) 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.

**HABITATS AND SPECIES (MAP X)**

Known spawning and juvenile rearing habitat is mapped in this reach for spring Chinook and summer steelhead. Brown trout, coho salmon, Dolly Varden/bull trout, eastern brook trout, rainbow trout, and westslope cutthroat are also documented.

**WATER QUALITY**

The reach is not listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters.

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

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The reach is constrained along most of its length by Highway 10, I-90, the John Wayne trail, and other hydromodifications areas.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>Land use along the reach is primarily rural (75%), with urban (7%), parks &amp; 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).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach. One hazardous waste generator is mapped near the center of the reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned for forest &amp; range (45%), rural residential (22%), industrial (11%), urban/suburban residential (4%), agriculture (2%), commercial (1%), parks &amp; open space (1%), and other (14%).</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>There are 2 recorded precontact sites, and 4 recorded historic sites located in the reach.</p>

## 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.
- Irrigation operations alter streamflows in the river, which negatively affects fish habitat.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 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.

**LAND COVER (MAP X)**

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

**HAZARD AREAS (MAP X)**

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

**HABITATS AND SPECIES (MAP X)**

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.

**WATER QUALITY**

The reach is not listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters.

## BUILT ENVIRONMENT AND LAND USE

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The lake, which was created by gravel mining activities, is directly adjacent to I-90 to the north.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>Land use is rural to the south of the lake (25%), parks &amp; open space to the east and west (47%), and other [I-90] to the north (27%). Land ownership is 100% private.</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned for forest &amp; range (44%) and other (56%) [I-90, to the north].</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>There are no recorded sites within the reach.</p>

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Restoration opportunities identified within the reach include:
  - (in progress)

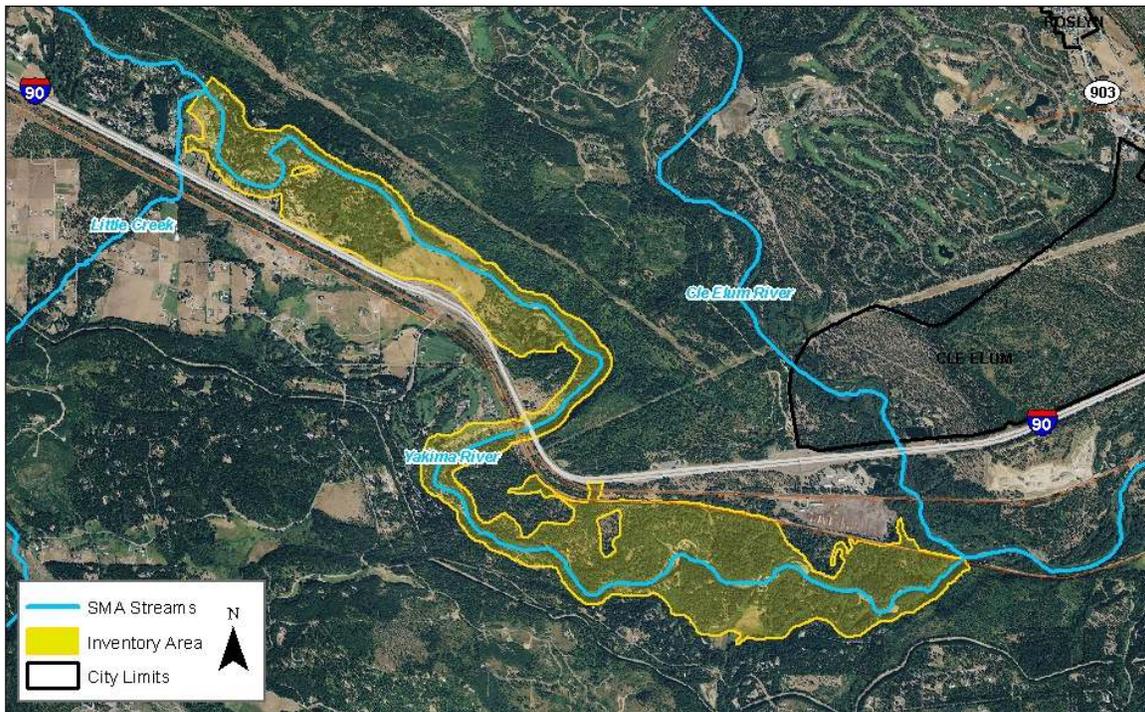
## YAKIMA RIVER-REACH 8

**SHORELINE LENGTH:**

7.4 Miles

**REACH INVENTORY AREA:**

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 X)**

Land cover within the reach is dominated by conifer-dominated 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 X)**

Roughly 91% of the reach 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.

**HABITATS AND SPECIES (MAP X)**

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 brown trout, coho salmon, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

**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.

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 X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

Lands within the reach are zoned primarily for rural residential (51%) west of the river and forest & range (40%) east of the river, with a 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.

## 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 high-density residential subdivisions). New development should be set back an adequate distance to protect stream functions and protect structures from flooding and channel migration.
- Irrigation operations alter streamflows in the river, which negatively affects fish habitat.
- Restoration opportunities identified within the reach include:
  - (in progress)

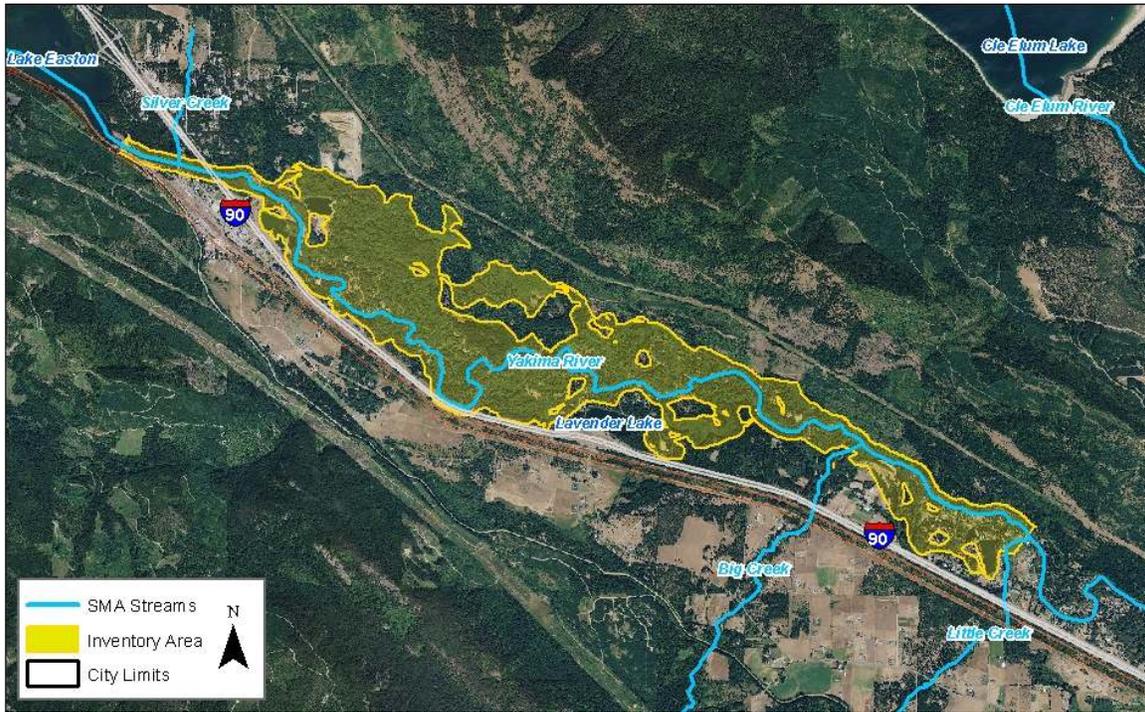
## YAKIMA RIVER-REACH 9

**SHORELINE LENGTH:**

7.9 Miles

**REACH INVENTORY AREA:**

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.

**LAND COVER (MAP X)**

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

**HAZARD AREAS (MAP X)**

A large portion of the reach (82%) 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.

**HABITATS AND SPECIES (MAP X)**

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 brown trout, coho salmon, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, rainbow trout, and westslope cutthroat is also mapped.

**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.

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 X)

Hydromodifications, some of which are associated with I-90 and residential development, are located along approximately one-third of the reach.

### PUBLIC ACCESS (MAP X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## 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 high-density 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, intact wetland and floodplain areas within the reach.
- Irrigation operations alter streamflows in the river, which negatively affects fish habitat.
- Restoration opportunities identified within the reach include:
  - (in progress)

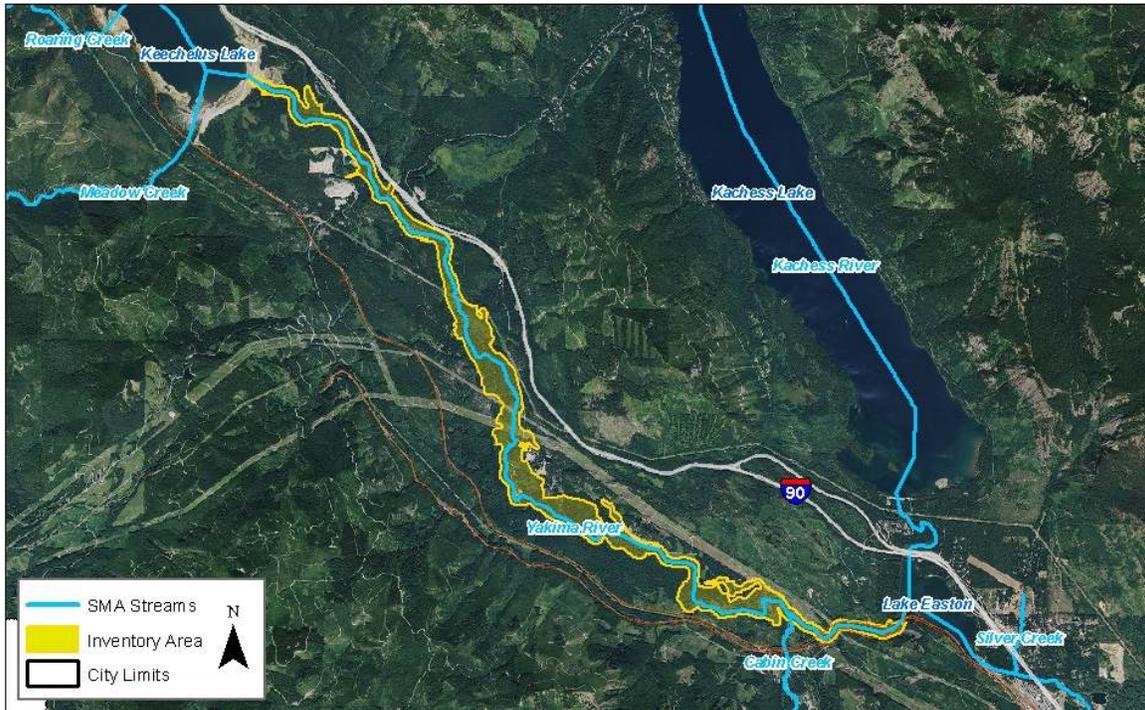
## YAKIMA RIVER-REACH 10

**SHORELINE LENGTH:**

10.6 Miles

**REACH INVENTORY AREA:**

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 X)**

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

**HAZARD AREAS (MAP X)**

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.

**HABITATS AND SPECIES (MAP X)**

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

**WATER QUALITY**

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

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 X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Protect the high-value, intact wetland and floodplain areas within the reach.
- Irrigation operations alter streamflows in the river, which negatively affects fish habitat.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.4 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.

### 4.4.1 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 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 stream flows 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 (Haring, 2001). 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 (Cabin Creek Watershed Analysis-DRAFT 1997; Haring, 2001).

### 4.4.2 Habitats and Species

#### *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).

### *Water Quality*

Lower Cabin Creek and lower Log Creek are on Ecology's 303(d) list for warm water temperatures.

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).

### *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 4.4.1.

### *Wetlands*

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

### *Priority 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.

## 4.4.3 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.

#### 4.4.4 Shoreline Function Analysis

*in progress*

#### 4.4.5 Public Access

*public access analysis still in progress*

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

#### 4.4.6 Reach Sheets

DRAFT



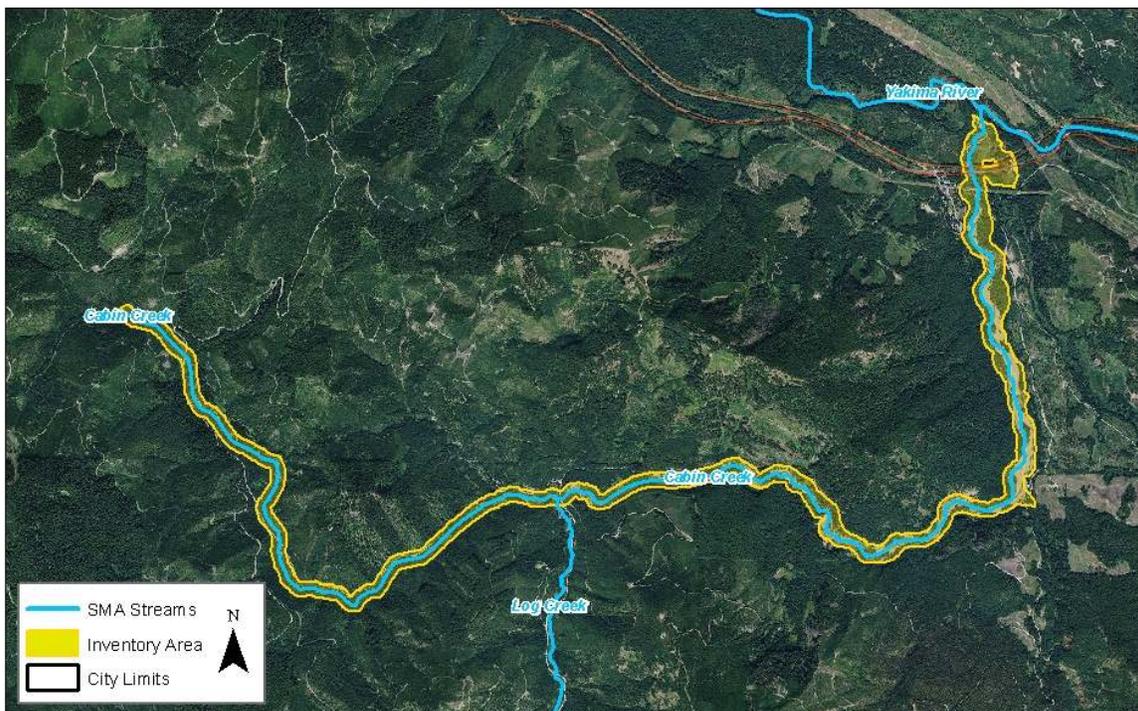
# CABIN CREEK

## SHORELINE LENGTH:

9.1 Miles

## REACH INVENTORY AREA:

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.

### LAND COVER (MAP X)

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%).

### HAZARD AREAS (MAP X)

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. Approximately two-thirds of the reach has potential for channel migration.

### HABITATS AND SPECIES (MAP X)

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

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 X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Restoration opportunities identified within the reach include:
  - (in progress)

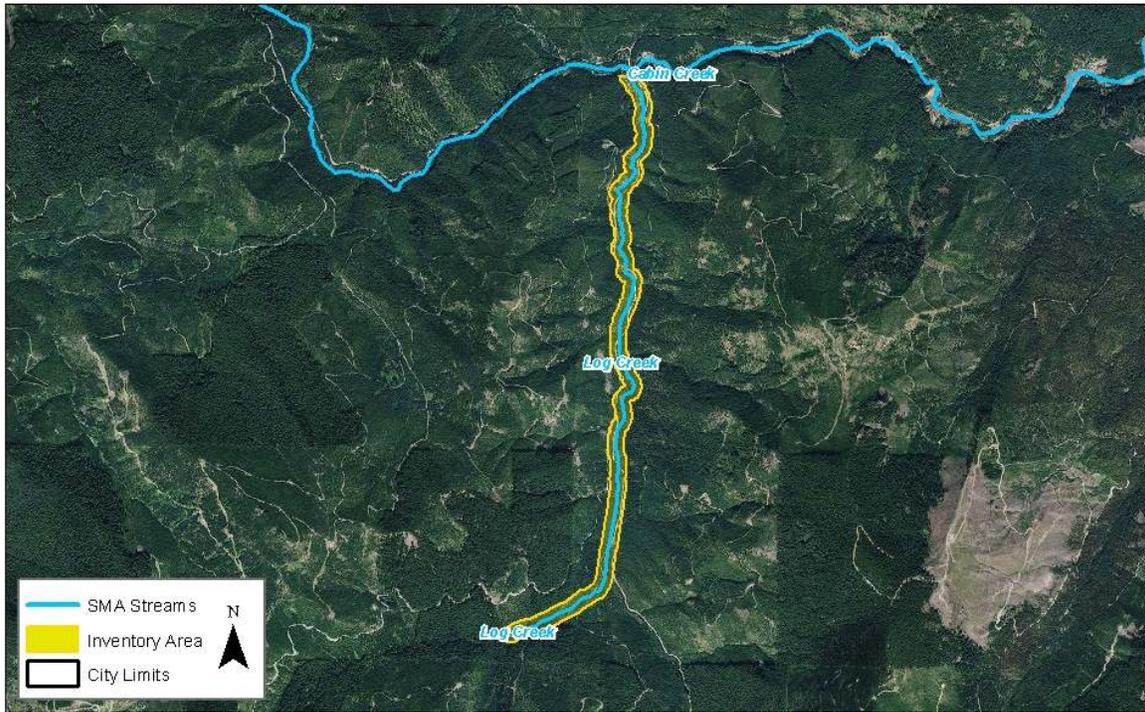
## LOG CREEK

**SHORELINE LENGTH:**

3.1 Miles

**REACH INVENTORY AREA:**

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 its length, with the exception of the downstream portion where the valley becomes broader.

**LAND COVER (MAP X)**

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

**HAZARD AREAS (MAP X)**

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

**HABITATS AND SPECIES (MAP X)**

WDFW mapping shows westslope cutthroat habitat within 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 waters for temperature.

## BUILT ENVIRONMENT AND LAND USE

<p><b>SHORELINE MODIFICATIONS (MAP X)</b> A Forest Service road parallels much of the reach.</p>	<p><b>PUBLIC ACCESS (MAP X)</b> Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b> Land use along the reach is forestry (100%). Land ownership is 89% private and 11% public (Forest Service).</p>	<p><b>CONTAMINATED SITES (MAP X)</b> No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b> Lands within the reach are zoned for commercial forestry (100%).</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b> There are no recorded sites within the reach.</p>

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.5 Lower Kachess River and Lake Easton

The 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.

### 4.5.1 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 Kittitas 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).

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.

### 4.5.2 Habitats and Species

#### *Fish Use*

The lower Kachess River and Lake Easton are used by spring Chinook, coho salmon, Dolly Varden/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).

### *Water Quality*

The Yakima River at Lake Easton is on Ecology's 303(d) list for low dissolved oxygen and 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 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 I-90 DEIS 2005)

### *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.

### *Wetlands*

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

### *Priority 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 I-90 DEIS 2005).

### 4.5.3 Land Use

The upstream half of the lower Kachees 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.

### 4.5.4 Shoreline Function Analysis

*in progress*

### 4.5.5 Public Access

*public access analysis still in progress*

Lake Easton can be accessed from Lake Easton State Park and the John Wayne Pioneer Trail, and a boat launch is located on the northeast shore of the lake. National Forest land bordering the lower Kachees River can be accessed from Kachees Dam Road.

### 4.5.6 Reach Sheets



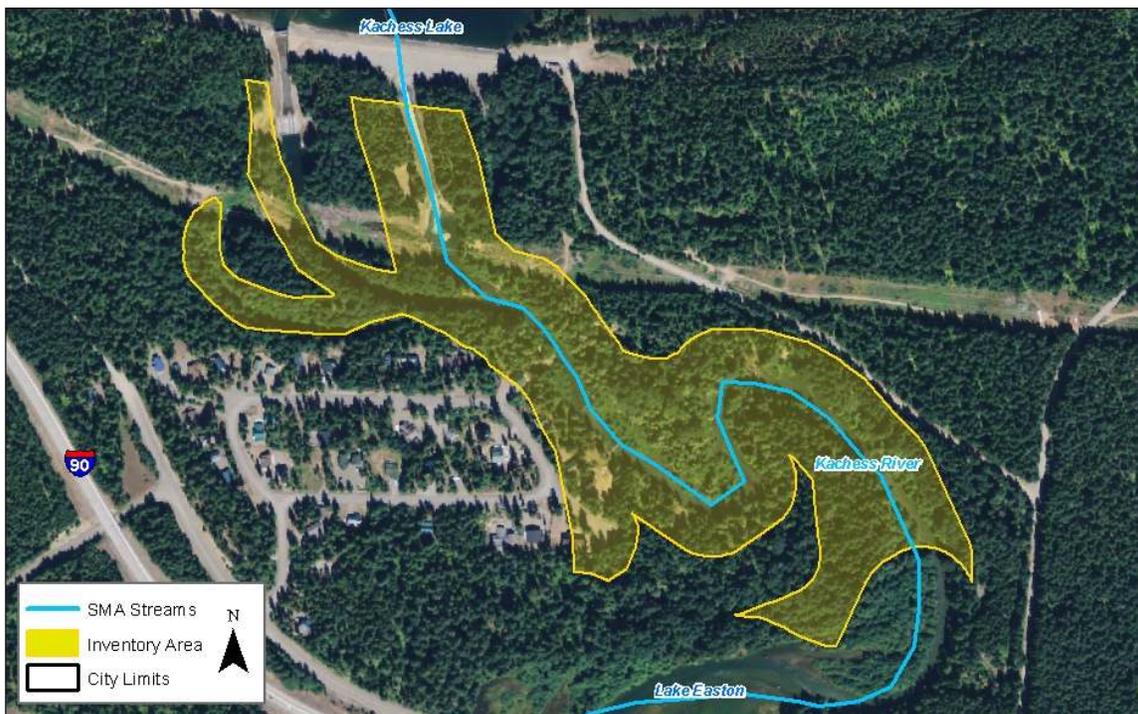
# KACHESS RIVER-REACH 1

**SHORELINE LENGTH:**

0.7 Miles

**REACH INVENTORY AREA:**

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 X)**

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

**HAZARD AREAS (MAP X)**

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. Approximately three-quarters of the reach has potential for channel migration.

**HABITATS AND SPECIES (MAP X)**

WDFW mapping shows the presence of coho salmon, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, rainbow trout, spring Chinook, summer steelhead, 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.

**WATER QUALITY**

The reach meets water quality criteria, per the State's Water Quality Assessment (2008).

## BUILT ENVIRONMENT AND LAND USE

### SHORELINE MODIFICATIONS (MAP X)

No shoreline modifications are identified within the reach.

### PUBLIC ACCESS (MAP X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

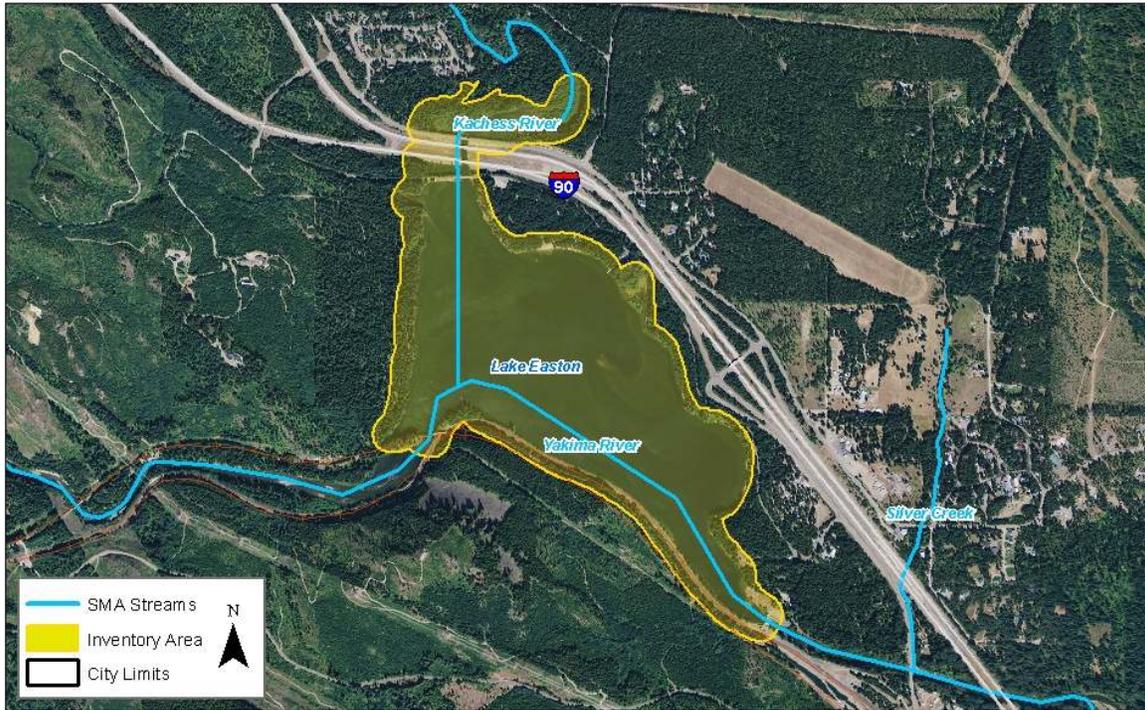
## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- 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.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 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 X)

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.

### LAND COVER (MAP X)

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

### HABITATS AND SPECIES (MAP X)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of brown trout, coho salmon, Dolly Varden/bull trout, eastern brook trout, 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.

## BUILT ENVIRONMENT AND LAND USE

### SHORELINE MODIFICATIONS (MAP X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

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

### ZONING (MAP X)

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.

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.6 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.

### 4.6.1 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 (USFS, 1997; 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).

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).

### 4.6.2 Habitats and Species

#### *Fish Use*

Kachess Lake supports Dolly Varden/bull trout rearing and spawning. Other fish that use the lake include kokanee salmon, rainbow trout, 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 (YRBS Vol 1 Reclamation and Ecology 2011).

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 (YRBS Vol 1 Reclamation and Ecology 2011).

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 (YRBS Vol 1 Reclamation and Ecology 2011).

### *Water Quality*

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

### *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 4.6.1.

### *Wetlands*

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

## *Priority Habitats and Species*

Most of the area immediately east of Lake Kachees 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.

### 4.6.3 Land Use

Kachees 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.

### 4.6.4 Shoreline Function Analysis

*in progress*

### 4.6.5 Public Access

*public access analysis still in progress*

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

### 4.6.6 Reach Sheet



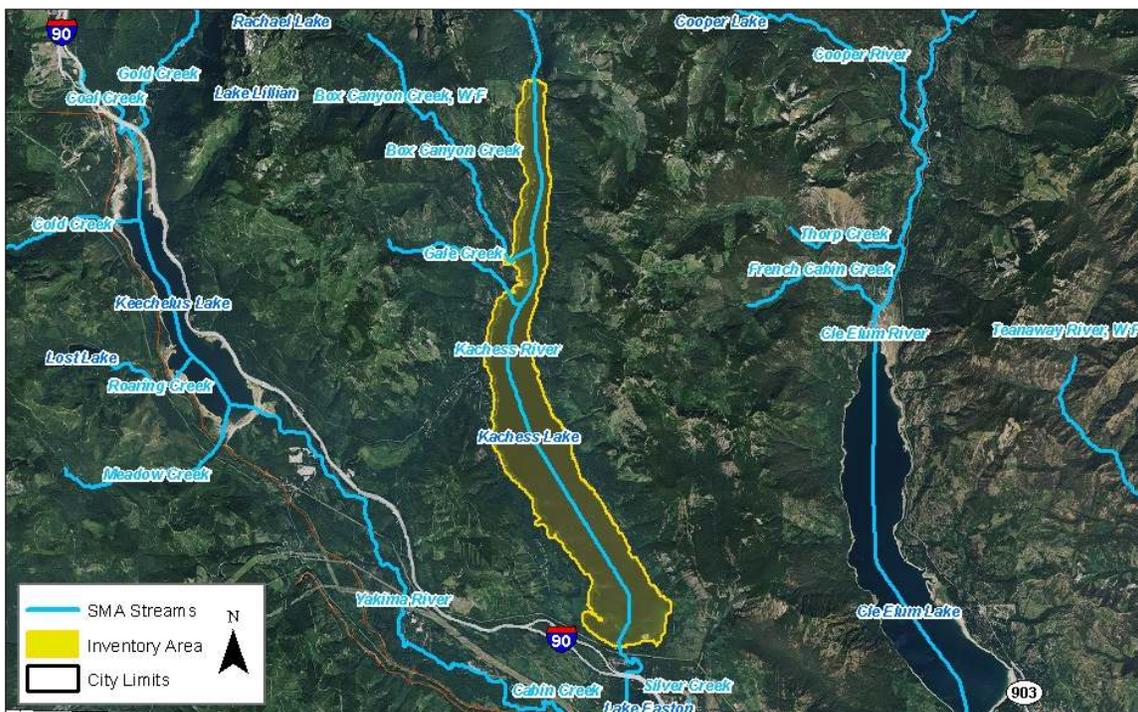
# KACHESS LAKE

## 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 X)

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 X)

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 X)

WDFW mapping shows that the reach provides spawning and rearing habitat for Dolly Varden/bull trout. The presence of kokanee salmon, rainbow trout, westslope cutthroat, and pygmy white 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 X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## 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.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.7 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.

### 4.7.1 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.

### 4.7.2 Habitats and Species

#### *Fish Use*

Table 4-2 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 (Harding, 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 (Harding, 2001). In addition, a culvert on Gale Creek was identified as a fish passage barrier (USFS, 1997; Harding, 2001).

**Table 4-2. Fish Use in Kachess Lake Tributaries (Source: StreamNet 2010)**

Species	Gale Creek	Box Canyon Creek	WF Box Canyon Creek	Upper Kachess River	Mineral Creek
Dolly Varden/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
Coho salmon				P/M	

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

## *Water Quality*

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

## *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 I-90 DEIS 2005).

## *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.

## *Priority 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.

### 4.7.3 Land Use

The tributary lakes and stream reaches to Kachees Lake are primarily located on National Forest lands.

### 4.7.4 Public Access

*public access analysis still in progress*

The tributary lakes and stream reaches to Kachees Lake are accessible via hiking and snowmobile trails.

## 4.8 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.

### 4.8.1 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).

### 4.8.2 Habitats and Species

#### *Fish Use*

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

#### *Water Quality*

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

#### *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.

#### *Wetlands*

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

#### *Priority Habitats and Species*

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

### 4.8.3 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.

### 4.8.4 Shoreline Function Analysis

*in progress*

### 4.8.5 Public Access

*public access analysis still in progress*

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

### 4.8.6 Reach Sheet



# SILVER CREEK

**SHORELINE LENGTH:**

0.8 Mile

**REACH INVENTORY AREA:**

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 X)**

20% of the reach is located within the FEMA 100-year floodplain. No landslide hazard areas are mapped within the reach. 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) Category 5 waters.

**LAND COVER (MAP X)**

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

**HABITATS AND SPECIES (MAP X)**

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 X)

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 X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Two fish-barrier culverts are located within the reach (I-90 and Sparks Road).
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.9 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.

### 4.9.1 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 surface water connection between the lake and the Yakima River.

### 4.9.2 Habitats and Species

#### *Fish Use*

Lavender Lake is stocked with rainbow trout (<http://wdfw.wa.gov/fishing/washington/269/>).

#### *Water Quality*

Lavender Lake is not included on Ecology's 2008 303(d) list of water bodies with impaired water quality.

#### *Riparian Habitat Conditions (Land Cover)*

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

#### *Wetlands*

No wetlands are mapped along the Lavender Lake shoreline.

#### *Priority Habitats and Species*

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

### 4.9.3 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.

### 4.9.4 Shoreline Function Analysis

*in progress*

### 4.9.5 Public Access

*public access analysis still in progress*

### 4.9.6 Reach Sheet

DRAFT

# 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 X)

Land cover within the reach is primarily open water (43%), conifer-dominated forest (33%), riparian vegetation (13%), and developed lands (10%).

### HAZARD AREAS (MAP X)

About one-quarter 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 X)

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 not listed on the State's Water Quality Assessment list of 303 (d) Category 5 waters.

## BUILT ENVIRONMENT AND LAND USE

<p><b>SHORELINE MODIFICATIONS (MAP X)</b> The lake, which was created by gravel mining activities, is directly adjacent to I-90 to the south.</p>	<p><b>PUBLIC ACCESS (MAP X)</b> Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b> Land use surrounding the lake is rural (100%). Land ownership is 100% private.</p>	<p><b>CONTAMINATED SITES (MAP X)</b> No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b> Lands within the reach are zoned for rural residential (44%) to the north and other (56%) [I-90] to the south.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b> There are no recorded sites within the reach.</p>

## KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- Restoration opportunities identified within the reach include:
  - (in progress)

DRAFT

## 4.10 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.

### 4.10.1 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).

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. Water diversions on Big Creek were installed by the late 1880s (KCCD, 1999; Haring, 2001). Currently, a dam is located at RM 2.1 along with unscreened agricultural water diversions (KRD/Haring, 2001). Downstream of this point, the stream sometimes lacks instream flow, particularly during the dry season because natural runoff in the stream is fully appropriated for irrigation (WDFW, 1998; Haring, 2001).

### 4.10.2 Habitats and Species

#### *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).

WDFW maps fish passage barriers at the I-90 crossing on lower Big Creek. An impassable dam and unscreened irrigation diversion at RM 2.1 prevent fish access to potential high-quality spawning habitat upstream. The lack of instream flow from the dam to the mouth of the stream is another barrier (Haring, 2001).

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 (YRBS Vol 1 Reclamation and Ecology 2011).

### *Water Quality*

The lower portion of Big Creek, just below the boundary of Wenatchee National Forest, is listed by Ecology for high water temperatures. 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).

### *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).

### *Wetlands*

Scattered wetlands mapped along Big Creek compose less than 5 percent of the shoreline inventory area.

### *Priority Habitats and Species*

Priority wildlife species mapped in the Big Creek watershed include northern spotted owl (federally listed threatened species), elk, and mountain goat.

## **4.10.3 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.

## 4.10.4 Shoreline Function Analysis

*in progress*

## 4.10.5 Public Access

*public access analysis still in progress*

A dogsled trail crosses Big Creek at the Big Creek Siphon, and a snowmobile trail crosses the creek within the electric transmission line corridor. Starting on National Forest land, the Big Creek trail borders much of the upper creek.

## 4.10.6 Reach Sheet

DRAFT



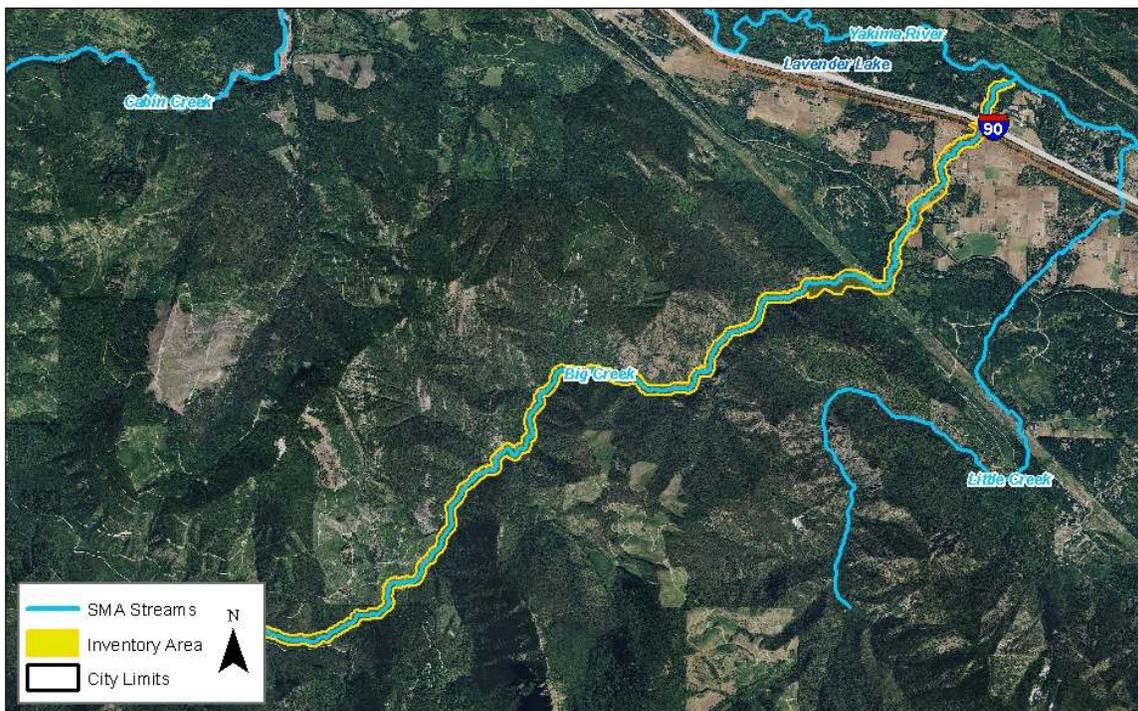
# BIG CREEK

## SHORELINE LENGTH:

10.4 Miles

## REACH INVENTORY AREA:

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 stream flows through flat terrain in a channel that exhibits limited migration.

### HAZARD AREAS (MAP X)

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.

### 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 X)

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 X)

WDFW mapping shows that the reach provides spawning habitat for spring Chinook and summer steelhead. The presence of Coho salmon, Dolly Varden/bull 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.

## BUILT ENVIRONMENT AND LAND USE

### SHORELINE MODIFICATIONS (MAP X)

Shoreline modifications includes I-90 and railroad crossings and an impassable dam and irrigation diversion at RM 2.1 blocks upstream fish passage. Other, unmapped diversion structures may be present, as well.

### PUBLIC ACCESS (MAP X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## 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.
- The dam/irrigation diversion at RM 2.1 is a barrier to fish passage.
- The creek experiences low summer flows because of irrigation diversion.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.11 Little Creek

Little Creek is a right-bank tributary to the Yakima River that enters at RM 194.6.

### 4.11.1 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). At least one water diversion structure at approximately RM 1.2 completely dewateres the channel during certain times of the year, downstream to about the confluence with the Yakima River.

The Little Creek channel may have been rerouted in the vicinity of the Yakima River floodplain to facilitate residential development (Renfrow/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.

### 4.11.2 Habitats and Species

#### *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).

A water diversion at approximately RM 1.2 dewateres the channel downstream to near the Yakima River confluence, precluding anadromous salmonid passage to suitable habitat upstream (Haring, 2001).

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 (YRBS Vol 1 Reclamation and Ecology 2011).

## *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).

## *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).

## *Wetlands*

A small portion of the Little Creek shoreline inventory area is mapped as wetland, located near the power line corridor crossing.

## *Priority Habitats and Species*

No priority habitats or species are mapped near Little Creek.

### 4.11.3 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 KR D 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.

### 4.11.4 Shoreline Function Analysis

*in progress*

### 4.11.5 Public Access

*public access analysis still in progress*

A dogsled trail crosses Little Creek at the Little Creek Siphon, and a snowmobile trail crosses the creek near the electric transmission line corridor.

### 4.11.6 Reach Sheet

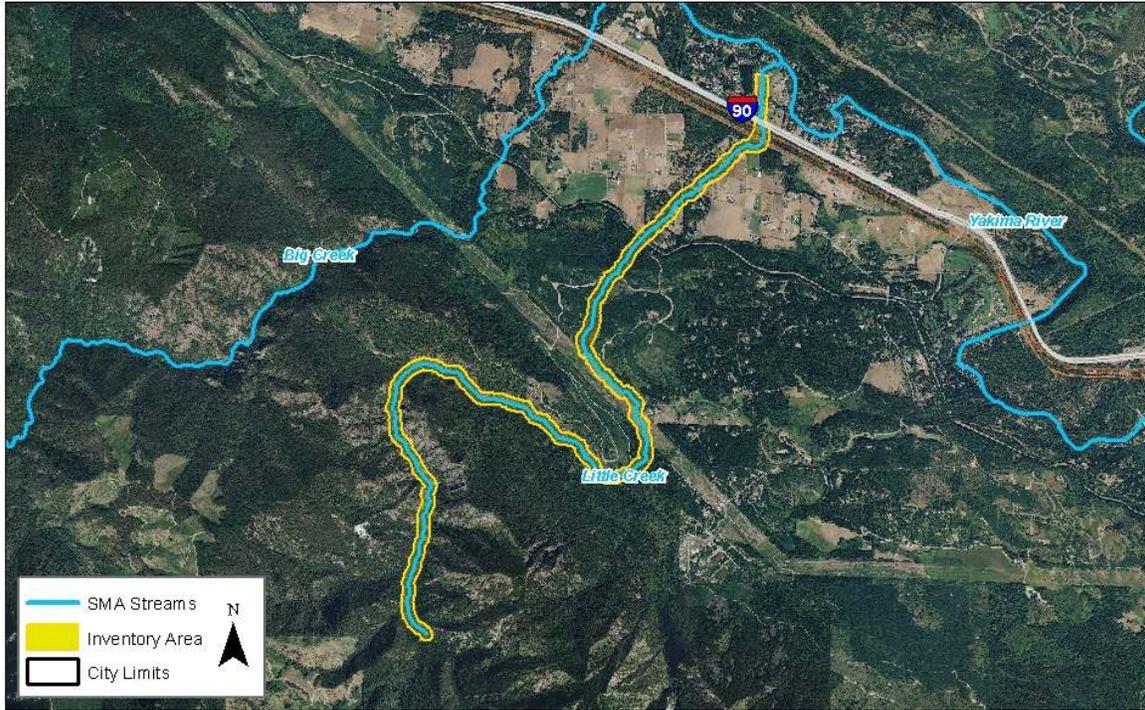
DRAFT



# LITTLE CREEK

**SHORELINE LENGTH:**  
7.1 Miles

**REACH INVENTORY AREA:**  
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 stream flows through flat terrain, but the channel is more confined and has been rerouted in the vicinity of the Yakima River floodplain.

### LAND COVER (MAP X)

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 X)

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 X)

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

### WATER QUALITY

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

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.

## BUILT ENVIRONMENT AND LAND USE

### SHORELINE MODIFICATIONS (MAP X)

Shoreline modifications includes I-90 and railroad crossings and a water diversion structure at RM 1.2. Other, unmapped diversion structures may be present, as well.

### PUBLIC ACCESS (MAP X)

Public access analysis still in progress

### EXISTING LAND USES AND OWNERSHIP (MAP X)

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 (MAP X)

No identified contaminated sites are located within this reach.

### ZONING (MAP X)

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.

## 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.
- A water diversion structure at RM 1.2 dewateres the channel downstream to near the Yakima River confluence, blocking fish passage.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.12 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.

### 4.12.1 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 (BOR, 2000; Haring, 2001).

Several landslides and steep slopes have been mapped along the lower river (WDNR, 2010; Kittitas County, 2012).

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.

#### *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.

## 4.12.2 Habitats and Species

### *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 Fish Passage FEIS 2011).

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). 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).

### *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 Fish Passage FEIS 2011).

## *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 4.12.1.

### **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.

### *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.

### *Priority 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.

## **4.12.3 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). From the Cle Elum Dam to approximately 1 mile downstream, the river flows through National Forest lands.

## *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.

### 4.12.4 Shoreline Function Analysis

*in progress*

## *City of Cle Elum*

*in progress*

### 4.12.5 Public Access

*public access analysis still in progress*

The lower Cle Elum River can be accessed from the Suncadia Conservancy, which borders the river from Bullfrog Road to the National Forest boundary.

## *City of Cle Elum*

*public access analysis still in progress*

### 4.12.6 Reach Sheet

*Reach sheet specific to Cle Elum is in progress*

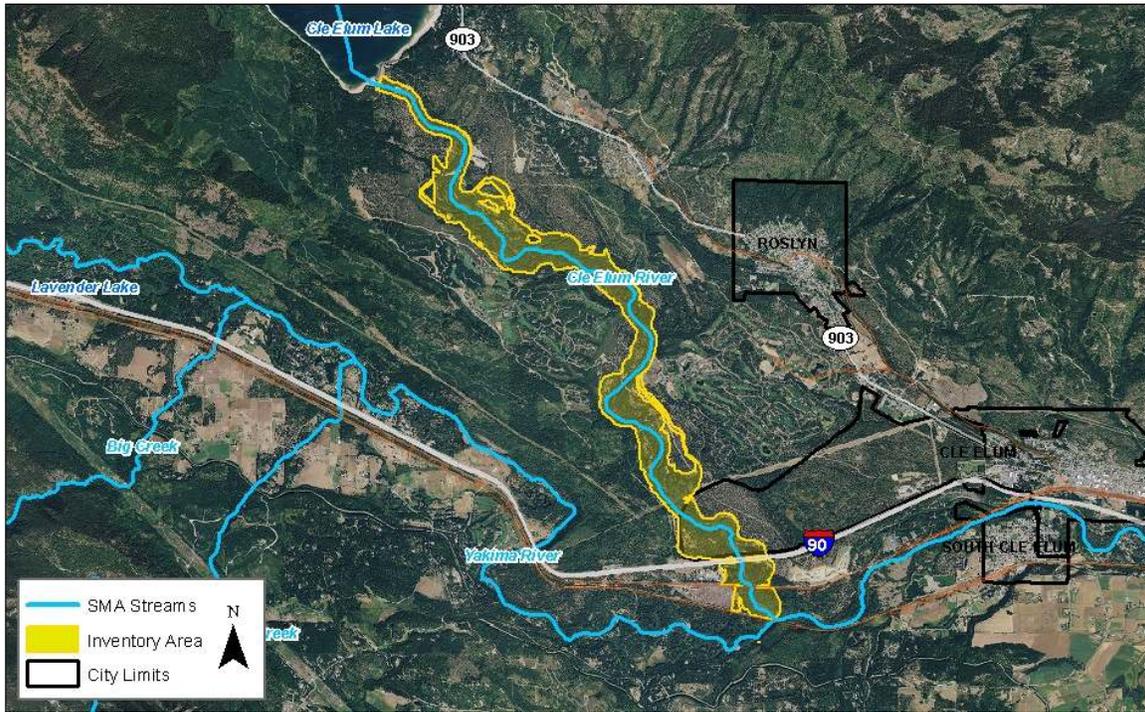
# CLE ELUM RIVER-REACH 1

**SHORELINE LENGTH:**

7.8 Miles

**REACH INVENTORY AREA:**

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 X)**

This reach is primarily conifer-dominated 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 X)**

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. The majority of the reach has migration potential.

**HABITATS AND SPECIES (MAP X)**

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

**WATER QUALITY**

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

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

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>There are several crossing (bridges) over the reach, including I-90, a railroad, and 3 other roadways.</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>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).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>A State cleanup site (pesticide dump) is located at the downstream end of the reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>Lands within the reach are zoned primarily for master planned resort (70%), with forest &amp; 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.</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

## 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.
- Irrigation operations alter streamflows in the river, which negatively affects fish habitat.
- Protect the high-value wetland and forested floodplain areas.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.13 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.”

### 4.13.1 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 (USFS, 1996; Haring, 2001). The maximum depth is approximately 258 feet. Lake levels fluctuate roughly 60 feet between the winter/spring and summer (WDFW, 1998; 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).

State Route 903 roughly parallels much of the eastern lake shoreline. The roadway provides 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 (WDFW, 1998; 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).

### 4.13.2 Habitats and Species

#### *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. Biologists believe approximately 29 miles of tributary habitat upstream of Cle Elum Lake are potentially accessible if passage at the dam were provided (Reclamation Fish Passage FPR 2011, 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. Native resident fish in the lake include burbot, Dolly Varden/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 Fish Passage FEIS 2011).

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 Fish Passage FEIS 2011).

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).

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 Fish Passage FPR 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 (YRBS Vol 1 Reclamation and Ecology 2011).

### *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).

### *Riparian Habitat Conditions (Land Cover)*

The riparian zone of Cle Elum Reservoir consists of forested areas with limited and scattered residential development.

### *Wetlands*

A small part of the lake's shoreline inventory area is mapped as freshwater emergent wetland.

### *Priority 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 Fish Passage FEIS 2011).

Grizzly bear observations have been recorded in the vicinity of Cle Elum Reservoir (WDFW, 2009a; WSDOT I-90 DEIS 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 Fish Passage FEIS 2011).

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 Fish Passage FEIS 2011; USFS restoration strategy 2010).

### 4.13.3 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.

### 4.13.4 Shoreline Function Analysis

*in progress*

### 4.13.5 Public Access

*public access analysis still in progress*

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, much of the eastern shore of Lake Cle Elum is bordered by a snowmobile trail.

### 4.13.6 Reach Sheet

DRAFT



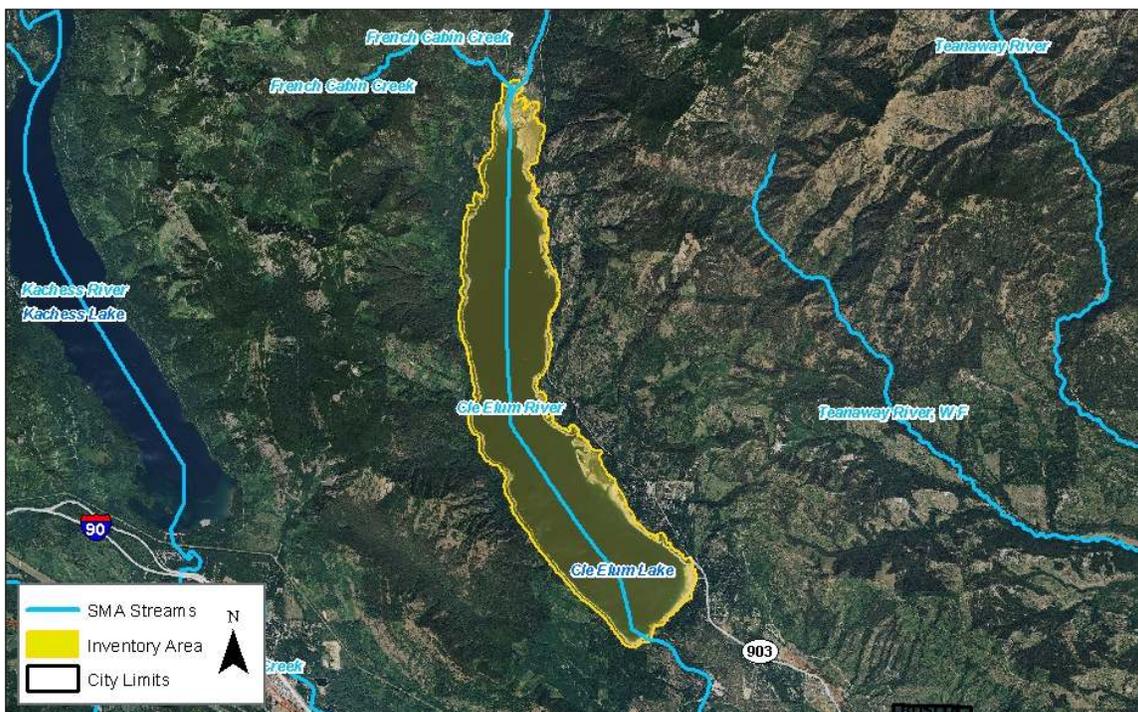
# LAKE CLE ELUM

## 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 X)

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 X)

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 X)

WDFW mapping shows that the reach provides spawning habitat for Kokanee salmon. The presence of burbot, Dolly Varden/bull trout, eastern brook trout, mountain whitefish, pygmy 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

<p><b>SHORELINE MODIFICATIONS (MAP X)</b></p> <p>The lake level is controlled by a dam (barrier to fish passage).</p>	<p><b>PUBLIC ACCESS (MAP X)</b></p> <p>Public access analysis still in progress</p>
<p><b>EXISTING LAND USES AND OWNERSHIP (MAP X)</b></p> <p>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 &amp; open space (8%). Land ownership is 23% private and 77% public (Forest Service).</p>	<p><b>CONTAMINATED SITES (MAP X)</b></p> <p>No identified contaminated sites are located within this reach.</p>
<p><b>ZONING (MAP X)</b></p> <p>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 &amp; range (9%) and other (11%).</p>	<p><b>CULTURAL AND ARCHAEOLOGICAL RESOURCES</b></p> <p>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.</p>

## 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.
- The Cle Elum Lake Dam is a complete barrier to fish passage.
- Restoration opportunities identified within the reach include:
  - (in progress)

## 4.14 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.

With the exception of the upper Cle Elum River, Cooper River, and Cooper Lake, all of the waterbodies listed above are located entirely on National Forest land. 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.

### 4.14.1 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 Elum 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 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 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).

## 4.14.2 Habitats and Species

### *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 2011).

Table 4-3 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 4-3. Fish Use in Lake Cle Elum Tributaries (Source: StreamNet 2010)

Species	French Cabin Creek	Thorp Creek	Upper Cle Elum River	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
Dolly Varden/Bull 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																		

P/M = presence/migration; S = spawning



## *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 Fish Passage FEIS 2011).

## *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 Fish Passage FEIS 2011).

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).

## *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.

## *Priority 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.

### 4.14.3 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.

### 4.14.4 Shoreline Function Analysis

*upcoming*

### 4.14.5 Public Access

*public access analysis still in progress*

The Lake Cle Elum tributary streams and lakes can be accessed from adjacent National Forest recreation areas and a network of hiking, horse, and snowmobile trails.

### 4.14.6 Reach Sheets

*upcoming*

## 4.15 Teanaway River and Tributaries

The Teanaway River is a left-bank tributary to the Yakima River at RM 176.1 (KCCD, 1999; Harding, 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.”

### 4.15.1 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 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 (YSS, 2001, Harding, 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 (Harding, 2001).

## 4.15.2 Habitats and Species

### *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 (Yakima Subbasin Plan).

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 Recovery Plan; Yakima Subbasin Plan). Current legal fisheries in the basin are highly regulated to reduce negative impacts on steelhead and bull trout (Steelhead Recovery Plan).

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. (Yakima Subbasin Plan).

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, Yakima Subbasin Plan).

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 (Yakima Subbasin Plan). 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 (Steelhead Recovery Plan). 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 (Yakima River DPEIS NOV 2011).

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 (Steelhead Recovery Plan, Yakima Subbasin Plan).

### *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 total maximum daily load (TMDL) for temperature in 2003 resulted in removal of the basin's streams from the 303(d) list (Yakima River DPEIS NOV 2011).

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, Yakima Subbasin Plan).

### *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 (Yakima Subbasin Plan).

### *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 (Yakima Subbasin Plan).

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 (Yakima Subbasin Plan, 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.

### *Priority 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 2011). 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 Teanaway River basin area, an ongoing spruce budworm outbreak has impacted large patches of spotted owl habitat (WDFW, 2011).

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, 2011; Yakima River DPEIS NOV 2011).

### 4.15.3 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.

### 4.15.4 Shoreline Function Analysis

*upcoming*

### 4.15.5 Public Access

*public access analysis still in progress*

There is no public access available to the mainstem Teanaway River or the downstream portions of its forks; the surrounding lands are privately owned. In the upper watershed, the Teanaway River forks are crossed by a snowmobile trail and can also be accessed from numerous hiking/horse trails within the National Forest.

### 4.15.6 Reach Sheets



## 4.16 Swauk Creek

Swauk Creek enters the Yakima River at RM 169.9 as a left-bank tributary. The stream generally flows north to south.

### 4.16.1 Physical Characterization

Precipitation is limited in the Swauk Creek watershed, resulting in low stream flows 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 (CBSP, 1990/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 (Kauffman et al/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).

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 (KCCD, 1999/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 (WDFW, 1998/Haring, 2001). Limited residential development is located adjacent to the stream in the lower portion of the upper watershed.

### 4.16.2 Habitats and Species

#### *Fish Use*

Swauk Creek supports Dolly Varden/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 (Steelhead Recovery Plan). 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).

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, Yakima Subbasin Plan)

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 (NELSON 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 (YAK RIVER DPEIS).

Other impacts to fisheries include undersized culverts that cause debris blockages, fish passage barriers, and localized erosion during peak flows (Haring, 2001).

### *Water Quality*

Ecology's 2008 303(d) list does not identify water quality problems on the mainstem Swauk Creek. However, some of its tributaries are listed for high water temperatures. Instream habitat has been degraded by sedimentation as discussed above.

## *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 (2006 Swauk Flow Study). Some high-quality riparian habitat remains in lower parts of the watershed that are protected by conservation easements (NELSON 2004 thesis, Yakima Subbasin Plan).

## *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, Yakima Subbasin Plan)

## *Priority 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 2011).

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).

### 4.16.3 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.

#### 4.16.4 Shoreline Function Analysis

*upcoming*

#### 4.16.5 Public Access

*public access analysis still in progress*

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.

#### 4.16.6 Reach Sheet

*upcoming*

DRAFT