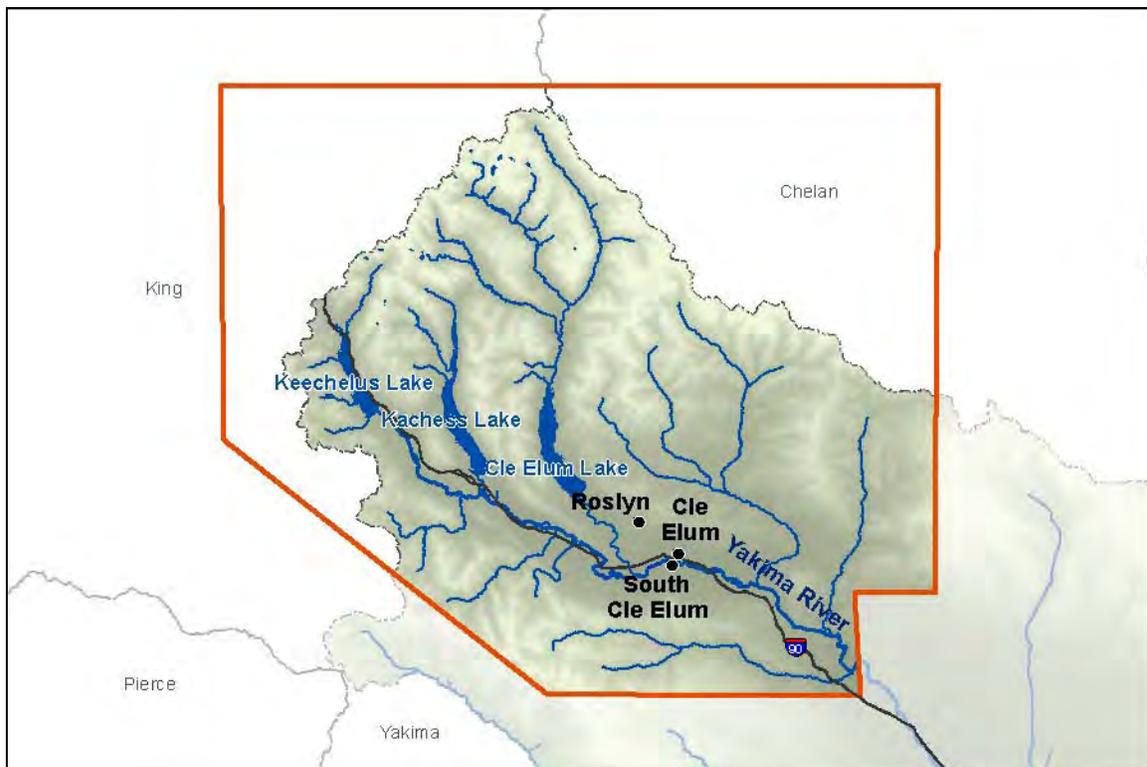


CHAPTER 3. UPPER COUNTY

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

Figure 3-1. “Upper County” shorelines.



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

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

3.1 Keechelus Lake

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

3.1.1 Physical Characterization

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

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

3.1.2 Habitats and Species

3.1.2.1 Fish Use

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

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

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

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

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

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

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

3.1.2.2 Water Quality

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

3.1.2.3 Riparian Habitat Conditions (Land Cover)

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

3.1.2.4 Wetlands

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

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

3.1.2.5 Wildlife Habitats and Species

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

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

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

3.1.3 Land Use

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

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

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

3.1.4 Public Access

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

3.1.5 Reach Sheet

KEECHELUS LAKE

SHORELINE LENGTH:
49.5 Miles

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



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX B)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

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.

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

The lake level is controlled by a dam (barrier to fish passage), and I-90 borders the eastern shore.

PUBLIC ACCESS (MAP FOLIO #4)

The John Wayne Heritage Trail is located along the west shore of the lake; cross-country ski trails border the western and southern shorelines of the lake. A boat launch is located on the northwest shore of the lake.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

The primary land use around the lake is forestry (95%), with some rural land along the north shore of the lake (5%). Land ownership is 25% private and 75% public (State and Forest Service).

CONTAMINATED SITES

No identified contaminated sites are located within this reach.

ZONING (MAP #5)

Land surrounding Keechelus Lake is zoned for commercial forestry (33%) at the north and south ends, and other (67%) [I-90 and John Wayne Trail] along the western and eastern shores.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

A total of 44 recorded sites and 1 National Register site located within the reach. Recorded sites include 22 precontact sites, 13 historic sites, and 9 sites that featured both precontact and historic components.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The lake provides habitat for several priority fish species (including spawning habitat for bull trout and Kokanee salmon), but is primarily managed as an irrigation reservoir and has listed water quality impairments.

TERRESTRIAL HABITAT QUALITY

Medium: The lake is connected to a large area of contiguous forest habitat to the west, but the eastern shore is closely bordered by I-90.

VEGETATION FUNCTIONS

Medium: Over half of the lake circumference is bordered by forest cover, while the remaining shoreline has been altered by development (primarily I-90).

HYDROLOGIC FUNCTIONS

Medium: The lake provides significant floodwater storage and it's the origin of the Yakima River, but it is managed as an irrigation reservoir.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

3.2 Keechelus Lake Tributaries

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

3.2.1 Physical Characterization

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

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

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

3.2.2 Habitats and Species

3.2.2.1 Fish Use

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

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

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

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

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

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

P/M = presence/migration; S = spawning

3.2.2.2 Water Quality

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

3.2.2.3 Riparian Habitat Conditions (Land Cover)

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

3.2.2.4 Wetlands

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

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

3.2.2.5 Wildlife Habitats and Species

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

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

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

3.2.3 Land Use

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

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

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

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

3.2.4 Public Access

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

3.2.5 Reach Sheets

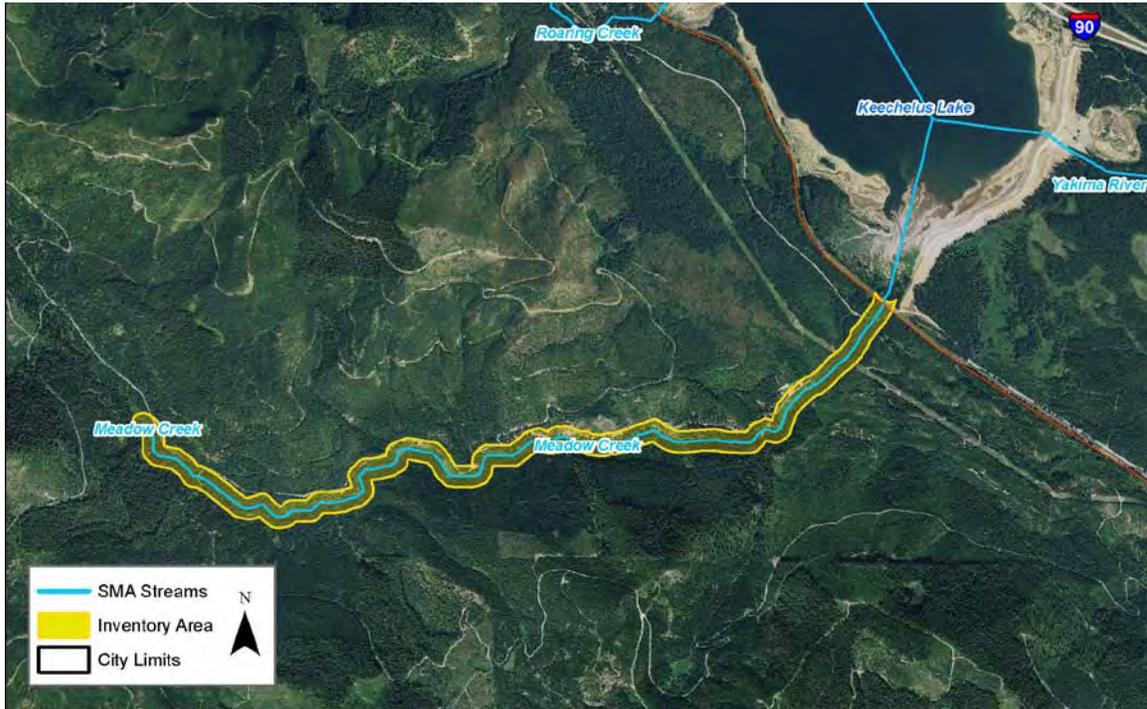
MEADOW CREEK

SHORELINE LENGTH:

3.4 Miles

REACH INVENTORY AREA:

165.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

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

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

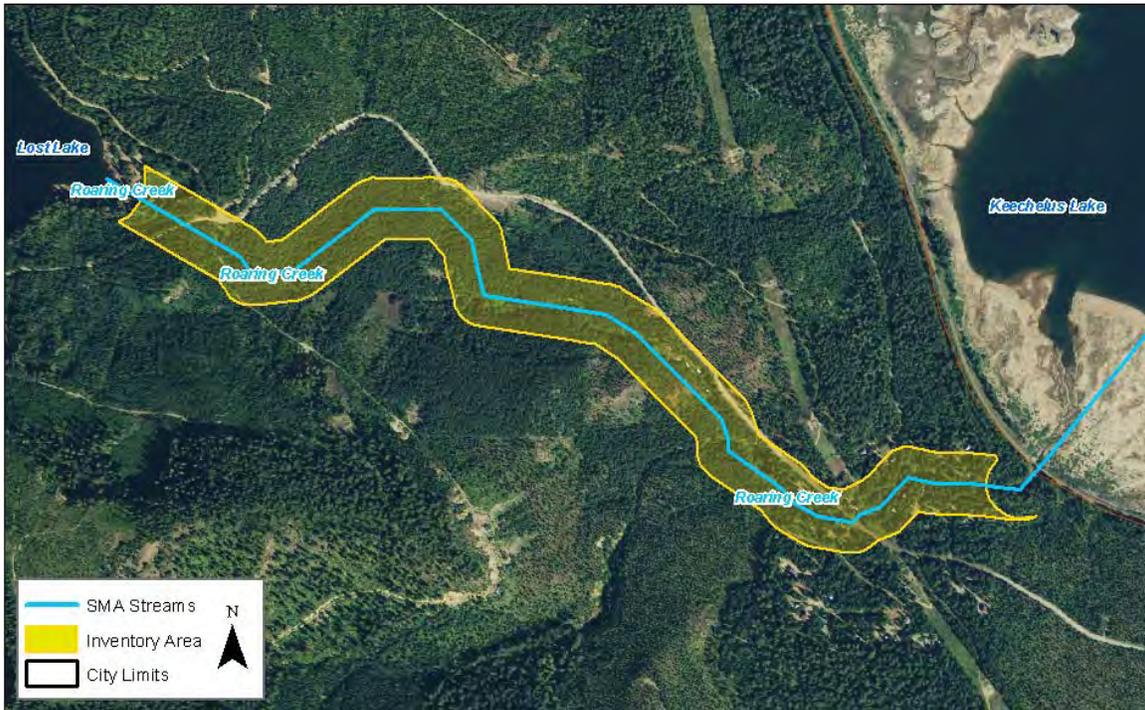
ROARING CREEK

SHORELINE LENGTH:

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.

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

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

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

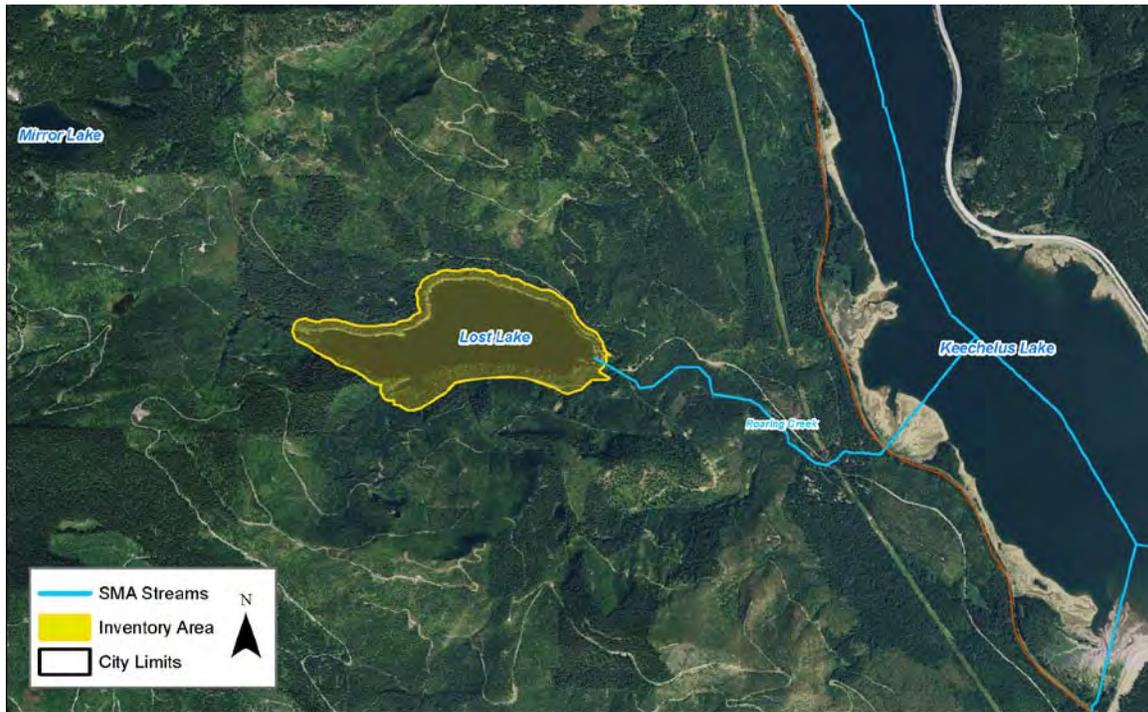
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- 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.
- Manage recreational activity to reduce impacts on vegetation and subsequent erosion.

LOST LAKE

SHORELINE LENGTH:
5.3 Miles

WATERBODY AREA: 155.0 Acres
REACH INVENTORY AREA: 247.4 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping identifies the presence of eastern brook trout and Kokanee salmon within the reach. No wetlands are mapped within the reach. No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

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

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

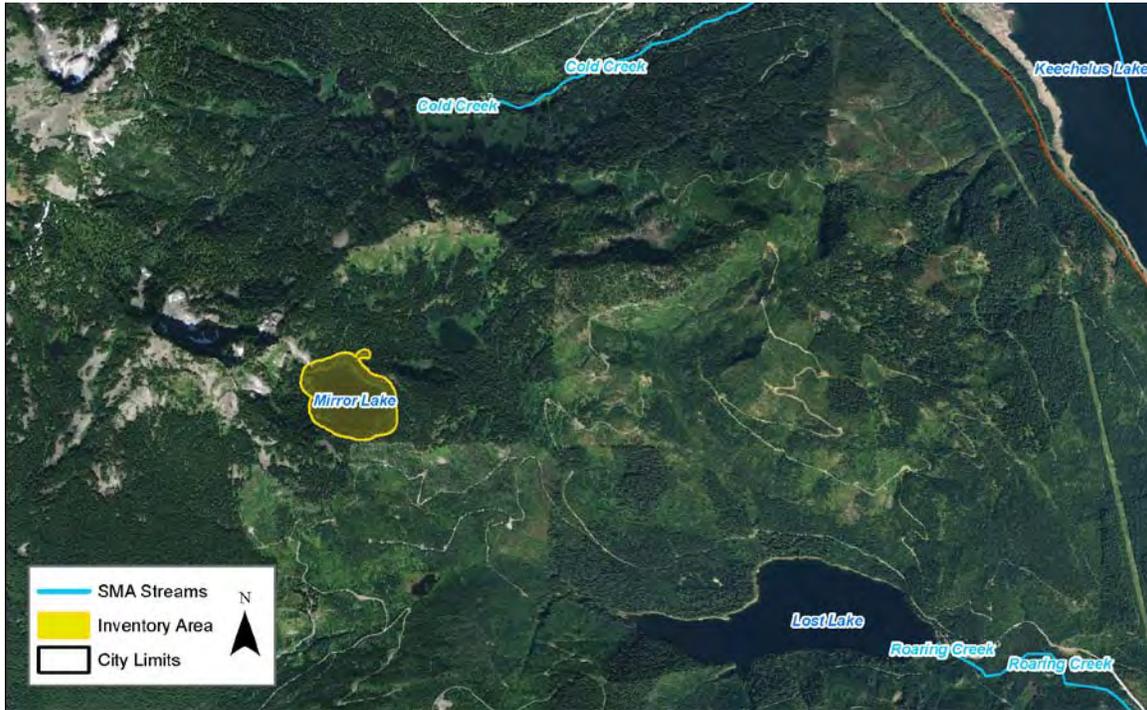
SHORELINE FUNCTION ANALYSIS	
<p>FISH HABITAT QUALITY Medium: The lake is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.</p>	<p>TERRESTRIAL HABITAT QUALITY High: The lakeshore is generally well-forested and is connected to a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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES
<ul style="list-style-type: none"> • Protect the high-quality forest habitat within the reach. • Manage recreational activity to reduce impacts on vegetation and subsequent erosion. • Decommission and revegetate any unused roads along the shoreline.

MIRROR LAKE

SHORELINE LENGTH:
0.9 Miles

WATERBODY AREA: 28.0 Acres
REACH INVENTORY AREA: 52.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping does not indicate the presence of any priority fish species within the reach. A very limited extent (3%) of the reach is mapped as wetland. No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

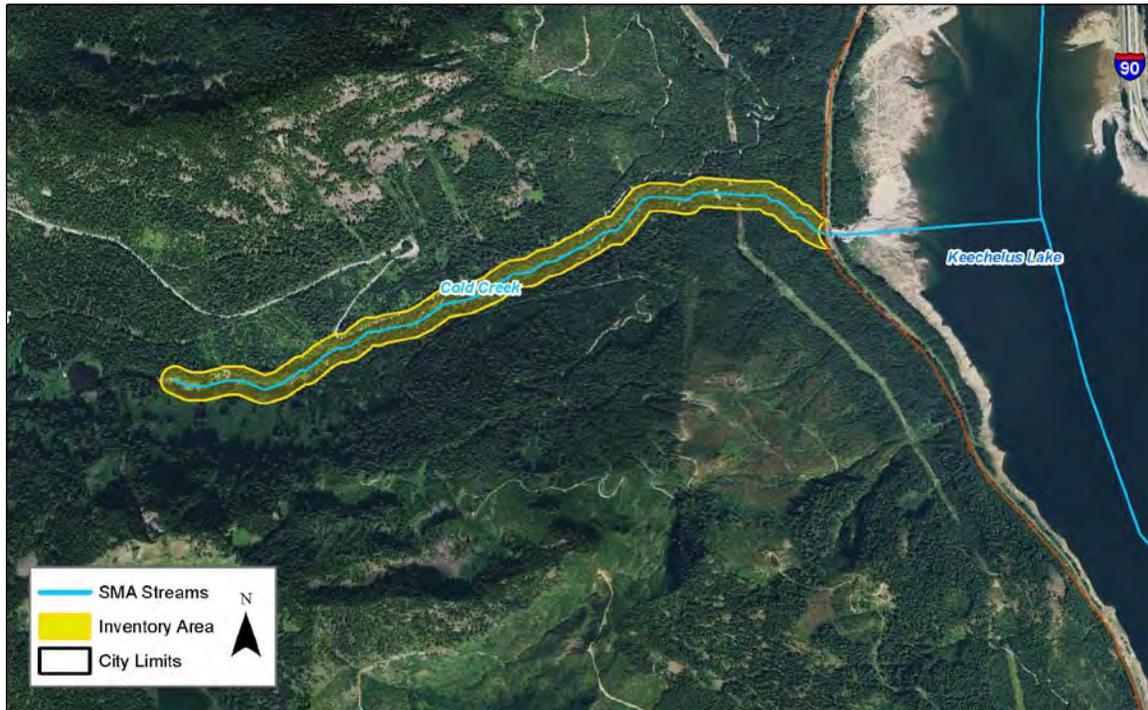
COLD CREEK

SHORELINE LENGTH:

2.0 Miles

REACH INVENTORY AREA:

96.3 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows the presence of rainbow trout and westslope cutthroat. No wetlands are mapped within the reach. No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

A Forest Service road borders much of the northern shoreline. The John Wayne Trail and a Forest Service road cross the downstream end of the reach.

PUBLIC ACCESS (MAP FOLIO #4)

A hiking trail crosses the upstream portion of the reach in two locations and a cross country ski trail borders the northern regulated stream area. The John Wayne Heritage Trail and a hiking trail cross the downstream portion of the reach.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use within the reach is forestry (100%). Land ownership is 2% private and 98% public (Forest Service).

CONTAMINATED SITES

No identified contaminated sites are located within this reach.

ZONING (MAP #5)

Lands within the reach are zoned for commercial forest (100%).

CULTURAL AND ARCHAEOLOGICAL RESOURCES

Historic features such as railroad tracks, campsites, rails, and a railroad grade from the Milwaukee Road Railroad were recorded within the reach. The historic features were determined not eligible for listing on the National Register.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

Medium: The stream is largely unaltered and provides habitat for several priority fish species, but no spawning or rearing habitat is identified.

TERRESTRIAL HABITAT QUALITY

High: The reach is generally well-forested and is connected to a large area of contiguous forest habitat.

VEGETATION FUNCTIONS

High: The reach area generally consists of dense, mature forest cover.

HYDROLOGIC FUNCTIONS

Medium: The stream is largely unaltered, but is located within a narrow floodplain.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

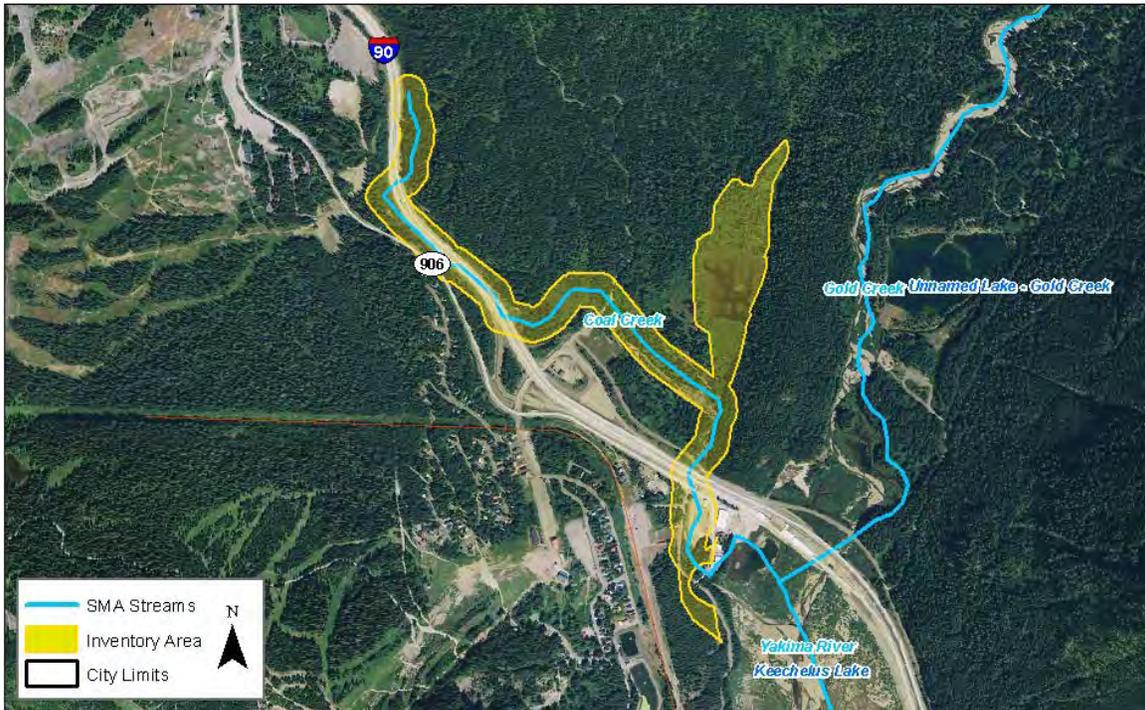
COAL CREEK

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

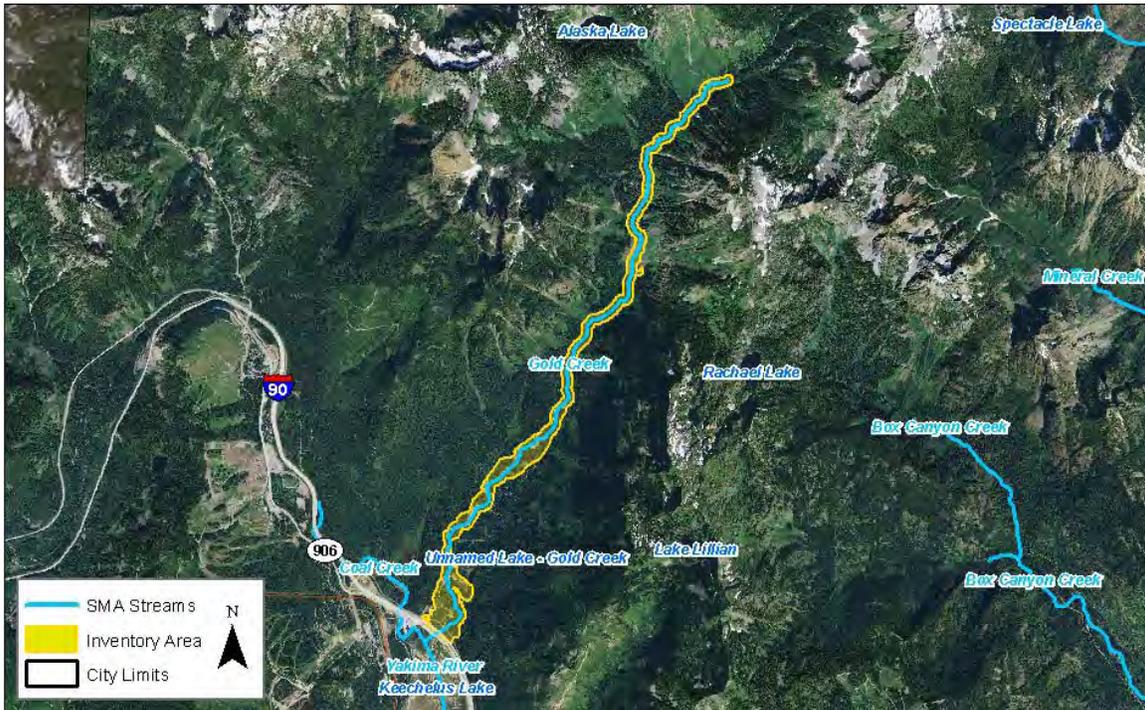
GOLD CREEK

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

<p>SHORELINE MODIFICATIONS (MAP FOLIO #1) I-90 crosses the reach at the downstream end.</p>	<p>PUBLIC ACCESS (MAP FOLIO #4) A hiking trail crosses the upstream portion of the stream at several locations.</p>
<p>EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along upper Gold Creek is forestry (59%), while land use along the lower creek is primarily rural (41%). Land ownership is 41% private and 59% public (Forest Service).</p>	<p>CONTAMINATED SITES No identified contaminated sites are located within this reach.</p>
<p>ZONING (MAP #5) Lands within the reach are zoned primarily for commercial forestry (59%), with some areas of forest & range (20%), mixed use (13%), and other (7%) at the downstream end.</p>	<p>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.</p>

SHORELINE FUNCTION ANALYSIS

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

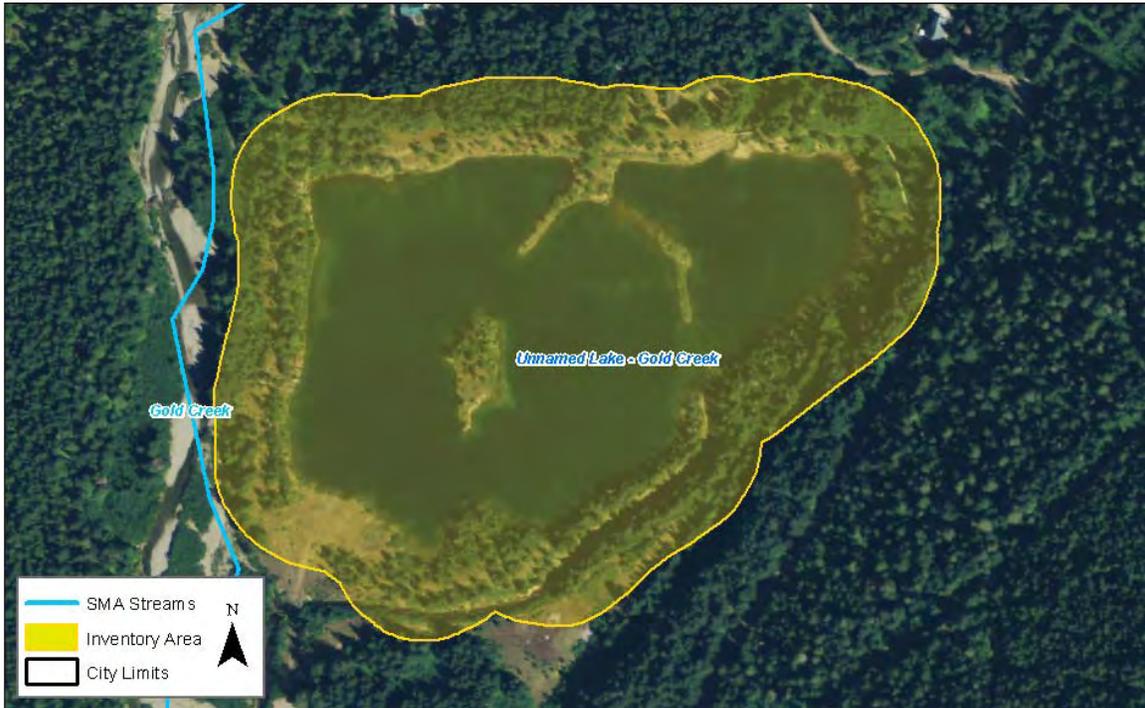
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

- 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.
- Decommission and revegetate any unused roads along the shoreline.
- Protect the high-quality forest and wildlife habitat within the reach.
- Low summer flows in the river are a limiting factor for salmon.

UNNAMED LAKE-GOLD CREEK

SHORELINE LENGTH:
1.3 Miles

WATERBODY AREA: 21.7 Acres
REACH INVENTORY AREA: 45.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows that the lake provides spawning habitat for Kokanee salmon, and the presence of mountain whitefish is also mapped. Approximately 3% of the shoreline is mapped as wetland habitat. No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

3.3 Upper Yakima River

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

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

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

3.3.1 Physical Characterization

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

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

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

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

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

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

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

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

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

3.3.1.1 City of Cle Elum

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

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

3.3.1.2 Town of South Cle Elum

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

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

3.3.2 Habitats and Species

3.3.2.1 Fish Use

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

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

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

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

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

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

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

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

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

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

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

- The Yakima/Klickitat Fisheries Project is managed by WDFW and the Yakama Nation. Its goal is salmon reintroduction through supplementation along with habitat protection and restoration. Species currently being enhanced include spring, summer and fall Chinook salmon, coho salmon, sockeye salmon, and steelhead trout.
- The Yakima River Side Channels Project is managed by WDFW and the Yakama Nation through the Yakima/Klickitat Fisheries Project. It focuses on restoring habitat in the Easton, Ellensburg, Selah, and Union Gap reaches on the Yakima River and the 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 County Conservation District. The Program seeks to restore fish passage to Yakima River tributaries that historically supported salmon and to improve habitat through measures such as fish screening and fish passage improvements, riparian plantings, fencing, and irrigation system improvements.
- Reclamation is leading a cooperative investigation to study the feasibility of providing fish passage at the five large storage dams of the Yakima Project (Bumping Lake, Kachess, Keechelus, Cle Elum, and Tieton). Fish passage efforts at each dam are discussed in the relevant sections of this report.

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

City of Cle Elum

See Section 3.3.2.1.

Town of South Cle Elum

See Section 3.3.2.1.

3.3.2.2 Water Quality

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

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

City of Cle Elum

See Section 3.3.2.2

Town of South Cle Elum

See Section 3.3.2.2

3.3.2.3 Riparian Habitat Conditions (Land Cover)

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

City of Cle Elum

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

Town of South Cle Elum

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

3.3.2.4 Wetlands

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

City of Cle Elum

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

Town of South Cle Elum

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

3.3.2.1 *Wildlife Habitats and Species*

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

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

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

City of Cle Elum

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

Town of South Cle Elum

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

3.3.3 Land Use

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

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

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

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

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

3.3.3.1 City of Cle Elum

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

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

3.3.3.2 Town of South Cle Elum

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

3.3.4 Public Access

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

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

3.3.4.1 City of Cle Elum

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

3.3.4.2 Town of South Cle Elum

The river can be accessed at South Cle Elum Way.

3.3.5 Reach Sheets

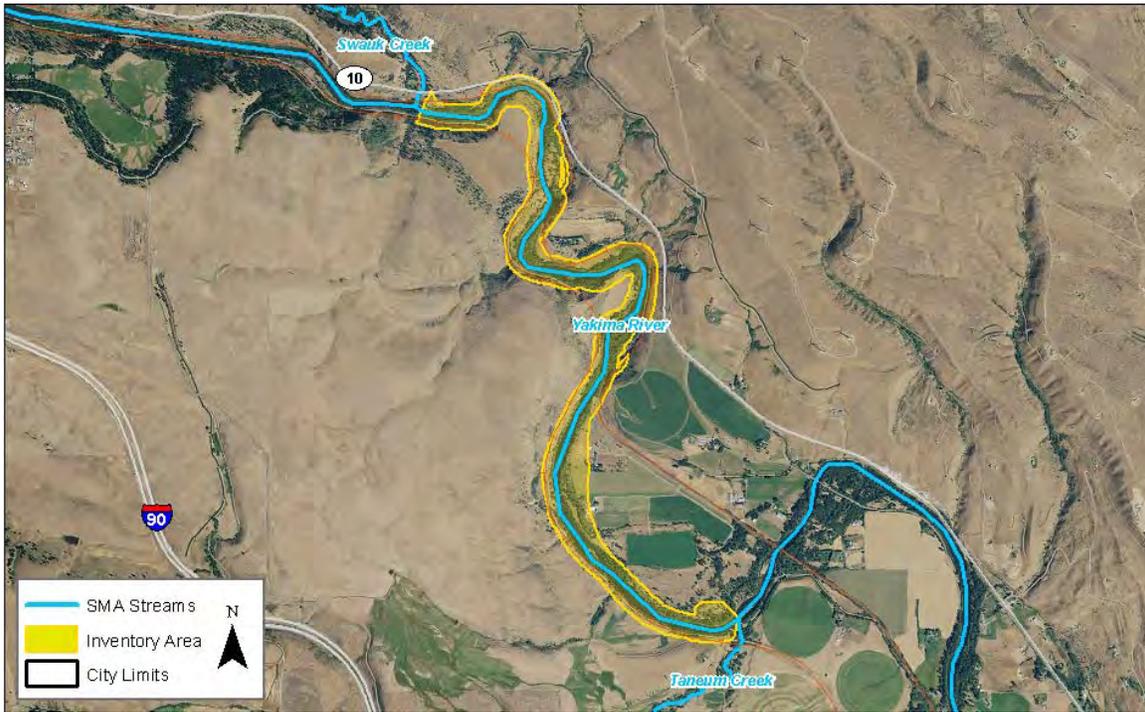
YAKIMA RIVER-REACH 5

SHORELINE LENGTH:

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.

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

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.

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

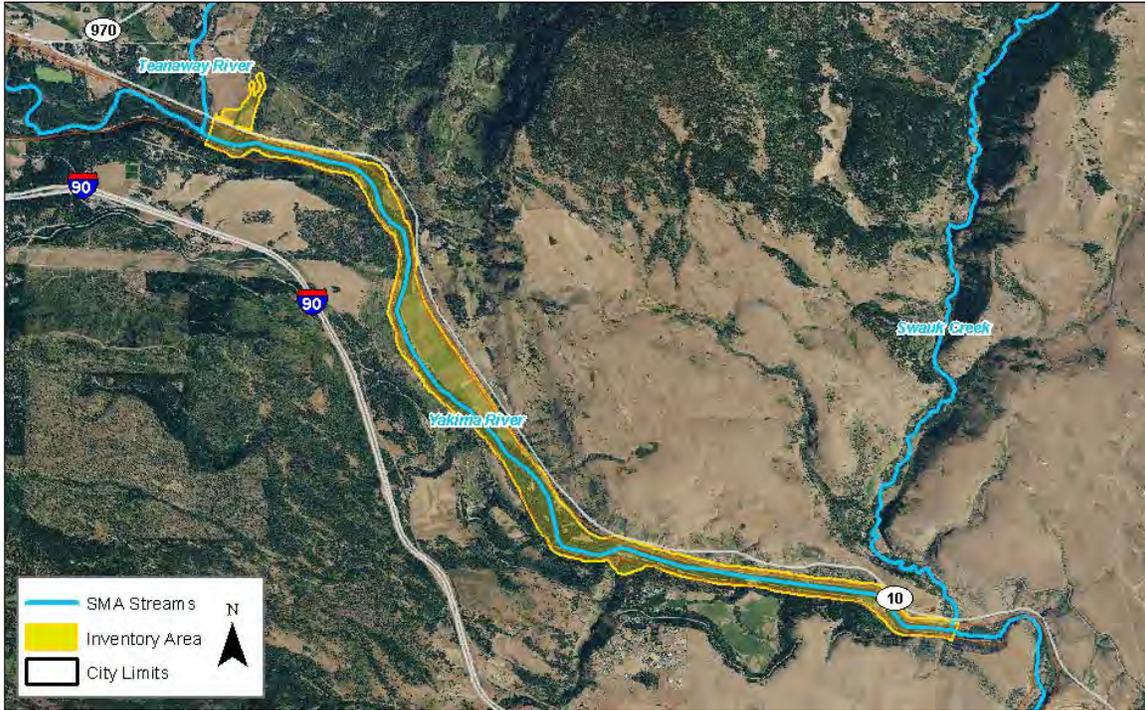
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

YAKIMA RIVER-REACH 6

SHORELINE LENGTH:
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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

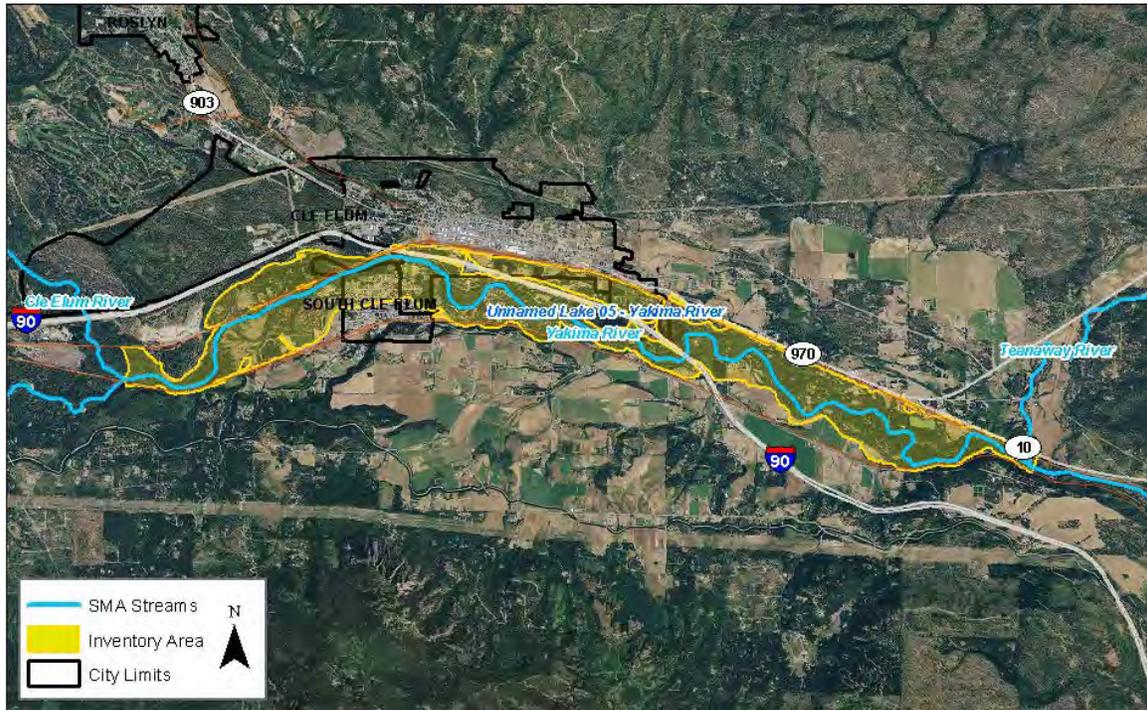
YAKIMA RIVER-REACH 7

SHORELINE LENGTH:

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, and the Teanaway River enters at the east end. Several gravel pits are present, and the channel is confined in several areas by the John Wayne trail, I-90, and Highway 10.

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

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

PUBLIC ACCESS (MAP FOLIO #4)

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

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

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

CONTAMINATED SITES

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

ZONING (MAP #5)

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

CULTURAL AND ARCHAEOLOGICAL RESOURCES

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

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

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

TERRESTRIAL HABITAT QUALITY

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

VEGETATION FUNCTIONS

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

HYDROLOGIC FUNCTIONS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

UNNAMED LAKE 5

SHORELINE LENGTH:
1.0 Mile

WATERBODY AREA: 18.3 Acres
REACH INVENTORY AREA: 36.2 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

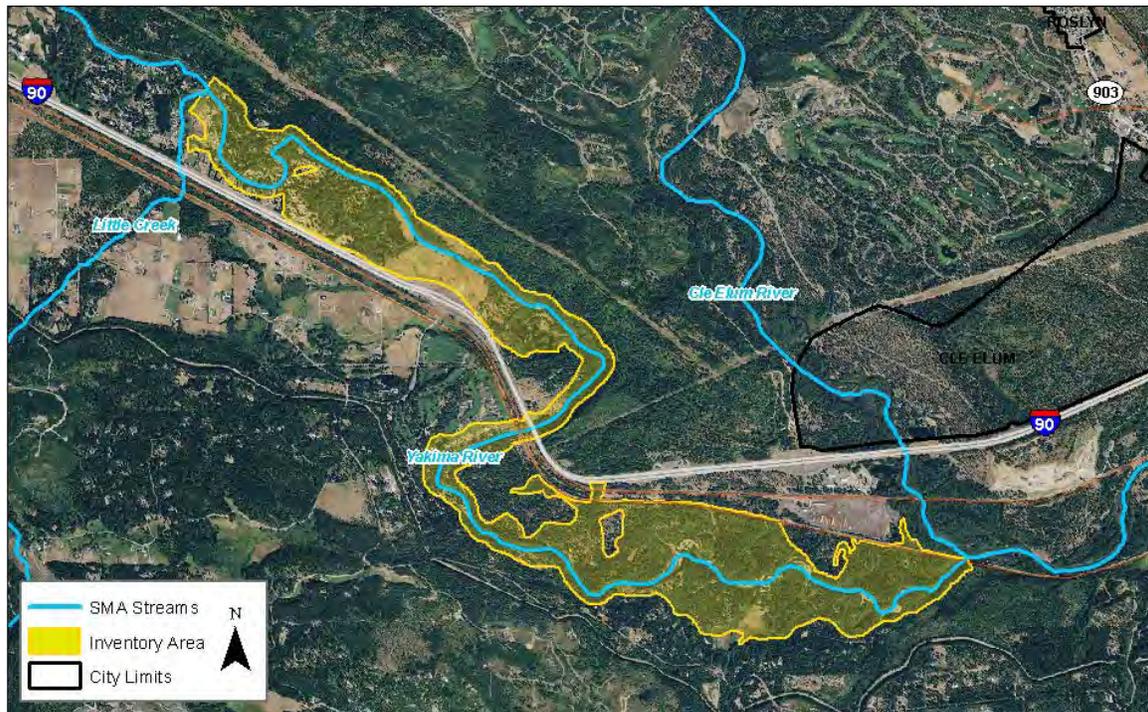
YAKIMA RIVER-REACH 8

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

<p>SHORELINE MODIFICATIONS (MAP FOLIO #1) Portions of the reach (approximately one-tenth) are constrained by hydromodifications, presumably to protect adjacent residences and I-90 at its bridge crossing.</p>	<p>PUBLIC ACCESS (MAP FOLIO #4) The John Wayne Heritage Trail crosses the river at several locations; access is also provided by undeveloped Washington State Parks land.</p>
<p>EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4) Land use along the reach is primarily rural (99%), with some resort land (1%) near the middle of the reach. Land ownership is 84% private and 16% public (State).</p>	<p>CONTAMINATED SITES No identified contaminated sites are located within this reach.</p>
<p>ZONING (MAP #5) Lands within the reach are zoned primarily for rural residential (51%) west of the river and forest & range (40%) east of the river, with patches of master planned resort (1%) and other (8%) [I-90].</p>	<p>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.</p>

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

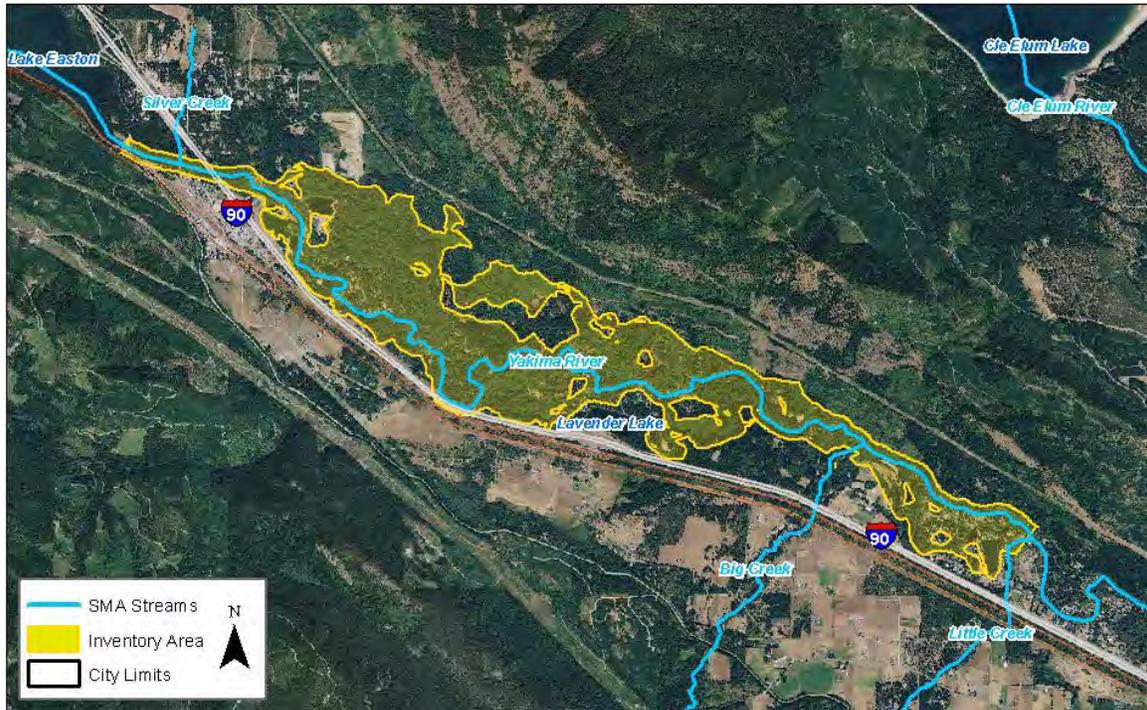
YAKIMA RIVER-REACH 9

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

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

PUBLIC ACCESS (MAP FOLIO #4)

Lake Easton State Park provides access at the upstream extent of the reach. A boat launch is located at Kinghorn Slough Access on the south side of the river, near the downstream extent of the reach.

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

Land use along the reach is primarily rural (81%) with forestry to the northeast (17%), and commercial (1%) and urban (1%) lands along the upstream end of the reach. Land ownership is 81% private and 19% public (State and Forest Service).

CONTAMINATED SITES

No identified contaminated sites are located within this reach.

ZONING (MAP #5)

Lands within the reach are zoned primarily for rural residential (36%) at the downstream end and forest & range (41%) and commercial forestry (15%) at the upstream end, with other (8%) [I-90] running the length of the reach.

CULTURAL AND ARCHAEOLOGICAL RESOURCES

There is 1 recorded precontact site within the reach.

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

High: The reach provides spawning and juvenile rearing habitat for priority fish species (including spring Chinook salmon), has generally low levels of hydromodifications, and exhibits a generally high level of channel complexity.

TERRESTRIAL HABITAT QUALITY

Medium: The majority of the reach consists of dense forest and shrub habitat, but connections to adjacent habitats have been disturbed by transportation corridors and other development.

VEGETATION FUNCTIONS

High: Some areas of alteration exist, but the majority of the reach consists of dense riparian forest and shrub habitat.

HYDROLOGIC FUNCTIONS

Medium: Portions of the river's floodplain are constrained by I-90 within the reach, but the river still has a connection to its floodplain in some areas, particularly in the more sinuous areas along the channel.

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

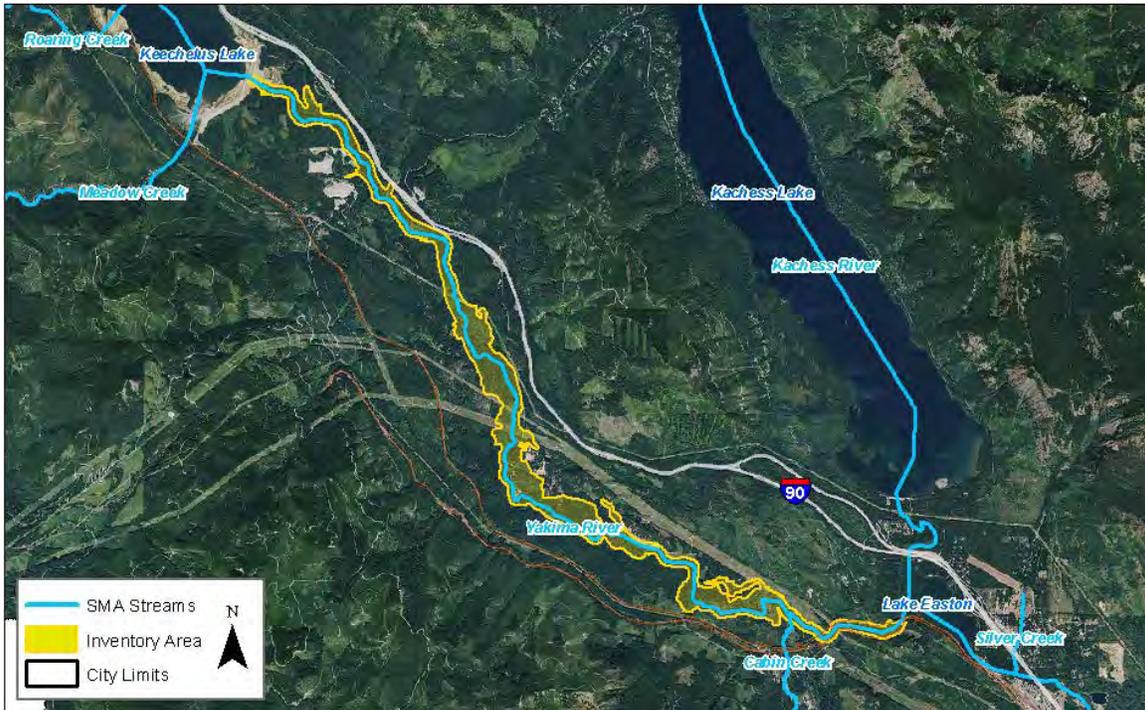
YAKIMA RIVER-REACH 10

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

<p>SHORELINE MODIFICATIONS (MAP FOLIO #1)</p> <p>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.</p>	<p>PUBLIC ACCESS (MAP FOLIO #4)</p> <p>Public access is provided by hiking and snowmobile trails/Forest Service roads that cross the river at several locations, and Easton Ponds.</p>
<p>EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)</p> <p>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).</p>	<p>CONTAMINATED SITES</p> <p>No identified contaminated sites are located within this reach.</p>
<p>ZONING (MAP #5)</p> <p>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.</p>	<p>CULTURAL AND ARCHAEOLOGICAL RESOURCES</p> <p>There are 3 recorded historic sites within the reach.</p>

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

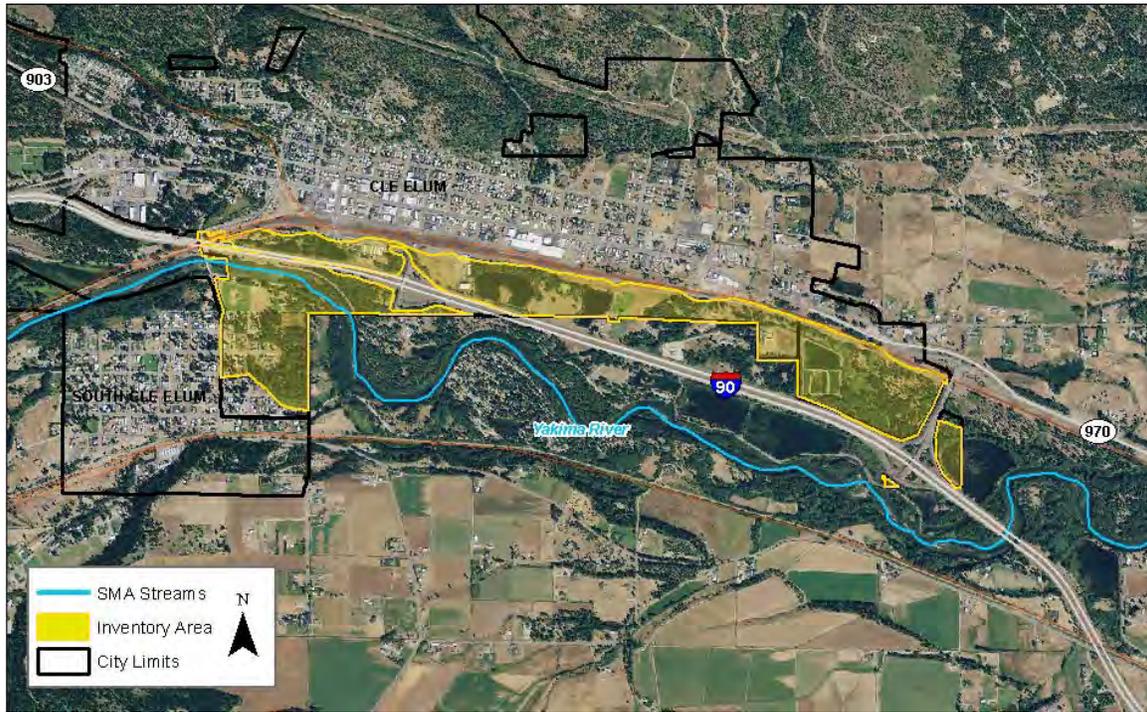
YAKIMA RIVER-CITY OF CLE ELUM REACH

SHORELINE LENGTH:

0.4 Miles

REACH INVENTORY AREA:

279.9 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

YAKIMA RIVER-TOWN OF SOUTH CLE ELUM REACH

SHORELINE LENGTH:

0.1 Miles

REACH INVENTORY AREA:

116.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

CHANNEL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

3.4 Cabin Creek and Log Creek

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

3.4.1 Physical Characterization

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

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

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

3.4.2 Habitats and Species

3.4.2.1 Fish Use

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

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

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

3.4.2.2 Water Quality

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

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

3.4.2.3 Riparian Habitat Conditions (Land Cover)

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

3.4.2.4 Wetlands

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

3.4.2.1 Wildlife Habitats and Species

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

3.4.3 Land Use

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

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

3.4.4 Public Access

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

3.4.5 Reach Sheets

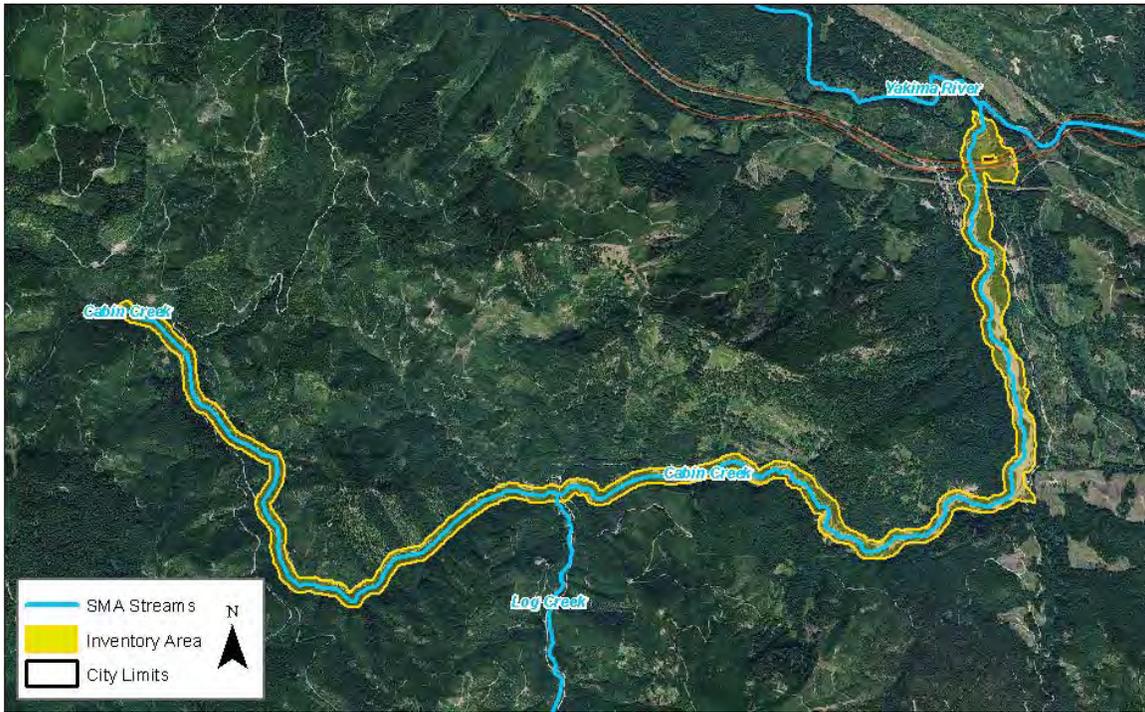
CABIN CREEK

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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	
<p>SHORELINE MODIFICATIONS (MAP FOLIO #1)</p> <p>A Forest Service road parallels the reach and crosses the stream at multiple locations. The road culverts may be fish passage barriers.</p>	<p>PUBLIC ACCESS (MAP FOLIO #4)</p> <p>The John Wayne Heritage Trail and Easton Re-Load Snopark allow access to the stream. A snowmobile trail/Forest Service road parallels most of the reach.</p>
<p>EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)</p> <p>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).</p>	<p>CONTAMINATED SITES</p> <p>No identified contaminated sites are located within this reach.</p>
<p>ZONING (MAP #5)</p> <p>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.</p>	<p>CULTURAL AND ARCHAEOLOGICAL RESOURCES</p> <p>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.</p>

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES
<ul style="list-style-type: none"> • Resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forestry to residential subdivisions). Future new structures should be set back an adequate distance to protect stream functions. • Cabin Creek has a large and unpredictable floodplain in the lower reach. • The Cabin Creek Historic District is located within the reach. • Manage recreational activity to reduce impacts on vegetation and subsequent erosion. • Several road culverts within the reach may be fish passage barriers. • Decommission or repair logging roads to reduce erosion. • Protect the remaining forested floodplain and wetland habitat within the reach.

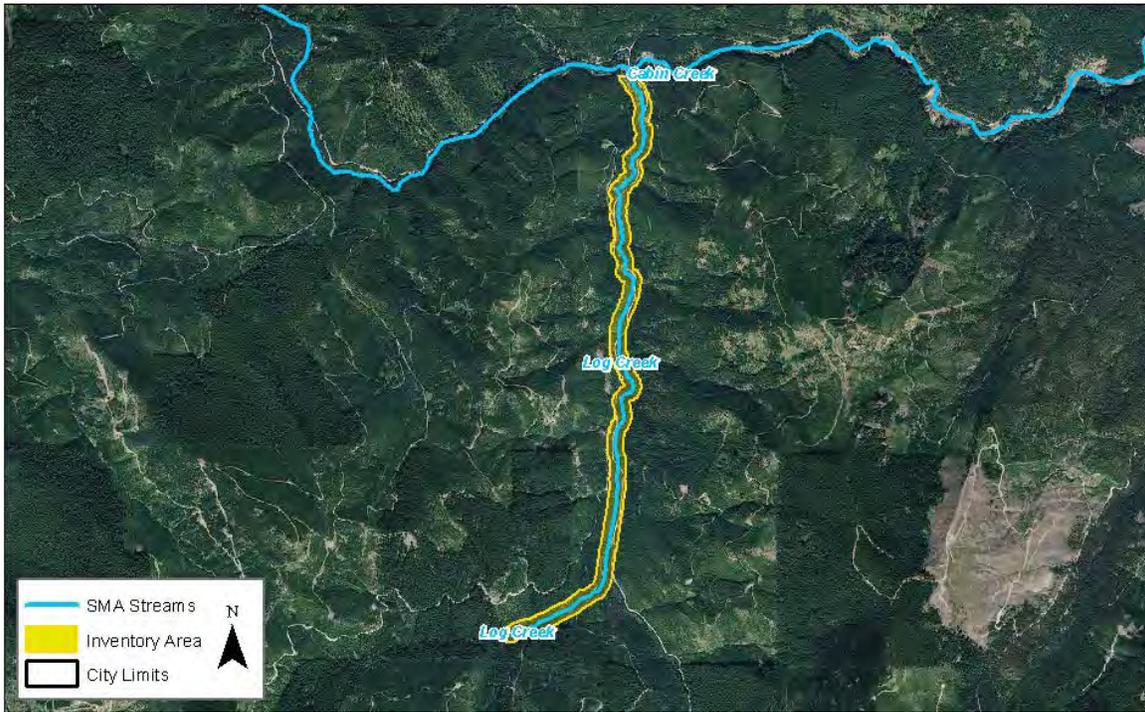
LOG CREEK

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

WDFW mapping shows westslope cutthroat habitat within the reach.
No priority habitats or species are identified in this reach by WDFW.

WATER QUALITY

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

3.5 Lower Kachess River and Lake Easton

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

3.5.1 Physical Characterization

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

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

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

3.5.2 Habitats and Species

3.5.2.1 Fish Use

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

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

3.5.2.2 Water Quality

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

3.5.2.3 Riparian Habitat Conditions (Land Cover)

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

3.5.2.4 Wetlands

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

3.5.2.1 Wildlife Habitats and Species

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

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

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

3.5.3 Land Use

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

3.5.4 Public Access

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

3.5.5 Reach Sheets

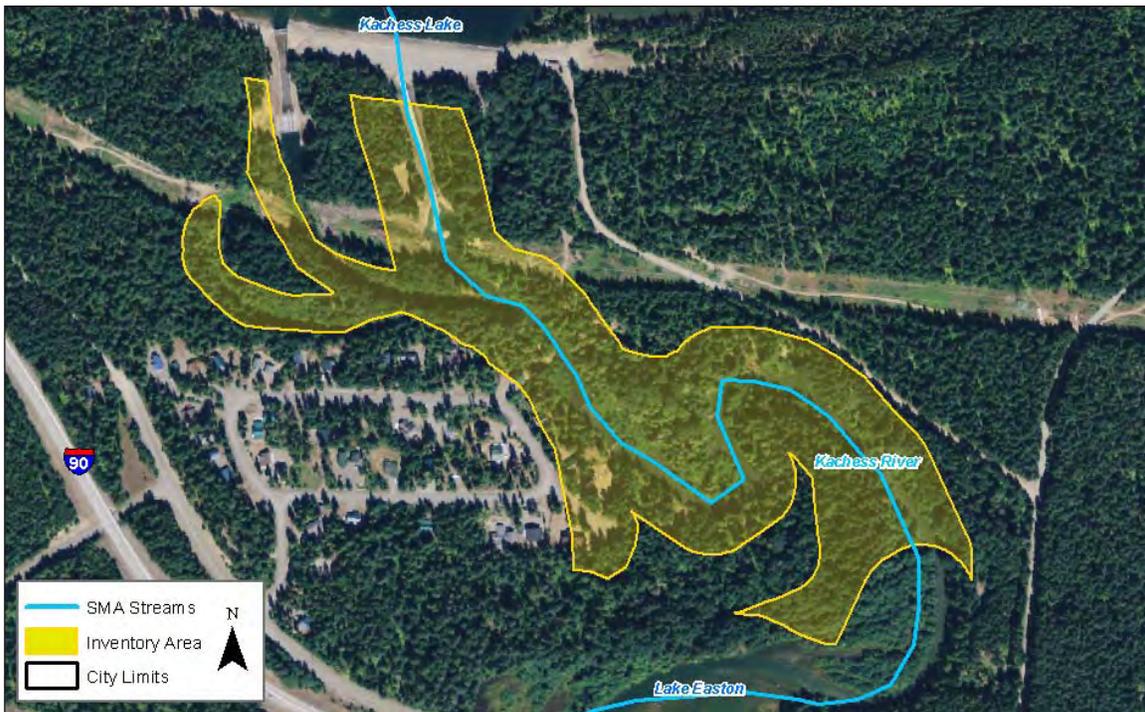
KACHESS RIVER-REACH 1

SHORELINE LENGTH:

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 FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

BUILT ENVIRONMENT AND LAND USE

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

SHORELINE FUNCTION ANALYSIS

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

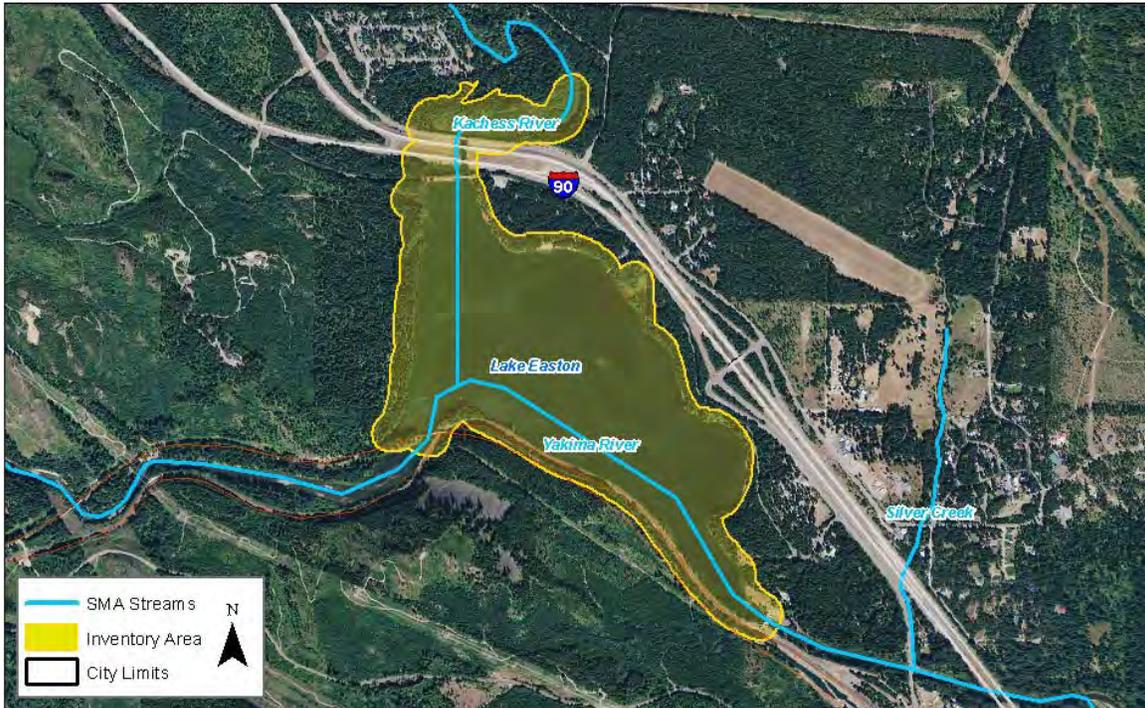
KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

LAKE EASTON

SHORELINE LENGTH:
8.0 Miles

WATERBODY AREA: 208.1 Acres
REACH INVENTORY AREA: 316.1 Acres



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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

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

BUILT ENVIRONMENT AND LAND USE

SHORELINE MODIFICATIONS (MAP FOLIO #1)

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

PUBLIC ACCESS (MAP FOLIO #4)

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

EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)

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

CONTAMINATED SITES

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

ZONING (MAP #5)

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

CULTURAL AND ARCHAEOLOGICAL RESOURCES

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

SHORELINE FUNCTION ANALYSIS

FISH HABITAT QUALITY

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

TERRESTRIAL HABITAT QUALITY

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

VEGETATION FUNCTIONS

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

HYDROLOGIC FUNCTIONS

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES

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

3.6 Kachess Lake

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

3.6.1 Physical Characterization

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

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

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

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

3.6.2 Habitats and Species

3.6.2.1 Fish Use

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

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

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

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

3.6.2.2 Water Quality

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

3.6.2.3 Riparian Habitat Conditions (Land Cover)

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

3.6.2.4 Wetlands

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

3.6.2.1 Wildlife Habitats and Species

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

3.6.3 Land Use

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

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

3.6.4 Public Access

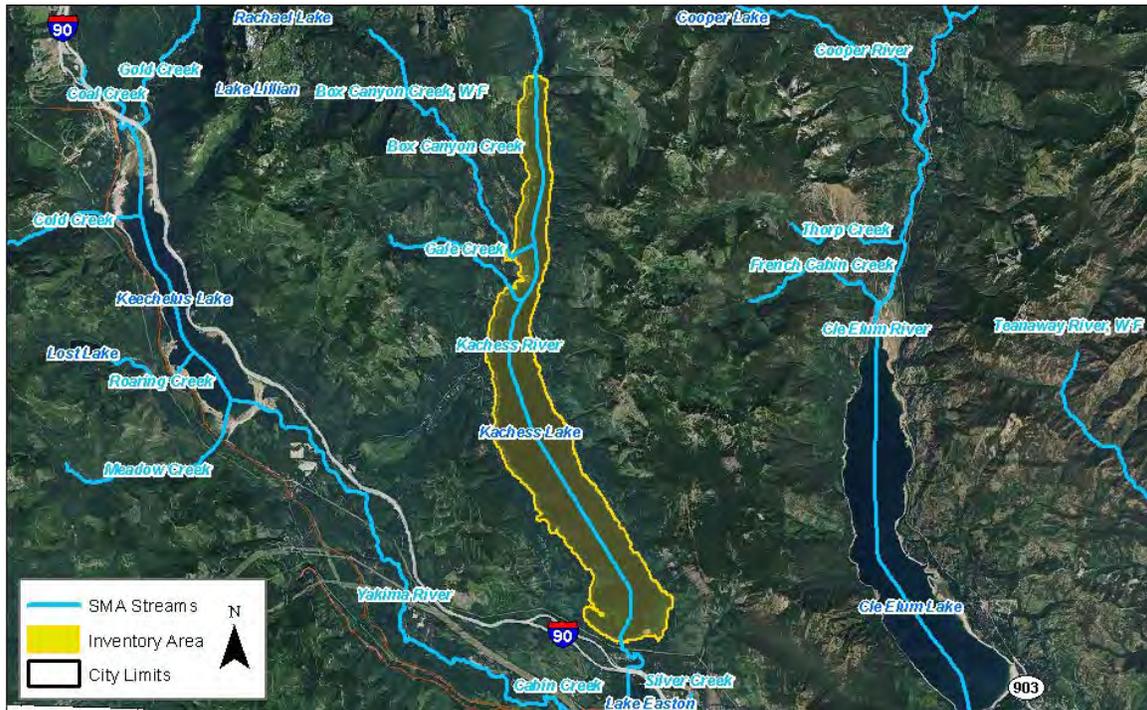
Hiking and snowmobile trails/National Forest roads border much of the Kachess Lake shoreline. A boat launch and National Forest campground are located on the west shore of the lake, off of Kachess Lake Road.

3.6.5 Reach Sheet

KACHESS LAKE

SHORELINE LENGTH:
77.1 Miles

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



PHYSICAL AND ECOLOGICAL FEATURES

PHYSICAL CONFIGURATION

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

LAND COVER (MAP FOLIO #3)

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

HAZARD AREAS (MAP FOLIO #2 & APPENDIX C)

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

HABITATS AND SPECIES (MAP FOLIO #1)

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

WATER QUALITY

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

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	
<p>SHORELINE MODIFICATIONS (MAP FOLIO #1)</p> <p>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.</p>	<p>PUBLIC ACCESS (MAP FOLIO #4)</p> <p>Hiking and snowmobile trails/Forest Service roads border the northwest and southeast shorelines of the lake. A boat launch and National Forest campground are located on the northwest shoreline of the lake, off of Kachess Lake Road.</p>
<p>EXISTING LAND USES AND OWNERSHIP (MAP FOLIO #4)</p> <p>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).</p>	<p>CONTAMINATED SITES</p> <p>No identified contaminated sites are located within this reach.</p>
<p>ZONING (MAP #5)</p> <p>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%).</p>	<p>CULTURAL AND ARCHAEOLOGICAL RESOURCES</p> <p>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.</p>

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

KEY MANAGEMENT ISSUES AND OPPORTUNITIES
<ul style="list-style-type: none"> • Based upon existing land use patterns in the area, resource lands within the reach have the potential to be converted to more intensive uses (e.g., from forest lands to residential subdivisions). New development should be set back an adequate distance to protect riparian functions along the lakeshore. • Kachess Dam is a complete barrier to fish passage. Participate in programs to install fish passage facilities at Kachess Dam. • Protect the high-quality forest and wildlife habitat within the reach. • Many important cultural and archaeological sites are located within the reach. • Educate shoreline property owners about measures to protect and restore riparian areas. • Decommission and revegetate any unused roads along the shoreline. • Encourage new/existing docks to be joint-use structures designed to be fish-friendly (e.g., grating to allow light penetration, use of non-toxic materials).

3.7 Kachess Lake Tributaries

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

3.7.1 Physical Characterization

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

3.7.2 Habitats and Species

3.7.2.1 Fish Use

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

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

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

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

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

3.7.2.2 Water Quality

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

3.7.2.3 Riparian Habitat Conditions (Land Cover)

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

3.7.2.4 Wetlands

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

3.7.2.1 Wildlife Habitats and Species

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

3.7.3 Land Use

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

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

3.7.4 Public Access

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

3.7.5 Reach Sheets