4. Lower Oregon Columbia Gorge Tributaries Watershed Assessment

4.1 Subbasin Overview

General Description

Location and Size

The Lower Oregon Columbia Gorge Tributaries Watershed consists of the 19 small Columbia River tributaries located between Bonneville Dam and the Hood River. Its major streams are Herman and Eagle creeks. The watershed is located in Hood River County, except for a small part of the Eagle Creek drainage, and includes the City of Cascade Locks and part of the City of Hood River. The watershed covers a drainage area of 63,714 acres or 99.6 square miles.

Geology

Volcanic lava flows, glaciers, and flooding were the key forces forming the Columbia Gorge landscape of basalt cliffs, waterfalls, talus slopes and ridges. Land elevations rise rapidly from 72 feet above sea level to approximately 5,000 feet. Mt. Defiance is the highest peak at 4,960 feet. Landslides are the dominant erosional process in recent history (USFS, 1998). Debris torrents and ice and snow avalanches are not uncommon in the winter months. Alluvial fan deposits at the mouths of the steeper, more constricted creeks suggest the frequent routing of debris torrents down these channels. The lower mile or so of creeks have gradients of about 5 percent, rising steeply at middle elevations, with lower gradient channels in glaciated headwater valleys.

Climate and Weather

The watershed lies in the transition zone between the wet marine climate to the west and the dry continental climate to the east. Precipitation amounts vary dramatically from east to west and with elevation, ranging from 40 to 125 to inches annually. Annual average air temperatures at Cascade Locks vary from a low of 29 degrees to a high of 81 degrees F (http://info. econ.state.or.us).

Land Cover

The majority of the watershed is in mid-seral stage forest reserves, with some sizeable late-successional stage forest stands largely along canyon bottoms at the upper elevations. The upper stream elevations in the Hatfield Wilderness and Columbia River Gorge National Scenic Area are in a nearly natural condition, with many diverse habitats interspersed within coniferous forest. Forest communities include riparian hardwoods including red alder, big leaf maple, black cottonwood, Oregon ash, and varied wetlands along the Columbia River that change rapidly to upland western hemlock forest in the west and Douglas fir, grand fir and Oregon oak/ponderosa pine forests on the east. The

abrupt topographic and climate changes along this stretch of the Gorge have created a patchwork of diverse habitats in closer proximity than found elsewhere in the Cascades (USFS, 1998). These include basalt cliffs, talus and scree slopes, low elevation forested slopes, wet meadows, dryland balds, riparian woodlands, and subalpine communities on the higher peaks. These habitats add niche diversity to the watershed, and are responsible for the large number of sensitive plant and lichen species. Detailed plant distribution and range information is lacking because of difficult terrain and limited botanical surveys.

Land Use and Population

Over 90 percent of the watershed is inside the Hatfield Wilderness and the Columbia River Gorge National Scenic Area (NSA). Numerous hiking trails are distributed across the watershed, but few roads above the 250' elevation band. The Columbia River, Interstate Highway 84, and Union Pacific Railroad form a major transportation corridor and a dominant land use feature in the watershed. Numerous developed recreation sites exist within one half mile of the I-84 corridor. A 90-mile trail system is located in the Hatfield Wilderness. An estimated population of 4,225 is concentrated within the City of Cascade Locks (1,140) and in the west side of the City of Hood River and its environs (Portland State University, 2003). Land use in the more populated areas include urban, commercial, industrial, rural residential, forestry, agriculture, and shallow draft marinas.

Economy

Outdoor recreation and tourism are the major economic activities in the Cascade Locks area. Recreation attractions include hiking trails, Bonneville Dam interpretive facilities, Wahtum, Rainy, and North lakes, campgrounds, picnic areas, a marina, sport fishing access to the Columbia River, and a scenic riverboat tour operation, all in proximity to the Portland area. Economic development is a priority since the loss of timber jobs in the 1980s. In the City of Hood River and Hood River County, the fruit orchard industry is a major part of the local economy. The economy has diversified in the last 20 years to become a retail trade center and a destination resort area. Tourism rose in the 1980s, due to the rise in water recreation activity on the Columbia River, notably windsurfing and more recently kite boarding. Timber harvest revenues from county-owned forest contribute significantly to public services in the county.

Land Ownership

Table 23. Land ownership in the Lower Oregon Columbia Gorge Tributaries Watershed.

Land Ownership	Acres	Percent
Hood River County	23	0.04%
Hood River County Forest	2,202	3.46%
OTHER	1,608	2.52%
Private	4,399	6.91%
S.D.S. Co., LLC	86	0.13%
State	267	0.42%
State Highway Comm.	46	0.07%
State Park	1,889	2.97%
USDA Forest Service	53,179	83.49%

Over 90 percent of the watershed is publicly owned, with 25,158 acres in the Columbia River Gorge National Scenic Area and 32,000 acres in the Hatfield Wilderness managed by the U.S. Forest Service. The State owns 2,202 acres of land, mostly in State Park, and the County owns 2,225 acres, mostly as managed timberlands (Table 23).

Human Disturbances to Aquatic and Terrestrial Environments

According to a 1998 Forest Service Watershed Analysis, 3 major changes have impacted the watershed since European settlement: 1) damming of the Columbia River; 2) development of the Columbia River Gorge as a major transportation route: and 3) suppression of the natural wildfire regime (USFS, 1998).

A major alteration of fish and wildlife habitat has been the inundation and loss of lowland riparian hardwood communities along the Columbia River (USFS, 1998). A diversity of stream delta, wetland, and floodplain habitats were permanently flooded in 1938 when Bonneville Dam was constructed. A GIS analysis by Chuti Fieldler, USFS-NSA, compared digitized aerial photographs from the early 1930s to current digital photographs. This analysis estimated that 1,465 acres of riparian and floodplain habitat and at least 6.5 miles of anadromous stream habitat in the Lower Oregon Columbia Gorge Tributaries were inundated by the Bonneville Pool. The most significant habitat losses occurred in the lowlands and deltas of Herman Creek; in the area extending from Starvation Creek to Viento Creek; and from Phelps Creek to the Hood River delta. Since 1938, excavation, fill, and revetment activities for port, industrial, and transportation purposes have further altered the Columbia River shoreline and creek mouth areas. The Bonneville Pool impedes or prevents mammals crossing the Columbia River, especially when coupled with highway and railroad tracks on both sides of the river. Prior to these developments, north-south migration of medium to large mammals was possible during low to moderate river flows, and during winters when the river froze over (USFS, 1998).

Aquatic and terrestrial habitat connectivity is interrupted by the Union Pacific Railroad, Interstate Highway 84, the Columbia River Historic Highway, the BPA transmission line, urban development, farms, parks, fish hatcheries, ports, and industrial sites. I-84 and the Union Pacific rail line run parallel to the Columbia River shoreline, traversing all creek drainages and disconnecting upland from lowland areas and the Columbia River. This is the primary east-west transportation corridor in Oregon. Rail and roadway fill, culverts, and crossings impede the natural movement of water, sediment, debris, and biota to lower creeks and the Columbia River. Fish migration barriers exist at two ODFW fish hatchery operations in the watershed. Transportation maintenance activities, including dredging and large woody debris removals upstream of road and railway crossings, have further modified channels and constrain meander development in the lower part of every stream in the watershed. Highway median barriers, fencing, and vehicle traffic prevent or impede wildlife access to and from the Columbia River. A daily annual average of 21,400 vehicles travel I-84 through the watershed and more than doubles from May-October (ODOT, 2001). The BPA Bonneville-Hood River powerline transmission corridor traverses the watershed parallel to I-84 through low elevation forest. Trees and tall growing vegetation are cut or managed within a 150-foot right of way corridor, contributing to habitat fragmentation and invasive weed infestations.

Fire suppression has altered forest ecology compared to the natural and historical conditions. Until the 1850s, Native Americans in the watershed used fire to maintain travel corridors and huckleberry fields. With the advent of the railroad in 1882, railroad tracks were a source of frequent fires. In 1902, fires burned over 100,000 acres in the Columbia River Gorge (USFS, 1998). Since then, fire has been suppressed to protect loss of human life, property, and transportation infrastructure. A Fire Regime Condition Class 2 is reported (http://sde.gis.washington.edu/arcims/nbii) for the watershed area. Uncharacteristic conditions including vegetation and fuel load in Condition Class 2 range from low to moderate, and the risk of loss of key ecosystem components is moderate (http://fire.org/frcc). A steadily increasing fuel load raises the risk of high intensity catastrophic fire events, and increases risk in areas that did not traditionally incur much fire damage, such as canyon riparian areas, cliffs, and talus slopes. The absence of low-intensity fire has changed the forest species composition and led to forest stands with more hemlock and grand or silver fir, and a reduction of vine maple (USFS, 1998). Because of the absence of fire, Ponderosa pine and Douglas fir are encroaching into oak stands in the easternmost part of the watershed near Phelps and Post Canyon creeks.

Land development in the watershed is concentrated at the lower elevations. Almost all fish and wildlife habitat in the watershed below the 240' contour line is significantly altered from reference conditions by transportation infrastructure, reservoir inundation, urban and industrial areas, and recreation development (C.Fiedler, CRGNSA, 2004). The altered land area totals 3,180 acres or approximately 5% of the watershed. In contrast, most lands above the 240' elevation are relatively unaltered, with the exception of recreation trails, and lands in the Phelps Creek drainage that are managed as industrial forest or mixed uses. Erosion and potential wildlife disturbance impacts associated with increasing and intensive recreational trail construction and use in the upper Phelps Creek and Post Canyon creek drainage has increased in recent years. A May 16, 2004 communication with Central Washington University herpetology professor Steven Wagner reported that the Post Canyon area forest habitat for the rare Oregon slender salamander *(Batrachoseps wrighti)* is highly affected by recreational mountain bicycle use, which includes a density of trails, structures, and exposed soil areas. Wagner noted that there was little visible impact from recreation use ten years ago.

Historic timber practices including stream clean-out have altered riparian and instream habitat conditions in lower elevations within 2 to 3 miles of the Columbia River. The U.S. Forest Service estimated the historical condition of anadromous fish habitat by comparing the relatively natural, unmanaged upper reaches of each stream with the lower reaches where timber harvest and other developments have occurred. The number of large wood pieces and pools in the upper stream reaches are considered close to presumed natural conditions. Pool habitat and large woody debris in lower stream reaches do not meet the aquatic habitat standards in the Mt. Hood National Forest Land and Resource Management Plan. For example, in 1998 Herman Creek surveys, 0 to 22 pieces of large woody debris per mile were found compared to a desired future condition of 80 or more pieces per mile (USFS 1998).

4.1.2 Subbasin Existing Water Resources

Watershed Hydrography and Hydrologic Regime

The watershed encompasses 170 miles of perennial stream and 208 miles of intermittent stream according to the 2003 Regional Ecosystem Office (REO) 1:24,000 mapping (Table 24). Sixth level Hydrologic Unit Code subwatershed boundaries are shown in Appendix A, Map 1. The largest stream drainages are Eagle, Phelps, and Herman creeks (Table 25). Numerous small lakes and ponds totaling 110 surface acres are concentrated in the glaciated areas above 3,800 feet elevation. Most lakes are shallow and under twelve feet deep. The largest is the 60-acre, 160 foot deep Wahtum Lake at the headwaters of Eagle Creek. The next largest is the 6-acre North Lake at the Lindsey Creek headwaters. Few stream surveys have been completed to headwater sources because of extreme gradients and vertical rock sidewalls. Headwaters above 3,000 feet tend to have low gradient channels within broad U- shaped valleys carved out by glacial melt during the Ice Age. Lower channels below 3,000 feet have extremely sheer side slopes and are contained in steep V-shaped valleys.

Table 24. Streamflow regime by REO 2003 Sixth Hydrologic Unit Code subwatersheds.

6th HUC Subwatershed Name		Miles
CARSON CREEK	Total	30.5
	Intermittent	*15.9*
	Perennial	*14.5*
EAGLE CREEK	Total	171.1
	Intermittent	*96.1*
	Perennial	*75.0*
GRAYS CREEK	Total	82.0
	Intermittent	*38.9*
	Perennial	*43.1*
HERMAN CREEK	Total	94.7
	Intermittent	*57.0*
	Perennial	*37.6*

Stream hydrology is characterized by a transient snowpack between 1,000 and 4,000 feet elevation. Extensive seeps and springs feed the creeks, as do high elevation lakes and wetlands. Stream flow percolates through alluvial deposits or debris fans at or near stream mouths, causing surface flow to disappear in some locations. The northerly aspect of stream channels and deep shaded canyons contribute to wet, cool conditions. Major floods are the result of rain-on-snow events coinciding with prior saturated conditions. Most floods occur between December and February. Discharge data for these streams are limited. The average annual runoff of Herman Creek was estimated at 81,000 acre-feet (State Water Resources Board, 1965). A large part of the surface water flowing from the south wall of the Columbia Gorge near Cascade Locks disappears underground and reappears in large springs including Oxbow Springs on the west to Crystal Springs on the east (Wheeler, C.L., 1966).

Table 25. Stream survey information with notes on barriers and flow regime (C. Fiedler, USFS Columbia River Gorge National Scenic Area Office, 2004.)

Stream Name	Length (mi.)	Comments	Years Surveyed
Eagle EF Eagle	12.0 2.9	Perennial stream with intermittent break at unknown river mile. E. Fork is intermittent, with headwater at Wahtum Lake. 80' natural falls barrier @ RM 2.0.	1990, 1997 2003
Ruckel	4.0	Intermittent flow in lower 2.1 miles. 40' natural falls at Historic Highway trail crossing at RM 0.2.	2003
Rudolph	2.0	Stream flows through western edge of city of Cascade Locks.	*
Dry	3.2	Intermittent flow below RM 2.0, perennial to at least RM 2.2. Natural falls at RM 2.2. No survey above falls.	1997, 2003
Herman	8.5	Perennial stream almost to headwater at Hicks Lake. 7' falls at RM 2.8 (coho barrier). Impassible 33' falls at RM 3.5	1994, 1998
E. Fork Herman	4.0	Perennial to headwaters at Mud Lake. Numerous barrier waterfalls beginning at RM 0.1	1995
Grays	1.5	Intermittent above I-84 (1993 photos). No formal survey.	*
Gorton	2.5	Perennial except from RM 0.11to 0.41,1526' above/below I-84 Series of impassable waterfalls at RM 0.83 to 1.0. No surveys above RM 1.0 @ 120' falls in box canyon. Mouth of stream in impounded pond formed by railroad fill.	1997, 2003
Harphan	2.0	Intermittent to RM 0.3 (1993 photos). No formal survey. Steep gradient starts around RM 0.9. 60' falls at RM 1.0.	*
Summit	1.5	Intermittent to RM 0.1. No surveys beyond RM 0.15 Series of 8-15' falls near RM 0.02. 50' falls at RM 0.15.	1979
Lindsey	4.0	Perennial to at least RM 0.86. No surveys above this point. Series of falls start near RM 0.25. Headwater is North and Bear Lakes. Mouth is impounded pond formed by railroad fill.	1979, 1996 2003
Wonder	0.5	Steep tributary to Warren Creek w/ falls near mouth. No formal survey.	*
Warren	2.5	Intermittent at mouth, up to RM 0.15. No survey above RM 0.2 (50' falls). Mouth is impounded pond by railroad fill. Headwater at Warren Lake.	1979, 2003
Cabin	1.0	Intermittent from mouth to near first waterfall (200') at RM 0.07 Perennial after RM 0.05 to end of formal survey at RM 0.8.	1990
Starvation	1.3	Perennial to survey end at RM 0.15, likely to at least RM 1.0.	1979, 2003
Viento	3.0	Perennial to survey end at RM 1.4. Falls at RM 0.5 is a potential coho barrier. Impassible above RM 0.8-1.0. Mouth is impounded pond formed by railroad fill.	1979, 1996 2003
Perham	1.6	No survey data	*
Mitchell	0.5	No survey data	*
Phelps	6.5	207' Wah Gwin Gwin falls at mouth. No survey data	*
Post Canyon	4.0	Tributary to Phelps Creek. No survey data	*

Water Quality

In general, water quality in the Lower Oregon Columbia Gorge Tributaries watershed is currently among the best in Oregon (USFS, 1998). Summer stream temperatures are typically between 55° and 60° F and are ideal for salmonid production. Eagle Creek is the exception, below the hatchery diversion, where 7-day average maximum stream

temperatures reach around 68° F every year during July and August below the. Temperature data collected by the USFS National Scenic Area suggests that maximum July and August monthly water temperatures in Lower Oregon Columbia Gorge tributaries were between 1.6 and 8.8 degrees F cooler than several Washington Gorge tributary streams for which data was provided (Appendix B). The average maximum July and August temperatures in lower Herman Creek in the years 2000 to 2003 was 57.7 degrees F, while the average daily water temperature at Bonneville Dam was 68 degrees or warmer. Herman Creek and possibly other watershed streams may provide important thermal refugia for upriver migrating salmon and steelhead during summer and fall months when the Bonneville Pool temperatures are warmest. Most streams have dissolved oxygen at maximum saturation levels. Water clarity in high lakes is excellent. In the Phelps Creek drainage, a dense network of forest roads and recreation trails exists and may contribute to elevated fine sediment levels, however, little water quality data exists for this drainage. The Phelps Creek drainage has the highest road density in the watershed at 5.8 mi/mi^2.

Riparian Resources

Riparian plants in upper stream elevations within the Upper Scenic Area in the Mt Hood National Forest and in the Hatfield Wilderness are believed to be in a natural condition. These riparian areas were assessed as meeting Aquatic Conservation Strategy Objectives (ACS) riparian plant objectives, and as having a high future potential to meet them (USFS, 1998). The lower 1-2 miles of streams in the watershed did not meet the ACS riparian plant objectives but were considered to have a future potential for some improvement. The ACS is a series of nine Northwest Forest Plan objectives that deal with maintaining or improving the ecological function of a watershed.

Wetland Resources

Less than 1% of the watershed is comprised of wetlands. A GIS analysis using National Wetlands Inventory data found 94 wetlands totaling 270 acres in the watershed. About 51% of the wetland acreage is in the Lacustrine System. Over half of these wetlands are adjacent to the Columbia River and include the artificial impoundments created by the road and railroad fill along the I-84/Union Pacific transportation corridor.

4.1.3 Hydrologic and Ecologic Trends in the Subbasin

Macro-climate and Influence on Hydrology and Ecology

The climate trends and influences are assumed to be similar in both the Gorge Tributaries Watershed and Hood River Subbasin planning areas.

Human Use Influence on Hydrology

The major human influences on hydrology are the Bonneville Dam and the rail and highway transportation systems. The damming of the Columbia River inundated a total of approximately 6.4 miles of anadromous stream habitat (Chuti Fieldler, USFS-NSA). Inundation has shifted the formation of stream deltas upstream to areas that are directly

adjacent to the Interstate 84, Union Pacific Railroad, and the Historic Columbia River Highway. These transportation systems have undersized culverts and stream crossings in many places, interrupting the natural flow of wood, water and sediment into downstream areas including the Columbia River. This has led to the need for routine dredging of stream channels to maintain water flow through the culverts under the highways and railroad tracks.

Water is diverted from aquifers, springs, and streams for a variety of uses. Viento and Grays creeks are diverted for irrigation and domestic water. Eagle and Herman creeks are diverted to operate state salmon hatchery facilities. The City of Cascade Locks withdraws its municipal water supply from 2 wells adjacent to Herman Creek that are hydraulically connected to the creek. The wells have a supply capacity of 1.3 MGD. Current average water demand is less than one third that amount, but can be expected to increase toward capacity depending on future levels of economic development and the degree to which water conservation practices are implemented. The City maintains wells and a storage reservoir adjacent to Dry Creek for use as a supplemental and emergency municipal water source.

Human Use Influence on Ecology

The Bonneville Pool inundated most of the former lowland hardwood riparian communities, and many remaining hardwood stands occur on private or other property subject to future development and loss of these communities.

Terrestrial wildlife habitat is permanently disconnected to the north by the I-84/Union Pacific transportation corridor and the Bonneville Reservoir. This problem is aggravated by solid concrete median barriers that are impossible for small to medium-sized wildlife to climb over or move through. Vehicle traffic volumes are expected to increase in the next 20 years at a rate of between one and three percent annually. ODOT monitors daily traffic volumes on I-84 using automated recorder stations. Daily traffic increased by 0.63 and 1.8 percent per year between 1992 and 2001 near Troutdale and The Dalles, respectively.

The City of Cascade Locks population is projected to increase from the present 1,130 to 1,377 by 2020 (Hood River County, 2003). The increase could be significantly higher depending on the outcome of economic development plans including a potential tribal casino resort in Cascade Locks. Population growth in the Portland and Columbia Gorge area is leading to increasing levels of outdoor recreation in backcountry and shoreline habitat areas. Recreational use will continue to rise into the foreseeable future. Steep terrain and limited road access might protect species able to use steeper, less accessible habitat from the impacts of increased human presence.

Urban-interface forest fuels reduction efforts will likely be implemented in the next few years. In September 2003, a fire caused by a powerline failure burned in the City of Cascade Locks causing evacuation of residential areas and the closure of I-84. A Community Wildfire Prevention Plan is being prepared for the City in 2004. Fuels treatment is likely to affect wildlife habitat availability and diversity either in a positive

or negative direction, depending on coordination or the degree to which wildlife habitat needs can be integrated into the plan.

The introduction of invasive exotic plants into native plant communities is causing a dramatic disturbance to native vegetation (USFS 1998). This trend is expected to continue. Roads, trails, and powerlines are corridors for the spread of weeds along with campgrounds, quarries, overgrazed lands, and construction sites. Currently, the highest priority species for prevention and control in the watershed are Japanese knotweed, hawkweed, and hounds tongue due to their extreme threat to ecosystems, their ability to spread to relatively undisturbed habitat areas, and the current opportunity for prevention and control (Robin Dobson, USFS-NSA, personal comm.). Knotweed infestations were found in Tanner and Moffet creeks just west of the watershed boundary in 2003, and in Cascade Locks and Ruthton Park in the watershed in 2004.

4.1.4 Regional Context

Relation to the Columbia Basin and Ecological Province

The Lower Oregon Columbia Tributaries watershed is part of the Columbia Gorge Subbasin in the Columbia Gorge Province, and is a small fraction of the Columbia River Basin (Figure 22). The Columbia Gorge Subbasin includes numerous small tributaries in Oregon and Washington, and the mainstem Columbia River from Bonneville to The Dalles dams. The Lower Oregon Columbia Tributaries watershed makes up approximately 25% of the Columbia Gorge Subbasin in the Columbia Gorge Province (Figure 23). The watershed is less than 5% of the Columbia Gorge Province.

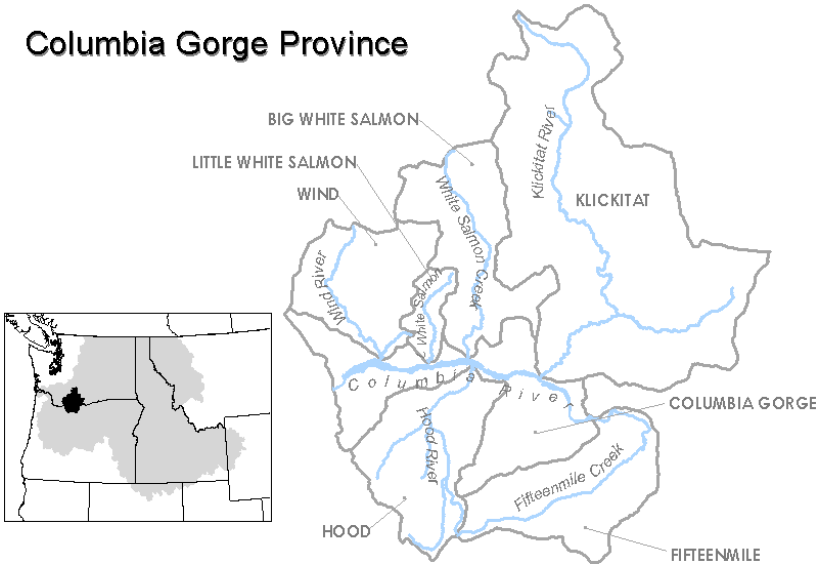

Figure 22. Relation of the Columbia Gorge Subbasin to the Columbia River Basin and ecological province.

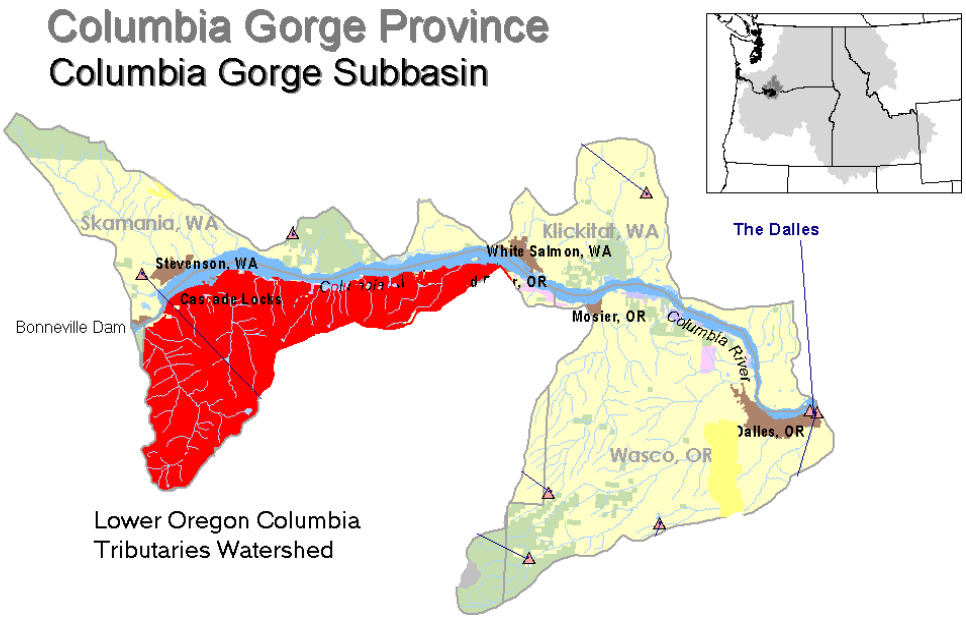

Figure 23. Relation of the Lower Oregon Columbia Tributaries watershed to the Columbia Gorge Subbasin.

Unique Qualities of the Subbasin Within the Province

The Columbia Gorge Subasin is an area of high terrestrial and aquatic biodiversity, and may provide important coldwater refugia for anadromous fish migrating to upstream Columbia River subbasins, including the Snake River. Abrupt topographic and climate changes that characterize the Columbia Gorge creates a patchwork of diverse habitats in closer proximity than found elsewhere in the Cascade Range (USFS, 1998). The middle and upper reaches of most streams in the Lower Oregon Columbia Tributaries Watershed are on National Forest or designated Wilderness Area. Limited road access and rugged terrain has afforded the upland areas considerable isolation from most development and human intrusion. Numerous waterfalls have naturally isolated resident rainbow and cutthroat trout populations in the area streams since late postglacial times, considered to be 10,000 to 32,000 years ago (Benke, 1992). The natural geologic barriers and remote drainages have sheltered the fish inhabiting these streams, potentially making a substantial contribution to the biodiversity of these species within the Province. Genetic samples taken from trout above and below the waterfalls within the watershed support this hypothesis (Spruell, 1998). The streams in this watershed may provide important thermal refuges for anadromous fish migrating upriver. Stream temperature data collected by the Forest Service indicate that these streams may be cooler than those on the Washington side of the Columbia Gorge (Appendix B). According to a fish passage report by the Independent Scientific Advisory Board (ISAB), upstream migrants, particularly Snake River summer and fall chinook and summer steelhead, experience warmer temperatures for a longer duration during migration than they did prior to construction of the large upstream water storage projects. In 1997, temperatures exceeded 20 ºC for 67 days in John Day Lock and south fish ladder. Temperatures in Portland District fish ladders have been extensively monitored (e.g., Dalen et al. 1996, 1997, and 1998). The ISAB points out that adult chinook salmon held above 15.6 ºC at hatcheries have a lowered reproductive potential. Bell (1991) states that the upper limit of

the optimum migration temperature range for chinook is 14 ºC. Bell also says that fish can detect temperature differences as small as 0.28 ºC. It is well known that many adult salmonids migrating through the lower Columbia River dip into the cooler tributary mouths along their way upstream. The USGS/NMFS data show that few chinook salmon stray temporarily into tributaries, but that large numbers of steelhead destined for the Snake River enter lower Columbia River tributaries temporarily. (http://www.nww.usace.army.mil/planning/ep/anadromousfish/AdultSalmon.html) Available harvest data from Eagle and Herman creeks (Table 32) suggest that summer steelhead and spring chinook, which are not produced in these creeks, may be using these creeks as thermal refuges during their upstream migration to other tributaries.

NMFS Evolutionary Significant Units (ESUs)

Steelhead in watershed streams were listed as a federally threatened species in March 1998 as part of the Lower Columbia River Ecologically Significant Unit (ESU). Fall chinook salmon using these streams are included within the Lower Columbia River Chinook ESU.

USFWS Designated Bull Trout Planning Units

There are no proposed critical habitat designations for bull trout in this watershed. Bull trout presence or absence in watershed streams has not been confirmed. Bull trout use the Columbia River and are potentially able to enter and use the mouths of tributaries in the watershed. While stream temperatures are cold enough to support bull trout, holding and rearing habitat above the creek mouths is lacking given the simplified and constrained channels below natural waterfalls (C. Fiedler, CRGNSA, *pers. comm*.).

Priority Species and Habitats

The Washington Department of Fish and Wildlife (WDFW) identifies priority species and habitats to support land use planning and habitat protection. The list of species for Region 5 includes the Columbia River Gorge and is available at the WDFW website http://www.wdfw.wa.gov/hab/phslist.htm. Priority habitats are those with unique or significant value to a diverse species assemblage. Priority habitat types in the Gorge include cliffs, caves, riparian and instream areas, wetlands, old growth and mature forests, Oregon white oak woodlands, snags and logs, talus, and urban natural open space. While Oregon has no similar program, the Oregon-Washington Chapter of Partners-in-Flight identifies bottomland hardwoods, old-growth and mature forest in the Pacific Northwest as priority habitats.

Summary of External Environmental Impacts on Fish and Wildlife

External impacts on fish and wildlife in the Gorge Tributaries watershed include climate cycles, mainstem fish passage, estuary and ocean conditions; harvest; habitat conditions and land use in adjacent subbasins, and human population growth. Anadromous fish survival during freshwater life stages is influenced by drought and flood patterns, while ocean survival is influenced by temperature and upwelling cycles that determine predator and prey abundance and distribution. Climate and precipitation cycles are associated with patterns of fire, drought, insects, and diseases that control forest and vegetation development. Climate effects can alter the distribution of vegetation types and associated

wildlife, strongly affecting biodiversity. Mainstem fish passage in the Columbia River at Bonneville Dam affects the survival of adult and juvenile fish migrating to and from the Gorge tributaries, along with predation and water quality in the Bonneville Reservoir. Estuary habitat modifications and elevated sea bird predation in the Lower Columbia River impose additional impacts. Population growth and land development in adjacent subbasins are significant external factors that can impact the health of migratory and resident wildlife populations in the watershed. Regional population growth is contributing to a rising demand for outdoor recreation and land development that ultimately affect fish and wildlife populations.

4.2 Focal Species Characterization and Status

4.2.1. Wildlife, Plants and Fish of Ecological Importance

According to the Northwest Habitat Institute database, a total of 438 species of fish and wildlife present or potentially present in the Columbia Gorge area (www.nwhi.org/ibis). This section provides a discussion of some of the species that occur in the planning area.

Anadromous Fish: Three anadromous salmonid species are present and two others are potentially present. Steelhead trout (*Oncorhynchus mykiss*) and Chinook salmon (*O. tshawytscha*) are observed in Eagle, Herman, Lindsey, and Viento creeks. Coho salmon (*O. kisutch)* are observed in the lower reaches of Herman, Lindsey and Viento creeks. A few chum (*O. keta*) and pink salmon (*O. gorbuscha*) may use these streams. Lamprey larvae are documented in the mouths of Perham and Viento creeks, and may occur in other tributary mouths. Three species including Pacific lamprey (*Lampetra tridentata*), river lamprey *(L ayresi),* and resident brook lamprey *(L. richardsoni)* may be present.

Resident Fish: Rainbow trout are the predominant resident salmonid. Cutthroat trout have been found in Lindsey, Dry, Starvation, Viento, and upper East Fork Eagle creeks in past USFS surveys. Cutthroat and rainbow trout are observed in Phelps Creek. An inland subspecies of rainbow trout *(O. mykiss irideus)* is suspected above barrier falls in Lindsey Creek but genetic confirmation is lacking. Torrent sculpin (*Cottus rhotheus*) are present. Non-native fish species in the Bonneville Pool may use tributary mouths.

Wildlife: Reptiles, birds, insects, amphibians, mammals, and mollusks and other invertebrates are present in the watershed. Large mammals include black tailed deer, elk, cougar, and black bear. A complete list is available from the Northwest Habitat Institute

Plants: Remnant stands of native bottomland hardwood trees especially cottonwood, big leaf maple, Oregon white ash, Oregon white oak, and willow exist in the watershed. Numerous rare or sensitive plant species are very likely present but botanical information was not included in this assessment. No federally listed plant species are known to occur. Non-native invasive plants are common at lower elevations.

Species Designated as Threatened or Endangered

Table 26. Fish and wildlife species present designated as Threatened or Endangered by the State of Oregon or the federal government.

Species	Federal Status (ESA)	State of Oregon
Bald eagle	Threatened	Threatened
Northern spotted owl	Threatened	Threatened
Steelhead trout	Threatened	Threatened
Bull trout	Threatened	Threatened
Chinook salmon	Threatened	Threatened
Wolverine		Threatened
Peregrine falcon		Endangered

Species Recognized as Rare or Significant to Local Area

A number of species and habitats were identified as important or rare in the 1992 Columbia River Gorge National Scenic Area Management Plan (Appendix A, Map 11). Other selected species and their status are listed in Table 27.

Table 27. List of selected wildlife species considered rare or significant to the Lower Oregon Columbia Gorge Tributaries Watershed.

Name	Status	Notes
Pileated woodpecker	Oregon State Sensitive Species	
Purple martin	Oregon State Sensitive Species	
Peregrine falcon	Endangered in Oregon	Removed from federal ESA listing
Larch Mountain salamander	Oregon State Sensitive species USFS Region 6 sensitive species	Documented in Starvation Creek in the 1980s
Cope's giant salamander	Oregon State Sensitive species USFS Region 6 sensitive species	
Red legged frog	State sensitive species USFS Region 6 sensitive species	
Cascade frog	Oregon State Sensitive Species	
Western pond turtle	Oregon State Sensitive Species USFS Region 6 sensitive species	
Painted turtle	USFS Region 6 sensitive species	
Basalt juga snail Species No. 2	Natural Heritage Rank: *Imperiled throughout its range & in Oregon*	Found only in wet cliff habitat in the Columbia River Gorge
Goshawk	Oregon State Sensitive species	
American Marten	Oregon State Sensitive species	
Fisher	Oregon State Sensitive Species	
Red fox		25 estimated county population 1980
Elk		3 herds regularly observed
Wolverine	(possibly extirpated)	4 estimated county population in 1980

Species with Special Ecological Importance to the Subbasin

Especially ecologically important species in this watershed include those species listed above, and other species which are good indicators of ecological health or biodiversity,

serve a critical functional role in the ecosystem, are critically linked with fish, or influence vegetation structure or other elements. All anadromous fish are especially important because their carcasses provide an important food source for scavengers, particularly in fall and winter when other food may be limited. Salmon carcasses also supply marine nutrients to the riparian area for vegetation growth, and are essential as a food or energy source for fish and macroinvertebrates in the aquatic food chain. Beaver are important because their pond structures serve as critical overwintering habitat for juvenile salmon and trout.

Species Recognized by Tribes For Cultural or Spiritual Significance

Most fish and wildlife species have a significant cultural or spiritual value to Native American tribes. The meat, skin, feathers, or other parts of numerous wildlife species have been and continue to be used for food, ceremonial, medicinal, or other purposes. Anadromous fish are of special importance to Pacific Northwest tribes and are relied upon by tribal members for ceremonial, subsistence, and commercial fisheries. The Confederated Tribes of the Warm Springs Reservation holds treaty fishing and hunting rights in the watershed. Deer and elk are an important subsistence species. Pacific lamprey are also valued for ceremonial and cultural uses, and are an important component of the tribal subsistence fisheries that occur annually in Fifteenmile Creek, Deschutes River and Willamette River subbasins. Lamprey are fatty and nutritious, and have also been used for medicinal purposes. Lamprey oils have been used as hair oil and were traditionally mixed with salmon and used as a cure for tuberculosis. The population status of Pacific lamprey is of concern region wide. Fish ladder counts at Bonneville and other Columbia River dams suggest a dramatic declining trend in lamprey numbers. Many more lamprey are counted passing Bonneville Dam than passing The Dalles Dam, however little is known about lamprey holding, spawning and rearing in the Bonneville Pool and tributaries.

4.2.2 Focal Species Selection

List of Species Selected

Fish:

- Steelhead trout
- Rainbow trout
- Chinook salmon

Wildlife:

- Bald eagle
- Black tailed deer
- Beaver
- Basalt juga (snail)
- Great blue heron
- Purple marten
- Northern spotted owl

Methodology for Selection

Focal species for fish and wildlife were selected based on their relevance to 2 or more of the following criteria using guidance from the Northwest Power Planning Council (NWPPC 2001-20):

1) Status under the Endangered Species Act (ESA), or sensitive status in Oregon and/or Forest Service Region 6;
2) Ecological significance or ability to serve as an indicator of environmental health for other species;
3) Importance to tribal culture;
4) Ability to gage the effectiveness of management actions;
5) Ability to represent an important land cover type or subcover type consistent with the Northwest Habitat Institute Interactive Biological Information System (IBIS).

Table 28. Focal species list and selection criteria for the Lower Orgeon Columbia Gorge Tributaries watershed.

Focal species	Population Status or Concern	Management Scope Exists	Ecological Significance or Indicator	Tribal Cultural Importance	Represents Priority Habitat Type
Steelhead trout	X	X		X	
Rainbow trout		X	X		X
Chinook salmon	X	X		X	
Bald eagle	X	X	X	X	X
Black tailed deer		X		X	X
Beaver		X	X	X	X
Basalt Juga snail	X	X	X		X
Great blue heron		X	X		X
Purple martin	X	X	X		X
Spotted Owl	X	X	X	X	X

All ESA-listed fish species were selected as focal species, except for chum salmon whose presence is undocumented in the watershed. Rainbow trout were selected to indicate the stream health for other species, including rare and sensitive aquatic invertebrates. Wildlife selection was also based on the species' ability to represent distinct land cover types or critical habitat elements. Added rationale for the wildlife focal species selection is provided below.

Bald Eagle: The bald eagle is a culturally significant bird and is sensitive to human disturbance. The bald eagle uses the mesic lowland hardwoods (big leaf maple, cottonwood, Oregon white ash, Oregon white oak, willow) for nesting and perching along the Columbia River, and conifer forests in Gorge canyons for nesting. Winter concentrations of eagles are associated with spawning salmon along the mainstem, sand flats, island edges, coves, and tributaries of the Columbia River.

Basalt Juga: This small snail, *Juga oreobasis species 2*, occurs only in the cliff habitat of the Columbia River Gorge, and nowhere else in the world. It is representative of the specialized and little-known fauna that lives in the cold springs or seeps on exposed basalt bedrock and talus, often with a moss-mat layer. Presence of basalt juga serves as

an indicator of high water quality and micro-site conditions within a highly specialized and unique ecosystem. Much of its habitat is along highway and railroad tracks that have modified the lower part of some springs. Roadside and track maintenance, development, spraying, and diversion of spring complexes impact known sites (Frest and Johannes, 1999). The Oregon Natural Heritage Program reports the Natural Heritage Rank of this species as *Imperiled throughout its range* and *Imperiled in Oregon*.

Beaver and Black-tailed Deer: The beaver and the black-tailed deer were selected to represent the physical connections between wildlife habitats that allow for the movement and dispersal of individuals, species, and gene flow between populations, often called wildlife migration corridors. Beaver and deer represent small and large mammals whose future status depends in part on actions to insure that habitat connectivity is incorporated in transportation systems and land use. Beaver movement occurs across a variety of wetland cover types and short stretches of land that connect these. Beaver were selected because of their ecological function, a close link to salmonid species, and their value in representing other small mammals for habitat connectivity. Beaver are killed on Highway I-84 (Davis, 2004), and represent other small and mid-sized animals that cannot climb over the solid median highway barriers found along Highway I-84. Special concerns are access to the Columbia River across I-84 for small mammals, and maintaining wildlife corridors in the Hood River Valley believed to be important to elk and deer to access winter range and year round foraging. Deer are a managed game species important to tribes and the general community. Both deer and elk utilize a wide range of available forest, edge, and mixed cover types, including agricultural lands on an opportunistic basis. Three well-known elk herds and are regularly seen between Herman Creek and Wyeth.

Great Blue Heron: This carnivore forages on a variety of vertebrates in shallow water and sand-gravel, cobble, mud shorelines. Colonial nesting (rookery) typically occurs within mesic lowland or bottomland hardwood or conifer stands along the Columbia River. Herons are sensitive to disturbance at nesting and foraging sites and may abandon rookeries (WDF&W, 1999). Herons are a good indicator of ecological conditions in their breeding and foraging habitats (Hayes, 2003).

Purple Martin: This long-distance, migratory swallow feeds aerially on a wide variety of flying insects, including damsel and dragonflies. It is tolerant of humans. The presence indicates understory and emergent wetland vegetation that support healthy invertebrate populations. This colonial nester focuses on open habitats with cavity structure and some wind protection, including water or fields/grasslands adjacent to water. It is a locally significant species, and has experienced population declines due to loss of structural nesting habitat and competition by introduced species. It is listed as a State Sensitive and Partners in Flight species (Marshall et al., 2003).

Table 29. Focal wildlife species and associated land cover or subcover types.

Focal Wildlife Species	**Land Cover Type** or Subcover Type
Bald eagle	Western lowland conifer-hardwood forest Bottomland hardwood forest Islands, gravel bars, and sand flats
Northern spotted owl	Western lowland conifer-hardwood forest Montane mixed conifer forest
Basalt Juga *J. oreobasis 2* (snail)	Basalt cliffs with springs
Black tailed deer	Mixed environs Movement patterns across cover types
Beaver	Movement patterns across cover types; Streams, ponds, backwater areas, and mainstem Columbia River wetland habitats
Purple martin	Low-elevation ponds, backwater areas, and mainstem Columbia River wetland habitats (with live and dead trees with cavities near open water)
Great Blue Heron	Bottomland hardwood forest Islands, gravel bars, and sand flats

4.2.3 Aquatic Focal Species Population Delineation and Characterization

Winter Steelhead Trout

Abundance, Productivity, and Life History Diversity: Smolt, adult, or juvenile population and life history data are not available for these streams. Steelhead spawning in the Lower Oregon Columbia Gorge tributaries are assumed to be winter run steelhead.

Carrying capacity: A historical abundance of 243 steelhead was estimated for all of the small Oregon and Washington tributaries between Bonneville Dam and the Hood River (Myers, J. M., et al, 2002). Carrying capacity in the watershed for steelhead is naturally limited by waterfalls and steep gradients close to the Columbia River.

Population trend: No information was found to characterize the population trend for steelhead in the Lower Oregon Columbia Gorge Tributaries watershed.

Unique Population Units/Genetic Integrity: Genetic analyses are not available to determine whether steelhead spawners or stocks are of natural or hatchery origin.

Population Risk Assessment: A risk assessment specific to the steelhead populations in this area are not available. A majority of the Biological Review Team for the updated status review for West Coast steelhead assembled by NOAA Fisheries considered the Lower Columbia Steelhead ESU populations to be in the "likely to become endangered" category. All of the major risk factors identified by previous BRTs still remain. Most populations are at relatively low abundance, although many have shown higher returns in the last 2-3 years, and those with adequate data for modeling are estimated to have a relatively high extinction probability. The hatchery contribution to natural spawning remains high in many populations (West Coast Salmon Biological Review Team).

Fall Chinook Salmon

Abundance, Productivity, and Life History Diversity: Smolt or juvenile population and life history data are not available for these streams. Spawning survey data is limited. A total of 892 live and 105 dead adult chinook salmon were observed in Herman Creek during the 2002 fall surveys conducted by the CRGNSA. During years of good ocean conditions, or even most years, the number of hatchery tule chinook spawning in many of these of streams likely exceeds carrying capacity. Superimposition of redds is common.

Carrying capacity: Estimates of carrying capacity are not available for these streams. Carrying capacity for fall chinook is naturally limited by waterfalls and steep gradients a short distance from the Columbia River.

Population trend: Fall chinook in this watershed are greatly influenced by hatchery origin fish spawning in the wild (Rod French, ODFW, pers. comm.).

Unique Population Units/Genetic Integrity: Fall chinook spawning in watershed streams may be hatchery strays or the progeny of hatchery strays from area fish hatcheries. Genetic analyses are not available to determine which stocks are of natural or hatchery origin.

Rainbow Trout

Abundance, Productivity, and Life History Diversity: Rainbow trout are believed to be the predominant resident salmonid present in the Lower Oregon Columbia Gorge Tributaries watershed. Juvenile population and life history data are not available.

Carrying Capacity: Estimates of carrying capacity are not available for these streams.

Population trend: No information was found to characterize the population trend for rainbow trout in the Lower Oregon Columbia Gorge Tributaries watershed.

Unique Population Units/Genetic Integrity: The development of numerous waterfalls since the postglacial period has likely contributed to allopatric populations of trout genetically segregated by these geologic barriers. The possible presence of an inland subspecies of rainbow trout *(O. mykiss irideus)* is noted above barrier falls in Lindsey Creek, and may be present in other streams, but genetic confirmation is not available.

Population Risk Assessment: A risk assessment for rainbow trout in this watershed is not available. It is assumed that rainbow trout populations inhabiting streams on federal lands in the watershed have a low risk of extirpation given a high land protection status, excellent water quality, and little influence from hatchery rainbow or introduced non-native stocks.

Current Distribution: A map of the current distribution of the focal fish species is provided in Appendix A, Map 8 and Map 9. With a few exceptions, anadromous fish distribution is curtailed by waterfalls or steep gradients within a half mile of the Columbia River. The total number of anadromous stream miles is 11.7 as mapped in Appendix A, Map 9. Steelhead, chinook, and coho spawning is primarily observed in Eagle, Herman, Lindsey, Perham, and Viento creeks. A summary of current and historic distribution, natural and artificial migration barrier information for each stream in the watershed is provided in Appendix B. Resident fish surveys at higher elevations have been limited by steep terrain, vertical rock sidewalls, and waterfalls, which make surveys arduous and sometimes unacceptably hazardous. Visual surveys in the lower reaches of these streams have noted both cutthroat and rainbow trout, sometimes in the same stream. Rainbow and cutthroat trout are closely related species that readily hybridize, and visual differentiation between these species is difficult especially in small fish (Spruell, 1998). Genetic tissue analysis is needed for absolute certainty to species identification.

Historic Distribution and Differences in Distribution Due to Human Disturbance

Changes in fish distribution caused by artificial migration barriers and Bonneville Reservoir inundation are summarized in Table 30. Under current conditions, an analysis found that over 13 miles of potential anadromous stream habitat length has been lost or impeded compared to historic conditions. A total of 6.46 miles of stream was inundated by the Bonneville Reservoir (Chuti Feidler, USFS-NSA, 2004). This calculation was based on a comparison of digitized orthophotos of the Columbia River from the year 2000 and the 1930s prior to dam construction. In the current condition, anadromous fish distribution is partially or fully curtailed by artificial barriers in 6 streams totaling of 6.59 miles of habitat.

Table 30. Stream habitat loss and changes in anadromous fish distribution due to human disturbance. Source: Chuti Feidler, USFS-NSA, 2004.

Stream Name	**Total Habitat Loss (miles)**	**Bonneville Reservoir Inundation** (miles lost)	**Artificial Year-round or Seasonal Barrier** (Miles blocked)	**Artificial Barrier Type**
Eagle	1.39	0.19	1.2	Fish hatchery diversion
Dry	2.04	0.04	2.0	Railroad, Frontage Rd culverts
Herman	2.71	0.71	2.0	Fish hatchery diversion
Grays	0.02	0.02		
Gorton	0.74	0.20	0.54	ODOT I-84/ railroad culvert, Historic Highway Bridge apron
Harphan	0.9	0.10	0.8	ODOT I-84 culvert
Summit	0.1	0.05	0.05	ODOT I-84/ railroad culvert
Lindsey	0.36	0.36		
Warren	1.12	1.12		
Cabin	0.16	0.16		
Starvation	1.48	1.48		
Viento	0.58	0.58		
Perham	0.10	0.10		
Mitchell	0.10	0.10		
Phelps	0.95	0.95		
TOTAL	**13.05**	**6.46**	**6.59**	

ODFW hatchery facilities curtail fish distribution compared to historic conditions. The Cascade Hatchery intake dam spans Eagle Creek at River Mile 0.8. This dam is 6' in height and stops almost all anadromous fish migration and carcass distribution up to a natural waterfall at River Mile 2.0. An occasional winter steelhead can pass the dam at high flows. A2003 fall spawning survey in Eagle Creek found that all available spawning habitat below the diversion dam was fully utilized, and redd superimposition by coho and Chinook salmon was noted. On October 29, 762 Chinook, 328 coho, 2

steelhead, and 59 redds were counted below the diversion dam in a 1,040 foot reach. No anadromous fish were found above the dam, although 2 test dig redds were observed and one Chinook was seen the previous week. Passage restoration at the Cascade Hatchery would facilitate the full utilization of the entire 2 miles of Eagle Creek habitat by fall spawning salmon (C. Fiedler, USFS-NSA, *pers. comm*). The Oxbow Hatchery diversion dam on Herman Creek at River Mile 0.8 has a short, narrow fish ladder that forms a partial passage barrier, especially at low stream flows in early fall. Waterfalls in Herman Creek are a natural barrier to coho and Chinook at River Mile 2.8 and to steelhead at River Mile 3.5.

Aquatic Introductions and Artificial Production Programs

Historic and Current Fish Introductions: Several of the small alpine lakes between 3,500 and 4,000 feet elevation have been stocked with brook trout *(Salvelinus fontinalis)* since the early 1900s. Current lake stockings are shown in Table 10. Records indicate Eagle and Herman creeks were stocked with fingerling coastal rainbow trout in the 1940s (USFS, 1998).

Table 31. Lake stocking information for the Lower Oregon Columbia Gorge Tributaries Watershed. Source: adapted from (USFS 1998).

Lake Name	Outflow	Current Species Planted	Species Present	Stocking Frequency	Natural Reproduction
Warren	Warren Cr	Eastern brook trout	EB	Every other year	None or uncertain
North	Lindsey Cr	E. brook trout	EB	Stocked every other year	Low
Bear	Trib. to Lindsey Cr	E. brook trout	EB	Stocked every other year	None or uncertain
Mud	EF Herman Cr	E. brook trout & rainbow trout	RB	Stopped in 1960s	Yes, fry noted
Wahtum	EF Eagle Cr	E. brook trout & rainbow trout	EB, RB	Brook trout stocked every other year	Yes, fry noted
Dublin	Trib. to Eagle Cr	E. brook trout	uncertain	Stocked every other year	
Hicks	Herman Cr	E. brook trout	EB	Stopped in 1960s	Yes, fry noted

Historic and Current Artificial Production: ODFW operates the Cascade Hatchery on Eagle Creek and the Oxbow Hatchery facilities on Herman Creek. The purpose of these programs is to help meet the goals the Columbia River Fisheries Development Program (U.S. v. Oregon Agreement). No direct fish releases are made from these facilities or anywhere in the watershed, and no adult fish are collected at either facility. The Cascade Hatchery produces coho salmon with eggs collected at the Bonneville Hatchery. Coho are reared and transported for release in Astoria, in Tanner Creek below Bonneville Dam,

and for further rearing at Oxbow Hatchery. The Oxbow Hatchery raises chinook and coho using eggs collected at the Clackamas, Bonneville, and Big Creek hatchery facilities. Fish reared at the Oxbow Hatchery are transported and released in the Clackamas and Sandy Rivers, and in other systems outside the watershed. The Oxbow Hatchery began operating in 1938. The Cascade Hatchery began operating in 1959.

Ecologic Consequences of Artificial Production and Introductions: Most lakes and ponds were probably fishless prior to stocking with brook trout, with the possible exception of Wahtum Lake (USFS, 1998). Concerns about high lake stocking have focused on predation and alteration of the food chain in historically fishless lakes negatively affecting native amphibian and other species; and the potential escape of stocked fish into downstream tributaries affecting native stocks. Zooplankton levels in stocked lakes in the watershed were found to be approximately half that of fishless lakes surveyed in the Bull Run watershed. Phytoplankton levels were twice as high in stocked lakes. Species considered most vulnerable to stocked fish were red legged and cascades frog *(Rana aurora and R. cascadae),* but the significance was believed to be localized. USFS surveys note some distribution of brook trout downstream of stocked lakes, but it has so far been limited to a few miles from stocked lakes. There is no documentation of brook trout occupation of areas used by native trout, although few surveys have been conducted due to rugged terrain and poor access.

Relationship Between Natural and Artificially-produced Populations

Given the many hatchery operations in the Columbia Gorge area, and easy access from the Columbia River, naturally spawning anadromous fish watershed streams are likely a mix of hatchery, naturalized, and wild stocks. Due to the relatively remote habitat, numerous geologic barriers, and very low records of hatchery trout stocking in the area, it is suspected that resident rainbow and cutthroat trout are largely from wild stock origins.

Harvest Levels

Estimates of recreational harvest of salmon and steelhead trout in lower Eagle and Herman creeks were available for the years 1976-1994 (Table 32). Estimated harvest is based on "punch-card" returns from anglers, corrected for non-response bias, and can include natural or hatchery-origin fish. It is assumed that many of the fish harvested, notably spring chinook and summer steelhead, were holding in these creeks on their way upstream to other river systems. Other sport and tribal fisheries occur in the Columbia River including tribal ceremonial and subsistence fisheries.

Table 32. Average estimated recreational harvest of salmon and steelhead trout in Herman and Eagle creeks, 1976-1994. Source: Eric Tinus, ODFW, unpublished records.

Stream	Fall Chinook salmon	Spring Chinook	Coho salmon	Summer steelhead	Winter steelhead
Eagle Creek	36	3	36	73	62
Herman Creek	26	--	7	53	12

Environmental Conditions for Aquatic Focal Species

Historic Environmental Conditions

Based on aerial photographs from the 1930s prior to Bonneville Dam construction, lower elevation stream, riparian, and floodplain habitats were more extensive, complex and interconnected. Stream habitats in the lower and middle elevations were also more structurally complex, with greater numbers and depths of pools and pieces of large woody debris. As described above, the length of stream habitat available for the focal species steelhead and chinook was potentially up to 13 miles greater in the historic condition prior to Bonneville Dam construction and other developments.

Current Environmental Conditions

The upper stream elevations in the Hatfield Wilderness or National Scenic Area are in a near natural condition, with most areas in mature forest reserves with hiking trails but few or no roads. In contrast, the Phelps Creek drainage is more fragmented by industrial timber harvest, roads and trails, and mixed land uses at the lower elevations. Riparian areas at upper stream elevations on federal land were assessed as meeting Aquatic Conservation Strategy objectives, and as having a high future potential to meet them (USFS, 1998). Lower stream elevations nearer the Columbia River have been altered by the Bonneville reservoir, highway, rail and other developments as well as historic logging and stream clean-out activities. Road culverts and channel modifications prevent floodplain and meander development. Aquatic inventories have not been completed on non-federal lands. Aerial photos and field observations indicate that riparian and instream conditions north of the I-84 corridor are highly altered. Gravel, woody debris, and water transport is restricted by culverts and other transportation crossing structures. Pools and large woody debris are few to absent, and riparian vegetation is low to variable. In a 1994 Forest Service survey, Herman Creek had no large woody debris (LWD) and only 2.4 pools per mile between its mouth and river mile 0.8 (Table 33),while Eagle Creek had 1 piece of LWD per mile.

Table 33. Selected stream habitat survey information for major anadromous streams in the Lower Oregon Columbia Gorge Tributaries watershed (USFS 1998).

Stream Name Survey Reach	Survey Date	Stream Habitat Condition		
		No. Pools /mile	Pieces LWD/mile	Gradient
Eagle Cr				
RM 0.5 - 5.5	1990	10.2	1	5%
Herman Cr				
RM 0.0- 0.8	1994	2.4	0	3%
RM 0.8-2.8		9.5	26.9	5%
RM 2.8-4.3		8.1	29.8	7%
RM 4.3-4.8		14.6	12.5	8%
E. Fork Herman Cr				
RM 0.0- 0.1	1995	39	29	12%
Lindsey Cr	1996	Summary data unavailable but # of pools low		

Potential Environmental Conditions for Long-term Sustainability

Riparian areas in upper stream elevations on federal land were assessed as meeting Northwest Forest Plan Aquatic Conservation Strategy objectives, and as having a high future potential to meet them (USFS, 1998). The lower 1-2 miles of streams in the watershed did not meet the ACS riparian plant objectives but were considered to have a future potential for some improvement.

Characterization of Future with No New Actions

Artificial barriers will continue to block or impede access to historically available anadromous fish habitat above salmon hatcheries or transportation infrastructure. Connectivity and natural stream processes will continue to be severed or interrupted between upstream and downstream areas above and below the I-84/Union Pacific Railroad corridor, limiting habitat quality for the focal species as well as other aquatic and terrestrial species.

Japanese knotweed will become well established in the aquatic habitats at lower elevations. It will transform riparian areas and stream channels, and interfere with gravel movement and streambed processes. It will displace native riparian species, dramatically altering the quality and productivity of salmonid habitats. Japanese knotweed represents an extreme threat to native fish and wildlife in the watershed. It spreads by rhizome, and is difficult to eradicate once established.

Uncharacteristic fuel loads will continue to rise in forest habitats along with an increasing risk of watershed damage from high intensity fire.

Levels of habitat complexity and key structural elements such as large woody debris will continue to be low in streams affected by continuing or historic timber practices or road maintenance activities. Riparian vegetation losses will continue on low elevation lands.

4.2.4 Terrestrial Focal Species Population Delineation & Characterization

Present Distribution

Information about focal species for the subbasin planning effort was compiled by wildlife biologist Catherine J. Flick, USFS-National Scenic Area. Maps of habitat areas and land cover types associated with focal species are provided in Appendix A, Map7.

Bald Eagle: Nesting occurs in large cottonwoods on Columbia River islands and in Douglas fir trees in Gorge canyons and slopes. Regular concentrations of eagle in winter are associated with spawning salmon along the Columbia River and in tributaries, including dead or dying fish that wash ashore on sandbars, gravel bars and islands. Existing active, alternate or former nest tree sites include those at Government Cove,

Wells Island, Wah Gwin Gwin peninsula, and potentially other areas. While winter communal sites and concentration areas have not been inventoried, groups of eagles have been observed feeding on the sandbar at the Hood River mouth (Flick, C.J. 2004).

Northern Spotted Owl: The spotted owl distribution includes all coniferous forest types that occur at low to middle elevations. It is most abundant in old-growth or mature forest, but is often associated with residual patches of old trees in burned or logged areas (Marshall et al., 2003). Spotted owl habitat is mapped for the federal lands in the watershed (Appendix A, Map 10). 39% of the watershed meets all life history functions for the spotted owl (Flick, C.J. 2004).

Basalt Juga: The snail *Juga oreobasis* species No. 2 occurs sporadically in the central and eastern Columbia River Gorge in basalt cliffs and talus slopes with springs, seepage, and moss mats. Many such areas are located along the Old Columbia Highway, Highway I-84, Union Pacific rail line, and in Gorge canyons and waterfall areas. The full distribution of occupied habitats is unknown. This species occurs only in the Columbia River Gorge (Furnish and Monthey, 1998).

Beaver: Beaver use and movement occurs in and along the Columbia River and its tributaries, shorelines, coves, backwater sloughs, and forested wetlands with hardwood vegetation, particularly willow and cottonwood. Underpasses along Highway I-84 may be used by beaver to access the Columbia River in these six or other locations: Herman Creek at Exit 47; Wyeth at Exit 51; Lindsey Lake at milepost 54; stream underpass at Exit 55; Viento State Park, east edge of milepost 56; at State Frontage and Westcliff Roads in Hood River, east of Exit 62.

Black-tailed Deer: This species is widely distributed and associated with forests and forest edges. Deer readily adapt to rural residential and agricultural areas. Recently disturbed habitats such as clear cuts or burns, with their characteristic grasses, forbs, and shrubs, are conducive to healthy deer populations. Most deer that summer in the high Cascades spend winter at lower elevations on the west slope (ODFW, 2004). The watershed is within the ODFW Hood Management Unit 42 which extends from the Pacific Crest trail to Highway 35. ODFW radio-tracking studies indicate that deer from the northern Hood River valley migrate into the Columbia Tributaries area during winter. While available winter range varies with snow elevation, a map of designated deer and elk winter range in the watershed and in the adjacent Hood River Subbasin is included in Appendix A. Deer attempt to cross Highway I-84 and may use some of the underpasses to access habitat along the Columbia River. No inventory of usual wildlife crossing locations or habitat usage in the land area north of I-84 has been made.

Great Blue Heron: Distribution and rookery locations are not well known in the watershed. Nesting rookeries are generally in cottonwoods on Columbia River islands. Foraging occurs around fish hatcheries, in the Columbia River and its tributaries, sloughs, coves, islands, and forested wetlands. Regional maps of summer and winter distribution can be found at www.mbr-pwrc.usgs.gov/bbs/htm96/map617/ra1940.html

Purple Martin: Two known colonies occur in artificial nest boxes on pilings at Government Cove and Ruthon Cove. Potential distribution includes Herman Cove pilings, Wells Island cove and pilings, and Lindsey and Viento lakes along the Columbia River. The number of breeding pairs in colonies are a data gap. A regional map of summer distribution is found at www.mbr-pwrc.usgs.gov/bbs/htm96/map617/ra6110.

Current population data and status

Bald Eagle: During a 2003 breeding survey, 96 nest sites were occupied and 0.99 nestlings per breeding pair along Columbia River from mouth to The Dalles (Issacs and Robert, 2003). Twelve active nests were found in the Columbia Gorge and the number of nests are increasing. Two active nests are in the watershed in 2004. Winter surveys along the Columbia River from Bonneville Dam to the John Day River in January 2003 reported nine individuals (Issacs, 2004). An increase in eagles in this area in late February and early March is observed (Issacs, 2004). Up to 9 immature eagles at once were reported on the sand flat at the Hood River delta in January and February 2004 (Flick, 2004).

Northern Spotted Owl: Eight spotted owl activity centers are known in the watershed and are centered within stream drainages.

Basalt Juga Snail: No population data is available for this species. It is reported to occur at 28 known sites within Mt. Hood National Forest and the Columbia River Gorge National Scenic Area (Furnish and Monthey, 1998). All potential sites have not been inventoried, particularly for habitats located in non-federal lands.

Beaver: Population data for beaver in the watershed is not available. The reported harvest of beaver in Hood River County in 2003 is 49 (Kohl, 2004). Road kill of beaver along I-84 is known to occur but the extent is unknown

Black-tailed Deer: A summer population of 1,400 deer is estimated for the Hood Management Unit by ODFW. The Hood Management Unit encompasses the Lower Oregon Columbia Gorge Tributaries watershed and extends from Highway 35 in the Hood River Subbasin to the Cascade crest north of Mt Hood. The current population nearly meets the management objective for this unit (1,500) (Kohl, 2004). Past timber harvest on summer ranges have dramatically increased the amount of forage for deer and elk in the Hood Unit, leading to an increase in deer and elk numbers compared to reference conditions (K. Kohl, ODFW, pers. comm.).

Great Blue Heron: Annual breeding surveys are not conducted in Oregon, therefore actual population data unknown. A rookery was historically located on Wells Island within the past 15 years, and no recent use has been documented.

Purple Martin: Two known colonies occur at Government Cove and at Ruthton Cove where a total of 150 nest boxes have been placed. The number of actual breeding pairs

are unknown. The Oregon 2002 population was estimated at 1,040 nesting pairs by the Western Purple Martin Working Group. The martin population has declined in the last 50 to 100 years, despite the establishment of nest box programs (WPMWG, 2002).

Locally Extirpated Species

The following species are known to be extirpated from the Lower Oregon Columbia Tributaries watershed. These species performed ecological functions that were potentially reduced or eliminated as a result of extirpation (Johnson and O'Neil, 2001).

- Grizzly bear
- Gray wolf
- Mountain Goat – see below
- California condor
- Fisher

The reintroduction of the mountain goat to its former habitat in the watershed is proposed by Oregon Department of Fish and Wildlife as part of a statewide bighorn sheep and mountain goat management plan (ODFW, 2003). A subspecies of Rocky Mountain goat is native to the Oregon Cascades, but were hunted to extinction. A Lewis and Clark expedition account from the early 1800s noted "a great abundance of sheep" on the Oregon side cliffs near Bradford Island, now Bonneville Dam, and "large flocks around steep rocks" (K. Kohl, ODFW, *pers. comm*.) From 1969-1976, goats were released in Tanner Butte but the last goat was seen in 1991. It is believed that release groups were too small for successful reproduction. Mountain goats were successfully reintroduced to the Elkhorn Mountains by transferring 21 animals from Idaho, Alaska and the Olympic Penninsula. Phase 1 of the ODFW plan is to trap 15–20 Elkhorn herd goats and transport them by helicopter to the Herman Creek drainage in July 2005. Herd movement and survival will be monitored using radio transmitters capable of operating for 5 years.

The wolverine is a rare species documented as present in Hood River County in the 1980s, and is probably at risk of extirpation. A wolverine was reportedly killed on Interstate 84 in 1990 at Starvation Creek. Although habitat and survival requirements are not completely understood, the critical component of wolverine habitat is the absence of human activity and development (Verts, 1998). The wolverine is most at home in regions with snow on the ground throughout winter. Winter recreation pressures and increasing human presence in backcountry areas may limit the capacity of the Mt. Hood National Forest area to support wolverine (Thurman, R., USFS, pers.comm.).

Introduced Species

Introduced species can affect gene pools, create structures, spread disease, alter vegetation structure and composition, predate upon, or compete with native wildlife for resources (Johnson and O'Neil, 2001). The barred owl has expanded its range into Oregon in 1974. Its range regionally now nearly overlaps that of the northern spotted owl. Competition with the barred owl aggravates spotted owl recovery efforts (Pearson and Livezy, 2004). Barred owls are larger than spotted owls, are aggressive toward them, and may compete with them. Spotted owls are more likely to abandon a site if barred owls take up residence nearby. Barred owls appear to be most abundant in riparian zones

and lowland forests and less common in upland forests. They may negatively affect dispersing juvenile spotted owls by creating a hostile environment. Besides competition for space, barred and spotted owl may compete for prey although barred owls have a wider prey selection.

Table 34. Partial list of introduced non-native animal species in the Columbia Gorge Subbasin (Marshall et al., 2003; Davis, 2004; Maser, 1998).

Species	Level of Occurrence
barred owl	uncommon, range expansion, competes for territory with spotted owl
brown-headed cowbird	common, range expansion related to agricultural pastures and farms, lays eggs in host birds' nests
Bull frog	common
Corbicula sp. (bivalve mussel)	widespread
California quail	widespread
domestic and feral cat	widespread
domestic dog	common in open areas
European cottontail	common around human habitation, released
eastern cottontail	widespread
eastern gray squirrel	common, competes for territory with western gray squirrel
eastern fox squirrel	common in Hood River, competes for territory with native western gray squirrel
house mouse	common around human habitation
Norway rat	common around human habitation
nutria	possible but locations unknown
wild turkey	widespread, east end of watershed
opossum	widespread
rock pigeon	widespread, prey for peregrine falcon
European starling	widespread
House sparrow	widespread

European starling and house sparrow are common in the Columbia Gorge lowlands. Early-season breeding and high fecundity give starling and house sparrow advantages over native birds. Competition for natural nest cavities has aggravated population declines in native birds including the purple martin. Specialized nest boxes designed for purple martin may improve martin reproduction and survival and deter use by starlings and house sparrows. The bullfrog is common along shoreline areas. Adults eat nearly any creature they can swallow. Biologists attribute bullfrogs to local declines in native amphibian, waterfowl, and turtle populations. Some native wildlife are more abundant than in historic conditions due to land use changes favoring some species. Examples are deer, elk, and Canada geese. Deer readily adapt to timber, agricultural and rural residential lands with openings for favorable forage growth and forest edges for cover. Damage to crops and gardens are common. Canada geese adapt well to using other species' nests including raptor nests. Non-migrating geese have become established year-round given food and habitat provided by crops and turf grasses.

Environmental Conditions for Focal Species at the HUC 6 Level

Maps of the historic and current distribution of the land cover types used by the focal species are shown Appendix A. The historic habitat cover data obtained from the Northwest Habitat Institute Interactive Biodiversity Information System (IBIS) was developed at a very coarse scale (1:1,000000, 1 km cell size). Because the data is being applied to a very small planning area, analysis results using the IBIS data should be viewed with caution. Other historic and current habitat information from the USFS-NSA was used to supplement the IBIS map data and develop assumptions about local environmental conditions. The most significant habitat losses have occurred at low elevations in the Carson Creek and Grays Creek 6 HUC watersheds for the focal species bald eagle, beaver, purple martin, and great blue heron. An estimated 95% or greater of the bottomland hardwood forest, islands, gravel bars, and sandflats were lost as a result of inundation and land development. A GIS analysis of habitat loss attributable to inundation behind Bonneville Dam calculated a loss of 1,465 acres of riparian and floodplain habitat (C. Fieldler, USFS, 2004). The 74% loss in Montane mixed conifer forest appears to be an error due to the coarse scale of the IBIS historic map data.

Table 35. Current and historic land cover or habitat types for focal species in the Lower Oregon Columbia Gorge Tributaries watershed as indicated by IBIS or other sources as noted.

Focal Species	Cover Type *or Subcover Type*	Current Acres	Historic Acres	% Gain or (Loss)
Bald eagle N. spotted owl	Westside lowlands conifer-hardwood forest	55539	36389	53%
N .spotted owl	Montane mixed conifer forest	3652	13926	(74 %)
Bald eagle, G. blue heron, Purple martin	*Bottomland hardwood forest**	82	1547	(95%)
Basalt Snail *Juga oreobasis*	*Basalt cliffs with springs**			62 acres lost
Beaver Purple martin	Westside riparian wetlands Open water, lakes, rivers, streams	161** 4286	219 152	(26%) 2720%
Bald eagle, Great blue heron	Islands* Gravel bars and sand flats*	174 <20	2947 611	(94%) (97%)
	Ponderosa pine forest and woodlands	686	2	
N. spotted owl	Eastside (interior) mixed conifer forest	-	7500	
	Agriculture, pasture, mixed environs; Urban Mixed environs	1280 2381	Assumed to be few	+100% +100%

*Source: Cathy Flick, USFS- NSA.

** National Wetlands Inventory, excluding Open Water classes and Upland systems

Condition, Trend, Connectivity, and Spatial Issues

Fire has been suppressed since 1902 in the watershed. The absence of fire as a major natural disturbance has changed the condition and quality of wildlife habitat especially in the Montane Mixed Conifer Forest and Lowlands Conifer-Hardwood Forest cover types (Johnson and O'Neil 2001). Past or continuing timber practices in accessible lower and middle elevation forest areas have produced uniform Douglas-fir plantations in these areas, reducing the habitat quality for the spotted owl and bald eagle in the more accessible areas of the HUC 6 subwatersheds. However, significant amounts of high quality old growth habitat for spotted owl exist in all of the HUC 6 subwatersheds.

Mixed Environs includes medium-density land use with light industry interspersed with high-density residential or urban areas, many of which are adjacent to or close to the Columbia River or other aquatic habitat. Development and wildfire suppression in these areas has reduced nesting cavities for focal species purple martin, and large trees near water for nesting and foraging perches for bald eagle and great blue heron. The supply of damaged live trees, standing dead trees, and large-diameter downed trees that provide nesting cavities, scanning perches, and insect-feeding substrate for birds and other wildlife is increasingly limited in these areas, especially given concern about fire fuels.

The availability of gravel bar and sand bar habitats used by Bald eagle and Great Blue Heron for foraging has been reduced by over 95% compared to historic conditions (Table 14). Sand deposits in the Columbia River may be subject to periodic dredging and removal for navigation purposes. Currently, the largest gravel and sand bar suitable for eagle foraging is at the Hood River mouth. The size of this sandbar is estimated at 8 –10 acres but varies widely with Bonneville Reservoir operations. The size of this sand bar increased after the October 2000 Newton Creek landslide transported large volumes of sediment down the Hood River channel from Mt Hood. The year round recreational use of the sand flat has steadily increased. It is currently used as a kite sailing lesson and launch area, and an informal off-leash dog area. Bald eagles are observed using this sand flat in January and February to feed on salmon carcasses (C. Flick, USFS, 2004). Increasing recreational use of this sandflat especially during winter is likely to affect bald eagle and great blue heron use of the area.

Access to the Columbia River for beaver and other wildlife is impeded by fencing along the Highway I-84/ Union Pacific Railroad, solid highway median barriers, and growing traffic volumes. Connectivity from the east may decrease as residential development rises in the Hood River Valley, particularly in the northeast and the Middle Mountain area. The total density of human travel corridors (roads, trails, and railroad) at the 6 HUC level is highest in the Carson and Grays subwatersheds at 5.9 and 4.4 miles per sq. mile respectively, and lowest in the Herman and Eagle subwatersheds at 1.6 and 1.4 miles per sq. mile (Table 36). Trail density in the Grays Creek HUC 6 subwatershed is underestimated because GIS data was available for federal lands only. The Phelps Creek drainage in the Grays Creek subwatershed has the highest combined density of roads and trails in the planning area. The road density is 5.8 miles per sq. mile, and an extensive network of unmapped user-developed recreation trails has been created in recent years. Hood River County is working with recreation groups to map and inventory trails on

County forest land. Unauthorized trail building and overall trail use levels on public and private forest lands by mountain bikers, off road vehicle and other users has sharply increased in the southeast Grays Creek subwatershed.

Table 36. Human travel corridors in the Lower Oregon Columbia Gorge Tributaries by 6 Level HUC watersheds. Trails include only those included on Forest Service GIS map data layers.

6 HUC Subwatershed	Travel Corridor Type	Miles	Density (Miles/Sq. Mi)
CARSON CREEK		**70.0**	**5.9**
	Railroad	7.5	0.6
	Road	45.0	3.8
	Trail	17.6	1.5
EAGLE CREEK		**48.8**	**1.4**
	Road	11.8	0.3
	Trail	37.1	1.1
GRAYS CREEK		**145.6**	**4.4**
	Railroad	14.2	0.4
	Road	107.9	3.2
	Trail	23.5	0.7
HERMAN CREEK		**30.3**	**1.6**
	Railroad	0.0	0.0
	Road	1.2	0.1
	Trail	29.1	1.5
Watershed Total		***294.9***	***3.0***

Riparian wildlife habitat zones within the Columbia Gorge area are directly related to the Columbia River and backwater pond areas. Other important riparian habitat exists along all perennial and intermittent streams. These riparian areas provide a variety of streamside vegetation and associated and health of wildlife species. Wildlife needs such as food, cover and water are satisfied partially or totally by the presence of riparian habitat. As the result of human activities, riparian areas within the Columbia Gorge have been reduced. Greatest impacts were caused by inundation resulting from Bonneville Dam and fill material placed for highway and railroad right-of-ways. Removal of this vegetation and ensuing human disturbances have made the remaining riparian areas very important for the benefit and survival of many wildlife species (Hood River County, c. 1986).

Habitats Currently Protected on Public and Private lands

Spotted owl habitat for all life history needs appears to be well protected by federal land ownership and management objectives in the watershed. The majority of the Eagle and Herman Creek 6 HUC watersheds are within the Hatfield Wilderness. Over 83% of the watershed is within the Hatfield Wilderness Area or National Scenic Area and is subject to Northwest Forest Plan allocations. The management allocation for federal lands within the National Scenic Area is for Late Successional Reserves. Late Successional Reserves allows for timber harvest in younger-aged forests provided that the specific long-term objective of the harvest is to promote healthy late-successional forest

conditions (C. Flick, USFS-NSA, 2004). At a smaller scale, the Northwest Forest Plan and the Columbia Gorge National Scenic Area Management Plan provide for riparian reserves, retention levels for snags /dead trees, and coarse woody debris following timber harvest. Mt. Hood National Forest Plan includes sensitive animal nest-site and rare plant protection buffers. According to a GIS analysis of the Lower Oregon Columbia Gorge Tributaries watershed using the IBIS Land Protection Status data, 56% of the Western lowland mixed conifer-hardwood forest and 22% of the Montane Mixed Conifer habitat types have a high protection status. The results of this analysis for all land cover types is provided in Appendix C.

Potential and Projected Future Condition with no Future Actions

Conflicts between wildlife needs and recreation are expected to rise as a result of an increasing year round human presence in backcountry areas, trails, and shorelines. The promotion of recreation and tourism in the Columbia Gorge is supported by a broad range of economic and governmental interests. Without a plan to identify and meet the spatial and temporal needs of wildlife, along with adequate public education and enforcement, species sensitive to disturbance are at risk of displacement from or avoidance of available habitats in forest and shoreline areas. Increasing year round recreational use of islands and sandbars, including camping, water sports, fishing, and off leash dog exercise may disturb or displace bald eagle and great blue heron use of these areas for breeding, foraging and migration stopovers. Intolerant species may become extirpated, reducing the biodiversity of the watershed. Deer and elk may increasingly move to areas such as rural residences or orchards where their presence is often not tolerated.

Continued loss of riparian vegetation in areas where no protective ordinances or rules exist shall reduce food resources and hiding cover for many of the focal species.

Planning to retain or improve habitat connectivity, dispersal routes, and access to big game winter range has not been a priority of any governmental agency. The available big game winter range is now mostly on or adjacent to private property and has reached its capacity (Hood River County, c. 1986). Future residential development in winter range will further limit its capacity.

As remaining Columbia River shoreline and scenic bluff properties are developed on other private or non-federal lands in the Gorge, the loss and recruitment of large conifer and cottonwood trees for perching and nesting is expected. Opportunities to maintain and plan for security cover for bald eagle nesting and perching and maintain human-wildlife distance during breeding season around these sites will be lost.

The continued loss of hardwood stands and trees from development on nonfederal lands will result in fewer cavities available for cavity nesting birds.

Forest fuels are at elevated levels because of fire suppression practiced since the turn of the century. If uncharacteristic conditions continue to worsen, habitat conditions for native wildlife will continue to deteriorate and the watershed may experience a catastrophic high-intensity fire. Sensitive canyon areas and large trees that would not

normally burn in a low intensity fire will be lost, and the risk of accelerated stream erosion and slope failures will increase. On the other hand, fuels reduction efforts that do not consider the needs of wildlife or forest diversity will lead to negative effects on focal species and habitats. An alarming September 2003 fire in Cascade Locks initiated by a power line failure caused the closure of I-84, property and other damages. The clearing of ladder fuels, snags, downed wood, and standing trees in urban interface areas and rural residential areas is expected to rise in the watershed. Without approaches that leave patches of snags, shrubs, downed wood and other elements, urban interface fuels treatment is likely further reduce the already scarce supply of structural habitat elements important to wildlife in the treated areas.

Invasive nonnative plants will continue to encroach upon and displace native plant communities and degrade wildlife habitat.

4.3 Out-of-Subbasin Effects

4.3.1 Aquatic

Information concerning out of subbasin effects was provided by Phil Roger (TOAST 2004). The focal species chinook and steelhead spend a large fraction of their lives in the Pacific ocean after leaving the Columbia River and its estuary, where they experience variable mortality from year to year from natural and artificial causes. Factors affecting the survival of salmon and steelhead from the Lower Oregon Gorge Tributaries during migrations in the Columbia River include habitat quality, temperature, river flow, juvenile travel time, juvenile migration timing, juvenile and adult survival at the Bonneville Dam (e.g. turbine and bypass-related mortality), predation, harvest, and competitive interactions with hatchery and other fish. The survival rate past the Bonneville Dam hydroelectric project assumed in the subbasin planning process averaged 88% for yearling and ~85% for subyearling chinook. Adult chinook survival past Bonneville Dam was assumed to average 93% (PATH 2000). Factors that affect fish in the estuary include habitat quality and quantity, river flow, temperature, harvest, and predation by birds and marine mammals. Ocean conditions and climate cycles strongly affect salmon survival. The most influential atmospheric cycles are the Pacific Decadal Oscillation and the El Nino-Southern Oscillation. No information concerning the ocean harvest rate on fish produced in the Lower Oregon Gorge Tributaries was found. A lack of available data precludes the development of meaningful assumptions concerning out-of-subbasin effects on the productivity or sustainability of the anadromous focal species in the Lower Oregon Gorge Columbia Gorge Tributaries at this time.

4.3.2 Terrestrial

ODFW population and harvest objectives for black-tailed deer appear to be met. Radio-tracking show that some deer move in and out of the watershed and may be subject to mortality although most movement is associated with finding winter range. Other than the need for habitat connectivity and wildlife migration corridors in adjacent subbasins for healthy gene flow and population dispersal, it is assumed that out of subbasin effects have a minimal effect on deer populations in the watershed. The abundance of spawning salmon is strongly influenced by ocean and climate conditions, is a factor in the distribution and or population level of bald eagle. Purple martin are neo-tropical migrating birds. In late summer they migrate south to their non-breeding range in South America, where conditions and mortality factors may influence the productivity or sustainability of purple martin. The availability of stopover areas that provide optimal foraging and security cover during spring and fall migration are important out of subbasin factors for bald eagle, great blue heron, and purple martin.

4.4 Environment/Population Relationships

4. 4.1. Aquatic

The Qualitative Habitat Assessment tool (QHA) was applied by subbasin planners for the focal species steelhead and rainbow trout based on their known or potential distribution. The QHA is a spreadsheet program developed by Mobrand Biometrics, Inc. to facilitate a structured ranking of stream reaches and attributes.

Table 37. Assumptions about optimal habitat characteristics for steelhead and rainbow trout.

ATTRIBUTE	DEFINITION	OPTIMAL CHARACTERISTICS
Riparian Condition	Condition of the streamside vegetation, land form and subsurface water flow.	Vegetation type and density is at natural potential for the site The stream channel is essentially fully connected to its floodplain.
Channel Stability	The condition of the channel in regard to bed scour and artificial confinement. Measures how the channel can move laterally and vertically and to form a "normal" sequence of stream unit types.	The channel is unconfined by artificial structures, stream shows no signs of entrenchment or aggradation, widening
Habitat diversity	Diversity and complexity of the channel including amount of large woody debris (LWD) and multiple channels	LWD at 80 pieces per mile if characteristic for area; numerous and diverse types pf pools, fast and slow water areas, backwaters, side channels
Key Habitat	The complex of habitat types formed by geomorphic processes (including LWD) within the stream (e.g. pools, riffles, glides etc.).	Pool area exceeds 35 % of the reach; spawning riffles with more than 35% gravel; large amounts of instream wood; glide areas
Sediment Load	Amount of fine sediment within the stream, especially in spawning riffles	intragravel fine sediment level <11%
High Flow	Frequency and amount of high flow events.	No increase over natural levels
Low Flow	Frequency and amount of low flow events.	No decrease over natural levels
Oxygen	Dissolved oxygen in water column and stream substrate	At saturation levels
Temperature	Duration and amount of high summer water temperature or low winter temperatures that can be limiting to fish survival	Summer temperatures between 50 and 60 degrees, or natural potential
Pollutants	Introduction of toxic (acute and chronic) substances into the stream	None
Obstructions	Artificial barriers to juvenile or adult fish migration	No artificial barriers

The QHA ranks the current constraints on fish habitat in a stream reach according to how a species is expected to use it. Weights are assigned to fish life stages and habitat attributes for stream reaches and applied to a physical habitat score. This score is the difference between a rating of fish habitat under the current condition and the condition of the reach for a given attribute in a reference or natural condition.

Environmental Potential of Subbasin

The quality of fish habitat for use by steelhead and resident rainbow trout was rated for the 10 attributes in Table 37 comparing current and potential conditions to determine the relative protection and restoration value or ranking among different stream reaches in the watershed for these species. Thirteen reaches (18.2 miles) were rated for steelhead and 18 reaches (50 miles) were rated for resident rainbow trout. The results are summarized below:

TOP 5 Relative Protection Reach Rank for Steelhead Trout

1. Eagle Creek Reach 2: from hatchery diversion dam upstream 1.2 miles to RM 2.0
2. Viento Creek Reach 1: from mouth to river mile 0.8
3. Perham Creek from mouth to river mile 0.2
4. Lindsey Creek Reach 1: from mouth to falls at river mile 0.25
5. Herman Creek Reach 2: from hatchery diversion dam to falls at river mile 2.8

TOP 5 Relative Restoration Reach Rank for Steelhead Trout

1. Herman Creek Reach 1: from mouth to diversion dam at river mile 0.8
2. Viento Creek Reach 1: from mouth to river mile 0.8
3. Herman Creek Reach 2: from diversion dam to falls at river mile 2.8
4. Perham Creek from mouth to river mile 0.2
5. Lindsey Creek Reach 1: from mouth to falls at river mile 0.25

TOP 5 Relative Protection Reach Rank for Resident Rainbow Trout

1. Dry Creek Reach 2: from falls to headwaters
2. Lindsey Creek Reach 2: from river mile 0.25 to falls at river mile 0.5
3. Herman Creek Reach 4: from falls at RM 3.5 to Hicks Lake
4. East Fork Herman Creek: from mouth to Mud Lake
5. Eagle Creek Reach 2: from diversion to river mile 2

TOP 5 Relative Restoration Reach Rank for Resident RainbowTrout

1. Phelps Creek Reach 2: Frankton Road to Post Canyon Creek
2. Post Canyon Creek: mouth to river mile 2.9
3. Phelps Creek Reach 3: Post Canyon Creek upstream 4.6 miles
4. Herman Creek Reach 2: from hatchery diversion dam to falls at river mile 2.8
5. Lindsey Creek Reach 1: from mouth to falls at river mile 0.25

Long-term Viability Based on Habitat Availability and Condition

The amount of potential spawning and rearing habitat available for anadromous fish including steelhead is restricted by natural waterfalls. Most of the habitat that is available is heavily impacted by the I-84/Union Pacific transportation corridor and other infrastructure. Restoration opportunities are limited in nature. However, water quality is generally good, but is at risk of chemical spills into steelhead habitat because of the proximity to the highway and railroad. Long term viability for steelhead is uncertain. Based on the land protection status, limited human accessibility to many stream areas due to steep terrain, and the high habitat quality for resident trout in most streams on federal lands, the long term viability of resident rainbow trout in the Lower Oregon Columbia Gorge tributaries appears to be excellent.

4.4.2. Terrestrial

Important Environmental Factors for Species Survival

Bald Eagle and Great Blue Heron

- Trees large enough to support a nest structure situated close to or in sight of water; and large enough to perch in.
- Adequate topographic and or vegetative security cover around the nest tree
- An ample supply of spawning salmon or other fish during the breeding season.
- Undisturbed breeding and foraging areas including gravel bars and sand flats during critical periods are important for bald eagle and great blue heron. Each species has a strong fidelity to traditionally used breeding and wintering areas.

Northern Spotted Owl

- Contiguous coniferous forest areas with adequate cover during juvenile dispersal following the breeding season
- Large live or dead trees with cavities for nesting habitat
- Old growth or late successional coniferous forest with multiple tree layers providing cover and food
- An ample food supply including pica, flying squirrels and other rodents based on mature forest ecosystems

Purple Martin

- Ample supply of aerial insects
- Natural or artificial nesting cavities in or near freshwater for breeding

Basalt Snail (Juga Oreobasis 2)

- Clean, cold water and a lack of disturbance to basalt seeps where they occur

Black-Tailed Deer

- Sufficient forest cover and/or edge habitat providing movement corridors for seasonal migrations
- Adequate winter range.
- Riparian areas are important in spring and high-elevation meadows and shrub lands are important in the fall.

Beaver

- Migration pathways between aquatic habitats including the Columbia River
- Suitable floodplain areas with sufficient riparian tree stands located were beaver activity including dam building can be tolerated by humans

Identification of Key Environmental Correlates

A key environmental correlate is one that exerts a high degree of positive or negative influence on the realized fitness of a given species (Johnson and O'Neil, 2001). The IBIS query performed for this assessment indicates that all of the focal species are

correlated with freshwater. Shoreline is a key environmental correlate for four focal species – bald eagle, purple martin, great blue heron, and beaver. Three focal species require an herbaceous ground vegetative layer, shrub layer, and edges. Four focal species are correlated with large diameter trees. Spotted owls, bald eagle, great blue heron, and purple marten are correlated with snags. Five species are correlated with wetlands, marshes, wet meadows, riverine wetlands, and swamps (IBIS, 2004). These key correlates emphasize the importance of the remaining patches of bottomland hardwood forest in this watershed for 5 of the 6 focal species.

Long-term Viability Based on Habitat Availability and Condition

Northern Spotted Owl: The outlook for long-term viability for spotted owl in the watershed is favorable. Mature and old-growth forest is broadly distributed in large contiguous blocks across the landscape with an opportunity for nearly continuous occupation and population interactions by the spotted owl and its associated prey species.

Basalt Juga Snail: The basalt juga snail is likely distributed in isolated patches of highly specialized habitat with a limited possibility of interaction between populations. Detailed information on the distribution of occupied sites is not available, however, the outlook for long-term viability is probably good if a high proportion of occupied habitats are located on federally protected lands. Other habitats may continue to be affected by human activities close to or associated with transportation routes.

Purple Martin: Purple martin colonies are patchily distributed with little opportunity for new colonies because of diminished recruitment and availability of nesting cavities due to the loss of bottomland hardwood forest, snags, and the absence of fire. Human intervention is needed create natural cavities in snags and artificial nest boxes to promote formation of new colonies, and prevent their prior occupation by other birds, the outlook for long term viability for purple martin is probably fairly good because suitable open water and wetland habitats exist and this species is tolerant of human activity.

Bald Eagle and Great Blue Heron: Remnant bottomland hardwood communities occur on several Columbia River islands and State Park lands, and are close enough to allow perching and nesting opportunities. The availability of spawning salmon and prey species may rise as salmon recovery efforts proceed. Habitat conditions in foraging areas for herons and eagles (islands, gravel bars, tributaries, sand flats) are increasingly impacted by human recreational uses. Given the likelihood of increasing residential view-home development on bluffs, impacts to remnant bottomland hardwood stands, and shoreline recreation and human activity on islands gravel bars and sand bars, the potential for increasing disturbance during nesting, roosting, and winter foraging, the outlook for these species in the watershed is uncertain.

Black Tailed Deer: Continued land development in winter range may limit the size of the population compared to current levels. Increasing year round recreation in the forest zone may affect deer populations. If these issues can be addressed, and habitat connectivity is retained to provide migration corridors, the outlook for this species is

probably good because of its adaptability, and because of its status as a managed game species.

Beaver: The outlook for this species likely depends on the amount of floodplain areas with suitable riparian tree stands on federal land, or the level of tolerance possible on other lands where beaver activity including dam building can occur. It also depends on providing connectivity between aquatic habitats including the Columbia River.

4.4.3 Interspecies Relationships

Fish Inter-Species Relationships

Little information is available to characterize interspecies relationships in the watershed. Redd superimposition by chinook and coho has been observed. Steelhead juveniles have been observed to distribute themselves in different microhabitats than coho and chinook when these species are present (Everest and Chapman, 1972). Steelhead and salmon are known to be more aggressive and displace cutthroat to less preferred, i.e., higher elevation or higher gradient habitat areas. Cutthroat and rainbow trout are believed to occur together in some streams, in which case cutthroat can be expected to be displaced to less favorable habitat.

Wildlife Inter-species Relationships

The barred owl competes with the spotted owl for nesting and foraging territory. The extent of competition between these two species in the watershed is not known. Both the bald eagle and great blue heron use medium to large-structure trees for nesting, which may occur adjacent to one another (IBIS, 2004 and WDF&W, 2004). In addition, these two species as overlap in their use of subcover types for foraging (IBIS, 2004). Purple martins poorly compete for nesting cavities because they arrive late on their summer range after other species such as European starling and house sparrow. Because cavity habitat is limited in the lowlands, competition is fierce, and martin are not as aggressive as these other species in securing limited nest space (Marshall et al. 2003).
Canada goose often uses nest structures originally constructed by osprey, red-tailed hawk, and eagles, which creates conflict when and if the raptors return to the nest site.
Mink use beaver and deer pathways.

Key Relationships Between Fish and Wildlife

Identification of key relationships between fish and wildlife include direct predator-prey relationships, similar food resources taken, and habitat developers. The beaver is a key player in developing pools used by fish, insects, amphibians, birds, and other mammals. Beaver ponds create diverse aquatic ecosystems including runways that are also used by black-tailed deer, aerating soils, creating standing dead trees and down logs (IBIS, 2004). Bald eagles consume both live or dead marine and fresh-water fishes. Great blue herons feed on fish, amphibians, and aquatic invertebrates. Salmon and other anadromous fish carcasses provide food for numerous species of wildlife.

4.5 Identification and Analysis of Limiting Factors/Conditions

4.5.1 Historic factors leading to decline of focus species/ ecological function-process - Aquatic

Key Factors Inhibiting Populations and Ecological Processes

- The inundation and loss of stream habitat, lowland hardwood forests, and structurally complex delta areas of tributaries following Bonneville Dam construction in 1938 and subsequent land development and fill activities.

- Important natural physical, hydrologic and biological connections between upper and lower stream segments and the Columbia River have been severed at numerous Interstate 84 highway/rail corridor crossing and fill structures and at structures associated with the Cascade and Oxbow fish hatcheries. Affected natural processes include the downstream transport and deposition of sediment and bedload, stream flows and floodwaters, large woody debris, and upstream and downstream migration of fish and macroinvertebrates, and floodplain-riparian interactions including lateral channel migration.

Identify Conditions That Can Be Corrected by Human Intervention

- Artificial fish passage barriers can be corrected in several locations.

- Culverts and bridge spans can be enlarged to eliminate restrictions in natural fluvial processes. Opportunities may exist to restore floodplains or streams from constrained channels, primarily in depositional reaches at or near stream mouths.

- Stream habitat development processes such as large woody debris recruitment has been inhibited and instream habitat simplified at lower elevations. This condition can be mitigated by the addition of large woody debris in low gradient areas below infrastructure, or in depositional areas upstream if determined to be compatible with downstream infrastructure. Hardwoods and conifers can be planted in suitable areas for future recruitment to stream structure in depositional reaches near stream mouths.

- Remaining lowland riparian and floodplain habitats can be protected and restored.

4.5.2. Historic factors leading to decline of focal species/ ecological function-process - Terrestrial

Key Factors Inhibiting Populations and Ecological Processes

- The inundation and loss of stream habitat, lowland hardwood forests, and structurally complex delta areas of tributaries following Bonneville Dam construction in 1938 and subsequent land development and fill activities.

- The absence of fire and loss of bottomland hardwood stands have contributed to a lack of natural nesting cavities for purple martin. Purple martins compete poorly for nesting cavities because they arrive late on their summer range and competition for cavities with other species is fierce (Marshall et al. 2003). Fire suppression has also contributed to the simplification of forest ecosystems for northern spotted owl.

- Reduction in the availability of large cottonwood and conifers for Bald eagle and great blue heron nesting and perching, and the loss of gravel bars, islands and sandbars for feeding.

- Forest habitat fragmentation and reduced terrestrial connectivity due to transportation infrastructure and other developments affecting movement corridors and habitat for beaver and black tailed deer. Limiting factors for deer in the Hood Unit include conflicts with agricultural crops mainly fruit orchards, diminished wintering range due to encroachment of residential development and agriculture; harassment or disturbance due to increased use of humans on roads, bike trails (motorized and non-motorized), hiking trails and other backcountry uses (Keith Kohl, ODFW, *pers. comm*).

Conditions that Can/cannot be Corrected by Human Intervention

- Bonneville Dam is likely to remain in place. Land development at lower elevations will continue. For example, traffic on I-84 will continue to expand and wildlife movement across it will become increasingly difficult. Fire will continue to be suppressed within and near urban interface areas to protect infrastructure and communities.

- Beneficial opportunities may exist to retain and enhance stands of low elevation hardwood trees and snag elements that are compatible with economic development plans.

- The spread of harmful invasive or noxious plants into natural areas can be prevented for species that have not yet gained a foothold in the watershed, and controlled in special habitat areas where infestation already occurs and control is determined to be important.

- The opportunity may exist to improve connectivity across Highway I-84 using culvert enlargement or underpasses for small and medium sized wildlife including beaver, or other appropriate measures.

- Natural and artificial cavities and specialized nest boxes can be provided in suitable habitat areas for purple martin. Special shoreline habitat areas including the stretch from Wells Island to Ruthton Park can be protected.

- Fire fuels reduction plans in the urban interface area can beneficially integrate the need for wildlife habitat diversity, and mimic some of the results of natural fire processes. For example, the overcrowded second-growth Douglas fir stands at Herman Creek Road could be thinned, leaving a few isolated patches of snag or brush areas for wildlife, and favoring hardwood trees during thinning to improve forest diversity.

- Basalt cliff areas can be protected from disturbances so that the specialized plant and animal communities, including the juga snail, can be preserved.

- The needs of wildlife in terms of wildlife corridors, habitat connectivity, and access to winter range, can be determined and actions taken to insure that big game movements and dispersal of other wildlife can occur in the future.

- The spatial and temporal needs of wildlife in shoreline and forest areas can be better understood so that actions are taken to insure that increasing recreation and development does not limit use of available habitats or interfere with breeding.

4.6 Synthesis/Interpretation

4.6.1 Subbasin-wide Working Hypotheses – Aquatic

Working Hypothesis A Protection of streams, wetlands, shorelines, riparian areas, and adjacent uplands which are in a natural or a near-natural condition is the highest priority in this watershed to maintain healthy fish and other aquatic life. By protecting these areas from degradation including removal of riparian vegetation, erosion, stream clearing, significant flow alterations, and invasive exotic plants, the future biological and physical integrity of these areas will be protected along with the health, sustainability, and diversity of native fish populations and other aquatic species.

Evidence Supporting Hypothesis A. Regional reviews of salmonid population status strongly implicate habitat degradation as a major cause of population decline (e.g, Nehlsen et al, 1991, Frisell 1993; National Research Council 1995). Roadless and other little-impacted areas provide a watershed level refugia for salmonids and other aquatic species (Henjum et al 1994). Although undisturbed steep headwater streams have habitat that is marginal compared to the more complex and productive fish habitat historically available in lower elevation streams, protection of headwater areas may be critical for the persistence and restoration of native fishes in Oregon (Henjum 1994 and Li et al 1995). These headwaters represent source areas for downstream critical habitat quality elements such as large wood, high quality water and sediment.

Working Hypothesis B: The working hypothesis is that restoring the physical, hydrologic and biological connections between upper and lower areas and within

floodplains, where opportunities exist, the natural stream ecosystem processes will be allowed to function and lead to improved habitat conditions for fish and other aquatic species. The habitat improvement will benefit fish and wildlife populations in the Lower Oregon Columbia Gorge Tributaries as well as other Columbia River populations that use these creek mouths as temporary cold water refuges during their adult migration.

Underlying assumptions for this hypothesis include:

1) Less wood recruitment and deposition is occurring in the lower reaches due to interruption by stream crossings and therefore there is less channel complexity than we would find under natural conditions
2) Natural sediment transport processes are interrupted and sediment supply is reduced below crossing structures. Sediment sizes are different above and below the crossing and tend to be finer below. Less spawning gravel recruitment from upstream areas. Macroinvertebrate communities downstream are lacking in species preferring larger substrate sizes compared to upstream reaches. Maintenance activities cause short term habitat disturbances and mortality.
3) The loss of marine nutrients from anadromous fish carcasses upstream negatively depresses biological productivity in the affected reaches, for both aquatic and terrestrial wildlife.

Evidence Supporting Hypothesis B: Most culvert pipes and crossing structures under the railroad and highways were not designed with sufficient capacity to pass bedload and large woody material, and instead must be actively maintained. Sediment accumulates at the crossing inlet. Maintenance dredging is required on a periodic basis or after storm events. Dredged material, much of which is spawning-sized gravel, is hauled away from the stream channel. Loss or disturbance of spawning and rearing habitat results from the removal of this desirable sized sediment. Streambanks are rip-rapped or hardened upstream of the transportation crossings to direct water into the culvert or bridge structure and to prevent channel shifting, inhibiting the natural tendency of these channels to maintain a dynamic equilibrium. Some stream crossing outlets are concrete spillways or heavily channelized streams. Several culvert crossings have created upstream fish passage barriers for adults and juveniles. Passage is blocked in Eagle and Herman creeks at the fish hatcheries because of the potential for anadromous fish access above the hatchery intake to elevate disease risks in the fish culture operation. The potential for large woody debris recruitment is reduced because large wood and fallen trees are regularly removed to minimize the risk of plugging culverts or crossings. In 2003, a large diameter countersunk culvert replaced a small diameter culvert in Perham Creek, restoring access to 1/4 mile of anadromous fish habitat. Spawning by cutthroat, steelhead, and coho was observed within weeks after project completion (ODOT).

Working Hypothesis C: Actively restoring large woody debris will improve fish habitat in Herman Creek and move it closer to reference conditions. The opportunity may exist to restore large woody debris to stream segments in a manner that can coexist with downstream transportation crossings and angling in the lower river.

Evidence Supporting Hypothesis C: Large woody debris does not meet ACS goals in the middle and lower reaches of Herman Creek. Forest Service staff note the existence of old abandoned terraces in the middle section of Herman Creek that suggest a more diverse aquatic habitat at some point in the past. These terraces are located above natural constrictions and may have been associated with old log jams. These jams are no longer present and the channel has simplified due to the lack of large wood supply (M. Kreiter, USFS, pers. comm.).

4.6.2 Subbasin-wide Working Hypotheses- Terrestrial

Working Hypothesis: Most of the watershed at mid to high elevation is federal land and is in a near-natural condition. The major historic impact to wildlife in this watershed has been the inundation and loss of bottomland hardwoods by Bonneville Dam, fragmentation and loss of connectivity by development of the I-84/Union Pacific Railroad transportation corridor, and fire suppression for the last one hundred years.

Evidence Supporting Hypothesis: Inundation by Bonneville Dam and subsequent shoreline development and fill along the Columbia River has reduced the availability of large cottonwood and conifers for Bald eagle and great blue heron nesting and perching, and the loss of gravel bars, islands and sandbars for feeding. The loss of bottomland hardwood stands and suppression of natural wildfire processes have combined to contribute to a lack of natural nesting cavities, and snags for wildlife, and simplification of ecosystems at lower and middle elevations. Forest habitat fragmentation and reduced terrestrial connectivity due to transportation infrastructure and other developments affect movement corridors and habitat for beaver and black tailed deer. Small to medium-sized animals such as beaver are killed as they attempt to cross I-84 which is a barrier to migration and access to and from the Columbia River. The incidence of mortality is aggravated by the solid concrete median barriers too high for some species to climb or jump over.

4.6.3 Desired Future Conditions –Aquatic

Desired future conditions for aquatic ecosystems include naturally functioning riparian and hydrologic processes that create habitat diversity and maintain connections between streams, floodplains, upslope areas, headwater tributaries, and intact refuge areas necessary to fulfill all life history requirements of native aquatic and riparian-dependent species. Anadromous fish are able to utilize historically available habitat up to the natural waterfall barriers. Given the existence of the Bonneville Dam and pool, the desired future condition in the Columbia River and associated lowlands is a healthy riparian hardwood community for riparian-dependent species, however, the opportunities for achieving this are limited due to urbanization and transportation developments in the lowest elevation areas. Future conditions will continue to support a diversity of native

anadromous and resident fish species, and will continue to contribute to tribal and non-tribal fisheries.

4.6.4 Desired Future Conditions – Terrestrial

The desired future conditions for lower elevation and Columbia shoreline lands in the watershed include an increase in bottomland hardwood forest stands, including large diameter trees and snags, with opportunities for nesting, perching, and nest cavity development. Adequate distance between breeding areas for sensitive species and human activity will be maintained. At moderate elevations, riparian hardwood and conifer forests would have an adequate supply of downed wood in various stages of decay, and adequate structure and cover elements important to wildlife. Wildlife species diversity will be maintained, and the health and integrity of forests, native plant communities, and special habitats will be protected and improved. Land use and transportation will insure retention of habitat connectivity among and between forest and riparian areas. Recreation activities will not disturb or displace wildlife during critical seasons or degrade important habitat areas. Desired future conditions in the terrestrial habitats on federal land is for healthy late-successional forest ecosystems that have high degree of structural and native plant species diversity. The ideal future condition for federal lands, if possible, would maintain vegetation characteristics, fuel composition, fire and associated natural disturbance patterns that are within the natural and historical range for the area.

4.6.5 Opportunities

Habitat for High Priority Protection

The Fish and Wildlife Commission identified a unique habitat area along the Columbia Shore from Wells Island to Ruthton Point. This area contains pilings, snags, and natural vegetation necessary for a varied habitat. The area is important as a resting, feeding, and reproductive area for a number of mammals, waterfowl, amphibians and reptiles. Some of the common species using the area are the canadian geese, mallard, coot, merganser, heron, osprey, mink, beaver, muskrat, several species of hawk, and the bald eagle. Songbirds frequent the area and most of the waterfowl species are perennial residents (Hood River County, c. 1986). The opportunity and need exists to identify and prioritize other lowland habitat areas for protection.

Opportunities to Restore Access and Connectivity

Opportunities exist to restore fish migration past artificial barriers at the Oxbow and Cascades fish hatcheries in Herman and Eagle creeks. ODFW is currently in the design stages for an improved fish ladder at the Oxbow hatchery. Fish passage can be restored by replacing culverts, bridges or other crossing structures in Dry, Grays, Gorton, Harphan, and Summit creeks (see Tables25 and 33). Culverts and bridge spans can be enlarged to eliminate restrictions in natural fluvial processes and possibly allow for wildlife migration. Additional opportunities may exist to restore floodplains or streams

from constrained channels in depositional reaches at or near stream mouths. Needs and opportunities for capacity increases at stream crossings in the watershed have not been inventoried. The opportunity may exist to improve connectivity across Highway I-84 using culvert enlargement or underpasses for small and medium sized wildlife including beaver, or other appropriate measures.

Habitat Restoration

The opportunity may exist to improve stream habitat complexity and riparian processes to improve conditions for anadromous fish holding, spawning, and rearing in lower Herman Creek by using riparian plantings and large woody debris placement. A feasibility investigation coordinated with the Port of Cascade Locks would help define this opportunity further. Opportunities for riparian vegetation plantings and invasive plant control exist at Viento and other State Parks. The opportunity to restore large woody debris to depleted stream reaches in Herman Creek above Highway I-84 may be evaluated in cooperation with ODOT. Opportunities may exist to improve forest health and diversity in coordination with local fire prevention and fuels treatment plans. Potential forest stand areas that could benefit from ecological thinning include Herman Herman Creek to Wyeth area, and additional areas in mid-elevation second-growth forest on National Forest lands.