Hood River Subbasin Plan

Including

Lower Oregon Columbia Gorge Tributaries

May 28, 2004

Submitted to
the Northwest Power and Conservation Planning Council

Writer/editor

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1. Executive Summary

The Subbasin Plan defines fish and wildlife goals, objectives, and strategies for the Hood River Subbasin and the adjacent Lower Oregon Columbia Gorge Tributaries for the next 10 to 15 years. The plan will be submitted to the Northwest Power Planning Council for adoption under the Council's Fish and Wildlife Program. Its purpose is to help direct Bonneville Power Administration funding to projects that address fish and wildlife populations adversely impacted by the Columbia River hydropower system. The Subbasin Plan components are a 1) Assessment, or evaluation of current and historic biological and physical conditions; 2) Inventory of existing fish and wildlife programs and measures; and 3) Management Plan outlining measurable biological objectives and prioritized strategies to meet those objectives. Given major differences in land use and ecosystem characteristics between the Hood River Subbasin and the Lower Oregon Columbia Gorge Tributaries planning units, a separate Assessment and Management Plan was prepared for each of these areas.

In the Hood River Subbasin, chronic human-caused habitat disturbances are believed to intensify and prolong the effects of frequent large scale natural disturbances leading to population declines in the focal species bull trout, spring chinook, fall chinook, and summer and winter steelhead. Key limiting factors for chinook and steelhead included flow, channel stability, habitat diversity, key habitat quantity, and sediment load. The scheduled removal of the Powerdale Hydroelectric Project and dam in 2010, and restoration of physical habitat connectivity for adult and juvenile life stages at other dams and diversions have the potential to substantially increase the survival of focal species in the Hood River. Six habitat restoration scenarios were run for salmon and steelhead using the Ecosystems Diagnosis and Treatment model developed by Mobrand Biometrics, Inc. The largest predicted increase in spawner and juvenile outmigrant production for all species from a single restoration action was the Large Woody Debris restoration scenario. This scenario resulted in a 39% increase in summer steelhead smolts ranging up to a 365% increase for spring chinook. However, other assessment information indicates that flow restoration and fish passage will have significant positive effects on population abundance.

Preventing further losses of big game winter range, including oak, pine and grassland habitats for focal species lark sparrow and gray squirrel, was found to be important to the populations and persistence of many focal species. Wildlife corridors and habitat connectivity need to be maintained and actions taken to insure that movements and dispersal of wildlife can occur in the future. The spatial and temporal needs of wildlife need to be defined and considered to insure that increasing backcountry recreation and land development does not degrade available forest habitats and adversely affect populations, and biodiversity can be maintained.

For the Gorge Tributaries Planning area, retention and enhancement of bottomland hardwood stands, nest cavity development for purple martin, protection of large conifer and cottonwood perch and nest trees, and increasing aquatic and wildlife connectivity across the Interstate 84/Union Pacific Railroad corridor were the priorities. Managing or preventing recreational disturbance near bald eagle nest trees and forage areas on sandbars was also identified as a need if bald eagle presence in the Gorge is to be maintained and enhanced. Fire fuels reduction plans in the urban-interface areas may better integrate wildlife habitat diversity needs, and mimic some of the results of natural fire processes.

2. Introduction

2.1 Description of Planning Entity

The plan was developed in collaboration with local communities and interests, state and federal agencies, the Mt. Hood National Forest-U.S. Forest Service, and the Confederated Tribes of the Warm Springs Reservation. It is intended to be consistent with requirements of Endangered Species Act recovery plans, Clean Water Act plans, tribal trust responsibilities and treaty rights, the Northwest Forest Plan, the Oregon Plan for Salmon and Watersheds, local land use plans, and Oregon Department of Fish and Wildlife basin plans and rules.

In late 2002, the Northwest Power Planning Council contracted with the Hood River Soil and Water Conservation District (SWCD) to serve as the fiscal and contract manager for the subbasin plan. Formed in 1953 under ORS Chapter 568, the mission of the SWCD is to provide educational, technical, and financial assistance to Hood River County landowners in order to protect, conserve, and restore natural resources. Five publicly elected directors serve on the District Board. The SWCD employs a 3 person staff including a Manager, Watershed Coordinator, and Agricultural Technician. The SWCD works closely with landowners, Oregon Department of Agriculture, Oregon State University Extension, and the Natural Resources Conservation Service to implement agricultural water quality, erosion control, and irrigation efficiency technical and cost-share programs, cooperative projects, and related public education. The SWCD formed the Hood River Watershed Group (council) in 1993 and serves as its fiscal manager.

The SWCD formed a Subbasin Planning Team to develop the plan. The Team included representatives from the Oregon Department of Fish and Wildlife (ODFW), Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO), Hood River Watershed Group (HRWG), and the U.S. Forest Service (USFS) including the Mt. Hood National Forest and the Columbia River Gorge National Scenic Area. A Technical Work Group assisted the Planning Team by developing an ecosystem model for the Hood River, and contributing data, analyses, and reviews. An Advisory Committee of local government officials, business, and other stakeholders was formed to provide input to the Planning Team and to review draft plan chapters and policies. The HRSWCD contracted with Natural Resources Consultants– GIS, Inc. and the US Forest Service for technical assistance wildlife habitat and population assessments, GIS mapping, and habitat model development. Writing and editing were provided by Holly Coccoli under a service contract with the NWPPC. Additional support was provided by the Oregon Technical Assistance Team and Mobrand Biometrics, Inc.

2.2 List of Participants

The following list shows project organization and membership.

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Subbasin Planning Team

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Katie Skakel, Farmers Irrigation District
John Buckley, East Fork Irrigation District
Brian Nakamura, Hood River Grower-Shippers Association
Steve Hansen, Longview Fibre Company
Richard McCulley, City of Cascade Locks
Chuck Daughtry, Port of Cascade Locks
Bob Willoughby, City of Cascade Locks
Robert Barnhart, Oregon Department of Transportation
Dave Harlan, Port of Hood River
John Trumbell, Union Pacific Railroad

2.3. Stakeholder Involvement Process

Organizations, businesses, and agencies in the planning area with potential direct interests in local land use, natural resource use, and fish and wildlife concerns were contacted and invited to participate on the Advisory Committee. Public and stakeholder involvement was facilitated through monthly meetings of the Hood River Watershed Group. The Watershed Group is a voluntary watershed council organization of landowners, irrigation districts, interested citizens, Confederated Tribes of the Warm Springs Reservation, the Forest Service, and government agencies involved in land and natural resource use in the Hood River Valley. Most stakeholders and Subbasin Planning Team members regularly participate in Hood River Watershed Group meetings. Additional meetings with stakeholders with specific interest in the Columbia Gorge Tributaries planning area were held in the City of Cascade Locks. Meeting announcements were published in the Hood River News and through mailings to the Hood River Watershed Group. The planning effort was introduced in October 2002 by Eric Bloch, Oregon member of the NWPPC, at a meeting of the Hood River Watershed Group after publicity in the Hood River News.

2.4. Overall Planning Approach

The Subbasin Plan was prepared according to guidance materials provided by the Oregon Subbasin Planning Coordination Group and the NWPPC[1].

For planning purposes, the planning area was divided into 2 watershed areas (Appendix A, Map 1):

1. **Hood River Subbasin**. The major stream is the Hood River, which drains 339 square miles, and flows into the Columbia River 22 miles upstream of the Bonneville Dam.
2. **Oregon Columbia Gorge Tributaries Watershed**. This area drains 143 square miles of land between Bonneville Dam and the Hood River, and is part of the Columbia Gorge Subbasin. Herman and Eagle creeks are the largest of the 19 independent Columbia River tributaries within this watershed.

The Subbasin Plan consists of an assessment, inventory, and management plan for each of the areas noted above. The assessment provides an updated technical evaluation of the historical and current biological and physical characteristics for the subbasin. The assessment describes scientific assumptions and hypotheses about species-habitat relationships and the predicted effectiveness of proposed habitat strategies. The inventory describes the existing fish and wildlife programs, plans and project accomplishments so that action gaps or needs can be highlighted. Based on the assessment, biological objectives and measurable targets for fish and wildlife habitat recovery were identified. A management plan was formulated to meet the biological

[1] Technical Guide for Subbasin Planners, Council Document 2001-20; Oregon Specific Guidance, October 2, 2002; Outline for Oregon Subbasin Plan revised 4/16/2003

objectives. In preparing the plan, existing data, reports, and information was used as much as possible, and updated as necessary. Existing aquatic habitat information for the Hood River and its tributaries was compiled into a database for use in a computer model called the Ecosystem Diagnosis and Treatment Model (EDT). The EDT model predicts the response of chinook and steelhead populations to different habitat conditions. Model results were compared to prior assumptions about habitat conditions developed in earlier assessments. A second spreadsheet model called Qualitative Habitat Analysis was applied for resident trout and for salmon and steelhead in the Columbia Gorge Tributaries Watershed, and for cutthroat trout in the Hood River subbasin. The Interactive Biological Information System database developed for subbasin planning by the Northwest Habitat Institute was used as much as time allowed.

Subbasin plan development was coordinated as much as possible with other on-going programs and plans for fish, wildlife, water quality, resource use, and watershed restoration. These included available Endangered Species Act recovery plans; the Columbia Basin Fish and Wildlife Program activities in the Hood River; watershed planning through the Oregon Plan for Salmon and Watersheds and Oregon Watershed Enhancement Board (OWEB), the Northwest Forest Plan, the Columbia River Gorge National Scenic Area management, Oregon Statewide Land Use Planning Goals, and the Total Maximum Daily Load (TMDL) water quality study.

2.5. Process and Schedule for Revising/Updating the Plan

The Subbasin Planning Team will meet every two years to review the plan and incorporate changes as needed. Prior to adoption, comments on proposed revisions will be sought from Technical and Advisory Committee members and other stakeholders at a watershed council meeting, and public notice will be provided in the Hood River News.

3. Hood River Subbasin Assessment

3. 1. Subbasin Overview

3.1.1 General Description

Location

The Hood River is located in Hood River County in north central Oregon and joins the Columbia River 22 miles upstream of the Bonneville Dam. The Hood River Subbasin is bounded on the west by the Cascade Mountain Range crest, on the east by Surveyors Ridge and the Wasco County line, on the south by the White River drainage. The subbasin includes the towns of Parkdale and Odell, and part of the City of Hood River.

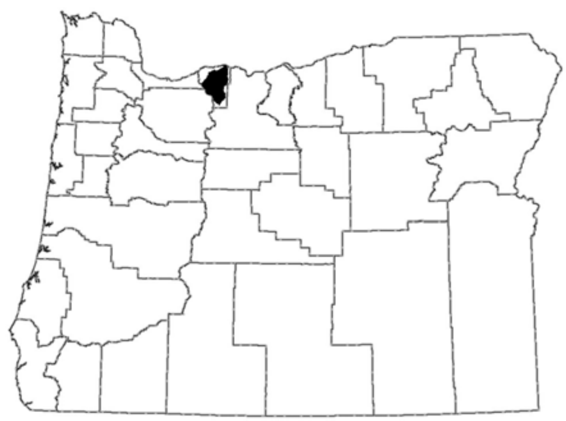

Figure 1. Location of Hood River Subbasin in Oregon.

Size

The Hood River drainage basin size is 339 square miles or 217,492 acres.

Geology

The Hood River Subbasin is dominated by the 11,245 foot high strato-volcanic cone of Mt. Hood formed of lava and pyroclastic flow deposits. Volcanic rock forms ridges and drainages beyond the base of Mt. Hood, and Columbia River basalt is the most widespread rock formation. Pleistocene-era glaciers and Holocene floods have shaped the landscape into steep narrow valleys, and terraces of clay, silt, sand, gravel and boulders (PacifiCorp, 1998). The Hood River Valley, as it is locally known, is separated into an upper and lower valley by the 2,642-foot elevation Middle Mountain. The lower valley is a broad north-sloping bench. The mainstem Hood River cuts deeply into this bench forming a steep canyon. Streams in the upper valley are less deeply incised. Most channels have high gradients, but the many streams including the Hood River and its East and West forks all contain gentle reaches under 2.5 percent gradient in relatively broad valleys. Boulder-rubble substrates dominate most streambeds. The Hood River's major tributaries originate on Mt. Hood and 5 uppermost tributaries are fed by glacial sources. These glacial streams transport large amounts of sediment into the Middle Fork, East Fork, and mainstem Hood River, and to a lesser extent into the West Fork Hood River. Mt. Hood continues to experience extensive glacial erosion. Natural landslides, debris flows, and dam-break floods originating on the moraines and slopes of Mt. Hood frequently impact downstream channels. Long, steep gradients allow small mass-wasting events to gain size and destructive force before reaching gentler slopes. The Newton Creek landslide in 2000 and the Pollalie Creek landslide in 1980 are examples of large catastrophic debris flows that were initiated by smaller landslides.

Climate and Weather

The Hood River is located in the transition zone between the west side marine climate and the drier continental climate to the east. Maritime weather systems sometimes enter via the Columbia River Gorge and moderate its otherwise continental climate (Pater et al. 1998). Annual precipitation has a pronounced geographic distribution with an average of 130 inches per year along the Cascade crest to less than 30 inches along the northeast subbasin boundary. Snowfall is heavy at high elevations and can reach 30 feet deep at timberline on Mt. Hood (SWRB 1965). Most precipitation falls from November through January. Rainfall amounts from June through September average less than one inch per month (Sceva 1966). The mean annual temperature near the City of Hood River at 510 feet elevation is 52 °F.

Land Cover

The greatest proportion of land cover in the subbasin is conifer forest. Vegetation cover types are variable depending on elevation, longitude, and aspect. Douglas fir dominates the western subbasin, interspersed with western hemlock, red cedar, Pacific silver fir, noble fir, grand fir, and Englemann spruce. Ponderosa pine and Douglas fir stands dominate the eastern subbasin area, interspersed with white pine, tamarack, and hemlock. At lower elevations, Oregon white oak and pine-oak stands are common, especially to the east and on south-facing slopes, with deciduous stands including large leaf maple in some areas, and grasslands on the eastern foothills of the Cascades.

Land Use and Population

Approximately half the subbasin is within the Mt. Hood National Forest or designated wilderness areas. Major land uses on non-federal lands are agriculture and timber production. Approximately 25 percent of the subbasin or 50,000 acres are managed as industrial forest. The majority of private land is zoned either as Forest or as Exclusive Farm Use (EFU). Of the 27,201 acres zoned as EFU land, 15,000 acres are planted in orchard crops. Small urban centers exist in Odell, Parkdale, and the City of Hood River. The population is dispersed, with 67% of residents living outside of urban growth boundaries (USFS, 1996a). An estimated 16,245 people were living inside the subbasin boundary in 2003. This estimate was obtained by subtracting half the current population of the City of Hood River and all of the City of Cascade Locks population from the current population of Hood River County (Portland State University, 2003). Hood River County experienced an annual growth rate of approximately 2% from 1990 to 2000.

Economy

Agriculture is the leading industry followed by tourism and forestry. The Hood River Valley contributes about a third of the total U.S. winter pear crop. Apples, cherries, blueberries, peaches, and wine grapes are also grown in smaller amounts. The fruit industry generates $65 to $70 million annually for the local economy and employs between 1,000 to 2,800 people depending on the time of year. The fruit industry is experiencing economic stress due to global competition, market consolidation, and other trends. Agriculture contributes about 10 percent of total income in the County, down from 20 percent in 1974 (USFS, 1996a). The wood products industry has declined in recent years, including the closure of two large sawmills. Tourism has expanded into the second biggest economy in the area. Recreational use of the Mt. Hood National Forest and other forest land has risen along with growth in Portland, in the Columbia River Gorge area, and in the tourism industry. The City of Hood River is an international windsurfing destination. Whitewater kayaking, angling, hiking, camping, backcountry winter sports, off-road vehicles, and mountain biking are increasing recreational uses. A strong link between tourism and land development in the Hood River Valley is noted by historians and continues today (USFS 1996b).

Land Ownership

Sixty-five percent of the Hood River watershed is publicly-owned. A map of land ownership is provided in Appendix A, Map 6. Fifty-two percent are federally managed lands in the Mt. Hood National Forest and the Mt. Hood Wilderness Area. About 25% of the subbasin is industrial forest land owned by Longview Fibre Company and Hood River County, and 21% is privately owned (Table 1).

Table 1. Land ownership in the Hood River Subbasin.

OWNERSHIP	ACRES	PERCENT OF SUBBASIN
Bureau of Land Management	367	0.17%
City of Hood River	14	0.01%
Hood River County	204	0.09%
Hood River County Forest	26206	12.04%
Longview Fiber Co.	27502	12.63%
OTHER	2453	1.13%
Private	45733	21.01%
S.D.S. Co., LLC	465	0.21%
State	1085	0.50%
State Highway Comm.	6	0.00%
USDA Forest Service	113661	52.21%

Human Disturbances to Aquatic & Terrestrial Environments

The principal human disturbances to aquatic habitats in the Hood River subbasin are:

- Loss of the extensive delta area at the Hood River mouth by inundation from Bonneville reservoir.

- Diminishment or depletion of stream flows at irrigation, hydropower and municipal water diversions
- Fish migration barriers at dams, diversions, and road crossings
- Loss of large woody debris recruitment and reduced riparian- floodplain interactions caused by historic timber practices
- Channel confinement and interference with stream and riparian processes by roads and other land use.
- Water quality alteration by sediment inputs from roads and irrigation networks, pesticide and nutrient contamination from agricultural and other non-point sources, temperature increases from flow modification, reservoir discharge (Laurance Lake), or riparian vegetation removal.

Principal terrestrial habitat disturbances include:
- Conversion of conifer forest to agricultural, residential and other land cover types
- Suppression of natural wildfire regimes,
- Introduction of non-native plants and animals,
- Fragmentation of forest stands by timber harvest and construction of road, rail, trail, and utility corridors.

Since the 1880s, streams have been diverted into canals and ditches to irrigate orchards and other crops. Dams were built for mills, irrigation, or power generation. The largest and most significant dams remaining in the subbasin are Powerdale Dam in the lower Hood River and Clear Branch Dam in Clear Branch of the Middle Fork Hood River. The ditching and draining of wetlands and springs has been common in agriculture and other land uses. Historic timber practices including splash damming and stream clearing continue to effect fish habitat. Symptoms of disturbance are channel incision, fewer pools and pieces of instream wood, and less variation in water velocity and substrate size (USFS 1996a; USFS 1996b). Channel confinement by roads, revetments, and bridge fills affects at least 24 miles of stream in the subbasin (HRWG 1999).

Timber management and fires suppression has altered the age, species composition, and structure of native forest stands in lower and mid-elevation forests while headwater forest areas remain less altered. The availability of contiguous mature forest habitat has been reduced by harvest-related fragmentation. Agricultural, industrial and residential land uses have created a net loss of shelter for resident birds and mammals, especially in winter, at elevations under 2,500 feet. Another structural attribute of native forests, missing in fruit orchards and most rural residential properties are damaged live trees, standing dead trees, and large-diameter downed trees that provide nesting cavities, scanning perches, and insect-feeding substrate for birds and a variety of other wildlife (Wells, J. 1999). Vehicle traffic and year-round trail and backcountry recreation has likely affected wildlife species that are intolerant of human activity.

3.1.2. Subbasin Existing Water Resources

Watershed Hydrography

The Hood River has 3 main tributaries – the East, West, and Middle Forks. These originate on Mt. Hood and flow generally northward. The West Fork joins the mainstem Hood River 12 miles from its mouth on the Columbia River, while the Middle and East Fork Hood River converge with the mainstem Hood River near River Mile 15.0. Other major tributaries include the Dog River, Clear Branch and Lake Branch, and Neal, Tony, Evans, Odell, and Green Point creeks. According to GIS analysis of this data, the Hood River subbasin has an estimated 992 miles of mapped stream, excluding segments labeled as ditch or canal. Of these, an estimated 123 miles are mapped as anadromous fish habitat and 260 miles as resident fish habitat. The watershed hydrography data source for this assessment was the Oregon/Washington Hydrography framework (REO, Version 13, 2003). This framework delineates 12 sixth-field Hydrologic Unit Code (or HUC 6 watersheds (Map 1, Appendix A.) These watershed boundaries are a significant departure from the fifty 6 HUC watersheds used in previous watershed assessments.

Hydrologic Regime

Fifty-two percent of mapped streams have perennial streamflow based on the GIS data used in this assessment. In the EDT model, the overall flow regime of the subbasin was characterized as “rain on snow transitional”. The hydrology of the Hood River is characterized by highly variable stream flows and rapid runoff. The relatively short, steep morphology of the drainage basin promotes flood peaks that are brief in duration, a characteristic sometimes described as “flashy”. Runoff is especially rapid during early winter storms before freezing conditions arrive at high elevations (SWRB 1965). Mt. Hood glaciers and snowmelt help support summer base streamflows in the Hood River. Five upper tributaries to the Hood River are fed by glacial sources. Snowmelt typically begins in April. The dynamic hydrograph of the Hood River is heavily influenced by glacial recession and rain-on-snow events.

Long-term flow records exist for gage stations on the Hood River and the West Fork Hood River. Flow duration statistics for the Hood River are shown in Figure 2. The mean annual flow of the Hood River is 1062 c.f.s. (U.S.G.S 1412000, Hood River at Tucker Bridge). The median monthly low flow of the Hood River at the Tucker Bridge gage is 369 c.f.s. in August (U.S.G.S, 1990). The West Fork Hood River contributes 51% of the average annual stream flow of the Hood River (Underwood, K.D. 2003). The mean annual flow of the West Fork Hood River is 554 c.f.s. and the mean monthly low flow is 157 c.f.s. and typically occurs in September.

Rain-on-snow floods are relatively common and occur most frequently between December and February. The reported flood threshold at the Tucker Bridge gaging station is 4,500 c.f.s. For comparison, the record daily Hood River discharge was 33,200 c.f.s. in December 1964 (USGS 1987). The second highest daily discharge occurred in February 1996 at 23,300 c.f.s. The record daily discharge for the West Fork Hood River was 15,000 c.f.s. in December 1964.

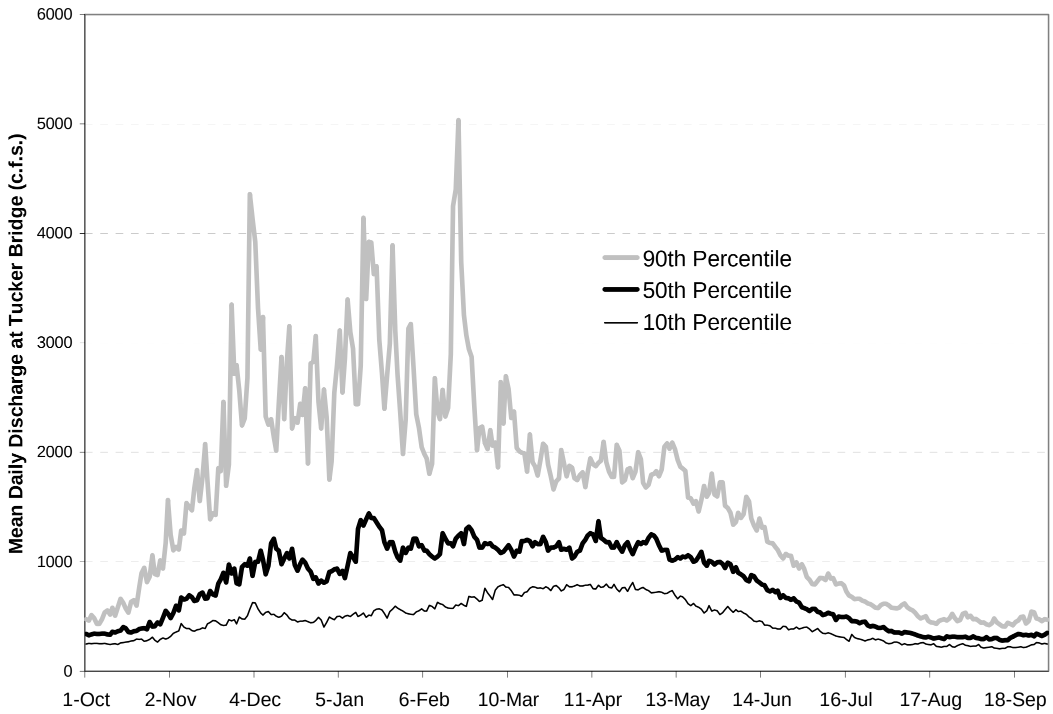

Figure 2. Flow duration statistics for the Hood River based on daily discharges at U.S.G.S. Gage 14120000 Hood River at Tucker Bridge, for the water years 1966 to 2002.

Several major springs discharge from lava rock formations. A 2002 infrared survey of the Middle Fork Hood River detected four cold-water springs between the Laurance Lake outlet and the East Fork Hood River confluence (Watershed Sciences, LLC, 2003).

Water Quality

Natural Conditions: Water quality in the Hood River is strongly influenced by Mt Hood glaciers. The transport of glacial flour, or fine ground-up sand and stone, from glacial headwater tributaries during summer melt can dramatically increase water turbidity in downstream areas. The West Fork is the least influenced by glacial turbidity, while the East Fork and Middle forks were the most heavily influenced (USFS, 1996b). Glacial melt typically occurs between July and October, however, glacial water turbidity is strongly affected by air temperatures on Mt. Hood and can vary widely within a 24-hour period and from day to day. Summer glacial turbidity levels vary around 2 to 20 NTU, with much higher levels at times in the glacial headwater streams. (Appendix B, Figure 1). Literature indicates that glacial turbidity levels such as those found in the Hood River subbasin are high enough to decrease primary production, macro-invertebrate production, and subsequent fish growth and survival. Lloyd et al. (1987) found that turbidity of only 5 NTU could decrease primary production in shallow streams by 3-13%. An increase of 25 NTU decreased primary production by 13-50% in shallow streams.

Water Quality Impairment: Water quality monitoring activities indicate that water temperature, turbidity and fine sediment, pesticide contamination, and nutrient enrichment are elevated in several stream reaches. These are briefly discussed below.

Temperature: Several stream segments were included in the 1998 Oregon 303-d List for exceeding Oregon water quality criteria (Figure 2). The 2002 Oregon 303-d List includes tributaries exceeding standards for the pesticides chlorpyifos and Guthion, and the metals iron and zinc. Temperatures exceeding state criteria have been measured in stream reaches influenced by water diversion, reservoir storage, and reduced riparian shade levels. In a few reaches, temperatures exceeding criteria, particularly the 10º C bull trout criterion, may occur under apparently natural conditions.

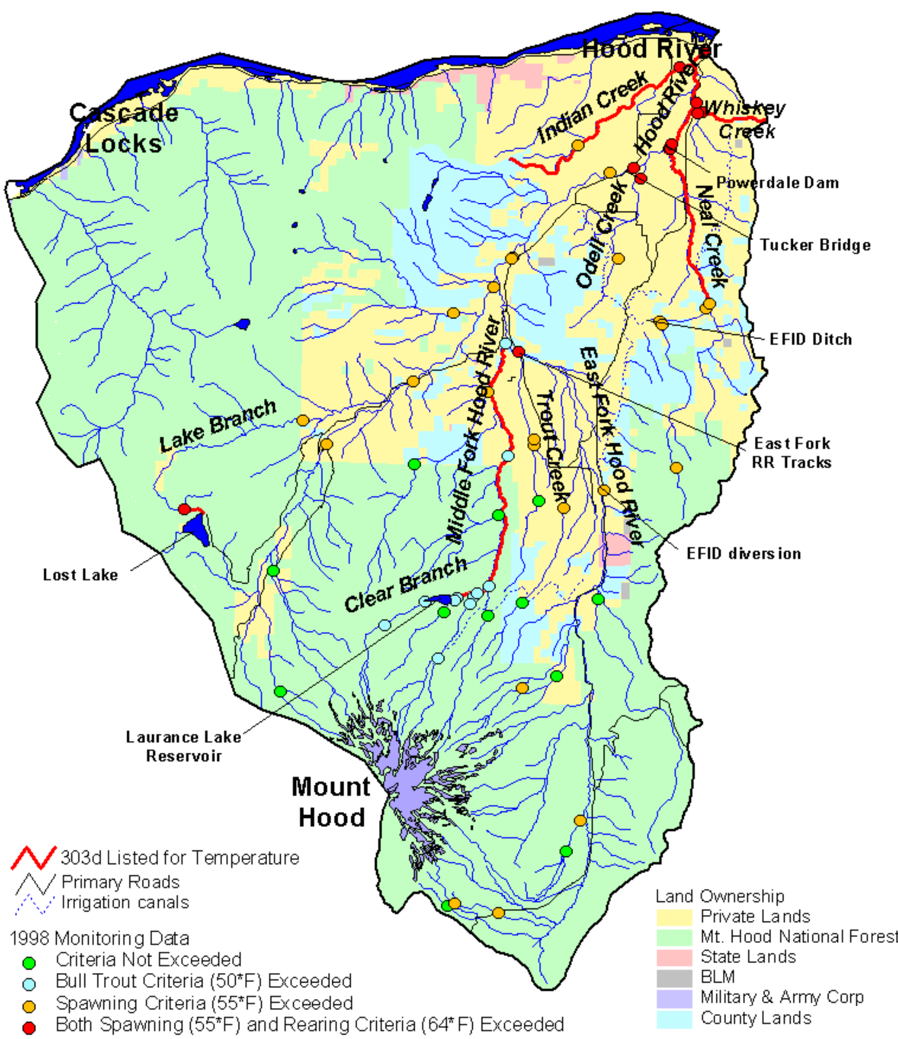

Figure 3. Stream segments where 1998 Oregon temperature standards are exceeded.

Locations where water temperatures are of particular concern are discussed below.

- *Clear Branch below Laurance Lake Reservoir*. Lower Clear Branch exceeds the bull trout criteria of 10º C. The bottom-outlet reservoir retains heat during spring and summer, eventually discharging water that can at times be 3º to 9º C warmer than Clear Branch inflows above the reservoir. Temperature increases occur during critical summer rearing and fall spawning periods for bull trout (Buchanan et. al., 1997). A longitudinal temperature profile of Clear Branch and the Middle Fork Hood River from an August 2, 2002 Forward Looking Infrared study graphically depicts warming below the reservoir (Appendix B, Fig. 2).
- *East Fork Hood River below the East Fork Irrigation Diversion*. Monitoring between 1990 and 1998 indicates that the 17.8º C criteria is consistently exceeded. A comparison of monitoring sites found that the lower East Fork at River Mile 3.7 had the warmest temperatures in the subbasin with average daily maximums of 21.0º and 21.5º C (USFS, 1996. Potential causes include extensive water diversion and solar heating due to a wide braided channel.
- *Neal Creek*. 1998 monitoring data shows a maximum 7-Day Moving Average (7DMA) of 20.7º C at the mouth, while the mouths of the East and West Forks showed maximum 7DMAs of 14.8º and 17º C, respectively. West Fork Neal Creek temperatures appear to be increased by the East Fork Irrigation District ditch system. Low riparian shade levels exist along several miles of the creek.
- *Hood River from Powerdale Dam to the Powerhouse* (R.M. 4.0 to R.M.1.0). The 17.8º C criteria was exceeded based on 1995 and 1996 monitoring. The hydro diversion of up to 500 c.f.s. contributed to warming in the bypass reach. Dam removal is scheduled for June 2010 under a 2003 settlement agreement filed with the Federal Energy Regulatory Commission. Interim measures in the agreement include minimum instream flow increases predicted to help meet state criteria.

Nutrient Enrichment: Phosphorous and nitrogen concentrations are elevated in some lower Hood River tributaries, notably Odell, Lenz, and Baldwin Creeks (HRWG, 1996). Potential sources include fertilizer, livestock waste, septic systems, wastewater discharge, and soil erosion. Several industrial and municipal wastewater discharge permits are administered by DEQ in the subbasin. Elevated phosphorous inflows and internal loading in the Laurance Lake Reservoir has stimulated annual cyanobacterial algal blooms since 1997. The lake is classified as mesotrophic, and lake P levels have ranged from 0.016-0.047 mg/L (Penuelas, R, 1999). The interaction of the 1996 flood and natural geologic factors are suspected as the source of the elevated P inflows.

Turbidity and Fine Sediment: Turbidity and sediment inputs from human activities include: (1) fine sediment runoff from forest roads; (2) irrigation system interbasin transfers, overflows, and return flows; (3) exposed soils in livestock areas adjacent to streams; (4) winter sanding of roads and parking lots; and (5) landslides from forest or irrigation activities. Turbidity and fines in the Neal Creek are heavily influenced by the creek's use as a conveyance for irrigation water from the glacial East Fork Hood River to to the lower east Hood River valley. Data collected by DEQ during the irrigation season on 8/6/98 showed that turbidity in Neal Creek downstream of the EFID ditch (impairment source) was 35 NTU and TSS was 36 mg/L (Appendix B, Figure 1).

Pesticide Contamination: Organophosphate and other insecticides are used on orchards in the winter, spring, and summer, and may be used year round in urban areas. The timing of use overlaps with adult and juvenile steelhead migration, spawning, early life stage development, and the life stages of other fishes and aquatic species. Between 1999 and 2003, water samples were collected at multiple locations during periods of pesticide use in orchards. DEQ toxicologists have monitored water, fish, and macroinvertebrates at selected sites and control sites since 1999. OSU has also collected water samples including 48-hour hourly auto-sampling events in Neal Creek. *Chlorpyrifos* (Lorsban) was detected in Neal and Indian creeks, with some samples exceeding both the acute and chronic state water quality criteria (DEQ 1999). Between 1999 and 2002, the maximum *chlorpyrifos* concentrations in Neal Creek grab samples ranged from 0.2 to 0.48 ug/L, or between 2.5 to 6 times the acute water quality criterion, and between 5 to 12 times the chronic criterion. *Azinphos methyl* (Guthion) was detected in the Hood River, Neal, Indian, and Trout creeks. Concentrations above the chronic water quality criteria were found in Neal and Indian creeks and the Hood River. Between 1999 and 2002, maximum *azinphos methyl* concentrations in Neal Creek grab samples in ranged from 0.04 to 0.186 ug/L (Jenkins, J. 2003), or between 4 and 19 times the chronic water quality criterion. No acute criterion is established for Guthion. Bioassay work by DEQ in 2001 and 2002 found that caged steelhead held in Neal and Lenz creeks exposed to high pesticide levels had depressed brain acetylcholine esterase activity compared to steelhead held at sites with low or no pesticide contamination or control fish. Within-season changes in macroinvertebrates were detected in sampling locations after periods of spray application. Post-spray collections had lower numbers of dominant species than in pre-spray collections (Foster, E. et al, 2003). Concerns about stream contamination have prompted a major effort by local growers to implement pesticide best management practices in orchards.

Riparian Resources

Riparian shade levels and large woody debris recruitment potential were assessed along 170 miles of stream length on non-federal lands in the Mainstem, East Fork, and Middle Fork Hood River watersheds using 1995 and 1999 aerial photographs (Nelson, C. 2000, Salmenin, E. 1999). Riparian large wood recruitment was unsatisfactory along 64 percent of the stream length assessed in the lower Hood River and its tributaries compared to 54 percent in the East and Middle Fork watersheds. Shade levels in the lower Hood River watersheds were found to be high (>70 percent shade) along 51percent of the total riparian area assessed, medium along 21percent, and low (<40 percent shade) along 28 percent. Results were similar in the East and Middle Fork subwatersheds. A detailed assessment of riparian vegetation was conducted by DEQ in 2001 for the Western Hood River Basin Total Maximum Daily Load study temperature model. The model predicted that achieving system potential riparian shade conditions reduced maximum daily temperatures in the East Fork Hood River, the Hood River, and Neal Creek compared to existing riparian conditions (DEQ, 2001).

Wetland Resources

A total of 783 wetlands covering 1,950 acres were identified by the 1981 National Wetlands Inventory (NWI) in the subbasin. Wetland density among 6th field HUC subwatersheds ranged from a low of zero to a maximum of 17 percent in the Lost Lake subwatershed, and was less than 1 percent overall. Actual acreages of wetlands and wetland disturbances in the subbasin are believed to be underestimated by the NWI (Salminen, 1999). Of the total acreage identified, 23 percent are in the Riverine System, 21 percent in the Lacustrine System, and 56 percent are in the Palustrine System. The NWI identified wetlands that have been modified by human activity but noted only 10 wetlands or 31 acres disturbed by draining or ditching. Wet meadows greater than 10 acres that are considered special habitats in the Mt. Hood Forest Plan include Elk Meadow and Horsethief Meadow. Outside of the federal lands, among the most significant wetland habitats is a sizable complex of forested and emergent wetland located at a former river bend along the Hood River near River Mile 2.5 A wetlands inventory and functional assessment prepared for lands within the City of Hood River Urban Growth Boundary (Saich, J. 2003) identified several significant smaller wetlands. No wetland field inventory is available for other non-federal lands in the subbasin.

3.1.3. Hydrologic and Ecologic Trends in the Subbasin

Macro-climate and Influence on Hydrology

Computer models are in general agreement that the Pacific Northwest climate will become warmer and wetter over the next 50 years with an increase of precipitation in winter and warmer, drier summers (USDA Forest Service 2004). This could result in more flooding and landslides (Mote et al. 1999), and increased wildfire risk compared to previous disturbance regimes. Many models predict warmer winter temperatures and loss of moderate-elevation snowpack in the region (Mote et al. 1999). This would lead to lower spring and summer runoff and negative impacts to streamflows and water supply. Alpine glaciers in the Cascade Range have shrunk substantially as average annual temperature has risen 0.5 to 2 degrees Celsius since the mid- to late 1800s (O'Connor, J.E., and Costa, J.E., 1993.), including Mt Hood glaciers in the Hood River Subbasin. Photos taken in 1901 of the Eliot Glacier in the subbasin show a dramatic retreat in the glacial ice volume of as much as 40-50% (Tom DeRoo, geologist Mt Hood National Forest). A series of drier, warmer years from 1975-1995 and 2001-2003 have been accompanied by lower streamflows and accelerated glacial recession. During an extensive warm and dry cycle, accelerated glacial retreat exposes more loose sand and moraines on Mt Hood that can become unstable during the following wet cycle. Following the warm dry period of the last 20 years, major debris flow events on Mt Hood have become much more frequent since 1996.

Macro-climate and Influence on Ecology

Little information was located on how climate change or climate trends are affecting vegetation and ecology in the Hood River Subbasin. Drought stress in recent years has favored bark beetle and spruce budworm infestations of Douglas fir, white pine, and Ponderosa pine stands in the subbasin (Bruce Hostetler, Mt Hood National Forest, pers comm). Climate change is generally associated with changes in disturbance regimes including long term patterns of fire, drought, insects, and diseases that influence forest development (USDA Forest Service, 2004). These changes could alter the distribution of vegetation types, affecting wildlife populations and /or biodiversity.

Human Use Influence on Hydrology in Subbasin

Hydrologic alterations in the subbasin include water diversion, changes in forest land cover to other uses, wetland conversion, road construction, and timber harvest. The Hood River mouth at its confluence with the Columbia River has been inundated by the Bonneville Pool and further modified by diking and landfill.

Water Diversion: Stream flow is interrupted or diminished by irrigation, domestic, municipal, and hydroelectric diversions. The total volume of legally appropriated water rights for out-of-stream uses is approximately 678,094 acre feet, or 94 percent of the estimated median natural stream flow at the Hood River mouth (Parrow, 1998). The estimated actual consumptive diversion for the peak summer irrigation period is at 296 c.f.s. or 40 percent of the average natural flow of the Hood River from July to September. Information about diversion points, return flows, and consumptive use levels are provided in Appendix B, Table 1.

The most significant alterations of the natural flow regime are the Pacificorp Powerdale Dam hydroelectric project (Hood River at RM 4.5) and irrigation withdrawals. Powerdale Dam diverts up to 500 c.f.s. from a 3 mile bypass reach in the Hood River. This diversion is subject to minimum instream flow requirements which up until recently allowed for a diversion of up to 80% of the available streamflow. Five irrigation districts account for the majority (~95%) of the consumptive water use in the subbasin. Major diversions are located on the East Fork Hood River (RM), mainstem Hood River (RM 11); Coe Branch; Eliott Branch; Clear Branch at the Dam; West Fork Hood River; The upper Dog River is legally depleted each summer at the City of The Dalles municipal diversion. Prior to efficiency measures in the mid 1990s, the East Fork Hood River became fully depleted below the East Fork Irrigation District diversion during severe droughts.

The majority of water supply in the subbasin is obtained by the direct diversion of surface water or springs. Only a small amount of groundwater is withdrawn for human use. Construction of Green Point Reservoirs in Ditch Creek and Laurance Lake Reservoir on Clear Branch inundated a total of 1.7 miles of stream habitat. Laurance Lake impounds 5,500 acre-feet behind Clear Branch Dam. The Farmers Irrigation District operates the Green Point reservoir system. The storage volume is approximately 1000 acre-feet.

Peak Flow Alterations: The Forest Service hypothesized that forest management, especially road construction and removal of wood from channels, has increased peak flows in the West Fork over natural conditions (USFS 1996a). Upland harvest has likely elevated peak flows in 2 to 5 year events, changing them to a chronic habitat disturbance.

Within the East and Middle Fork watersheds, Trout, Evans, and Tony creeks and the Lower East Fork Hood River were found to be the least hydrologically recovered, while the remaining watersheds met or surpassed the recovery threshold based on canopy closure. Road systems and impervious surfaces are assumed to affect the hydrology of drainage basins by intercepting surface and subsurface water flow, altering runoff patterns, and constraining stream channels from natural movement and adjustment patterns. GIS analysis of road densities among the eleven 6 HUC watersheds in this assessment indicate a range from 6.2 miles/ mi^2 (Lower Hood River) to a low of 1.3 miles/ mi^2 (Pinnacle Creek). Impervious surface is generally low in the subbasin.

Historic timber practices have reduced instream wood recruitment compared to natural conditions. Large woody debris (LWD) slows moving water and tends to desynchronize the timing of peak inflow from the outflow, lowering the peak flow (Watershed Professionals Network 1999). The use of splash dams occurred through the 1940s in the subbasin, and stream clearing was an encouraged practice in the 1960s and 70s. All large wood was cleared from the East Fork Hood River between Robinhood and Sherwood campgrounds in 1979. Reduced LWD has resulted in higher flood velocities, less interaction between streams and floodplains. Historic logging and clearing of streams and riparian areas has decreased large woody debris recruitment, in turn reducing pool area, pool complexity and pool frequency compared to natural conditions in the majority of subbasin streams. Flood refuge, hiding cover, over-wintering and productive early rearing habitats (i.e. shallow lateral habitats, side channels) for fish are lacking. Most channels lack the complex structure needed to retain gravels for spawning and invertebrate production.

Base Flow Alterations: The use of drain tiles and ditches to reduce soil saturation is associated with agriculture and other land uses in the subbasin. A network of open irrigation ditches and road ditches intercept surface flows and shallow groundwater at numerous locations. Loss of wetland recharge and storage functions has probably had a greater effect on base flows in small streams than on subbasin peak flow characteristics (Rick Ragan, USFS, pers comm). Irrigation overflows and canal leakage may increase summer stream flows in Baldwin, Odell, and Tieman creeks. The West Fork Neal Creek flows during the irrigation season are increased 5 to 10-fold over the natural baseflow by the creek's use as an inter-basin irrigation transfer system.

Human Use Influence on Ecology in Subbasin

Forest Land Conversion: Vegetation and wildlife habitats in the middle and lower subbasin area have been substantially altered in the last 150 years. Conversion of conifer forest to agriculture, residential, and other development is the most significant change since the late 1800s. A major ecological consequence of the conversion of low elevation conifer forest to orchard and residential environments is the loss of winter range and key structural habitats for wildlife. Fruit tree and most residential landscapes lack the year-round hiding, thermal and snow accumulation cover or shelter for birds and mammals that conifer forests provide. The result is a net loss of shelter for resident birds and mammals, especially in winter, at lower basin elevations (Wells, 1999). Other attributes of native forests that are lacking in most low elevation lands are damaged live trees, standing dead trees, and large-diameter downed trees. This has decreased the availability of nesting cavities, scanning perches, and insect-feeding substrate for birds and a variety of other wildlife. Remnant forest patches among cultivated and developed lands in the subbasin are often fragmented. In many areas, riparian vegetation is the last stronghold of native plant form and function in the Hood River Valley.

Timber Harvest: Timber harvest has increased forage and edge habitat preferred by deer and elk, and in turn has probably increased these populations relative to pre-European settlement, along with cougar, their main predator. The winter range of large migratory animals like deer and elk in the Hood River Valley has been usurped by human habitation (Wells 1999). Half the remaining winter range of deer and elk in the subbasin as a whole is on private land.

Fire Suppression: Fire suppression since the 1880s has resulted in changes in forest structure and ecology including an invasion of Douglas fir into Oregon white oak stands in the subbasin (Robin Dobson, USFS). In absence of periodic wildfire, stands of fire-dependent vegetation such as oak are diminishing, reducing forage and cover for the wildlife species associated with these communities.

Fragmentation by Human Travel and Utility Corridors: The construction of utility corridors and human travel corridors (roads, highways, railroads and trails) has resulted additional fragmentation and disturbance of wildlife habitats. According to the GIS analysis performed for this assessment, the combined human travel corridor density is 4.3 miles per sq. mile, excluding utility lines and unmapped trails (Appendix A, Map 2)

Wetland and Stream Alteration: The ecology of wetland and stream habitats has been altered as well by human activity. Vegetation removal, water diversion, and storage contributes to warm water temperatures exceeding the preferred ranges for salmonids in a number of stream reaches. Agricultural and other human activities have resulted in pesticide contamination and elevated nitrogen and phosphorous levels in several lower Hood River tributaries, with some evidence of adverse effects on macroinvertebrates and fish. Chronic fine sediment inputs and increased turbidity from forest road runoff and irrigation systems affects primary production and macroinvertebrate production. Lloyd et al. (1987) found that turbidity of only 5 NTU could decrease primary production in shallow streams by 3-13%. An increase of 25 NTU decreased primary production by 13-50% in shallow streams.

3.1.4. Regional Context

Relation to the Columbia Basin

The Hood Subbasin is 169 miles from the mouth of the Columbia River at the Pacific Ocean. The Hood Subbasin is one of 62 subbasins in the Columbia River. At 349 square miles, the Hood Subbasin makes up 1.6 percent of the Columbia River Basin. Anadromous fish produced in the Hood River must pass a single Columbia River mainstem dam, Bonneville Dam, and its reservoir, Lake Bonneville, as smolts and returning adults.

Relation to the Ecological Province

The Columbia Gorge province includes the Columbia River and all tributaries between, and including, Bonneville and The Dalles Dam. The Hood River Subbasin is one of 7 subbasins within the Columbia Gorge Province. The Hood Subbasin represents 11 percent of drainage area in the Province.

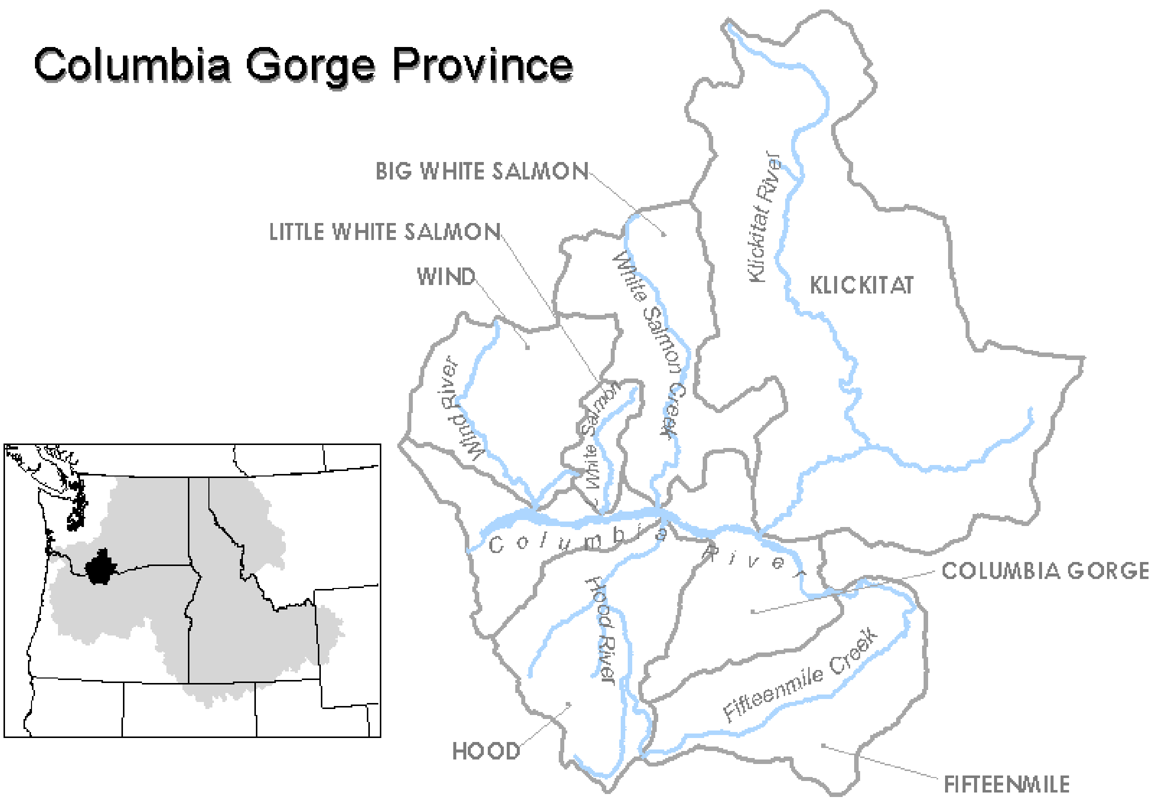

Figure 4. Relation of the Hood Subbasin to the Columbia Gorge Province.

Relation to Other Subbasins within the Province

The Hood Subbasin ranks 4th in size among the other subbasins in the Columbia Gorge Province. Within this Province, the Hood Subbasin accounts for 51 percent or 139,861of the total salmon production goal the Columbia Gorge Province (Phil Roger, Draft Interim

Subbasin and Provincial Objectives, April 23, 2002 memo to Oregon Coordinating Group).

Unique Qualities of the Subbasin within the Province

The Hood River supports a greater diversity of native salmonid fish species compared to other subbasins in the Columbia Gorge Province. These include spring chinook, fall chinook, and coho salmon, winter steelhead, summer steelhead, bull trout, cutthroat trout, and rainbow trout. Due to the influence of glacial recession and other natural disturbances, aquatic habitat conditions in the Hood River subbasin vary dramatically from year to year.

NMFS Evolutionary Significant Units (ESUs)

The Hood River drainage is within the Lower Columbia River ESU for steelhead (Threatened - 3/98), one of 5 ESUs for steelhead in the Columbia River basin. The Hood River drainage is the western-most drainage in Lower Columbia River ESU. This ESU also includes the Sandy, Wind, Willamette, Washougal, Lewis, Kalama and Cowlitz river drainages. The Hood River drainage is the westernmost drainage within the Lower Columbia River ESU for chinook salmon (Threatened - 3/98), one of 8 ESUs for chinook in the Columbia River basin. The lower 5 or so miles of the Hood River are included in the Columbia River Chum Salmon ESU.

USFWS Designated Bull Trout Planning Units

The U.S. Fish and Wildlife Service listed the Columbia River Distinct Population Segment of bull trout as a threatened species under the Endangered Species Act on June 10, 1998 (63 FR 31647). Within the Columbia River Distinct Population Segment, the recovery team identified 22 recovery units including the Mt. Hood Recovery Unit (RU). The Mt Hood RU encompasses the Hood River drainage in its entirety, and drainages eastward up to and including Fifteen Mile Creek, westward up to and including the Sandy River, and the adjacent mainstem Columbia River. The northwestern limit of the Mt. Hood RU extends to Bonneville Dam. The Hood River drainage is identified as the core habitat area within the Mt Hood RU because it currently supports the only known spawning population of bull trout in the unit. Bull trout migrate seasonally from the Hood River to the mainstem Columbia River using the Columbia during part of their life history. Designation of the Mt. Hood RU is based in part on the inclusion of Hood River bull trout within a single Gene Conservation Group (GCG) by Oregon Department of Fish and Wildlife (Kostow 1995). Three records of bull trout in the Sandy River indicate the possibility that the Sandy River watershed supports a population of bull trout, or that bull trout foraging or overwintering in the Columbia River, possibly from the Hood River population, may occasionally be entering the Sandy River or other tributaries downstream of the Hood River recovery unit boundaries.

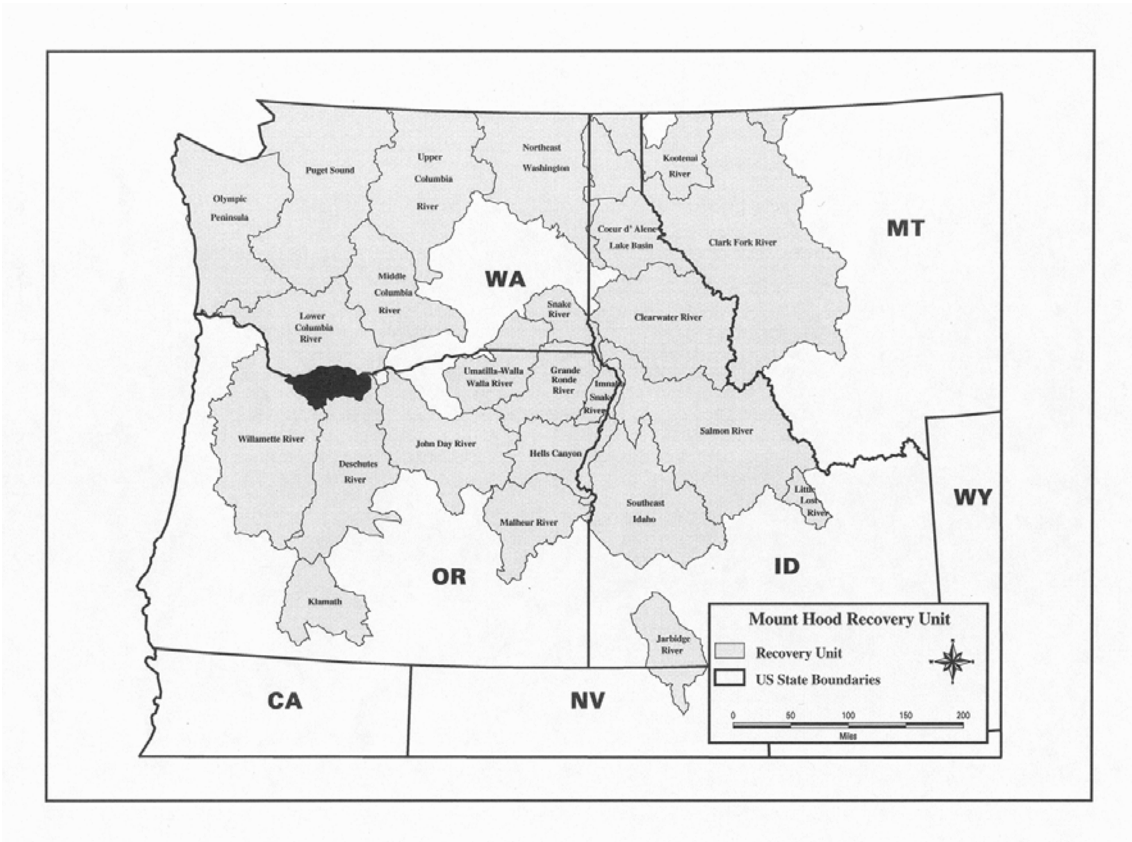

Figure 5. Mt Hood Recovery Bull Trout Recovery Unit is shown in black within the Columbia River Distinct Population Segment.

External Environmental Impacts on Fish and Wildlife

External impacts on fish and wildlife in the Hood River 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. Mainstem fish passage in the Columbia River at Bonneville Dam, such as predation and warm summer and fall temperatures in the Bonneville reservoir, affects the survival of adults and juvenile fish migrating to and from the Hood River. Estuarine habitat modifications and artificially elevated sea bird and/or marine mammal predation in the Lower Columbia River represent an additional impact. 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 the ecology of the subbasin. Growth and land development in adjacent subbasins are a significant factors that impact migratory wildlife. Regional population growth is contributing to a rising demand for outdoor recreation opportunity and real estate development that ultimately affects fish and wildlife in the subbasin.

3.2. Focal Species Characterization and Status

3.2.1 Ecologically Important Native or Non-native Fish and Wildlife

Fish species known to occur in the Hood River Subbasin are shown in Table 2. According to the Northwest Habitat Institute database, 402 species of wildlife are present or potentially present in the Hood Subbasin. This list is available online at www.nwhi.org/ibis.

Table 2. List of fish species present in the Hood River Subbasin.

Anadromous Fish	Native (N) or Introduced (I)
Spring chinook salmon	**N**
Fall chinook	**N**
Summer steelhead	**N**
Winter steelhead	**N**
Sea-run coastal cutthroat trout	**N**
Pacific lamprey	**N**
Coho salmon	**N**
Resident Fish	
Bull trout	**N**
Coastal cutthroat trout	**N**
Rainbow trout	**N**
Mountain whitefish	**N**
Sculpin *(Cottus sp.)*	**N**
Suckers *(Catostomous sp.)*	**N**
Northern pikeminnow	**N**
Dace	**N**
Stickleback	**N**
Brown trout	**I**
Brook trout	**I**
Kokanee	**I**
Smallmouth bass	**I**
Brown bullhead	**I**

Species Designated as Threatened or Endangered

Three fish and two wildlife species occurring in the Hood River Subbasin are listed as Threatened under the federal Endangered Species Act (ESA) or by the state of Oregon. No species currently listed as Endangered by either Oregon or the federal government are known to regularly occur in the subbasin. No plant species in the subbasin are listed under the Endangered Species Act. The Lower Columbia River anadromous or sea-run form of coastal cutthroat trout *Oncorhynchus clarki clarki*, including the Hood River population, is listed as a Critical Sensitive Species by Oregon. The resident form of cutthroat trout is listed as a Vulnerable Sensitive Species. The Northern gray squirrel is listed as Threatened in the State of Washington. Pacific lamprey were listed as a state sensitive species in 1993. Because of the apparent declines in lamprey populations, conservation groups in Oregon, Washington and California prepared a petition to give lamprey federal protection under the Endangered Species Act in January 2004.

Table 3. Fish and wildlife species listed as threatened in the Hood River subbasin.

Species	Federal Status (ESA)	State of Oregon
Bull Trout *(Salvelinus confluentus)*	Threatened	Threatened
Steelhead Trout (*Oncorhynchus mykiss)*	Threatened	Threatened
Chinook Salmon *(O. tshawytscha)*	Threatened	Threatened
Bald Eagle *(Haliaeetus leucocephalus)*	Threatened *proposed for de-listing*	Threatened
Northern Spotted Owl *Strix occidentalis caurina*	Threatened	Threatened
Wolverine *(Gulo gulo)* possibly extirpated, present in the 1980s	---	Threatened

Species Recognized as Rare or Significant Locally

Table 4. Selected wildlife species that are known to occur in the Hood River subbasin that are recognized as rare, uncommon and/or sensitive.

Birds		
Pileated woodpecker	Bufflehead	Loggerhead shrike
Northern goshawk	Barrows goldeneye	Three-toed woodpecker
Mountain quail	Lark sparrow	Lewis woodpecker
Great gray owl	Clarks nutcracker	White headed woodpecker
Flammulated owl	Common loon	Williamsons sapsucker
Northern pygmy owl	Harlequin duck	Black-backed woodpecker
Western bluebird	Sandhill crane	Pileated woodpecker
Horned grebe	Black rosy finch	Clark’s nutcracker
Lark sparrow	Wood duck	
Amphibians		
Cascades frog	Cascade torrent salamander	Larch Mountain salamander
Spotted frog	Copes giant salamander	Western toad
Tailed frog	Oregon slender salamander	
Red-legged frog	Larch mountain salamander	
Reptiles		
Western pond turtle	Painted turtle	Sharp tailed snake
Mammals		
American Marten	Long-eared myotis	Townsend’s big-eared bat
Fisher	Long-legged myotis	Hoary bat
Red fox	Silver-haired bat	Red tree vole

Species of Special Ecological Importance to the Subbasin

The carcasses of anadromous fish are a significant source of food and marine nutrients for aquatic and terrestrial species. Salmon carcasses provide a critical aquatic and terrestrial food source in the fall and winter, and steelhead in spring. Larval lamprey or ammocoetes are important because they clean the stream by filter feeding organic material and provide a food source for predator fish, including juvenile salmonids.

Beaver create and maintain wetlands and complex stream habitats of great value to several salmonid species especially as critical overwintering habitat. Beaver ponds provide habitat for wildlife species and promote stream-floodplain interaction and groundwater recharge. Beaver are an IBIS "Critically Linked with Fish" species.

Resident coastal cutthroat trout *Oncorhynchus clarki clarki* are important as indicators of the water quality and habitat integrity of headwater and other streams. American marten are a Forest Service Management Indicator species with a role as a medium home-range carnivore in mixed-conifer cover types from mid to high elevation.

Black-tailed deer and elk are managed game species and a Forest Service Management Indicator Species. Big-game movement patterns indicate the degree of connectivity across cover types in the subbasin, and are dependent upon adequate summer and winter range habitat. Grazing, browsing and foraging by deer and elk in the subbasin influences forest vegetation structure, composition, and density.

Clark's nutcracker is an alpine Partners in Flight (PIF) species associated with old-growth white-bark pine and is dependent on its pine cone seeds. These pines grow at high elevations at or above the timberline in the Mt Hood and Cooper Spur area. There are declines in white-bark pine stands, especially in early succession, from fire suppression, replacement by competing conifers, lack of regenerating young trees, and more recently due to blister rust disease. The pine appears to be totally dependent on Clark's nutcrackers (Marshall et al. 2003) for stand regeneration. Clark's nutcrackers cache huge numbers of white-bark pine seeds (up to 100,000 seeds per bird each year) in small, widely scattered caches usually on bare ground. This is ideal for regeneration of the pine since many caches are never used.

Lark sparrow is a PIF species associated with oak savanna, oak-pine stands, and eastside interior grasslands found mostly on along the mid to lower eastern boundary of the Hood River subbasin. Western gray squirrel is an Oregon Game Species and a Forest Service Management Indicator Species, that uses a Ponderosa pine dominant, westside oak and dry Douglas-fir forest type. Fire is an integral part of the ecosystem for both the lark sparrow and the western gray squirrel and helps control invasive plant species and retain native plant species.

Northern spotted owl is associated with mixed-conifer forest cover types with old-growth or late-succession forest structural characteristics (snags, coarse woody debris, and multiple vegetative layers). Large contiguous blocks of forest are critical to the owl's successful reproduction and survival.

Species Recognized by Tribes For Cultural or Spiritual Significance

Members of the Confederated Tribes of the Warm Springs Reservation retain fishing, hunting, and gathering rights in the subbasin arising from the Treaty with the Tribes of Middle Oregon signed on June 25, 1855. Under this treaty, seven bands of Wasco and Sahaptin-speaking Indians ceded ownership of ten million acres of tribal land, including the Hood River Subbasin, to the United States (BPA 1996). A wide range of fish, wildlife, and plants are utilized by the Tribes and have a significant cultural or spiritual value. Pacific lamprey are a valued traditional food and have religious, medicinal, and ceremonial importance to tribal members. Lampreys are an important component of the tribal subsistence fisheries that occurs annually in Fifteenmile Creek, Deschutes River and Willamette River. Lampreys are fatty and highly nutritious. Lampreys have also been used for medicinal purposes. The oils of the "eels" have been used as hair oil and were traditionally mixed with salmon and used as a cure for tuberculosis. Spring chinook are an especially significant species in Northwest tribal culture in part because it is the first salmon to return each year and it appears as a bright plump fish months prior to spawning. Deer and elk remain a very important cultural and subsistence species for the Tribes. In addition to the meat, skins, horns and other parts are used to make drums, clothing, and other traditional items.

3.2.2. Focal Species Selection

List of Species Selected

Aquatic

Bull trout
Steelhead trout (summer and winter run)
Chinook salmon (fall and spring run)
Coastal cutthroat trout
Pacific lamprey

Terrestrial/Wildlife[2]

Northern spotted owl
Western gray squirrel
Lark sparrow
Clark's nutcracker
Black tailed deer
Elk

[2] American marten were originally selected as a focal species but later deleted due to a significant overlap with spotted owl habitat. Harlequin duck were also originally selected, but deleted due to time constraints.

Methodology for Selection

The focal species were selected based on their relevance to 3 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 5. Focal species list and selection criteria for the Hood River Subbasin

FOCAL SPECIES	Population Status or Concern	Management Scope Exists	Ecological Significance or Indicator	Tribal Cultural Importance	Represents Priority Habitat Type (WILDLIFE)
Steelhead trout	X	X	X	X	
Cutthroat trout	X	X	X		
Bull trout	X	X	X	X	
Chinook salmon	X	X	X	X	
Pacific lamprey	X	?	X	X	
N.spotted owl	X	X	X	X	X
Elk	X	X	X	X	X
Black tailed deer		X		X	X
Lark sparrow	X	X	X		X
Clarks Nutcracker	X	?	X		X
Western gray squirrel	X	X	X		X

Each ESA-listed fish species in the subbasin were selected as focal species. Although the subbasin is within the Lower Columbia Chum Salmon ESU, chum were not selected because they are not present and little is known about historical populations in the Hood River. Although they are not included in the Lower Columbia Chinook ESU, spring chinook were selected because they are the target of an ongoing salmon reintroduction program and are of special cultural significance the tribes. Coastal cutthroat trout were selected because of their Sensitive species listing by the U.S. Forest Service Region 6 and the State of Oregon, and because they may serve as indicators of the health of headwater and other streams for rare or sensitive invertebrates.

Wildlife selection was based on the added criteria of the species' ability to represent distinct IBIS land cover types in the subbasin (Table 6). Deer and elk are managed game species that are important to tribal culture and subsistence, and to the general community. Both deer and elk utilize a wide range of available forest, edge, and mixed cover types, including orchards and pasture on an opportunistic basis. Because of their extensive migrations both within the subbasin and to adjacent subbasins, elk were selected to represent migration routes and forest habitat connectivity as a subcover element also important for other species. Lark sparrow and western gray squirrel represent important and threatened lower elevation cover types in the subbasin, that also provide deer and elk winter range. Despite its listed status, the bald eagle was not selected because they are more common along the Columbia River, and management strategies for fish were expected to improve habitat conditions for bald eagle in the subbasin.

Table 6. Focal wildlife species and associated IBIS vegetative land cover types.

Wildlife Species	**IBIS Vegetative Cover Type** ***Subcover Type***
Clark's nutcracker	Subalpine Parkland Alpine Grasslands and Shrublands
Lark sparrow	Ponderosa Pine Dominant; Interior Grasslands, Westside Oak and Dry Douglas-fir
Northern spotted owl	Mesic Lowland Conifer-hardwood forest; Montane Mixed Conifer forest; Interior mixed conifer forest
Western gray squirrel	Ponderosa Pine Dominant Westside oak and Dry Douglas-fir
Black-tailed deer Elk	All forest types in subbasin Mixed Environs *(including the opportunistic use of agriculture and pasture)* *Movement patterns across all cover types*

3.2.3 Aquatic Focal Species Population Delineation and Characterization

Steelhead Population Data and Status

Winter Steelhead Abundance: Escapements to the Powerdale Dam trap ranged from 206-1,017 wild, 108-917 Hood River stock subbasin hatchery, and 1-38 stray hatchery winter steelhead for the 1991-1992 through 2000-2001 run years (Olsen, E., 2003). (Figure 6)

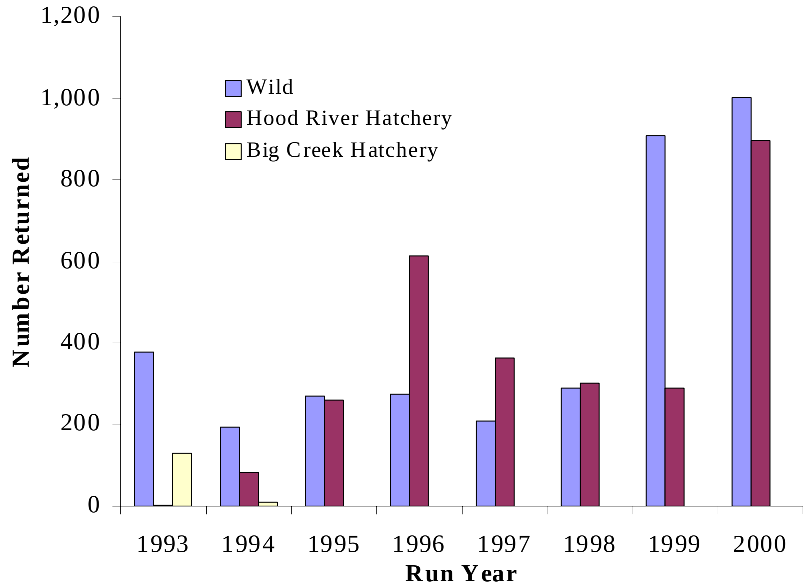

Figure 6. Number of adult hatchery and wild adult winter steelhead captured at Powerdale Dam for run years 1994-2001.

Summer Steelhead Abundance: Adult returns of wild/natural origin summer steelhead to Powerdale Dam ranged from 79 to 650 fish for the years 1992 to 2003 with an average of 261 fish (Rod French, ODFW, pers. comm.). Escapements to the Powerdale Dam trap ranged from 79-490 wild, 485-1,726 Skamania stock subbasin hatchery, 7 Hood River stock subbasin hatchery, and 2-18 stray hatchery summer steelhead for the 1992-1993 through 2000-2001 run years (Figure 7).

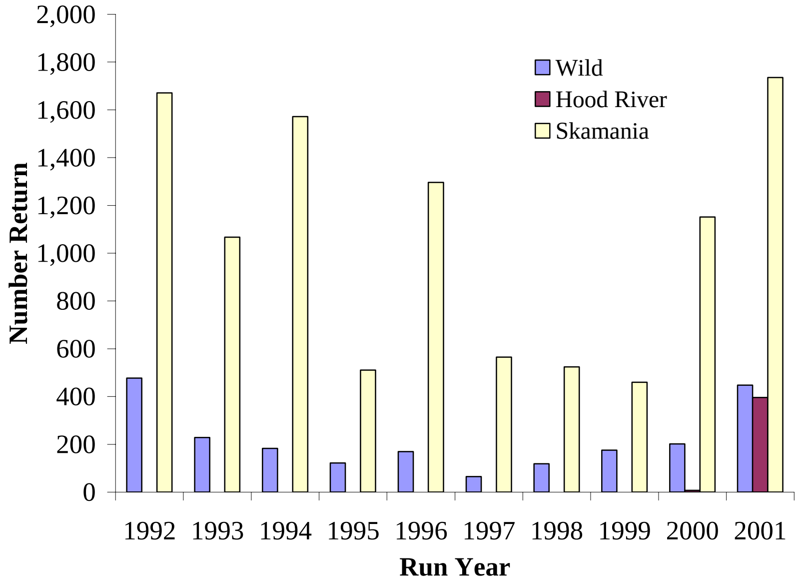

Figure 7. Number of adult hatchery and wild adult summer steelhead captured at Powerdale Dam for run years 1992-2001.

Winter Steelhead Productivity: During the period from 1994 to 2001, the recruits per spawner (R/S) for wild winter steelhead averaged 1.98 and ranged from 0.87 to 3.71.

Summer Steelhead Productivity: For summer steelhead, the recruits per spawner (R/S) averaged 0.18, and ranged from 0.38 to 0.09. The low R/S for summer steelhead indicated the natural spawning population was not replacing itself (Underwood, K.D. et al, 2003).

Winter and Summer Steelhead Life History Diversity: Steelhead return to the Hood River at 2 to 6 years of age, with most fish returning at age 4. Adults typically spend from 1–3 years in the ocean, with an average of 2 years. About 6% of returning steelhead adults are repeat spawners. Smolts range in age from 1- 3 years with most spending 2 years of their life in freshwater (Olsen, E. 2003). Outmigration extends from late March through July, and peaks in early May. Screw trap data indicate that winter steelhead smolts primarily migrate from the East Fork in the fall and move into the upper mainstem Hood River. In contrast, winter steelhead smolts migrate from the Middle Fork primarily in the spring. Summer steelhead in the Hood River tend to remain and rear near their spawning reach and migrate from the West Fork in the spring.

Winter and Summer Steelhead Carrying Capacity: The annual smolt production potential of the Hood River for steelhead was estimated for the BPA Hood River Production Program Review in 2003. This analysis estimated a subbasin habitat production potential of 16,970 winter steelhead smolts and 13,860 summer steelhead smolts (Underwood, K.D. et al, 2003). These estimates were developed using the Unit Characteristic Method or UCM (Cramer, S. 2001). UCM carrying capacity estimates for the Hood River were lower than previous estimates developed in 1990 using the Smolt Density Model (SDM). UCM smolt densities estimates ranged from 0.1 to 3.4 smolts/100m^2. In contrast, the

SDM assigned densities from 3 to 10 smolts/100m^2. The estimated actual number of juvenile steelhead migrating from the Hood River ranged from 2,664 to 24,481 annually during 1994 to 2001, based on screw trap data. Screw trap data indicate that the current number of smolts migrating from the Hood River are significantly lower than the predicted estimates from either the UCM, SDM, or EDT models (Table 7).

Table 7. Comparison of subbasin habitat production potential estimates from three different models to actual steelhead juvenile migrant trap data in the mainstem Hood River at river mile 4.5.

Population	**Unit Characteristic Method**	**Smolt Density Model**	**Ecosystem Diagnostic and Treatment Model**
Winter steelhead	16,790	69,958	35,975
Summer steelhead	13,860	57,750	47,411
Model estimate totals	*30,830*	*127,708*	*83,386*
Estimated # of steelhead outmigrants from trap data 1994-2001	2,664 – 24,481		

Winter and Summer Steelhead Population Trend: Hood River steelhead are considered depressed by ODFW and CTWS, and were listed in 1998 as threatened under the ESA. Harvest records indicate that thousands of steelhead returned to Hood River each year during the 1960s. The annual sport harvest of summer steelhead ranged from 2,406 and 4,455 between 1980 and 1990 (O'Toole and ODFW 1991). However, the proportion of hatchery fish in the sport catch was not documented. The short-term trend for wild winter steelhead returns since 1999 is substantially higher than the previous 6 years based on continuous trap data. Wild summer steelhead do not show the same increasing trend.

Steelhead Unique Population Units: Both summer and winter run steelhead populations exist in the subbasin. The differences between the two stocks include adult return timing, median time of spawning, spatial distribution, emergence timing, and relative size at return (Olsen, E. pers. Comm.). Winter steelhead returns begin in February, peak in late April, and decline in May. Winter steelhead spawning occurs from February 15 to June 15. Summer steelhead returns begin in mid-March, peak in early July, decline in August, and have a second peak in November. Summer steelhead spawn from February 15 to April 30. The median spawning period for winter steelhead is about 2 weeks later than for summer steelhead. Winter steelhead spawn primarily in the Hood River mainstem, Middle Fork, and East Fork, while summer steelhead spawning is limited to the West Fork. Due to their later return, summer steelhead spend longer in the ocean and return at a larger size compared to winter steelhead of similar saltwater age.

Steelhead Genetic Integrity: DNA sampling has shown that winter steelhead and summer steelhead in the Hood River are genetically distinct from one another (Neraas, L.P. and P. Spruell, 2001). Indigenous winter steelhead have had less genetic influence from out of basin hatchery stocks than summer steelhead population. No non-indigenous winter steelhead have been stocked into the Hood River since 1992 when a Hood River broodstock program was initiated. Indigenous summer steelhead are likely to have experienced more interbreeding and genetic influence from out of basin hatchery stocks, particularly the Foster/Skamania stock. No non-indigenous hatchery summer steelhead have been allowed to spawn with wild/natural origin fish above Powerdale Dam since August 1997 (HRWG 1999).

Steelhead Population Risk Assessment: The probability of declining to a 4-year average of 50 spawners per year within 100 years was recently calculated to be 84% for winter steelhead and 99% for summer steelhead (NOAA, 2003). This calculation used stochastic projections based on factors including 1992-2000 abundance levels, and the average percent of spawners of hatchery origin (52% for winter steelhead and 82% for summer steelhead). Wild summer steelhead have had significant genetic influence from non-native hatchery stocks, and their spawning habitat area is limited to the West Fork Hood River. Environmental variation adds another element of risk to the subbasin steelhead populations, given the frequency of large-scale debris flows on Mt. Hood and other natural events.

Chinook Population Data and Status

Spring Chinook Abundance: The current actual wild or natural escapement of spring chinook in the Hood River ranged from 18 to 89 adults between 1992 and 2003, and averaged 54 fish (Rod French,ODFW, pers comm.). Total combined wild and hatchery returns to the Powerdale Dam trap ranged from 53 to 1091 adults (Figure 8).

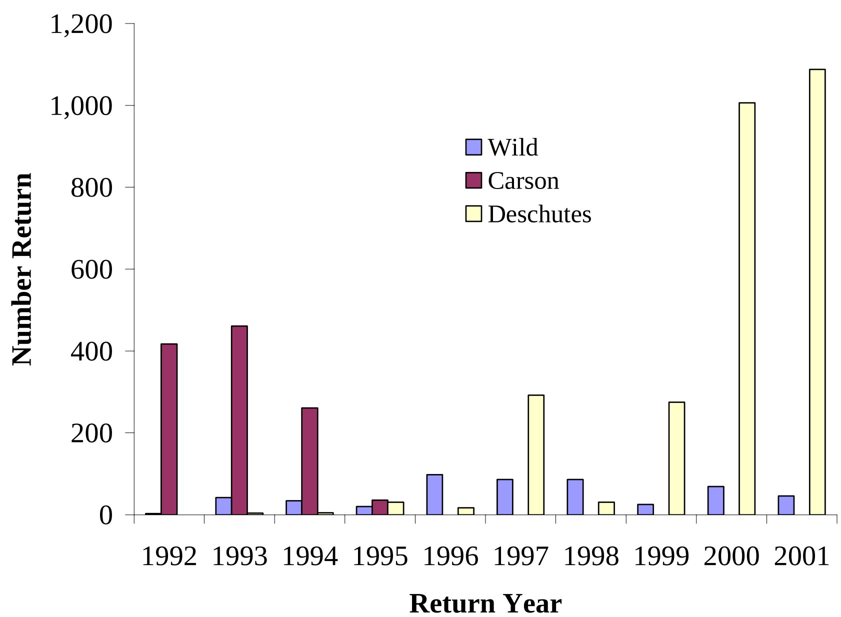

Figure 8. Number of adult hatchery and wild spring chinook captured at Powerdale Dam for run years 1992-2001.

Fall Chinook Abundance: Fall chinook abundance in the Hood River is currently very low. For the period from 1992 -2003 the annual return of fall chinook to Powerdale Dam has averaged 26 fish, with a range from 6 to 70. Between 1992 and 1998, fall chinook returns to Powerdale Dam ranged from 6 to 36 unmarked fish, with 2 to 7 marked hatchery strays (Olson and French 1999).

Spring Chinook Productivity: Recruits per spawner (R/S) estimates for spring Chinook were less than one from 1993-1995 due to poor egg-to-smolt survival. Hood River egg-to-smolt survival was very low, averaging 0.55% compared to an average egg-to-smolt survival of 8.71% in the Warm Springs River (Underwood, K.D. et al, 2003).

Chinook Life History Diversity: Spring chinook enter the Hood River from April to September, and spawn beginning in mid-August through late September. Fall chinook enter from early July through October, and spawn in late September through early November. Outmigrant trap data from 1994 to 2001 suggests that wild spring Chinook predominantly migrated out of the Hood River in the fall (Underwood, K.D. et al, 2003). Ocean-type fall migrants, or those that outmigrate in late summer/fall after emergence are estimated to make up 85% of the population. Stream-type residents and transients, or those that either leaver the subbasin as yearlings in the second spring after emergence and near their spawning reaches, or rear by redistributing to locations downsteam from their spawning reach, make up 15% of the population. Scale analysis indicates that naturally produced spring chinook returning to the Hood River migrated as both subyearling (23%) and yearling smolts, while fall chinook migrate as subyearlings (Underwood, K.D. et al, 2003). Mini-jacks and jacks, i.e. precocious male spawners, accounted for a high proportion of hatchery spring chinook returns to Powerdale Dam compared to wild returns, apparently a result of the fast growth of fish reared in the hatchery compared to wild fish (Underwood, K.D. et al, 2003). The age at adult return for most wild/naturally spawning spring and fall chinook was age 4, although it ranged from 1-5 years.

Chinook Carrying Capacity: The annual average production potential of the Hood River for spring chinook was recently estimated to be 15,692 smolts in recent BPA Hood River Production Program Review (Underwood, K.D. et al, 2003). This estimate was made using the Unit Characteristic Method or UCM and was lower than an earlier estimate of 42,410 smolts using the Smolt Density Model. The UCM predicted that the maximum smolt densities to be 1.6 to 3.5 smolts/100m^2 per stream reach. Actual smolt production measured by screw trap data reached 11,745 smolts in 1994, and ranged from 873 to 1,723 during the period 1995 to 1999. These data suggest that the subbasin was producing less than 10% of the estimated capacity (Underwood, K.D. et al, 2003). Screw trap data indicate that the current number of smolts migrating from the Hood River are significantly lower than the predicted estimates from either the UCM, SDM, or EDT models (Table 8). A life cycle model developed for the HRPP review estimated that roughly 125 adult spring Chinook were needed to fully seed the Hood River to capacity.

Chinook Population Trend: The indigenous spring chinook stock was extirpated by the early 1970s (CTWS and ODFW 1991). A population is being reintroduced as part of the

HRPP using spring chinook from the Deschutes River. Since 1994, the number of returning hatchery spring chinook increased, while the number of wild (naturally produced) fish decreased, suggesting that the current hatchery program was not meeting its supplementation goal (Underwood, K.D. et al, 2003). The indigenous fall chinook stock is extinct. Little is known about its historical abundance. Fall chinook in the Hood River are believed to be hatchery strays and the progeny of hatchery strays. Coincident with a record high run at Bonneville Dam, 109 fall chinook returned to Powerdale Dam in 2003. The prior record was 36 since continuous trapping began in 1992.

Table 8. Comparison of subbasin habitat production potential estimates from three different models to actual chinook juvenile migrant trap data in the mainstem Hood River at river mile 4.5.

Population	**Unit Characteristic Method**	**Smolt Density Model**	**Ecosystem Diagnostic and Treatment Model**
Spring Chinook	15,692	42,410	7,311 (w/o harvest)
Fall chinook	--	--	63,408 (w/o harvest)
Estimated # of chinook outmigrants from trap data 1994-1999	873 - 11,745		

<u>Chinook Unique Population Units</u>: Both spring and fall-run chinook occur in the Hood River. Differences in life history characteristics between the two stocks include adult return timing, median time of spawning, spatial distribution, smolt age, age at return, and relative size at return. The majority of the fall chinook spawn in the lower Hood River below Powerdale Dam, although spawning also occurs in the lower East Fork (BPA 1996) and West Fork Hood River. Spring chinook spawning occurs primarily in the West Fork Hood River and in the lower portions of several West Fork tributaries

<u>Genetic Integrity:</u> The present spring chinook run is mostly from Deschutes River stock. Deschutes River spring chinook smolt releases began in 1993, while releases from Carson hatchery broodstock were made from 1986 to 1990. The genetic makeup of fall chinook is likely very similar to Spring Creek National Fish Hatchery (R. French, ODFW, pers. comm.).

<u>Population Risk Assessment</u>: Without continued hatchery supplementation, the spring chinook population could face a moderate to high risk of extinction. While the number of hatchery fish has increased, the population size of wild or natural spawning spring chinook remains low. Suitable spawning habitat for chinook is geographically restricted to mostly to the West Fork subwatersheds, as the East and Middle Fork mainstems are less suitable for fall spawning due to glacial sediment loads. The supplementation program has not yet worked to create a locally adapted population, although productivity may increase in response to recommended changes in hatchery practices by taking broodstock from fish only returning to the Hood River, and continued habitat restoration

(Underwood, et al. 2003). Environmental variation adds another element of risk to the population, given frequent large-scale debris flows on Mt. Hood and other natural events. Spring chinook adults are vulnerable to poaching, hooking, and/or harvest-related mortality due to their extended exposure to spring and summer sport and tribal fisheries. The fall chinook population, which is believed by area fish managers to be the progeny of hatchery strays, faces a high risk of extirpation because of stock origin and because its distribution is limited to the mainstem Hood River, which experiences high glacial sediment loads.

Bull Trout Population Data and Status

Bull Trout Abundance: A comprehensive population assessment is not available, but at present the total number of adult bull trout in the recovery unit is believed to be less than 300 (USFWS, 2003). A population size of at least 500 adults is recommended in order for the population to be considered recovered (USFWS, 2003). Snorkel surveys conducted in Clear Branch above Clear Branch Dam found annual high counts of 51 to 200 adult and juvenile bull trout between 1996 and 2003. Surveys below Clear Branch Dam found annual high counts of 0 to 3 bull trout. Migratory bull trout have been counted at the Powerdale Dam fish trap continuously since 1992, with numbers trapped ranging from a high of 28 fish in 1999 to 2 fish in 1993 (Figure 9). Counts were made from 1963-1971, but these are considered incomplete because they were either not continuous or made in only one of two dam fish ladders operated at the time.

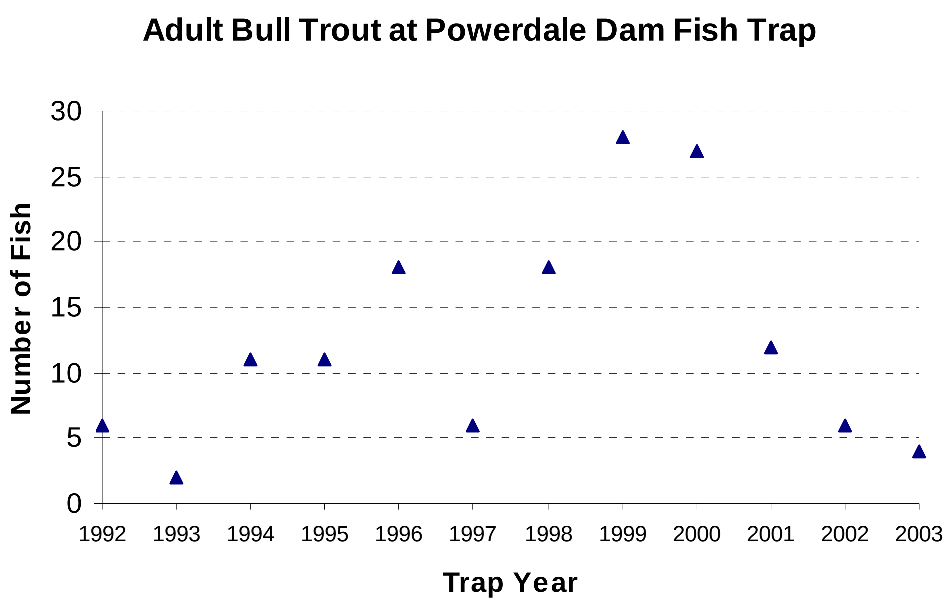

Figure 9. Adult bull trout captured in the Powerdale Dam trap for years 1992 to 2003.

Bull Trout Productivity: Data is not available to develop an estimate of productivity for bull trout in the subbasin.

Bull Trout Life History Diversity: Bull trout in the Hood River subbasin remain in freshwater throughout their life history and are believed to exhibit 3 life history patterns.

Resident and migratory life history forms are found above and below the Clear Branch Dam. A fluvial population migrates between tributaries used for spawning and early rearing, using larger streams such as the Hood River mainstem and the Columbia River for late juvenile or adult rearing. An adfluvial population spawns and rears in upper Clear Branch and Pinnacle Creek and uses Laurance Lake for rearing. Resident bull trout generally confine their migrations within their natal stream (Buchanan et al. 1997). Scale analysis indicates that of bull trout captured at Powerdale Dam are 3 to 8 years old.

Bull Trout Carrying Capacity: Data is not available to develop an estimate of habitat carrying capacity for bull trout in the subbasin.

Bull Trout Population Trend: The current population trend is unclear from the available data. Both the annual snorkel survey data from 1996 -2003 and the Powerdale Dam adult trap counts from 1992-2003 show moderate to high variation from year to year. In 2002 and 2003, an increase in juveniles was observed in Clear Branch above Clear Branch Dam compared to previous years, while the number of adults remained similar to previous years. It is too early to tell whether this recent increase in juveniles reflects a population trend, a shift in rearing distribution in response to habitat restoration, or a short-term environmental variation in juvenile recruitment. A population that is below recovered abundance levels, but that is moving toward recovery, would be expected to exhibit an increasing trend in indicators including trap counts, redd counts, and juvenile and adult observations.

Bull Trout Unique Population Units: Two Local Populations of bull trout were identified in the draft US Fish and Wildlife Service Bull Trout Recovery Plan, one in Clear Branch and one in the Hood River. The two local populations are separated by the Clear Branch Dam, which has blocked the upstream migration of bull trout since its construction in 1969. The success of downstream passage during spillway operation is uncertain, and an effort to trap fish at the base of the dam for upstream transport has not succeeded to date. The Clear Branch Local Population occurs in Laurance Lake Reservoir and in Clear Branch and Pinnacle Creek above the Dam. The Clear Branch Local Population is considered the stronghold for the recovery unit where bull trout numbers are highest and where high-quality habitat is most available. This population unit has an adfluvial life history component, where bull trout forage and overwinter in the reservoir and spawn in the tributaries. Spawning has been confirmed in Pinnacle Creek and in Clear Branch above the reservoir. The Hood River Local Population has fewer bull trout and occurs in Clear Branch below the dam, the Middle Fork Hood River and several tributaries, the Hood River mainstem, and the Columbia River. Spawning has been confirmed in Compass and Bear creeks. The extent to which Clear Branch Dam has imposed a gene flow barrier between the two local populations is uncertain. DNA analysis indicated that Hood River bull trout are genetically distinct from other bull trout in Oregon (Spruell and Allendorf 1997). Genetic analysis suggests that the subbasin was colonized by bull trout from both the coastal and the Snake River local populations (Spruell et al. 2003).

Population Risk Assessment: The Hood River Core Area is considered to be at least at an intermediate threat level based on less than ten years of population trend data (U.S. Fish and Wildlife Service, 2003). Bull trout above Laurance Lake in the Clear Branch are considered to be at risk of a random extinction event due to low numbers, isolation, and at the time of ESA listing were thought to be restricted to a single known spawning area (U.S. Fish and Wildlife Service, 1998). Hood River bull trout are threatened by periodic natural disturbance events, such as glacial outbursts, that are relatively frequent within the spawning areas. Well-distributed and more numerous local populations are essential to spread the risk of these disturbance events. For example, between 1999 and 2003, lower Compass Creek was overtaken by Coe Branch, a glacial stream. Compass Creek is one of only 2 tributaries where the Hood River Local Population below the Clear Branch Dam is known to spawn. It is not known whether Compass Creek still provides suitable spawning habitat, and it is possible that an entire generation of bull trout in Compass Creek was lost during this event (D. Morgan, *pers. comm*., 2003). Bull trout in the subbasin are also threatened by isolation and habitat fragmentation from passage barriers including dams, impaired water quality, and habitat impacts from past and ongoing forest management and water diversion for irrigation (U.S. Fish and Wildlife Service, 1998). Potential hooking mortality in the Laurance Lake sport fishery, and predation by the introduced smallmouth bass population in the lake, are also risk factors but no data is available at the present time for confirmation.

Coastal Cutthroat Trout Population Data and Status

Abundance: Coastal cutthroat trout are native to the Hood River subbasin, and are most numerous as resident fish in the upper tributaries of the East Fork Hood River. Robinhood Creek was found to have had the highest density of cutthroat trout in the subbasin with up to 610 cutthroat per 1000 m^2 of stream (Olsen and French 1996). Annual counts of adult cutthroat trout at Powerdale Dam during 1992-2004 have ranged from 0 to 11.

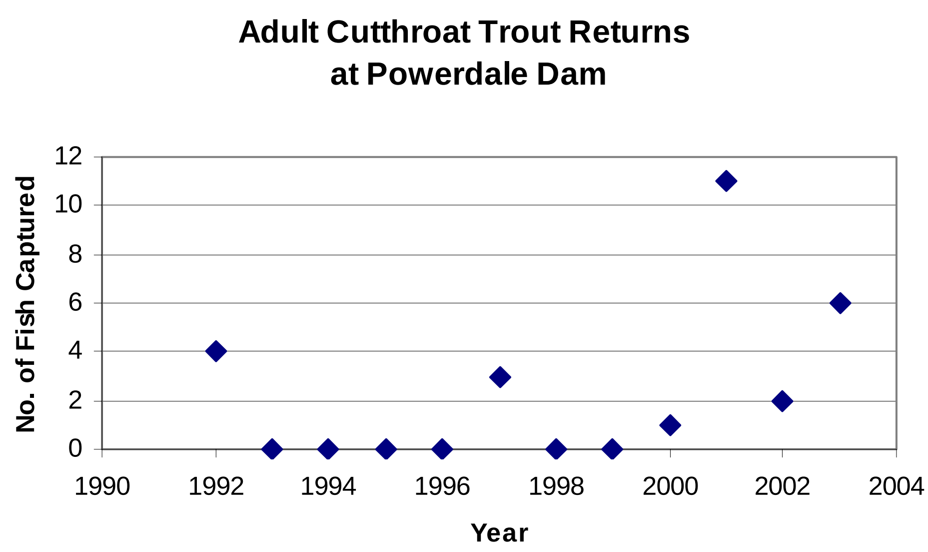

Figure 10. Annual counts of adult cutthroat trout captured at Powerdale Dam 1992-2004.

Productivity: Data is not available to estimate the productivity of cutthroat trout.

Life History Diversity: Both a resident and a sea-run life history form occurs in the subbasin. Very few sea-run or adult cutthroat trout have been counted at the Powerdale Dam fish trap in recent years.

Carrying Capacity: No estimates of cutthroat trout carrying capacity have been developed.

Population Trend and Risk Assessment: While little data exists to assess the population trend of cutthroat trout, the resident life history form is believed by area fish managers to be stable. Nehlsen et al. (1991) considered the Hood River sea run stock of cutthroat trout "at high risk of extinction". As is the case in the Lower Columbia Basin generally, the anadromous or sea run form of cutthroat is severely depressed. Counts of sea run cutthroat trout at Powerdale Dam during 1963-1971 ranged from 17 to 177 adults (Hooten, B. 1997). In contrast, between 1992 and 2003, the annual counts of sea run cutthroat trout passing Powerdale Dam ranged from 0 to 11 adults (Figure 9). In six out of twelve years, no adult sea run cutthroat trout were captured at the dam. In 1995 and 1996, only 16 and 24 downstream migrant cutthroat were captured in juvenile migrant traps. Captures of cutthroat at screw traps were too few to determine trends in abundance or condition (Underwood, K.D. et al, 2003).

Unique Population Units: Pure cutthroat strains exist in upper East Fork tributaries including Dog River, Tilly Jane, Rimrock, Robinhood, Pocket, and Bucket creeks. Pinnacle Creek fish are largely cutthroat with some rainbow hybridization (USFS 1996b). Dog River, Emil, Robinhood, Pocket and Bucket creek cutthroat were found to have the genetic characteristics of pure cutthroat trout (Greg and Allendorf 1995). An isolated population of cutthroat was found above a falls on Clear Branch a few miles above Laurance Lake (G. Asbridge, p*ers. comm*). The present or historic spawning distribution of sea-run cutthroat trout is unknown. In Tony and Bear creeks, 4 of 11 fish sampled were hybrid cutthroat and rainbow. Lower Dog River contained both pure rainbow and cutthroat tout as well as hybrid fish. No first generation hybrids in the Mt Hood area were observed, suggesting that either hybridization occurred historically more frequently in these populations, or more likely episodically (Spruell, P. et al, 1998).

Pacific Lamprey Population Data and Status

Lamprey Abundance: Historic or current Pacific lamprey abundance in the Hood River subbasin has not been estimated. Lampreys have not been documented above Powerdale in decades. Adults are occasionally observed downstream of the dam. Surveys for western brook lamprey have not been conducted in the basin therefore their presence in the basin is unknown.

Productivity: If lamprey passage is restored at Powerdale dam they may re-colonize the Hood River basin. It is unknown as to whether or not lamprey are present downstream of the dam in sufficient numbers to successfully re-seed the watershed
Carrying Capacity: The Hood River subbasin Pacific lamprey carrying capacity is unknown.

Population Trend and Risk Assessment: Lamprey were reported as widespread "throughout the basin" in a 1963 Oregon Game Commission Report on the Hood River (USFS, 1996a), but have not been observed above Powerdale Dam in at least the last decade. Pacific lamprey may have been extirpated from the Hood River upstream of the Powerdale dam (river mile 4.5). However if dam passage was not limiting, other risks to the lamprey populations in the Hood River would include peak flows, decreased flows, increased water temperatures and poor riparian areas, predation in all life stages, artificial barriers and the lack of appropriate diversion screening for lampreys (C. Brun, 2004). Lamprey are particularly vulnerable to pollution and erratic stream flows during their juvenile or ammocoete life stage because of the length of time they reside in the stream substrate. Migrating ammocoetes are especially vulnerable to predation during their in-river and ocean migration. Most movement appears to occur at night, but their size (up to 10 cm) and the number of predators, especially in the Columbia River poses a serious risk. 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 its tributaries, including the Hood River.

Unique Population Units: No unique populations of Pacific lampreys in the Hood River are identified. Little is known about Pacific lampreys in part because taxonomy and field identification of the various species is difficult. Generally species differentiation is based on adult characteristics, but lampreys are adults for a rather short period of their total lives (Kostow 2002). Historic life history information for the Hood River lamprey does not exist. Much of the information contained in this assessment is based on observations and data from other Columbia River Basin or Pacific Northwest lamprey populations. Pacific lampreys are an anadromous, parasitic species. They are parasitic during that portion of their life cycle that occurs in the ocean. Adult lampreys return to the Columbia River basin during the summer months. It is assumed that they over-winter in streams prior to spawning the following spring or early summer. Willamette River subbasin lampreys spawn from February through May (Kostow 2002). Lampreys do not feed once they enter freshwater. Adult lampreys may be attracted to pheromones (chemical stimuli) produced by larvae (ammocoetes) living in the stream substrate, rather than relying on a homing instinct. During the over-winter period individuals survive on stored body fats, carbohydrates, and protein. Measurements of adults reported in literature include 39.3 to 62.0 cm for migrating adults and 33.2 to 54.2 for spawning adults (Kostow 2002). Characteristically spawning occurs in a nest constructed of gravel substrate located at the tail-outs of pools or in riffles. Lamprey fecundity is thought to be highly variable, which might suggest a variety of life history patterns or age classes in a single spawning population. It has been estimated that the fecundity rate may vary from 15,500 to 240,000 eggs/female (Kostow 2002). Lampreys spawn in low gradient stream sections. Most authorities believe that all lampreys die after spawning. Lamprey eggs hatch within 2-3 weeks, depending upon water temperature. The juveniles emerge from the spawning gravel at approximately 1 cm in length. The ammocoetes burrow into the soft substrate downstream from the nest and may spend up to six or seven years in the substrate. They are filter feeders that feed on algae and diatoms. The ammocoetes will move gradually downstream, moving primarily at night, seeking coarser sand/silt substrates and deeper water as they grow. They appear to concentrate in the lower parts of basins before undergoing their metamorphism. When body transformation, or metamorphism, from the juvenile to adult stage is complete, they migrate to the ocean from November through June (Kostow 2002). In the Deschutes and Umatilla Rivers this out-migration was observed to occur in the winter to early spring (Kostow 2002, Graham and Brun 2003). Pacific lampreys enter saltwater and become parasitic, feeding on a wide variety of fishes and whales. They appear to move quickly offshore into waters up to 70 meters deep. The length of their ocean stay is unknown, but some have speculated that it could range from 6 to 40 months (Kostow 2002).

Current Focal Fish Species Distribution

Steelhead: The distribution of steelhead spawning and rearing covers a significant portion of the subbasin. Winter steelhead inhabit the East and Middle Forks of the Hood River, while summer steelhead inhabit the West Fork (Appendix A, Map 15). Both summer and winter steelhead occupy the Hood River mainstem. Distribution in the East Fork Hood River extends to Sahalie Falls and includes tributaries below Sahalie Falls. In the Middle Fork Hood River, distribution extends to Clear Branch Dam, part way up Coe Branch, and in several tributaries below. Steelhead extend throughout the West Fork Hood River mainstem, in McGee and Elk creeks, and several tributaries below. Important West Fork tributaries below Elk and McGee include Lake Branch and Green Point Creek (Underwood, K.D., et al.2003).

Chinook: Fall chinook spawn and rear in the mainstem Hood River, in Neal Creek, and in the West Fork Hood River. Spring chinook spawning and rearing primarily occurs throughout the mainstem West Fork and part way up Elk, McGee and Jones creeks, and the lower mile of Lake Branch (Appendix A, Map 15). Spring chinook use of the Middle and East Fork Hood River is believed to be limited to non-existent. Glacial silt loads in believed to quash the effectiveness of fall spawning in these tributaries (Underwood, K.D., 2003).

Bull Trout: The current bull trout distribution occurs in 4 major subbasin areas: the Hood River, the West Fork Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River (USFWS in litt. 2003). Bull trout are consistently found only in the Hood River, the Middle Fork Hood River, and the Clear Branch of Hood River (Appendix A, Map 14). Bull trout distribution in the West Fork is based on isolated, infrequent sightings. Bull trout are found in the Middle Fork mainstem and its tributaries Clear Branch, Laurance Lake reservoir, Pinnacle, Compass, Bear, and Tony creeks, Coe Branch, and Eliot Branch. The bull trout located within the West Fork Hood River are considered a potential local population. Past sightings in the East Fork Hood River are considered incidental and bull trout use of the East Fork is thought to be unlikely due to unsuitable habitat conditions and absence of bull trout during surveys (U.S. Fish and Wildlife Service, 2003).

Cutthroat Trout: Cutthroat are distributed primarily in tributaries to the Hood River, and the Middle Fork and East Forks of the Hood River up to elevations of 3,600 feet or higher (Appendix A, Map14). Cutthroat are not numerous in the West Fork Hood River, where rainbow trout are the dominant resident species. From 1994 to 2003, just one cutthroat was captured in each of only two years in the downstream migrant trap in the West Fork (Olson, E, 2004, unpublished data) compared to an average of 10 in the East Fork and 4 in the Middle Fork. Cutthroat trout are the dominant species in Bear, Tilly Jane and Robinhood creeks. Cutthroat are common throughout Clear Branch above and below Laurance Lake reservoir.

Pacific Lamprey: Pacific lamprey distribution today is believed to be limited to the lower four miles of the Hood River below Powerdale Dam. Lamprey have not been observed above Powerdale Dam in at least the last decade. Several modifications in the fish ladder configuration at Powerdale Dam occurred between the 1960s and the present, and any related effects on adult lamprey migration are unknown. Lamprey do not enter the fish trap at Powerdale Dam. Incidental and limited observations of lamprey have been reported below the dam by local agency fish biologists. However, specialized field surveys for lamprey ammocoetes have not been conducted and the distribution and abundance of lamprey species either above the dam or below the dam is uncertain.

Historic Focal Fish Species Distribution

Steelhead: The historic distribution of steelhead was somewhat more extensive than the current distribution. In the Middle Fork Hood River, steelhead were documented upstream to Clear Branch above Pinnacle Creek by the Oregon Fish Commission in 1963. Steelhead were likely distributed further upstream above the existing diversion dams in Coe and Eliot Branches. Steelhead distribution extended further upstream in Neal Creek.

Chinook: The historic distribution of chinook is believed to approximate the current distribution, based on existing knowledge.

Bull trout: Historic distribution is believed to approximate current distribution based on existing knowledge (U.S. Fish and Wildlife Service. 2003).

Cutthroat Trout: Historic distribution of cutthroat trout is believed to approximate the current distribution based on existing knowledge.

Pacific Lamprey: Historically, Pacific lamprey likely had the widest distribution of any of the anadromous species in the subbasin (Brun, C. 2004). Natural barriers that effectively interrupt the migration of other fish can often be negotiated by this species. Lamprey *"were reported as widespread throughout the basin in a 1963 Oregon Game Commission Report on the Hood River"(*quoted in USFS, 1996a).

Differences in Distribution Due to Human Disturbance

Artificial barriers that are believed to create total barriers to adult steelhead distribution are Clear Branch Dam, Neal Creek irrigation diversion dam, and a road culvert in Eliot Creek at Hutson Drive. These barriers curtail a total of about 4.2 miles of historic spawning and rearing habitat in Neal Creek (~2.2 mi.), in Clear Branch (~ 0.5 mile) and 1.5 in Evans Creek.

Bull trout distribution is blocked at Clear Branch dam (~1 mi.), Eliot diversion (~0.25 mi.), and Coe diversion (~1 mi.). Adult cutthroat trout are blocked at a number of road culverts. About a quarter mile of spawning habitat for steelhead and coho salmon was inundated by the construction of Clear Branch Dam in 1965, eliminating the native coho salmon population in the Middle Fork Hood River.

Powerdale Dam in the Hood Rier (RM 4.5) is suspected to be a barrier to lamprey migration, based on the fact that lamprey have been observed below the dam yet have not been observed above Powerdale Dam in at least the last decade, and were documented as widespread in the subbasin in a 1963 Oregon Game Commission report (USFS, 1996a).

Aquatic Introductions and Artificial Production Programs

Current Fish Introductions

The Oregon Department of Fish and Wildlife (ODFW) stocks legal size rainbow trout and fingerling brook trout into six high lakes on an annual or bi-annual basis to provide sport fishing opportunity (Table 9). Releases of anadromous fish in the subbasin are described under Artificial Production.

Table 9. Current high lake stocking program in the Hood River subbasin.

Release Location	Species	Comments
Lost Lake	Rainbow Trout	17,000 legal sized
Laurance Lake Reservoir	Rainbow Trout	~7,000 legal sized stocked annually with adipose fin-clips
Kingsley/Green Point Reservoir	Rainbow Trout	10,000 legal sized
Black Lake	Brook Trout	bi-annually fingerling
Scout Lake	Brook Trout	bi-annually fingerling
Rainy Lake	Brook Trout	bi-annually fingerling

Historic Fish Introductions

Stocking of trout and salmon into high elevation lakes is documented since the 1950s. Rainbow and sea-run cutthroat trout were released in the Hood River by ODFW for a trout sport fishery from the 1950s through the 1980s, primarily (Appendix B, Table 2). The last release rainbow trout occurred in 1996 (ODFW Fish Propagation, Portland as cited in Cramer et al. 1997), although unfed rainbow trout fry were liberated in Odell

Creek in 1997 by Wyeast Middle School as part of the ODFW STEP program (ODFW, 1997). Salmon and steelhead releases to streams are described under Artificial Production in the next section.

Artificial Production: Current

Two separate and distinct artificial production programs are cuurently ongoing in the Hood River subbasin (1) the BPA-funded Hood River Production Program (HRPP) and (2) the ODFW Skamania stock summer steelhead program. An overall description of these programs is provided below followed by program information by species. The current artificial production program represents a 33% total reduction in hatchery releases made above Powerdale Dam, and a 10% overall reduction compared to previous hatchery releases in the subbasin (BPA, 1996). Current release targets are shown in Table 12.

Table 10. Current target anadromous fish releases in the Hood River. Adapted from Underwood, K.D, 2003.

Species	Number	Size	Stock	Stream	Sites/Type	Release Duration
Spring Chinook	95,000	Smolt	Deschutes	West Fork Hood R	2 sites, acclimation	1996 - present
Spring Chinook	30,000	Smolt	Deschutes	Middle Fork Hood R	1 site, acclimation	1997 - present
Summer Steelhead	30,000	Smolt	Skamania	Mainstem RM 4.5	1 site, direct release	1998 - present
Summer Steelhead	40,000	Smolt	Hood River	West Fork Hood R	2 sites, acclimation	1998-present
Winter Steelhead	25,000	Smolt	Hood River	East Fork Hood R	1 site, acclimation	1996 - present
Winter Steelhead	25,000	Smolt	Hood River	Middle Fork Hood R	1 site, acclimation	1999 - present

Hood River Production Program (HRPP)

The HRPP began in 1991 and is jointly implemented by ODFW and CTWSRO. The HRPP is currently composed of 7 inter-related BPA funded contracts: Hood River Production Program PGE: O&M (Proj. No. 1988-053-06), Hood River Production Program - CTWSRO M&E (Proj. No. 1988-053-03), Hood River Production Program - ODFW M&E (Proj. No. 1988-053-04), Hood River Fish Habitat (Proj. No. 1998-021-00), Parkdale Fish Facility (Proj. No. 1988-053-07), Powerdale/Oak Springs O&M (Proj. No. 1988-053-08), and Hood River Steelhead Genetics Study (Proj. No. 2003-054-00). These contracts provide funding for hatchery supplementation, habitat restoration, and monitoring and evaluation (Olsen, E. 2004). Hatchery practices have been adaptively managed since the program began. A 10-year comprehensive review of the HRPP was recently completed by S.P. Cramer and Associates for BPA (Underwood, K.D. et al, 2003). This review recommended further program modifications including smaller fish release targets based on revised carrying capacity estimates, more changes in hatchery practices, and additional research.

The HRPP is intended to mitigate for fish losses related to the operation of federal dams in the Columbia Basin, and to contribute to the recovery of salmon and steelhead.
Its goals are to:

- Re-establish a natural self-sustaining spring chinook salmon population in the Hood River subbasin;
- Rebuild naturally self-sustaining runs of summer and winter steelhead;
- Maintain the genetic characteristics of wild anadromous populations;
- Protect high quality habitat and restore degraded fish habitat; and
- Contribute to tribal and non-tribal fisheries, ocean fisheries and NW Power Planning Council interim goal of doubling Columbia River salmon runs.

While harvest is a program objective, the supplementation goals and methods of the HRPP differ from those of a traditional hatchery program (BPA, 1996). Fish release numbers are small compared to traditional hatchery programs. Broodstock are collected from indigenous or naturally-spawning local stock (steelhead), or from nearby similar systems (spring chinook reintroduction). Rearing occurs at low densities in ponds or raceways that mimic natural environments. Smolts are acclimated in ponds to imprint on potential spawning waters and leave the ponds on a volitional basis. Adult fish return to natural spawning areas.

During the 1990s, the use of domesticated out-of-basin origin hatchery stocks of steelhead was phased out. A DNA sample from every fish passed above Powerdale Dam has been collected since 1991and analyzed to estimate the relative reproductive success of hatchery and wild steelhead.

HRPP Facilities: Facilities in both the Deschutes and Hood subbasins are used in the HRPP. The ODFW Round Butte and Oak Springs hatcheries, and the Pelton Ladder in the Deschutes Basin, are used for incubation and/or rearing. HRPP facilities in the Hood River are sbown in Appendix B, Figure 3. The Powerdale Dam Adult Fish Trap the Hood River at RM 4.5 is a major support facility for the program, and is operated by ODFW. The trap is used for brood stock collection, for monitoring hatchery and wild adults, and for controlling entry of hatchery fish into spawning grounds above the dam. The trap is operated as a complete barrier to upstream passage. This enables counts of all adult fish returns, genetic sampling, and other data collection, and allows ODFW to prevent all out-of-basin stock hatchery strays from spawning upstream of Powerdale Dam. The protocol used states that no more than 50% of the total run allowed upstream to spawn can be composed hatchery-origin fish (from Hood River stock), and no more than 25% of the wild run can be taken for eggs. Juvenile rotary screw traps are operated at 5-6 sites to monitor fry and smolt migration from different parts of the subbasin. Smolt acclimation occurs in temporary ponds including fiberglass circular tanks, rigid lined raceways, and concrete bays in the East Fork Irrigation District sand trap facility. All HRPP hatchery steelhead have coded-wire tags and/or fin clips to facilitate evaluations and harvest management. The Parkdale Fish Facility in the Middle Fork Hood River is to for adult holding, spawning, early incubation, and smolt acclimation, and is operated by the CTWSRO.

Spring Chinook Reintroduction: It is believed that the native spring chinook run became extirpated from the Hood River by the 1970s. In 1996, an effort was initiated to reintroduce spring chinook to the Hood River using Deschutes River stock. The objective has been to create a locally-adapted naturally-reproducing population. The annual release goal is 125,000 age-2 smolts. Broodstock are taken at Powerdale Dam and are held and spawned at the Parkdale Fish Facility. The Pelton Ladder in the Deschutes Basin is used for rearing. Smolts are acclimated and released in the West Fork and Middle Fork Hood River. Adults returning to the Hood River and allocated to the hatchery program are a mix of hatchery and wild/natural-origin fish. The brood collection goal is 110 adults and 5-10 jacks to represent the percent of jacks in the wild run. Except in 1997, too few adults have returned to the Hood River to meet production goals for the program. As a result, eggs from adults returns to the Deschutes River were taken to make up the difference. Program success has been hampered by disease incidents (IHN virus, bacterial kidney disease, fungus and Ceratomyzosis), high level of mini-jack or jack returns, loading injuries at Pelton Ladder, and high straying rates back to the Deschutes. The stray rates of Deschutes stock spring Chinook released from the 1993-1997 brood years averaged 18% and were as high as 35%. Recommendations to address these problems were made as part of the HRPP Program Review (Underwood, K.D. et al, 2003). With regard to disease, the Program Review recommended moving spring chinook production to another hatchery facility if the problems cannot be resolved.

Winter Steelhead Supplementation: The objective of the HRPP winter steelhead supplementation has been to increase natural production without changing the genetic makeup of the wild or naturally spawning population. The first releases of smolts from the progeny of wild winter steelhead collected from the Hood River began in 1993. Based on information available thus far, this program appears to be successful in meeting its objectives (Underwood, K.D. et al, 2003; Blouin, M. 2003). The current brood stock collection goal is 70 adults for the production of 50,000 smolts. In accordance with wild fish protection policies, no more than 25% of the wild run is taken for broodstock. During the first 3 years of the indigenous winter steelhead program, 98% of the brood were from wild-origin fish, after which hatchery-origin fish were allowed as brood stock. Since 1995, wild-origin fish have composed 51% to 99% of the brood stock. Adults are collected at Powerdale Dam and are held and spawned at the Parkdale Fish Facility. Smolts are acclimated and released in the Middle and East Fork of the Hood River.

Summer Steelhead Supplementation: In 1999, the summer steelhead program moved from releasing a non-indigenous Skamania hatchery stock to releasing the progeny of wild/natural origin summer steelhead collected in the Hood River at Powerdale Dam. The goal has been to collect 160 adults to produce 150,000 smolts, with an interim goal 40,000 smolts and an interim adult collection goal of 40 wild adults. After 4 years of relying entirely on wild brood returning to the Hood River, no hatchery-origin fish have been used as broodstock. According to protocol, no more than 25% of the wild run can be exploited for broodstock. It was too early in the indigenous summer steelhead program to gage its success (Underwood, K.D. et al., 2003).

ODFW Skamania Summer Steelhead Program

ODFW makes annual direct releases of 30,000 Skamania stock summer steelhead smolts to the Hood River below Powerdale Dam. The purpose of this program is to support tribal and sport fisheries in the subbasin and Columbia River. The current Skamania program was initiated in 1998. No Skamania stock steelhead are allowed upstream from Powerdale into potential spawning areas.

Artificial Fish Production: Historic

Hatchery releases of adult and juvenile hatchery steelhead, spring chinook, and coho salmon have occurred in the Hood River subbasin since the 1950s using both non-indigenous and Hood River stocks. These activities are discussed below and summarized in Table 11. Information sources include Oregon Game Commission Report, 1963; 1965 Summary Report; Hood River Steelhead Project, 1990; Hood River Subbasin Salmon and Steelhead Protection Plan, 1995; Draft Report of the Hood River Production Plan; USFS 1996a and 1996b.

Summer Steelhead: The release of non-indigenous summer steelhead to the Hood River upstream of Powerdale Dam were made until 1998. Annual releases of about 10,000 juveniles were made from 1958 to 1966 from Hood River stock. A total of 812 adult summer steelhead from Big Creek, Hood River, Cascade and unknown stock, were released in the East and West Fork Hood River in 1968 and 1969. From 1967 to 1974, and in 1977, Washougal stock releases occurred. Since 1975, Skamania stock was used, including the annual direct release of 75,000 Skamania smolts to the West Fork Hood River from 1988–1997.

Winter Steelhead: Releases of non-indigenous winter steelhead were made up until 1993, when the first group of Hood River stock was released. From 1962 to 1976, releases of Nestucca and Alsea fingerlings were made periodically (ODFW, 1998). Big Creek smolts were released from 1978 to 1986 into the East and Middle Fork Hood River. A total of 427 adult Big Creek winter steelhead were released into Bear Creek and the East Fork Hood River in 1966 and 1967. Releases of Klaskanine and Big Creek hatchery fry were made by through the ODFW STEP program between 1985-86. Direct annual releases of up to 30,000 Big Creek smolts were made from 1988-1992. In 1992, Big Creek and Hood River steelhead were hybridized, producing 4,595 smolts that were directly released to the Hood River in 1994.

Spring Chinook: The indigenous Hood River spring chinook population became extinct by the 1970s. Fry releases from Carson and Clackamas stocks were made by the ODFW STEP program between 1985-86. From 1988 to 1992, 140,000 Carson Hatchery smolts were directly released into the West Fork Hood River annually. Between 1993-1995, direct releases of 125,000 Deschutes stock smolts were made annually.

Table 11. Historic releases of anadromous fish in Hood River subbasin streams.

Release Location	Species	Years Released	Comments/Stocks
West Fork Hood River	Spring Chinook	1984-1992	Carson, Clackamas, Deschutes
	Summer steelhead	1958-87	Hood River, Cascade, unknowns, Washougal
	Winter steelhead	1962	Unknown
Clear Branch	Coho salmon	1966	Unknown
	Winter steelhead	1963, 1985-87	Unknown, Klaskanine, Big Cr
	Coho salmon	1968 1967	Unknown Little White Salnon
	Winter steelhead	1962-63, 1985-88	Unknown, Big Cr, Klaskanine
Bear Cr	Winter steelhead	1966, 1986	Unknown, Big Cr
Tony Cr	Winter steelhead	1962, 1985-87	Unknown, Klaskanine, Big Cr
East Fork Hood River	Coho salmon	1968, 1970 1967, 1971, 1977	Unknown, Sandy R Little White Salmon, Cascade, Washougal
	Winter steelhead Sea run cutthroat	1962-63, 1967, 1978 1973-1978,1985-1987	Unknown, Big Cr Nestucca R, Alsea R,
	Summer steelhead	1957, 1968	Hood, Big Cr
Dog River	Winter steelhead	1985-86	Klaskanine, Big Cr
Evans Cr	Winter steelhead	1986-87	Big Cr, Klaskanine R
Lenz Cr	Coho salmon	1967, 1971, 1977	
Neal Cr	Coho salmon Sea run cutthroat	1968 1973-1978, 1985-1987	 Nestucca R, Alsea R,

<u>Fall Chinook and Coho</u>: No hatchery releases of fall chinook are documented in the Hood River. No releases of coho salmon have occurred since 1977. Hatchery coho juveniles were released in 1967,1971, and 1977 in numbers ranging from 230,000 to 970,000 fish. An early release was made in 1958 in Lost Lake. Between 225 to 1,480 adult coho from the Bonneville Hatchery were released into Clear Branch and Neal Creek and the East and Middle Forks of the Hood River in 1966, 1968, and 1970.

Artificial Production/ Introduction: Ecologic Consequences

Among the potential consequences of hatchery and introduced fish are 1) elevated predation upon and competition with natural populations; 2) interbreeding and adverse genetic changes in populations; 3) disease introduction; 4) increased harvest on non-target populations; and 5) alteration of trophic structure in stocked lake ecosystems.

The Hood River Production Program (HRPP) review addressed several of these issues (Underwood, K.D. et al, 2003). An HRPP goal has been to minimize predation and competition between hatchery and wild fish by releasing only smolt-stage fish that would emigrate quickly from the Hood River, and by preventing the release of smolts that do not volitionally migrate from the acclimation ponds. The review found that emigration of hatchery steelhead smolts was rapid and competition with wild fish appeared minimal. However, the actual extent or affect of predation or competition from hatchery fish in the Hood River could not be determined since monitoring has not included the behavior or stomach content analysis of hatchery fish. The largest potential source of predation from the HRPP was from residualized steelhead. The residualism rates for winter steelhead remained below the goal of 5% in three of five years monitored, rising to 12% and 9% in the other two years. Predation may also exist in the lower Hood River from precocial hatchery spring chinook. The proportion of precocial spring chinook returns since the 1991 brood year has averaged 12% compared to a 5% average in wild spring chinook since the 1987 brood. Evaluation of the extent of predation by spring chinook was considered unnecessary if actions, such as reducing smolt size at release, are taken in the hatchery program to reduce the precocial rate. Hatchery summer steelhead smolts captured at the mainstem screw trap were significantly larger than wild smolts. Larger hatchery smolts may negatively impact wild smolts through competitive interactions throughout the migration, however, the degree of impact was unknown. Competition between HRPP smolts and bull trout or cutthroat trout was considered unlikely because most cutthroat and bull trout populations are located upstream of anadromous populations (BPA,1996).

Genetic studies in the HRPP steelhead program thus far confirm the theory that the use of indigenous stocks in hatcheries produces greater fitness for natural production than introduced stocks (Blouin, M. 2003). Samples show that fish that bred in the early to mid 1990s from old domesticated hatchery stocks had a much lower total fitness than wild fish, but that “new” or Hood River-origin hatchery stocks have a fitness similar to that of wild fish, and are producing substantial numbers of wild-born offspring. The similar fitness of Hood River-origin hatchery and wild fish suggests that wild-born offspring of Hood River-origin hatchery fish are unlikely to have negative genetic effects on the population when they in turn spawn in the wild. This hypothesis will be tested once enough offspring of the progeny of hatchery fish have returned (Blouin, M. 2003).

Given the low numbers of adult returns, the straying of Deschutes stock hatchery spring chinook from the Hood River was found not likely to have had a significant genetic influence on other populations, especially since 86% strayed into the Deschutes River. Data suggested that straying of hatchery winter steelhead from the Hood River is low, although summer steelhead were not coded wire tagged and their stray rate is unknown. A potentially large source of stray hatchery steelhead is from the sport fishery “recycle” program, where non-native or excess hatchery fish captured at Powerdale Dam are trucked back to the Hood River mouth to provide additional sport harvest opportunity (Underwood, K.D. et al, 2003).

Steelhead were diagnosed with diseases common to the region and therefore were not believed to transmit exotic diseases to fish populations in the Hood River subbasin. The incidence of illness was low. In 2 out of 8 years, the HRPP released spring chinook smolts with high BKD levels, which could have served as a reservoir of disease transmittable to wild fish.

Eastern brook trout stocked in Rainy, Black, and Scout lakes in the West Fork Hood River watershed have distributed downstream into Gate, Cabin, and Dead Point creeks. Brook trout are found in Lake Branch, Rogers Spring, and Tilly Jane creeks and in Cold Springs Creek upstream of Tawanamas Falls (S. Pribyl, ODFW, pers. comm). These fish may be reproducing naturally and competing with or predating upon native trout. By replacing amphibians as the dominant predator, introduced fish likely have altered the food chain in historically fishless high elevation lakes (USFS 1996a). The illegal introduction of smallmouth bass into Laurance Lake has led to a reproducing smallmouth population which may predate upon bull trout, cutthroat trout, and other native species.

The hatchery program increases angling opportunity in the lower Hood River and therefore may increase incidental hooking or harvest mortality in non-target populations, particularly bull trout and possibly steelhead smolts. Bull trout is a highly catchable species. While low numbers of bull trout pass Powerdale Dam annually, their timing overlaps with the peak of angler effort (Underwood, K.D. et al, 2003). Very little harvest occurs on natural fall Chinook or coho in the lower Hood River, so increased harvest on HRPP fish did not adversely affect these species. Furthermore, run timing of these coincided with the least amount of harvest effort in the lower river.

Relationship Between Natural & Artificially-produced Fish Populations

The majority of the summer steelhead and spring chinook adults returning to the Hood River are hatchery fish. Since 1991, all steelhead passed upstream of the Powerdale Dam have been sampled for scales and genotyped using extracted from the scale samples. Monitoring of juvenile production in the HRPP has focused on trapping outmigrants, so information was not adequate to detect changes in resident cutthroat trout or rainbow populations, nor on other native populations including whitefish, dace, sculpin, and suckers (Underwood, K.D. et al, 2003). Genetic studies indicated that breeding with either resident rainbow or residual steelhead likely accounted for up to half of all steelhead adults returning to Powerdale Dam (Underwood, K.D. et al, 2003). Up to half of the winter steelhead spawning above Powerdale Dam are hatchery fish of Hood River hatchery stock origin. The indigenous winter steelhead hatchery program initiated in 1993 appears to have benefited the wild winter steelhead population by increasing population size (Blouin, M. 2003) (Figure 11).

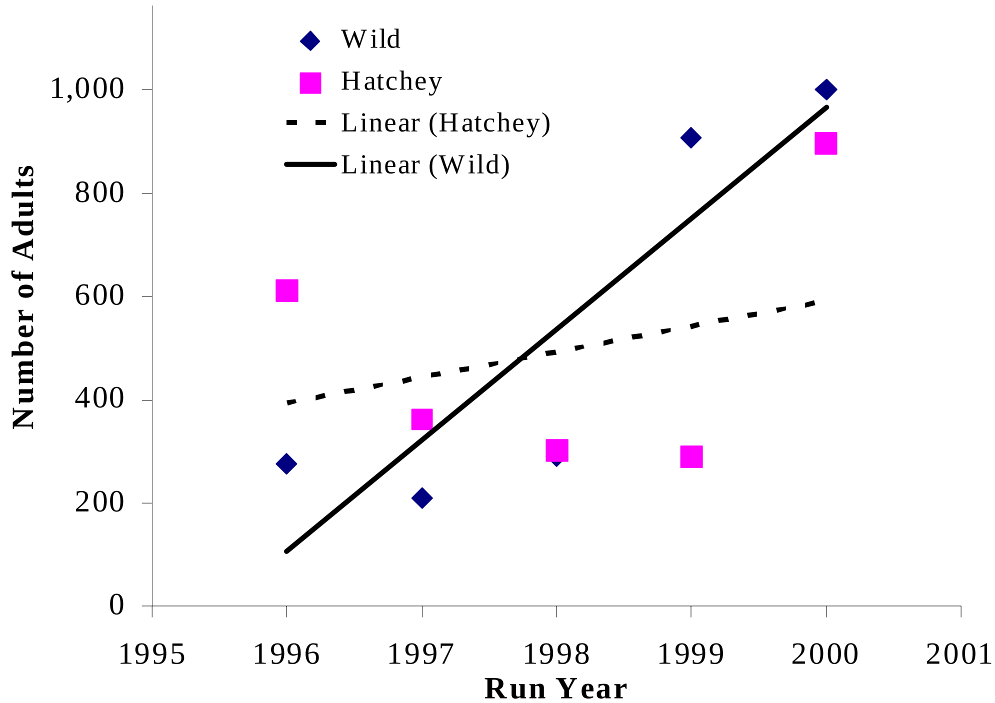

Figure 11. Wild and hatchery winter steelhead adult return to Powerdale Dam (Olsen July 2002).

The non-indigenous Skamania stock of summer steelhead exhibit a different adult return timing than the wild summer steelhead. A majority of the Skamania stock and wild adults entered the Hood River in May through June, but unlike the Skamania stock, wild adults also showed a strong return in October and November.

Current Direct and Indirect Harvest in the Subbasin

The Hood River continues to maintain popular steelhead fisheries particularly for summer steelhead. Steelhead harvest would not have been possible without the hatchery program due to low numbers of wild fish and strict ESA conservation measures in place. (Underwood, K.D. et al, 2003). ODFW regulations have banned the harvest of wild steelhead and bull trout in the subbasin since 1998. The Hood River has been closed to all salmon and steelhead fishing above Powerdale Dam since 1998. The West Fork Hood River is closed year round to all angling in order to protect juvenile steelhead. The CTWSRO holds off-reservation fishing rights at its usual and accustomed fishing sites in the Hood River pursuant to the 1855 Treaty with the Tribes of Middle Oregon (12 stat. 963). Tribal harvest occurred in only two years, 2001 and 2002, and was primarily directed at spring chinook. Tribal harvest of steelhead in the subbasin is very low. Very little harvest occurs on either natural fall Chinook or coho in the lower Hood River (Underwood, K.D. et al, 2003). No data is available for incidental harvest mortality from catch and release or other angling. ODFW “recycles” or transfers non-native or excess hatchery steelhead captured at Powerdale Dam back to the Hood River mouth for release.

The released fish are expected to migrate back upstream to the dam, exposing themselves to anglers a second time to increase the number of fish harvested. The recycling program accounted for 9% to 48% of the fish harvested in the years 1996-2001. The spring chinook harvest, including in the ocean and Columbia River, averaged 53 adults from 1997- 2001. Wild fish comprised about half of all spring chinook harvested until 2001, \when angling regulations were changed, and virtually all of the harvest was hatchery fish. Tribal harvest of spring chinook above Powerdale Dam from 1999-2001 did not exceed 100 fish per year (Underwood, K.D. et al, 2003).

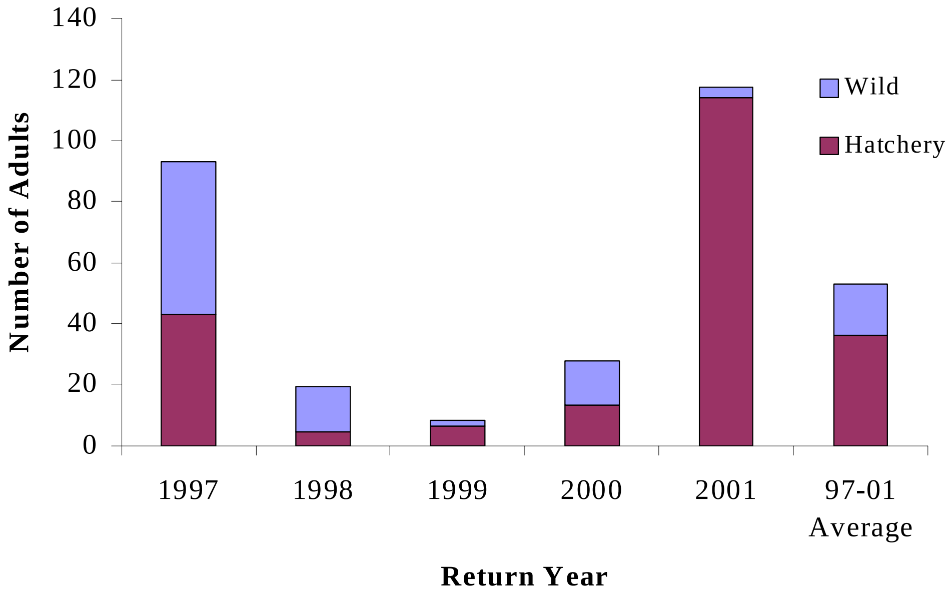

Figure 12. Total harvest of spring chinook in the Hood River subbasin, including ocean and Columbia River harvest (from Underwood, K.D. et al, 2003).

The summer steelhead harvest in the Hood River during 1996-2001 was determined by creel survey and ranged from 226 to 727 fish annually with an average of 474 fish (Table 12). The vast majority of winter steelhead harvest during this period was on hatchery fish. In-basin harvest accounted for roughly half the total harvest in freshwater.

Table 12. Hatchery summer steelhead Columbia and Hood River harvest, 1996-2000. Based on the ODFW/WDFW Status Report: Columbia River Fish Runs and Fisheries, 1938 – 2000 and Olsen (July 2002)

	Harvest		Adult Return	Hood River
Year	Columbia R.	Hood R.	Powerdale	Harvest Rate
1996	321	727	1,296	0.3594
1997	142	335	564	0.3726
1998	139	352	524	0.4018
1999	109	226	460	0.3294
2000	259	486	1,158	0.2969
2001 (part)	390	719	2,131	0.2522

Average	227	474	953	0.3353

The winter steelhead harvest in the Hood River from 1996–2000 ranged from 172 to 351 adults, with an average of 257 adults (Table 15). The vast majority of winter steelhead harvest during this period was on hatchery fish. Tribal harvest of steelhead in the subbasin is very low (ODFW and CTWSRO, 1990).

Table 13. Annual estimates of harvest rate on hatchery winter steelhead in the Hood River (Olsen July 2002).

Run	Harvest		Hatchery	Harvest
Year	Columbia R.	Hood R	PD Returns	Rate
1996	19	317	613	0.3409
1997	12	231	363	0.3889
1998	10	172	303	0.3621
1999	10	214	290	0.4246
2000	25	351	897	0.2813
Average	**15**	**257**	**493**	**0.35956**

Incidental hooking mortality of bull trout may occur in Laurance Lake and the lower Hood River. While few adult bull trout pass Powerdale Dam each year, their timing overlaps with the peak of angler effort in the lower Hood River (Underwood, K.D. et al., 2003). In the Rapid River, Idaho, an estimated 12.3% of steelhead anglers incidentally caught adult bull trout (Elle 1994). Since only 2-28 bull trout pass Powerdale Dam per year, one kept fish could be a significant loss.

Historic In-basin Harvest Levels

Estimates of in-river sport catch of salmon and steelhead were obtained from punch card returns from Streamnet.org and from ODFW and CTWS, 1990.

Table 14. Estimates of in-river sport catch of salmon and steelhead obtained from punch card returns.

Species or Race	Run Years	Annual Harvest Range (average)
Summer steelhead	1969 - 1993	899 to 4,455 (2,290)
Winter steelhead	1976 - 993	358 to 2,451
Steelhead – unknown	1956 - 1969	642 to 1647 (1,312)
Coho	1969 - 1994	0 to 52 (12)
Fall chinook	1977 - 1994	0 to 116 (15)
Spring chinook	1963 - 1971	0 to 15
Spring chinook	1977 - 1994	0 to 984 (144)
Salmon – “mixed”	1956 - 1968	6 to 189 (79)

Historic Environmental Conditions for Aquatic Focal Species

The time period of around 1880 was selected to represent "historic", "template" or "reference" conditions in this assessment for the purposes of EDT model development and general discussion. The landscape at that time was often described as majestic expanses of timber as far as the eye could see (e.g., Winans, E. 1991). One of the major differences between current and historic conditions is believed to be a much greater historical potential for large instream wood due largely to riparian forest composition (USFS, 1996a & b). Riparian areas produced substantial quantities of large-diameter trees that were available to the stream channel. Large whole trees were transported into the stream by natural processes of channel meander and avulsion, bank undercutting or erosion, windfall, landslides, debris flows, floods and other pathways. These trees mixed with other materials, formed numerous logjams and obstructions, trapped gravel, created pools and hiding cover for fish and a substrate for fungi, bacteria and invertebrates. Alder, willow and cottonwoods dominated gentler gradient floodplains while conifers dominated the riparian zone in higher gradient areas. The lower East Fork Hood River consisted of a series of wide wetland complexes within a braided stream network where downed logs, side channels and continuous riparian forest stands were common (USFS, 1996b). This area would have provided abundant rearing and refuge habitats for fish.

Streams in depositional areas had high levels of interaction with floodplains. Three main depositional areas of low gradient, broad floodplain in the East Fork were likely to collect large woody material and allow development of high quality fish habitat. These areas in the East Fork mainstem were (1) between Baldwin and Tilly Jane Creeks; (2) a half-mile upstream of the Pollallie Creek mouth; and (3) from Cold Spring to Robinhood Creek. Two areas of the Middle Fork watershed had similar potential for high quality fish habitat development – (1) the lower mainstem between Tony and Bear Creeks; and (2) the reach of Clear Branch inundated by Laurance Lake. Tributary streams believed to have had large volumes of instream wood and heavy salmonid use were Tony Creek, lower Dog River and the lower East Fork tributaries (USFS, 1996b). Reaches in the West Fork Hood River and other tributaries that were likely to have had higher wood densities and more extensive floodplain interactions were identified in the Hood River EDT model, as well as the Hood River Watershed Assessment (1999) and the US Forest Service Watershed Analysis (1996a).

April- September stream flows were higher prior to being substantially diverted for agriculture. Peak flows were probably lower in the West Fork under historic conditions prior to road construction and removal of wood from channels. Closed-canopy (i.e., mature) stands intercept more snow from falling to the ground and insulate the snowpack, resulting in less accumulation and a slower melt than in open areas or deciduous stands (USFS 1996a). Large forest openings historically were caused by fire, and fire-caused canopy openings had a high snag density, which retards the development of a large snowpack and in turn leads to a smaller contribution to peak flow than would be experienced by a clear cut of equal size (Newberry, D. 1996, Hydrologists report WF).

Natural disturbance types that occur in the Hood River subbasin include rain on snow floods, glacial dam break floods, fire, mudflows, landslides, beaver ponding, and insect and disease epidemics. Evidence suggests that most natural disturbance processes in the West Fork watershed are driven primarily by climate. Stand-replacing fire historically was a large-scale but rare event. Below 4,000 feet, fire return was and is driven by seasonal drought combined with prolonged drought. A rain-on-snow flood was documented as early as 1887 in Neal Creek (Krussow 1989). Most streams in the West, Middle and East Fork Hood River lie entirely within the rain-on-snow elevation zone, which usually is under 4500 feet, but due to its orientation and the influence of Mt Hood, the entire East Fork watershed is subject to rain on snow flooding (USFS 1996b). Catastrophic landslides and debris flows are common in several upper East Fork and Middle Fork Hood River tributaries. These events were a major force in shaping riparian and aquatic habitat conditions. Mudflows in Ladd Creek in the West Fork are a large-scale and semi-frequent to rare disturbance event.

Current Environmental Conditions for Aquatic Focal Species

The Powerdale Hydroelectric Project and irrigation withdrawals are the most significant hydro-modifications in the subbasin. Powerdale Dam impedes upstream and downstream migration, and both the dam and the irrigation withdrawals remove water from the stream channels, altering flow and temperature and reducing rearing habitat. An estimated 40% of the natural flow of the Hood River is withdrawn by consumptive water withdrawals in the basin, and up to 80% of flow has been withdrawn from a 3-mile bypass reach in the Hood River below Powerdale Dam. However, some flow restoration below irrigation diversions has occurred in recent years through voluntary efficiency efforts by several irrigation districts. A June 2003 multi-agency settlement agreement was signed by Pacificorp concerning an interim operations and dam decommissioning plan (Pacificorp et al, 2003). Prior to dam removal in 2010, a substantial set of interim mitigation measures were instituted in April 2003. The interim measures are believed to significantly improve upstream and downstream migration conditions for anadromous fish and bull trout in the subbasin. Measures include instream flow increase in the bypass reach and an April15-June 30 annual diversion shutdown to protect downstream migrants in lieu of fish screen replacement.

The upstream migration of salmon, steelhead, and resident trout is blocked or impeded at several locations by diversion dams and other structures, resulting in the failure to seed historical spawning and rearing habitat. Direct mortality of downstream migrant salmonids still occurs at unscreened or inadequately screened water diversions. However, new fish screens have been installed since 1996 at major irrigation diversions in the East Fork mainstem, the Hood River mainstem, West Fork mainstem, and at 2 small diversions on East Fork tributaries. Most recently, the Farmers Irrigation District diversion fish screen on the mainstem Hood River (RM 11.0) was replaced in 2002. Testing indicates a much reduced, if not eliminated, entrainment (G. Asbridge, USFS pers. comm. 2004). The remaining adult and/or juvenile passage barriers and/or fish screening needs are at water diversions in the subbasin are in Neal Creek, Tony Creek, Eliot Branch and Coe Branch.

Habitat diversity is believed to be lower compared to historic conditions. Given its rapid runoff and confined channel characteristics, the lack of instream habitat structure is believed to be an especially significant limitation. Historic riparian timber harvest, splash dams, and stream clean-out has resulted in simplified channels, and riparian zones with low or reduced large wood recruitment potential. Pool area, pool complexity, and pool frequency is very low in most streams. Flood refuge, hiding cover, over-wintering and productive early rearing habitats (i.e. shallow lateral habitats, side channels) are lacking. Most channels lack structure to retain gravels for spawning and invertebrate production and are instead dominated by coarse boulder and rubble substrates. Sediment deposition and meander processes have been disrupted causing channels to downcut and disconnect from their floodplain, while others have widened and aggraded.

Streamflow levels are significantly reduced (i.e., 10% or greater depletion of natural low flow) at Powerdale Dam, Farmers Canal Diversion, Greenpoint Creek, Dee Diversion, City of The Dalles diversion, Coe Branch, Eliot Branch, Clear Branch, Lake Branch, and the East Fork Hood River. Low flow conditions below water diversions in summer and fall reduce aquatic habitat and may impede anadromous or resident fish migration. Low summer flows contribute to warm water temperatures and water quality impairment.

Summer and early fall water temperatures exceed reported preferred ranges for salmonid life stages in a number of stream reaches. Elevated nutrients, high pH episodes and pesticide contamination have been measured. Road construction, power lines, livestock, forestry and agricultural land use have removed riparian vegetation decreasing shade, bank stability and water retention capabilities; and raising summer water temperatures.

Channelization, road fill, bank armoring has narrowed stream channels and limits meander along the East Fork Hood River and in a few other places. This has created shorter channels, steeper gradients, higher velocities, bed armoring, entrenchment, and other effects. Channel modifications interact with each flood event to further aggravate these channel changes. The construction and maintenance of State Highway 35 is considered a significant and chronic impact to the East Fork Hood River and its floodplain (USFS, 1996a). Road construction, bank stabilization, and channelization has also altered Neal Creek, confining the stream in places and isolating it from its floodplain (ODEQ 2001a).

The Forest Service postulated that forest management in the West Fork, especially roads and removal of wood from channels, has increased peak flows over natural conditions, although flow records are not available for confirmation (USFS 1996a). Timber harvest and high road density place Long Branch, Divers Creek and Lake Branch at high risk of increased peak flow in 1 to 10- year events. Upland harvest has likely elevated peak flows in 2 to 5 year events changing them to a chronic habitat disturbance (USFS 1996a).

Sediment input to streams due to human activity occurs due to roads, undersized culverts at road crossings, and irrigation ditches. Roads and management-related debris flows account for the majority of fine sediment production in the West Fork of Hood River watershed (USFS 1996b). Bear, Evans, Tony, and Trout creeks, and the East Fork of

Hood River have relatively high road densities that expand the drainage network by intercepting subsurface and overland flow, resulting in increased erosion and delivery of fine sediment to area streams.

Potential Conditions for Long-term Sustainability

The Hood River is heavily influenced by frequent natural disturbances and limitations attributable to its geology. Glacial recession and rain on snow events cause a dynamic hydrograph and high summer turbidity especially the East and Middle Fork mainstems (Underwood, K.D et al, 2003). Channel morphology limits salmonid production, with most gradients exceeding 2.5%. Glacial sediment loads are high, and debris flows are a frequent occurrence. According to the scientific literature, glacial turbidity levels in the Hood River are sufficient to depress primary production and macroinvertebrates, fish growth and survival. Given these natural conditions and disturbances, the long-term sustainability of the focal species depends on alleviation of chronic human disturbances and restoration of natural physical and biological processes in the aquatic environment where such opportunities exist.

The removal of the dam and Powerdale Hydropower Project decommissioning is scheduled for June 2010. It is assumed that this action will greatly improve the potential for sustainability for Hood River fish populations. At that time, the dam will be completely removed and the dam site restored to its pre-dam morphology, eliminating a significant source of mortality and impact to downstream migrants affecting the entire subbasin. The 500 c.f.s. hydroelectric water right will be transferred back instream consistent with state statutes. After dam removal in 2010, the cessation of sediment sluicing into the bypass reach, elimination of impacts including the delay and pre-spawning mortality associated with adult passage at the fish ladder, improved passage and reduced predation associated with low bypass reach flows, entrainment of fry and fingerlings into the power canal, and elimination of any pre-spawning mortality or reduced reproductive success are expected to contribute to an increase in focal species abundance in the Hood River. The Powerdale Hydroelectric Project Interim Operations and Decommissioning Settlement Agreement (Pacificorp et al, 2003) also provided for a substantial set of interim mitigation measures that were initiated in April 2003. These include substantial April-November instream flow increases in the bypass reach and an April 15-June 30 annual diversion shutdown to protect downstream migrants in lieu of fish screen replacement.

The potential exists to partially restore streamflows below major irrigation diversions for improved spawning, incubation, rearing and migration conditions exists in the subbasin. This would be achieved through voluntary improvements including ditch to pipe conversion and increased use conservation or waste elimination. Some streamflow restoration has already been initiated using these approaches by 3 irrigation districts.

The potential exists to restoring fish passage connectivity at Clear Branch Dam and at other barriers and diversions.

Half of the subbasin is within National Forest-managed lands. Current management of these lands is specified by the Mt Hood Forest Plan and the Northwest Forest Plan. The latter plan established an aquatic conservation strategy including large riparian reserves that apply in addition to allocation-based standards and guidelines. The guidelines are intended to maintain the ecological health of watersheds and aquatic ecosystems on the National Forest and will enhance the potential for long-term sustainability of the focal species.

Commercial forest operations on non-federal land continues as a major land use on non-Federal lands in the subbasin (NPPC 2000). Improvements in road maintenance and riparian standards are being achieved on these lands, sometimes exceeding requirements of the Forest Practices Act. Objectives such as low road densities and maintenance of a high percentage of closed-canopy forest cover are subordinate in commercial forest operations to economic objectives, and opportunities to minimize peak flow impacts are probably limited.

The potential exists to increase habitat diversity in the short term through LWD additions where LWD would have accumulated under reference conditions. Riparian protection measures have been established on all land ownerships, the most protective on federal lands, but all represent an improving trend in riparian vegetation stands.

Characterization of Future with No New Actions

The benefits of the Powerdale Hydroelectric Project Interim Operations and Decommissioning Agreement, which were described above, are likely to be implemented with no new actions required as a result of FERC proceedings.

Downstream fish passage connectivity has been improved at 3 major diversions since 1996 through fish screen installation or replacement. The benefits of these projects will continue. However, downstream fish passage will remain compromised at 5 other diversions in the subbasin. Upstream fish passage for focal species will continue to be impeded at dams and diversions in Tony, Evans, Neal, the West Fork Hood River (Dee) Coe, Eliot, East Fork Hood River (EFID push up dam) and at several road culverts. Bull trout and steelhead passage will remain blocked in upper Clear Branch and bull trout local population exchange prohibited by Clear Branch Dam. The Laurance Lake reservoir will continue to accumulate and discharge heat to Clear Branch below Clear Branch Dam during the bull trout spawning period.

Neal Creek will continue to experience unnatural turbidity and sediment loading due to East Fork Irrigation District’s 100-year old delivery system, blocked steelhead passage to 2.5 miles, and entrained and stranded juvenile salmonids each year in the Eastside Lateral Canal.

The West Fork Hood River streamflows will be reduced as municipal water diversions increase along with population in the urban growth area of Hood River. Streamflows will continue to be limited from April 15 - October below irrigation diversions in Green

Point Creek, Clear Branch below the dam, and in the East Fork Hood River below the EFID diversion.

A lack of riparian function and instream LWD will continue to keep key habitat quantities for focal species life stages very low compared to historic conditions. Channels are likely to continue to degrade and entrench. Habitat diversity will continue to be limited. Floodplain and fluvial sediment transport and deposition processes will continue to be altered and lateral habitats will continue to be constrained in the Est Fork Hood River along State Highway 35 and at narrow bridge span crossings.

Japanese knotweed will invade and become established in fish habitats, reducing the amount of gravel for spawning and interfering with natural riparian and sediment transport processes. As of May 25, 2004, a total of 28 sites have been identified in Hood River County. Heavy infestations are not yet known to occur in the Hood River, but it is just a matter of time if no action is taken. Knotweed threatens salmon habitat because it colonizes gravel bars in mainstem riparian areas, creates dense monocultures that preclude the establishment of woody shrubs and trees, and can survive high stream flows. Stillaguamish Implementation Review Committee, May 14th, 2003 www.co.snohomish.wa.us/publicwk/swm/salmon/StillyPlan

Pesticides will continue to contaminate tributary streams bordered by orchards, reducing macroinvetebrate production and limiting fish growth and survival from these streams. Riparian losses will continue unless educational efforts on private land are maintained and the ordinances enforced. Recreational trail erosion and proliferation of trails and stream crossings may degrade riparian areas and wet meadows and increase sediment delivery to streams.

3.2.4 Terrestrial Focal Species Population and Characterization

Present Distribution

A map of land cover types and associated focal wildlife species are provided in Appendix A, Maps 16. It is assumed that these land cover types approximate the distribution of the focal species.

Black-tailed Deer and Elk: The cover types and distribution of deer and elk in the subbasin were not mapped in this assessment. Deer and elk will opportunistically utilize all forest types and mixed environs in the subbasin (Keith Kohl, ODFW, pers comm.). Instead, the emphasis of this assessment for deer and elk was on the status of winter range, migration corridors, habitat fragmentation including disturbance from increasing recreation trail and backcountry use levels (Appendix A, Map 2 and Map 18).

Northern Spotted Owl: Maps of spotted owl habitat on federal lands is provided in Appendix A, Maps 16 and 17. The spotted owl distribution includes all coniferous forest types that occur at low to middle elevations. The land cover types associated with this species include Western lowland conifer-hardwood forest and Montane mixed conifer forest. Spotted owls are most abundant in old-growth or mature forest, but are often associated with residual patches of old trees in burned or logged areas (Marshall et al, 2003).

Clark's Nutcracker: The nutcracker is associated with whitebark pine stands that grow at high elevations at or above the timberline in the Mt Hood and Cooper Spur area. Land cover types where the bird is found are Subalpine Parkland and Alpine Grasslands and Shrublands (Appendix A, Map 16). The distribution and seasonal movements of the nutcracker may be broader where these forests are lost or damaged by the fungus. East of the Cascade crest, white pine is found within both the subalpine forest and treeline zone (Katherine C. K.,U.S. Geological Survey http://biology.usgs.gov/)

Lark Sparrow: The lark sparrow generally inhabits open prairies, grasslands, and other other open lands, preferring open dry areas with scattered brush and trees. It also inhabits forest edges, cultivated areas, orchards, fields, and savannahs. It is associated with the land cover types Eastside Interior Grasslands, Ponderosa Pine Dominant Forest, and Westside oak and dry Douglas fir (Appendix A, Map 16).

Western Gray Squirrel: Ponderosa pine dominant, westside oak and dry Douglas-fir forests comprise the cover type for this species (Appendix A, Map 16). This type of habitat is most abundant in the lower eastern part of the subbasin, but small scattered patches exist at low to mid elevations. A combination of grasslands, wetlands, oak woodlands, and continuous cover in variable-aged conifer forests are all beneficial to this species by providing diversity in food sources, escape cover, and travel ways between stands.

Current Population Data and Status

Black-tailed Deer and Elk: A summer population of 1,400 deer and 400 elk 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 deer and elk populations meet management objectives for this unit (Kohl, 2004). Past timber harvest on summer ranges have 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 (Keith Kohl, ODFW, pers. comm.).

Northern Spotted Owl: Thirty owl activity centers are identified by the Mt Hood National Forest in the subbasin. Demographic data from northern spotted owls in 14 study areas in Washington, Oregon, and California for the time period 1985-2003 indicate that spotted owl populations have experienced a 6.6% annual decline on non-federal lands, compared to a 2.5% decline on federal lands (Anthony, et al. 2004).

Clark's Nutcracker: Because occurs in specialized high elevation habitat, Breeding Bird Survey population trend information is not available for this species (C.J. Flick, USFS, pers. comm.).

Lark Sparrow: Population data in the subbasin is not available for this species. The Oregon Breeding Bird Survey trends show a 9.8% decrease in lark sparrow statewide for 1966-2000.

Western Gray Squirrel: Population data in the subbasin is not available for this species

Locally Extirpated and Introduced Species

The following species are known to be extirpated from the Hood River Subbasin.

- Grizzly bear
- Gray wolf
- California condor
- Fisher

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 reported as killed in the watershed on Interstate 84 in 1990 at Starvation Creek (NPPC, 2000). Although wolverine habitat suitability and survival requirements are not completely understood, the critical component of modern day 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. They are morphologically suited to hunting in the snow and may rely heavily on this advantage during severe winters (Wilson, 1982). 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, 2004 and Fiedler, 2004).

The barred owl has expanded its range from southeast Canada, eastern United States, and eastern Mexico moving into Oregon in 1974. Its range now nearly overlaps that of the northern spotted owl. Barred owls are larger than and aggressive toward spotted owls. Surveys suggest that spotted owls are more likely to abandon a site if barred owls take up residence close to that site (Pearson and Livezy, 2004). Barred owls appeared to be most abundant in riparian and lowland forests and less common in upland forests. They may negatively affect dispersing juvenile spotted owls by creating a hostile environment. Besides direct competition for space, it appears that these two species may also compete for prey, although barred owls have a wider prey selection than the spotted owl. Competition with the barred owl aggravates recovery efforts for the spotted owl.

The Eastern Gray Squirrel is arboreal in habit and well established in the towns within the Hood River subbasin. Eastern gray squirrels compete for habitat and displace native western gray squirrels. They may also transmit disease to native squirrels (WDF&W, 1994). This species, in conjunction with land development and the loss of oak woodlands with contiguous cover, has likely influenced the decline of western gray squirrel populations in the subbasin.

Table 15 Partial list of introduced non-native animal species in the Hood River subbasin (Marshall et al., 2003; Davis, 2004; Maser, 1998).

Species	Level of Occurrence
Bullfrog	
Barred owl	uncommon, range expansion, competes for territory with spotted owl
Eastern gray squirrel	common in Hood River, competes for territory with native western gray squirrel
brown-headed cowbird	common, range expansion, lays eggs in host birds' nests
Corbicula species (bivalve mussel)	widespread and here to stay
domestic and feral cat	widespread
domestic dog	common, associated with humans
eastern cottontail	widespread
eastern fox squirrel	common in Hood River
house mouse	common around human habitation
Norway rat	common around human habitation
nutria	possible but unknown locations
opossum	widespread
rock pigeon	widespread, prey for peregrine falcon
European starling	widespread
House sparrow	widespread
California quail	widespread

Some native wildlife populations are elevated compared to historic conditions due to land use changes that favor those species. Examples include deer, elk, and Canada geese. Deer readily adapt to timber, agricultural and rural residential lands with openings for favorable forage growth, shrubs, and forest edges and riparian habitat for cover. Deer and elk damage to orchards, residential gardens or landscaping are common in parts of the watershed.

Historic and current habitat distribution

Historic and current habitat cover data was obtained from the Northwest Habitat Institute Interactive Biodiversity Information System (IBIS). In consultation with NWHI, available IBIS map layers were used to analyze changes between historic and current distribution of wildlife habitat or cover types for focal species (Appendix A, Maps 16 and 16A). Two factors confounded our analysis. First, there were significant differences in the data resolution and scale between the current and historical data sets. Second, the small size of the subbasin magnified the problem. The 1:1,000,000 scale at which the historic habitat data was available for this subbasin does not lend itself well to analysis in relatively small basins like the Hood River. For example, smaller areas of key land cover types for 2 focal species were not included in the historic maps. These are Westside Oak and Dry Douglas-fir Forest and Woodlands (876 acres) and Eastside Interior Grasslands (1,538 acres). Standard change detection procedures are not well suited for analysis of disparate data cell resolutions between the Historic (1 km) and Current (80 m) wildlife habitat layers (M. Garner, Natural Resources Consulting, Inc., pers. comm.). Representing the results of this analysis by 6 HUC subwatersheds adds to the problem by greatly overstating the actual change at the scale at which this assessment was conducted. This can be readily seen in the “Land Cover Change” maps provided at the end of Appendix A. The map legends were changed from the IBIS suggested format to a more readily interpreted version that conveys the same message.

Table 16. Current and historic land cover types for focal wildlife species in the Hood River Subbasin as indicated by the IBIS map data.

Focal Species	Cover Type	Current Acres	Historic Acres
--	Agriculture, pasture and mixed environs	33,392	-
Clark’s nutcracker	Alpine grassland and shrublands	4,469	233
Lark sparrow	Eastside (interior) grasslands	1,538	--
Northern spotted owl	Eastside (interior) mixed conifer forest	23,189	16,4197
Northern spotted owl	Montane mixed conifer forest	47,889	6,620
Lark sparrow	Ponderosa pine forest and woodlands	4,738	26,073
Clark’s nutcracker	Subalpine parkland	4,394	--
--	Urban and mixed environs	763	--
Northern spotted owl	Westside (Mesic) lowlands conifer-hardwood forest	95,370	18,366
Lark sparrow Western gray squirrel	Westside oak and dry Douglas-fir forest and woodlands	876	--

According to a GIS anaylsis of map data provided by Hood River County and ODFW, 39% or 45,752 acres of historic big game winter range largely in the Hood River Subbasin have been lost by human development. About 66% of the remaining available winter range is on non-federal land. Currently, approximately 72,254 acres are designated by ODFW as big game winter range in Hood River County. Land outside of urban, residential, and agricultural areas that are below the normal snow elevation level is designated as available winter range. The approximate boundaries of designated winter range were informally mapped to assist the County Planning Department. The actual extent of winter range varies widely with snow levels (K. Kohl, ODFW, pers. Comm.) Of the remaining designated winter range, about 5,057 acres or 7% of undeveloped land are at medium (Forest F-1 zoning) or high risk of development (Residential and Exclusive Farm Use zoning) (Appendix A, Map 18).

Condition, Trend, Connectivity and Spatial Issues

Planning to retain or improve habitat connectivity, dispersal routes, and access to big game winter range is a critical need. In addition to the Hood River canyon and other intact riparian buffers throughout the subbasin, an important mid-elevation east west wildlife migration corridor is believed to exist through the Middle Mountain area (Keith Kohl, ODFW, pers comm.). This corridor consists of undeveloped forest and residential zoned lands (Appendix A, Map 18). Another important migration corridor at low elevation exists in the Whiskey Creek drainage and the lower east boundary of the subbasin. Undeveloped forest, residential, and EFU lands at in this area facilitate big game and other wildlife movement westward into the lower Hood River canyon and south away from the Hood River urban area and I-84 transportation corridor to re-access forest lands.

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.

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 marten. 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. 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. 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 and around most agricultural and residential areas, especially given growing concern about fire fuels in urban-interface areas.

Limiting factors for deer and elk 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 backcountry uses (Keith Kohl, ODFW, *pers. comm*).

Overall year round recreational trail and backcountry use levels on public and private forest lands by hikers, snowshoers, mountain bikers, off road vehicles, etc. has sharply increased in the last 10 years. This trend is likely increasing habitat fragmentation, degradation, and disturbance-related impacts to wildlife. Unauthorized trail development is also an increasing trend, especially in the 6 HUC watersheds Neal Creek, Hood River/Odell Creek, and Dead Point Creek. Trail inventories on private and county-owned timber lands in these and other areas are not available at this time to characterize the potential impacts (Appendix A, Map 2). Map 2 in Appendix A shows mapped human travel corridors in the subbasin overlain with deer and elk winter range, and highlights areas of recent unauthorized trail development where trail inventory and other actions are needed.

An estimated 237 miles of trail within the subbasin are mapped on Forest Service lands, amounting to an average trail density of 1.3 miles per sq. mile. The Bonneville Power Administration high-voltage Big Eddy-Ostrander transmission line right-of-way travels 17 miles across the subbasin from Bald Mountain to Lolo Pass and averages 425 feet in width. Trees and tall shrubs in the right of way are not allowed except in canyons between towers. Power line corridors on National Forest are infested with dense scotch broom. Travel and powerline corridors have served as avenues for dispersal of invasive plants, altering native plant communities and degrading wildlife habitat. Table 15 shows the miles and density of human travel corridors in the subbasin that are mapped to date. The table underestimates the miles of trail in the subbasin because only those trails mapped on mostly federal lands are shown, and high density trail areas exist on private and county forest ownerships.

Tansy ragwort, Canada thistle, scotch broom, and knapweed have become well established in the County. Knapweed aggressively displaces pasture and native grasses and plants. Purple loosestrife is found along streams near Odell and parts of the East Fork Irrigation District canals. Scotch broom has proliferated and has infested 6% of the County (Dean Guess, Hood River County Weed and Pest Department, pers comm.). Himalayan blackberry competes with native plants for moisture in open riparian areas, and more alarming, Japanese knotweed was discovered in the subbasin in 2004.

Table 17. Mapped human travel corridors in the Hood River subbasin by 6 HUC watersheds. Trails include only those on Forest Service GIS map data layers.

6 HUC Watershed	Type	Miles	Density (miles/sq. mi.)
CAMP CREEK		**128.4**	**3.4**
	Road	95.3	2.5
	Trail	33.1	0.9
DEAD POINT CREEK		**148.5**	**4.2**
	Road	138.3	3.9
	Trail	10.2	0.3
DIVERS CREEK		**138.7**	**4.8**
	Road	112.0	3.9
	Trail	26.7	0.9
DOG RIVER		**45.2**	**3.6**
	Road	33.5	2.6
	Trail	11.8	0.9
HOOD RIVER/ODELL CREEK		**160.3**	**4.9**
	Railroad	6.9	0.2
	Road	152.3	4.6
	Trail	1.1	0.0
LOWER EAST FORK HOOD RIVER		**199.1**	**4.7**
	Railroad	6.9	0.2
	Road	181.9	4.3
	Trail	10.3	0.2
LOWER HOOD RIVER		**112.2**	**6.8**
	Railroad	9.7	0.6
	Road	102.5	6.2
MIDDLE EAST FORK HOOD RIVER		**78.6**	**3.0**
	Road	40.8	1.5
	Trail	37.8	1.4
MIDDLE FORK HOOD RIVER		**122.0**	**4.9**
	Road	112.3	4.5
	Trail	9.7	0.4
NEAL CREEK		**136.9**	**4.5**
	Railroad	2.2	0.1
	Road	133.2	4.3
	Trail	1.5	0.0
PINNACLE CREEK		**55.4**	**2.8**
	Road	25.7	1.3
	Trail	29.7	1.5
UPPER EAST FORK HOOD RIVER		**137.3**	**4.4**
	Road	71.8	2.3
	Trail	65.5	2.1

Habitats Currently Protected on Public and Private lands

According to a GIS analysis using the Northwest Habitat Institute IBIS Land Protection Status data, Alpine and Subalpine cover types have the greatest percent protection followed by Montane Mixed Conifer habitat type. A map of Land Protection Status is provided in Appendix A, Map 5. Spotted owl is protected by federal land ownership and management objectives in the subbasin. Mt. Hood National Forest Plan includes sensitive animal nest-site and rare plant protection buffers. 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). The Northwest Forest Plan provide for riparian reserves, retention levels for snags /dead trees, and coarse woody debris following timber harvest. The State Forest Practices Act also has riparian vegetation and snag retention standards.

Potential and Projected Future Condition with no Future Actions

The projected condition without action is likely to be one of further loss and degradation of habitat cover types for lark sparrow and gray squirrel, loss and degradation of winter range, including further habitat fragmentation and simplification on almost all cover types, and increasing conflicts between wildlife, recreation, and development. Increasing residential or recreational development in forest habitat types and interior grasslands will result in further fragmentation and loss of wildlife habitat. Some of the impacts to wildlife associated with land development in wildlife habitats include mortality by domestic pets, avoidance of suitable habitat due to the presence of pets, conflict between humans and wildlife especially bear, cougar, deer, elk, and gophers; mortality of resident and migratory birds colliding with large uncovered windows; forest fragmentation that leads to penetration by songbird-nest-parasitizing birds such as cowbird; and clearing of downed wood, snags, and brush cover to reduce fire hazard around homes and buildings. The clearing of ladder fuels, snags, downed wood, and standing trees in urban interface forest 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 in the treated areas.

The absence of fire will lead to continued encroachment of fir and other trees into oak and white-bark pine stands. Invasive nonnative plants will continue to encroach upon and displace native plant communities and degrade wildlife habitat.

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. 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.

3.3. Out-of-Subbasin Effects

3.3.1. Aquatic Species

Anadromous fish including focal species chinook and steelhead spend a large fraction of their lives in the Pacific ocean after varying amounts of time in the Columbia River and its estuary. The subbasin planning process must account for mortality effects that occur outside of the Hood River. These effects are likely to vary from year to year, and are either natural, human-caused, or both (Roger, P. 2004). The Ecosystem Diagnosis and Treatment model was used to assess the effects of out-of-subbasin subbasin conditions on anadromous salmon populations (TOAST, 2004). Model parameters roughly represent a 1990 – 1999 base period, and represent the effects of the hydropower system, estuary and ocean conditions, and harvest regimes during the base period. Additional parameters represent the biological effects of density-dependent interactions in the mainstem Columbia River and genetic effects of hatchery fish inter-breeding with naturally-produced adults (Roger, P. 2004). The EDT model incorporates out-of-subbasin effects by applying an average survival rate for each population from when juveniles enter the Columbia River to when adults return back to the Hood River. This rate was computed using the total number of adult returns divided by the total number of juvenile outmigrants for each population. The major sources of out-of-basin impact were aggregated into a single smolt-to-adult-return rate or SAR (Table 18).

Table 18. Bonneville Pool Point of Entry SARs assumed for use in the EDT model (TOAST,2004).

Species (age)	Average	Low	High
steelhead	4.13	2.54	11.44
Chinook yearling	2.2	0.73	7.26
Chinook subyearling	1	.33	1.33

Mainstem Columbia River Survival: The major factors affecting the survival of Hood River focal species during their juvenile and adult migrations through the Bonneville reservoir and Dam include water temperature, river flow, juvenile travel time, juvenile migration timing, passage survival at the Dam (juvenile turbine and bypass-related mortality, upstream migration delay or injury), predation, harvest, habitat quality, and competitive interactions with hatchery and other fish. The EDT applied an average survival rate past the Bonneville Dam hydroelectric project of 88% for yearling and ~85% for sub-yearling chinook. Adult chinook survival past the Bonneville Dam was assumed to average 93% (PATH 2000).

Harvest and Hatcheries: Ocean harvest on fish produced in the Hood River is believed to be minimal. The harvest rate in the Columbia River on hatchery Hood River summer steelhead for the years 1996-2001 ranged form 109 to 390 with an average of 227 fish, while the winter steelhead harvest in roughly the same period was approximately 15. However, out of basin harvest could be considerably higher than this estimate, as it does not include incidental catch in commercial spring chinook fisheries, and very limited data available from winter zone 6 fisheries. Besides the potential for genetic effects incorporated as an EDT model parameter, releases from large production hatcheries may overwhelm the food supply in the Columbia River and estuary at the expense of wild fish, but may also buffer wild fish from avian and other predators.

Climate Patterns: In addition to the steady state conditions represented in the EDT model, three complex interacting climatic patterns affect ocean and freshwater conditions and, consequently, salmon production. These are the Pacific Decadal Oscillation (PDO), the El Nino/Southern Oscillation (ENSO), and climate change. Studies show that Pacific salmon experience large year-to-year fluctuations in survival rates of juvenile fish making the transition from freshwater to marine environment (Hare et al. 1999). Climate-related changes have the most affect on salmon survival very early in the their marine life history (Pearcy 1992, Francis and Hare 1994).

The Pacific Decadal Oscillation is a recurring pattern of ocean-atmospheric variability that alternates between climate regimes every 20-30 years (Hare et al. 1999). The PDO affects water temperatures off the Oregon and Washington coast and has cold (negative) and warm (positive) phases. A positive PDO phase brings warmer water to the eastern North Pacific, reducing upwelling of nutrient-rich cooler water off the coast of North America and decreasing juvenile salmon survival (Hare et al. 1999). The negative phase has the opposite effect, tending to increase salmon survival. PDO and ENSO also affect freshwater habitat of salmon. Positive PDO and ENSO events generally result in less precipitation in the Columbia Basin. Lower stream flows result in higher water temperatures, a longer outmigration period, and a likelihood that less water will be spilled over Columbia and Snake river dams to assist smolt outmigration (Hare et al. 1999).

Climatic effects are manifested in both fish returns and harvests. Mantua et al. (1997) found evidence that the negative PDO phase resulted in larger harvests off Oregon, Washington, and in the Columbia River, and lower harvests in Alaskan waters. In the positive phase, warmer water off Oregon and Washington were accompanied by lower harvests (and runs) in the Columbia River, but higher harvests in Alaska. Phase reversals occurred around 1925, 1947, 1977, and possibly 1999. The periods from 1925-1947 and from 1977-1999 were periods of low returns to the Columbia River, while periods from 1947-1977 and the current period are periods of high returns.

Like the PDO, the El Nino-Southern Oscillation (ENSO), commonly referred to as El Nino and La Nina, affects water temperatures off the coast of Oregon and Washington and has both a cold (negative) and warm (positive) phase. ENSO events are much shorter than PDO events, typically occurring every 2-7 years and lasting 12-18 months. Positive ENSO events occur more frequently during positive PDO phases and less frequently during negative PDO phases (Hare et al. 1999). ENSO events either intensify (during congruent negative or positive events) or moderate (when one cycle is positive and the other negative) the effects of the PDO cycle on salmon survival. A positive ENSO (El Nino) event also results in higher North Pacific Ocean temperatures, while a negative ENSO (La Nina) results in lower temperatures.

Climate change on a longer term than the PDO could have a large impact on the survival of Columbia Basin salmon. Computer models generally agree that the climate in the Pacific Northwest will become, over the next half century, gradually warmer and wetter, with increased precipitation in winter and warmer, drier summers (USDA Forest Service 2004). The general outlook of increased winter flooding and decreased summer and fall streamflows, along with elevated stream and estuary temperatures, are especially problematic for salmon habitat. For salmon runs that are already under stress from degraded freshwater and estuarine habitat, these changes may cause more severe problems than for more robust salmon runs that utilize healthy streams and estuaries. The main question appears to be how long the present favorable PDO period will last and the timing and intensity of the subsequent unfavorable period. Prudence suggests planning for a shorter favorable period and a subsequent longer, if not more intense, unfavorable period (Roger, P. 2004).

Assumptions About Effects on Productivity and Sustainability

Hood River steelhead must pass only one mainstem Columbia River dam (Bonneville) compared to many Basin populations. Ocean harvest is believed to be minimal, and terminal harvest is mostly on hatchery fish. Consequently, it is assumed that populations can at least maintain themselves (natural summer steelhead) or are capable of increasing their numbers (natural and hatchery winter steelhead). The base period used for these comparisons was one of relatively poor ocean environmental conditions and could be considered a worst-case scenario (Roger, P. 2004). Returns in recent years are significantly greater and can be used to reach subbasin goals more rapidly, support more fisheries, or a combination of these actions.

It is assumed that improved survival within the Hood River subbasin will have larger positive impacts on the naturally spawning populations than any likely changes outside the subbasin. Considering that anticipated future climate changes are likely to make summer rearing conditions less favorable than during the base period, strategies which improve summer rearing areas should receive higher priority than other restoration strategies.

These assumptions are based on life cycle estimates of within-subbasin and out-of-subbasin survival or performance of three Hood River steelhead populations using direct observations from the Hood River Production Program monitoring and evaluation studies. Data for hatchery summer steelhead, spring and fall chinook were not considered sufficient for a life-cycle analysis of mortality (Roger, P. 2004).

Within the Hood River subbasin, naturally spawning winter steelhead had a higher average egg-smolt survival rate (0.97%) than did naturally spawning summer steelhead (0.56%). Hatchery winter steelhead had the highest egg-smolt survival of all three steelhead populations (60.74%), reflecting the known survival advantages of the protected hatchery environment (Appendix B, Table 3). Survival during residence outside of Hood River shows a different pattern (Appendix B, Table 4). Naturally spawning winter steelhead have the highest smolt-to-adult-return survival (7.5%), followed by naturally spawning summer steelhead (4.8%) and hatchery winter steelhead

(1.0%). Repeat spawning adults are a small but important proportion of both naturally spawning populations. Over the entire life cycle, all three populations had a positive return rate (returns per female spawner, Appendix B, Table 5). The hatchery winter steelhead population was most productive (22.48 returns per female) followed by naturally spawning winter steelhead (2.89 returns per female) and naturally spawning summer steelhead (1.17 returns per female).

With regard to out of basin effects on spring chinook, captures of spring chinook juveniles in smolt traps in the lower Hood River for the last ten years suggest that wild spring chinook predominantly migrate out of the Hood River in the fall as subyearlings The fate and contribution of these fall migrating spring chinook juveniles to adult returns is considered a critical uncertainty by area fish managers. Out of basin effects on adfluvial bull trout including in the Columbia River and Bonneville Dam passage are not understood well enough to make any specific assumptions. Sea run cutthroat trout are believed to spend 8-9 months in the estuarine or marine environment. Survival and return rates are extremely depressed, including in populations below Bonneville Dam. Sea-run cutthroat trout behavior and survival in the Lower Columbia River and estuary is under investigation by the USFWS (http://columbiariver.fws.gov/programs/cutthroat) and others. Poor survival of sea run cutthroat trout is a concern throughout the lower Columbia region, including populations in streams below Bonneville Dam. Out-of-subbasin factors, including conditions at the Bonneville Dam and in the estuarine or near shore marine environment, are assumed to be affecting the survival of sea-run cutthroat from the Hood River Subbasin. However very little life history information is available specific to Hood River fish. It is assumed that there are negative fish passage impacts to lamprey at the Bonneville dam.

3.3.2. Terrestrial Species– Out of Subbasin Effects

It is assumed that out of subbasin effects currently have a minimal effect on deer and elk populations in the watershed. Population and harvest objectives for elk and black-tailed deer appear to be met. However, ODFW radio-tracking data show that some deer and elk move in and out of the watershed, although most movement is associated with finding winter range. The need to maintain habitat connectivity and adequate winter and summer range in adjacent subbasins is important for healthy gene flow and population dispersal. Climate change may affect the distribution and abundance of deer and elk populations forage base by changing the distribution and composition of vegetation.

3.4. Environment/Population Relationships

3.4.1. Aquatic

Important Environmental Factors for Species Survival by Life Stage

Appreciation is expressed to Gary Asbridge, U.S. Forest Service, Hood River Ranger District, who compiled the sections of the assessment to help summarize and interpret the EDT baseline diagnostic and restoration scenario reports for the Hood River Subbasin for the planning team.

Hood River subbasin planners used the Ecosystem Diagnostic Treatment model (EDT), developed by Mobrand Biometrics Inc., to identify and analyze potential limiting factors affecting production of chinook and steelhead focal species. The species “rules” in EDT that are required to run the model have yet to be finalized for bull trout or cutthroat trout however, these reaches were included in the modeling and EDT will be run when the rules are completed.

The Hood River watershed was broken into 147 distinct reaches representing the known or potential distribution of focal species in the watershed. Reaches were delineated based on geomorphology and barriers to fish passage (both natural and anthropogenic). Twenty- nine reaches were considered obstructions to fish passage. For each reach, various habitat and biological attributes were rated by a team comprised of area fish biologists and hydrologists familiar with the watershed for both the current and template (i.e. historic) conditions[3].

EDT uses this reach information, along with focal species life history information and out of subbasin effects to estimate adult and juvenile focal species productivity, capacity, and abundance for both the current and template conditions. The model produces summary and diagnostic reports that outline the above parameters and limiting habitat factors by stream and reach. Reaches are prioritized for both protection and restoration based on their potential response to future degradation or improvement (provided later in this section).

Based on known adult escapement at Powerdale Dam and estimated smolt outmigration from ten years of screw trap data collected for the Hood River Production Program, the EDT model appears to overestimate the current numbers of adult and juvenile focal species in the subbasin (Tables 1 and 2). Another production model recently developed for the Hood River (Underwood, K.D. et al., 2003) also estimated lower carrying capacity numbers of adults and juveniles. Fall chinook estimates are the most disparate with current EDT projections. Powerdale Dam trap counts indicate that for the period from 1992 –2003, the annual return of fall chinook to Powerdale Dam has averaged 26 fish,

[3] Our team decided the template condition would be the late 1800’s. We estimated habitat and species conditions to the best of our ability based on existing conditions, experience and professional judgment.

with a range from 6 to 70. It is also believed that the Hood River never supported large numbers of fall chinook historically, certainly not as large as the EDT estimates below. Area fisheries managers are unclear as to why the model is overestimating fall chinook. Summer steelhead are currently much less abundant than estimated by EDT although not to the extent that fall chinook are. Adult returns of wild/natural origin summer steelhead ranged from 79 to 650 fish for the years 1992 to 2003 with an average of 261 fish. The number of wild summer steelhead smolts migrating past the screw trap ranged from 550 to 2,000 per year for the period 1991-2001. Although the adult and juvenile numbers estimated for spring chinook and winter steelhead appear somewhat high they are much closer to the current reality based on available adult and juvenile trapping data.

Table 18. EDT estimates of adult focal species population metrics based on current and template conditions in the Hood River Subbasin. Harvest effects occur out of subbasin.

Population	Scenario	Diversity index	Productivity	Capacity	Abundance
Hood River Fall Chinook	Current without harvest	44%	1.5	3,489	1,111
	Current with harvest	8%	0.6	1,565	-
	Historic potential	99%	6.1	8,360	6,979
Hood River Spring Chinook	Current without harvest	44%	1.2	1,779	309
	Current with harvest	39%	1.1	1,664	197
	Historic potential	99%	6.2	4,772	4,002
Hood River Summer Steelhead	Current without harvest	69%	2.8	2,338	1,495
	Current with harvest	69%	2.8	2,338	1,495
	Historic potential	99%	8.9	3,568	3,168
Hood River Winter Steelhead	Current without harvest	37%	1.6	2,742	1,046
	Current with harvest	37%	1.6	2,742	1,046
	Historic potential	97%	7.6	5,117	4,446

Table 19. EDT estimates of juvenile focal species population metrics based on current and template conditions in the Hood River Subbasin.

Population	Scenario	Productivity	Capacity	Abundance
Hood River Fall Chinook	Current without harvest	72	298,820	63,408
	Current with harvest	67	299,725	-
	Historic potential	221	592,785	428,422
Hood River Spring Chinook	Current without harvest	27	54,090	7,311
	Current with harvest	27	54,093	4,920
	Historic potential	105	111,337	87,933
Hood River Summer Steelhead	Current without harvest	81	77,728	47,411
	Current with harvest	81	77,728	47,411
	Historic potential	236	109,340	95,409
Hood River Winter Steelhead	Current without harvest	53	102,562	35,975
	Current with harvest	53	102,562	35,975
	Historic potential	201	164,279	138,794

Key Limiting Factors

As expected by local biologists, the key factors identified by EDT that limit anadromous salmonid production were similar throughout the subbasin and for all focal species. The five primary limiting factors (called level 3 survival factors in EDT) in the subbasin were channel stability, flow, habitat diversity, sediment load, and key habitat quantity. Other factors having lesser effects included obstructions, chemicals and food.

Each limiting factor has different effects on the various focal species depending on the life stage in question (Table 19). For example, channel stability is assumed not to have an effect on chinook salmon spawning whereas habitat diversity and key habitat quantity (in this case spawning habitat) has a potentially large effect. For each limiting factor and life stage there are one or more attributes that “drive” model results. Key habitat quantity is a good example: for the egg incubation life stage the primary attribute driving key habitat is the amount of pool tail habitat (where the eggs are incubating, in other words) whereas for the fry colonization stage the primary attribute is the amount of backwater pool habitat.

Table 20. Summary of the primary limiting factors or key environmental correlates identified by EDT for focal species by life stage. Those listed below were indicated most frequently in the reach diagnostic reports.

Spring chinook	
Life Stage	**Key Limiting Factors**
Spawning	Key habitat quantity, habitat diversity
Egg incubation	Channel stability, sediment load, key habitat quantity
Fry colonization	Habitat diversity, key habitat quantity
0-age active rearing	Key habitat quantity, habitat diversity
0-age migrant	Habitat diversity, key habitat quantity
0-age inactive (winter inactivity)	Habitat diversity, key habitat quantity, sediment load
1-age active rearing	Key habitat quantity, habitat diversity
1-age migrant	Habitat diversity, obstructions (Powerdale Dam)
1-age transient rearing	
2+ -age transient rearing	
Pre-spawning migrant	Obstructions, habitat diversity
Pre-spawning holding	Key habitat quantity, habitat diversity, flow

Fall chinook	
Life Stage	**Key Limiting Factors**
Spawning	Key habitat quantity, habitat diversity
Egg incubation	Channel stability, sediment load, key habitat quantity
Fry colonization	Habitat diversity, key habitat quantity
0-age active rearing	Key habitat quantity, habitat diversity
0-age migrant	
0-age inactive (winter inactivity)	
1-age active rearing	
1-age migrant	
1-age transient rearing	
2+ -age transient rearing	
Pre-spawning migrant	Flow, key habitat quantity, obstructions
Pre-spawning holding	Key habitat quantity, habitat diversity, flow

Table 20, continued. Summary of the primary limiting factors or key environmental correlates identified by EDT for focal species by life stage. Those listed below were indicated most frequently in the reach diagnostic reports.

Summer steelhead	
Life Stage	**Key Limiting Factors**
Spawning	Key habitat quantity, habitat diversity
Egg incubation	Channel stability, sediment load, key habitat quantity
Fry colonization	Habitat diversity, flow, channel stability, sediment load
0-age active rearing	Flow, habitat diversity
0, 1-age inactive (winter inactivity)	Flow, habitat diversity, channel stability, sediment load
1-age migrant	Key habitat quantity, habitat diversity
1-age active rearing	Habitat diversity, flow
2+ -age active rearing	Habitat diversity, flow
2+ -age migrant	Habitat diversity (minimal effect)
2+ -age transient rearing	
Pre-spawning migrant	Obstructions (Powerdale)
Pre-spawning holding	Key habitat quantity

Winter steelhead	
Life Stage	**Key Limiting Factors**
Spawning	Key habitat quantity, habitat diversity
Egg incubation	Channel stability, sediment load, key habitat quantity
Fry colonization	Habitat diversity, flow, channel stability, sediment load
0-age active rearing	Flow, habitat diversity
0, 1-age inactive (winter inactivity)	Flow, habitat diversity, channel stability, sediment load
1-age migrant	Key habitat quantity, habitat diversity
1-age active rearing	Habitat diversity, flow, key habitat quantity
2+ -age active rearing	Habitat diversity, flow
2+ -age migrant	Habitat diversity (minimal effect)
2+ -age transient rearing	
Pre-spawning migrant	Obstructions (Powerdale), key habitat quantity
Pre-spawning holding	Key habitat quantity

Note: In Lenz and Neal Creek chemicals were a significant negative effect for winter steelhead.

For most life stages all of 5 primary limiting factors (channel stability, flow, habitat diversity, sediment load, and key habitat quantity) played a role. The primary limiting factors outlined below are those that consistently appeared to limit production of one or more life stages of all focal species throughout the subbasin. In some streams or reaches other factors were certainly limiting and the most prevalent will be discussed as well.

Channel Stability

Channel stability affected all focal species from the egg incubation life stage through juvenile rearing. Channel stability is tied primarily to the bed scour attribute – the more bed scour the larger the effect[4] on the various life stages for each focal species. The most

[4] In EDT the limiting factors, or survival factors, are described in terms of the relative loss or gain compared to the template condition. In the case of channel stability, which is driven primarily by bed

deleterious effect appeared to be during the egg incubation stage with moderate effects on the fry colonization and inactive rearing (i.e. overwintering) stages. These effects are not surprising due to the glacial nature of the mainstem tributaries in the subbasin (where much of the spawning occurs), as well as the flashy hydrograph and relatively frequent occurrence of rain on snow events that likely lead to relatively high levels of bed scour.

Channel instability is largely the normal state in this subbasin – the Hood River is a dynamic and volatile system. However, area managers do believe that past land management has led to increases in channel instability. Timber harvest, roads, and other impervious surfaces have likely increased the flashiness of the system and the frequency and occurrence of peak flows. This has, in turn, increased bed scour in the subbasin.

Flow

Flow effects ranged primarily from small to moderate for all focal species. Life stages affected varied but were primarily the juvenile portion of the overall species life histories although adult migrating and pre-spawning holding chinook were often affected. Flow effects depend on the time of year and life stage, for example, the chinook fry colonization life stage is affected by high flows (as they are colonizing in late winter or spring) whereas 0-age rearing chinook are affected by low flows in summer and fall.

Virtually every stream modeled was affected by flow. High flows have been exacerbated relative to the template condition by an increase of impervious surfaces, increases in the drainage network (more roads and ditches), and timber harvest. The primary impact to low flows has been water withdrawals for irrigation and power production. In some areas past timber harvest may have also reduced base flow levels by increasing runoff rates with a concurrent reduction in infiltration resulting in less water stored for the summer and fall. The fact that flow rarely had a high affect on any given species or life stage, and was in fact often a low affect, indicates that despite past land management and withdrawals the impact in any given reach may not be as important to species survival compared with other limiting factors such as channel stability and habitat diversity. However, although sometimes small, flow effects were widespread across the subbasin and are an important contributor to the decline of focal species since the template condition.

Habitat Diversity

Habitat diversity, as defined by EDT, is the effect of the extent of habitat complexity within a stream reach on the relative survival or performance of the focal species. Essentially, the more diverse the habitat in any given reach the greater the chance the species will survive and flourish in that reach. Habitat diversity was a limiting factor in most streams modeled and it affected both chinook (to a greater extent) and steelhead (to a lesser extent). Virtually all life stages were impacted although in most reaches it was the younger life stages (fry colonization until smolt outmigration) that were affected most.

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scour, a “loss” of stability actually means there is more bed scour currently than historically and hence the effects are more deleterious.

Habitat diversity is a function of gradient, channel confinement, riparian function, and large woody debris. Large wood levels are lower today than historically due to logging and stream clean out. This is one of the primary reasons habitats are less complex today compared to the template condition. In some reaches the stream is more confined due to roads, railroads, or other infrastructure. Other reaches are more confined because of past splash damming, which incised the channel, or the stream has downcut due to confinement and wood removal.

Sediment Load

Sediment load is defined as the effect of the amount of fine sediment present in, or passing through, the stream reach on the relative survival or performance of the focal species. The EDT model treats focal species life stages differently in terms of the sediment load attribute[5] that is most limiting. Turbidity and/or embeddedness are more important in terms of survival or performance (i.e. they "drive" the model results) than the overall amount of fine sediment in streambed for all life stages except egg incubation when eggs and sac-fry are in the gravel. Embeddedness is more of a factor during inactive life stages when juveniles need to find refuge in the substrate and turbidity is more limiting during active life stages.

Sediment load was a limiting factor in virtually all streams and reaches modeled and it affected all focal species. By far the largest impact was on the egg incubation stage, usually rating as a high or even extreme impact on survival in the EDT reach diagnostic summary. Juvenile life stages, most notably age 0 and 1 inactive (overwintering) and fry colonization were often negatively impacted as well, which relates primarily to the level the larger substrate particles are embedded by fine sediment. Older life stages were impacted in some stream reaches and high levels of turbidity appear to decrease survival or performance but not nearly to the degree younger life stages are affected.

The sediment load in the Hood River subbasin is naturally high due primarily to glacial streams that feed the three main forks of the system. Volcanic ash soils, which are highly erosive, also contribute to the overall sediment load. Our template ratings in the EDT model reflect this naturally high sediment load and this is likely one of the reasons the subbasin is not as productive in terms of fish numbers compared to other subbasins of similar size in the Pacific Northwest. Despite this we believe the sediment load is currently higher than the template condition due to land management practices that have increased runoff and erosion rates including high road densities in some areas, removal of large wood and riparian vegetation from stream systems, and in some portions of the watershed large timber harvest units.

Key Habitat Quantity

A key habitat is the primary habitat used by a particular focal species life stage; quantity is expressed the percent of the wetted surface area of the stream channel. For example, the key habitats for adult spawning are pool tails and small cobble riffles whereas pools

[5] The three attributes that make up the sediment load limiting factor are fine sediment (as in the amount of fine sediment), turbidity, and embeddedness.

and glides are the key habitats for age 0 and 1 rearing. The EDT model compares the current amount of the various habitat types against the template condition, tracks whether there has been a loss or gain, and alters survival and performance of particular life stages accordingly. Although linked with habitat diversity, key habitat quantity is a focused assessment of those habitats particularly important to various life stages.

Key habitat quantity was likely the most prevalent limiting factor across the subbasin as it affected all focal species and impacted at least one life stage in virtually every reach modeled. Primary impacts (those most often rated high) for all focal species were tied to the following life stages: pre-spawning holding (primary pools), spawning and egg incubation (pool tails and small cobble riffles), fry colonization (backwater and primary pools), and 0-age active rearing (primary and backwater pools). The latter life stage effect was primarily for spring and fall chinook. Impacts to 1 and 2-age juveniles were often, but not always, either absent in a given reach or rated as a low impact, particularly for steelhead. It is interesting to note that there has been a gain of steelhead key habitats compared to the template condition in some reaches. The gains were often small and they were across the board in terms of life stages affected. When looking at habitat preference and use steelhead are more of a generalist, or opportunistic, species compared to chinook. Model results reflect this as some life stages will use a variety of habitats and in some cases those habitats have increased in area since the late 1800's. An example is an increase of both small and large cobble riffles. Although this is usually accompanied by a loss in pool habitat there are some steelhead life stages that use these habitats such as adults during spawning (small cobble riffles) and juveniles for rearing or overwintering (large cobble riffles).

The loss of key habitat is very likely due to similar factors that have contributed to the loss of habitat diversity – reductions in the amount of large wood and increased channel confinement due to infrastructure and/or down cutting as a result of land management or channel alteration. Natural events, such as debris torrents and floods, have certainly contributed to key habitat loss (and gain) but we believe in many cases the negative effects of natural events has been exacerbated by land management.

Other Limiting Factors

Other factors that appear to limit survival and performance of focal species include obstructions and chemicals. Obstructions, such as culverts and irrigation diversions, are located primarily in tributaries to the three forks and the mainstem Hood River. Collectively they completely or partially block access to upstream habitats or, in the case of some irrigation diversions, entrain downstream migrating fish into irrigation canals. These obstructions, although certainly of importance to survival and life history diversity, would have a greater impact if more were located on the major forks and mainstem as this is where the majority of the focal species reside. One obstruction, however, that was a major limiting to all focal species was Powerdale Dam on the mainstem Hood River. This facility has a major impact on downstream migrating juveniles and is also a partial impediment to upstream migrating adults.

Chemicals (toxic substances or conditions that effect the relative survival or performance of the focal species) were not considered much of an impact over the subbasin as a whole with one exception – Neal Creek. Only winter steelhead utilize Neal Creek so the impacts are restricted to that focal species. From the confluence of West Fork Neal Creek downstream chemicals had a moderate to high impact on virtually every winter steelhead life stage. There were some minor chemical effects in the mainstem Hood River below Powerdale Dam few other reaches where chemicals were considered a problem in the EDT model. Both Neal Creek and the mainstem Hood River have been the most extensively studied streams in regards to pollution, primarily agricultural related pesticides and herbicides. Given the wide area in the low Hood River Valley where these chemicals are used it is possible chemicals have a wider impact than displayed in EDT.

Aquatic Protection and Restoration Priorities

EDT uses the attribute information comparing current to template conditions to prioritize geographic areas (i.e. streams) for protection and restoration. Tornado diagrams are generated to display these priorities for each focal species (Figures 13 . In many cases any given stream is rated high for both protection and restoration. These may seem at odds with each other but they are not because of the way the terms are defined in EDT. A stream or reach with a high preservation value is a prime candidate for protection because its degradation would have a disproportionately severe impact on focal species production. A stream or reach with a high restoration value, on the other hand, means that a given restoration treatment applied there would result in considerably more benefit to the focal species population than if the same treatment were applied on a stream with a lower restoration value. Therefore many streams, due to their importance to the various focal species, rate high for both protection and restoration.

In general, the larger streams were ranked higher from both a protection and restoration standpoint. The focal species modeled spend much of their life cycle in these streams as opposed to the smaller tributaries so this result is not surprising. However, note that there are generally many streams that show up in the diagrams that have some protection and/or restoration potential (especially for steelhead). This is an important factor in regards to life history diversity because it is an index of the streams that are either known to support the focal species or have the potential to do so. The more streams that show up the more widespread the actual or potential species distribution and the more diverse the population – a valuable trait given the volatile nature of the Hood River subbasin where a single flood event could conceivably wipe out one or several year classes in any given stream.

Figure 13 - Hood River Winter Steelhead
Relative Importance of Geographic Areas for Protection and Restoration Measures

Geographic Area	Protection benefit rank	Restoration benefit rank
East Fork Hood River	1	1
Mainstem Hood River	2	2
Middle Fork Hood River	2	3
Evans Creek	9	5
Green Point Creek	8	6
Cold Spring Creek	3	12
Robinhood Creek	7	8
Tony Creek	5	10
Neal Creek	12	4
Polallie Creek	6	11
Bear Creek	4	14
Baldwin Creek	16	7
Clear Branch	11	13
Dog River	9	18
Tieman Creek	18	9
Rogers Springs Creek	10	19
West Fork Hood River	15	14
Whiskey Creek	13	16
Crystal Spring Creek	14	17
Culvert Creek	17	14
Coe Branch	21	11
Lenz Creek	19	16
West Fork Neal Creek	20	15
Eliot Branch	22	18

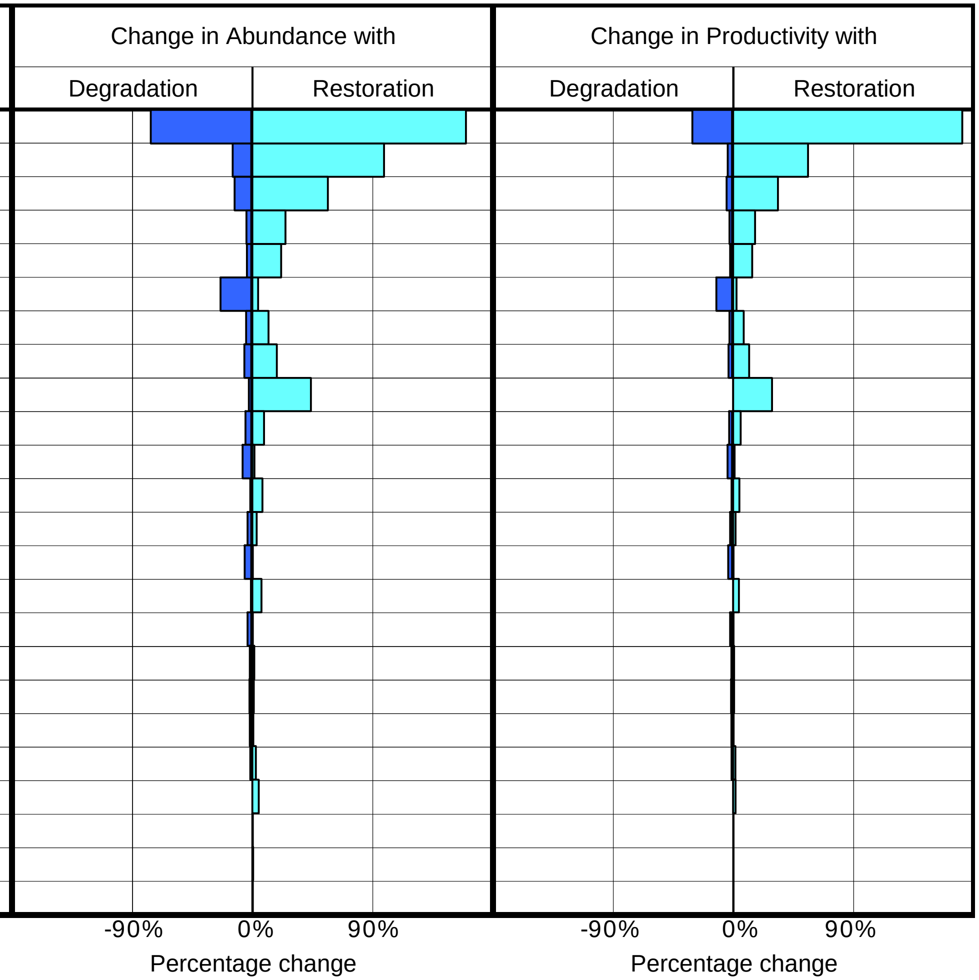

Figure 14- Hood River Summer Steelhead
Relative Importance of Geographic Areas for Protection and Restoration Measures

Geographic Area	Protection benefit rank	Restoration benefit rank
Lake Branch	1	2
West Fork Hood River	2	1
McGee Creek	3	3
Mainstem Hood River	6	2
Elk Creek	5	4
Jones Creek	4	6
Red Hill Creek	6	5
Divers Creek	7	7
Whiskey Creek	8	8

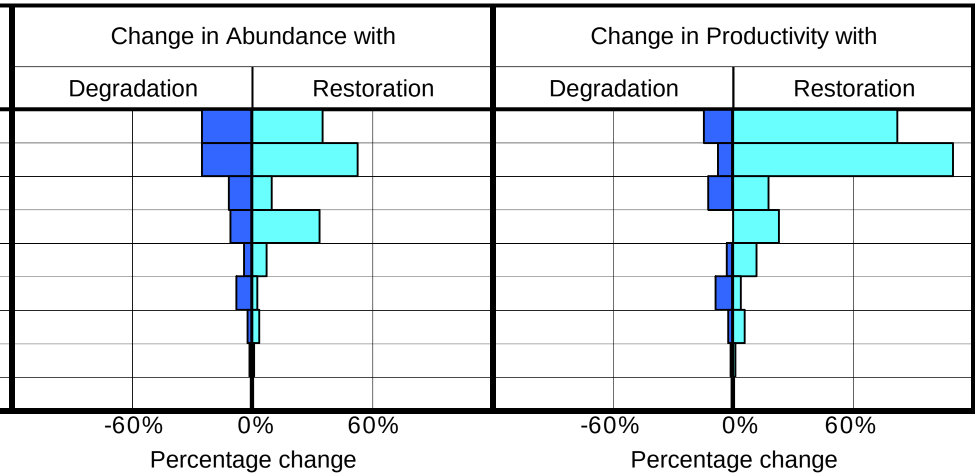

Figure 15- Hood River Spring Chinook
Relative Importance of Geographic Areas for Protection and Restoration Measures

Geographic Area	Protection benefit rank	Restoration benefit rank
West Fork Hood River	1	1
Mainstem Hood River	2	2
McGee Creek	3	3
Lake Branch	4	4
East Fork Hood River	7	3
Tony Creek	5	5
Middle Fork Hood River	6	6
Rogers Springs Creek	6	7

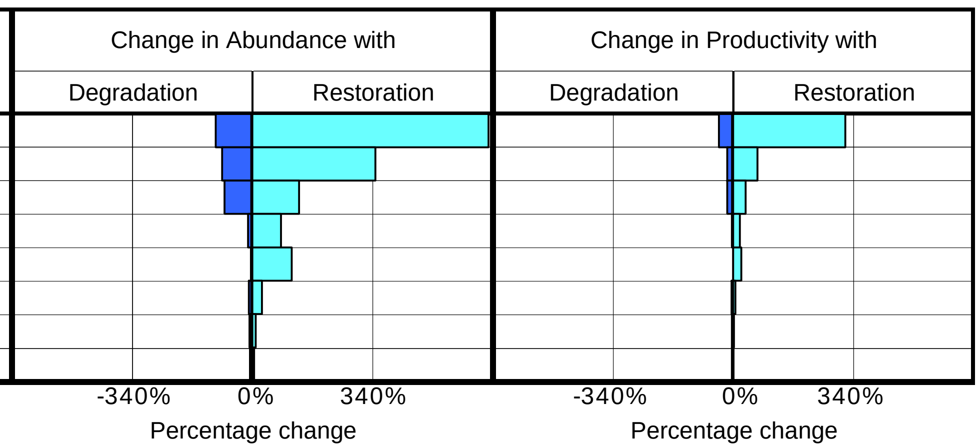

Figure 16 - Hood River Fall Chinook
Relative Importance of Geographic Areas for Protection and Restoration Measures

Geographic Area	Protection benefit rank	Restoration benefit rank
Mainstem Hood River	1	1
East Fork Hood River	3	2
Whiskey Creek	2	4
West Fork Hood River	4	3

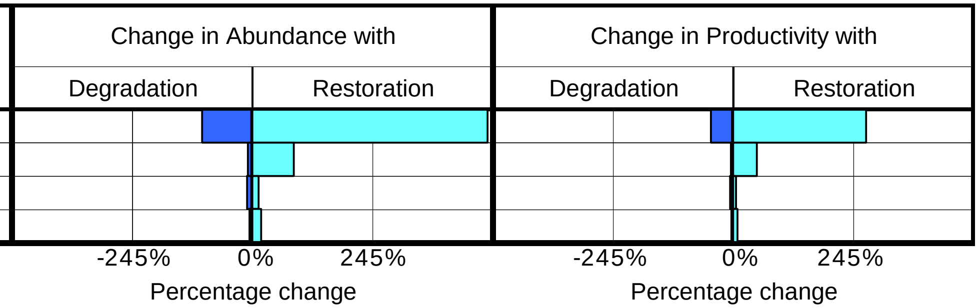

Fig. 17- Hood River Summer Steelhead Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	***Channel stability/landsc.1/***	***Chemicals***	***Competition (w/ hatch)***	***Competition (other sp)***	***Flow***	***Food***	***Habitat diversity***	***Harassment/poaching***	***Obstructions***	***Oxygen***	***Pathogens***	***Predation***	***Sediment load***	***Temperature***	***Withdrawals***	***Key habitat quantity***
Divers Creek	◯	◯	•				•		•									
Elk Creek	◯	◯	•				•		•						●			●
Jones Creek	◯	◯					•											●
Lake Branch	◯	◯	●				•		•						●			●
Mainstem Hood River	◯	◯	●				•		•		●				●			●
McGee Creek	◯	◯	•				•		•						●			●
Red Hill Creek	◯	◯	•				•		•						●			●
West Fork Hood River	◯	◯	●				•		•						●			●
Whiskey Creek	◯	◯	•	•			•		•						●			●

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A		**B**		**C**	
◯	High	○	Medium	∘	Low
⬤		●		•	

Fig. 18- Hood River Winter Steelhead Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration																	
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Baldwin Creek		A	C	C			C	C	C	C					A			B
Bear Creek	A	C	C				C		C									C
Clear Branch	C	C					C		C						B			B
Coe Branch		C	B				C				A				B			B
Cold Spring Creek	A	C					C		C									
Crystal Spring Creek	C	C					C								B			
Culvert Creek		C					C								A			B
Dog River	A	C					C											B
East Fork Hood River	A	A	B				C		C						B			B
Eliot Branch		C	B				B		C						B			B
Evans Creek	A	A	C				C		C		A				A			B
Green Point Creek	A	A	B				B		B						B			B
Lenz Creek		C	C	B			C		C						B			
Mainstem Hood River	A	A	B				C		C		B				B			B
Middle Fork Hood River	A	A	B				C		C						B			B
Neal Creek	C	A	C	B			C		B	C	A				B			B
Polallie Creek	A	C	C				C		C						B			
Robinhood Creek	A	A	C				C		C						A			
Rogers Springs Creek	A																	B
Tieman Creek		A	C	C			C		C						A			B
Tony Creek	A	A	C				C		C		A				B			B
West Fork Hood River	C	C	C				C		C						C			C
West Fork Neal Creek		C	C				C		C						B			A
Whiskey Creek	C	C	C	C			C		C						B			B

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C
High	Medium	Low

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Fig. 19- Hood River Spring Chinook Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration															
Geographic area	**Protection benefit**	**Restoration benefit**	***Channel stability/landsc.1/***	***Chemicals***	***Competition (w/ hatch)***	***Competition (other sp)***	***Flow***	***Food***	***Habitat diversity***	***Harassment/poaching***	***Obstructions***	***Oxygen***	***Pathogens***	***Predation***	***Sediment load***	***Temperature***	***Withdrawals***	***Key habitat quantity***
East Fork Hood River	○	○	●				•		●						●	•		●
Lake Branch	○	○	●				•		●						●	•		●
Mainstem Hood River	○	○	•				•		●		●				●			●
McGee Creek	○	○	•				•		●						●			●
Middle Fork Hood River	○	○	•				•		●						•			●
Rogers Springs Creek	○	○							•									●
Tony Creek	○	○	•				•		●						●			●
West Fork Hood River	○	○	●				•		●		•				●			●

Key to strategic priority (corresponding Benefit Category letter also shown)

	A	B	C
	High	Medium	Low
Protection/Restoration benefit	◯	○	∘
Attribute class	⬤	●	•

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Fig. 20- Hood River Fall Chinook
Protection and Restoration Strategic Priority Summary

Geographic area priority			Attribute class priority for restoration																
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
East Fork Hood River	A	A	B				C		B						B			B
Mainstem Hood River	A	A	B				B		B		B				B			B
West Fork Hood River	A	A	B				C		B						B			B
Whiskey Creek	A	A	C	C			C		B						B			B

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	B	C
High	Medium	Low

EDT RESTORATION SCENARIO SUMMARY

This section presents a summary of the results of 6 restoration scenarios tested using the EDT model in order to determine the relative benefits of different restoration actions for the focal populations. Each scenario addressed one or more limiting factors for the various species and life stages. A "full restoration build-out scenario" was included that combined all the major restoration actions identified and assumed their full implementation. Scenarios were based on EDT results for the baseline population and known limiting factors in the subbasin that have been documented by fishery managers. These scenarios included the following action

- Powerdale Dam Removal: This scenario modeled the removal of the dam and its effects on fish populations from both a flow restoration and fish passage improvement perspective. Passage survival was assumed to be 100% and flow was restored to 65-70% of the natural base level upon removal of the dam.
- Passage Obstruction Removal: Full passage restoration was modeled at irrigation diversions and culverts throughout the watershed except for Powerdale Dam. Culverts that were at the upper range of anadromy were not included, nor were natural barriers.
- Flow Restoration at 20%: Modeled the increase of low stream flows by reducing irrigation withdrawals by 20% at selected diversions, and also included flow benefits from Powerdale Dam removal. Twenty percent is a reasonable estimate of maximum water savings expected given current and future agricultural and hydropower demand. Municipal diversions were not included as these are expected to, at best, remain steady through a conservation effort, or increase due to increasing demand in the absence of a conservation program including rate reform.
- Flow Restoration at 10%: Same as above except irrigation withdrawals were reduced by 10% as opposed to 20%.
- Basin-wide LWD Addition: Modeled the restoration of large wood levels in and along streams to levels approximating the template condition. For the most part only depositional reaches where wood normally would have accumulated were modeled although a few other reaches with steeper gradients were included based on local professional experience.
- "Full Restoration Build Out": This scenario combined Powerdale Dam removal, passage obstruction removal, flow restoration at 20%, and basin-wide LWD addition. This scenario reflects anticipated improvements from basin-wide restoration.

The results of these model runs are summarized below. For details of the assumptions and methods used, please refer to Appendix B, *Hood River Basin EDT Actions and Scenarios.* For the future scenario spawner and juvenile outmigrant population performance reports, please refer to Appendix B, *Report 3*.

Not surprisingly the full build out scenario resulted in the largest increases in adult and smolt numbers, followed by LWD addition and Powerdale Dam removal (Tables 21 and 22). Addition of LWD was predicted to affect a wide variety of attributes across a widespread area in the subbasin. Since the positive effects were both widespread with a large degree of change the model predicted a corresponding large increase in population numbers, especially for spring chinook. Large wood should improve several conditions related to habitat diversity and key habitat quantity, both limiting factors that affected all focal species and most life stages. These are the changes that likely drove much of the increase in fish numbers. For spring chinook the creation of more pool habitat would do much to improve habitat conditions for both adults and juveniles. It is also worth noting that the LWD addition scenario resulted in the greatest improvement in life history diversity (loosely defined as the breadth of suitable habitat across the watershed) of the scenarios modeled except for the "full restoration build out" scenario.

Table 21. Current adult abundance (estimated by EDT) and the estimated percent increase in abundance for the 6 scenarios modeled for four focal species in the Hood River subbasin. The estimates assume no harvest outside the subbasin.

Population*	Current	Powerdale	Obstructions	Flow10%	Flow20%	LWD	Full
ChF	1,111	55%	0%	55%	57%	69%	140%
ChS	309	65%	5%	3%	4%	379%	493%
StS	1,495	10%	0%	2%	2%	38%	51%
StW	1,046	28%	3%	2%	3%	60%	104%

Table 22. Current juvenile outmigrant abundance (estimated by EDT) and the estimated percent increase in abundance for the 6 scenarios modeled for four focal species in the Hood River subbasin. The estimates assume no harvest outside the subbasin.

Population*	Current	Powerdale	Obstructions	Flow10%	Flow20%	LWD	Full
ChF	63,408	54%	0%	63%	65%	62%	130%
ChS	7,311	53%	4%	3%	4%	375%	435%
StS	47,411	4%	0%	1%	1%	39%	43%
StW	35,975	15%	1%	1%	2%	58%	81%

*ChF – Fall chinook
ChS – Spring chinook
StS – Summer steelhead
StW – Winter steelhead

Powerdale dam removal had mixed effects among focal species although all species responded favorably. Increases were much larger for chinook than steelhead. For fall chinook the increase in flow in the lower 4.5 miles of stream would greatly increase the amount of available spawning and rearing habitat and thus the model likely assumed an increase in fish numbers as well. For spring chinook the increase in numbers relates primarily to the fact that most of the smolt outmigration occurs in the fall when survival would be enhanced by both higher flows and the assumed 100% passage survival. Increased steelhead numbers were lower than anticipated but reflect primarily passage improvements for adults and juveniles as well as some increases in available habitat for various life stages and water quality improvements.

What was somewhat surprising was the small estimated increase in fish populations associated with flow restoration, with the exception of fall chinook. Both flow restoration scenarios included flow improvements as a result of Powerdale dam removal as the intent was to model improvements in flow across the entire watershed. Since fall chinook spawned and reared in the lower Hood River the benefits resulting from increased flows include increased available habitat and better water quality throughout the year. What is somewhat unclear is why flow increases did not have the same impact on steelhead, especially given that they are believed to spawn and rear below Powerdale Dam as well (spring chinook were the only focal species that did not have spawning habitat identified below Powerdale Dam). Further, the EDT predicted a lower benefit for flow restoration than a UCM life cycle model effort performed for the Hood River subbasin focal species, and, more significant, a regression analysis based on actual streamflow and fish data from the Hood River as part of the Hood River Production Program (E. Olsen, 2004).

The very small increase in numbers associated with obstruction removal besides Powerdale is not surprising. Most of these diversion or culverts are in smaller tributaries that have relatively low production potential compared with the mainstem forks. Since fewer fish use these tributaries to begin with the increase associated with improving passage is low. This is compounded by the fact that many of the barriers are located near the headwaters so the habitat gain is not great.

3.4.2. Terrestrial Environment - Population Relationships

A great deal more information is available for each of the wildlife focal species than the information that is presented here. Time and staffing limits has not allowed for more than a partial treatment of this section.

Important environmental factors for species survival

Black-tailed deer and elk: Winter range, summer range, and connectivity

Clark's nutcracker: The nutcracker is associated with old- growth white-bark pine and dependent on its pine cone seeds. It will undergo extensive movements when seeds are unavailable. There are declines in white-bark pine, especially in early succession, from fire suppression, replacement by competing conifers, lack of regenerating young trees, and more recently due to disease (white pine blister rust).

Lark sparrow: A balance between shrubs, grassland, and even some bare ground is a requirement for this species (Marshall et al., 2003). They are associated with oak savanna and oak-pine stands where fire is an integral part of the ecosystem

Northern spotted owl: Mixed-conifer forest cover types with late-succession structural characteristics (snags, coarse woody debris, and multiple vegetative layers) in large, contiguous blocks are critical to the spotted owl's successful reproduction and survival. Nests are on moss, mistletoe brooms, old nest platforms of other species, or in cavities.

Western gray squirrel: A combination of grasslands, wetlands, oak woodlands, and continuous cover in variable-aged conifer forests are all beneficial to this species by providing diversity in food sources, escape cover, and travel ways between stands. Fire is an integral part of the ecosystem for this species and helps control invasive plant species and retain native plant species (Ryan and Carey, 1995).

Long-term Viability Based on Habitat Availability and Condition

Northern Spotted Owl: The outlook for long-term viability for spotted owl in the subbasin is favorable based on habitat. Mature and old-growth forest is broadly distributed in contiguous blocks with an opportunity for nearly continuous occupation and population interactions by the spotted owl and its associated prey species. However, competition with the barred owl is a threat to this species.

Black Tailed Deer and Elk: 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 good because of its adaptability, and because of its status as a managed game species.

Lark Sparrow: Uncertain outlook due to limited habitat availability and future land development.

Western Gray Squirrel: Uncertain outlook due to limited habitat availability, lack of fire, encroachment of oak woodlands by Douglas fir, competition from non-native squirrels, and future land development.

Determination of Key Ecological Functions

A table is provided in Appendix C that identifies key ecological functions of the focal wildlife species. The table was generated by the NWHI for the focal species within the Columbia Gorge Ecological Province.

3.4.3. Selected Interspecies Relationships

Fish

Limited information exists in the subbasin to characterize the inter-species relationships among fish populations. Most cutthroat trout populations were located upstream of anadromous populations (BPA 1996), but do occur along with bull trout and rainbow trout or steelhead in several tributaries. Bull trout, cutthroat, rainbow trout, and smallmouth bass occur together in Laurance Lake reservoir. Snorkel surveys have found all of these species using the littoral zone at the same time (D. Morgan, USFS pers comm.). 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. Interactions between young of the year cutthroat and steelhead in spring and early summer may limit the size of cutthroat populations in streams where they occur together (Trotter et al, 1993).

Wildlife

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 in the subbasin, however, the number of barred owls in Oregon is reportedly rising.

Key Relationships Between Fish and Wildlife

Some of the 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). Salmon and steelhead carcasses, steelhead and lamprey carcasses are known to provide food for a variety of wildlife both directly and as a source of nitrogen to riparian vegetation. Species noted as critically linked with fish on the IBIS system are provided in Appendix C.

3.5. Identification and Analysis of Limiting Factors/Conditions

3.5.1. Historic Factors for Decline of Focal Species and Ecosystem Function and Process - Aquatic

The EDT model results for the Hood River Subbasin suggest that the environmental attributes that have had the greatest effect on the focal species chinook and steelhead are channel stability, flow, habitat diversity, sediment load, and key habitat quantity. Obstructions were most important overall to winter steelhead, and a lessor factor for spring chinook and summer steelhead. In general, the EDT model results are consistent with earlier assessment results with regard to limiting factors. The principal historic factors identified in earlier assessment work believed to inhibit the focal species' populations were associated with historic forest management, agriculture, transportation, and land development activities (HRWG, 1999; USFS, 1999 a&b). These include:

- Impairment of upstream juvenile and adult fish passage at dams, water diversions, and road crossings;
- Inadequate or absent fish screens at water diversions;
- Streamflow reduction at irrigation and hydropower diversions;
- Water quality degradation including temperature, pesticides, sediment, nutrients;
- Reduced riparian-floodplain function and instream habitat diversity;
- Increased peak flows

We postulate that fish passage was not identified in the EDT as a higher priority restoration need for all species compared to prior assessments because a) bull trout were not modeled in the EDT and bull trout are severely impacted by Clear Branch Dam; and b) recently completed fish screens and other fish passage improvements were included as the current condition in the model. Pesticides and temperature were identified as by the EDT as influential limiting factors in certain tributary reaches, as expected by subbasin planners, but not as a subbbasin-wide limiting factor.

Factors limiting natural fish production focusing on steelhead and spring chinook were also identified in the recent HRPP Review which modeled subbasin habitat conditions. This review identified natural subbasin characteristics of turbidity, glacial fine sediment loads, rain on snow floods, cold rearing temperatures in the West Fork, and channel morphology as limiting natural production. Analysis of habitat data and UCM modeling showed that a lack of pool habitat, combined with low wood complexity, high fines, and high turbidity were key factors limiting freshwater capacity and survival. This analysis identified habitat restoration, water withdrawals, and fish screening and fish passage at diversions as priorities for restoration activities.

The single most important fisheries issue identified in the U.S. Forest Service watershed analysis for the Middle and East Forks of Hood River was the loss of large wood from streams, and the future large wood recruitment potential from the adjacent riparian areas (1996a).

Historic Factors Leading to Decline of Bull Trout

In general, the same factors and conditions discussed above have limited bull trout populations in the subbasin. However, dams and road density impacts may have had particularly severe effects on bull trout. Existing and abandoned dams have contributed to the reduced migration and isolation of bull trout and other species and are believed to be a major limiting factor (Buchanan et al. 1997). The Clear Branch Dam was constructed in 1969 without fish passage, inundating a mile of bull trout, coho, and steelhead spawning habitat (USFS 1996a). The dam isolates the upper 2.75 miles of the Clear Branch and all of Pinnacle Creek from the rest of the Hood River, forming a barrier between the Clear Branch Local Population and the Hood River Local Population. An upstream fish trap was installed in 1997 but has not yet functioned effectively. The dam outlet may entrain bull trout into the pressurized pipe system due to inadequate screening (Pribyl et al. 1996). The dam prevents natural movement of stream sediments important to maintain spawning habitat in lower Clear Branch and the Middle Fork Hood River. Reservoir impounded waters increase stream temperatures below the dam beyond those suitable for bull trout at certain times of the year (Buchanan et al., 1997). The Laurance Lake reservoir is currently is the subject of a thermal study.

Road density appears to be a limiting factor for bull trout. Road networks paralleling stream channels are commonly associated with increased sediment loading from gravel or native surface roads, intercepting surface and subsurface water flow and altering runoff patterns, and constraining stream channels from natural movement and adjustment patterns (USFWS, 2003). A landscape analysis correlating road density and population status among four non-andromous salmonid species indicated that increasing road densities had a strong negative correlation with the status of the species (Lee et al. 1997). In this analysis, bull trout were generally found to be absent where the mean road density of all upstream subwatersheds was 1.71 miles per square mile. These findings are highly consistent with those in the Hood River subbasin. The Pinnacle Creek Subwatershed encompasses the habitat of the Clear Branch Local Population of bull trout. Coincidentally, the Pinnacle Creek 6 HUC Subwatershed has the lowest mean road density of all Hood River subwatersheds at 1.3 miles per square mile, and provides the only known breeding habitat for bull trout in the Recovery Unit.

Conditions That Can be Corrected by Human Intervention

Human intervention can have a beneficial effect on most of the above factors by actions aimed at restoring natural physical and ecological functions and processes where it is possible and feasible to do so. Conditions likely to respond to human intervention include the active and passive restoration of riparian function including large woody debris supplies, restoration of streamflows closer to natural flow levels as opportunities allow, screening water diversions, removing culverts, enlarging or bridge replacement, enlargement or removal of culverts to allow passage of fish, water, sediment, wood and other organic matter. Enhancement of riparian areas, reduction in road densities in priority subwatersheds, removal of artificial sediment sources, moving roads or road segments out of floodplains can help correct some of the conditions mentioned above.

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.

3.5.2. Historic Factors for Decline of Focus species/ecological function-process - Terrestrial

Deer and Elk: Limiting factors for deer and elk 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 (K. Kohl, ODFW, *pers. comm*).. The available winter range which is now mostly on and adjacent to private property has now reached capacity which will limit further increase in deer and elk numbers.

Clark's Nutcracker: The loss of white-bark pine stands in the alpine and subalpine elevations are the main limiting factor for this species. The causes of decline in white-bark pine are blister rust disease, and the absence of fire which has led to encroachment of white-bark pine stands by other conifer species.

Northern Spotted Owl: Habitat loss on non-federal lands and competition from the barred owl appear to be the major limiting factors for this species.

Gray Squirrel: Major limiting factors for these species include the absence of fire leading to encroachment of oak stands by Douglas fir, habitat loss, and competition from non-native squirrels.

Conditions That Can Be Corrected by Human Intervention

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. 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. Further losses of winter range, which include habitats for lark sparrow and gray squirrel, can be prevented or minimized.

3.6. Synthesis and Interpretation

3.6.1. Subbasin-wide Working Hypothesis – Aquatic

Overall Working Hypothesis: ***Chronic habitat disturbances have intensified and prolonged the effects of frequent natural disturbances leading to fish population declines. Removing or minimizing these chronic disturbances can lead to population recovery.*** We hypothesize that the populations have not naturally recovered in the last century to historic abundance because chronic anthropogenic habitat disturbances have occurred on top of the short-term impacts of natural events – contributing to a persistent decline in the abundance and productivity of the focal fish species. Chronic human disturbances have included unscreened and inadequately screened water diversions, fish passage barriers, flow depletions, decreased stream habitat complexity and floodplain interactions due to past riparian harvest, removal of LWD, transportation and land use-related channel modifications, and water quality impairment. The release of hatchery fish from non-native domesticated hatchery stocks has led to lower reproductive success and other genetic changes in some stocks.

Evidence for Hypothesis The Hood River is a dynamic environment in which fish population abundance is naturally variable over time and fluctuates in response to large-scale natural disturbances such as droughts, floods, and debris flows originating on Mt. Hood. Natural mass wasting events may cause direct losses of multiple age classes of fish, as well as create adverse habitat conditions over periods of weeks, months, or years. Impacts can be restricted to local areas or affect large portions of the subbasin. In the absence of chronic environmental disturbances, the depression in populations from natural events is temporary and is followed by increased abundance levels as fluvial processes re-create high quality habitat. Artificial channel confinement in the East Fork Hood River from highway fill and revetments, and narrow bridge spans encroach heavily into the floodplain and restrict channel development and habitat recovery after debris flows and floods. Periodically, natural dams created by moraines at receding glaciers on Mt. Hood break causing floods and debris flows. Landslides originating on the slopes of Mt Hood are common. Ladd, Coe, Pollalie, Eliot, Clark and Newton Creeks have a history of these events, which can be triggered by intense rainstorms. On December 25, 1980, a landslide and massive debris dam break in Pollalie Creek caused one fatality, obliterated sections of Highway 35, and damaged the East Fork Hood River for miles. Effects of the 1980 flood on the East Fork channel are still readily observed. A major washout in Ladd Creek occurred September 1, 1961. Newton Creek experienced a similar event in November 1991. A large mudflow in Eliot Branch occurred Thanksgiving 1999, wiping out a bridge and a diversion dam. The most recent event was the massive Newton Creek debris flow on September 30, 2000, which resulted from the failure of pyroclastic sediments on Mt Hood at the foot of the Newton Glacier. This event carried large volumes of sand and sediment all the way to the Hood River delta with sand movement and turbidity lasting for several months. A wide range of adult returns have occurred over the last 10 year period. The subbasin experienced drought in 1987,1992,1994, and 2001 and 2003.

Working Hypothesis A: *The scheduled dam removal at the Powerdale Hydroelectric Project, and restoration of physical habitat connectivity for adult and juvenile life stages at other dams and diversions will substantially increase the survival of focal species in the Hood River.*

<u>Evidence for Hypothesis A</u>: The benefits of adding fish screens at major diversion sites were evaluated in the recent HRPP Review (Underwood, K. D. et al, 2003) by estimating the number of mortalities that were prevented with screens of various efficiencies. Estimates of entrainment (fish loss) at Powerdale Dam indicated that up to 85,000 wild and hatchery juvenile steelhead and spring Chinook would be lost if there were no screen at the diversion. Screens of progressive efficiencies in increments of 20% decreased the number of lost juveniles by 17,000. The number of juveniles lost in each group (origin, life stage, or species) was relative to their abundance passing the diversions. Losses were highest among hatchery spring Chinook smolts, with significant losses also occurring among hatchery and wild steelhead smolts. Entrainment losses at the East Fork Irrigation Diversion were comprised solely of wild steelhead juveniles. Under a no screening scenario, an estimated 7,200 wild steelhead juveniles were lost each year. Increased screen efficiencies of 20% decreased entrainment by 1,400 steelhead at each level of efficiency. Many of those lost were steelhead fry. Losses from entrainment at the Dee Irrigation Diversion were relatively minor with an estimated 86 juveniles lost annually. Diversions at the Farmers Irrigation Diversion were estimated to loose approximately 13,000 juveniles under no screen conditions. Additions of screens with increments of 20% efficiency decreased the loss by 2,600 juveniles for each increment. The removal of the dam and Powerdale Hydropower Project decommissioning is scheduled for June 2010. It is assumed that this action will greatly improve the potential for sustainability for Hood River fish populations. At that time, the dam will be completely removed and the dam site restored to its pre-dam morphology, eliminating a significant source of mortality and impact to downstream migrants affecting the entire subbasin. The 500 c.f.s. hydroelectric water right will be transferred back instream consistent with state statutes. After dam removal in 2010, the cessation of sediment sluicing into the bypass reach, elimination of impacts including the delay and pre-spawning mortality associated with adult passage at the fish ladder, improved passage and reduced predation associated with low bypass reach flows, entrainment of fry and fingerlings into the power canal, and elimination of any pre-spawning mortality or reduced reproductive success are expected to contribute to an increase in focal species abundance in the Hood River.

Working Hypothesis B: Flow restoration at Powerdale and below major irrigation diversions will increase the survival and production of the focal species in the Hood River.

Evidence for Hypothesis B: A regression analysis based on empirical data collected in the HRPP M& E program found a strong positive relationship (R-squared = 0.69) between mean summer and early fall streamflow in the Hood River and the production of age 2 steelhead smolts (Figure 21). The HRPP Program Review recommended flow restoration as a habitat priority in the subbasin based on a modeling estimate of a 10,000 to 20,000 increase in summer and winter steelhead parr (3,500 to 7,000 smolts at 35% parr-to-smolt survival) and 7,500-12,500 increase in spring chinook parr (or 2625 to 4375 smolts) in the subbasin by restoring 10 c.f.s. of streamflow at each major irrigation diversion and 250 c.f.s. at below Powerdale Dam. While the modelers cautioned that given the methods used, these estimates of increased rearing capacity were likely inaccurate, but were useful as an order of magnitude reference for flow restoration benefits (Underwood, K.D. et al, 2003). The EDT model scenario returning stream flow found only a small benefit to flow restoration except for a 65% increase in juvenile outmigrant abundance for fall chinook.

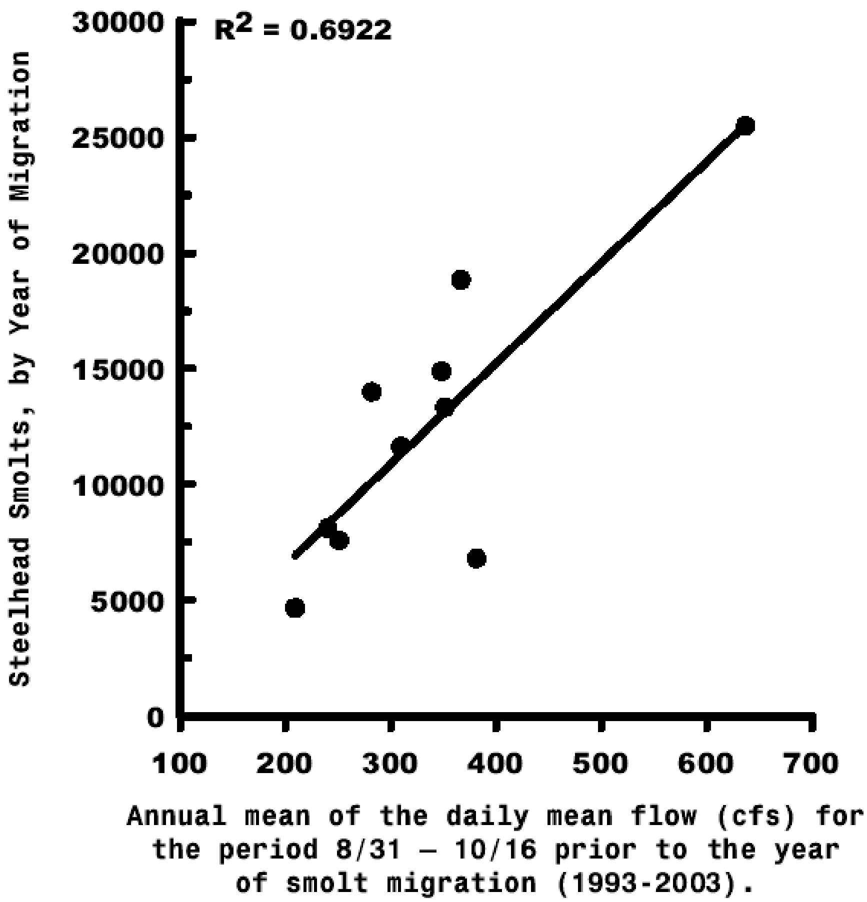

Figure 21. Number of steelhead smolts versus streamflow at Tucker Bridge during late summer and early fall rearing in the year prior to outmigration (E. Olsen, 2004, unpub)

Working Hypothesis C*: Restoration of habitat diversity and improving floodplain-riparian function will increase focal species abundance by increasing channel stability and the amount of key habitats and habitat complexity available for focal species life stages including pools, spawning gravels, and slow water lateral habitats.*

<u>Evidence for Hypothesis C</u>: Most channels in the Hood River are lacking in pools, LWD, backwaters, side channels and habitat diversity as a result of past timber management practices and in some cases, artificial channel confinement, or natural geomorphology. The EDT model results indicated that habitat diversity and key habitat quantity was particularly important for spring and fall chinook. Mature riparian forests, large woody debris in channels and riparian areas, and high levels of floodplain interaction promote increased habitat diversity and development of key habitat areas. Channel stability affected all focal species from the egg incubation life stage through juvenile rearing. Channel stability is tied primarily to the bed scour attribute – the more bed scour the larger the effect on the various life stages for each focal species. The most deleterious effect appeared to be during the egg incubation stage with moderate effects on the fry colonization and inactive rearing (i.e. overwintering) stages. High levels of bed scour are not surprising given the glacial nature of the major tributaries where most spawning occurs, a flashy hydrograph, and frequent rain on snow events. However, area managers do believe that past land management has led to increases in channel instability and bed scour (e.g., USFS 1996a; 1996b). Timber harvest and roads have likely increased the flashiness of the system and the frequency and occurrence of peak flows. Historic large woody debris is believed to have moderated the effects of small to medium sized peak flows (USFS 1996a; 1996b). Historic levels of large wood created backwater and other lateral flood refuge areas, as well promoted gravel retention and stability in smaller events. The EDT model predicted increases in smolt abundance from 39% and 58% for summer and winter steelhead to 62% and 375% for spring chinook, respectively.

3.6.2. Subbasin-wide Working Hypotheses - Terrestrial

Hypotheses: Preventing further losses of big game winter range, which include oak and grassland habitats for lark sparrow and gray squirrel is important to maintaining the health and persistence of these focal species. Support for this hypothesis is derived from the fact that a large percentage of winter range is already lost, and oak and grassland habitats are geographically limited at risk and at risk of degradation and/or loss due to development or other impacts. If prescribed fire is unsafe or infeasible, then efforts to control Douglas fir and other plant invasions into oak stands will reduce competition for water and nutrients, improving the survival and health of remaining oak stands, and hence benefiting gray squirrel in terms of acorn production. The needs of wildlife in terms of wildlife corridors, habitat connectivity, and winter range, summer range, 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. 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.

3.6.3. Desired Future Conditions – Aquatic

In general terms, desired future conditions are those that will ensure the maintenance of biological diversity and sustainability of harvestable natural resources (FEMAT 1993). In this desired future condition, the development and distribution of a diversity of aquatic and riparian habitats generated by natural processes that meet adapted life history requirements. Natural disturbances, e.g., floods and debris flows, are an important part of the ecology of PNW watersheds. They create and maintain diverse aquatic environments to which salmonids and other native fish have adapted over time (Bisson, PA et a.1997).

The desired future condition for the Hood River subbasin is one where the dynamic natural cycles of disturbance and recovery are allowed to occur as naturally as possible. In the desired future habitat condition, riparian and instream recovery processes involving the transfer of sediment, wood and organic matter between terrestrial and aquatic habitats are not altered or are only minimally impeded by artificial structures or maintenance activities. Specifically, stream channels are fully able to interact with and connect to their floodplains, and the adjacent riparian forest has a natural distribution of vegetation age and type, and the periodic input, movement and deposition of coarse sediment and organic material occurs at natural rates, streamflow regimes are as natural as possible, and wherever possible, beaver activity is allowed to occur. (Naiman et al, 1992, Stanford and Ward 1992). Channels are moving towards historical levels of large woody debris and increased habitat diversity and complexity.

Achievement of these desired future conditions is not possible everywhere the subbasin because of existing land use or because of natural geomorphic constraints. However, opportunities may exist to make land use or management activities more compatible with natural disturbances or processes to the extent possible. For example, stream flows can be restored by ditch conversion and other activities, culverts enlarged or replaced with bridges to allow water, sediment and debris to flow more freely under road crossings, riparian vegetation can be protected and enhanced, road densities can be reduced in some areas, and it may be possible in some locations to remove road fill out of stream channels or floodplains.

Population objectives for steelhead are to maintain the abundance and life history diversity to withstand dynamic events. A wide range in carrying capacity reflects the variation in habitat productivity, and the ability of the population to withstand or cope with natural events.

3.6.4. Desired Future Conditions – Terrestrial

In general terms, the desired future conditions for wildlife habitat in the subbasin include retention of winter range, including cover types such as interior grasslands and pine-oak woodlands, and connectivity across cover types. The desired future condition is for greater connectivity of forest stands across cover types, and the minimization or control of invasive plants in important habitat areas. The desired future condition includes the retention and enhancement of snags and other important natural habitat structural elements on all cover types, and the reintroduction of fire where feasible and safe, or the ability to manage forest cover types to mimic some of the effects of fire consistent with fuels treatment and forest disease treatment approaches.

3.6.5. Opportunities

Note: Opportunities are explained in greater detail in the Hood River Management Plan, Chapter 5.

Westside oak and dry Douglas fir, interior grasslands, and ponderosa pine dominant forests. Much of this is winter range for big game as well as habitat for western gray squirrel and lark sparrow. Opportunities exist to acquire lands, conservation easements, or promote development standards that are effective in preventing additional losses of important habitat areas for wildlife.

Opportunities exist to acquire or purchase easement or other approaches to maintain the existing lower mid elevation east-west migration corridor from the Neal Creek drainage through middle mountain to the Green Point drainage, and the existing corridor from the whiskey creek drainage (and north to the Old Columbia Highway) west to the Hood River canyon.

Habitats that are currently in good condition and are used by focal species should be the priority for protection. An example is the West Fork Hood River which includes important spawning reaches for summer steelhead and spring chinook that are geographically limited and vulnerable to disturbance.

Habitat restoration needs and opportunities for the Hood River Subbasin have been discussed in earlier sections, many are identified in the 2002 Hood River Watershed Action Plan, which is available at http://www.oweb.state.or.us/publications/ws_assessments, and will be summarized in the Management Plan for the Hood River Subbasin.

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.

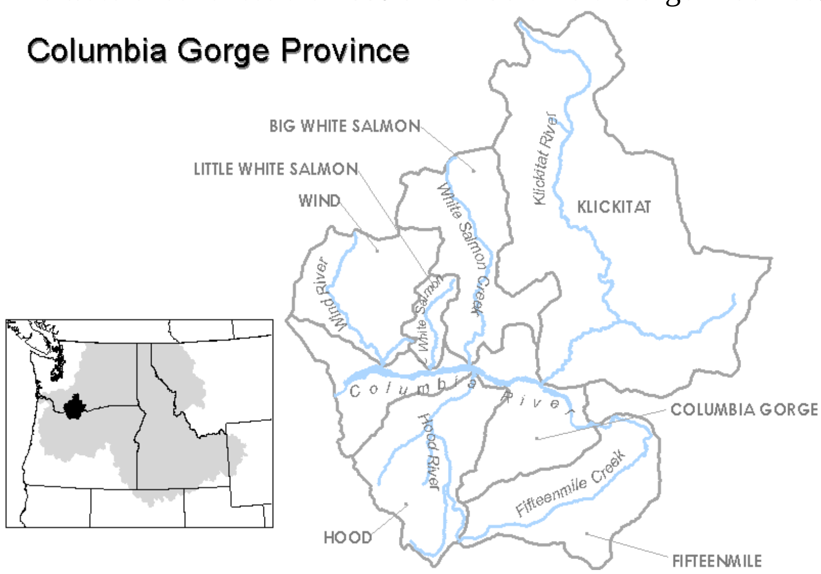

Figure 22. Relation of the Columbia Gorge Subbasin to the Columbia River Basin and ecological province.

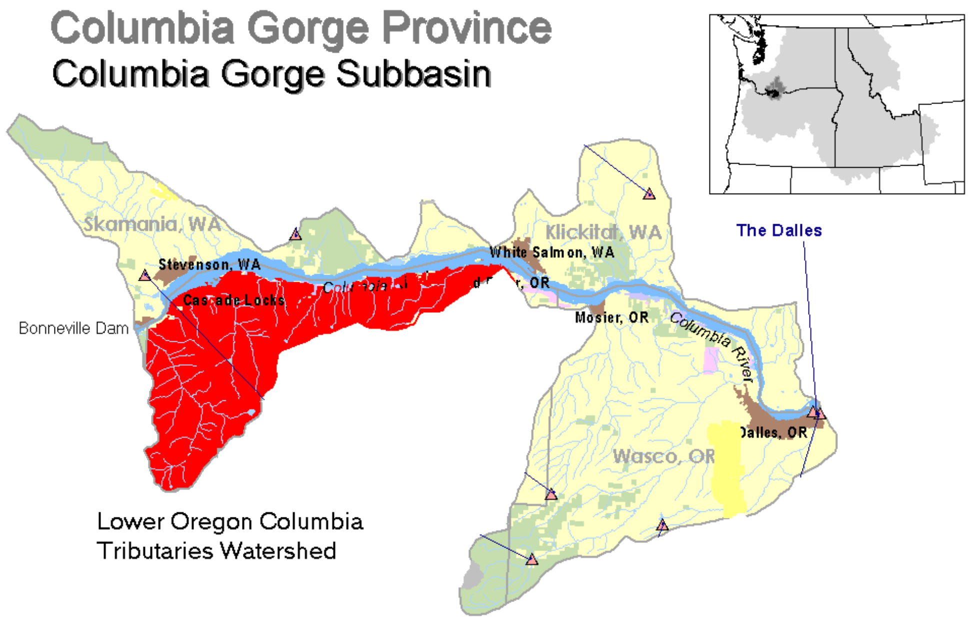

Figure 23. Relation of the Lower Oregon Columbia Tributaries watershed to the Columbia Gorge Subbasin.

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

<u>**Historic and Current Artificial Production:**</u> 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 RM 0.8-2.8 RM 2.8-4.3 RM 4.3-4.8	1994	2.4 9.5 8.1 14.6	0 26.9 29.8 12.5	3% 5% 7% 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.

<u>Evidence Supporting Hypothesis B</u>: 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).

<u>Working Hypothesis C</u>: 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.

5 Inventory of Existing Activities

This Chapter evaluates existing legal protections, projects, plans, and activities against actions needed to address the limiting factors for native fish and wildlife populations identified in the Assessments for the both Hood River Subbasin and the Lower Oregon Columbia Gorge Tributaries.

5.1 Existing Legal Protection

This section describes legal protections that apply to specific geographic areas or waterways such as stream buffers, land use ordinances, conservation designations, or water resources protection.

- Land Protection Status Analysis

The results of a GIS analysis using Land Protection Status map data prepared by the Northwest Habitat Institute (NWHI) for the subbasin planners are shown in Table 38. Analysis results are presented by land cover type are provided in Appendix C, Table 1.

Table 38. Overall percentage of land in each Land Protection Status category based on NWHI map layers and definitions (www.nwhi.org/ibis).

Planning Area	High	Medium	Low	None
Hood River Subbasin	11	0	45	44
Lower Oregon Columbia Gorge Tributaries	51	2	33	14

The following definitions are used by NWHI to determine land protection status:

High: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management. *Note: This category includes designated federal Wilderness.*

Medium: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

Low: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally listed endangered and threatened species throughout the area. *Note: NWHI includes Forest Service and County-owned forest lands here.*

None: No known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout. *Note: NWHI includes all private-owned land.*

- Hood River County Zoning Ordinance

The Zoning Ordinance implements policies of the County Comprehensive Land Use Plan (amended March 2004) that identifies areas zoned as forest land and where protection articles apply (Appendix A, Map13). Zoning especially relevant to fish and wildlife includes:

a) Article 35- Natural Area Zone (NA) is designed to protect identified natural areas by allowing only uses that will not adversely impact or destroy the Natural Area. Timber, mining, and farm uses including buildings are permitted conditional uses subject to approval criteria.

b) Article 44 – Floodplain Zone (FP) is for the protection of life and property from natural disasters and hazards. Key section is Section 44.55 (C) Water Course Setbacks, which states that all buildings shall be set back 100 feet from the ordinary high water line except for water-dependent uses.

c) Article 43 – Environmental Protection Zone (EP) is for protection and maintenance of soil stability, water quality, watersheds, natural drainage areas, fish and wildlife habitat, and natural areas. Low intensity recreation, agriculture, and irrigation water uses are allowed, as are utilities and road crossings provided floodplain alteration does not occur or compliance with Article 44 is met. Other development may be allowed if a finding is made that the proposal complies with conditions including approval by a registered engineer, geologist or architect.

d) Article 45 – Geologic Hazard Zone (GH) identifies existing or potential geological hazards and related precautions or development restrictions.

e) Article 75 - National Scenic Area Ordinance has additional requirements for protection of wetlands, streams, and natural areas.

f) Article 42- Stream Protection Overlay Zone became effective in March 2004 with passage of Ordinance No. 253, and regulates land use within a 50-foot buffer zone along all fish bearing streams except the Hood River, where 75-foot buffers apply (Appendix A, Map 3). Native vegetation removal is prohibited inside the buffer with certain exceptions. Activities on farm or forest zoned lands regulated by the Forest Practices Act are exempt, as are agricultural activities regulated under State Senate Bill 1010. Activities along fishless streams were not addressed. The article helps meet county obligations under the DEQ Hood Basin TMDL and the Statewide Planning Goal 5 for Natural Resources.

- Riparian Areas Protected under the Oregon State Forest Practices Act

OAR 629-Division 600 to 680 and ORS 527 regulates commercial timber production and harvest on state and private lands. It establishes riparian management area widths of 50, 70 and 100 feet on fish bearing streams depending on stream size and where specific vegetation retention standards apply.

- USFS Northwest Forest Plan Riparian Reserves

The Aquatic Conservation Strategy (ACS) in the *Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species*

Within the Range of the Northern Spotted Owl (1994) set forth Riparian Reserves on National Forest lands with widths of 300 feet slope distance from either side of the stream channel on all fish-bearing streams, 150 feet on perennial non fish-bearing streams, and 100 feet along intermittent streams, small wetlands, and unstable areas (Appendix A, Map 3). Activities inside the reserves must not prevent or retard attainment of ACS objectives. Timber harvest is allowed only where thinning or other harvest measures help attain ACS objectives. The Riparian Reserves offer the most comprehensive riparian habitat protection in the subbasin.

- <u>Designated Wilderness Areas</u>

Approximately 22,000 acres of the Hood River Subbasin on the north upper slopes of Mt Hood are within the federal Mt Hood Wilderness, encompassing numerous glaciers and headwaters of the West and Middle Fork Hood River, and part of the East Fork Hood River. About 32,099 acres are included in the Mark Hatfield Wilderness in the Lower Oregon Columbia Gorge planning area. These areas are withdrawn from timber harvest. Management goals are to preserve and perpetuate wildlife, solitude, watershed protection, scenic, and related values.

- <u>Designated Drinking Water Watershed Areas</u>

Approximately 4,000 acres of National Forest in the headwaters of Dog River are within The City of The Dalles Municipal Watershed. Human access restrictions and timber harvest controls protect drinking water quality under 1912 and 1972 agreements with the USDA Forest Service, which benefits wildlife and water quality on the affected lands.

- <u>Columbia River Gorge National Scenic Area Act</u>

One of the purposes of the 1986 Scenic Area Act is to protect and enhance natural resources including fish and wildlife. The lower 3 miles of the Hood River and its adjacent canyon walls are inside the Scenic Area boundaries and proposed land use is subject to review by the Forest Service to insure consistency with the Scenic Area Management Plan. The Scenic Area Management Plan includes protection standards for sensitive wildlife and plant species buffer zones, riparian and wetland buffer zones.

- <u>Hood River Agricultural Water Quality Management Area Rules</u>

OAR chapters 603-095-1100 to 1160 established rules as directed under State Senate Bill 1010 that apply to agricultural activities in the subbasin. These rules address streamside vegetation in 603-095-1140(2): " *…agricultural activities must allow the establishment, growth and maintenance of vegetation along streams. Vegetation must be sufficient to control water pollution by moderating solar heating, minimizing streambank erosion, filtering sediments and nutrients from overland flows, and improving the infiltration of water into the soil profile. The streambank should have sufficient vegetation to resist erosion during high streamflows, such as those reasonably expected to occur once every 25 years"*; and waste management in 603-095-1140(3): *"…no person shall violate any provision of ORS 468B.025 or 468B.05".* The latter refers to existing state statutes addressing waste discharges, including that no person shall *"cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means"*.

▪ Water Resources Protection

Instream water rights are established at 7 locations in the Hood River Subbasin and in Lindsey Creek (Table 39). OAR 690-033-0115 through 690-033-0140 limits new water appropriations between April 15 to September 30 for the purpose of consistency with the Columbia River Basin Fish and Wildlife Program. ORS 538.200-210 names 11 streams forming waterfalls near the Columbia River Highway as withdrawn from appropriation, although vested and riparian rights are not affected (State Water Resources Board, 1965). Minimum instream flow requirements are included as federal or state hydropower license conditions at 3 subbasin locations: (1) Below Clear Branch Dam: minimum flow is 3 c.f.s. May 15 - August 31; 15 c.f.s. September 1-15, and 30 c.f.s. September 16 until reservoir refill; (2) Green Point Creek: minimum flow is 20 c.f.s. October 15 - December 31, and 40 c.f.s. January 1 - April 15; (3) Hood River below Powerdale Dam: 140 c.f.s. January-December; 220 c.f.s. February-March; 250 c.f.s. May-October; 220 c.f.s. November.

Table 39. Instream water rights established by the State of Oregon in Hood River County.

Instream Water Rights in the Hood River Subbasin (Cubic Feet per Second)											
Location	**OCT**	**NOV**	**DEC**	**JAN TO MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**Priority Date**
Hood R. below Powerdale Dam	45 100	45 100	45 170	45 270	45 270	45 170	45 130	45 100	45 100	45 100	9/22/65 11/3/83*
W. Fork Hood R	100 195	100 255	100 280	100 150	100 255	100 255	100 255	100 150	100 180	100 176	9/22/65 12/6/91*
Lake Branch	35.7	67	67	67	168	113	66.9	44.8	38.6	37.1	2/6/91
E. Fork Hood R. abv M. F.	150	150	150	100	150	150	150	100	100	100	11/3/83
Neal Creek	20	20	13	13	20	20	20	13	13	5	11/3/83
Dog River	7.79	14.7	12	12	20	20	20	12	7.01	6.05	12/6/91
M. Fork Hood R.	10	10	10	10	10	10	10	10	10	10	9/22/65
Lindsey Cr (Gorge)	3.1	6.7	7.3	13 15.3 15.7	16.2	7.8	3.2	1.6	1.3	1.8	12/6/91

**Flows listed include flows established by earlier dated instream water rights.*

▪ Special Area Angling Restrictions

The Oregon Fish & Wildlife Commission closed the Hood River above Powerdale Dam to all salmon and steelhead angling in 1998 to protect threatened steelhead and bull trout, and closed the West Fork Hood River to all angling to maximize protection of juvenile and adult steelhead. Special angling regulations are in effect in Laurance Lake to protect bull trout. The Columbia River Inter-Tribal Fisheries Enforcement (CRITFE) monitors tribal fisheries and enforces fishing regulations in the Columbia River between Bonneville and McNary Dams.

- Oregon Removal-Fill Law

Oregon Division of State Lands, under Removal-Fill Law (ORS 196.795-990) and the U.S. Army Corps of Engineers, under Section 404 of the Clean Water Act, regulate the removal and filling of materials in wetlands and waterways. Under state law, permits are required for projects involving 50 or more cubic yards of material in wetlands and streams. Permit applications are reviewed by ODFW and may be modified or denied based on project impacts to fish. Projects that may affect ESA-listed species require consultation with NOAA Fisheries or the US Fish and Wildlife Service to insure compliance with the Endangered Species Act. The Oregon Removal-Fill Law requires a permit for most removal and fill activities in areas designated by the state as essential indigenous salmonid habitat (http://statelands.dsl.state.or.us). Essential salmonid habitat is defined as the habitat necessary to prevent the depletion of native salmon and trout species during their life history stages of spawning and rearing. The designation applies to species listed as Sensitive, Threatened or Endangered by a state or federal authority.

5.2 Existing Plans

Current plans in the Lower Oregon Columbia Gorge and in the Hood River Subbasin that specifically and directly address local fish and wildlife populations are summarized below. Plans are categorized by the headings of Land Use, Water Resources and Watersheds, or Fish and Wildlife.

Land Use

- Hood River County Comprehensive Land Use Plan

Amended in March 2004, the Comprehensive Plan guides land use on private and County-owned lands in the subbasin in accordance with statewide goals and requirements, with oversight from the Land Conservation and Development Commission. The Hood River County Comprehensive Plan consists of the: 1) County Policy Document; 2) County Comprehensive Plan Map; 3) Zoning Map, and Zoning and Subdivision Ordinances; 4) Background Reports; and 5) Exceptions Document. Pertinent policy goals are to a) Conserve open space and protect natural and scenic resources, b) Conserve and/or preserve fish, wildlife, and their habitat areas, and c) Insure protection and provision of adequate habitat for wildlife species native to the area.

- Northwest Forest Plan and Mt. Hood Forest Plan

Land allocation, management standards, and guidelines are specified in *Mt. Hood National Forest Land and Resource Management Plan* (USFS 1990) and the *Northwest Forest Management Plan Standards and Guidelines for Management of Habitat for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern*

Spotted Owl (1994). The Northwest Forest Plan includes an Aquatic Conservation Strategy to maintain and restore the health of watersheds and aquatic ecosystems on public lands. Components riparian reserves, key watersheds, watershed analysis and watershed restoration, are designed to operate together to maintain and restore the productivity and resiliency of riparian and aquatic ecosystems on federal lands. All existing and proposed USFS management activities in the subbasin are designed to meet ACS objectives. The West Fork Hood River is designated a Key Watershed in the Plan.

- Columbia River Gorge National Scenic Area Management Plan

The CRGNSA Management Plan (Columbia River Gorge Commission and USDA Forest Service, 1992) is implemented by the USFS and the Columbia Gorge Commission to insure that land use is consistent with the Scenic Area Act. The lower 3 miles of the Hood River are in the Scenic Area boundary. Proposed land use is subject to review by the County and the Gorge Commission for consistency with the Management Plan, elements of which address fish and wildlife habitat protection. [summary needed here].

Water Resources and Watershed Plans

- Powerdale Hydroelectric Project Interim Operations and Decommissioning Plan

An interagency Settlement Agreement was submitted to FERC regarding PacifiCorp-owned Powerdale Hydroelectric Project FERC No. 2659 (PacifiCorp et al., June 2003). Key provisions include dam removal in 2010 and partial removal of flowline structures, and interim measures to improve habitat conditions for listed and other fish. Interim measures include minimum instream flow increases from May-November in the Hood River below the dam, and an April 15-June 30 annual diversion shutdown to protect fish in lieu of fish screen replacement. Hydroelectric water rights will be transferred to an Instream Water Right pursuant to ORS 543A.305. Approximately 500 acres of land along the lower Hood River and a $154,000 land stewardship fund (2003 dollars) will be transferred to a yet-to-be-named public agency or land trust for the purpose of preserving fish and wildlife habitat and maintaining low-intensity recreation access. If no suitable landowner is found by 2012, then Pacificorp may sell the land. A working group of state, local, and tribal representatives was formed to resolve the lands transfer issue.

- Oregon Plan for Salmon and Watersheds

Approved by the Oregon legislature in 1997, Oregon Plan for Salmon and Watersheds and the 1998 Steelhead Supplement outlines a statewide approach to ESA concerns based on watershed restoration, ecosystem management, coordination among state agencies, and local solutions to protect and improve salmon and steelhead habitat. The Oregon Watershed Enhancement Board provides grant funds and technical support for the Hood River Watershed Group and others to help implement the Oregon Plan locally.

- Hood River Watershed Action Plan (HRWG, 2002)

A 5-year Watershed Action Plan was developed by the Hood River Watershed Group, a voluntary conservation organization made up of irrigators and water districts, landowners, and federal, state, local, and tribal government agencies. Plan development was sponsored by the Oregon Watershed Enhancement Board, irrigation districts, and the

Tribes. The Action Plan identifies projects, strategies, and priorities to improve water quality and fish populations based on a 1999 Hood River Watershed Assessment. Measures address fish passage, stream flow restoration, water quality, habitat protection and restoration, and public awareness using cooperative partnerships. In its first year of implementation 18 of a total 67 projects were completed. Plan goals are to (1) protect stream reaches in good condition; (2) restore stream reaches in degraded condition but have the potential for high-quality habitat, and impacts and opportunities are known; (3) collect data to monitor trends or fill information gaps; and (4) educate the public about watershed stewardship and best management practices.

- Western Hood Subbasin TMDL & Water Quality Management Plan (Department of Environmental Quality, 2001)

The TMDL (Total Maximum Daily Load) and Plan addresses stream temperatures that exceed water quality standards in the subbasin. The Plan describes strategies to achieve temperature TMDL allocations and attainment of water quality standards.

Table 40. Proposed measures to meet TMDL load allocations and management agencies designated by DEQ for implementation (B. Lamb, DEQ, 2004).

Management Agency	Key Management Measures to Meet TMDL	Timeline or Mechanism
City of Hood River	Riparian corridor vegetation protection	Implementation Plan due by June 31, 2004
Hood River County	Riparian corridor vegetation protection	Implementation Plan due by June 31, 2004
Middle Fork Irrigation District	Reservoir water quality management plan to control temperature impacts of Laurance Lake	Data collection through spring, 2004; computer modeling and development of plan to occur after that time
Oregon Dept. of Agriculture	Riparian corridor vegetation protection	Agricultural Water Quality Management Area Plan and Rules (2001), subject to biennial review
Oregon Dept. of Transportation	Road maintenance and construction, stormwater practices	Statewide NPDES MS4 waste discharge permit (2000) and Road Maintenance Water Quality and Habitat Guide (1999)
ODF	Riparian vegetation protection, forestry best management practices	Forest Practices Act
BPA	Transmission system vegetation management	BPA Transmission System Vegetation Management Program Final Environmental Impact Statement (2000)
USFS	Riparian reserves and other riparian vegetation protection	Mt. Hood National Forest Plan (1990) and Northwest Forest Plan (1994)
DEQ	NPDES wastewater permits and 401 Certifications	Renewal of permits and re-certification of 401 projects

- Hood River Agricultural Water Quality Management Area Plan (ODA et al, 2001)

Under State Senate Bill 1010, a local advisory committee, the Oregon Department of Agriculture, and the Hood River SWCD identified strategies and best management practices to reduce agricultural pollution. OAR chapters 603-095-1100 to 1160 established Area Rules adopted in the plan that apply to agricultural activities (see Legal Protection). Recommended best management practices address runoff, soil erosion, pesticides, irrigation, and riparian vegetation. The SWCD is the local implementing agency. ODA is responsible for enforcement of the Area Rules. Plan review occurs every 2 years, including a DEQ review to assess success in meeting TMDL and other goals.

- Water Conservation and Management Plans: Water Conservation Plans promote efficient use of the state's water resources and future supply planning. Farmers Irrigation District *Water Conservation and Management Plan* (1995) and *Sustainability Plan* (2000) outline objectives and opportunities for the irrigation system serving the west side of the subbasin, including instream flow and watershed restoration projects. This Plan proposes construction of a fully piped collection system and distribution network to replace remaining open canals and ditches. A goal is to increase streamflow in Green Point Creek and the Hood River through system and on-farm efficiency improvements, while maintaining adequate water supply for agriculture and hydropower generation at the district's 2 small hydro plants. Future increases in irrigation demand will be met through efficiency gains rather than increased storage or diversion, and conserved water will be left instream. Specific goals are to improve metering, modify reservoir storage, enhance fish screen facilities, educate water users, maintain and enhance agency interaction, restore watersheds, and develop conservation incentive programs. The Middle Fork Irrigation District and East Fork Irrigation District are drafting conservation plans for approval by the Oregon Water Resources Department.

Fish and Wildlife Plans

- Bull Trout Recovery Plan

A Bull Trout *Salvelinus confluentus* Draft Recovery Plan, Chapter 6, Hood River Recovery Unit (U.S. Fish and Wildlife Service, 2003) was prepared with input from a local working group, and many of its elements have been incorporated into this subbasin plan. The overall goal for bull trout in the Hood Recovery Unit is to increase their population stability and potential for long term persistence to the point where they are no longer likely to become an endangered species in the foreseeable future. Four objectives addressing distribution, abundance, habitat, and genetics are established to accomplish this goal. Prioritized tasks are identified to target water quality, upland habitat, research and monitoring, fish passage, interactions with nonnative fish, harvest and incidental angling mortality, and educational needs, and recovery criteria are established.

- Hood River Subbasin Salmon and Steelhead Production Plan

Initial planning for the current hatchery supplementation, habitat protection and restoration was developed as part of Columbia Basin System Planning (ODFW and CTWS, 1990). BPA is funding this plan and related activities in the ongoing Hood River Production Program jointly implemented by ODFW and CTWS. Activities in support of this plan were initiated in 1991 and capital facilities completed in 1999.

- Hatchery Genetics Management Plans

Regional federal, state and tribal fishery managers are collaborating to adopt Hatchery and Genetic Management Plans (HGMP) for anadromous fish artificial production programs by March 2004. Hood River Subbasin HGMPs for spring chinook, native summer and winter steelhead, and Skamania/Foster summer steelhead were provided in electronic form to the NWPPC as part of this subbasin plan. The goal is to ensure that production activities comply with the ESA, and identify reforms to reduce risks to naturally spawning populations and improve survival of natural and artificially produced fish. Reforms include hatchery modifications intended to better define and achieve production and harvest objectives not necessarily related to ESA. Congress mandated that NWPPC review all artificial production facilities and programs in the Columbia Basin. The Council's Artificial Production Review and Evaluation (APRE) is in progress. The HGMP process will take into account APRE recommendations and agreements made in the US v Oregon proceedings.

- Fisheries Enforcement Plans

Oregon State Police and ODFW develop annual action plans to focus enforcement effort in specific areas and to resource priorities identified by ODFW. These areas have included Herman Creek, Laurance Lake, West Fork Hood River, and Hood River below Powerdale Dam.

- Fishery Management Evaluation Plan

The Hood River Fishery Management Evaluation Plan (FMEP) (Oregon Department of Fish and Wildlife, 2003) was prepared for NOAA Fisheries to ensure that sport harvest activities comply with the Endangered Species Act and to identify reforms to reduce risks to naturally spawning populations and improve survival of naturally produced steelhead. The Hood River FMEP specifies that ODFW shall maintain the angling regulations currently in effect for the Hood River, because the existing regulations do not appreciably reduce the likelihood of survival and recovery of listed steelhead in the Hood River. The monitoring and evaluation tasks specified in the FMEP will assess the catch of wild fish, fishery mortality, the abundance of hatchery and wild fish, and angler compliance. NOAA Fisheries and ODFW will review the FMEP at a specified interval to evaluate whether the FMEP objectives are being met.

- Hood River Habitat Protection, Restoration and Monitoring Plan

This Plan (CTWSRO 2000) was prepared by the Confederated Tribes of the Warm Springs Reservation in support of tribal fisheries goals. Based on watershed assessment and federal watershed analysis reports, the Plan identified primary habitat needs as (1) improved fish screening and fish passage at water diversions; (2) improved instream habitat structure and diversity; and (3) improved water quality and riparian conditions. The Plan outlines projects and strategies to protect existing high quality habitat, correct known fish survival problems, and improve natural production capacity to meet HRPP goals. Many of the Plan's approaches have since been incorporated into the Hood River Watershed Action Plan (HRWG, 2001).

5.3 Existing Management Programs

This section identifies public or private management programs that have a significant effect on fish, wildlife, water resources, riparian or upland areas.

- Hood River Production Program (HRPP)

The HRRP is a major BPA-funded program initiated in 1991as a mitigation measure for Columbia River hydrosystem impacts on anadromous fish. It is jointly implemented by CTWSRO and ODFW. The program consists of supplementation, research, monitoring, evaluation, and habitat improvements. Capital facilities located in the subbasin are the Powerdale Dam fish ladder trap and the Parkdale Fish Facility. Broodstock are collected at the Powerdale Dam Fish Trap and held at the Parkdale Fish Facility. Incubation and rearing occurs primarily at facilities on the Deschutes River. Spring chinook, summer steelhead and winter steelhead smolts are acclimated at 4 upriver sites and released annually. Monitoring and research includes migrant fish trapping, life history data collection, creel surveys, spawning surveys, electrofishing, radiotracking, and genetic sampling. Habitat projects have included riparian fencing, fish passage, irrigation ditch to pipe conversion, water quality monitoring, habitat assessment, and watershed council support. A detailed review of the HRPP was completed in 2003 for BPA by S.P. Cramer and Associates (Underwood, K. D. et al, 2003) and recommends specific program modifications.

- Oregon Department of Fish and Wildlife Programs

ODFW is responsible for protecting and enhancing fish and wildlife and their habitats for present and future generations. ODFW monitors and regulates sport fish harvest and hunting in the subbasin, assists agencies and the public in reviews of forest practices, fill-removal permits, land use proposals, habitat plans, and restoration activities. ODFW and CTWSRO jointly implement the BPA-funded Hood River Production Program. ODFW maintains offices in The Dalles and offers cost assistance for landowners for fish screens. Harvest and habitat management in the subbasin is guided by ODFW policies and federal and state legislation. ODFW policies and plans applicable to the subbasin include the Natural Production Policy (OAR 635-07-521 to 524), Wild Fish Management Policy Native Fish Conservation Policy (OAR 635-007-0502 to 635-007-0509, Oregon Guidelines for Timing In-Water Work to Protect Fish and Wildlife Resources (ODFW 1986) and Hood River Subbasin Salmon and Steelhead Production Plan (ODFW & CTWSRO 1990) and Natural Resource Damage Assessment Procedures (ORS 468B.060 and OAR 635-410-0000 to 0030).

- Confederated Tribes of the Warm Springs Reservation of Oregon Programs

The CTWSRO implements programs in the subbasin to protect and enhance treaty fish and wildlife resources and habitats for present and future generations. Tribal members have federally reserved treating fishing and hunting rights pursuant to the 1855 Treaty with the Tribes of Middle Oregon and affirmed in United States v. Oregon 1974. CTWSRO co-manages fish and wildlife with ODFW, and jointly implements the Hood River Production Program, where it acts as the program lead for habitat-related projects and plans. In addition, CTWSRO reviews development proposals affecting treaty fish and wildlife resources in the subbasin.

- Oregon State Forest Practices Program

The Oregon Department of Forestry enforces the Oregon Forest Practices Act (OAR 629-Division 600 to 680 and ORS 527) regulating commercial timber production and harvest on state and private lands. The OFPA contains guidelines to protect forests and streams in forest management activities including road maintenance, road construction, chemical application, slash burning, timber harvest, and reforestation.

- US Forest Service Programs

The Hood River Ranger District in Parkdale works with the Mt Hood National Forest (MHNF) and Region 6 to implement forest plans and activities including fire, recreation, and forest management, road maintenance, fish and wildlife habitat restoration and protection, watershed analyses, and public education on federal lands. As funds and staffing allows, it provides technical or financial assistance on projects on non-federal lands, and participates in local partnerships and the Watershed Council. Stream surveys and wildlife inventories are conducted on federal lands in the subbasin. Forest management plans specify a forest road density goal of under 2.5 miles per square mile designed to protect wildlife and this is assumed to protect aquatic habitat as well. Several roads have been closed to reduce sedimentation and others obliterated. As funding allows, the USFS upgrades road drainage systems to reduce sediment runoff and landslide potential. Hydrologic recovery goals control cumulative risks of timber harvest activities on aquatic habitat such as aggravated rain on snow flood damage (USFS 1996a and 1996b). The MHNF budget has declined sharply in recent years.

- Department of Environmental Quality Water Quality Program

With oversight from the US Environmental Protection Agency, DEQ is responsible for implementing the 1972 Clean Water Act and enforcing water quality standards to protect aquatic life and other beneficial uses. DEQ administers the Clean Water Act through a number of programs, including the 303(d) List of impaired water bodies which is submitted to EPA every two years, the National Pollutant Discharge Elimination System permit program, and the development of TMDLs for water bodies included on the 303(d) List. Oregon Department of Agriculture has the lead enforcement role in agricultural water quality violations and implementation of TMDLs on agricultural lands. DEQ provides technical assistance, low-cost loans, and grants in the subbasin. DEQ maintains an ambient water quality monitoring site at the Hood River mouth, and has conducted mixing zone studies of fruit packing plans, wastewater treatment plants, and other point source discharges for NPDES program compliance.

- Enforcement of Angling and Hunting Regulations

Oregon State Police (OSP) enforces fishing and hunting regulations in the subbasin with special attention to ESA-listed salmonids through covert and overt patrols, and routine checks for licenses, tags, bag limits, weapon/gear type, area, season, and other regulations. Two Fish and Wildlife Law Enforcement Officers are based in Hood River, one of which is funded by the Oregon Plan for Salmon and Watersheds. The officers are part of a regional team of 7 covering a 5-county area. The Columbia River Inter-Tribal

Fisheries Enforcement (CRITFE) monitors tribal fisheries and enforces fishing regulations in the Columbia River between Bonneville and McNary Dams.

- Oregon Water Resources Program

The Oregon Water Resources Department (OWRD) regulates water use in the subbasin. OWRD acts as trustee for instream water rights issued to the state and held in trust for the people of the state. The Hood Basin Program and its amendments classify surface and ground water permitted uses, can establish preferences between uses, may withdraw water from future appropriation and reserve water for specific uses. Guidelines for appropriation (ORS 537) determine the maximum rate and volume of water that can be legally diverted.

- Endangered Species Act Programs

The U.S. Fish and Wildlife Service administers the Endangered Species Act (ESA) for listed species including spotted owl, bull trout, and bald eagle in the Hood River. NOAA Fisheries administers the ESA for listed anadromous fish including steelhead and chinook in the Hood River. These agencies prepare recovery plans for listed species. NOAA Fisheries hopes to use subbasin plans as the foundation for the freshwater habitat components of ESA recovery plans for salmon and steelhead. ESA consultations and requirements are imposed at a programmatic level for agency activities or a project-specific level where federal permits or funds are involved, or impacts to Essential Fish Habitat (EFH) may occur.

- Hood River Soil and Water Conservation District Programs

The Soil and Water Conservation District (SWCD) operates through a locally-elected Board of Directors and conducts activities to promote conservation and best management practices on private lands. The SWCD is the local management agency for the Hood River Agricultural Water Quality Management Area Plan pursuant to State Senate Bill 1010. It administers the OWEB small grant program, and is the fiscal sponsor for the Hood River Watershed Group (HRWG), a voluntary watershed council organization made up of landowners, agriculture, agencies, tribes, business, environmental, sports fishers, and other interests. The HRWG facilitates public awareness and cooperative partnerships to address resource issues in the subbasin. Its mission is to *"sustain and improve the Hood River watershed through education, cooperation, and stewardship."*

- Natural Resource Conservation Service Programs

The NRCS provides technical assistance to agricultural landowners in the subbasin and distributes federal cost-share funds to improve environmental practices and assist agricultural production, and provides technical support to the Hood River SWCD. The NRCS currently employs a District Conservationist in Hood River to develop farm conservation plans, provide engineering support, and implement federal programs for resource protection and restoration on agricultural land. The main NRCS landowner cost-share program in the subbasin is the *Environmental Quality Incentives Program.*

- Hood River District Integrated Fruit Production Program

The Integrated Fruit Production (IFP) program promotes the economical production of high quality fruit using ecologically sound methods and minimize side effects and use of agricultural chemicals. This is a continually developing industry education program that covers orchard planting, fertilizer, soil, and irrigation management methods, spray application efficiency, integrated pest management, and the packing and marketing of tree fruit. It is implemented through the Hood River Grower-Shipper Association and the OSU Mid-Columbia Agricultural Research and Extension Center.

- Oregon State University Extension Service Hood River Program

This program in part maintains an Extension Horticultural Agent located in Hood River County to assist landowners, growers, and other groups with agricultural best management practices while conducting related research. The Agent provides critical assistance to the NRCS, the SWCD, the Watershed Council, growers, and the public.

- Hood River County Noxious Weed Control Program

Currently 23 invasive plant species are targeted for control or eradication by the County Weed and Pest Department, which controls noxious weeds, combining biological controls, herbicide use and mechanical mowing or removal. Hood River County serves as a coordinating agency and contracts with BPA, State Parks, Oregon Department of Transportation, and the U.S. Forest Service to control noxious weeds in the subbasin.

- Oregon Department of Transportation Routine Road Maintenance Program

ODOT road maintenance activities in the subbasin follow its Water Quality and Habitat Guide (ODOT, 1999) and it conducts related monitoring, employee training, and reporting. This program helps ODOT to fulfill its commitment to the Oregon Plan for Salmon and Watersheds by (1) maintaining and improving its roadway structures to facilitate the passage of salmon, and (2) ensuring that road maintenance activities have minimal impact on salmon bearing streams and sensitive areas. The program has been approved by NOAA Fisheries under the 4(d) rule. Activities are coordinated with ODFW, NOAA Fisheries, and other agencies as required.

- Bonneville Power Administration Powerline Corridor Vegetation Management

The Big Eddy-Ostrander transmission line traverses the subbasin from Bald Mountain to Lolo Pass in a 946 acre of right-of-way of 425 feet average width. Vegetation control methods include chain saw, mechanical mowing and hand-applied herbicide sprays. Herbicide is not allowed on the National Forest, so BPA manually cuts plants every 2 years. Since a 2000 EIS review, BPA has adopted an integrated vegetation management policy seeking to establish low-growing, native plant communities under power lines.

5.4 Existing Restoration and Conservation Projects

This section describes restoration and conservation projects completed since 1998 and earlier projects of special significance. This information is organized by limiting factor or ecological process and is displayed in maps, tables, or narrative text. Monitoring, research, and evaluation activities are briefly described as well.

Most of the projects completed since 1998 address resource needs or limiting factors that were identified in earlier subbasin assessments (USFS, 1996a and 1996b; HRWG, 1999).

- Fish passage and/or screening at dams, diversions, and road crossings
- Instream habitat structure and riparian function
- Water quality (temperature, sediment, nutrient enrichment, and pesticides)
- Instream flow restoration below diversions
- Reduced forest road density for wildlife and sedimentation

The Oregon Watershed Restoration Inventory database indicated that $2,010,996 was spent on 33 restoration projects reported in the Hood River subbasin between 1996 and 2002. Over half the projects were road, riparian, and instream habitat improvements. The OWEB database does not include forest service projects. In 2002 and 2003, a sum of $7.2 million in local, state, and federal funds was committed to initiate or complete 30 out of 67 projects identified in the Hood River Watershed Action Plan (HRWG 2002). Project costs have ranged from $250 for a streamcare education brochure to $3.5 million to convert an open irrigation ditch to a pipeline. The majority of Action Plan projects addressed water quality and fish passage.

The unnumbered tables on the following pages summarize on-the-ground habitat improvement projects categorized by the primary ecological process or limiting factor addressed, i.e., fish passage; instream and riparian function; water quality, and flow restoration. The locations of completed projects are shown in Appendix A, Map 4.

Hood River Subbasin Projects Summary

Limiting Factor / Ecological Process: Fish Passage						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Fish screen	Farmers Canal Fish Screen – Hood River (RM 11.0)	Farmers Irrigation District	2002	BPA OWEB FID NFWF USDA -FS	Improves survival of downstream migrant fish from 2/3 of subbasin, at significant (80 c.f.s.) water diversion	Early tests found no injury or delay of migrants, facility testing and annual fish salvage & monitoring in canal continuing
Fish screen	East Fork Irrigation District Diversion Fish Screen - East Fork Hood River (RM 8.6)	East Fork Irrigation District	1996	FEMA EFID	Critical to survival of steelhead produced in East Fork above diversion	Facility performance good. Annual fish salvages show declining entrainment into canal below the screen.
Fish Screen	Dee ID Canal West Fork Hood River (RM 6.0)	ODFW	1999	ODFW	Improved survival of downstream migrant spring chinook and summer steelhead.	Screen constructed to NMFS specifications, and believed to function effectively.
Fish Screen and Upstream Passage	Rock Weirs and Screen - Teiman Cr (RM 1)	ODFW HRWG	2003	OWEB Landowner BPA	Watershed Action Plan measure to improve habitat quality, passage, landowner awareness in lower East Fork Hood tributaries	Juvenile and adult fish passage restored over small private irrigation diversion dam.
Upstream Passage	Upper Teiman Cr Bridge (RM 3.6)	HR County Forestry	2003	OWEB	Replaced undersized culvert as part of area sediment control project	Cutthroat trout juvenile & adult passage restored between well utilized habitats, flood transport capacity increased under road
Upstream Passage	Pinnacle Cr Bridge (RM 0.07) Pinnacle Cr Culvert Removal (RM 1.2)	USFS	2001 1999	USFS	Part of bull trout recovery actions around Laurance Lake Reservoir	Upstream passage improved at all reservoir elevations Upstream passage for all life stages of fish restored

Limiting Factor / Ecological Process: Fish Passage						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Upstream Passage		USFS		USFS	Part of bull trout recovery actions around Laurance Lake	
Upstream Passage	Powerdale Dam Fish Ladder Attraction Hood River (RM 4)	Pacificorp	1998	Pacificorp	High priority fish passage remediation site	Fish ladder attraction appears to be good, with exception on radial gate operations.
Fish screen (operational change)	Powerdale Dam Seasonal Diversion Shutdown Hood River @ RM 4	Pacificorp	Initiated in 2003	Pacificorp	In set of interim measures in the FERC Powerdale Hydroelectric Project Interim Operations and Decommissioning Plan	Migrants protected from entrainment. Voluntary cessation of power generation between 4/15 and 6/30 annually
Dam Removal (3)	Evans Cr Fish Passage & WQ Improvement @ RM 1.6, 3.2, 5.0	Middle Fork Irrigation District	1998 -2003	BPA OWEB	Evans Cr is a high priority for passage remediation. Project compliments bridge at RM 0.9	Information not yet available
Upstream Passage	Lower Evans Cr Bridge @ RM 0.9	CTWSRO	2003	BPA OWEB	Highest priority culvert barrier for remediation in high priority Evans Cr	Juvenile and adult anadromous passage fully restored & flood capacity increased
Upstream Passage	Tony Cr @RM 0.75	CTWSRO	1999	BPA	Interim low-cost action in creek identified as a priority for fish passage remediation	Project needs review to determine effectiveness for juvenile migration
Trap & Haul	Clear Branch Dam	Middle Fork Irrigation District	1996	MFID	Part of bull trout recovery actions around Laurance Lake	No fish passed to date. Poor attraction or predation suspected. Investigation ongoing
Spillway Improvement	Clear Branch Dam	Middle Fork Irrigation District	1992	MFID	Effort to address spillway design problem and fish passage	Effectiveness uncertain, as no comprehensive tests were conducted
Upstream Passage	Punchbowl Falls Fish Ladder Maintenance – West Fork Hood R. @RM 0.1	CTWSRO	annually	BPA	Insures ability of spring chinook & steelhead to access prime spawning habitat	Continued good performance of facility with storm debris removal from ladder entrances

Limiting Factor / Ecological Process: Fish Passage						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Fish screens (10)	10 headwater streams in West Fk & Hood R	Farmers Irrigation District	1995-2000	FID	Led to further innovations by FID of horizontal screen designs	These are resident trout or fishless streams; some screens need upgrades
Fish Screen and Upstream Passage	Phoenix Pharms Trout Ponds Baldwin Cr @ RM 1.3	ODFW	2000	ODFW	Watershed Action Plan measure to improve habitat quality, passage, landowner awareness in lower East Fork Hood tributaries	Facilities appear to function as designed
Upstream Passage	Meadows Creek culvert replacement	USFS	2002	USFS	Also prevents future road washout	open bottom arch culvert installed after washout

Limiting Factor / Ecological Process: Instream and Riparian Function						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Floodplain Restoration	Robinhood Cr Levee Setback	USFS	1999	USFS	Addresses need to restore channel/floodplain interaction.	Flood capacity and interaction with floodplain increased
Large Woody Debris Placement & Riparian Plantings	Green Point Creek Restoration	Farmers Irrigation District	1994 and 2000	OWEB USFS	Improves habitat quality for steelhead in reach where further flow restoration is planned	6600 cedar plantings at 90% survivals. Cabled '94 LWD improved habitat. '00 LWD still in place but awaits flood scour to create desired effects. Physical monitoring only.
Floodplain Restoration & Side Channel Reconnection	Upper Clear Branch Restoration	USFS	2000	USFS	Addresses need to restore habitat diversity, including slow water habitats. Part of bull trout recovery actions	2 miles and 30 acres restored. Large increase in bull trout using the treated section of mainstem channel and increasing trend in the old growth side channel.
Side Channel Reconnection	Lower East Fork Hood River	ODFW	1999	ODFW BPA	Addresses need to restore habitat diversity, including slow water habitats	Year-round flow restored to a 3500 ft long abandoned channel 2 steelhead redds found in restored channel in 1999, 5 redds in 2000.
Large Woody Debris Placement	Lake Br; Upper East Fork Hood River, West Fork, McGee Cr	USFS	1983-2003	USFS BPA	Addresses need to restore habitat diversity, including slow water habitats	Over 12 miles treated with addition of in-channel and floodplain large wood. Later projects more effective due to lessons learned
Wetland Protection	Baldwin Cr Wetland Easement/ Perimeter Fence at Miller Road	HRWG CTWSRO	2001	Mt Hood Meadows Ski Resort, Inc. DEQ BPA	Watershed Action Plan measure to improve habitat quality, passage, landowner awareness in lower East Fork tributaries	Chronic wetland disturbance, including periodic ditching eliminated. Monitoring not included in project scope
Large Woody Debris Placement	West Fork Hood R	Longview Fibre Company	1999	Longview Fibre Company	Addresses need to restore habitat diversity, including slow water habitats	Treated 3,000 feet of stream, installing 5 structures 90 pieces of LWD. Monitoring needed
Large Wood Placement & Volun. Rip. Tree Retention	Laurel Creek, Greenpoint Cr	Longview Fibre Company	2001	Longview Fibre Company	Addresses need to restore habitat diversity, including slow water habitats	Monitoring not included in project scope

Limiting Factor / Ecological Process: Water Quantity / Flow Regime						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Streamflow Restoration	Powerdale Dam Hydroelectric Project Hood River Minimum Instream Flow Requirements @ RM 4	Pacificorp	2003	Pacificorp	Mitigation measure in the FERC Powerdale Dam Interim Operations and Decommissioning Plan, TMDL	April – November minimum instream flows increased by a maximum of 150% in 3 mile bypass reach (see Appendix)
Streamflow Restoration	Increased return flow/powerhouse discharge just above Powerdale dam – Hood River @ RM 4.05	Farmers Irrigation district	1994-2003	Farmers Irrigation district	Related to voluntary irrigation system efficiency improvements and on-farm water conservation programs	April - October Minimum powerhouse discharge increased to 20-25 cfs from only 12 cfs in 1993
Streamflow Restoration	East Fork Hood River below East Fork ID diversion	East Fork Irrigation District	1996-2003	East Fork Irrigation District	Result of voluntary irrigation system efficiency improvements in subbasin	Channel dewatered in 1994, since then a minimum 20-30 cfs maintained through 2001 and 2003 droughts
Streamflow Restoration	Steelhead incubation flow augmentation below Clear Branch Dam	Middle Fork Irrigation District	1998- present	Middle Fork Irrigation District	Result of voluntary irrigation system efficiency improvements in subbasin, steelhead recovery	Incubation survival improved for steelhead Flow augmented in excess of 3 c.f.s. minimum requirement by 15-20 c.f.s for up to six weeks in May and June

Limiting Factor/Ecological Process: Water Quality						
Project Type	Name	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Forest road decommissioning	Clear Branch Watershed Restoration	USFS	2000	USFS	Help restore riparian areas, reduce sedimentation, reduce wildlife harassment. Part of bull trout recovery actions	2 miles decommissioned
Forest road closures	Clear Branch Watershed Restoration	USFS	2000	USFS	Same as above	3.5 miles closed
Forest road decommissioning	Various sites	USFS	1996-2003	USFS	Help restore riparian areas, reduce sedimentation & wildlife harassment.	Approximately 50 miles of road decommissioned throughout the basin.
Campsite relocation	Various sites	USFS	1996-2003	USFS	Same as above	Two campsites relocated out of the riparian area
Forest road obliteration and improvements	Upper Teiman Cr	Hood River County	2001	Hood River County	Help restore riparian area and reduce sedimentation	¼ mile native soil road bed ripped up, mulched and replanted with conifers
Forest road reconstruction and improvements	Upper Neal Cr, West Fork Hood R., Greenpoint Cr & Ditch Cr	Longview Fibre Company	1998 2001 2002	Longview Fibre Co.	Help reduce sedimentation	Road surface drainage improved, peak flow passage capacity improved
Bridge and road improvement	Greenpoint Creek Bridge		2000 2001	Longview Fibre Co.	Help reduce sedimentation	Road surface drainage improved, peak flow passage capacity improved
Ditch to pipe conversion	Evans Creek Fish Passage and Water Quality Improvement	Middle Fork Irrigation District	2003	OWEB BPA USDA-FS	Watershed Action Plan measure to eliminate interbasin transfer of glacial silt	Glacial sediment input eliminated. Results to be evaluated for streambed fines, turbidity, benthos
Livestock Fencing & Riparian Plantings	Various sites	CTWSRO HRSWCD USFS	1996-2003	OWEB BPA	Watershed Action Plan measure to improve riparian habitat and agricultural water quality, TMDL	5.12 miles treated. Plant survivals good where maintenance occurred.
Miscellaneous agricultural water quality projects	Various sites – piping, plantings, drainage, erosion control, manure management	HRSWCD NRCS	1998-2003	NRCS OWEB	Watershed Action Plan measure to improve riparian habitat and agricultural water quality, TMDL	Projects begin to address multiple nonpoint pollution sources. Long term monitoring needed to verify improvements.

Columbia Gorge Tributaries Projects Summary

Project Type	Project Name/ location	Lead Entity	Year Completed	Funding Source	Relationship to other subbasin activities	Effectiveness or Outcome
Adult and juvenile fish passage, wildlife crossing, monitoring	Culvert replacement /Perham Creek at I-84 crossing	ODOT	2002	FHWA	Compliments other fish passage improvements; part of bridge safety upgrades	Restored access to 1/4 mile of anadromous habitat for cutthroat, coho, steelhead, chinook. Spawning by cutthroat, steelhead, and coho was observed after project completion. Monitoring will continue through 2005.
Adult and juvenile fish passage, monitoring	Culvert retrofit /Viento Creek at I-84 crossing	ODOT	2002	ODOT	Compliments other fish passage improvements.	Restored access to ½ mile of habitat for cutthroat, coho, and steelhead. Spawning by steelhead and coho observed after project completion. Monitoring to continue through 2005.
Noxious weed control	Routine roadside maintenance	ODOT	1998-present	ODOT	Compliments other noxious weed control activities	Removal of noxious weeds in the highway clear zone, reseeding with locally adapted grasses to prevent weed invasion.
Road Stormproofing	Hood River County Roads	USFS	2003	USFS Payco	Road drainage improvements to reduce sediment and restore more natural flow regimes	6 miles of road was treated to improve drainage by increasing culverts sizes and armoring fill and surfaces to reduce erosion
Large Wood Debris Placement	Eagle Creek	USFS	2000	USFS	Addresses need to restore habitat diversity	Habitat complexity increased by addition of in-channel and floodplain large wood
Road Decommissioning	Wyeth Bench	USFS	2001	USFS	This action will help restore riparian areas, reduce sedimentation, reduce wildlife harassment.	3 miles of road was decommissioned
Fish Screen Improvement	Herman Creek Oxbow Hatchery Intake Screen	ODFW	2002	ODFW USFS	Improves juvenile survival/connectivity in downstream direction	Screen upgraded to meet state and federal criteria, upstream passage not fully addressed

Water Quality Monitoring

Water quality monitoring has been conducted throughout the subbasin under a variety of different programs.

- *DEQ Ambient Monitoring*: DEQ maintains an ambient monitoring site at the mouth of the Hood River. This site has generally been monitored every other month for a variety of biological and chemical parameters since 1993.

- *DEQ Mixing Zone Studies*: DEQ has conducted periodic mixing zone studies of fruit packing and wastewater treatment plants, and other point source discharges for the purpose of Clean Water Act/National Pollutant Discharge Elimination System (NPDES) program compliance. Studies have been conducted in Lenz, Neal, Odell, McGuire, Wishart, and Trout Creeks and the East Fork Hood River.

- *DEQ TMDL Monitoring*: DEQ conducted intensive baseline monitoring at 39 sites in the subbasin during 1998 for TMDL development. Sites were monitored for a variety of biological and chemical parameters during one week in June, August and October.

- *Stream Temperature Monitoring*: Continous temperature data has been collected at up to 60 sites since the early 1990s by the USFS, CTWSRO, HRWG, Mt. Hood Meadows Ski Resort, and irrigation districts. Data is collected to identify trends and the effectiveness of TMDL implementation and ongoing restoration projects.

- *Laurance Lake Reservoir Temperature Study*: Middle Fork Irrigation District initiated this study in 2003 with DEQ and OWEB funds to address TMDL load allocations for the reservoir. Temperature, flow and weather data collection continues at sites in the lake, in Clear Branch, and in Pinnacle Creek. A computer model developed at Portland State University will be used to evaluate reservoir management options to reduce warming in the reservoir and heat discharges to Clear Branch Creek.

- *Pesticide Monitoring*: Pesticide monitoring and bioassay studies in Hood River tributaries were conducted from 1999 to 2003 by DEQ and Oregon State University in consultation with the Hood River Grower-Shippers Association. The purpose has been to identify baseline conditions and to gage the effectiveness of pesticide best management practices. Future monitoring depends on funding availability.

- *Additional Baseline Studies*: Temperature, bacteria, and nutrients are monitored in streams as resources allow by the Hood River Watershed Group in consultation with DEQ. The County Health Department occasionally measures bacterial contamination in surface waters, most recently in 1999.

Biological Monitoring

Various monitoring activities for fish and wildlife populations are carried out by ODFW, CTWS, Forest Service, volunteer organizations, and others. ODFW, CTWS, and USFS conduct annual spawning surveys for anadromous fish and juvenile and adult surveys for bull trout.

Culvert and Road Surveys

The Hood River County Forestry Department completed a forest road hazard inventory in 2000 to identify fish passage, sedimentation, and drainage improvements needed in the county forest road system. In 1998, the Oregon Department of Transportation and ODFW completed a culvert fish passage survey on public non-forest roads. The survey identified 46 culverts for remediation, with 18 culverts ranking as a medium priority and the remainder as a low priority. A 2001culvert survey by the Mt Hood National Forest identified 52 culverts for remediation. Fish passage remediation in the subbasin was prioritized geographically based the “old” 6th HUC subwatersheds (Asbridge, G. et al., 2002). ODFW inventoried small private and public diversions and pumps to assess upgrades needed to meet screening criteria (ODFW, 1999).

Wildlife Survey Activity	Locations	Lead Entity	Duration or Frequency
Bald Eagle Mid-Winter Survey	Columbia River	ODFW	1979- Present
Bald Eagle Nest Site Survey	Columbia River Gorge	US Forest Service	1982- Present
Black Swift Survey	Hood River and Gorge subbasins	American Bird Conservancy	2003- Present
Breeding Bird Survey	Hood River Subbasin	US Geological Survey	1969-1995 and 2002-Present
Carnivore Snow-Tracking & Camera-Set Surveys	Hood River Subbasin	US Forest Service	1996- Present
Christmas Bird Count Survey	Columbia River Gorge	National Audubon Society	1988- Present
Common Nighthawk Survey	Hood River Breeding Bird Survey Route	Local Volunteer Biologist	2002- Present
Deer and Elk Radio Telemetry	Hood and White River Management Units	ODFW	1997- Present
Harlequin Duck Brood Surveys	Hood River and tributaries	US Forest Service	1998- Present
Northern Spotted Owl Nest-Site Occupancy	National Forest	US Forest Service	1988 - 1994
Peregrine Falcon Nest-Site Survey	Columbia River Gorge	US Forest Service	1990- Present
Hawk Watch/ Raptor Fall Migration Survey and Banding	Bonney Butte	HawkWatch International, Inc.	1998- Present
Terrestrial Mollusk & Salamander Surveys	National Forest	US Forest Service	1996- Present
Sandhill Crane Breeding Surveys, & Nestbox Monitoring	Mt. Hood National Forest	US Forest Service	1988 - Present
Amphibian Surveys	Mt. Hood National Forest	US Forest Service	1988- Present

5.5 Gap Assessment of Existing Protections, Plans, Programs and Projects

This section evaluates gaps in projects or activities needed to address the limiting factors or threats to fish and wildlife populations identified in the assessment. The gaps were determined by evaluating the extent to which limiting factors or threats have been addressed or eliminated by the projects, legal protections, plans, and programs described in this chapter.

Fish Passage and Habitat Connectivity: Fish passage has been restored at numerous sites however a number of high priority fish passage projects affecting listed steelhead and bull trout remain to be completed.

Instream habitat structure, floodplain and riparian function and processes : Available information indicates that woody debris placement in riparian and instream areas, especially projects completed in the last 5 years, have been effective in assisting physical processes needed to restore and improve habitat structure, including pools and hiding cover for fish. The EDT model suggests that increasing habitat diversity would have a strong effect on fish production. Additional stream reaches are in need of treatment or evaluation. The County floodplain ordinance and stream protection overlay zone may not sufficiently prevent incompatible development in natural channel migration areas along the East Fork Hood River. Portions of the East Fork Hood River are subject to channel avulsion, debris flows, and frequent channel changes. The East Fork Hood River channel migration zone was partially mapped by Hood River County Planning Department. Development in floodplains has sometimes been allowed if criteria including certified engineer approval is met. County stream corridor and riparian vegetation standards apply to fish bearing streams only and do not address vegetation protection on non-fish bearing and intermittent streams. Vegetation removal along these smaller channels will affect downstream areas in the fish bearing portions of streams.

Water Quality: While many projects have been and continue to be completed, nonpoint source pollution occurs at dispersed sites over time and is a continuing effort. Resources for continued pesticide monitoring and agricultural extension programs are needed.

Instream Flow Restoration: Opportunities exist to return water instream by continuing to assist irrigation districts in converting open ditches and canals to pipe, and to promote on-farm and user efficiency through technology and education. Field data has not been collected recently about the instream flow needs of fish in the Hood River subbasin . Existing instream water rights were established several decades ago. Since that time, instream flow assessment methodologies have evolved a great deal. Instream flow field studies would help gage the adequacy of existing instream water rights or future flow restoration targets based on field data collection. Resources are needed to continue voluntary instream flow restoration below diversions.

More information is needed to quantify the amount of water being diverted by non-water system users to insure that legal limits are not being exceeded and that opportunities to eliminate waste are acted upon. Most domestic and irrigation water systems report their diversion or consumption amounts. Although private irrigators use small amounts of water relative to the public systems, most private users divert or pump from the small streams where the effect may be significant. Water conservation plans are not completed by all districts and water providers. Conservation is not actively promoted except by the largest irrigation districts and agricultural organizations. Smaller water and irrigation systems have limited resources to commit to these purposes, or their water rights substantially exceed current use levels and conservation planning is considered a low priority.

Wildlife Habitat Protection and Monitoring: Legislated changes in Oregon's Land Conservation and Development Commission periodic review requirements no longer require Hood River County local governments to update Statewide Planning Goal 5 requirements to inventory and protect wildlife habitat and wetlands. As part of Goal 5 periodic review, a wildlife habitat and wetland inventory was prepared for the City of Hood River and included lands located inside the urban growth boundary (Joel Shaich, PWS, Wetland Consulting, Portland, OR) but protection standards for these habitat areas were not adopted. A lack of current wildlife habitat information on non-federal lands is a significant gap since areas of high biodiversity exist outside of the MHNF, and many of these areas face development. Such information would help in long range planning, in development reviews, and in voluntary strategies including conservation easements or acquisitions to maintain wildlife populations and diversity. Similarly, the only other wetland information available is limited to the 1984 National Wetland Inventory that is viewed as non-comprehensive, and may prevents identification of opportunities to protect or restore other potentially significant wetland habitats. The Hood River County Comprehensive Plan includes policy goals such as *"conserve and/or preserve fish, wildlife, and their habitat areas"* and *"insure protection and provision of adequate habitat for wildlife species native to the area"*, but it is uncertain how effectively these goals are being met, particularly for wildlife. Continued development in the forest zone and other undeveloped natural areas likely will result in habitat loss, fragmentation, disturbance, and other impacts to wildlife. No mechanism is in place to monitor whether state or local natural resource policy goals are being met over time as additional development occurs.

Education and Awareness of Wildlife Habitat: There is a gap in awareness and education about needs and opportunities to maintain or improve wildlife habitat in rural residential properties. The loss of historic conifer forest to agriculture and development has resulted in a net loss of shelter for resident birds and mammals, especially in winter, at elevations under 2,500 feet. Missing in many rural residential properties are damaged live trees, standing dead trees, and large downed trees that supply nesting cavities, scanning perches, and insect-feeding substrate for birds and other wildlife.

Land Conservation Strategies for Important Habitat Areas: No voluntary conservation, acquistion, or incentive programs or plans address preservation of remaining high-value low elevation wildlife habitat or migration corridors in critical habitat areas such as Hood River Mountain/Old Dalles Road, Middle Mountain, Fir Mountain, and the Whiskey Creek drainage. No site-specific wildlife mitigation projects have been funded by BPA in the Hood subbasin. Voluntary opportunities exist for private and public landowners, regional land trusts, local governments, and local non-profit organizations to work together to acquire, enhance, restore, or protect significant wildlife habitat areas. Opportunities will diminish over time if no action is taken.

Coordinated Plan for Forest Fuels Reduction: Wildfire hazard and forest fuels reduction planning needs to be addressed in a coordinated manner for all land ownerships, with adequate consideration of wildlife habitat needs as well as forest health, prevention of catastrophic watershed damage, and protection of life and property. The potential to mimic the effects of natural wildlife on forest communities using thinning and other techniques can be examined.

Coordinated Plan to Minimize Recreational Impacts to Wildlife: Increasing use and demand for forest and back-country recreation require a coordinated plan for multiple ownerships that addresses erosion and stream sedimentation, trail proliferation, and wildlife disturbance. Recreation use of forest roads, trails, shorelines, and backcountry areas is rising with regional population growth, tourism, the proliferation of new forms of recreation, and technological advances in recreation equipment and vehicles. Access to publicly-owned lands is a large part of the appeal of the Columbia River Gorge area. In recent years, county and private forest lands have experienced significant increases in both motorized and non-motorized trail use, including unauthorized construction of trails, stream crossings, and ramp structures. Trail and off-trail backcountry use on National Forest lands have increased at the same time. There is a need to involve wildlife biologists, land managers, local communities, recreation groups and businesses, environmentalists, and elected officials in developing a Columbia Gorge-wide plan to identify the needs of wildlife and to manage trail, backcountry, and shoreline recreation activities and developments in a manner that is sensitive to wildlife populations. The goal of such a plan would be to have and enjoy recreational opportunities that are compatible with the long term maintenance of healthy wildlife communities. Concerns about diminishing USFS budgets to maintain trails and facilities and manage recreation impacts. Impacts to wildlife from chronic recreational disturbance may range from direct mortality, habitat loss or degradation, to changes in behavior including avoidance and displacement from breeding and foraging habitat, habituation or changes in distribution leading to conflicts with humans, or attraction to humans as a source of food (www.montanacws.org). Access to certain areas may need to be controlled spatially or seasonally to minimize disturbance to wildlife and fish habitat, and insure that wildlife can continue to utilize historic forage and breeding areas. Moving recreation activities back from lake and stream shorelines could further improve conditions (USFS 1998).

Forest Management and Maintenance: Appropriated funds for forest road maintenance on National Forest lands have declined over the last 10 years in part because of declining timber sales. It is estimated that the Mt Hood National Forest is underfunded by more than 50% ($2 million in needs vs. $800,000 budget) to maintain the current road network to full objective maintenance-level standards.

Additional Resources for Knotweed Control: As of May 2004, 28 sites with Japanese knotweed have been identified in Hood River County. A multi-year inventory and control effort is needed to keep knotweed from infesting and taking over fish and riparian wildlife habitats in the planning area.

Public Awareness of Local and Regional Fish and Wildlife Efforts: There is a need to improve awareness, education, coordination, and communication between local communities and agencies regarding the goals of the Columbia Fish and Wildlife Program, ESA, CWA, NWFP, NSAMP, and Oregon Plan for Salmon and Watersheds. A large proportion of the public is unaware of the goals or existence of these programs.

6. Hood River Subbasin Management Plan

This Chapter presents a vision that describes goals or desired future conditions for the subbasin. It also proposes measurable biological objectives for the recovery and protection of focal species, and prioritized strategies to meet the objectives based on limiting factors for focal populations described in the Assessment in Chapter 3. The planning horizon for this Management Plan is 10-15 years.

The Ecosystem Diagnosis and Treatment (EDT) model was used in the Hood River Subbasin as an assessment tool to evaluate fish habitat conditions. The EDT results were compared to those of earlier assessments, and to observed fish population and life history data collected in the Hood River Production Program and in other ongoing aquatic evaluation efforts.

In general, the EDT results were consistent with prior assumptions and assessments with regard to limiting factors. The EDT baseline model run suggested that the most influential limiting factors for subbasin chinook and steelhead populations were 1) key habitat quantity, 2) channel stability, 3) habitat complexity,
4) flow effects, and 5) fine sediment load. The model also found fish passage, juvenile entrainment and flow effects at Powerdale Dam to be influential in population abundance and productivity for these focal species. Among the six EDT future habitat restoration scenarios modeled, the largest gains in population abundance among the four focal species were achieved by basinwide large woody debris (LWD) restoration, and Powerdale Dam removal including full flow and passage restoration. However, the EDT model results appeared to underestimate the benefits of streamflow restoration for steelhead and spring chinook, based on 1) an analysis of 10 years of steelhead smolt trap data and August-October streamflow records; and 2) a habitat-population modeling effort recently completed for the BPA Hood River Production Program Review. Further, because streamflow assumptions in the EDT flow restoration scenario were based on flow measurements taken on August 8, 1998, typical lower late summer/early fall flow conditions may not have been adequately represented.

For bull trout population-habitat relationships, assessment information from the draft Mt Hood Bull Trout Recovery Plan was used along with local knowledge to develop assumptions about limiting factors for this focal species. Habitat connectivity is a key limiting factor for the bull trout population. In addition, though the EDT model was not run for bull trout because model rules for this species are not yet available, it is believed that many of the other limiting factors identified by the EDT for salmon and steelhead also apply to bull trout.

6.1 Vision for the Hood River Subbasin

An overall goal statement for the Hood River Subbasin was prepared by the Hood River Watershed Group and subbasin planners as follows:

> ***"A watershed where water is abundant, cool, and clean; where natural systems that create and sustain fish and wildlife and their habitat are respected; and where a healthy economy is compatible with healthy native fish and wildlife populations."***

Consistent with the vision for the 2000 Columbia Basin Fish and Wildlife Program, wherever feasible, this vision will be accomplished by protecting and restoring natural ecological functions, habitats, and biological diversity. Where this is not feasible, hatchery supplementation or other methods that are compatible with naturally reproducing fish and wildlife populations will be used. Where impacts have irreversibly changed the ecosystem, efforts will be made to protect and enhance the habitat and species that are compatible with the altered ecosystem.

6.1.1. Human Use of the Environment

Economically and environmentally sustainable agriculture and natural resource use will continue to be the foundation of the community. The high quality of life in the Hood River Valley will be maintained for future generations. Residential, recreation and tourism, and other future land uses and developments will occur with respect for agriculture as well as Oregon land use laws. Tribal treaty reserved fishing and other rights will be honored. The community and those doing business in the subbasin will recognize land stewardship as an important responsibility. Actions taken under this plan will be cost-effective, affordable, and consistent with a sustainable local economy.

6.1.2. Aquatic Species

The Hood River will maintain its current diversity of native anadromous and resident fish species, and restore species such as lamprey that may have been extirpated. Aquatic ecosystems will be protected and where possible, restored, including the natural physical processes that create habitat diversity, and hydrologic connections within stream systems including floodplains, wetlands, upslope areas, headwater tributaries, and intact refuge areas. Fish abundance will be restored to levels that approach the basin's natural productive capacity, and will continue to contribute to sport and tribal fisheries.

6.1.3. Terrestrial Species

Wildlife populations and their existing habitat in the Hood River Subbasin will be protected and improved where appropriate. Wildlife species diversity and viability will be maintained, and the health and integrity of forests, native plant communities, and special habitat areas will be protected and improved. Further extirpations or local extinctions will be avoided. Land use and transportation will insure retention of habitat connectivity among and between forest and riparian areas. Backcountry recreation and trail use will be managed to consider the seasonal or other needs of wildlife species that may be sensitive to disturbance.

Hood River Watershed Action Plan Goals

A 5-year Hood River Watershed Action Plan was prepared in 2002 by the Hood River Watershed Group with broad local and stakeholder participation. Participants included irrigation and water districts, landowners, timber and other business interests, citizens, Confederated Tribes of the Warm Springs Reservation, and local, state and federal agencies involved in resource management. The Watershed Action Plan is part of Oregon statewide strategy to address endangered species and water pollution concerns using locally developed solutions. Action Plan measures and strategies help to address requirements of the federal Endangered Species Act, the Clean Water Act, and related state legislation. The Plan strongly supports or compliments state and tribal fish recovery plans for the Hood River Subbasin and the NWPPC Columbia Basin Fish and Wildlife Program. Numerous aspects of the Plan are being implemented with funding assistance from BPA through the Fish and Wildlife Program. The scientific basis of the Action Plan is based on a watershed assessment prepared in 1999 using the Oregon Watershed Enhancement Board Watershed Assessment Manual focusing on aquatic ecosystems (Watershed Professionals Network, 1998). The Subbasin Plan assessment findings are generally consistent with the limiting factors identified in the 1999 Watershed Assessment Report. Many of the strategies identified in the Action Plan will contribute to meeting biological objectives in the Hood River Subbasin Plan. The 2002 Hood River Watershed Action Plan is being submitted by the Hood River Watershed Group as an electronic file for inclusion and adoption as part of the Management Plan for the Hood River Subbasin. Because of their applicability and relevance, the goals of the Hood River Watershed Action Plan are incorporated into the Hood River Subbasin Management Plan.

2002 Hood River Watershed Action Plan - General Goals:

1) Protect stream reaches in good condition.
2) Restore stream reaches currently in degraded condition but with potential to support high-quality habitat and fish populations – and where impacts and opportunities are known.
3) Recommend ongoing education and awareness projects to educate the public about watershed issues and best management practices for improved stewardship.
4) Recommend further study or data collection as necessary.

2002 Hood River Watershed Action Plan - Specific Goals/Objectives:

A) Promote economically and environmentally sustainable agriculture and natural resource use; preserve the high quality of life in the Hood River Valley for future generations.
B) Reduce contaminants to protect aquatic life, human health, and beneficial uses. Comply with state water quality standards and/or EPA guidelines consistent with natural conditions.

C) Address requirements under the Endangered Species Act. Protect and restore abundance and diversity of native species. Provide improved sport and tribal fishing opportunity.

D) Improve streamflows where opportunities exist to do so, while also protecting existing water rights. Meet instream water rights on streams where these are established. Minimize alteration of natural hydrology. Where feasible, protect and restore the hydrologic functioning of upland, wetland, and riparian areas.

E) Improve fish passage conditions where affected by artificial impediments; protect and restore riparian vegetation; protect remaining natural floodplain areas; restore/enhance aquatic habitat structure; and restore channel interaction with historic floodplains where compatible with existing land use.

F) Promote preservation of native plant communities and viable wildlife populations.

G) Recommend ongoing education and awareness projects to educate the public about watershed issues and promote improved stewardship of land and water.

6.2 Biological Objectives

The Northwest Power Planning Council has defined biological objectives to have two components: (1) biological performance describing responses of focal species to habitat conditions and described in terms of capacity, abundance, productivity, and life history diversity, and 2) environmental conditions needed to achieve the desired biological performance. Where possible, the Council intends biological objectives to be measurable and based on a clear scientific rationale or working hypothesis (NWPPC, 2001).

6.2.1 Aquatic Species

BULL TROUT OBJECTIVES

The following objectives are adopted from the U.S. Fish and Wildlife Service Draft Bull Trout Recovery Plan for the Mt. Hood Recovery Unit (USFWS, 2003) and are based on assessment information from the Recovery Plan and background documents. EDT modeling was not conducted for bull trout because bull trout population modeling rules have yet to be completed.

Biological Performance

BuT-1. Maintain stable or increasing trends in bull trout abundance to contribute the long-term recovery goal criteria of 500 or more adult bull trout in the Mt. Hood Recovery Unit.

Discussion: The current adult bull trout population in the Hood River subbasin is estimated to be around 300. The assumption or working hypothesis is that adult bull trout abundance will increase in response to a set of habitat restoration and other measures, including the Priority 1Tasks under the Draft Bull Trout Recovery Plan. Priority 1 Tasks will be completed in the next 5 years once the Recovery Plan is adopted and funding made available. Priority 1 tasks address critical fish passage barriers, fish screening at water diversions, flow restoration, restoration of channel conditions, improving water temperature, and bull trout ecology/trophic interactions in the Laurance Lake reservoir. Any expected increase in abundance was not predicted given data and modeling limitations. However, the assumption that this set of actions will meet the biological objective can be tested using data from bull trout snorkel surveys at existing long term index areas above Clear Branch Dam through the year 2019 (the next 15 years), and other monitoring methods. Additional performance indices may include the numbers of adult bull trout captured in the Powerdale fish trap until Powerdale Dam removal in 2010, in the Clear Branch Dam fish trap, surveys below the Clear Branch Dam, and possibly creel survey data to estimate incidental catch and release of bull trout in Laurance Lake and in the Hood River. Powerdale fish trap data from 1992-2003 and snorkel survey data from 1996-2003 can serve as a baseline to gauge success in meeting this objective. Additional recovery actions aimed at further life history research and population inventory data will be needed to meet this objective. An added assumption is that population diversity including resident, fluvial, and adfluvial life history forms will be maintained and strengthened. Capacity and productivity estimates were unavailable for bull trout in the Hood River Subbasin.

BuT-2. Conserve bull trout genetic diversity and maintain and expand opportunity for genetic exchange.

Discussion: Connectivity between existing bull trout populations is essential for continued survival and recovery by allowing for the potential of genetic exchange, migratory behavior, and the survival of individuals and re-colonization of areas vacated following stochastic events (USFWS, 2003). The assumption or working hypothesis is that restoring habitat connectivity by eliminating or ameliorating passage barriers to bull trout will ensure opportunities for connectivity within and among local populations of bull trout. Barriers include Clear Branch Dam, irrigation dams, diversion screening and seasonal water quality barriers. Further evaluations are needed to address passage issues at Clear Branch Dam. The fish trap at the base of the dam has not operated efficiently to attract and catch upstream migrants, and little is known about the effectiveness of downstream juvenile passage over the spillway.

BuT-3. Maintain the current distribution of bull trout and expand existing distribution to suitable habitat in the subbasin.

Discussion: Distribution of bull trout is geographically restricted to 2 local populations, the Clear Branch and Hood River local populations. The primary population is in the Clear Branch of the Middle Fork Hood River above Laurance Lake. This population is considered to be at risk of a random extinction event due to low numbers, and isolation (USFWS, 1998). The risk to the 2 existing local populations from catastrophic landslides and other stochastic natural events is further elevated by their narrow distribution, especially given the frequent natural debris flows on Mt Hood, including in Clear Branch and Middle Fork Hood River tributaries where bull trout spawning and rearing is documented. Additional local populations, if they can be established, will help insure the long term persistence of bull trout in the subbasin. The assumption is that by expanding the distribution to the West Fork Hood River or possibly the East Fork Hood River watersheds, the risks to bull trout from stochastic events will be reduced. Recovery actions may lead to better-defined spawning and rearing areas for additional local populations. Further studies and a better understanding of bull trout fidelity to their natal streams are needed to better define local populations in the recovery unit (USFWS, 2003).

BuT-4. Maintain and restore suitable habitat conditions for all bull trout life history stages and life history strategies.

Discussion: The draft Recovery Plan states that bull trout recovery will entail reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access that allows for the expression of various life-history forms.

Environmental Conditions to Achieve Desired Biological Performance
Achieving successful juvenile and adult fish passage connectivity at Clear Branch Dam and other dams and diversions at 95% passage and screening effectiveness or better. Maintaining or restoring healthy upland conditions including low road densities (e.g., <1.7 miles/sq. mile) in bull trout spawning and rearing areas; improving water temperature in Clear Branch below Laurance Lake reservoir to meet the bull trout standard of 52 degrees F. Increasing streamflows by a goal of 20% or more if feasible, especially during critical life stages such as spawning and migration, restoring fully functioning riparian, floodplain and instream channel conditions including side channel development and large woody debris at levels that approach template conditions characteristic to the Hood River. Improved rearing conditions in Laurance Lake include cool water temperatures, an adequate prey base, and natural predation levels. Depending on research results, this may necessitate reducing the abundance of non-endemic fishes present in bull trout habitats including smallmouth bass and brook trout.

COASTAL CUTTHROAT TROUT OBJECTIVES

Biological Performance

CuT- 1: Maintain or increase the abundance of cutthroat trout in the watershed.

CuT-2. Maintain the current distribution of cutthroat trout and restore habitat connectivity where affected by artificial barriers.

Discussion: Given limited information, the population of resident cutthroat in the subbasin is assumed to be stable. Productivity and capacity for cutthroat trout in subbasin streams is unknown. The population of sea-run cutthroat trout in the Hood River Subbasin is known to be severely depressed compared to historic levels based on

Powerdale Dam fish trap data. Poor survival of sea run cutthroat trout is a concern throughout the lower Columbia region, including populations in streams below Bonneville Dam. Out-of-subbasin factors, including conditions at the Bonneville Dam and in the estuarine or near shore marine environment, are assumed to be affecting the survival of sea-run cutthroat from the Hood River Subbasin. However very little life history information is available specific to Hood River fish. Sea-run cutthroat trout behavior and survival in the Lower Columbia River and estuary is under investigation by the USFWS (http://columbiariver.fws.gov/programs/cutthroat.htm) and others. The working hypothesis is that by protecting and restoring cutthroat stream habitat conditions, abundance and carrying capacity for cutthroat trout will be maintained or increased. The assumption is that by restoring habitat connectivity in cutthroat streams, the potential for expression of life history diversity and full utilization of carrying capacity will increase. Progress in meeting these objectives can be measured against baseline electrofishing data 1994 -2002 in resident fish/other index areas; adult and juvenile fish trap data until Powerdale Dam removal in 2010 compared to baseline data from 1992-2004; and future surveys and juvenile migrant trapping after Powerdale Dam removal.

Environmental Conditions to Achieve Desired Biological Performance
Environmental objectives for cutthroat trout include the protection and restoration of fully functioning natural riparian and instream processes in cutthroat trout habitats, including unimpeded corridors that link seasonal rearing habitats and spawning areas. A Qualitative Habitat Assessment (QHA) model ranked streams for protection and restoration values for cutthroat trout in the subbasin. According to the QHA, Bucket, Meadows, West Fork Neal, and upper Clear Branch had the highest rankings for protection while Odell, Indian, and Green Point (for rainbow trout) creeks were among the top priority for restoration. Artificial migration barriers affecting cutthroat trout habitat with high reference ratings for habitat quality are the most important priority for passage remediation.

FALL CHINOOK SALMON OBJECTIVE

Biological Performance

FCh-1. Achieve an increasing trend in the number of adult fall chinook returning to the Hood River by 2019.

Discussion: For the period from 1992 -2003 the annual return of fall chinook to Powerdale Dam has averaged 26 fish, with a range from 6 to 70. EDT baseline model run conducted for the assessment predicted a current fall chinook spawning population of 1,111 without harvest, 0 with harvest, and a historic spawning population of 6,979. The Lower Columbia Technical Recovery Team identified 1,400 as a target population level for fall chinook in the Hood River based on population viability.[1]. These EDT and TRT-identified population levels for fall chinook are considered unrealistically high by

[1] Paul McElhaney, PCC Targets file, untitled, via email from Patricia Dornbush, NOAA Fisheries, Recovery Plan Coordinator.

subbasin planners. The historical fall chinook run in the Hood River is believed to have always been low, although higher than current levels. Area fish managers believe that egg-to-fry and fry to smolt survival is extremely poor for fall chinook in the Hood River due to largely natural factors. Most fall chinook spawning occurs in the Hood River mainstem where high glacial sediment loading and a flashy peak flow pattern leads to poor overwinter incubation survival. Shallow stream margin and off-channel habitats important to emergent and early fry survival are scarce in the mainstem Hood River due natural channel morphology and habitat modification. It is as yet unclear what inputs into the EDT model caused it to overestimate fall chinook production in the Hood River by such a magnitude.

Environmental Conditions to Achieve Desired Biological Performance
The working hypothesis is that natural production of fall chinook in the Hood River will increase as a result of interim mitigation measures at the Powerdale Dam Hydroelectric Project and dam removal in 2010. Interim mitigation measures were instituted in April 2003. The EDT model predicted that Powerdale Dam removal and associated flow restoration would increase the fall chinook spawner population by 55%, and by 140% if combined actions including LWD restoration were implemented ("full restoration build out scenario"). Interim mitigation measures at the Powerdale Dam Hydroelectric Project include an April 15- June 30 diversion shutdown in lieu of fish screen replacement, and an increase in minimum streamflows below the dam in the bypass reach including during the fall chinook return period. After dam removal in 2010, the cessation of sediment sluicing into the bypass reach, elimination of delay and pre-spawning mortality associated with adult passage at the fish ladder, improved passage and reduced predation associated with low bypass reach flows, entrainment of fry and fingerlings into the power canal, and elimination of any pre-spawning mortality or reduced reproductive success are expected to contribute to an increase in fall chinook abundance in the Hood River. The Large Woody Debris scenario consisted of inputting maximum ratings for large wood in key restoration reaches believed to have high instream wood levels under pre-settlement conditions. Subbasin planners caution that the Hood River, being on the east slope of the Cascades, may have had somewhat lesser wood densities than those represented in the EDT model. Nevertheless, the working hypothesis is that increasing instream and riparian large woody debris would result in an increase in habitat carrying capacity for fall chinook.

SPRING CHINOOK SALMON OBJECTIVES

Biological Performance

SCh-1. Achieve an average spawning escapement of 125 natural-origin spring chinook returning to the Hood River by 2014, and an average spawning escapement of 200 by 2019.

SCh-2. Achieve a natural smolt production increase from the current estimated range of 15,700 smolts to 20,000 smolts by 2019. A one percent smolt to adult return will produce the adult objectives in SCh-1.

SCh-3. Achieve and maintain a naturally-spawning spring chinook population made up of a stock that is adapted to the Hood River.

SCh-4. Increase the smolt to adult survival rate of hatchery-reared stock spring chinook.

SCh-5. Provide an annual average harvest of 2,000 spring chinook for tribal and non-tribal fisheries by 2019.

Discussion: Native spring chinook were extirpated from the Hood River by the 1970s. A reintroduction program using spring chinook from the Deschutes River stock was initiated in 1995 under the BPA-funded Hood River Production Program. The goal of the program has been to reestablish a naturally-spawning population and include a harvest component to support tribal and non-tribal fisheries for spring chinook. Tribal and sport harvest opportunity is a priority for spring chinook in the Hood River and will likely depend on continued hatchery supplementation to fulfill harvest needs and reduce pressure on wild populations. Many of the same factors that affect fall chinook have a similar affect on spring chinook, such as glacial sediment, flashy peak fall and early winter flows, and limited distribution, but to a lesser extent since they spawn in the less glacial West Fork Hood River. The current actual wild or natural escapement of spring chinook in the Hood River ranged from 18 to 89 adults between 1992 and 2003, and averaged 54 fish. The EDT model estimated a current spawning population abundance of 197 spring chinook with harvest. Current juvenile carrying capacity was estimated at 54,090 and smolt abundance at 4,920. Actual smolt production estimates from screw trapping ranged from 873 to 1,723 during the period 1995 to 1999, with one exceptional year in 1994, when an estimated 11,745 smolts emigrated from the mainstem (Olsen, in Underwood, K.D. et al., 2003). In a recent HRPP review, an average annual production potential of 15,692 spring chinook smolts was estimated for the Hood River using the Unit Characteristic Method based on habitat conditions in 2003 (Underwood, K.D. et al. 2003). The spring chinook spawning escapement level needed to fully seed available subbasin habitat in that analysis was estimated at 125.

A goal of the supplementation program has been to establish a new spring chinook run in the Hood River that would become adapted over time to the environmental conditions in the Hood River. However, low smolt to adult survival of hatchery smolts, and poor in-basin production from naturally-spawning fish has not significantly increased run size since the program was initiated. A shortage of spring chinook adults returns to the Hood River necessitated the continued use or “backfilling” of Deschutes River broodstock. The shortage has been exacerbated by a high straying rate of Hood River program spring chinook back to the Deschutes River, despite smolt acclimation in the West Fork Hood River, and by health problems in smolts reared at Deschutes Basin rearing facilities. This has impeded progress toward the goal of creating a stock that can be allowed to evolve toward adaptation to the Hood River. The assumption is that there is a genetic component to survival and productivity, and that stocks become adapted to the specific environmental conditions in their native streams. The further assumption is that it is possible, within some range, for a stock from one system to become adapted to a different system over time. The hypothesis is that egg to smolt survival will improve over time and natural production will increase in a broodstock program that uses only wild/naturally produced spring chinook returning to the Hood River, in combination with habitat restoration.

Environmental Conditions to Achieve Desired Biological Performance
The EDT model predicted a smolt increase of 53% and 375% for spring chinook smolts as a result of restoration scenarios Powerdale Hydroelectric Project removal and LWD restoration, respectively. The assumption is that flow restoration associated with Powerdale dam removal in 2010 and interim Powerdale hydropower mitigation measures will improve conditions for adult migration, reduce pre-spawning mortality, and improve outmigration survival of spring chinook. The LWD scenario consisted of inputting maximum ratings for large wood in key restoration reaches believed to have high instream wood levels under pre-settlement conditions. The working hypothesis is that increasing instream and riparian large woody debris will result in an increase in fry to smolt survival for spring chinook by increasing riparian-floodplain interactions and increasing the amount of key habitat including shallow backwaters, and slow velocity margin habitats. These habitats are scarce because habitat diversity and LWD supplies have been greatly reduced by past riparian management practices in spring chinook spawning and rearing areas. Subbasin planners caution that the Hood River, being on the east slope of the Cascade, may have had somewhat lesser wood densities than those represented in the EDT model. The modeling effort included in the HRPP review estimated a 7,500-12,500 increase in spring chinook parr (or 2,625 to 4,375 smolts at 35% parr-to-smolt survival) by restoring 10 cfs of flow at each of the major irrigation diversions as well as returning 250 cfs below Powerdale Dam. The modelers cautioned that given the methods used, this estimate of increased rearing capacity is likely useful only as an order of magnitude reference for flow restoration benefits (Underwood, K.D. et al, 2003). It is assumed that a combination of Powerdale Dam removal in 2010, interim hydropower mitigation initiated in 2003, flow restoration, and restoring habitat structure in the West Fork Hood River will increase habitat carrying capacity, reproductive success, and will lead to higher returns of natural origin spring chinook in the Hood River in the near term (by 2014) and long term (by 2019), especially when implemented together with strategies that address Objectives SCh-3 and SCh-4, and recommended changes in the spring chinook hatchery program detailed in the recent BPA Hood River Production Program 10-year review.

SUMMER STEELHEAD OBJECTIVES

Biological Performance

SSt-1. Achieve and maintain an average wild/natural origin spawning population of 600 adult summer steelhead returning to the Hood River by 2019.

SSt-2. Achieve and increase in habitat carrying capacity from 13,860 smolts to 20,000 by 2019. This assumes a 3% smolt to adult survival to meet the 600 adult objective.

SSt-3. Maintain the unique genetic character of wild summer steelhead in Hood River.

Discussion: Adult returns of wild/natural origin summer steelhead ranged from 79 to 650 fish for the years 1992 to 2003 with an average of 261 fish. The EDT model baseline report predicted a current spawner population abundance of 1,495 without harvest. The EDT predicted a baseline smolt abundance of 47,411 smolts. We believe the EDT estimates are high for summer steelhead. The spawning distribution of summer steelhead is naturally restricted to the West Fork Hood River. An annual average production of 13,860 summer steelhead smolts for the subbasin was estimated by S.P. Cramer and Associates in the Hood River Production Program review using the Unit Characteristic Method (UCM) habitat model and a life cycle model. The summer steelhead spawning escapement level needed to fully seed available habitat in the subbasin in that analysis was estimated at 304. Area fish managers believe that the summer steelhead adult capacity estimated by the UCM is too low as a spawning abundance goal. This is because 304 adults would not likely fully seed all available habitat, and mate selection and pairing would be difficult at the low density of spawners that were estimated by the UCM. The 600 spawner objective in SSt-1 is consistent with the Lower Columbia River Technical Recovery Team Hood River PCC target of 600 summer steelhead spawners by the year 2024, a target that is based on a NMFS-NWFSC population viability model. The summer steelhead rebuilding effort in the Hood River has suffered from low stock productivity due to past introgression with out of basin Skamania stock hatchery steelhead. The change to Hood River-origin-only summer steelhead broodstock in the hatchery supplementation program was recently implemented in 1999. As of 2004, not enough time has passed to assess the survival benefits of the program change in rebuilding the wild Hood River summer steelhead population.

Environmental Conditions to Achieve Desired Biological Performance

The EDT model predicted an increase of 43% in summer steelhead smolt abundance as a result of the “full restoration buildout scenario” scenario, which included fish passage barrier removal, flow restoration, Powerdale Hydroelectric Project removal, and LWD restoration. 39% of the increase was attributed to LWD. Summer steelhead would benefit from increased habitat diversity including more pool habitats for later rearing and holding, and riffles for spawning and early rearing. This population has experienced unscreened diversions in the past, low streamflows, limited pools, the effects of high natural sediment levels, low LWD levels, and a natural distribution limited to the West Fork alone. Increases in summer and fall streamflows are believed to be especially important for summer steelhead. Summer steelhead hold in the Hood River and the West Fork for extended periods prior to spawning, and are exposed to low flow conditions and high stream temperatures during summer and early fall. Based on ten years of smolt trap data, August- October streamflow levels in the Hood River in the first year of rearing are positively correlated with the abundance of 2 year old steelhead smolts (R-squared =. 69) the following year (Olsen, E. 2004, Figure 21 in Chapter 3). However, the EDT model estimated only a 1% increase in smolt abundance in the restoration scenario that increased flows by 20% below all major diversions and by 100% below Powerdale Dam. In contrast, a modeling effort in the HRPP review estimated a 3,500 to 7,000 increase in summer and winter steelhead smolt production in the subbasin by restoring 10 c.f.s. of streamflow at each major irrigation diversion and 250 c.f.s. at below Powerdale Dam. The modelers cautioned that this estimate of benefit was likely inaccurate except as an order of magnitude reference for flow restoration benefits (Underwood et al, 2003).

WINTER STEELHEAD OBJECTIVES

Biological Performance

WSt-1. Achieve and maintain an average wild/natural origin spawning population of 1,100 adult winter steelhead returning to the Hood River by 2019.

WSt-2. Retain the genetic integrity of wild winter steelhead in the Hood River subbasin.

Discussion: Actual adult returns of wild/natural origin winter steelhead to Powerdale Dam ranged from 209 to 1,034 for the years 1993 through 2003, and averaged 529 fish for the same period. The EDT model estimated a baseline spawner population at 1,046. The EDT model estimated a current smolt abundance of 35,975, which is substantially higher than actual smolt production based on screw trap data. An average annual production of 16,970 winter steelhead smolts was estimated for the subbasin using the Unit Characteristic Method (UCM) (Underwood, K.D., 2003). The winter steelhead spawning escapement level needed to fully seed current available subbasin habitat in that analysis was estimated at 712. Due the relatively large amount of available winter steelhead habitat in the subbasin, it is believed this escapement estimated by the UCM is too low to fully seed the available habitat and promote mate selection and pairing. The 1,100 spawner abundance level selected by subbasin planners is less than the Lower Columbia River Technical Recovery Team PCC target of 1,400 for the year 2024 based on its population viability model. Area fish managers believe that an average winter steelhead population of 1,400 may be too high for the subbasin based on habitat modeling in the HRPP review, and stock-recruit data collected by the HRPP. These analyses suggest that less than 1,400 spawners are needed to fully seed available habitat. While it is possible to achieve a 1,400 population level under scenarios of high ocean survival, available juvenile habitat would likely be fully seeded at lower levels.

Environmental Conditions to Achieve Desired Biological Performance

The working hypothesis is that a combination of Powerdale Dam removal in 2010, the interim hydropower mitigation measures initiated in 2003, flow restoration, habitat improvements in the East and Middle Fork Hood River and winter steelhead tributaries will increase habitat carrying capacity, reproductive success, and will increase egg to smolt survival ultimately leading to higher returns of winter steelhead in the Hood River.

The EDT model predicted an increase of 1% to 81% in winter steelhead smolt abundance as a result of different and combined restoration scenarios. The largest gain (58%) was associated with the LWD restoration scenario. An increase in pool habitat area and frequency would benefit steelhead juveniles and adults. Winter steelhead habitat in the subbasin, particularly in the East Fork Hood River and in Neal Creek, is severely lacking in pool habitat and habitat diversity due to past land management, channel modifications, and a lack of channel stability due to natural large-scale events. The least gain predicted by the EDT was a fish passage scenario excluding Powerdale Dam (1%), a 10% flow restoration scenario (1%) and a 20% flow restoration scenario. As with summer steelhead, the EDT model may underestimate the benefit of flow restoration to winter steelhead based on juvenile trap and life history data collected in the Hood River over the last 10 years. Increased streamflow is believed to be very important to winter steelhead in both the East and Middle Fork Hood River and their tributaries. Low flow conditions in the East Fork Hood River in summer and fall appear to cause juvenile winter steelhead to move to downstream areas in the mainstem Hood River where preferred habitats are occupied, or to exit the subbasin. Juvenile migrant trapping indicates that a significant number of winter steelhead presmolts migrate from the East and Middle Fork Hood River to overwinter in the mainstem Hood River, where density-dependent factors may limit survival and production potential. Again, based on ten years of smolt trap data, August-October streamflow levels in the Hood River in the first year of rearing are positively correlated with the abundance of 2 year old steelhead smolts (R-squared =. 69) the following year (Olsen, E. 2004, Figure 21 in Chapter 3). The HRPP review estimated a 10,000 to 20,000 increase in summer and winter steelhead parr in the subbasin by restoring 10 c.f.s. of streamflow at each major irrigation diversion and 250 c.f.s. at below Powerdale Dam. Again, the modelers cautioned that given the methods used, this estimate of increased rearing capacity is likely useful only as an order of magnitude reference for flow restoration benefits (Underwood et al, 2003).

High natural sediment loads decrease potential production especially in the Middle and East Fork Hood River. Improved access as well as riparian function, habitat complexity, and water quality conditions in tributaries are desired to provide juvenile steelhead with refuge areas from debris flows and flood events. Winter steelhead are the focal species whose habitat most overlaps with tributaries affected by water quality degradation. The Neal Creek system is degraded by both increased turbidity and fine sediment caused by an irrigation system that carries glacial silt into the creek, and pesticide contamination from orchard sprays. Improving water quality in Neal Creek and habitat diversity is important as it is the only accessible winter steelhead tributary in the Hood River mainstem.

PACIFIC LAMPREY OBJECTIVES

<u>Biological Performance</u>

PL-1. Restore the historic distribution of lamprey to habitat above Powerdale Dam after dam removal 2010.

Discussion: Lamprey were reported as widespread “throughout the basin” in a 1963 Oregon Game Commission Report on the Hood River (USFS, 1996a), but have not been observed above Powerdale Dam in at least the last decade. Several modifications in the fish ladder configuration at Powerdale Dam occurred between the 1960s and the present, and any effect of such changes on adult lamprey migration are unknown but presumed to have had a detrimental effect on this species. Incidental and limited observations of lamprey have been reported below the dam by local agency fish biologists. However, specialized field surveys for lamprey ammocoetes have not been conducted and the distribution and abundance of lamprey either above the dam or below the dam is uncertain. It will be necessary to collect field survey information for lamprey ammocoetes, including species identification and subbasin distribution above and below Powerdale Dam prior to and after dam removal in 2010. Powerdale Dam may be a migration barrier to adult lamprey as they have not been captured in the fish ladder trap which has been continuously monitored since 1991. Very few adult lamprey have been observed downstream from the ladder, which could indicate that factors other than Powerdale Dam may affect lamprey. At present, the working hypothesis is that lamprey distribution will expand upstream in the subbasin after dam removal.

Environmental Conditions to Achieve Desired Biological Performance
Additional life history information is needed to better understand habitat conditions needed for lamprey passage at Powerdale and condition of available upstream spawning habitat. Fish passage at artificial barriers is well documented as a factor limiting for lamprey populations. The objective is to achieve an unimpeded stream migration corridor in the Hood River so that lamprey have the opportunity to recolonize formerly used habitats in the subbasin. The degree of fidelity of lamprey to natal streams is unknown, along with whether lamprey will actually return to former spawning areas after being extirpated from an area. Other risks to the lamprey population include the degradation of stream habitat including erratic or intermittent flow, decreased flows, increased water temperatures and poor riparian areas, predation in all life stages. Lamprey are particularly vulnerable to pollution and erratic stream flows during their juvenile or ammocoete life stage because of the length of time they reside in the stream substrate.

6.2.2. Terrestrial Species – Biological Objectives

Northern Spotted Owl

1. Continue to help meet Northwest Forest Plan objectives for spotted owl on federal lands that establish or maintain >25% of landscape units in mixed conifer stands as moving towards dominance of old growth and mature forest conditions in appropriate land allocations.

2. Maintain or improve juvenile dispersal habitat conditions on federal lands in low and mid elevations, as defined as tree stands averaging 11to 16 inches in diameter and $\geq$ 40% canopy cover.

3. Maintain or work toward multiple vegetative layers (herbaceous, shrub-sapling, and two tree layers) and promote healthy old-growth and mature forest conditions on federal lands in lower to mid elevations.

4. Retain sufficient habitat components such as live and dead standing and fallen trees with cavities and coarse woody debris in various diameter classes and stages of decay on private and county forest lands where opportunities exist and where consistent with land management objectives.

Black Tailed Deer and Elk
Maintain current summer population objectives for deer and elk consistent with the ODFW goal of 1,500 deer and 400 elk for the Hood Wildlife Management Unit (Hwy 35 to Cascade Crest). Maintain viable migration corridors for deer, elk, and other wildlife to access winter range and other movement purposes. Protect the amount and integrity of winter range available for deer and elk. Maintain a "hunt-able" or harvestable population to control damages to orchards and minimize conflicts with humans.

Lark Sparrow
Protect the amount and integrity of grasslands and oak woodlands used by the lark sparrow. Maintain preferred conditions of scattered shrubs, bunchgrass, saplings and oaks, with vegetation structure as scattered shrub cover at 5-15% and variable grass heights <46 cm. Patch size is >8 hectare. (Source: Altman, Bob. 1999. Conservation Strategies for Westsde Lowlands and Valleys Landbird Conservation Planning Region. Oregon-Washington PIF.)

Clarks Nutcracker
Protect and re-establish viable populations of white-bark pine. Where ecologically appropriate, initiate actions in white-bark pine habitats to maintain or provide >30% trees in late-successional stage with >10% cover in early-succession stages (seedlings and saplings).

Western Gray Squirrel
Maintain prairies, wetlands, oak woodlands, and continuous cover in variable-age conifer forests. Oak-conifer forests are transitional communities that require continued management for their maintenance. Western grays preferr larger stands (> 0.8 ha) closer to water (<600 m). Control invasion of Scotch broom, retain native plant species, reduce the invasion by Douglas-fir, invading grasses, and lessen the amount of brush in oak woodlands in order to allow oaks to regenerate. Retaining some coarse woody debris provides moist microhabitat for fungi, an important food item. Lastly, manage road locations, speed limits, and density carefully in these areas to reduce squirrel mortality.

6.3. Prioritized Strategies

Proposed habitat protection and restoration strategies to meet the biological objectives for the focal fish and wildlife species are listed in the section below. These strategies are intended address the limiting factors and issues identified in the assessment for all species. In the next section, species- specific strategies for focal fish species are provided, including harvest and hatchery-related strategies to help meet the objectives.

6.3.1 Aquatic Species

PRIORITY 1 HABITAT RESTORATION STRATEGIES

The assessment indicates that the following 4 restoration strategies will lead to the largest gains in abundance of the focal species, especially when implemented together. Where appropriate, strategies will be implemented according to the geographic priorities identified in the assessment.

Powerdale Interim Operation and Decommissioning Agreement

The implementation of the Powerdale Hydroelectric Project Interim Operation and Decommissioning Agreement is a key strategy to achieve biological objectives for all species. This is included by default as a high priority strategy, and will be funded by PacifiCorp as part of FERC requirements. Interim measures including increased minimum flow releases and a spring diversion shutdown to protect migrants began in April 2003. The dam is scheduled for removal in June 2010 after which the dam site will be restored to a pre-dam river morphology, and the hydropower water rights will be transferred instream according to the relevant state statutes.

Flow Restoration

The flow restoration strategy seeks to increase summer and fall instream flows that are available for fish while protecting human water uses, principally through partnership projects that increase irrigation system and user efficiency and reduce waste. The strategy consists of 1) continued conversion of open ditches and canals to pipe and mutually acceptable agreements with irrigation districts that instream flows will benefit from water savings; 2) Education, technical and financial assistance to promote water conservation awareness and efficiency measures on farms, pastures, and urban/residential lands; 3) Improve metering, measurement, and monitoring capabilities and correct excessive irrigation water system pressures where they exist; 4) Help insure that legal water right amounts are not exceeded and that water uses are authorized; 5) development and implementation of water conservation plans by water providers including the Farmers Irrigation District Water Conservation and Management Plan (1995) and Sustainability Plan (2000); and 6) Restore healthy watershed hydrologic conditions (floodplain and riparian storage, wetlands, mature forest canopy, low road density) where feasible to slow runoff, promote aquifer recharge, and increase summer stream flows

Large Woody Debris Restoration

As a single action, the EDT model predicted the largest gain significant gains from restoring LWD to the Hood River subbasin as a way to increase habitat diversity and key habitat quantity. This strategy would use EDT reach data and other information to identify historic locations of high wood densities. Evaluate opportunities and constraints to LWD placement at each site. Plan and implement projects that treat floodplain and riparian areas as well as instream areas. Wherever possible, use whole trees and rootwads and avoid use of cable or anchoring. Develop a monitoring plan to assess effectiveness in increasing habitat diversity, complexity, and amounts of key habitats for focal species life stages.

Habitat Connectivity

This inclusion of this strategy as a high prrority is driven in part by the Bull Trout Recovery Plan, but it believed that it will benefit the focal species habitat modeled by EDT more than the model results may indicate, particularly when implemented together with other Priority 1 strategies. This strategy consists of the following types of activities: Implement actions to reconnect aquatic habitats now disconnected by structures that interfere with upstream or downstream migration and full utilization of fish habitat. Assist Middle Fork Irrigation District in a cooperative partnership arrangement to improve upstream and downstream passage at Clear Branch Dam. Work with irrigation districts and others in a cooperative partnerships to upgrade or install fish screens on remaining unscreened or inadequately screen water diversions in the subbasin, conduct fish passage evaluations if needed, and insure upstream passage at push up and other dams. Continue to work with Hood River County Public Works Department and ODOT on culvert replacement using geographic priorities developed in the Watershed Action Plan.

PRIORITY 1 HABITAT PROTECTION STRATEGIES

The following protection strategies are essential to meet biological objectives over the long term. Where appropriate, strategies will be implemented according to the geographic priorities identified in the assessment.

Protection of Riparian and Floodplain Function

- Prevent the spread of Japanese knotweed by supporting and actively assisting Hood River County Weed and Pest Department and others in a multi-year inventory and eradication campaign.
- Promote awareness and implement projects designed to protect and establish system potential riparian vegetative communities. Conduct and support educational activities to increase awareness and enforcement of state and local land use, Statewide Planning Goal 5 riparian corridor protection, and timber harvest rules designed to protect riparian forest stands, and encourage voluntary actions to restore habitat where opportunities exist.
- Encourage Hood River County to amend its floodplain ordinance to include channel migration zones on the East Fork Hood River. Implement projects in the Hood River Watershed Action Plan that address floodplain confinement and function, particularly along State Highway 35.

Protection and Improvement of Water Quality

- Assist the East Fork Irrigation District to complete Central Canal Pipeline to eliminate the historic use of Neal Creek to carry turbid glacial irrigation water.
- Implement water quality management plans outlined in the Western Hood Subbasin Total Maximum Daily Load study (ODEQ 2001), including County stream corridor protection ordinance, the Forest Practices Act riparian standards, and Northwest Forest Plan riparian reserves.
- Support and assist outreach, research and implementation activities by the Hood River Grower-Shipper Association, Oregon State University Extension and Mid-Columbia Agricultural Research and Experiment Center, and DEQ aimed at improved pesticide, fertilizer, irrigation, and other orchard practices
- Apply the Hood River Agricultural Water Quality Area Management Plan (ODA 2000) and rules (OAR 603-095-1100 through 603-095-1160). Implement landowner projects and conduct education activities to promote best management practices designed to control pollution of ground and surface waters by animal and human waste and fertilizers
- Promote road management and maintenance (including road closure and obliteration) on all land ownerships to control fine sediment delivery

Focal-species specific strategies are proposed below, in order of priority for that species where appropriate.

BULL TROUT STRATEGIES

1) Implement all Priority 1 Tasks in the Draft Bull Trout Recovery Plan as follows:

- reestablish up and downstream connectivity at Clear Branch Dam;
- provide passage at Coe Branch Diversion;
- determine passage options at Tony Creek diversion;
- Develop and implement a reservoir management or modification plan to improve water temperatures for bull trout below Laurance Lake Reservoir;
- improve fish passage at road crossings;
- improve instream flows;
- restore channel conditions (LWD in historical locations, floodplain connectivity)
- screen diversions
- investigate bull trout ecology in Laurance Lake

This strategy addresses key factors including restoring the physical and biological connection between the Clear Branch and Hood River Local Populations. This strategy consists of measures including evaluating and improving the effectiveness of the upstream fish trap at the base of the dam; providing adequate outlet screening to protect downstream migrants from entrainment into irrigation systems; determining whether and when bull trout attempt to migrate downstream; determining the effectiveness of the dam spillway to evaluate the need for spillway modifications or bypass system. This strategy also reestablishes connectivity in Coe Branch, Eliot Branch, and Tony Creek through effective fish screening and upstream juvenile and adult passage at water diversions. Implementation of this strategy is advanced by a partnership funding approach with the Middle Fork Irrigation District. Conduct the studies necessary to develop and implement a reservoir management or dam modification plan to improve in-stream temperatures for bull trout below Laurance Lake Reservoir.

2) Continue to support road closures, treatment, and obliteration meet the Mt Hood National Forest road density objective of 2 miles per sq. mile in bull trout areas, or $\leq$1.7 miles per sq. mi, and where not possible, conduct road maintenance activities to eliminate forest road sediment runoff into potential and known bull trout habitats.

SUMMER STEELHEAD STRATEGIES

Increase rearing capacity and improve adult holding conditions through flow restoration and projects that increase pools and habitat complexity. Remove artificial barriers to tributaries within the summer steelhead distribution, such as at Red Hill Creek.

Increase egg to smolt survival of summer steelhead by preventing interbreeding between Hood River stock and Skamania stock fish in order to eliminate any further genetic influence of Skamania stock on Hood River summer steelhead population. Continue to block access of Skamania stock returns from summer steelhead spawning areas in the West Fork. The egg to smolt survival of Skamania stock spawning in the wild is very low. Continue to eliminate out of basin hatchery fish at Powerdale Dam. Maintain genetic monitoring program with hatchery broodstock to protect unique stock identity. Determine the feasibility of collecting hatchery broodstock, monitoring run size, and removing excess hatchery fish at the Punchbowl Falls fish ladder after Powerdale Dam removal in 2010 (Table 40).

WINTER STEELHEAD STRATEGIES

Increase rearing capacity in the East and Middle Fork Hood River through flow restoration, and by improving habitat structure and complexity. Provide refugia from floods and debris flows by improving habitat conditions in and access to small tributaries where artificially impeded. Improve conditions in Neal Creek by completing the Central Canal Pipeline Project to remove chronic turbidity and fine sediment loading from the 100-year old irrigation water delivery system.

SPRING CHINOOK STRATEGIES

Investigate the cause of low egg-to-smolt survival in the spring chinook population to confirm the factors limiting production. Depending on the results of the investigation, increase egg-to-smolt survival in the West Fork Hood River drainage and potentially in downstream spawning and rearing habitats by improved stock fitness and habitat diversity. Restore LWD to key restoration reaches in the West Fork Hood River drainage and potentially in mainstem spawning and rearing habitats to increase rearing capacity and low velocity stream margin and lateral habitats for emergent fry and parr. Reduce the straying rate of hatchery spring chinook by using only broodstock returning to the Hood River in the hatchery program. Increase egg-to-fry and fry to smolt survival by increasing habitat diversity and the availability of key habitats such as low velocity lateral early rearing areas. Improve hatchery smolt to adult survival with improved disease control, smolt size control. Incorporate naturally produced fish into the broodstock.

Continue to monitor the health and stock fitness of the natural population to determine if there are adaptive changes that are occurring over time to improve survival. Consider moving production to Parkdale Fish Facility if it will better achieve the overall goal of spring chinook reintroduction. Improve fish passage at the Dee diversion in the West Fork Hood River.

LAMPREY STRATEGY

Conduct before and after field surveys to document lamprey distribution relative to Powerdale Dam after dam removal in 2010. Investigate habitat suitability of Hood River for lamprey. Evaluate further actions based on this information.

HARVEST AND HATCHERY SUPPLEMENTATION STRATEGIES

Hatchery Genetics and Management Plans for Hood River hatchery programs were submitted to the NWPPC as part of the subbasin plan as electronic files.

The HRPP currently uses a supplementation strategy to help rebuild steelhead and spring chinook populations while providing tribal and sport harvest opportunity when available after population recovery objectives are met. Harvest occurs on hatchery fish in excess of broodstock and escapement needs. Based on a hatchery smolt to adult escapement goal of 3.5%, the current steelhead smolt release levels leave approximately 1,150 hatchery winter steelhead and 1,100 hatchery summer steelhead available for harvest after meeting spawner escapement and broodstock collection goals.

The spring chinook reintroduction program has not yet met with much success and harvest opportunity has been limited at best. As with steelhead, former harvest objectives have been revised downward. Recommended revisions to the spring chinook program were made in a recent HRPP 10 year review completed for BPA by SP Cramer and Associates (Underwood, K.D. et al, 2003). As a result, revisions to the program will include: (1) boodstock will be taken only from Hood River returning adults to Powerdale Dam, this has happened in only two of the past ten years. In past years, broodstock were taken from Deschutes fish returning to Round Butte Hatchery; (2) achieve a smolt size of about 15 per pound which should reduce the problem of unusually high percentage of jacks and mini-jacks; (3) reduce the incidence of fish straying to the Deschutes by either moving juveniles to Hood River earlier or moving all Hood River production to Parkdale; and (4) eliminate disease problems of juveniles reared in Pelton Ladder. Currently the spring chinook program does not meet the disease standard developed by the Pacific Northwest Fish Health Protection Committee. If it appears the disease problems cannot be overcome in Pelton Ladder, production should be moved to a disease-free station, preferably in the Hood River subbasin.

The current HRPP supplementation strategy is scheduled to continue through 2010 when Powerdale Dam is removed. It will then be reevaluated to determine whether to continue the strategy or modify it (Table 40). The interim strategy is to continue acclimating and volitionally releasing spring chinook smolts (now using Hood River returns as broodstock) into historic spring chinook habitat in the Hood River. The interim strategy will continue to supplement the indigenous wild winter and summer steelhead populations with a hatchery program consisting of Hood River origin broodstock and the volitional release of acclimated smolts (50,000 WSt and 40,000 SSt) to historic distribution areas to enhance natural production. Broodstock for both the spring chinook and steelhead hatchery programs will be collected from fish returning to the Powerdale Dam Fish Facility.

Following the removal of Powerdale Dam in 2010, hatchery production release numbers will be evaluated and be adjusted if needed, based upon monitoring and evaluation results from the HRPP (Table 40). Feasibility studies of potential hatchery broodstock collection sites, and run monitoring facilities, will be conducted in the interim period before the removal of Powerdale Dam.

Potential broodstock acquisition and run monitoring sites include:

- Constucting an adult fish trap in the fish ladder at Punchbowl Falls on the West Fork. Installing a weir and trap on Rogers Spring Creek at the Parkdale Fish Facility in the Middle Fork.
- Installing temporary weirs and traps at tributary sites throughout the subbasin.

Table 40. Proposed hatchery and harvest strategies before/after Powerdale Dam removal scheduled in 2010 (adapted from Underwood 2003).

Allocation Scheme	Time Frame	Summer Steelhead	Winter Steelhead	Spring Chinook
Escapement Number above Powerdale Dam	**Before Dam Removal in 2010** ------------ ***After Dam Removal 2010-2019***	Allow all wild fish above Dam except for hatchery broodstock allocation. Based on wild adult run size, allow only up to 50% of spawners upstream of Powerdale to be composed of known Hood River origin hatchery fish. --------------------------------------- *Allow all returning wild fish to spawn in historic habitat except for hatchery broodstock allocation to be collected at an undetermined site. Hatchery fish allowed to spawn at only up to 50% of spawning population..*	Allow all wild fish above Dam except for hatchery broodstock allocation. Based on wild adult run size, allow only up to 50% of spawners upstream of Powerdale to be composed of known Hood River origin hatchery fish. ------------------------------------ *Allow all returning wild fish to spawn in historic habitat except for hatchery broodstock allocation to be collected at an undetermined site. Hatchery fish allowed to spawn at only up to 50% of spawning population..*	Allow all wild and hatchery fish above Dam except for hatchery broodstock allocation. --------------------------------------- *Current program will be evaluated, continued supplementation likely.*
Hatchery Allocation	**Before Dam Removal In 2010** -------- ***After Dam Removal 2010-2019***	40 adult collection target collected at Powerdale to produce 40,000 smolts. Wild fish will make up 100% of brood, not to exceed 25% of wild run. 50% of brood are females. Brood taken over the entire run period. -------------------------------------- *Smolt production target to be determined based on achieving a spawning run not exceeding 50% hatchery fish, or not exceeding estimated carrying capacity. Smolt production likely to remain similar to pre-removal goals. Feasibility of trapping broodstock at Punchbowl Falls on West Fork will be evaluated.*	70 adult collection target collected at Powerdale to produce 50,000 smolts. Wild fish will make up 100% of brood, not to exceed 25% of wild run. 50% of brood are females. Brood taken over the entire run period. --------------------------------------- *Smolt production target to be determined based on achieving a spawning run not exceeding 50% hatchery fish or not exceeding estimated carrying capacity. Broodstock Collection at Parkdale Fish Facility will be evaluated. Temporary adult weirs in the East or Middle Fork will be evaluated. Angler harvest of broodstock will be evaluated.*	110 adult collection target collected at Powerdale to produce 125,000 smolts. Hatchery fish will make up 100% of the brood. 50% of brood are females. Brood will be taken over the entire run period. --- *Continued supplementation likely. Feasibility of trapping broodstock at Punchbowl Falls on West Fork will be evaluated.*
Harvest	**Before 2010 Dam Removal** ---------- ***After Dam Removal 2010-2019***	Hatchery only. No harvest above Dam. --- *Hatchery only. Upper extent of harvest in Hood River to be determined by fish agencies and tribes. Harvest is a key component to maintain ratio of hatchery and wild spawners.*	Hatchery only. No harvest above Dam --- *Hatchery only. Upper extent of harvest in Hood River to be determined by fish agencies and tribes Harvest is a key component to maintain ratio of hatchery and wild spawners.*	Hatchery only, harvest depending on run size prediction. Tribal-only harvest above Dam. 2000 hatchery fish harvest goal. --- *Harvest will be evaluated based upon goals of program.*

6.3. 2. Terrestrial Species

Priority A

Protect remaining undeveloped winter range from incompatible development through acquisition, conservation easements, education, and development standards.

Minimize further fragmentation of remaining habitats. Avoid road and trail development impacts on big game winter range and riparian habitats. Seasonal roads should be closed to reduce harassment to wildlife during stress periods of winter and early spring. Roads no longer used for fire protection or logging should be closed permanently. Areas designated as big game winter range should be maintained in low density or forest uses.

Implement actions to retain forested wildlife travel corridors such as land acquisition, conservation easements, and landowner education.

Prevent the spread invasive plant species into high value habitat areas.

Conduct a wildlife habitat inventory on non-federal lands to identify and prioritize restoration and enhancement opportunities, inform future land use actions and plans, and fulfill statewide goals to protect wildlife habitat.

Promote a policy of “no net loss” of oak-pine woodland habitat by mitigating habitat conversions and natural losses with equal or greater replanting and restoration efforts. Prioritize and maintain existing moderate to high quality oak-pine woodland stands, and actively mange to promote their sustainability, regardless of size. Emphasize conservation of large patches of oak-pine woodland habitat with large-diameter and open-form oaks. Prioritize retention of oak and ponderosa pine trees and snags >53 cm diameter. Initiate actions to minimize conifer intrusion into oak stands and ensure <10% canopy cover of conifers in stands where pure oak stands are ecologically appropriate. Maintain or initiate actions to provide young, subcanopy oaks and young regenerating pine saplings (recruitment trees) and native shrubs and herbaceous vegetation in the understory. Improve the quality of degraded oak-pine woodland habitat through appropriate management actions. Initiate actions to enhance size and connectivity of existing oak-pine woodland patches (reduce fragmentation) through restoration and acquisition efforts. Evaluate the feasibility of using prescribed low intensity fire to maintain natural characteristic conditions in grasslands and oak stands.

Provide protection for federal and state threatened, endangered, and sensitive wildlife species in all resource management plans and land use proposals. Implement state and local land use rules and policies designed to protect wildlife habitat. Continue enforcement of wildlife laws.

Support recommendations for wildlife habitat protection, enhancement and restoration specified in the U.S. Forest Service Watershed Analysis and Northwest Forest Plan allocations and activities for Hood River Ranger District.

Support adequate funding for Hood River Ranger District, ODFW, and Oregon State Police secure staff resources to address wildlife issues, enforce wildlife harvest regulations, and manage increasing recreation to protect wildlife and sensitive habitats.

Priority B

Work with Hood River County Forestry Department, ODFW, and recreation groups to evaluate the feasibility and need for selective seasonal forest road and/or recreation trail closures to protect the integrity of wildlife habitat and control disturbance and/or harassment due to rising recreation use. Educate and enforce against the unauthorized development of recreation trails on private and public forest lands.

Promote and support development and implementation of coordinated wildfire hazard and forest fuels reduction plans across all land ownerships, with integration of wildlife habitat and forest health needs and benefits.

Involve wildlife biologists, land managers, local communities, recreation groups and businesses, and elected officials in developing a Gorge-wide plan to identify data gaps and manage trail, backcountry, and shoreline recreation activities and developments in a manner that is sensitive to wildlife populations. The goal of such a plan would be to have and enjoy recreational opportunities that are compatible with the long-term maintenance of healthy wildlife communities.

6.4 Consistency with ESA/CWA Requirements

The Management Plan proposes objectives and strategies that are consistent with the Endangered Species Act (ESA) requirements for listed species. Specific strategies in the Management Plan seek to continue, and if possible, enhance existing habitat protection of spotted owl on forest lands. Several strategies confirm or support mandatory measures such as Riparian and Late Successional Forest Reserve allocations and protection of special habitat areas on federal land under the Northwest Forest Plan. Other strategies seek to implement voluntary habitat protection for listed species on non-federal land, such as the retention of snags and downed wood, and provision of dispersal habitat for spotted owl. As for bull trout, the proposed objectives and strategies are adopted directly from the US Fish and Wildlife's 2003 Draft Mt Hood Unit Recovery Plan for Bull Trout. Local stakeholders, state, federal and tribal agencies had collaborated for several years on action measures in the plan with the USFWS. As for listed chinook and steelhead, each of the proposed management objectives and strategies will promote habitat protection and restoration or otherwise support recovery of the populations. Major strategies include restoring stream connectivity, protecting and restoring riparian vegetation, and restoring instream flow and habitat diversity.

In the Hood River Subbasin the Federal Clean Water Act is implemented largely through State water quality standards, Total Maximum Daily Loads (TMDLs) and TMDL implementation by designated management agencies. The Western Hood Subbasin TMDL for temperature was approved by EPA in January, 2002. Since completion of the TMDL, stream segments have been identified as water quality limited for chlorpyrifos (Indian Creek, Neal Creek, Lenz Creek), Guthion (Neal Creek), zinc (Lenz Creek, Mitchell Creek), and iron (Neal Creek). TMDLs for these parameters will be developed by ODEQ after 2010. This document recognizes that both the Subbasin Plan and TMDL processes are adaptive in nature. When TMDLs are re-evaluated by ODEQ, the Subbasin Plan will also be re-evaluated as part of its review process to incorporate new findings and ensure consistency with future TMDLs and/or new 303(d) listings.

Management strategies in the Hood River Subbasin Plan are consistent with the Western Hood Subbasin Temperature TMDL, and in fact, anticipate management strategies that will likely be needed to address future TMDLs for pesticides (chlorpyrifos and Guthion). With regard to temperature, effective shade surrogate measures were identified in the TMDL based on the establishment of System Potential riparian vegetation. Attainment of the effective shade measures is equivalent to attainment of the nonpoint source load allocations. Management strategies identified in the Subbasin Plan under “Protection and Restoration of Riparian and Floodplain Function” and “Protect and Improve Water Quality” are consistent with the System Potential riparian vegetation goals in the TMDL. The bull trout strategy to develop and implement a plan to reduce temperatures below Laurance Lake reservoir is also consistent with the TMDL. The Subbasin Plan and the Western Hood Subbasin Temperature TMDL are also consistent in their recognition of the importance of stream flow restoration. Although the TMDL does not base allocations on any changes in flow diversions, modeling runs were done to demonstrate the thermal effects of increased instream flows. Based on TMDL modeling scenarios for the East Fork Hood River and Hood River, restoring flows to the river appeared to have a bigger impact on improving instream temperatures than did restoring riparian conditions.

Achievement of the TMDL, in part, occurs through implementation of nonpoint source management plans: the Agricultural Water Quality Management Area Plans (SB 1010), the Oregon Forest Practices Act, County Comprehensive plans, and Federal policies/plans on Forest Service lands. These plans vary from voluntary to proscriptive but all have reasonable assurance of implementation. Management oversight is normally conducted through the local, state or federal land use authority. It is also worth noting that there are numerous NPDES permits regulated by ODEQ within the Hood Subbasin. These permits are primarily for fruit packing plant and wastewater treatment plant discharges. These discharges typically occur on smaller tributaries to the Hood River. ODEQ is presently working on re-writing the permits for these facilities to be in compliance with the TMDL. Initiative-based restoration/protection and public funding dovetails with TMDL implementation and is an important implementing mechanism.

ODEQ recognizes that Subbasin Planning is a key effort that supports TMDL implementation.

6.5 Research, Monitoring and Evaluation

This section describes critical research needs, monitoring and data gaps for monitoring focal habitats and focal species to determine achievement of the biological objectives. These activities will measure trends and improvements in habitat conditions and populations, conduct research to address critical uncertainties, and validate assumptions about limiting factors, and provide information for adaptive management of all aspects of the Subbasin Plan.

This section begins with a background on the Hood River Production Program and then describes eight aquatic research, monitoring, and evaluation (RME) strategies along with a comprehensive justification for each strategy. These materials were contributed by Erik Olsen of ODFW. Following the comprehensive discussion, nine specific RME measures are listed that address other questions and assumptions about habitat restoration, or ecological uncertainties.

The objective of the BPA research, monitoring, and evaluation in the Hood River subbasin is to determine if the Hood River Production Program has achieved its biological fish objectives relative to populations of wild and hatchery salmonids in the Hood River subbasin. The Northwest Power Planning Council (Council) was directed to develop and adopt "a program to protect, mitigate, and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries" (Section 100; NPPC 1987). The Council subsequently developed the Columbia River Basin Fish and Wildlife Program (Program; NPPC 1987). The Council's Program set doubling runs to the Columbia River Basin "as a reasonable interim goal to guide program planning, implementation, measurement and evaluation" (Section 203(a); NPPC 1987). As an integral part of achieving this goal, the Council Program directed Bonneville Power Administration (BPA) to fund development of a master plan for artificial production facilities that could be used to rear hatchery production for the Hood River subbasin (Section 703(f)(5)(A) in NPPC 1987). Upon completion of the master plans, the Council Program further directed BPA to fund the planning, design, construction, operation, maintenance, and evaluation of these facilities (Section 703(f)(5) in NPPC 1987). Additionally, the Council Program directed BPA to fund the propagation of either spring chinook salmon or steelhead smolts in Pelton ladder (Section 703(g)(3) in NPPC 1987). Part of the Pelton ladder spring chinook salmon smolt production is currently released into the Hood River subbasin.

The various BPA funded projects that were an outgrowth of the Council directives, as well as the action items identified in CRITFC (1996), have come to be defined as the Hood River Production Program (HRPP). The HRPP is currently composed of seven inter-related BPA funded contracts. They are as follows: Hood River Production Program PGE: O&M, Hood River Production Program - CTWSRO M&E, Hood River

Production Program - ODFW M&E, Hood River Fish Habitat, Parkdale Fish Facility, Powerdale/Oak Springs O&M, and Hood River Steelhead Genetics Study. These seven contracts primarily provide funding for three broad categories of activities. They include hatchery supplementation, habitat restoration, and Monitoring and Evaluation (M&E).

The HRPP's M&E program is comprehensively outlined and defined in the Hood River and Pelton ladder master plans (O'Toole and ODFW 1991a, O'Toole and ODFW 1991b, and Smith and CTWSRO 1991) and in the Hood River/Pelton Ladder Master Agreement (ODFW and CTWSRO Undated). The master plans were approved by the Council in 1992 and the Master Agreement was submitted to BPA in 1993. The need for an M&E component to the HRPP is also identified in the Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (CRITFC 1996); as one of several actions required to improve natural production in the Hood River subbasin.

The primary goals of the HRPP are 1) to increase production of wild summer and winter steelhead (Oncorhynchus mykiss) commensurate with the subbasins current carrying capacity, 2) to reintroduce spring chinook salmon (O.tshawytscha) into the Hood River subbasin, and 3) provide in-basin sustainable harvest opportunities. The HRPP's performance goals relative to it's biological fish objectives (i.e., numerical harvest and escapement goals) are identified in the Hood River Subbasin Summary (Coccoli, 2000). Strategies for achieving the HRPP's biological fish objectives are based on various assumptions about subbasin smolt and spawner escapement carrying capacities, egg-to-smolt survival rates, smolt-to-adult survival rates, pre-spawning mortality rates, and current escapements of anadromous salmonids to the mouth of the Hood River subbasin. A comprehensive monitoring and evaluation program is needed to collect the life history and escapement information needed to 1) evaluate the HRPP relative to it's performance goals and 2) determine whether or not the assumptions used to develop the HRPP's biological fish objectives are valid, or need to be revised.

We propose collecting species, race, and stock specific life history, production, escapement, run size, morphometric, meristic, and genetic information at juvenile and adult migrant traps located at various sites in the Hood River subbasin. Information collected at the trapping facilities will be used to 1) refine the numerical fish objectives for wild summer and winter steelhead and natural spring chinook salmon, to more accurately reflect the subbasins current and potential species and race specific spawner escapement and smolt production carrying capacities; 2) refine the numerical fish objectives for subbasin run size and harvest of hatchery summer and winter steelhead and spring chinook salmon, 3) more accurately estimate species, race, and stock specific estimates of subbasin smolt-to-adult survival rates; 4) evaluate acclimation as a management tool for increased post release survival; 5) develop guidelines for implementing the HRPP in a biologically sound manner, 6) evaluate both the Pelton ladder rearing facilities and the proposed expanded hatchery facility at Parkdale, 7) develop guidelines for implementing the hatchery supplementation program in a manner that will minimize the HRPP's impact on indigenous populations of resident and anadromous salmonids; and 8) develop and refine strategies and guidelines for implementing the HRPP in a manner that will improve program efficiency and benefits.

Strategy 1. Monitor harvest of hatchery summer and winter steelhead and spring chinook salmon in the Hood River subbasin.

Justification: One of the primary goals of the HRPP is to provide increased Hood River subbasin recreational and tribal harvest opportunities for summer and winter steelhead and spring chinook salmon. Consumptive recreational fisheries currently harvest summer and winter steelhead and spring chinook salmon (i.e., as run size permits) in the Hood River subbasin. Tribal fisheries are known to have historically existed in the subbasin but there is no information to determine historical harvest rates.

The HRPP's numerical harvest objectives were defined in the Hood River Subbasin Summary (Coccoli, 2000) for summer and winter steelhead and spring chinook salmon. The harvest objectives were revised downward in 2004, based on data collected on the current M&E program, and are defined in this subbasin plan in terms of making 1,100 summer steelhead, 1,150 winter steelhead, and 2,000 spring chinook salmon available for harvest in both non-tribal and tribal fisheries located in the Hood River subbasin.

We primarily propose implementing creel surveys in the Hood River subbasin to collect information needed to evaluate whether or not the HRPP is achieving it's numerical harvest objectives. Harvest would be estimated for both non-tribal and tribal fisheries located throughout the subbasin. The exploitation rates associated with each fishery would then be used to determine if fisheries located in the Hood River subbasin limit or constrain the HRPP's ability to consistently achieve the spawner escapement objectives for summer and winter steelhead and spring chinook salmon. Additionally, harvest estimates will be used in conjunction with estimates of run size (see Strategy 2) in order to allocate harvest opportunities among potential fisheries. This is a particularly critical need with respect to the spring chinook salmon run. Between year variation in subbasin escapements of hatchery spring chinook salmon have been highly variable over the past 10 years and in-season estimates of harvest and escapement have provided information critical to developing season opening and closure dates designed to ensure that the HRPP would achieve both it's spawner escapement objectives for spring chinook salmon (see Strategy 2) and it's broodstock collection needs for spring chinook salmon.

In addition to estimating harvest, creel surveys will be used to collect the biological information required to evaluate 1) the fisheries impact on selected life history patterns of returning wild, natural, and hatchery produced fish; 2) estimate both the harvest and exploitation rate of coded wire and PIT tagged experimental hatchery groups; 3) estimate smolt-to-adult survival rates for wild, natural, and hatchery produced salmonids; and 4) provide demographic information on both non-tribal and tribal anglers.

Strategy 2. Monitor escapements of wild and hatchery summer and winter steelhead and spring chinook salmon to the mouth of the Hood River subbasin.

Justification: The primary goals of the HRPP are 1) to increase production of wild summer and winter steelhead (Oncorhynchus mykiss) commensurate with the subbasins current carrying capacity, 2) to reintroduce spring chinook salmon (Oncorhynchus tshawytscha) into the Hood River subbasin, and 3) to provide in-basin sustainable harvest opportunities. The HRPP's numerical escapement objectives associated with the above two goals were defined in the Hood River Subbasin Summary (Coccoli, 2000) for summer and winter steelhead and spring chinook salmon. The escapement objectives were revised in 2004, based on data collected on the current M&E program, and are defined in this subbasin plan as follows: to achieve and maintain a spawner escapement of no less than 6000 wild summer steelhead, 1100 wild winter steelhead, and 200 natural spring chinook salmon.

The approach taken to achieve the HRPP's numerically defined fish objectives has been to 1) restrict harvest of unmarked summer and winter steelhead and spring chinook salmon and 2) supplement the Hood River subbasin with Hood River stock hatchery summer and winter steelhead and Deschutes stock spring chinook salmon. The HRPP's ability to achieve the programs numerical escapement objectives are based on the general hypothesis that subbasin spawner escapements are currently below the level needed to fully seed the subbasin (see Strategy 3). Fishery managers consider the information required to reject or accept this hypothesis as critically important in refining the approach ultimately taken to implement the HRPP over the time frame of this subbasin plan. We propose monitoring adult escapements at Powerdale Dam, and at other proposed adult trapping facilities that come on-line after Powerdale Dam has been de-commissioned.

The HRPP's current M&E program is just beginning to collect the complete juvenile and adult life history information required to answer the above hypothesis, but continued monitoring of adult escapements is required to obtain the complete brood return numbers required for the more recent years estimates of subbasin smolt production. Maintaining the existing data string is also considered particularly important in light of an increase in subbasin production capacity anticipated as a consequence of 1) revised changes in guidelines for implementing the hatchery supplementation component of the HRPP, 2) several proposed habitat improvement projects, and 3) the de-commissioning and removal of Powerdale Dam.

Strategy 3. Monitor production of wild and naturally produced anadromous salmonids in the Hood River subbasin.

Justification: The primary goals of the HRPP are 1) to increase production of wild summer and winter steelhead (Oncorhynchus mykiss) commensurate with the subbasins current carrying capacity, 2) to reintroduce spring chinook salmon (O. tshawytscha) into the Hood River subbasin, and 3) provide in-basin sustainable harvest opportunities. There are no numerically defined subbasin smolt production objectives for the HRPP, but the subbasins smolt carrying capacity is inextricably linked with the HRPP's numerical fish objectives for subbasin spawner escapement (see Strategy 2). The HRPP's defined spawner escapement objectives for summer and winter steelhead and spring chinook are implicitly based on two general hypotheses 1) that the Hood River subbasin is currently under seeded in terms of summer and winter steelhead smolt production and 2) that the

Hood River subbasin is capable of supporting a self-sustaining population of spring chinook salmon.

The HRPP's current M&E program has annually estimated Hood River subbasin steelhead smolt production. Estimates are available in Olsen (2003) for the 1994-2001 years of migration and in Olsen (draft) for the 2002-2003 years of migration. The M&E programs estimates of subbasin steelhead smolt production were used to refine the HRPP's initial numerical fish objectives for steelhead spawner escapement; as defined during the early planning and implementation stages of the HRPP (see Strategy 2). The revised spawner escapement objectives have been incorporated into this subbasin plan. Fishery managers consider the continuation of this particular component of the M&E program to be highly critical given the fact that it is anticipated that subbasin carrying capacity will increase as a consequence of 1) revised changes in guidelines for implementing the hatchery supplementation component of the HRPP, 2) several proposed habitat improvement projects, and 3) de-licensing and removal of Powerdale Dam. Information gathered from the continued monitoring of subbasin smolt production will be used to 1) refine the HRPP's numerical fish objectives for spawner escapement (see Strategy 2) and 2) refine the approach for implementing the HRPP's hatchery supplementation program. These refinements will occur as subbasin carrying capacity increases in response to those actions implemented by the HRPP to increase the Hood River subbasins carrying capacity. We propose estimating subbasin smolt production at juvenile downstream migrant trapping facilities located at various sites throughout the Hood River subbasin.

In addition to determining subbasin carrying capacity, data collected from the smolt monitoring component of the proposed M&E program will be used to estimate egg-to-smolt and smolt-to-adult survival rates for wild steelhead. The numerical fish objectives for wild and hatchery run size (see Strategy 2), harvest of hatchery fish (see Strategy 1), and subbasin spawner escapement (see Strategy 2) are currently based on the M&E programs estimates of the current egg-to-smolt and smolt-to-adult survival rates for both wild and hatchery components of the run. Continued monitoring and refinement of the smolt-to-adult survival rates for both wild and hatchery components of the summer and winter steelhead and spring chinook salmon runs is considered critical to implementing the HRPP in a manner that will continue to 1) minimize the programs impact on indigenous populations of anadromous salmonids and 2) optimize the benefits associated with the program. Also, preliminary data from the HRPP's M&E program would suggest that removal of Powerdale Dam will significantly increase the smolt-to-adult survival rate for both wild and hatchery smolts. Accurately determining the degree of change will provide the basis for fishery managers to re-assess the level of hatchery supplementation required to achieve the HRPP's numerical fish objectives, both in a biologically sound and cost effective manner.

Strategy 4. Monitor selected life history and morphometric and meristic characteristics of juvenile and adult wild and hatchery anadromous salmonids and resident trout in the Hood River subbasin.

Justification: The Northwest Power Planning Council (NPPC) expressed a concern that the HRPP should be designed and implemented in a manner that minimized any negative impact the program might have on indigenous populations of fish in the Hood River subbasin. As a consequence, the hatchery supplementation component of the HRPP was designed within the context of achieving two basic principles: 1) to produce a hatchery product that would be both biologically and genetically suited to the Hood River subbasin and 2) that all actions implemented under the umbrella of the HRPP would have a minimal negative impact on indigenous populations of fish. Preliminary data collected from the M&E component of the HRPP indicated that specific management decisions may have resulted in 1) modifying the run timing of wild and Hood River stock hatchery runs of summer and winter steelhead, 2) the cross breeding of summer and winter steelhead in the hatchery broodstock, 3) impacted genetic fitness of indigenous populations of summer and winter steelhead, and 4) increased straying rates for spring chinook salmon. The above problems occurred as an unintended consequence of ongoing activities related to the implementation of the HRPP, but more importantly the existing M&E program provided data that identified these problems during the early stages of implementation and fishery managers were able to use the data to develop biologically sound measures for correcting the problems.

The current M&E program has provided, and continues to provide, data that can be used to monitor changes in genetically heritable life history and morphometric and meristic characteristics. Without the M&E program, it is doubtful that fishery managers would be able to identify any negative impact the HRPP might have on indigenous populations of fish, and there would be no bio-data available to develop biologically sound corrective measures for rectifying the problems. Fishery managers consider the on-going collection of bio-data on the HRPP's target species as critical to implementing the HRPP in a biologically sound manner. We propose bio- sampling salmonids collected in 1) non-tribal and tribal fisheries (see Strategy 1), 2) juvenile (see Strategy 3) and adult (see Strategy 2) migrant traps, and 3) stream reaches that we propose electro-shocking to estimate both rearing densities and species composition of both resident and anadromous salmonids. We also propose bio- sampling jack and adult salmonids collected from 1) radio telemetry studies we propose implementing to more accurately define the spatial distribution of indigenous populations of wild and hatchery salmonids, 2) wild and hatchery salmonids that we propose either CWT or PIT tagging to gather both in-basin and out-of-basin life history information, and 3) spawning ground surveys we propose conducting to monitor temporal and spatial distribution of both spawning and the habitat utilized for spawning.

Strategy 5. Monitor population genetic structure, systematics, and distribution of steelhead, cutthroat, resident rainbow trout, and bull trout populations indigenous to the Hood River subbasin.

Justification: State and federal agencies have established laws and guidelines that identify measures for protecting populations of anadromous salmonids and resident trout. The problem with implementing these measures in the Hood River subbasin is the lack of any information to indicate where reproductively isolated populations exist. For some species, the Hood River subbasin is on the boundary between subspecies, and the taxonomic designation is uncertain.

There are several species of anadromous and resident salmonids indigenous to the Hood River subbasin. They include summer and winter steelhead, spring and fall chinook, coho salmon, rainbow/redband trout, cutthroat and bull trout, and mountain whitefish. We propose focusing genetic studies on populations of steelhead, rainbow/redband trout, cutthroat trout, and bull trout. We do not propose sampling for coho or fall chinook salmon at this time, but may propose analyzing existing samples, and collecting additional samples in the future, if a review of existing allozyme data indicates that sampling is warranted. There are currently no plans to study mountain whitefish.

The Hood River subbasin is geographically located on the boundary between two subspecies of Oncorhynchus mykiss. They include O. mykiss irideus (coastal rainbow/steelhead) and O. mykiss gairdneri (Columbia River redband/steelhead). The identity of the O. mykiss subspecies native to the Hood River subbasin is unknown. The Hood River subbasin and the adjacent Fifteenmile Creek subbasin are thought to be the most inland Columbia River subbasins containing the coastal cutthroat (O. clarki clarki). It is alternatively conceivable that the Hood River subbasin contains members of the Westslope Cutthroat (O. clarki lewisi), which is found in the John Day River subbasin. Consequently, because of the uncertainty in O. clarki taxonomy two alternative hypothesis exist: 1) O. clarki may be a natural hybrid of two of the species or 2) O. clarki may be an artificial hybrid caused by past hatchery programs. For the above reasons, the identity of the O. clarki subspecies native to the Hood River subbasin warrants investigation.

We propose sampling both steelhead and resident trout because of the risks associated with introgression within species, and hybridization between species, of wild and hatchery populations. Some subspecies of O. mykiss and O. clarki are naturally sympatric without cross species hybridization. Others, including coastal rainbow and some inland cutthroat subspecies, readily hybridize and then introgress when artificially brought into contact as a result of hatchery supplementation programs. Hybrid zones do occur naturally along the boundary of some species and subspecies. Hybridization caused by the introduction of hatchery produced fish is considered to pose a significant risk to the wild population. Interbreeding between resident trout and anadromous life histories of O. mykiss appears to occur naturally as well. Direct interbreeding between resident and anadromous populations is rarely observed (generally involving resident males interbreeding with steelhead females) but both steelhead and resident trout life history patterns are thought to produce offspring with the alternative life history pattern; thus facilitating gene flow between both populations. Therefore, both the resident and migratory life histories types of O. mykiss need to be studied.

We propose studying both the migratory and resident life history patterns of both O. mykiss and O. clarki and also the resident trout of uncertain taxonomic status discussed above. Both species will be studied because of the potential for interbreeding between both the wild and hatchery fish. The results will provide the information needed to develop and refine hatchery guidelines to protect populations located in the Hood River subbasin.

Strategy 6. Monitor the physical, chemical, and environmental biology parameters limiting wild and natural production of anadromous salmonids in the Hood River.

Justification: Carrying capacity for the Hood River subbasin is currently estimated based on two computer models: 1) the Unit Characteristic Method (UCM) model and 2) the Ecosystem Diagnosis and Treatment (EDT) model. Output from both models was derived from subbasin specific physical; environmental; and species, race and stock specific biological data collected from the HRPP's current M&E program, and other available data. Information provided in the modeling efforts include: 1) annual estimates of subbasin juvenile and adult salmonid production (see Strategies 1-3); 2) selected life history and morphometric and meristic characteristics of indigenous populations of salmonids (see Strategy 4); 3) the quantity, quality, and diversity of available habitat in the subbasin; and 4) summer flows at selected sites in the subbasin. However, none of the data used in the modeling efforts should be treated as static. Habitat improvement work, proposed under the umbrella of the HRPP, is designed to increase subbasin carrying capacity. The EDT model provides the basis for evaluating the percent change in subbasin carrying capacity that might be anticipated from the proposed habitat improvement projects, but both the UCM and EDT models would lack the empirical data required to accurately quantify the numerical increase in salmonid production that occurs in response to the proposed habitat improvement work. Fishery managers consider it critically important to monitor both the individual and cumulative benefits of each project, and that the evaluation takes into consideration other land management activities in the drainage that may have the potential for reducing project benefits. We propose monitoring physical, chemical, and environmental biology parameters that limit subbasin production of indigenous populations of anadromous and resident salmonids. Parameters we propose monitoring include, but are not limited to: 1) turbidity; 2) temperature; 3) total dissolved solids; 4) pesticides; 5) pesticide effects on aquatic life (physiological and biochemical measurements); 6) macroinvertebrates; 7) streamflow; 8) precipitation; 9) bedload movement; 10) sediment movement; and 11) quantity, quality, and diversity of available habitat.

Strategy 7. Monitor and evaluate the health of wild and hatchery juvenile and adult summer and winter steelhead and spring chinook salmon spring in the HRPP and Hood River subbasin.

Justification: A fish health monitoring program at HRPP hatchery facilities is necessary to monitor for parasitic and infections disease agents that can reduce egg-to-smolt and post release survival rates of hatchery fish. The program will primarily focus on monitoring for Bacterial Kidney Disease (BKD), Erythrocytic Inclusion Body Syndrome (EIBS), and cultured viruses. These are the primary infectious disease agents that are known to effect egg-to-adult survival rates. Parasitic disease agents will be monitored to determine if they have become a problem at HRPP hatchery facilities. Information will be used to anticipate disease problems and 1) provide the basis for implementing remedial measures before serious losses might occur and 2) determine the disease status of HRPP production groups prior to transfer to the Hood River subbasin. Information on the disease status of HRPP production groups will be used to determine whether or not the production groups can be transferred to the Hood River subbasin without having a significant impact on native populations of anadromous and resident salmonids. The decision to approve transfer of HRPP production groups to the Hood River subbasin would be based in part on a combination of both the parasitic and infectious disease agents identified in each production group and the incidence level found in each production group.

Several species of resident and anadromous salmonids are presently found in the Hood River subbasin. Endemic species include summer and winter steelhead; spring and fall chinook salmon; coho salmon; rainbow/redband, cutthroat, and bull trout; and mountain whitefish. The current status of each population varies for each species and race. The endemic populations of summer and winter steelhead are considered to be at depressed levels; the spring chinook population is considered to be functionally extinct; and although the current status for populations of rainbow/redband trout, cutthroat trout, bull trout, and fall chinook and coho salmon is unknown. The primary concern with respect to the HRPP is the potential health risk the hatchery supplementation program poses to the Hood River subbasins endemic populations of salmonids. Biological systems are highly complex in nature and are not completely understood. While it is believed that guidelines for implementing the HRPP will minimize the health risks to the above species, it is likely that some level of interaction will take place that will pose a potential health risk. We propose monitoring the same infectious disease agents in the subbasins wild populations of salmonids, that are monitored at the HRPP's various hatchery facilities.

Strategy 8. Monitor indigenous populations of redband/rainbow, cutthroat, and bull trout in the Hood River subbasin.

Justification: The hatchery supplementation component of the HRPP has the potential for negatively impacting species of resident and anadromous salmonids in the Hood River subbasin that are not the main target of the program. Non- target indigenous populations of salmonids that are of critical concern include rainbow/redband, cutthroat, and bull trout. Limited information is available to characterize the status of these populations. It is difficult to either quantify or qualify the potential risks the HRPP may pose to these populations, primarily because biological systems are highly complex in nature and are not completely understood. However, hatchery summer and winter steelhead can hybridize with indigenous populations of wild steelhead and rainbow trout (see Strategy 5) and the potential for interaction between wild and hatchery salmonids raises a health issue with respect to all three of the identified non- target populations of salmonids (see Strategy 7). Fishery managers consider some level of population monitoring as critically important for developing biologically sound guidelines that will minimize any negative impacts the HRPP may have on populations of rainbow/redband, cutthroat, and bull trout. A considerable amount of population and bio- data relative to these indigenous species can be collected in association with activities outlined in Strategies 1-7, strategies which are primarily intended to collect information on the HRPP's target species. We also propose collecting additional population density and biological data from 1) stream reaches we propose either electro-shocking or conducting snorkel surveys in to estimate both rearing densities and species composition, 2) radio telemetry studies we propose implementing to more accurately define the spatial distribution of each population, 3) wild salmonids we propose PIT tagging to gather both in-basin and out-of-basin life history information, 4) spawning ground surveys we propose conducting to monitor temporal and spatial distribution of both spawning and the habitat utilized for spawning, and 5) creel surveys we propose conducting to monitor incidental hook mortality in steelhead, salmon, and rainbow trout fisheries located in the Hood River subbasin.

Additional Research, Monitoring, and Evaluation for Fish and Wildlife

1. Investigate bull trout ecology in Laurance Lake reservoir including fish species interactions and lake trophic state.

2. Monitor the abundance, distribution, habitat utilization, and life history of bull trout using juvenile and adult spawner surveys to provide a means to monitor future trends and evaluate restoration actions, including the potential use of PIT tagging bull trout and using an array of PIT tag receivers to obtain specific life history and abundance information.

3. Evaluate and determine the feasibility of bull trout passage at Clear Branch Dam.

4. Continue pesticide monitoring in streams to evaluate effectiveness of best management practices

5. Conduct a wildlife habitat inventory on non-federal lands to identify and prioritize restoration and enhancement opportunities, inform future land use actions and plans, and fulfill statewide goals to protect wildlife habitat.

6. Research effects of recreation on wildlife in the subbasin and what actions are need to avoid or minimize effects.

7. Monitor stream temperatures to identify trends and evaluate success of measures such as flow and shade restoration.

8. Conduct the studies necessary to develop and implement a reservoir management or outlet modification plan to improve stream temperatures for bull trout below Laurance Lake Reservoir .

9. Monitor the effectiveness of LWD placement and other habitat projects to determine fish utilization, changes in fish distribution, physical habitat development, and the movements of structures in high flow events.

7. Lower Oregon Columbia Gorge Tributaries Management Plan

7.1 Vision for the Subbasin

An overall vision statement for the Lower Oregon Columbia Gorge Tributaries watershed was drafted by Advisory Committee members and subbasin planners in Cascade Locks in December 2003. It reads as follows:

> *"An ecosystem with productive and sustainable levels of fish and wildlife that provide substantial and sustainable environmental, cultural, economic and recreational benefits."*

7.1.1. Economic and Social Considerations

The subbasin includes the distinctly different communities of Cascade Locks, and part of the City of Hood River and its and Urban Growth Boundary. Quality of life and economic opportunity are important to both communities. The City of Hood River's Planning Department stated mission is to ensure the residents of the City and the Urban Growth Area an aesthetically pleasing and livable environment. The mission of the Port of Hood River is to initiate, promote and maintain quality of life and a healthy economy throughout the Port District and the Columbia River Gorge. The community of Cascade Locks is on the verge of developing better economic and social standards for the community with the collaboration of the City and Port entities. The City operates sewer, water, electricity, broadband, and a cable television system- however with these developments comes maintenance while attempting to maintain the sustainability of local natural resources. Land use in Cascade Locks is restricted by many state agencies therefore smart development is a constant awareness. Cascade Locks is an economically struggling community with 59% of the residences living at a lower income levels. Many positive steps have been made that show progress. Actions taken under this plan need to address sustainability for the community in both economic and environmental terms, and recognize the need to improve current living conditions in the city.

7.1.2. Aquatic Species

The Lower Oregon Columbia Gorge Tributaries watershed will continue to support a diversity of native anadromous and resident fish species, and will continue to contribute to tribal and non-tribal fisheries. Aquatic ecosystems will be protected and where possible, restored, including the natural physical processes that create habitat diversity, and hydrologic connections within stream systems including floodplains, wetlands, upslope areas, headwater tributaries, and intact refuge areas.

7.1.3. Terrestrial Species

Wildlife populations and their existing habitat in the Lower Oregon Columbia Gorge Tributaries will be protected and improved where appropriate. 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.

7.2 Biological Objectives

7.2.1 Aquatic Species

Fall Chinook and Winter Steelhead

a) Improve physical and biological connectivity of stream channels and restore natural watershed processes including the transport and deposition of water, sediment, and large woody debris by 2019.

b) Maintain or achieve natural spawning populations of fall chinook and winter steelhead at abundance levels that that reflect full utilization of available habitat as measured by spawning surveys in Herman, Eagle, Viento, Perham, and Lindsey, and other streams accessible to anadromous fish.

c) Restore the spawning distribution of chinook and steelhead to historic habitat above artificial barriers where opportunities exist.

d) Maintain, and where needed, improve water quality and quantity in Gorge streams to protect their value as cold water refuge for upriver migrating adult salmon and steelhead.

e) Identify opportunities to improve the quality of habitat in Herman Creek and other areas used as adult holding for upriver migrating adult salmon and steelhead.

Rainbow Trout

f) Protect the genetic integrity of resident rainbow stocks especially those isolated above natural waterfalls.

g) Improve riparian habitat, instream diversity, and water quality in Phelps and Post Canyon creeks.

7.2.2. Terrestrial Focal Species – Biological Objectives

Bald Eagle

a) Insure the availability and integrity of nesting trees, perch trees, foraging, and winter roosting sites with a goal of doubling the 2003 nesting population in the Gorge from 12 to 24 by the year 2019 with the goal of having an occupied nest territory approximately 2 miles apart along the Columbia River in the Bonneville Pool.

b) Protect eagle nests from disturbance by maintaining recommended buffers between eagle nest sites and human activity to help achieve a nesting success of around one young per pair annually within the Bonneville Pool. Avoid or minimize disturbance to eagles from recreational use of shorelines, stream deltas, islands and sand flats where regular foraging occurs.

Northern Spotted Owl

a) Retain sufficient habitat components such as live and dead standing and fallen trees with cavities and fallen coarse woody debris in varied diameter classes and stages of decay in clumps or scattered across forest stands.

b) Continue to meet Northwest Forest Plan objectives for spotted owl on federal lands that establish or maintain >25% of landscape units in mixed conifer stands as moving towards dominance of old growth and mature forest conditions in appropriate land allocations. The Lower Oregon Columbia Gorge Tributaries watershed meets this objective with 39% of federal land in mature and old-growth stands.

c) Maintain or improve juvenile dispersal habitat conditions on federal lands in low and mid-elevations, as defined as tree stands averaging 11to 16 inches in diameter and $\geq$ 40% canopy cover.

d) Maintain or work toward multiple vegetative layers (herbaceous, shrub-sapling, and two tree layers) and promote healthy old-growth and mature forest conditions on federal lands in lower to mid elevations.

Basalt Juga

a) Protect the integrity of basalt cliff habitat with seeps, moss mats, and springs along Old Columbia Highway and railroad grade and .

Great Blue Heron

a) Protect the integrity of heronry sites and feeding areas used regularly by significant numbers of herons.
b) Protect and enhance bottomland hardwood stands, including large diameter trees, on islands and at low elevations along Columbia River in areas suitable for use as rookeries. Bring back a successful heron breeding colony or rookery in the Columbia Gorge by 2019.

Black Tailed Deer

a) Continue to meet the ODFW management goal of a summer population of 1,500 deer for the Hood Wildlife Management Unit (Hwy 35 to Cascade Crest).

Beaver

a) Maintain viable populations and adequate distribution in order to maintain of beaver activity in Hood River County as indicated by harvest records and other distribution and abundance indices.

Purple Martin:

a) Protect existing colonies and achieve 4 new colonies in the watershed by 2019.

b) Achieve 49 nesting pairs using natural nest cavities in snags or live trees in the watershed.

c) Contribute to the Oregon statewide objective to increase populations to 1,600 pairs by 2010 by increasing the local population to 244 breeding pairs based on the current status of 148 nest boxes.

d) Retain and plant native hardwood tree species that readily create cavities including black cottonwood, Oregon white oak, and bigleaf maple, and increase hardwood trees in purple martin areas along or near the Columbia River by 200% or higher by 2019.

7.3. Prioritized Strategies

7.3.1 Aquatic Species

Specific strategies to meet the biological objectives for the focal fish species are proposed, in priority order, in the section below. These strategies address limiting factors identified in the assessment.

Fall Chinook and Winter Steelhead

1. Support ODFW efforts to improve adult fish passage up to the natural barrier in Herman Creek by modifying the fish ladder at the Oxbow Hatchery diversion. Consult with ODFW to restore fish passage at the Cascades Hatchery up to the natural barrier in Eagle Creek Creek, as compatible with hatchery operations and production goals, and to explore ways to reduce summer stream temperatures below the Hatchery diversion.

2. Prevent the spread of aggressive invasive aquatic plants especially Japanese knotweed.

3. Work with ODOT, UPR, and others to improve fish passage and transport of water, sediment and debris where impeded by artificial barriers at transportation crossings. Prioritize by anadromous stream length to be gained. Enlarge capacity of culverts or replace with bridges where needed. Prioritize non-anadromous sites by the degree of constriction and the frequency of maintenance dredging or flood damages.

4. Work with local landowners and governments to conduct physical and biological surveys of streams and riparian corridors to better identify restoration opportunities in lower elevation streams accessible to anadromous fish. Where opportunities exist, restore riparian vegetation, habitat structure, function and diversity that has become degraded as a result of human activities.

5. Cooperate with the Port of Cascade Locks to evaluate the potential to improve fish habitat for adult steelhead and chinook holding in lower Herman Creek through riparian plantings and instream structures such as large woody debris and boulder placement.

6. Consult with ODOT and UPR to implement the Herman Creek Fish Habitat Enhancement and Restoration Project (log and boulder placement) between RM 1.1 and 3.0.

Rainbow Trout

1. Protect areas of high quality stream and riparian habitat through awareness and enforcement of federal, state and local land use regulations designed to protect fish habitats, as well as incentives and voluntary actions.

2. In land areas where they are applicable, continue to fully implement the Hood River Agricultural Water Quality Area Management Plan (ODA 2000) and rules (OAR 603-095-1100 through 603-095-1160); the Oregon Forest Practices Act, and Hood River County Stream Corridor Ordinance.

3. Restore degraded areas and encourage voluntary actions to restore habitat where opportunities exist.

4. Quantify the distribution of nonnative and native resident trout species within area streams.

Prioritized Strategies for All Aquatic Species

1. Rely on natural production to maintain fish populations in Gorge Tributaries streams.

2. Support effective enforcement of angling and harvest regulations.

3. Support the development and implementation of ecologically sound urban-interface fuels treatment or forest health plans on all ownerships that can reduce the risk of catastrophic high intensity forest fire and prevent elevated landslides and increased sediment delivery.

4. Continue to improve communication and working relationships on salmon recovery efforts with active participation between local communities, railroad, tribal, Federal, County, Port, and State entities, including transportation departments.

7.3. 2. Terrestrial Species

Specific strategies intended to address the biological objectives for each focal wildlife species are listed, in priority order, in the section below.

Bald Eagle

1. Promote inventory efforts by appropriate state and federal agencies to identify current and historic nest trees and investigate protection needs and opportunities.

2. Identify protection needs and opportunities to retain forest stand integrity around nest trees, known day perches, and communal night roosting sites regularly used by numbers of eagles.
3. Avoid developing recreation trails near current or historic (alternate) nest sites
4. Educate the public and explore ways to avoid or minimize recreational disturbance on sand flats and gravel bars during winter that are regularly used as feeding areas.
5. Identify protection needs and opportunities to retain large, mature cottonwood, conifer, and other trees suitable for perch, roost or foraging > 20 inch diameter within 250 feet from the top of a stream bank or Columbia River shoreline, including islands.
6. Inventory, evaluate and rank bottomland hardwood stands on islands and lowlands for restoration or under planting opportunities in areas such as Wells Island, Wah Gwin Gwin spit, Viento and Lindsey state parks, Wyeth, Herman Cove, Eagle Island, and Government Cove.

Spotted Owl

1. Continue to support Northwest Forest Plan recovery objectives for spotted owl on federal lands
2. Explore opportunities to improve the quality of dispersal habitat in degraded or overgrown mixed-conifer forest by thinning in areas such as Herman Creek Road from Herman Creek to Wyeth and additional areas in mid-elevation second-growth forests.
3. Promote and support development and implementation of coordinated wildfire hazard and forest fuels reduction plans across all land ownerships, with integration of wildlife habitat and forest health needs and benefits.
4. Enhance size and connection of existing high quality habitat patches and reduce fragmentation in low and mid-elevation lands, particularly near the urban-interface areas.

Basalt Juga Snail

1. Conduct surveys to better identify the range of occupied habitats on federal and non-federal lands
2. Protect and/or restore native riparian plant communities around juga snail habitats that maintain shade, cold water temperatures, control sedimentation, and supply leaf litter to support key energy pathways in the specialized ecosystem.
3. Avoid or mitigate activities that could introduce pollution including sedimentation, chemical contamination, or nutrient transport in occupied sites
4. Avoid or mitigate activities that could cause submersion of cold springs, reduce water flow, velocities, and dissolved oxygen levels below those necessary to sustain viable populations.

Great Blue Heron

1. Increase awareness of and protection of great blue heron nesting colonies and concentrated foraging areas by focusing on inventories, information exchange,

and public education. Coordinate with interested agencies, community groups, and the Great Blue Heron Western Working Group on these activities.

2. Inventory, evaluate, and rank bottomland hardwood stands on islands and in lowlands for protection or recruitment opportunities (underplanting) in areas such as Wells Island, Herman Cove, Government Cove, and the inner Hook in Hood River.
3. Protect colonies from human disturbance by leaving an adequate buffer zone around the periphery of colonies during courtship and nesting season between February 15 and July 31.
4. Monitor the effect of human disturbance on heron colonies.

Black-Tailed Deer

1. Work with ODFW and Hood River County Planning and Forestry Departments to evaluate opportunities in the Hood River Valley and Phelps Creek drainage to maintain viable east-west migration corridors for deer, elk, and other wildlife to access winter range and other migration purposes.
2. Work with ODFW and local governments to find ways to avoid or mitigate losses of winter range and prevent increasing conflicts with residential development.
3. Minimize disturbance of deer and other wildlife on winter and summer ranges on public lands used for recreation. Work with recreational users, timber companies County Forestry Department, and the US Forest Service to educate and enforce against the unauthorized development of recreation trails on private and public forest lands.
4. Work with Hood River County Forestry Department, ODFW, and recreation groups to evaluate the feasibility and need for selective seasonal forest road and/or recreation trail closures to protect the integrity of wildlife habitat and control disturbance and/or harassment due to rising recreation use.

Beaver

1. Wherever feasible and consistent with land use, promote tolerance of beaver activity in suitable habitat areas.
2. Collect baseline data about existing crossing patterns and locations of road kill.
3. Work with ODOT to evaluate needs and opportunities to make I-84 more amenable to wildlife crossings including permeable fence lines, median barriers with gaps or 18-inch height openings at base, bridge spans, underpasses or other alternatives. Coordinate and integrate wildlife connectivity needs with fish passage improvements.

Purple Martin

1. Conserve tree snags for cavity nesting. Desired vegetation structure is >1.2 snags per hectare >30 cm dbh and >6 m in height, no physical obstructions within 10 m of cavities.
2. Retain old pilings in the Columbia River for use by martin as cavity nesting structures

3. Create artificial nest boxes designed or managed for martins that deter fierce competitors such as starlings and house sparrows. Add more martin nest boxes at martin hotspots at Herman Creek Cove, Government Cove, and Ruthton Cove
4. Repair and maintain nest boxes in disrepair from the 1996 flood at Government Cove (~50 boxes) and Ruthton Point (~98 boxes).
5. Install nest boxes at new sites where natural cavities are lacking, in coordination with landowners. Potential sites include Cascade Locks Heritage Park, Herman Creek Cove (west of Government Cove), Lindsey Lake, Viento Lake, and Wells Island.
6. Retain and recruit hardwood tree species that readily form nesting cavities such as black cottonwood, big-leaf maple, and Oregon white oak.
7. Coordinate with the City and Port of Cascade Locks to retain some of the dead conifers between the shoreline of Government Cove and the railroad tracks. If necessary, drill cavities in these snags to promote their use by nesting martin pairs.
8. Create snags out of live trees in forest openings and along forest edges by girdling, topping, or inoculating with fungi.

Prioritized Strategies for All Terrestrial Species

Priority A

- Work cooperatively with private and public landowners to promote retention of dead and dying trees where no safety hazard exists, and retain live and dead trees with cavities in low elevation areas in land use and development plans.
- Work cooperatively with private and public landowners to promote protection of larger diameter trees and older aged native bottomland hardwood tree species such as black cottonwood, Oregon white oak, and big leaf maple in land use and development plans. Promote mitigation strategies where development impacts to bottomland hardwoods are unavoidable, such as planting these species at replacement or higher levels.
- Encourage and support timely completion of wildlife habitat inventories on non-federal lands to identify and prioritize restoration and enhancement opportunities, inform future land use actions and plans, and fulfill statewide goals to protect wildlife habitat.
- Involve wildlife biologists, land managers, local communities, recreation groups and businesses, and elected officials in developing a Gorge-wide plan to research and manage trail, backcountry, and shoreline recreation activities and developments in a manner that is sensitive to the needs of wildlife. The goal of such a plan would be to have and enjoy recreational opportunities that are compatible with the long-term maintenance of healthy and diverse native wildlife populations.
- Support enforcement of wildlife hunting regulations by advocating for adequate funding levels for area fish and wildlife patrol officers.
- Encourage compliance with provisions of the Columbia River Gorge National Scenic Area Management Plan that address wildlife habitat protection.

Priority B

- Promote and support development of coordinated wildfire hazard and forest fuels reduction plans across all land ownerships, with integration of wildlife habitat and forest health concerns.

- Prevent the spread of aggressive invasive plant species into high value habitat areas. Identify and prioritize the location of high value terrestrial habitat areas at risk of infestations from invasive plants.

Priority C

- Encourage integration of native plant and tree species into urban and residential areas to increase wildlife diversity, reduce the need for irrigation, pesticide and fertilizers in these areas.

- Educate homeowners about how to minimize conflicts with wildlife and encourage control of domestic pets.

7.4. Consistency with ESA/CWA Requirements

CLEAN WATER ACT

In the Lower Oregon Columbia Gorge Tributaries the Federal Clean Water Act is implemented in large part through the State's preparation of water quality standards, Total Maximum Daily Loads (TMDLs) and TMDL implementation by designated management agencies. As of the 2002 303(d) list, the Oregon Department of Environmental Quality (ODEQ) had not identified any water quality limited stream segments in this area. The Western Hood Subbasin TMDL for temperature was approved by EPA in January, 2002. This TMDL includes the Lower Oregon Columbia Gorge Tributaries. Because there were no 303(d) listed streams in the Gorge Tributaries area, no specific thermal modeling was done here in the TMDL. Instead, surrogate shade targets were established based on "Potential Vegetation Zones". These targets rely on restoring or protecting riparian vegetation to increase stream surface shade and channel stability in situations where human activities cause an increase in stream temperatures above the numeric criteria identified in the State's water quality standards. Management strategies identified in the Management Plan are consistent with the TMDL. The aquatic focal species strategies directed at protecting existing healthy riparian conditions, and restoring degraded riparian areas where opportunities exist.

ENDANGERED SPECIES ACT

It is worth noting that there are three NPDES permits regulated by ODEQ within the Gorge Tributaries Area. These NPDES permits are for two fish hatcheries on Herman Creek and one on Eagle Creek. Data collected in 2002 by ODEQ indicated that lower Eagle Creek exceeded the numeric criterion for salmon and trout rearing and migration, in part because of withdrawal of a good portion of the stream flow by the hatchery. The

Western Hood TMDL states that future modifications of these permits will be based on a water quality impact analysis to ensure compliance with water quality standards. This analysis has not yet been scheduled by ODEQ.

Achievement of the TMDL in part occurs through implementation of nonpoint source management plans: the Agricultural Water Quality Management Area Plans (SB 1010), the Oregon Forest Practices Act, County Comprehensive plans, and Federal policies/plans on Forest Service lands. These plans vary from voluntary to proscriptive and management oversight is normally conducted through the local, state or federal land use authority. In the Columbia Gorge tributary area, Federal policies/plans for the Columbia River Gorge National Scenic Area are the primary TMDL implementation mechanism. Initiative-based restoration/protection and public funding dovetails with TMDL implementation and is an important implementing mechanism. ODEQ recognizes that Subbasin Planning is a key effort that supports TMDL implementation, and both are adaptive in nature. When TMDLs are re-evaluated by ODEQ in the future, the Management Plan may also be re-evaluated to incorporate new findings and ensure consistency with future TMDLs and/or new 303(d) listings.

The Management Plan proposes objectives and strategies that are consistent with the Endangered Species Act (ESA) requirements for listed species. Specific strategies in the Management Plan seek to enhance habitat protection of Threatened bald eagle and spotted owl on both private and publicly owned lands. Several strategies confirm or support mandatory measures such as Riparian and Late Successional Forest Reserve allocations and protection of special habitat areas on federal land under the Northwest Forest Plan. Other strategies seek to implement voluntary habitat protection for listed species on non-federal land, such as the retention and enhancement of bottomland hardwoods and large trees suitable for nesting and perching for eagle, protection of breeding and foraging eagles from human disturbances, and improvement of dispersal habitat for spotted owl. As for Threatened chinook and steelhead, several management objectives and strategies will help protect and restore habitat for these species. These include including improving fish passage and stream connectivity, protecting and restoring riparian vegetation, and restoring instream structure. Objectives and strategies promote voluntary measures and enforcement of existing laws to enhance protection and improvement of water quality and streamflows on non-federal lands.

7.5. Research, Monitoring and Evaluation

Monitor the abundance, genetics, distribution, habitat condition, and life history of anadromous and resident fish using juvenile and adult spawner surveys to provide a means to monitor future trends, identify priority habitats, and evaluate actions.

Collect baseline habitat survey and water quality information in Phelps and Post Canyon creeks

Monitor the status of threatened, rare, and sensitive wildlife populations
Monitor stream temperatures in area streams to identify the extent of human-induced changes that may be causing negative impacts to salmonid production or persistence.

Determine the distribution of stream reaches that harbor genetically pure or unique stocks of resident trout so that these reaches may be protected from habitat modification or non-native species introgression.

Collect baseline stream habitat and fish species distribution on previously unsurveyed streams or reaches as identified in Table 3 (section 1.1.2) to have accurate and complete baseline data for future planning and analysis efforts.

Determine the distribution of lamprey, and other declining aquatic species, to determine the habitat-related causes and potential stream restoration opportunities.

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TOAST - UNDERSTANDING OUT-OF-SUBBASIN EFFECTS FOR OREGON SUBBASIN PLANNING Oregon Technical Outreach and Assistance Team
With particular reference to Ecosystem Diagnosis and Treatment assessments
February 27, 2004

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