3. Fifteenmile Subbasin Assessment

DRAFT

May 25 2004

Compiled by Wasco County Soil and Water Conservation District
in cooperation with
Fifteenmile Coordinating Group

Assessment Overview

The Fifteenmile Subbasin Assessment focuses on four aquatic focal species and seven wildlife species. The majority of the assessment focuses on the aquatic focal species, and particularly on Mid-Columbia winter steelhead, which is listed as threatened on the Federal Endangered Species List.

The discussion of fish is broken geographically into three regions: Fifteenmile Watershed, The Dalles and Mosier. Fifteenmile Watershed includes Fifteenmile Creek

and its tributaries, Eightmile Creek, Fivemile Creek, Ramsey Creek, Dry Creek and Cedar Creek. The Dalles area includes Threemile, Mill Creek and Chenowith Creek, each of which are tributaries of the Columbia River flowing through the City of The Dalles. Mosier includes Mosier Creek and Rock Creek, tributaries of the Columbia flowing through the city of Mosier.

Most fish population and habitat data is available for Fifteenmile Watershed. Therefore, Ecosystem Diagnosis and Treatment (EDT) was run for winter steelhead in Fifteenmile Watershed. Much of the assessment is based on the results of this model. EDT was used to characterize the life history diversity, productivity, capacity and abundance of winter steelhead in Fifteenmile Subbasin. EDT results were compared to on-the-ground data to verify accuracy and calibrate conclusions.

Because of the major data gaps in The Dalles and Mosier areas, Qualitative Habitat Assessment was used to prioritize reaches for restoration and protection in these areas.

Both the EDT and QHA analyses were limited by gaps in our knowledge of the focal species and their habitat. These gaps are identified at each stage of the analysis of results. Major data gaps are summarized.

Wildlife is discussed in section 3.5. Seven focal species were chosen based on an analysis of habitat changes since settlement of the area by American pioneers. This analysis is not as in-depth and quantitative as the aquatic assessment, because of lack of population data for the chosen focal species.

3.1. Subbasin Overview

3.1.1. General Description

The Fifteenmile Subbasin, located in north central Oregon, drains approximately 368,300 acres (575 square miles) of Wasco and Hood River Counties. The Subbasin actually consists of several distinct watersheds, all of which originate on the east slopes of the Hood River Range, a north-south mountain range running from about nine miles east of Mount Hood north to the Columbia River. These watersheds are the Fifteenmile, Threemile, Mill Creek, Chenowith, Mosier Creek and Rock Creek Watersheds.

Fifteenmile Creek originates within the Mount Hood National Forest near Lookout Mountain (highest point in Watershed, 6,525 feet). Eightmile Creek originates north of Fifteenmile, and Fivemile Creek originates immediately north of Eightmile. All three flow toward the northeast. Fifteenmile then curves north, then west, before merging with Eightmile and turning northwest for the final two miles to the Columbia River. The elevation at the mouth of Fifteenmile is 78 feet. Fivemile Creek flows into Eightmile one mile up from the mouth of Eightmile Creek. Dry Creek originates on the north side of Tygh Ridge, and flows northward, before turning northeastward and paralleling Fifteenmile for approximately three miles, collecting most of the runoff from Tygh Ridge (maximum elevation 3,200 feet) before joining Fifteenmile at the historic site of Rice. Mill Creek originates north of Fivemile Creek at an elevation of 4,900 feet. Mosier

Creek originates north by northwest of Mill Creek at an elevation of 3,400 feet and Rock Creek originates at an elevation of 3,000 feet. Threemile Creek and Chenowith Creek both originate at approximately 2,600 feet in elevation.

The geology of Fifteenmile Subbasin is dominated by north-tilting basalt lava flows that are collectively more than 3,000 feet thick. Tygh Ridge, an anticline or convex fold in the geologic layers, forms the south boundary of the subbasin. From there, the landscape slopes gradually to the north. Fifteenmile Creek and its major tributaries cut through the geologic layers, forming a landscape of rolling ridges and valleys.

Through the Columbia Gorge, geology is characterized by a number of north-south oriented folds visible in the northern part of the subbasin from The Dalles westward. The areas around Mosier Valley and The Dalles represent synclines (downward folds), whereas Sevenmile Hill and Hood River Mountain (west of Mosier) represent anticlines (upward folds). The Rock Creek Watershed is an active fault line splitting the Hood River Mountain Anticline.

The climate in the Fifteenmile Subbasin is influenced both by marine air that flows through the Columbia Gorge from the west and by continental weather patterns that spread from the Great Basin to the East. Both summer and winter air temperatures can be somewhat extreme in the eastern portion of the subbasin.

The majority of the precipitation is generally brought by winter storms blowing east from the Pacific Ocean. The Hood River Range, including Lookout Mountain, Surveyor's Ridge and Fir Mountain, which forms the western boundary of the subbasin, features the highest elevations and therefore receives the highest precipitation and the highest percentage of precipitation as snow. Persistent winter snowpack is found only at elevations above approximately 2,800 feet. The Cascade Mountains produce a rain-shadow effect, drastically reducing the total precipitation in the eastern end of the Fifteenmile Subbasin. Average annual precipitation varies from 65-80 inches in the higher elevation headwaters to 10 inches on the eastern border of the subbasin.

Only 5-10% of the precipitation falls from June through August. Because of both the seasonality of moisture and the low total precipitation, tributaries originating at lower elevations are usually not perennial.

The higher elevations of the subbasin are located in 3 separate ecoregions[1]:

Cascade Crest Montane Forest: a mixture of Western Larch *(Larix occidentalis)*, Mountain Hemlock *(tsuga mertensiana)*, Western Red Cedar *(thuja plicata)*, Pacific Silver Fir (*Abies amabilis*) and Englemann Spruce (*Picea engelmannii*).

Grand Fir Mixed Forest: a mixture of Grand Fir (*Abies grandis*), White Fir (*Abies concolor*) and some ponderosa pine.

[1] OR Natural Heritage Foundation, http://www.gis.state.or.us/data/alphalist.html April 2004.

Oak/Conifer Eastern Cascades Foothills: Douglas fir dominates in the coolest and wettest sites, while ponderosa pine is more common at lower elevations, and Oregon White oak dominates in the driest and warmest sites. This ecoregion is also commonly found at lower elevations along the Columbia River between The Dalles and Mosier.

The eastern part of the watershed is located in the Columbia Plateau and Pleistocene Lake Bottom ecoregions, characterized by bunchgrass prairie with mixed hardwood trees in the riparian zones. Further information on each of these ecoregions can be found in the appendices.

Of the 368,300 acres in the subbasin, about 37% is cropland, 21% is rangeland; and 38% is forestland. Urban areas constitute about 1.5% (5,500 acres) and another 2.5% (9,700 acres) is zoned for rural residential development. Of the cropland, less than 15,000 acres (4% of the subbasin) is irrigated. The irrigated cropland consists mostly of orchards, vineyards, pasture and hay, with some irrigated wheat and other crops.[2] "The non-irrigated cropland is almost exclusively in wheat or other grain production."[3]

The population of Wasco County was estimated at 23,750 in July of 2002.[4] The average population density in Wasco County is 12 people per square mile.

The economy of the Fifteenmile Subbasin is based on agriculture, recreation, and grazing, with a smaller component of forest production. Until 2001, the aluminum plant in The Dalles was a significant employer. The aluminum plant has since shut down most operations. Mid-Columbia Medical Center is currently the largest single employer with its latest addition of the Celilo Cancer Treatment Center.

The entire Fifteenmile subbasin is located within the boundary of lands ceded to the United States government by the seven bands of Wasco- and Sahaptin-speaking Indians whose representatives and head men were signatories to the Treaty with the Tribes of Middle Oregon of June 25, 1855. The Confederated Tribes of the Warm Springs Reservation of Oregon are the legal successors to the Indian signatories to the treaty.

The majority of the acreage (81%) in Fifteenmile subbasin is privately owned. This includes 20,000 acres owned by private timber companies and the Nature Conservancy.

The U.S. Forest Service manages the mid to high elevation forests in approximately 15% (35,000 acres) of the Fifteenmile Creek subbasin. The primary land uses on the National Forest are timber management and recreation.

The Bureau of Land Management (BLM) owns 2,770 acres (approx. 1%) of mostly forested land in the middle elevations of the subbasin.

---

[2] Clark, Jennifer, SWCD. Personal Communication. 2003.

[3] Eddy, Dusty, NRCS. Fifteenmile Creek Subbasin Summary. 15 Nov. 2000.

[4] OR Economic & Community Development Department: The Dalles Community Profile. August 2003

Major human disturbances include:

- Changes to land cover that affect wildlife habitat, hydrologic regimes, and erosion rates;
- Alteration of instream and riparian conditions through channelization of streams, road-building, removal of large woody debris, and historic logging patterns;
- Pesticide and fertilizer use;
- Groundwater overdraft.

The disturbances noted above are not distributed evenly throughout the subbasin. Some stream systems are more affected by certain factors than others.

3.1.2. Subbasin Existing Water Resources

Irrigation is the largest water use in the watershed. Low stream flows during the growing season limit the amount of irrigation. Summer flows on most streams have been fully appropriated since the early 1900's.

The hydrologic regime of the Fifteenmile Subbasin is influenced by many factors, with no single factor adequately explaining the streamflow patterns. Factors include precipitation and snow levels, soil characteristics, land management, and interbasin water transfers.

Precipitation varies across the watershed from high elevations to low, and from west to east. Average annual precipitation varies between 50 and 80 inches per year[5] on Lookout Mountain, to as low as 10 inches in the eastern part of the subbasin.

The majority of the precipitation in the Fifteenmile Subbasin falls during the winter. Winter snowpack is mostly confined to elevations above approximately 4,000 feet. Streams with headwaters in this region tend to exhibit an extended period of high flow lasting from April to June due to spring snowmelt.

Oregon Department of Environmental Quality lists all mainstem streams in the Fifteenmile Watershed as water quality limited due to high summer water temperatures.[6] In addition, the Fifteenmile and Eightmile creeks are listed as water quality limited due to sedimentation, which affects spawning success of salmonid fish. Organophosphate pesticides were detected in the mainstem of Mill Creek in 2002 and 2003 and in Threemile Creek in 2003. DEQ plans to list Mill Creek for this form of pollution in 2004.

[5] Climate. Maps. USDA, Oregon State Climatological Service, Hood River Department of Forestry.

[6] 303(d) List of Water Quality Limited Waterbodies. Department of Environmental Quality. 2002.

Hydrology is heavily influenced by the permeability of soils and underlying geologic strata. Sixty-three percent of all soils in the subbasin are "B" soils, typically deep, sandy loam or silt loam soils with low clay contents[7].

Small wetlands are found throughout the subbasin in the form of artificial or natural ponds. Many of these wetlands are vernal in nature. The higher forest ecosystems include more year-round palustrine wetlands, though most are still small. Larger wetlands are found at the mouths of Threemile, Chenowith and Mosier creeks. The mouth of Mill Creek was formerly an extensive delta, until it was put into an 800-foot culvert with construction of Interstate 84.

3.1.3. Hydrologic and Ecologic Trends in the Subbasin

Climate varies across the Subbasin from west to east and from high elevations to low. The natural hydrology and ecology of the subbasin are affected by this variation, as is the sensitivity of the subbasin to human disturbance.

The forested ecosystems of the western part of the subbasin have had less human disturbance. These areas have naturally low runoff rates, which are not greatly increased by forest management activities. Very little conversion has taken place from forestry to other land uses. Road densities in commercial timber management areas are comparable to urban areas. Paved roads are uncommon, but placement of roads alongside streams is a widespread issue and a source of sedimentation and pollution.

By contrast, the eastern end of the watershed, which receives much less precipitation, is a shrub-steppe ecosystem of which over half has been converted to tilled agriculture. The hydrologic regime in Fifteenmile and Eightmile creeks is highly sensitive to these land use changes.

Because of the permeability of the soils and porous nature of the geologically young Cascade Mountains, most of the subbasin has active groundwater aquifers, featuring relatively quick recharge rates.

Conversion of shrub-steppe habitat to tilled agriculture increased runoff rates and peak flows in Fifteenmile Creek and its tributaries. According to USDA models, peak flows increased by as much as 600% between 1850 and 1950.[8] Since that time, peak flows have partially recovered with the adoption of minimum-till techniques, and most recently with no-till farming techniques. From 1998 to 2003 nearly half the agricultural acreage in the Fifteenmile Watershed has been converted to direct-seed/no-till systems, dramatically reducing runoff and erosion while increasing water infiltration.[9]

[7] Soil Survey: Northern Wasco County Oregon. March 1982.

[8] Fifteenmile Watershed Assessment. Wasco County Soil & Water Conservation District and Fifteenmile Watershed Council. 2002.

[9] Fifteenmile Watershed Assessment. Wasco County Soil & Water Conservation District and Fifteenmile Watershed Council. 2002.

Forest management activities in the Mount Hood National Forest are modeled to have increased runoff events in the forest from 1 to 6%.[10]

3.1.4. Regional Context

Fifteenmile Subbasin is home to the easternmost run of wild winter steelhead (*Onchorhynchus mykiss*) in the Columbia Basin. This run is considered part of the Mid-Columbia Evolutionarily Significant Unit, which was listed as threatened under the Endangered Species Act by NOAA Fisheries in March 1999. The run is particularly significant because no hatchery steelhead have ever been stocked in Fifteenmile Subbasin. Therefore, the run represents a relatively intact wild genetic stock, and should be considered highly significant for recovery of Mid-Columbia winter steelhead. NOAA fisheries identifies Fifteenmile winter steelhead to be an independent population.[11] In addition to steelhead, aquatic focal species are Pacific lamprey (*Lampetra tridentata*), coastal cutthroat trout (*O. clarkii*), and resident red-band trout (*O. mykiss*). The Fifteenmile Subbasin does not support bull trout, and is not believed to have done so historically.

The Fifteenmile Subbasin represents the eastern end of the Columbia Gorge Province, an area of extreme climatic and habitat diversity and home to eight hundred species of flowering plants, including fifteen endemic plant species.[12]

3.2. Aquatic Focal Species Characterization and Status

3.2.1. Fish of Ecological Importance

At least 18 species of fish inhabit the Fifteenmile Subbasin, including 4 anadromous species, and 5 salmonid species, 3 of which are anadromous. Table 3.1 lists fish species observed or known to have been introduced in the past.

Table 3.1. Fish Species in Fifteenmile Subbasin:

Common Name	Scientific Name	Where found
Winter Steelhead	*Oncorhynchus mykiss*	Most habitat found in Fifteenmile and Mill Creek watersheds. Believed to be found in Threemile, Chenowith, Mosier and Rock creeks, downstream of passage barriers.
Rainbow-type Trout	*Oncorhynchus mykiss*	Fifteenmile, Threemile, Mill, Chenowith, Rock Creek.
Coho salmon	*Onchorhynchus kisutch*	Mill Creek, Mouths of Fifteenmile, Threemile, Chenowith, Mosier and Rock
Chinook	*Onchorhynchus*	Fifteenmile and tributaries

[10] Miles creeks Watershed Analysis. US Forest Service. 1994. See also Fifteenmile Watershed Assessment.

[11] ICB-TRT July 2003.

[12] Jolley, Russ. Wildflowers of the Columbia Gorge. 1988.

salmon	*tshawytshaw*	
Cutthroat Trout	*Oncorhynchus clarkii*	Mill Creek, Mosier Creek, Rock Creek, Fivemile and Lower Fifteenmile Creek.
Pacific Lamprey	*Lampetra tridentata*	Fifteenmile and tributaries; Distribution not well defined, Possibly in Mill Creek
Western Brook Lamprey	*Lampetra richardsonii*	Fifteenmile and tributaries; Distribution not well defined, possibly in Mill Creek
Sculpin	*Cottus spp.*	Fifteenmile and tributaries, Mill, Threemile, Chenowith, Mosier
Mountain sucker	*Catostomus platyrhynchus*	Lower Fifteenmile and tributaries, Mill, Threemile, Chenowith
Bridgelip sucker	*Catastomid columbianus*	Lower Fifteenmile and tributaries, Mill, Threemile, Chenowith
Largescale suckers	*Catostomus macrocheilus*	Spawning run from Columbia in mouths of all streams
Speckled dace	*Rhinichthys osculus*	Fifteenmile and tributaries, Mill, Threemile, Chenowith
Northern Pikeminnow	*Ptychocheilus oregonensis*	Mouths of Fifteenmile, Mill, Threemile, Chenowith
Redside shiner	*Richardsonius balteatus*	Mouths of Fifteenmile, Mill, Threemile, Chenowith
Chiselmouth	*Acrocheilus alutaceus*	Mouths of Fifteenmile, Mill, Threemile, Chenowith
Three-Spined Stickleback	*Gasterosteus aculeatus microcephalus*	Mouths of most creeks on Columbia, noted in Chenowith and Threemile
Non-native Rainbow trout	*Oncorhynchus mykiss*	Fifteenmile, Mosier (introduced in past, probably no longer present)
Non-native Brook trout	*Salvelinus fontinalis*	Certain tributaries of upper Mosier Creek (probably an illegal introduction)

Rainbow trout were stocked by ODFW in Fifteenmile Creek at the Taylorville bridge until 1974 and the downtown Dufur bridge until 1991. Hanel Lake has been stocked annually with approximately 500 catchable trout since 1994. These are coastal rainbow trout from a private hatchery/trout farm near Sandy, OR. Wolf Run Ditch is screened, preventing migration of stocked fish out of the reservoir. ODFW stocked rainbow trout in Mosier Creek from 1952-1963 and 1968-1971. Hatchery rainbow trout can interbreed with rainbow-type and steelhead, but gene pool dilution is believed to have been minimal.[13] The particular stock of rainbows used for these introductions were believed to not survive the summer due to susceptibility to a naturally occurring disease

[13] Appendix F. USFS. 1994

(Ceratomyosis), to which native rainbow-type are resistant.[14] Brook trout have been found in Ketchum Reservoir and in one tributary in upper Mosier Creek. As there is no record of legal stocking of brook trout, these appear to be an illegal introduction.

3.2.2. Focal Species Selection

Aquatic Focal Species

Fisheries management in Fifteenmile Subbasin focuses on cold-water anadromous fish, downstream from natural passage barriers, and on cold-water resident salmonids throughout the watersheds. The cumulative range of the chosen focal species covers all perennial streams, and many seasonal reaches.

All focal species are native to the subbasin. Chinook and coho were rejected as focal species, both for their limited range, and because the fish that have been observed are not believed to be native. Table 3.2 lists the focal species and the reasoning behind their selection.

Table 3.2. Aquatic Focal Species in the Fifteenmile Subbasin and Reasoning for Choice

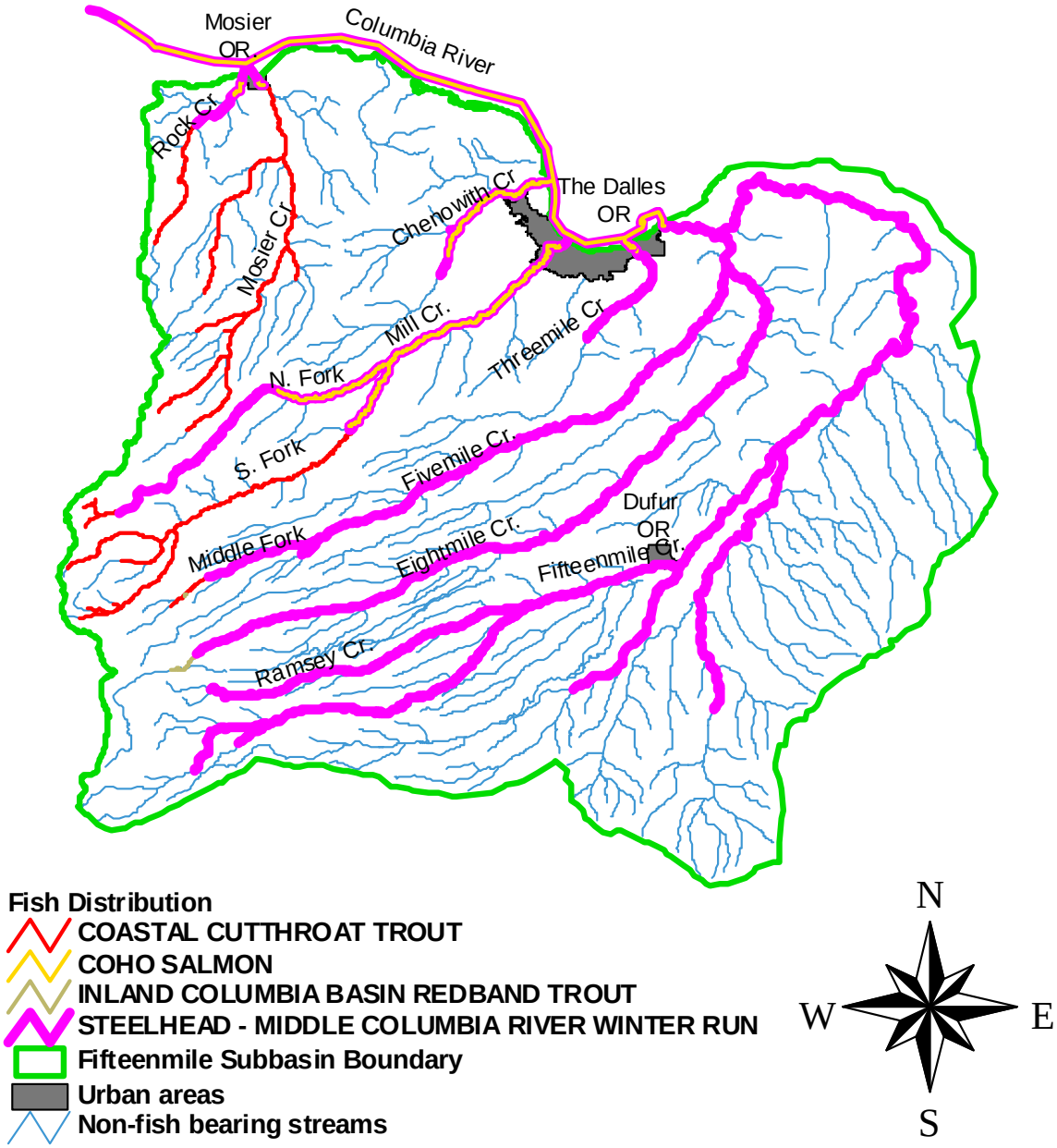
Species	Reason for Choice
Winter Steelhead	Federally listed as threatened, unique run of anadromous fish, culturally important to tribes
Rainbow-type/Rainbow Trout	Same species as steelhead, greater range within tributaries, slightly different habitat needs
Pacific Lamprey	Anadromous fish with similar habitat and range as steelhead, culturally important to tribes
Cutthroat Trout	Resident cold-water fish that tend to occupy habitat not accessible to anadromous species

Figure 3.1 shows the distribution of salmonid fish throughout Fifteenmile Subbasin, as noted on the StreamNet website.[15] The map fails to show Chinook salmon, which are consistently sited in Mill Creek, and have been noted in recent years in Fifteenmile Creek.

[14] French, Rod. Personal Communication. 2002

[15] http://www.streamnet.org/online-data/GISData.html

Figure 3.1. Distribution of Salmonid Fish in Fifteenmile Subbasin (Source: Streamnet website)*



* Chinook salmon are found in Mill Creek at least to the forks, and have been found in Fifteenmile above Ramsey Creek.

[16] French, Rod. ODFW. Personal Communication. 2002.
[17] ODFW 2003
[18] ODFW 2003
[19] Oregon Department of Fish and Wildlife, 1999b
[20] Steve Pribyl. Oregon Department of Fish and Wildlife. Personal Communication. 2003.

Coho salmon have been documented spawning in the lower part of Fifteenmile Creek below and just above Seufert Falls. They are thought to spawn only in the lower few miles of Fifteenmile Creek.[21] It is believed that coho spawning in this area are likely stray hatchery fish from other subbasins. Coho would have difficulty completing their juvenile freshwater rearing in this portion of the stream.

From 1998 to 2000, ODFW maintained a screw trap near the mouth of Fifteenmile Creek to monitor out-migrating smolts (salmonids that are physiologically changing in preparation for migration to the ocean). The screw trap was operated again in 2003 jointly by US Forest Service and ODFW. A screw trap is a downstream migrant juvenile fish trap. Captured fish are held in the trap until sampled. Coho juvenile migrants were captured in 1998 and 2003. In each year, two juveniles were captured. In 1999 and 2000, no coho were captured at the screw trap.[22]

Chinook salmon appear to spawn and possibly rear in Mill Creek at least to the forks. These salmon are believed to be hatchery strays from the Klickitat fall Chinook stock.

Chinook salmon have been sighted in recent years in Fifteenmile Creek. Juvenile migrants captured at the screw trap have varied from a high of 90 in 1999 to a low of 2 in 2003[23]. The population was estimated in 1999 at 928 (+/-609) juvenile downstream migrants.[24] In 1997, one carcass and one live adult Chinook were seen in Fifteenmile Creek above the Dufur City Water Intake and one live adult was seen in Eightmile.[25] Prior to 1997, Chinook had not been documented in Fifteenmile Watershed. The origin of these fish is uncertain, but they are believed to be hatchery strays. Fifteenmile Creek generally lacks large pools and cool water temperatures that adult *spring* Chinook require for summer holding before spawning in the fall. On the other hand, Fifteenmile Creek generally lacks adequate streamflow in the late summer or fall that would be required by migrating adult *fall* Chinook.

Prior to settlement, warm water fish, such as stickleback and Northern Pike Minnow, were probably restricted to the mouths of the creeks on the Columbia. Their range may be expanding with warmer water temperatures. They are not a focus of local management, and were rejected as a focal species. Likewise, suckers and dace are restricted to the lower watershed.

Sculpin are commonly found in the upper parts of the watershed. They are not a focus of local management, but are likely ecologically important.

Fisheries management in the Fifteenmile Subbasin is based on the species listed as focal species in Table 3.2. All four species are cold-water species, and occupy the higher levels in the aquatic food chain.

[21] French, Rod. ODFW. Personal Communication. 2002.
[22] ODFW 2003
[23] ODFW 2003
[24] Oregon Department of Fish and Wildlife, 1999b
[25] Steve Pribyl. Oregon Department of Fish and Wildlife. Personal Communication. 2003.

Steelhead and rainbow-type trout are the same species and are generally found in the same habitats. Steelhead are listed as threatened on the Federal Endangered Species list. Rainbow-types are on the Forest Service and Oregon State sensitive species lists. Steelhead are a culturally important species to the Confederated Tribes of the Warm Springs Indian Reservation.

The Confederated Tribes of Warm Springs retained the right to hunt, fish, and gather within the lands ceded to the United States government. Species of significance to the Warm Springs Indians for subsistence and for cultural and spiritual purposes include elk, deer, steelhead, cutthroat trout, and lamprey.

A significant population of Native Americans are known to have historically utilized resources within the Fifteenmile Subbasin with a suspected harvest on elk, deer, steelhead, and lamprey. Cutthroat trout may be included as a resident fish providing basic sustenance during the off season when steelhead and lamprey were not present.

Pacific lamprey are another anadromous species that are believed to have largely the same habitat requirements as steelhead. They are also a culturally important species to the Confederated Tribes. Little is known about this species' range or population within the subbasin. They are generally believed to have a range similar to steelhead.

Coastal cutthroat trout are generally found in the Fifteenmile Subbasin in areas that are isolated from anadromous fish and rainbow-type trout. South Fork Mill Creek, Mosier Creek and Rock creeks all have resident populations of coastal cutthroat above natural migration barriers. Fivemile Creek also has a population of cutthroat, even though it does not have a complete migration barrier. In some parts of Fivemile Creek, rainbow-type and cutthroat are found to overlap. More information is included below.

3.2.3. Aquatic Focal Species Population Delineation and Characterization

Steelhead were listed as threatened throughout the Mid-Columbia River Evolutionarily Significant Unit, under the Endangered Species Act in the spring of 1999.[26] Steelhead were chosen as a focal species because they are Federally listed as threatened, and are the species of primary concern in management decisions by State, Federal and Tribal natural resource agencies. Pacific Lamprey were also chosen as a focal species, because of their cultural significance to the Confederated Tribes, and because their habitat needs are similar to those of steelhead. For those reaches where steelhead are not present, rainbow-type and cutthroat were used as focal species.

[26] Endangered Species Act Status of West Coast Salmon & Steelhead. http://www.nwr.noaa.gov/1salmon/salmesa/pubs/1pgr.pdf March 2004.

Steelhead and Rainbow-type Trout

Population Description

Winter steelhead (Table 3.3) have been found in Fifteenmile Creek, Ramsey Creek, Eightmile, Fivemile, Dry Creek, Mill Creek and its forks, Mosier Creek, and Rock Creek, as well as near the mouths of Threemile and Chenowith creeks and many intermittent streams.

Table 3.3. Rationale for Selection of Steelhead and Rainbow-type Trout as Focal Species.

Species Designation	Special Ecological Importance	Tribal Recognition
Fifteenmile winter steelhead are included in the Mid-Columbia ESU, that portion of the Columbia River Basin extending from White Salmon River and Fifteenmile Creek in the west, and up to and including the Yakima River in Washington. Steelhead within this ESU were federally listed as threatened in March 1999. The resident rainbow-type trout was proposed for ESA listing throughout its range, but a listing was determined not warranted at that time.	Steelhead and rainbow-type trout serve as an important food source for a variety of wildlife and contribute nutrients that have wide-reaching benefits to the biota of the subbasin. Spawning of steelhead and rainbow-type is partially separated both temporally and geographically. Resident trout tend to use smaller gravels and spawn later in the year, thus maintaining two separate populations, though offspring of either steelhead or resident may adopt either life history pattern.	Native Americans throughout the Pacific Northwest, including the Confederated Tribes of the Warm Springs, maintain strong cultural values for steelhead. These fish have long had important tribal subsistence, ceremonial and commercial value.

It is not known if steelhead in the other watersheds are genetically identical to those in Fifteenmile. Resident rainbow-type trout are the same species as steelhead and probably interbreed with them. There is some uncertainty as to whether all rainbow-type trout in the subbasin are of this subspecies. Local fish biologists suggest that there may be some intergradation between coastal "rainbow" trout and interior "rainbow-type" trout (Fifteenmile Coordinating Group meeting, 4/16/04). Genetic analysis of trout taken from Fifteenmile Creek suggests that they are more closely related to rainbow-types than to coastal rainbows.[27] The Miles Creeks Watershed Analysis refers to these resident trout as Eastern Cascades "redbands."[28]

The Interior Columbia Basin Technical Recovery Team suggests that the resident trout may represent a separate population with little or no interbreeding with steelhead:

[27] Gregg, R. and F. W. Allendorf. 1995. Spruell, P., et. al. 1998.
[28] Miles creeks Watershed Analysis Appendix F. US Forest Service. 1994..

> "Within the population, genetic samples from Eightmile Creek (Currens 1997) Interior Columbia River Salmon Populations July 2003 91 were highly divergent from samples from Fifteenmile Creek, the Deschutes River, and the Lower Columbia ESU (see Appendix A). These Eightmile Creek samples appear to represent a resident redband rainbow population with little or no interbreeding with anadromous fish…"[29]

For the purposes of this assessment, resident *O. mykiss* trout will be called "rainbow-type trout."

Relatively little life history information has been collected on winter steelhead and rainbow-type trout in the Fifteenmile Subbasin. What information has been collected is almost entirely from Fifteenmile Watershed. Steelhead in Mill Creek and other Columbia tributaries are presumed to have similar life histories to Fifteenmile Watershed.

Winter steelhead enter Fifteenmile Creek during February and March. Spawning is generally completed by the end of May when stream flows are sufficient to provide good fish passage. Fry emergence has been estimated to occur in Fifteenmile streams from May into July. Juvenile steelhead spend 1 to 4 years rearing in Fifteenmile Creek before smolting and migrating downstream in the spring.

Rainbow-type trout spawn during April and May. Emergence of fry is usually from May into July. Rainbow-type trout adults are usually smaller than adult steelhead and utilize a finer size of gravel.

In 2002, the US Forest Service conducted redd surveys on the Forest in North Fork Mill Creek. Five redds and nine adult steelhead were found on the National Forest. Steelhead passage appeared to be limited by a culvert three miles upstream of the Forest Service boundary. The Forest Service plans to replace this culvert by 2005 to open up at least one more mile of spawning habitat.[31]

Local observation confirms steelhead spawning in South Fork Mill Creek below Mill Creek Falls and in the mainstem of Mill Creek[32], as well as North Fork Mill Creek to mile 9, and the mouth of Chenowith Creek.[33] Local residents report steelhead migration into the lower portions of Mosier Creek and Rock Creek, but as of January 2003, these reports are unconfirmed by qualified observers. Rod French, ODFW, speculates that largescale sucker may be commonly confused with steelhead by untrained observers. Natural waterfalls prevent upstream migration on South Fork Mill Creek at mile 3, Mosier Creek at mile 0.4, and Rock Creek at approximately mile 2.

---

[29] ICB-TRT July 2003.

[30] Miles creeks Watershed Analysis Appendix F. US Forest Service. 1994..

[31] USFS report to The Dalles Area Watershed Council. August 2002.

[32] Anderson, Dave. City of The Dalles Water Quality Manager. Personal Communication. January 2003.

[33] French, Rod. Oregon Department of Fish & Wildlife. Personal Communication. January 2003.

Abundance Estimates

Spawning surveys have been conducted by the Forest Service and ODFW for more than 15 years in Fifteenmile and Eightmile upstream of US 197 and in Ramsey Creek. Within the surveyed areas, the following reaches appear to be particularly productive for steelhead: Eightmile Creek from US197 to Walston Grade, the lower five miles of Ramsey Creek, and Fifteenmile Creek from US197 to 1 mile above Dufur City Intake. Prior to 2003, neither Fifteenmile Creek nor Eightmile Creek had been surveyed downstream of US197, although redds had been seen in those reaches.[34] These areas were assumed, based on habitat and water quality, to be the primary spawning reaches in the watershed. Fivemile Creek had been surveyed upstream of the Forest Service boundary.

In 2003, a new protocol was used to estimate basin-wide spawning. The watershed was broken up into five-mile reaches. From each of these reaches, one mile was chosen at random for redd surveys. In addition to these randomly chosen reaches, five miles were chosen by fisheries managers aiming to capture the most productive spawning areas. Spawning was documented in 2003 from the mouths of Fifteenmile Creek, Ramsey Creek and Eightmile Creek to their headwaters on the Forest.[35] They also documented spawning in the lower 10 miles of Fivemile Creek.

Estimates of the winter steelhead run in Fifteenmile Watershed since 1990 vary from 127 to 1,077 adults[36]. Several methods were used to generate these estimates:

- Best professional judgement of four local fish biologists sets the population level between 300 and 800 adult spawners.[37]

- A limited series of juvenile smolt counts are available (See discussion below and table 3.4). Applying a 6.5% smolt-to-adult survival ratio to the counts of outmigrants 165mm and larger produces a population range from 296 to 683.

- Counts are available for wild winter steelhead passing Bonneville Dam. Dan Rawding estimates that 40% of these fish return to Hood River, 25% to the Klickitat River, 5% to Mill Creek, 5% to the Wind River, and 25% to Fifteenmile Creek. Estimating on this basis gives a low value of 129 spawners to Fifteenmile for the 1995 brood year and a high value of 663 spawners for the 2002 brood year.[38] This method also produces the only

[34] Steve Springston, Oregon Department of Fish & Wildlife. Personal Communication. January 2003.

[35] USFS and ODFW draft spawning report 2003

[36] ODFW 2004, Memorandum from Steve Pribyl to Rod French.

[37] Dan Rawding, Washington Department of Fish and Wildlife, Gary Asbridge, Mount Hood National Forest, Chris Rossel, Barlow Ranger District, USFS, and Steve Pribyl, Oregon Department of Fish and Wildlife, as quoted in March 26th memorandum from Steve Pribyl to Rod French, District Fish Biologist, The Dalles OR ODFW.

[38] IBID

available estimate of Mill Creek spawning runs which varies from 26 to 133 adult returns.

- In 2003, the first attempt was made to estimate total redds in the Fifteenmile Subbasin using multiple passes, total redd counts in randomly selected reaches thought to be representative of the total available spawning habitat in the watershed. Counted redds were expanded using two separate methods, and estimates of 525 and 645 redds were produced. Multiplying this by Steve Pribyl's estimate of 1.67 spawners per redd gives a range of 877 to 1,077 spawners for the 2003 run. While the 2003 redd counts provide the best available estimate of total redds in the system, it should be noted that 2003 is believed to have been a favorable year for salmonid runs throughout the Columbia Basin.

NOAA Fisheries Interior Columbia Technical Recovery Team (TRT) set interim abundance targets for steelhead in each subbasin of the Middle and Upper Columbia River. While Fifteenmile Subbasin was inadvertently left out of the published report,[43] the target generated for Fifteenmile Subbasin was 500 adult steelhead. This number was based on the drainage area of the subbasin, smolt production estimates from the NWPPC Smolt Density Database, and state/tribal quantitative objectives (1991 SubbasinPlan).[44] This target includes production from Mill Creek Watershed, as well as Fifteenmile Watershed. Based on Dan Rawding's estimate that 5% of the wild winter steelhead that pass Bonneville Dam return to Mill Creek, while 25% return to Fifteenmile[45], the IC-TRT interim recovery goal could be split with 417 spawners returning to Fifteenmile and 83 returning to Mill Creek or other streams in the subbasin.

In years 1998, 2000, and 2003, ODFW maintained a screw trap near the mouth of Fifteenmile to monitor out-migrating smolts. A screw trap is a downstream migrant juvenile fish trap. Captured fish are held alive in the trap until sampled. Captured fish are enumerated by species, and a subsample is marked before being released. Marked fish are released upstream of the trap to determine a recapture rate and trap efficiency. This mark-recapture methodology is employed to estimate the total number of downstream migrants. Steelhead smolt estimates for each year are given in table 3.4. Due to the low number of recaptured marked fish, population estimates are not precise. In many cases, 95% confidence intervals exceed the population estimates themselves (Table 3.4). Furthermore, due to the extreme annual variation in flows on Fifteenmile Creek, the screw trap is operated from April to early June only. A certain number of fish may

[39] Pribyl, Steve. ODFW. Personal Communication. 2004. Based on a study
[40] USFS report to The Dalles Area Watershed Council. August 2002.
[41] Anderson, Dave. City of The Dalles Water Quality Manager. Personal Communication. January 2003.
[42] French, Rod. Oregon Department of Fish & Wildlife. Personal Communication. January 2003.
[43] NOAA Fisheries 2002
[44] Lynn Hatcher, pers. comm. Via e-mail, 4/30/2004.
[45] Dan Rawding, WDFW. Quoted in memorandum from Steve Pribyl to Rod French, March 26th, 2004

migrate out of the subbasin before or after that period. Smolt to adult survival is unknown in Fifteenmile Watershed, but is estimated at 5-7% in the Hood River.[46]

Table 3.4. Estimated total number of downstream migrant rainbow/steelhead at mouth of Fifteenmile Creek. Figures in parentheses are 95% confidence intervals. [47]

Year	Fork length below 150mm (Represents mostly presmolts and Rainbow-types)	Fork length 150mm or greater*	Fork length 165mm or greater (represents mostly smolts)
1998	2,169 (+/-1,572)	5,835 (+/-4,439)	4,559 (+-3,500) [a]
2000	1,328 (+/-1,905)	13,221 (+/-19,913)	10,504 (+/-15,700) [a]
2003	4,266 (+/-5,026)	16,779 (+/-10,718)	9,794 (+/-6,300) [a]

*Steelhead juveniles with fork lengths between 150mm and 165mm may or may not be smolts. Smolts are salmonids that are physiologically changing in preparation for migration to the ocean.

[a]Estimate is based on the size distribution of fish captured in the trap.

Diversity and Spatial Structure

The Interior Columbia Technical Recovery Team considers the Fifteenmile Subbasin (including Mill Creek and other streams) to be an independent population with only minor straying from nearby subbasins such as Klickitat River or Hood River.[48]

Hatchery steelhead have never been released in the Fifteenmile Subbasin. Because Fifteenmile represents an independent population and is at the upper end of the winter steelhead distribution in the Columbia Basin, the probability is that few hatchery strays enter Fifteenmile. According to the local ODFW staff, few hatchery strays are positively identified during spawning surveys.[49]

From approximately 1885 to 1937, the Seufert Cannery maintained a diversion dam at the top of Seufert Falls that was most likely a complete barrier to adult passage. Two local residents independently report that there were no steelhead in Fifteenmile Creek during their childhoods prior to the removal of the Seufert diversion dam, but there were steelhead in Mill Creek at that time.[50] Furthermore, numerous other passage barriers existed on the stream up through the 1990's. Between 1988 and 1997, the ODFW Fish Screen and Passage Program installed 80 fish screens and five fish ladders at diversion structures that were considered adult passage barriers.

[46] Olson, Ron & Rod French. Oregon Department of Fish & Wildlife. Draft Summary of Fifteenmile Screw Trap Results. 2000. Unpublished data.

[47] Unpublished Reports, ODFW. 1999 and 2003.

[48] IC-TRT 2003

[49] Steve Pribyl, ODFW The Dalles, pers. comm.. 5/13/04

[50] Rick Cantrell and Dick Overman, pers. comm..

If this is so, the presence of steelhead in Fifteenmile today may be due to primarily to continuous spawning in Mill Creek. However, since the Mill Creek Watershed has an estimated 1/5 of the capacity of Fifteenmile Watershed (see above), this period of time may have compromised the genetic diversity or integrity of the population.

Five culverts are currently considered to be total barriers to adult steelhead migration: one on Middle Fork Fivemile, two at Eightmile Campground, and two on Ramsey Creek, on the National Forest. Together, these eliminate spawning in a total of 7,623 feet of marginal spawning habitat. A recent review of the Endersby Road culvert at RM10 on Eightmile Creek revealed that it is a juvenile passage barrier during summer flows, and is an adult barrier in some flows. Spawning surveys show the reaches above this culvert to be some of the most productive spawning areas in the watershed. Infrared aerial surveys were conducted on Eightmile Creek on August 3, 2002. At the time of the surveys, the stream temperature just downstream from this culvert was 6^{o}C warmer than it was upstream (17^{o}C versus 23^{o}C).[51] Thus, this culvert might have a significant effect on juvenile survival in August.

On Mill Creek, numerous structures become barriers in certain flows, including the City water pipeline, which follows the mainstem of the creek and crosses it at multiple points. Passage is the major issue on Threemile Creek. The culvert at I84 cuts off all steelhead access to that watershed. Upstream of that, a stabilized headcut creates a 20 foot cascade at RM 4.5. Between those points, there are other potential barriers. Prior to settlement, Threemile Creek might have provided up to ten miles of steelhead spawning habitat.

An even more serious loss of spatial structure is likely due to the concentration of water quality problems in the lower watershed. Fifteenmile Creek, Eightmile Creek, Mill Creek and other tributaries are listed on the Oregon Department of Environmental Quality's 303(d) list for temperature and/or sedimentation. These problems originate from nonpoint sources throughout the watershed, but the effect on water quality is heaviest in the lower part of the watershed. While spawning appears to occur throughout most of the presettlement spawning range, as much as half of that range may be unsuitable for survival of one or more lifestages. The majority of successful smolt production in the subbasin may be due to the upper half to one third of Fifteenmile and Mill Creek watersheds (west of longitude -121^{o} 15').

Cutthroat Trout

Cutthroat trout are found in Middle and South Forks of Fivemile Creek, Threemile Creek, South Fork Mill Creek, Mosier Creek and Rock Creek.

Cutthroat trout have been documented as the most numerous species in lower Threemile Creek.[52] This population was reported to be strong and self-sustaining.

[51] Watershed Sciences, LLC, 2003.
[52] Field Inventory. Oregon Department of Fish & Wildlife. December 1986.

On April 24, 1989, gill nets were used in Crow Creek Reservoir to sample the fish population. The bulk of the cutthroat trout among those captured were small, with only five of the 68 individuals exceeding 11 inches in length. The fish were also very slender with the 66 fish samples yielding an average condition factor of 0.82. This is considerably lower than the optimum condition factor of 1.00 to 1.20 for cutthroat trout.

On August 22, 1989, a follow-up sampling of the fish population in Crow Creek Reservoir was taken. A total of 26 cutthroat trout were found and, was the case in April, the population consisted of small, rather slender fish. In this sample, 7.7% of the fish were over 11 inches compared to 7.4% in the previous sample. The average condition factor was 0.89, which is not significantly higher than the 0.82 of the previous sample. The length frequencies of the captured fish indicated that their growth rate was fairly slow. It is possible that trout have entered the reservoir via the aqueduct from Dog River, a tributary of the Hood River. This aqueduct diverts water from Dog River for the City of The Dalles water supply. [53]

Mosier Creek is locally known for its population of cutthroat trout. This population lives upstream of Pocket Falls, and thus does not represent an anadromous population. Cutthroat have been observed both in the mainstem of Mosier Creek, and in West Fork Mosier Creek, as well as numerous smaller tributaries.

The selection of cutthroat trout as a focal species is justified in Table 3.5. According to the Mile creeks Watershed Analysis, resident cutthroat trout are found in the Middle Fork and South Forks of Fivemile Creek. Cutthroat are often found in smaller headwater streams than rainbow-type trout. Typically cutthroat and rainbow-type trout are not sympatric. In areas where they are, cutthroat are often more abundant in areas where rainbow-type trout cannot gain access, such as above waterfalls or gradient barriers. As no natural barriers exist in Fivemile that would separate the two species, the potential for hybridization exists.[54] A total of 46 cutthroat trout were captured in the 4 years that the ODFW screw trap has been in operation at the mouth of Fifteenmile Creek.[55] No cutthroat were recaptured, and thus population estimates are not possible. These migratory fish may or may not represent an anadromous population. Cutthroat trout are an Oregon state and USFS sensitive species, however USFWS has determined that listing under the ESA is not warranted at this time.

Table 3.5. Rationale for Selection of Cutthroat Trout as a Focal Species.

Species Designation	Special Ecological Importance	Tribal recognition
Cutthroat trout are listed as a sensitive species by the State of Oregon and USFS. Coastal cutthroat were considered for Federal listing in 2002, but listing was considered not warranted.	Cutthroat trout occupy a range that overlaps with rainbow-type trout and steelhead, but they also occupy streams above barriers to anadromous migration in Mosier Creek, Mill Creek and Rock Creek. Their presence in these	A native resident fish species, cutthroat is culturally important to the Confederated Tribes of the Warm Springs. They were utilized, in conjunction with other native foods to complement diet for the tribal people.

[53] ODFW 1994.
[54] Miles creeks Watershed Analysis, Appendix F. US Forest Service. 1994.
[55] Unpublished Report ,Oregon Department of Fish & Wildlife. 2003.

	watersheds indicates that they have been present longer than rainbow-type trout. Because these populations exist above anadromous barriers, these populations likely contain diverse genetic characteristics.	

Little life history information has been collected on the cutthroat trout in the Fifteenmile Creek subbasin. It is assumed that this population has a life history cycle similar to that of cutthroat trout in other lower Columbia River subbasins. Spawning of cutthroat trout occurs from April through May in small headwater streams. Fry emerge from the gravel in approximately two months. Emergence is dependent on the spawning date and the water temperature.[56]

Lamprey

Pacific lamprey are an Oregon state sensitive species. Pacific lamprey were historically and are currently of significant cultural value to the Confederated Tribes of the Warm Springs Reservation of Oregon. Their selection as a focal species is made apparent in Table 3.6.

Table 3.6. Rationale for Selection of Pacific Lamprey as a Focal Species.

Species Designation	Special Ecological Importance	Tribal recognition
Pacific lamprey were listed as a state sensitive species in 1993. In 1997 they were given further legal protected status by the state. They are not listed as a federally threatened or endangered species. Conservation groups in several western states petitioned to give lamprey federal protection under the Endangered Species Act in January 2003. Budget limitations forced the USFWS to defer formal consideration of the petition.	Historically this species likely had the widest distribution of any anadromous species in the subbasin. Lamprey can often negotiate barriers that effectively interrupt migration of other fish. Most adult lampreys die shortly after spawning, feeding various scavenger species and contributing rich nutrients throughout their freshwater habitat.[57]	The species is culturally significant for Native Americans, including the Warm Springs Tribes. They have ceremonial importance. Fatty and highly nutritious, they are a traditional food for some Native Americans..[58] The only active Tribal fishery in the subbasin is the Lamprey fishery at Seufert Falls.

Historic lamprey counts at Bonneville and The Dalles dams suggest that lamprey production swung between tens of thousands and hundreds of thousands in just a few years.[59] In recent years, Pacific lamprey abundance throughout the Columbia River Basin has decreased significantly.[60] The current carrying capacity for Pacific lamprey in the Fifteenmile Subbasin is unknown. However, because of their high fecundity rate, lamprey

[56] Wydoski & Whitney. 1979.
[57] Kostow. 2002.
[58] Kostow. 2002.
[59] Kostow 2002
[60] Oregon Department of Fish & Wildlife 1997.

populations may be able to quickly rebound if freshwater and ocean survival conditions are favorable.

The distribution and population of lamprey have not been extensively studied in the Fifteenmile Subbasin, but the historic range of Pacific lamprey in the Columbia Basin was coincident with anadromous salmonids. Pacific lamprey use similar spawning gravel as steelhead. Lamprey spend 1 to 2 years in the ocean before returning to fresh water to spawn.[61] Adult Pacific lamprey probably enter the Fifteenmile Creek subbasin in early summer. Pacific lampreys are an anadromous species that is parasitic during their life in the ocean. It is assumed that they over-winter in subbasin streams before spawning the following spring or early summer. Spawning occurs from May through June in depressions up to 2 feet in diameter in the small gravel of riffles. Lampreys' fecundity is thought to be highly variable, possibly ranging from 15,500 to 240,000 eggs/female. This may suggest a variety of life history patterns or age classes in a single spawning population. Most authorities believe that all lampreys die after spawning. However, there have been several reported observations of robust lamprey kelts migrating downstream and an indication of repeat spawning in one Olympic Peninsula population.[62]

Lamprey eggs hatch within 2-3 weeks, depending upon water temperature. Newborn ammocetes emerge from the spawning gravel at approximately 1 cm in length and burrow into the soft substrate downstream from the nest, where they may spend up to seven years. They are filter feeders that feed on algae and diatoms. The ammocoetes will move gradually downstream, often 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, or body transformation. After completing their metamorphism from the juvenile to adult stage, they migrate to the ocean from November through June. In the Umatilla River this out-migration was observed to occur in the winter to early spring. Pacific lampreys enter saltwater and become parasitic. They feed on a wide variety of fish. They appear to move quickly offshore into waters up to 70 meters deep. Some individuals have been caught in high seas fisheries. The length of their ocean stay is unknown, but some have speculated that it could range from 6 to 40 months.[65]

Little is known about straying of lamprey from neighboring subbasins to the Fifteenmile Subbasin. Studies of sea lamprey (*Petromyzon marinus*) in the Great Lakes indicate that some lampreys have essentially no homing behavior. Instead, the adults may be attracted to streams with concentrations of ammocoetes, which were detected by some chemical stimuli.[66] If these observations apply to Pacific lampreys, straying may be common if the chemical stimuli are an indiscriminate attractant for all lampreys.

---

[61] Wydoski & Whitney, 1979.
[62] Kostow 2002.
[63] Kostow. 2002.
[64] Kostow. 2002.
[65] Kostow 2002
[66] Kostow 2002.

There have been no artificial lamprey production programs anywhere within the Fifteenmile Subbasin or within the neighboring Deschutes or Hood Subbasins.

Pacific lampreys are not parasitic while in fresh water. There is an overlap of fresh water habitat with other subbasin focal fish species, but since the lampreys are filter feeders there is little opportunity for competition. Juveniles are likely a food source for other fish.

Rapid or prolonged water withdrawals that dry out edgewater habitat are the greatest risk to larval lamprey.[67] Risks to lamprey populations include stream habitat degradation (including erratic or intermittent flow, decreased flows, increased water temperatures and poor riparian areas), predation in all life stages, artificial barriers and the lack of appropriate screening for lampreys. They 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. Because of their high lipid (fats and oils) content, they can concentrate lipid-soluble toxic chemicals. Migrating ammocoetes are especially vulnerable to predation during their in-river and ocean migration. While most movement appears to occur at night, their small size (up to 10 cm) and the number of predators, especially in the Columbia River and impoundments, pose a serious risk.

A total of 97 adult lamprey and 1,501 juvenile lamprey were caught in the screw trap at the mouth of Fifteenmile Creek over the four years of its operation[68]. In August 2000, a pesticide spill caused by an accident on US 84 killed a documented 5000-6000 juvenile lamprey and 20 adults in the lower quarter mile of Fifteenmile Creek.[69] Population estimates are not available.

Fishing Regulations in Fifteenmile Subbasin

Table 3.7 defines the current fishing regulations by creeks within the subbasin. Sportfishing for steelhead has been closed in Fifteenmile Subbasin since 1979. Trout fishing is open for catch and release angling from May 22nd to October 31st.

Table 3.7 Fishing Regulations in the Fifteenmile Subbasin

Fifteenmile Creek	Catch and release for trout fourth Saturday of May to Oct 31.
Chenoweth Creek	Catch and release for trout fourth Saturday of May to Oct 31.
Mill Creek and tributaries	Catch and release for trout fourth Saturday of May to Oct 31.
Mosier, Rock, Threemile creeks	Open fourth Saturday of May to Oct 31 for trout. Catch limit of 2 per day, 8-inch minimum size.

[67] Miles creeks Watershed Analysis, Appendix F. US Forest Service. 1994.
[68] Unpublished Report. ODFW. 2003.
[69] Pribyl, Steve, comments at Fifteenmile Coordinating Group meeting, April 16th, 2004

The intent of the current regulations is to provide protection to juvenile steelhead where they are present, since they can be mistaken for trout by anglers. In steelhead streams, only catch and release is allowed. In Mosier, Rock and Threemile creeks, which are considered non-steelhead streams, a limited trout harvest is allowed between May 22nd and October 31st.

Tribal harvest of lamprey remains popular at the Suefert Falls area during the spring.

Environmental Conditions for Aquatic Focal Species

Fifteenmile Watershed

Historic Conditions and Changes

Historically, Fifteenmile Watershed is believed to have been substantially different in its lower reaches than the current condition. From their headwaters in the conifer forests, the mainstem creeks flowed into relatively wide valleys with galleries of cottonwood, willow and conifers. Streams interacted strongly with floodplain soils. Beavers dammed the creek in multiple locations. Both peak flows and base flows were probably moderated, compared to the current condition. Stream temperatures were probably moderated both by the steady baseflows and by the floodplain interaction within the riparian galleries.

Uplands were conifer forests in the western half of the watershed and shrub-steppe in the eastern half of the watershed.

The Tribes of Middle Oregon ceded the Fifteenmile Watershed to the United States of America in the Treaty of 1855. They retained rights to hunt, fish and gather at usual and accustomed locations in common with the people of the USA and are known to have utilized the natural resources within the subbasin.

The first major change to the condition of the watershed occurred in the early 1800's, when the Northwest Company, and later the Hudson's Bay Company, trapped beaver out of most of the Oregon Territory. By 1838, the fur trade was declining due to a lack of beaver.[70]

American pioneers began settling in the watershed in the 1850's and '60's. The first permanent homestead at Dufur dates to 1852.[71] Petersburg dates to 1858.[72] Early settlements were established close to Fifteenmile Creek. The first wheat was planted in the uplands of Fifteenmile Watershed in about 1863.[73]

Mount Hood National Forest was first established as the Cascade Forest Reserve in 1893. The name was changed to Mount Hood National Forest in 1924.[74]

[70] Corning, 1956
[71] Dufur Historical Society, 1993
[72] Wagenblast, unpublished. Available at Columbia Gorge Discovery Center.
[73] McNeal, 1953.
[74] Friends of Maupin Library, 1986

By 1910, the population of Wasco County had reached 16,191 people—about 70% of its current level.[75] Irrigated farms and pastures occupied the floodplains of Fifteenmile, Eightmile and Fivemile creeks.

The Seufert Cannery was established near the mouth of Fifteenmile Creek in 1885. A diversion dam at Seufert Falls may have blocked fish passage into Fifteenmile Watershed until it was removed in 1937.

A number of other major fish passage barriers remained after 1937. Fifteenmile Watershed Council members recalled at least half a dozen concrete dams that remained in Fifteenmile Creek up through the 1980's. The ODFW Fish Screening and Passage Project (see Inventory, section 4.3.3.) designed and installed 5 fish ladders and 80 fish screens in the Fifteenmile Watershed between 1988 and 1997. While these structures are no longer considered barriers to adult migration, some may still be barriers to upstream juvenile migration. During the time that these structures were adult barriers, the winter steelhead population may have been reduced to near zero.

World Wars I and II increased demand for wheat. By 1950, dryland wheat farms had been established on more than 100,000 acres in the Fifteenmile Watershed. Soil loss from water erosion reached as high as 20 tons per acre per year, due to steep slopes and the practice of "clean tillage" with a moldboard plow. Peak flows by this time are estimated to have been increased by 300 to 600% over pre-settlement conditions, leading to exaggerated streambank erosion and sedimentation.[76] Baseflows were lowered due both to the changed hydrologic conditions and to irrigation withdrawals.

The flooding that occurred throughout the Northwest in 1964 is credited with motivating construction of terraces and sediment basins to reduce erosion. Further flooding in the 1970's motivated stream channel straightening and cleaning with federal assistance from the USDA.[77] Further stream manipulation has occurred over the years due to road-building.

Between 1950 and 1980, timber harvest from the Mount Hood National Forest approximately doubled.[78]

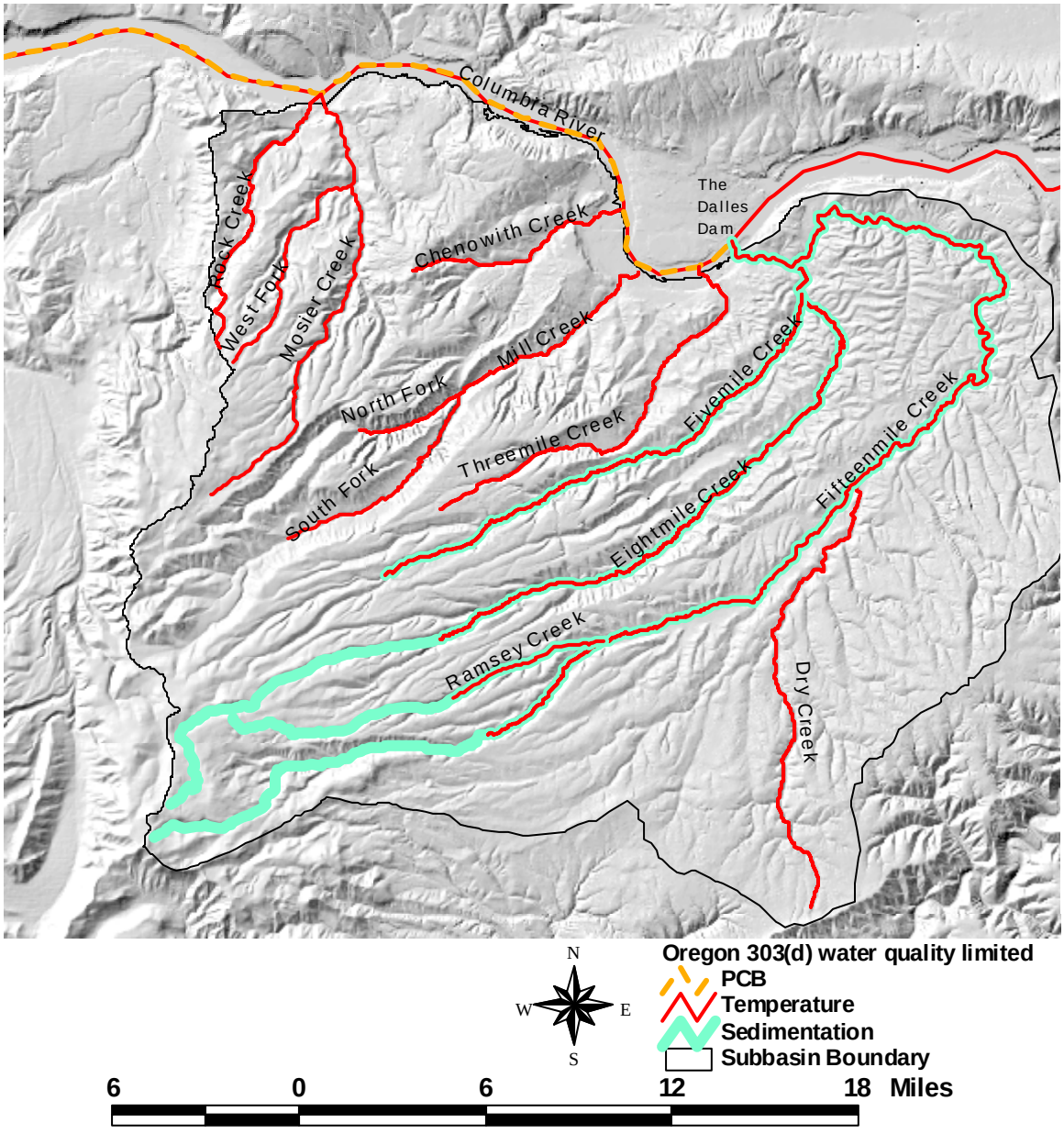
By 1980, riparian vegetation and large woody debris had been nearly eliminated, leading to an almost complete loss of floodplain function. Riparian areas on forest were also heavily impacted, though to a lesser extent.

Due to the combination of reduced riparian function and extensive irrigation withdrawals, summer stream temperatures in the lower half of Fifteenmile watershed reached lethal temperatures for cold-water fish. Pre-settlement water temperatures are unknown, but are presumed to have been significantly lower than current conditions, due to higher flows,

[75] Internet: http://usgenweb.com
[76] Wasco Co. SWCD 2003a.
[77] Wasco Co. SWCD 2003a
[78] Friends of Maupin Library, 1986

greater shade and strong riparian/floodplain interactions. Fifteenmile Creek, Eightmile Creek and Dry Creek are listed on the Oregon State List of Water Quality Limited Waterbodies (303(d) List) for exceeding the state water temperature standards for cold water fish.

Figure 3.2. Water Quality Limited Waterbodies in the Fifteenmile Subbasin and Nearby Columbia River.



The lower half of the Fifteenmile Watershed (Lower Fifteenmile, Eightmile and Fivemile) have been particularly hard hit by the combination of low flows, high summer temperatures, erosion, channel constriction and general loss of habitat. This combination of factors has led fish managers to assume that fish survival is minimal in the lower

reaches. Assuming that the lower part of the watershed was amenable to fish survival prior to settlement, this represents a significant loss of life history diversity and species range.

Soil management in upland farm fields began to change with the 1985 Farm Bill, which required residue management on all highly erodible lands enrolled in USDA farm subsidy programs. "Clean tillage" was largely abandoned in favor of "minimum till." Today, the trend is toward the adoption of "no-till," which uses state-of-the-art seed drills and fertilizer injectors to plant seed directly into standing crop stubble. Nearly half of the non-irrigated croplands in Fifteenmile Watershed are now farmed using the no-till equipment and practices. While these changes are highly positive, runoff and erosion levels are still elevated compared to pre-settlement conditions. Pebble count data from the Forest Service indicates elevated sand and fine sediment in many locations throughout the watershed, including both public and private land.[79]

The Northwest Forest Plan adopted in 1994 changed management priorities in the Mount Hood National Forest, resulting in a sharp decline in harvest levels and new guidelines for both riparian and upland management. For instance, since the late 1980's, the Forest Service has been attempting to replace large woody debris in stream channels and on floodplains.

In 1998, ODFW conducted a culvert survey with funding from Oregon Department of Transportation (ODOT)[80] The surveyor identified eleven culverts in the Fifteenmile Watershed as not meeting fish passage criteria, affecting Long Hollow, Douglas Hollow, Standard Hollow, Japanese Hollow, Mays Canyon Creek, Whiskey Gulch, Japanese Hollow and North Fork Fivemile Creek. All of these sites are dry in the summer.

Several thousand acres of uplands have been converted to orchards, irrigated with groundwater, with a cover crop between the tree rows. This system includes a number of environmental tradeoffs. On the positive side, it features a very low runoff and erosion rate. On the negative side, orchards are water and chemical intensive, requiring careful management and monitoring to reduce environmental impacts.

Riparian areas in the lower parts of the Watershed have been re-established and protected through ODFW and USDA programs. Beavers have recently begun to re-colonize the lower watershed. During the recent Aquatic Inventory Survey, more than 30 beaver dams were noted in the lower 20 miles of Fifteenmile Creek. Beavers are not only an indicator of improved riparian conditions, but will further improve conditions by their activities.

Despite the recent positive trends, summer stream temperatures and low flow in the lower half of the watershed remain above lethal limits for cold-water fish during portions of the summer. Fine sediment (less than 6mm) levels remain at levels detrimental to spawning and fry emergence.

[79] Provided by Bonnie Lamb, Oregon DEQ April 2004
[80] McDermott, February 1999.

Potential Reference for Long-Term Sustainability

This document generally assumes a reference condition similar to pre-settlement conditions. For the future, however, Fifteenmile Watershed will have a certain density of population, roads, and agriculture. However, human land use can be managed to minimize hydrologic effects, pollution, and direct impacts on riparian corridors. In a priority situation, roads could be realigned to avoid riparian corridors. Agriculture and grazing can be carefully managed to allow healthy riparian corridors and floodplain function. Housing and other infrastructure can be placed back from streams.

Future With No Actions

If current conservation programs are allowed to lapse, and no further actions are taken, then:

- Upland runoff and erosion rates will remain elevated compared to presettlement condition, particularly on agricultural lands that have not yet adopted no-till farming methods.
- Upland activities will have unknown impacts on wildlife populations.
- Impacts from orchards will increase directly with increasing orchard acreage.
- Streambank erosion and stream sedimentation will remain above reference levels, particularly in reaches where restoration has not yet taken place.
- Baseflows in summer and fall will remain significantly below presettlement conditions.
- Summer stream temperatures will remain lethal to cold-water fish in the lower watershed.
- If climate change scenarios are accurate, summer flows will decrease due to decreases in snowpack.[81] High temperature areas will extend upstream.
- Forest fire frequency may increase in the upper watershed, increasing risk of flood events and erosion.
- Stream channels will remain straightened and incised and habitat will remain degraded.

The Dalles Area Watersheds—Threemile Creek, Mill Creek and Chenowith Creek

Historic Conditions and Changes

Threemile Creek, Mill Creek and Chenowith Creek all run to the Columbia through the present day location of the City of The Dalles. All three have provided habitat for anadromous fish in recent years. Mill Creek provided more habitat than the other two systems combined.

Both forks of Mill Creek originate above 4,000 feet elevation. High flows were generated both by spring snowmelt and by rain-on-snow events. Steelhead spawned in North Fork

[81] Service, 2004

Mill Creek from headwaters to mouth. On the South Fork, steelhead spawned up to the base of Mill Creek Falls at RM 3. In total, the system boasted greater than 20 miles of anadromous habitat. Today, coho utilize much of the same habitat, and Chinook are also seen to enter the system. It is not known whether coho or Chinook salmon historically utilized any habitat in Mill Creek, although conditions near the mouth were suitable for both. Upstream of Mill Creek Falls, the South Fork and its tributaries offer another fifteen to twenty miles of resident salmonid habitat, currently utilized by cutthroat trout.

Upland vegetation varied from a mixed conifer forest in the headwaters, through an extensive area of pine-oak forests and open grasslands, and trended toward more open and drier conditions near the mouth. South-facing slopes were generally warmer and more open than north-facing slopes.

Floodplains were relatively unconstrained along the entire mainstem and near the mouths of the forks. Riparian vegetation most likely consisted of mixed conifer and hardwood galleries throughout the watershed. The mouth of mainstem Mill Creek expanded into an extensive delta with wetland characteristics.

Both Threemile and Chenowith creeks originate at lower elevations. Their hydrology was and is dominated by rain-on-snow events and winter rainfall. Flow in both streams was lower than in Mill Creek, and the headwaters reaches dried up in the summer. Both streams flowed into wetland deltas near their mouths. Both streams provided from five to ten miles of steelhead habitat. Threemile Creek also had cutthroat trout, with a range that overlapped that of anadromous salmonids.

The Tribes of Middle Oregon ceded the Fifteenmile Watershed to the United States of America in the Treaty of 1855. They retained rights to hunt, fish and gather at usual and accustomed locations in common with the people of the USA.

A Methodist mission was established near present-day The Dalles in 1838.[82] In 1843, the first group of settlers arrived on the Oregon Trail.[83] In 1860, there were 1,300 people living in "Dalles City." Nineteenth century industries included timber harvest, cattle ranching, fruit orchards, a brewery, and—on the Columbia River—the commercial salmon fishery.

Sawmills were erected along Mill Creek, both in The Dalles and near the headwaters.

The earliest fruit orchards date back to 1854 in Rowena, 1866 in the Chenowith Creek Watershed, and 1877 in the Mill Creek Watershed. Cherries were first planted commercially in 1886 and have since come to dominate the orchard industry around The Dalles. The most extensive orchards were established in the lower valley bottom along mainstem Mill Creek and Threemile Creek, and on the ridge between them. As farming expanded and roads were built up the valley bottoms, the streams were constricted and channelized, and riparian vegetation was eliminated or reduced to, in many cases, a single

[82] Howell, 1966.
[83] The Dalles Watershed Assessment. Wasco County Soil & Water Conservation District. 2000.

row of trees. Almost the entire length of the mainstem of Mill Creek is downcut and channelized. The banks have been extensively armored to protect roads, homes or agricultural lands.

In the 1920's, The Dalles Water Commission constructed a diversion pipeline to take water from Dog River, a tributary of Hood River, to South Fork Mill Creek. The maximum capacity of the diversion is 12 cfs. The City holds a municipal water right for the entire flow of the Dog River. The City built the Wick's Water Treatment Plant and reservoir to collect and water from the South Fork for municipal drinking water. From the 1920's to the 1980's, the reservoir was a complete fish passage barrier. Wick's Reservoir was removed in the 1980's to allow spawning as far upstream as Mill Creek Falls.[84] Until 2002, the City would, at times, withdraw all water from South Fork Mill Creek at the point of diversion. In 2002, the City built a fish screen with the assistance of ODFW. The City now spills a minimum of 2-3 cfs throughout the summer to provide bypass flow for this screen. The natural flow at the mouth of South Fork Mill Creek would be 7.2 cfs in September.[85]

Crow Creek Reservoir was constructed in 1967 and 1968 upstream of Mill Creek Falls on South Fork Mill Creek. The dam is 100 feet high and 800 feet across. The reservoir has a storage capacity of 267 million gallons.[86] Cutthroat trout now reside in the Crow Creek Reservoir. As there was no fish screen on the Dog River diversion, some or all of these fish may have originated in Dog River.

The first aluminum plant was established in The Dalles in the 1950's. From the 1950's until it closed in 2002, it was a major employer in The Dalles.

Bonneville Dam on the Columbia River was completed in 1938,[87] backing water up into the mouths of all three creeks. For a time, the former wetland deltas were probably replaced with open water, until sedimentation recreated wetlands.

The Union Pacific railroad was established along the southern bank of the Columbia River in 1882. Construction began on the Columbia River Scenic Highway (US 30) in 1913 and was completed in 1925. Interstate 84 was constructed in 1955 and widened to four lanes in 1976. By that time, Mill Creek had been placed in an 800-foot long culvert from Second Street in The Dalles to the Columbia River, in which it remains to this day. All wetland characteristics at the mouth of Mill Creek were destroyed at that time. Threemile Creek was also highly affected by the construction of these roads.

The Schoolmarm Fire burned 9,710 acres of forestland in the South Fork Mill Creek Watershed in 1967. The sediment and ash from this fire created such a treatment problem for the municipal water supply that the City and the US Forest Service developed a cooperative management agreement designed to maximize water quality in

[84] Dave Anderson, Report to The Dalles Watershed Council, January 18th, 2001.
[85] Oregon Water Resources Department website http://www.wrd.state.or.us (WARS)
[86] IBID
[87] Internet April 27th 2004: https://www.nwp.usace.army.mil/pa/cms/history.asp

the South Fork and in Dog River. The entire watershed of the Dog River is within the Mount Hood National Forest. Of the 22,000 acres in the South Fork Watershed, 15,000 acres are within the Mount Hood National Forest and another 5,000 acres are owned by the City of The Dalles. The majority of the remaining acres are owned by SDS Lumber Company. The municipal watershed is closed to public access, except under the conditions of permits issued from time to time by the City. Timber cuts in the municipal Watershed have focused on forest health. Most harvests are selective cuts, with no single clearing of more than five acres created at any time.[88]

The Dalles Irrigation District was established in 1965 with the help of the Bureau of Reclamation. The Irrigation District provides 2 feet of water from the Columbia River to 5,900 acres in the Threemile and Mill Creek Watersheds from April through October. Some orchards also have water rights from wells or from the creeks.[89] Prior to establishment of The Dalles Irrigation District, limited water availability required frequent tillage in the orchards to eliminate grass between the tree rows. This resulted in very high rates of erosion and runoff. Following establishment of the irrigation district, orchardists were abler to plant cover crops and virtually eliminate erosion in their orchards.

In 2000, DEQ placed electronic temperature loggers in Threemile Creek, Mill Creek, and Chenowith Creek., as part of their TMDL development process. All streams were found to exceed the state temperature standard for salmonid spawning and rearing. These streams were subsequently placed on the 2002 303(d) list of Water Quality Limited Waterbodies.

In 2002 and 2003, DEQ tested for organophosphate pesticides in Mill Creek at the request local growers. They discovered chlorpyriphos in March and malathion in June. A single sample in Threemile Creek also found malathion. Both of these chemicals exceeded state standards and were potentially lethal to fish.[90] Potential sublethal effects include changes in the food web, fish behavior, fecundity, fertility, and sex ratio.

In response, the Wasco County Fruit and Produce League and Wy'East Resource Conservation and Development Council have developed an Integrated Fruit Production program designed to minimize the use of broad-spectrum pesticides and minimize the impacts of those that are used. Practices include use of insect growth regulators and other low-impact pesticides, weather monitoring to improve spray timing and minimize drift, and the planting of spray drift buffers along the creeks.[91] Since this program was implemented, 1.5 miles of Threemile Creek have been enrolled in the Conservation

[88] Dave Anderson, City of The Dalles, Report to The Dalles Area Watershed Council, January 18th, 2001.

[89] Mike Richardson, The Dalles Irrigation District, Report to The Dalles Area Watershed Council, January 18th, 2001.

[90] Eugene Foster, Report to The Dalles Area Watershed Council, March 19th, 2003 and pers. comm.. 2003.

[91] Mike Omeg, Report to The Dalles Area Watershed Council, March 19th, 2003.

Reserve Enhancement Program, which establishes forested riparian buffers.[92] Monitoring must be continued to determine if current voluntary efforts by orchardists resolve the issue.

During the 1996 flood, debris flowing down Mill Creek plugged the Mill Creek tunnel, causing water to back up into the downtown of The Dalles, parts of which is built on fill that covers the former Mill Creek delta. This water had no outlet and did not drain until the Mill Creek tunnel was unplugged. Debris included household appliances, house-trailers, and associated urban pollutants.

The City's pipeline follows the stream from Wick's Water Treatment Plant to the City distribution system. It crosses the stream at numerous places, where it has been armored with concrete in response to flood events. These crossing points have been identified as partial fish passage barriers, along with a number of irrigation diversion structures, and road crossings. From time to time, one or another of these barriers becomes a more serious passage barrier due to streambed erosion. Most recently, City and ODFW officials witnessed Chinook salmon attempting to pass a City sewer line below the Ninth Street Bridge at RM1.[93] Typically, the City addresses such issues by filling the stream channel downstream of the pipeline with large rock, thereby bringing the channel bottom up to the top of the obstruction. Results have been satisfactory in the short term, but the structures may not perform as intended over the long term.[94]

The flood event in 1996 created a number of fish passage barriers in Threemile Creek. Sediment was deposited on the floodplain between US 30 and I84, raising the streambed to above the level of the I84 culvert. Currently, water actually drains vertically downward to the mouths of the culvert, creating a complete fish passage barrier. ODOT has tentative plans to upgrade this culvert in 2006. Two more culverts exist within 2000 feet of the US 30 culvert which may or may not be passage barriers.

At river mile 4.5 on Threemile Creek, a deep headcut beneath a bridge on a private driveway was stabilized with federal assistance following the 1996 flood. The vertical drop at this point is approximately 20 feet, creating a complete fish passage barrier.

Chenowith Creek is currently a perennial stream only along its lower 2 miles. The mouth of this creek is affected by fluctuations in the Bonneville Pool. Upstream of this fluctuation, the stream flows through a braided channel wetland inhabited by beaver and utilized by steelhead for spawning. The vegetation in this region is dominated by reed canary grass, Himalayan blackberry, poison oak, and various native and nonnative hardwood trees—similar to the wetland vegetation on Threemile Creek.

Between US 30 and I84, Chenowith Creek flows through a horse pasture owned by Northwest Aluminum. In 2002, the streambed was studied using a Wolman pebble count.

[92] USDA NRCS records, The Dalles Field Office, March 2004.

[93] Dave Anderson, City of The Dalles, Comments to The Dalles Area Watershed Council, October 20th, 2003.

[94] Rod French. ODFW. Personal Communication. Dec. 2003

The streambed was found to be heavily polluted by horse manure. In 2003, following fencing of the creek, the same site was resurveyed. The streambed consisted entirely of gravel with no visible sign of horse manure. [95]

Between US 30 and 10th Street, Chenowith Creek flows past the western end of residential development in The Dalles. The Creek flows through many different land ownerships at this point, and management of the creek is highly variable.

Upstream of 10th Street (river mile 2), Chenowith Creek is considered to be in relatively good condition, due to its position in the bottom of a steep canyon.

Potential Reference for Long-Term Sustainability

Mill, Chenowith and Threemile creeks have the potential to provide spawning and rearing habitat for anadromous fish, including steelhead, coho and Chinook salmon. However, a number of human impacts must be considered permanent changes to the landscape in this area.

The combination of the Bonneville Pool, Interstate 84 and the Union Pacific Railroad has modified the mouths of all three streams, but most noticeably Mill Creek. While the delta/wetland environment that previously existed at that site will probably never be completely recovered, modification of the Mill Creek Tunnel to recreate some floodplain function may remain within the realm of possibility.

The City of The Dalles Municipal Water Supply will remain in place to serve the people of The Dalles. This includes the Dog River Diversion, Crow Creek Reservoir and the diversion at Wick's Water Treatment Plant.

In year 2000, the population of The Dalles was 11,637. The urban area of the City of The Dalles covers more than 3000 acres of land, approximately half of which is impervious surface. Runoff from this area is routed into a storm sewer system, much of which flows into Mill Creek below RM1.

For subbasin planning purposes, the stabilized headcut at RM4.5 was treated as the upper end of fish distribution in Threemile Creek, although anadromous fish may have ranged higher than that under presettlement conditions.

While these features can be modified to improve watershed health, they must be considered permanent features of the landscape.

Future With No Actions

If no action is taken, anadromous use of the watershed will be limited by passage barriers, pollution sources, urbanization, low flows, high temperatures and habitat simplification.

[95] Wasco Co. SWCD, with assistance from US Forest Service.

Future flood events on the scale of 1996 are expected to recur approximately every 25-50 years. Such events will again back water up into the downtown of The Dalles, likely leading to heavy sediment and chemical pollution loads for short periods of time.

Stream channels will remain straightened and incised and habitat will remain degraded.

Mosier Area Watersheds

Historic Conditions and Changes

In the 1850's, Mosier Watershed and Rock Creek Watershed were both heavily forested from headwaters to mouth. Forest types varied from mixed conifer stands in the headwaters to Ponderosa pine, Oregon White oak and Douglas fir near the mouth. The mouth of Mosier Creek is known from photographs to have flowed over an alluvial delta through a dense cottonwood gallery. Stumps of these trees can still be seen when the Bonneville Pool is low.

Prior to construction of Bonneville Dam, the shores of the Columbia River were lined with wetland habitat. Mosier Creek flowed into the side-channel which today forms Mosier City Lake. This channel varied seasonally from open water in the early spring to mudflat in the late summer.

Mosier Creek is believed to have had a higher flow than it does currently, due to additions from groundwater. Rock Creek reportedly flowed year-round until the late 1950's. Since then, the rock pit at RM1 is believed to have contributed so much cobble that stream flows now run under the surface.

In 1854, the first sawmill was established at Pocket Falls in the current location of the City of Mosier. Timber harvest was soon a major industry, with movable sawmills following the creeks and logging the riparian corridors first. As logging operations continued, permanent roads were established following the creeks, and homesteaders, many of whom started as loggers, filed claims in the newly cleared land. Portable sawmills gradually gave way to permanent mills. Permanent sawmills operated in at least two locations on Mosier Creek, and one location on Rock Creek through the 1950's.[96]

The use of drain tiles and ditches to drain wet areas for agriculture and roadways was common and continues to the present. Many wetlands and stream channels have been drained or diverted to reduce saturated soil conditions.

The first passable wagon road through Mosier to Hood River was built in 1863and improved in 1867. In 1882, the railroad came through Mosier. Wood was the fuel for both the steam-driven paddle wheel boats on the river and the locomotives. Mosier became an important fueling stop for both these vehicles. In the winter months, many Mosier farmers cut oak wood and hauled it to the railroad station and to the steamboat landing.

[96] Mosier Watershed Assessment. 2002.

Bonneville dam was constructed in 1938. The Bonneville Pool backed water up to the base of Mosier Falls, nearly one mile upstream of the mouth of the creek, creating a navigable harbor, in which local residents built a boat launch. In 1955, Interstate 84 was constructed, initially with 2 lanes. In 1976, the interstate was widened to 4 lanes. The interstate, railroad and dam eliminated floodplain habitat from the banks of much of the river, while simultaneously creating lakes on the south side of the road.

The 1964 flood deposited debris behind the interstate, railroad and the historic highway, ending the navigability of this reach. The lower half-mile of the creek now meanders through a well-vegetated and functioning wetland. Further sedimentation has created a delta at the mouth of the creek. Willows and other riparian vegetation are currently establishing themselves on both the delta and the banks of the interstate, recreating some of the floodplain functions that existed before construction of the dam.

The first fruit orchard in Mosier was installed in 1878. Mosier Fruit Growers was formed in 1907. The maximum extent of orchards was probably in the 1950's, after which many of the higher elevation orchards were removed, and have since reforested or remained as grasslands[97].

Most of the orchards in Mosier were not irrigated until the 1970's. In the late 1960's, designs were developed for an irrigation district that would divert water from a reservoir on upper Mosier Creek. Many of the prospective members opted out, and the proposal was abandoned. Beginning in the 1970's and continuing into the 1990's, almost all 1440 acres of commercial orchard were converted to irrigation from either private stream water rights or wells.

In 1971, the City of Mosier drilled Well #3, an artesian well in the lower Mosier Valley that has served ever since as the main source of domestic water for the City. The City has no other water supply suitable for drinking water.

Oregon Department of Water Resources conducted a thorough study of well levels in the Mosier Valley from 1985 to 1987. This study found that groundwater in the Lower Mosier Valley was being overdrawn. As a result of this study, the Pomona and Priest Rapids aquifers in the Lower Mosier Valley were closed to new groundwater withdrawals. Since 1988, the Water Resources Department has continued to monitor numerous wells within and around the area of withdrawal. Results of this monitoring suggest that the Priest Rapids aquifer continues to be overdrawn. In addition, the Frenchman Springs aquifer, which had been little used prior to the 1980's, now appears to be dropping as well.

In the 1960's, USGS studied the interaction of the aquifers with Mosier Creek. They found that at that time, the stream gained flow as it intersected the upper end of the Priest Rapids aquifer. In the 1980's, the Water Resources Department duplicated that study, and found that the stream actually **lost** flow as it intersected the same geologic layers, indicating that the stream interacts with the section of the aquifer that has lost hydrologic

[97] Hastings, Ron. Personal Communication. 2001.

head. This potentially may affect not only stream flows, but surface water temperatures, and loss of springs and wetlands.

Oregon Water Resources Department believes that wells in the Mosier Valley are prone to "co-mingling," in which water flows under artesian pressure from one aquifer into water-bearing strata at higher elevations. City of Mosier's Well #3 was identified as a co-mingler. In 1989, the City was served with an order to abandon well #3. Since that time, the City of Mosier has been searching for an alternate drinking water source, but has had trouble securing financing.

In 2000, DEQ placed electronic temperature loggers in Mosier Creek and Rock Creek., as part of their TMDL development process. Both streams were found to violate the state temperature standard for salmonid spawning and rearing. These streams were subsequently placed on the 2002 303(d) list of Water Quality Limited Waterbodies.

The upper ends of Mosier and Rock creeks are subject to the heaviest commercial timber harvest in the Fifteenmile Subbasin. While this is so, general runoff levels seem little affected, and the stream has not been observed to carry a heavy sediment load under most high water events.

Extensive channel modification has occurred in the lower portions of both Mosier Creek and Rock Creek. Most channel modification in the lower Mosier Creek Watershed occurs because of rural residences located in the riparian areas. In Rock Creek, the lower one-mile of the creek has been channelized and rip-rapped to accommodate the ODOT gravel quarry and several bridge crossings. Rock Creek currently runs subsurface during the summer in this reach. Downstream of the gravel mining area, Rock Creek is further restricted by a private building (Giroux House), the US30 bridge, Union Pacific trestle and Interstate 84 overpass. Between the railroad and the Interstate, the Rock Creek floodplain is used as a parking lot and launch site by windsurfers and local fishermen. Mosier Creek is similarly constricted at its mouth by US30, the railroad and the interstate.

Potential Reference for Long-Term Sustainability

The mouths of both Mosier and Rock creeks have been permanently changed by the inundation of the Bonneville Pool and the construction of Interstate 84, the Union Pacific railroad and US 30. These features are unlikely to change.

Roads have been built along most of the length of Mosier Creek, as well as parts of its tributaries. These features would be difficult, but not impossible, to move.

Future With No Actions

If current trends are allowed to continue, groundwater depletion will result in loss of streamflow in Mosier Creek and therefore, continued loss of water quality and fish habitat quality. It will also result in severe economic loss for the local community not limited to the collapse of the commercial orchard industry in the Mosier Valley.

3.3. Out of Subbasin Effects (OOSE) for Aquatic Species

Steelhead and Pacific Lamprey migrate to the ocean and back, spending a large portion of their lives outside the subbasin. Lamprey typically spend most of their life as juveniles in freshwater, but gain most of their growth in the ocean. Planning requires accounting for conditions during the time these populations exist away from their natal subbasin. Out-of-subbasin effects (OOSE) encompass all mortality factors from the time anadromous fish leave a subbasin to the time they return to the subbasin. These effects can vary greatly from year to year. Out-of-subbasin factors can be natural in origin (e.g. ocean productivity), human-caused (e.g. fisheries) or a combination (e.g. mainstem survival is dependent on both mainstem flows and dam operations).

Juvenile survival through the mainstem Columbia River depends upon habitat quality and quantity, river flow at the time of migration, juvenile travel time, juvenile migration timing, dam survival, transportation survival, estuary effects, natural ocean survival, and harvest.

The model used for this assessment, Ecoystem Diagnostic and Treatment (EDT)[98] does not directly input all of these factors. EDT allows the user to specify the age distribution (age 1, age 2, and age 3) of outmigrating smolts. It then summarizes the major sources of out-of-subbasin mortality into a survival multiplier from the point that juveniles enter the mainstem Columbia River to the point that adults reenter the subbasin. The Smolt-to-Adult Survival rate (SAR) is computed as the total number of adult returns divided by the total number of smolts. If local data exists for this rate, the model can be calibrated to agree with local data.

The age of out-migrating smolts from the Fifteenmile Watershed has been estimated based on data collected at the fish trap operated by Oregon Department of Fish and Wildlife near the mouth of Fifteenmile Creek[99]. Approximately 27% of the outmigrating smolts from Fifteenmile appear to be one year old fish, 59% are two years old, and 14% are three years old or more. The number of one year old smolts is quite high when compared to similar data collected in Hood River, where only 9% of all smolts were one-year-olds, and 77% were two-year-olds (Table 3.8). This would tend to increase juvenile production by speeding up the process of producing a generation, and by eliminating second-year mortality.[100] Further monitoring is called for to verify these numbers.

Table 3.8. Age of Out-migrating Winter Steelhead Smolts from Fifteenmile Watershed and Hood River (based on juvenile migrant counts conducted by ODFW)

	Age 1	Age 2	Age 3
Fifteenmile	27%	59%	14%

[98] Mobrand Biometrics, Inc.
[99] ODFW Unpublished data, 1999 and 2004, Eric Olson ODFW, pers. comm.
[100] Greg Blair, Mobrand Biometrics, Inc. pers. comm.. April 2004.

Hood River	9%	77%	14%

Smolt-to-Adult Survival rates have not been determined for Fifteenmile Creek, as returning adults have never been counted. However, both outmigrating smolts and returning adults have been counted in the Hood River since 1994. The average SAR for wild winter steelhead in Hood River for brood years 1994 to 1999 is approximately 6.7%, varying from 3.66% to 9.45%[101]. The relatively younger age of the Fifteenmile smolts might be expected to result in a higher out-of-subbasin mortality rate than that experienced by the Hood River population, thus resulting in a lower Smolt-to-Adult Survival rate. EDT was calibrated to produce a Fifteenmile Smolt-to-Adult survival rate of 5.5%. Monitoring of returning adults would be necessary to confirm the validity of this assumption.

3.3.1. Modifying Conditions

Steelhead spend one to four years in the ocean. Early ocean survival is considered to be a time of particularly high mortality. A growing body of evidence from field, tagging, and correlation studies shows that juvenile anadromous fish making the transition from freshwater to marine environment experience large year-to-year fluctuations in survival rates.[102] Climate-related changes have the most effect on salmon survival early in the salmon's marine life history.[103]

Pacific Decadal Oscillation: The Pacific Decadal Oscillation (PDO) is a recurring pan-Pacific pattern of ocean-atmospheric variability that alternates between climate regimes every 20-30 years.[104] The PDO affects water temperatures off the coast of Oregon and Washington and has cold (negative) and warm (positive) phases.[105] 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.[106] The negative phase of the PDO has the opposite effect, tending to increase salmon survival.

Climatic changes are manifested in both returns and harvests. Mantua et. al. [107] found evidence of an inverse relationship between harvests in Alaska and off the coast of Oregon and Washington. The negative phase of the PDO resulted in larger harvests of Columbia River stocks and lower harvests of Alaskan stocks. 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.

[101] ODFW Hood River/Pelton Project Annual Report, 2001.
[102] Hare et al. 1999
[103] Pearcy. 1992. & Francis and Hare 1994.
[104] Hare et al. 1999
[105] Hare et al. 1999
[106] Hare et al. 1999
[107] Mantua et al. 1997

El Nino/Southern Oscillation: The El Nino-Southern Oscillation (ENSO), like the PDO, 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 in that events typically occur every 2-7 years and last 12-18 months. Positive ENSO events occur more frequently during positive PDO phases and less during negative PDO phases.[108] ENSO events intensify or moderate the effects of PDO changes on salmon survival, depending on whether the phases of these cycles coincide or not.

PDO and ENSO also affect freshwater habitat of salmon. Positive PDO and ENSO events generally result in less precipitation and lower streamflows in the Columbia Basin. Lower stream flows result in higher water temperatures and a longer outmigration. Negative PDO and ENSO events have the opposite effect.

Climate Change

Climate change on a longer term than the PDO could have a large impact on the survival of Columbia Basin salmon. Finney et. al. [109] used lake sediment elemental composition to find evidence of long term cycles of abundance of sockeye salmon in the Bristol Bay and Kodiak Island regions of Alaska over the past 300 years. There may have been similar variations in the abundance of Columbia Basin salmon.

Computer models agree that the climate in the Pacific Northwest will become, over the next half century, warmer and wetter, with an increase of precipitation in winter and warmer, drier summers.[110] These trends agree with observed changes over the past century. Wetter winters would mean more flooding of certain rivers, with higher levels of wood and grass fuels and increased wildland fire risk compared to previous disturbance regimes.[111] The region's warm, dry summers may see slight increases in rainfall, according to the models, but the gains in rainfall will be more than offset by increased evaporation. Warmer temperatures will lead to less snowfall and more rain at mid-elevations. Loss of mid-elevation snowpack will have negative impacts on the region's water resources, forests, and salmon,[112] including diminished ability to store water in reservoirs for summer use, and spawning and rearing difficulties for salmon. 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.

Climate models lack the spatial resolution and detailed representation of critical physical processes that would be necessary to simulate important factors like coastal upwelling and variation in currents. Different models give different answers on how climate change will affect patterns and frequencies of climate variations such as ENSO and PDO.

[108] Hare et al. 1999
[109] Finney et al. 2000
[110] USDA Forest Service 2004
[111] USDA Forest Service 2004
[112] Mote et al. 1999

While it is straightforward to describe the probable effects of these environmental patterns individually, their interaction (PDO, ENSO, climate change) is more problematic. The main question appears to be the duration of the present favorable PDO period 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.

3.4. Limiting Environmental Factors and Populations of Aquatic Species

Two tools were used to identify and analyze factors leading to decline of aquatic focal species. Ecosystem Diagnostic and Treatment[113] (EDT) was applied to the Fifteenmile Watershed. Qualitative Habitat Assessment[114] (QHA) was used for all other watersheds. To the extent possible, EDT relies on habitat data, whereas QHA relies primarily on professional opinion. There was insufficient data to use EDT in the watersheds other than Fifteenmile.

3.4.1. Winter Steelhead in Fifteenmile Watershed

Fifteenmile Watershed was broken into forty one reaches, including five passage barriers with reach length equal to zero. These reaches are defined in Figure 3.3.

The forty one reaches represent the known or potential range of steelhead in Fifteenmile Watershed. For each of these reaches, habitat characteristics were described by a team of biologists and natural resource managers familiar with the Fifteenmile system. EDT uses this habitat data, together with certain assumptions about the life cycle and out-of-subbasin effects of Fifteenmile winter steelhead to generate an estimate of the adult and juvenile *life history diversity, productivity, capacity* and *abundance*.

- *Life history diversity*, as reported by EDT, refers to the percentage of steelhead life history trajectories generated by EDT that complete a life cycle. Life history diversity in EDT is a measure of habitat breadth--the "window of opportunity" for the focal species in regard to space (reaches along the stream) and time (months within a year) in which suitable habitat conditions exist for the focal species.

- *Productivity* refers to the steelhead survival rate, from redds to a particular life stage, when density-dependent factors are not in play—i.e. when competition for resources is not a factor. In this context, productivity is not equivalent to the current rate of expansion of the population. Productivity refers rather to the potential rate of expansion, if no other factors limit the population.

- *Capacity* is the maximum population that the habitat can support given a specified level of natural resources.

[113] EDT, Mobrand Biometrics
[114] QHA, Mobrand Biometrics

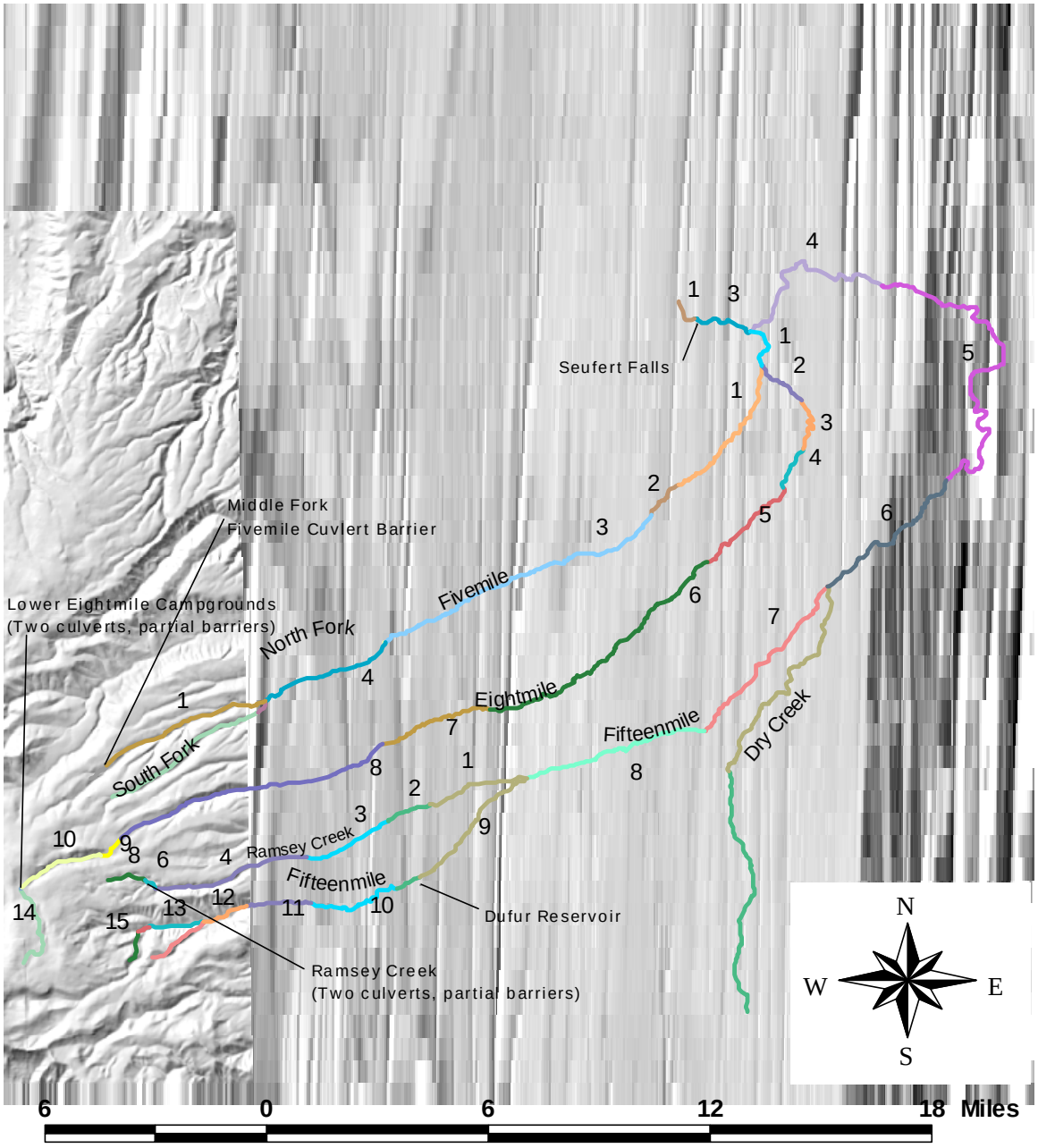
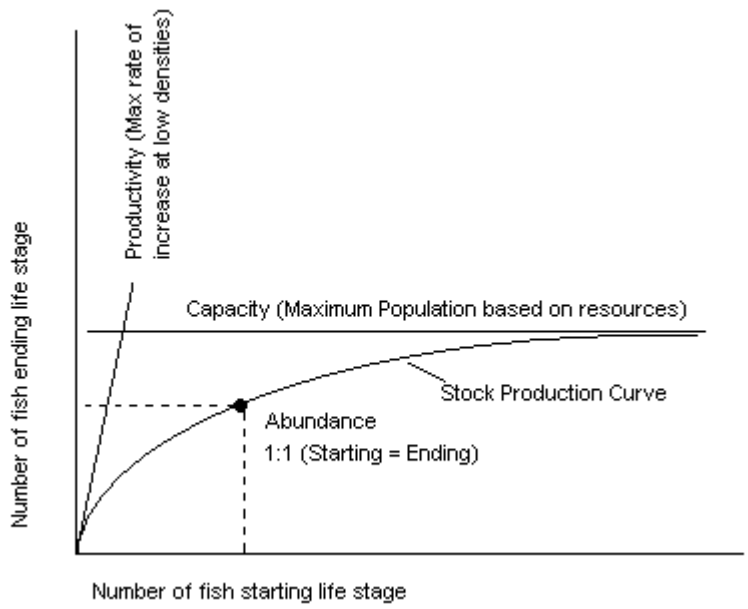

Seufert Falls
Middle Fork
Fivemile Cuvlert Barrier
Lower Eightmile Campgrounds
(Two culverts, partial barriers)
Fivemile
North Fork
Eightmile
South Fork
Fifteenmile
Dry Creek
Ramsey Creek
Dufur Reservoir
Ramsey Creek
(Two culverts, partial barriers)
N
W
E
S
6 0 6 12 18 Miles

Figure 3.4. Stock Recruitment Curve showing Theoretical Relationship of Productivity, Capacity and Abundance.



EDT produces a diagnostic report describing the limiting factors in each stream reach and prioritizing reaches for restoration or protection based on their potential response to restoration or further disturbance.

EDT estimates that the current steelhead abundance of Fifteenmile Watershed is approximately 1,261 adults and 21,061 juveniles. This compares to 4,367 adults and 47,377 juveniles under modeled presettlement conditions (Tables 3.9 and 3.10).

The life history diversity index (Table 3.9, column two) indicates that under modeled presettlement conditions, 97% of the life histories generated by the model successfully produced spawners, but in the current condition, only 34% did so. As described by Chip McConnaha of Mobrand Biometrics, Inc.: "The habitat breadth is 66% smaller under the current condition than it was under the reference condition. There is now a smaller window of opportunity and therefore a greater likelihood that a catastrophic event or environmental change will extirpate the population."[115]

Geographically, the areas with viable life histories show a distinct geographic pattern. Figure 3.5a shows that in the modeled presettlemtn condition, steelhead could complete viable life histories throughout the majority of the watershed. Figure 3.5b shows that steelhead are currently not able to survive to spawning stage in the lower two thirds of the Fifteenmile Watershed. The population now appears to be restricted to the reaches in the forested upper elevations, where flows and temperatures remain in fairly good condition. Further degradation would quickly put this population at risk of extinction.

[115] Chip McConnaha, Mobrand Biometrics Inc, vie e-mail, 5/5/04

EDT reports productivity to have been reduced from 29.5 returns per spawner under modeled presettlement conditions to 11.2 returns per spawner under current conditions (Table 3.9, column 3). Again, this does not represent the return rate for any given year, but rather the potential return rate when the population is not limited by density-dependent factors, natural disasters or other mortality factors. It represents the potential for a depressed population to recover when conditions improve. The high productivity noted for Fifteenmile is encouraging.[116] It indicates that the population could recover rapidly in response to improved habitat conditions.

Table 3.9. Fifteenmile Winter Steelhead Adult Productivity, Capacity and Abundance (output from EDT).

Scenario	Life History Diversity Index	Productivity (returns per spawner at low densities)	Capacity (maximum population, as modeled by EDT)	Abundance (self-sustaining population, as modeled by EDT)	Abundance as estimated locally
Current	34%	11.8	1,261	1,155	127-1,077
Modeled Presettlement	97%	41.3	4,367	4,261	

Table 3.10. EDT Estimates of Fifteenmile Creek Winter Steelhead Juvenile Outmigrant Productivity, Capacity and Abundance.

Scenario	Productivity (Outmigrants per spawner at low densities)	Capacity (maximum population)	Abundance (self-sustaining population, as modeled by EDT)	Abundance according to on-the-ground counts in Fifteenmile
Current	207	23,098	21,067	4,559-10,504
Modeled Presettlement	483	48,494	47,377	

[116] By contrast, the productivity generated by EDT for the nearby Klickitat River is only 4.5 returns per spawner under current conditions and 14.6 under modeled presettlement conditions (EDT Online, registered dataset for Klickitat River winter steelhead, April 30, 2004).

Figure 3.5a. Percentage of Viable* Life Histories Modeled in the Template Condition (Mobrand Biometrics, May 2004)

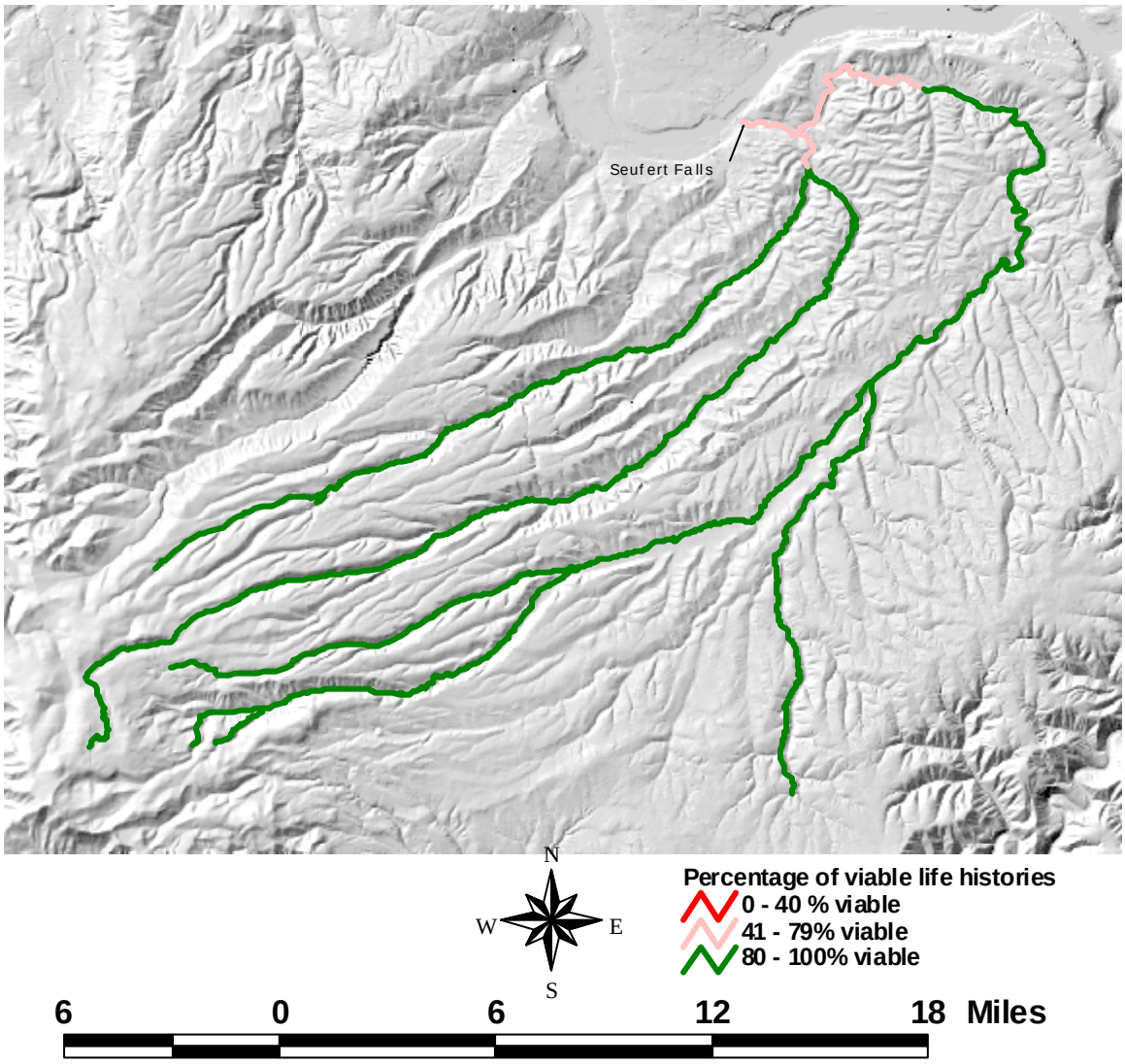
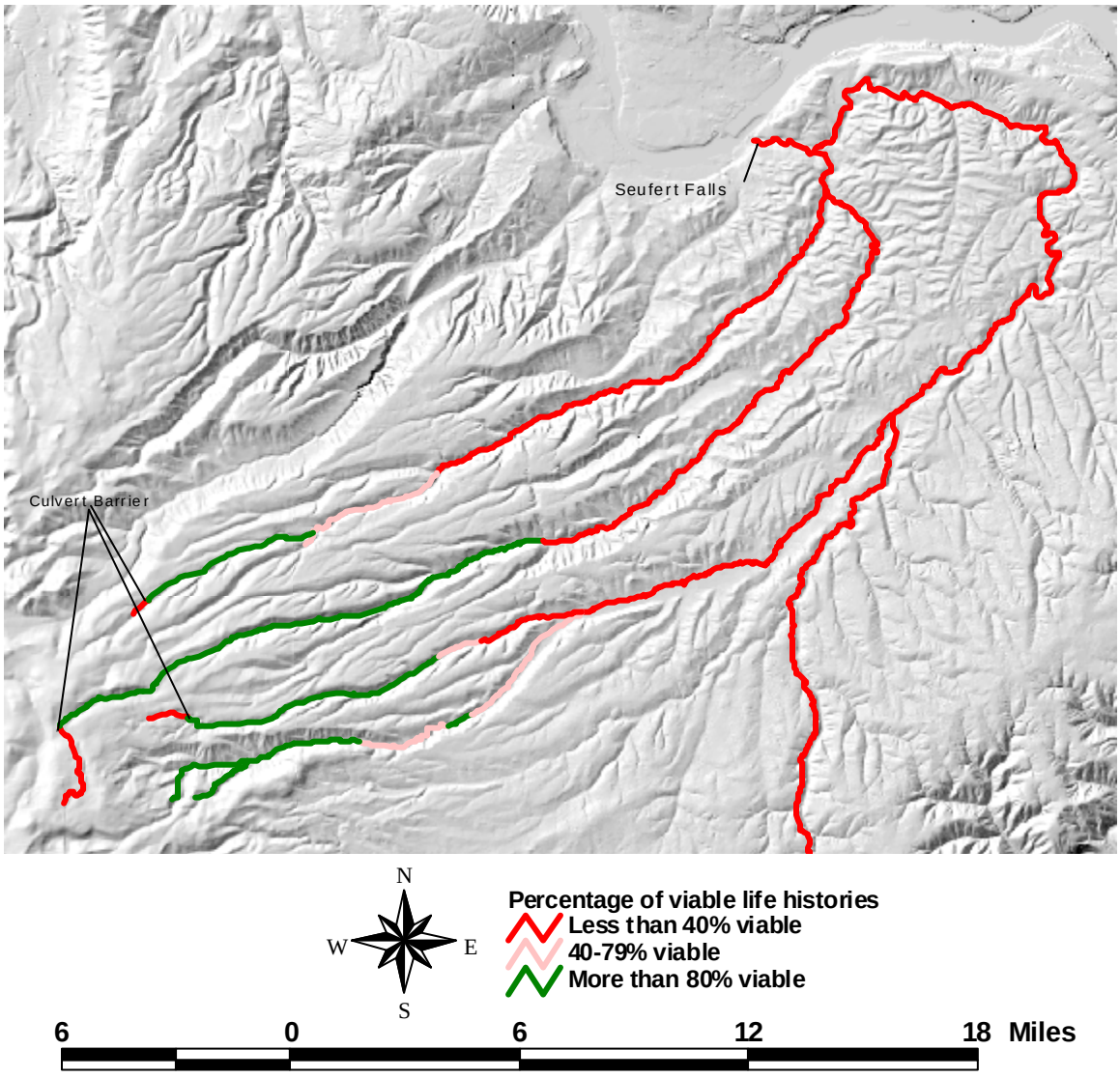


Figure 3.5b. Percentage of Viable* Life Histories Modeled in the Current Condition (Mobrand Biometrics, May 2004)



*Viable is defined here as having a productivity >1.0.

Reality Check: Model Output versus Local Data

The EDT output for adults is slightly above the high end of local estimates. As described in section 3.2.3, the number of spawners in 2003 can be estimated based on redd counts somewhere between 845 and 1,077 fish. That year was marked by good ocean conditions and heavy runs throughout the Columbia Basin. By contrast, in the late 1980's and early 1990's, estimates of adult spawners range between 127 and 800 fish.

In terms of juvenile migrants, the best available data is based on the screw trap studies conducted in 1998, 2000 and 2003 by ODFW at the mouth of Fifteenmile Creek. In 1998, the estimate was 4,559 smolts, whereas in 2000, the estimate was 10,504 smolts and in 2003, there were an estimated 9,794 smolts.

EDT outputs over twice as many smolts as the screw trap data indicates (Table 3.10). As noted before (Table 3.8), steelhead juveniles in Fifteenmile appear to smolt at an earlier age than in Hood River (or in coastal streams[117]). Estimates of juvenile migrants from Fifteenmile only exist for three years, but are comparable to values from the Deschutes River, where 29% of steelhead in a sample of 100 had smolted at one year of age.[118] As an experiment, EDT was run for Fifteenmile assuming the smolt-age distribution found in Hood River, the next subbasin to the west. Using the Hood River age distribution, EDT estimates the Fifteenmile smolt production at 12,000, which is quite close to the numbers counted in 2000 and 2003. Further monitoring of juvenile migrants is needed to determine the true age distribution of Fifteenmile smolts.

Little or no data exists regarding the true presettlement condition. Model input for the presettlement condition was based on professional opinion and experience with similar systems. In particular, the presettlement estimate is based on the assumption that Seufert Falls was passable prior to the establishment of Seufert Cannery. Seufert Cannery, established in 1885, built a diversion structure at Seufert Falls which was impassable part or all of the year. In 1937, this diversion was removed by ODFW, although pilings are still visible. It is not known whether the steelhead population was actually extirpated while the obstruction was present. Rick Cantrell, a local resident born in 1920 on a farm near Fifteenmile Creek, reports that there were no steelhead in Fifteenmile Creek during his childhood, though there was a healthy trout population with adult sizes reaching 10-14 inches. [119] Dick Overman, another lifelong resident, independently reported the same thing, but noted that steelhead were present in Mill Creek.[120] Bob Hammel noted that there were at least six concrete dams on Fifteenmile Creek, most of them with no fish passage provisions, until as late as the 1990's.[121] NOAA Fisheries considers the steelhead in Mill Creek and Fifteenmile to be a single population.[122] It is possible that this population would have been extirpated in the early 20th Century, were it not for the continuous presence of steelhead in Mill Creek.

Key Disturbance Factors and Potential Responses

As indicated by EDT, the key factors inhibiting steelhead populations and aquatic ecological processes within the Fifteenmile Watershed are habitat diversity, sedimentation, flows, water temperature, key habitat quantity, pathogens, and channel

[117] Greg Blair, Mobrand Biometrics, Inc, pers. comm.
[118] Olsen, et. al. 1991.
[119] Rick Cantrell, pers. comm.. April 17th, 2004
[120] Dick Overman, Wasco Co. SWCD Board Meeting, 5/5/04
[121] Bob Hammel, Wasco Co. SWCD Board Meeting, 5/5/04
[122] ICB-TRT 2003.

stability,. Other factors that have a lesser effect are food supply, harassment and dissolved oxygen. These environmental factors are defined by life stage in Table 3.11.

Table 3.11: Key Environmental Correlates for each Life Stage (EDT 2004, Fifteenmile Subbasin)

Life Stage	Key Environmental Factors
Spawning	Habitat Diversity, Temperature, Sediment
Egg incubation	Temperature, Sediment, Channel Stability
Fry colonization	Temperature, Flow, Habitat Diversity, Oxygen
0-age active rearing	Temperature, Flow, Habitat Diversity, Pathogens
0,1-age inactive (Winter inactivity)	Temperature, Flow, Habitat Diversity, Sediment
1-age migrant	Habitat Diversity and Quantity, Sediment
1-age active rearing	Temperature, Flow, Habitat Diversity
2+-age active rearing	Temperature, Flow, Habitat Diversity
2+-age migrant	Habitat Diversity and Quantity
2+-age transient rearing	None
Prespawning migrant	Habitat Quantity, Sediment
Prespawning holding	Habitat Diversity and Quantity

Habitat Diversity and Key Habitat Quantity

EDT tracks the percentage of various types of habitat in each reach. The categories tracked are backwater pools, beaver ponds, glides, large cobble/boulder riffles, small cobble/gravel riffles, pool tailouts, primary pools and off-channel habitat. The Fifteenmile Subbasin has been extensively surveyed over the last four years, and this data was entered into the model. The makeup of habitat types on forest in the presettlement condition was estimated based on channel type[123]. In middle elevations, presettlement assumptions were based on Shitike Creek Reach 2, a stream in the Deschutes Subbasin

[123] Catherine Serres, Mt. Hood National Forest, 2003

with a gradient and flow similar to Fifteenmile Creek. Shitike Creek 2 has a gradient of approximately 2%, so was used as a reference only for reaches with a gradient between 1 and 3%[124].

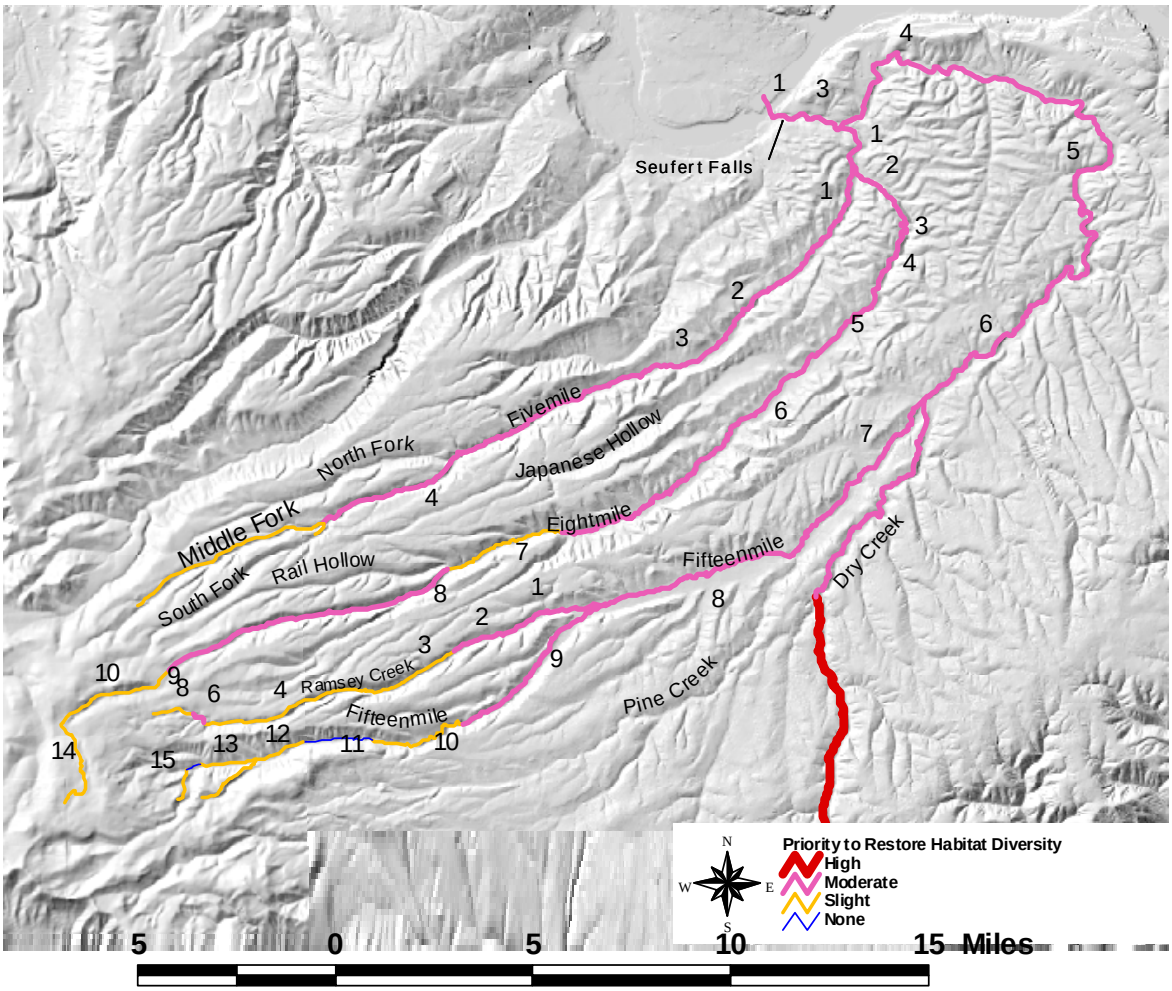
Fifteenmile has been extensively channelized and straightened and has subsequently downcut. Based on historical aerial photos, the stream is known to be shorter and steeper now than prior to the 1970's. The priority to restore habitat diversity was **high** in Dry Creek and **moderate** in most of the watershed (except in one reach near the headwaters) on spawning, active rearing of all age classes, juvenile migration, winter inactivity, and prespawning holding.

Key habitat quantity refers to specific habitat types that are important to various lifestages. EDT's priority reaches for restoring habitat diversity are portrayed in Figure 3.4. EDT typically found a small to moderate loss in key habitats for all lifestages except 2+ age transient rearing. In all reaches, at least six lifestages were affected (EDT recognizes 12 lifestages).

Habitat diversity and quantity can be restored through activities that address the floodplains and allow the stream to recover its former floodplain and channel complexity. Possible activities include riparian buffers, tree planting, large woody debris placements. Placement of engineered structures (weirs, jetties, etc.) might be used in particular cases, in conjunction with other activities.

[124] Shitike Creek #2, from Warm Springs water intake to road crossing at 2300 foot level; Deschutes Subbasin EDT: Pools: 17%, tailouts: 3%, backwater, 0%, beaver ponds, 0%, glides 2% small cobble 59%, large cobble 18%.

Figure 3.6. Priority Reaches to Restore Habitat Diversity (EDT, May 2004)

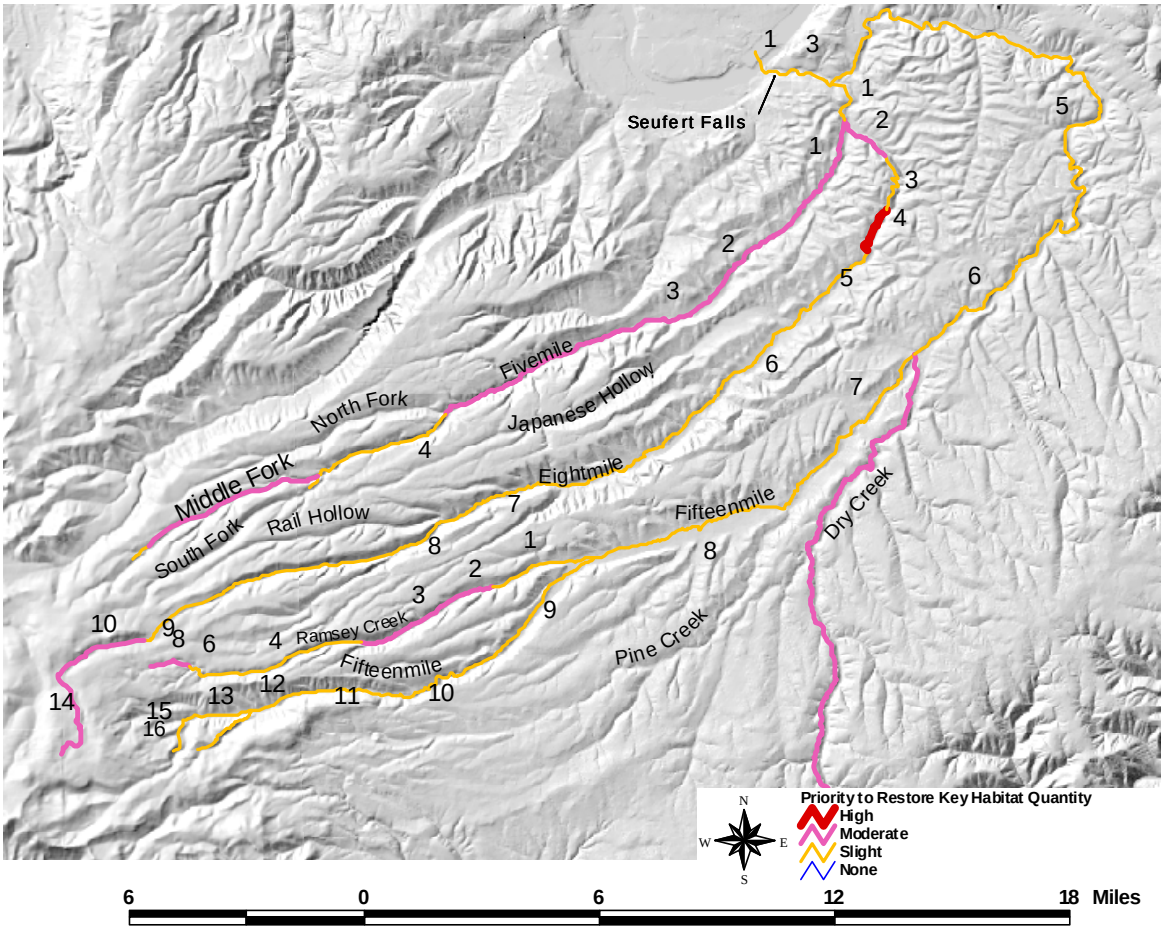


Confidence in the Data: EDT rates habitat diversity primarily based on gradient, and secondarily based on confinement, riparian function, and wood. Channel straightening and confinement by dikes and roads has shortened the stream length, thereby increasing gradients in many reaches. Current gradients were estimated based on map analysis. Estimated presettlement gradients were adjusted based on the amount of confinement estimated for each reach. For each artificially confined reach, the presettlement gradient was decreased by 20% of the assumed confinement. Therefore, a reach that was rated as 90% confined was arbitrarily assumed to have been 18% less steep in the presettlement condition, compared to the current (measured) condition. A reach that was modeled as 20% confined was assumed to have been 4% less steep in the presettlement condition. Similarly, reach length was assumed to have been longer in the presettlement condition by the same percentage. These estimates are based on professional judgement and are open to question.

Key habitat is different for each life stage. Pool tailouts are the key habitat for spawning in EDT, whereas primary pools are key habitat for rearing and holding lifestages. However, EDT models all habitat as reduced where stream width and length are reduced.

EDT's priority reaches for restoring key habitat quantity are identified in Figure 3.6. Maximum stream width was estimated to have been reduced in artificially confined reaches, and reach length was estimated to have been decreased in the confined reaches, thus explaining the high importance that EDT placed on key habitat quantity. The accuracy of the assumptions about presettlement length and width are open to question.

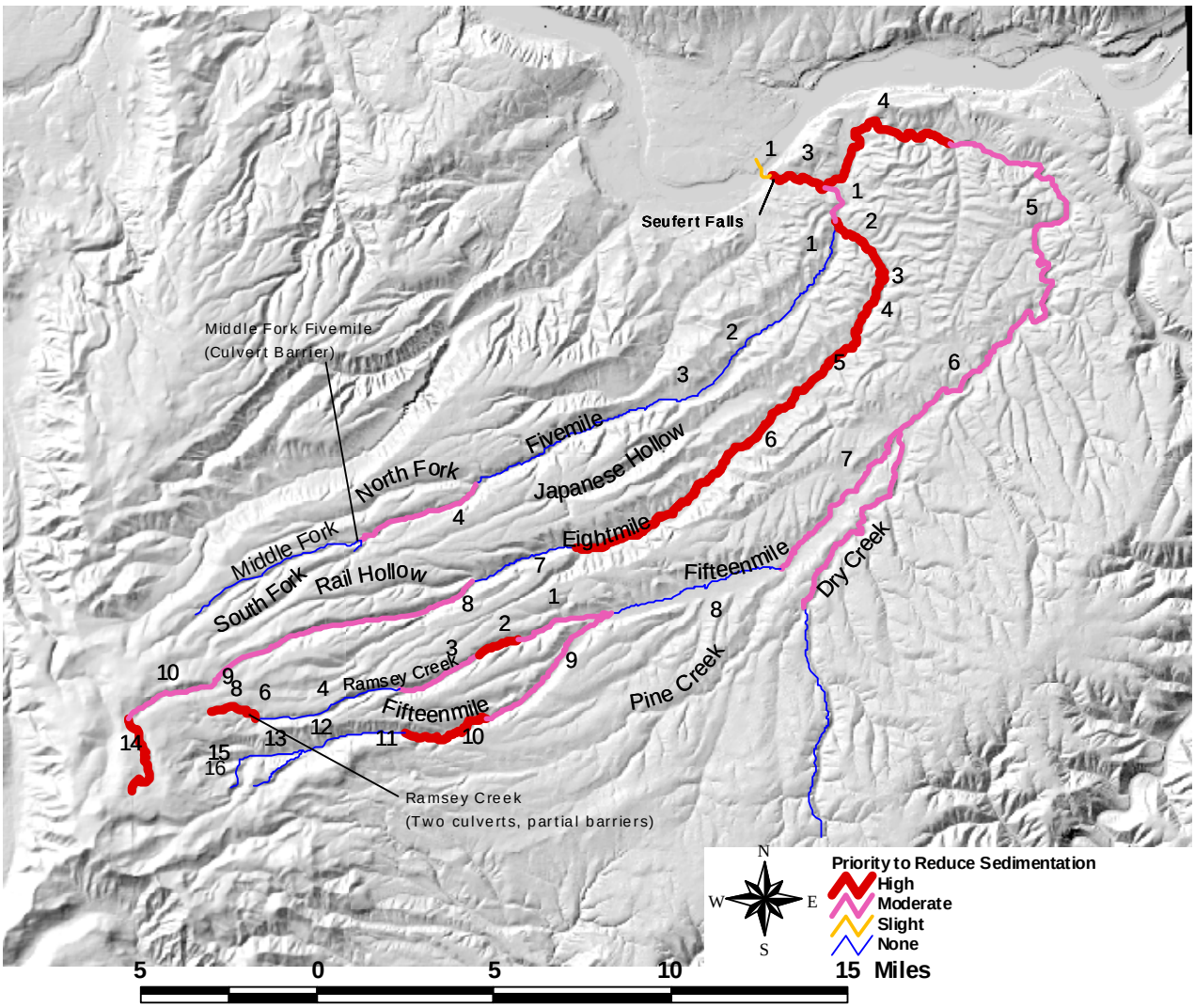
Figure 3.7. Priority Reaches to Restore Key Habitat Quantity (EDT, May 2004)



Sediment

Fine sediments (particles of silt, clay and organic material less than 1mm in diameter), when present in high levels, can clog spawning gravels and smother eggs. Sand (particles from 1-6mm in diameter) can also reduce spawning success when present in high enough quantities. Fifteenmile Creek and Eightmile Creek are listed for sediment on the 2002 Oregon State 303(d) list of Water Quality Limited Waterbodies. Priority reaches for reducing sedimentation of spawning beds, as rated by EDT, are shown in Figure 3.8.

Figure 3.8. Priority Reaches in which to Reduce Sedimentation of Spawning Beds (EDT, May 2004)



Sediments enter the Fifteenmile through both natural and anthropogenic causes. The most widespread natural cause is The Dalles Formation, a highly erodible layer of pyroclastic sandstone located between the less erodible and more common basaltic lava flows that make up the geologic landscape of Fifteenmile Watershed.

Three primary sources of anthropogenic sediment exist in the watershed:

- Approximately 100,000 acres are used for production of cereal grains without irrigation. Many of these lands are located on steep slopes and are considered highly erodible by the US Department of Agriculture. Under the tillage techniques common in the watershed prior to the 1990's, erosion rates commonly exceeded 50 tons per acre on the most erodible soil types. Since the passage of the 1985 Farm Bill, the adoption of first minimum till and later direct-seed practices has reduced these erosion levels. However, in cases where land is kept

clear of vegetation through the winter, erosion rates can still be above sustainable levels. Sediment delivery to the streams is highest where such fields are located adjacent to streams.

- Roads can be a significant source of sediment when poorly maintained or designed, when placed near a stream, or on steep slopes. The highest densities of roads within riparian areas are on the private lands of Mosier Creek, Fivemile, Eightmile, and Lower Fifteenmile, all of which have more than a half mile of road per mile of stream within 200 feet of the stream. The Mount Hood National Forest has an active program of road closures to deal with the high density of logging roads in prior timber sale areas.

- Eroding streambanks deliver 100% of their sediment to the stream. Streambank erosion may be natural or may be caused by removal of riparian vegetation, stream channel manipulation, or other human activities.

Confidence in the Data: Aquatic Inventory Project (AIP) data did not support the rating of sediment as a high priority for restoration. When EDT was run based solely on AIP habitat survey data, sediment was a minor factor in steelhead mortality. However, this result did not agree with local experience. Local fish biologists uniformly believe that Fifteenmile Watershed is more highly impacted by fine sediment than any steelhead system other than the Umatilla River system (Fifteenmile Coordinating Group, April 16th, 2004).

AIP surveys used "ocular estimates" of sediment, a highly subjective method that tends to overestimate larger substrates, such as gravel and cobble which are easier to see. In year 2000, the Forest Service conducted Wolman Pebble Counts at 28 sites throughout Fifteenmile, Eightmile, Fivemile and Ramsey Creeks. Dry Creek was not tested, nor were the forks of Fivemile. Wolman pebble counts are more objective than ocular estimates, but also tend to be biased toward larger substrates. The Forest Service data showed that sediment of less than 6mm in size constituted more than 30% of the substrate at 10 sites. When EDT was run again using this new data, sediment and habitat diversity tied as the greatest restoration priority in Fifteenmile Watershed. This sensitivity of the model demonstrates the need for further pebble counts to pinpoint the distribution of this problem.

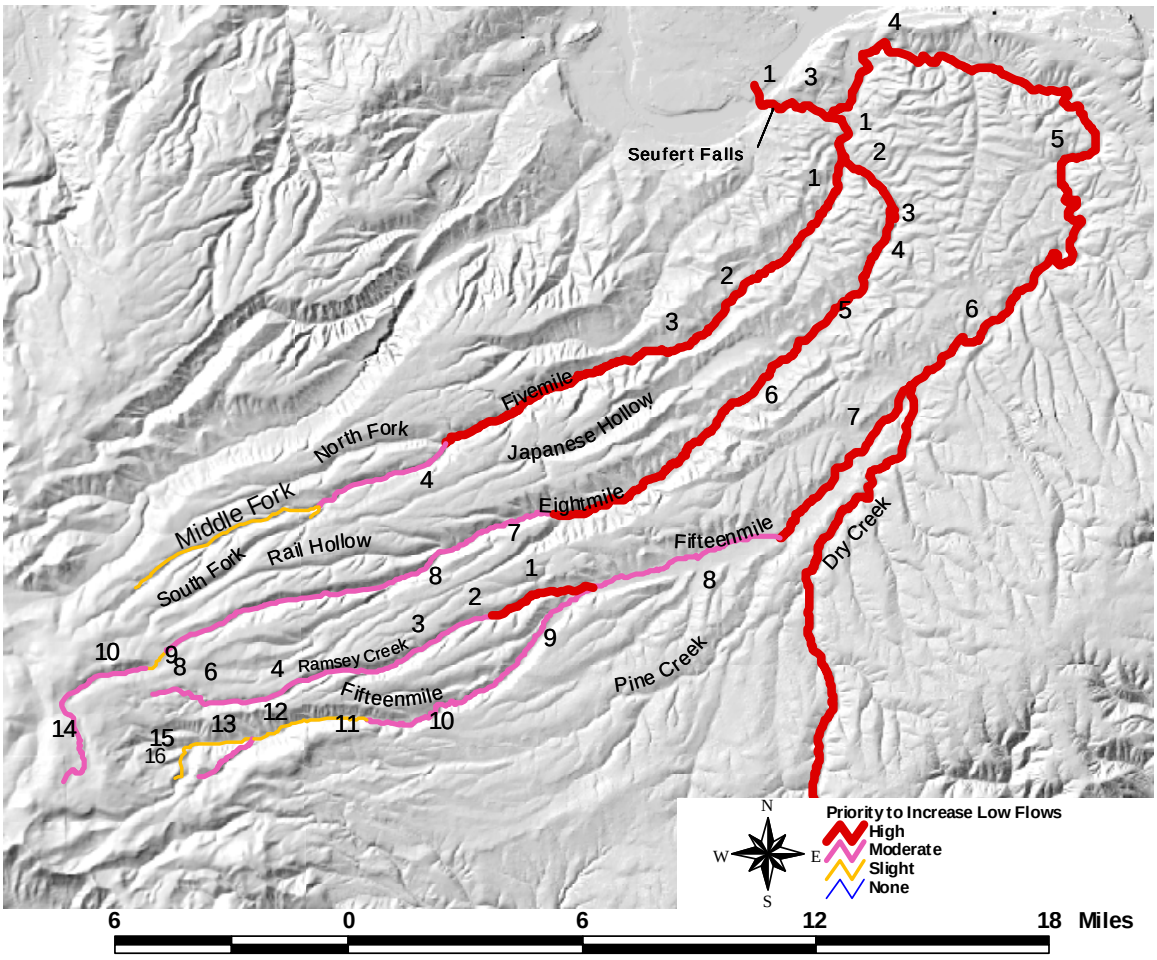
Low Flow

According to EDT, both high flows and low flows reduce steelhead populations in every reach (Figures 3.9 and 3.10). Fifteenmile Watershed naturally experiences extreme annual fluctuation in flow levels which are only made more intense by irrigation withdrawals and human-caused changes in the runoff characteristics of the watershed. In the absence of any withdrawals, average monthly flow at the mouth of Fifteenmile Creek

varies from 197 cfs in March to 10.7 cfs in August .[125] After irrigation withdrawals, the figure in August is 3.45 cfs.

Low flows affect active summer rearing for 0-2 age juvenile steelhead. The priority to restore low flows ranged from **low** to **high**, with the priority increasing downstream. Restoration of low flows is a high priority in the lower reaches of Eightmile and Fivemile, in Fifteenmile from the mouth upstream to Dufur, in Ramsey Creek from the mouth to the Olsen Diversion and in Dry Creek. Low flows had only a moderately negative effect in Fifteenmile Creek upstream of the National Forest boundary.

Figure 3.9. Priority Reaches in which to Increase Low Flows (EDT, May 2004)



Low flows can be restored primarily by reduction of irrigation withdrawals, either through efficiency projects, water rights transfers or reduction in irrigated acreage. Low flows are also addressed by actions that address the hydrologic behavior (i.e. upland

[125] Oregon Water Resources Department website 2004, http://www.wrd.state.or.us/. These figures are based on modeling, which is calibrated to existing stream gage data, which can be accessed at the same website.

runoff) of the watershed, such as continued adoption of no-till farming and floodplain restoration.

Confidence in the Data: Flow data came from Oregon Water Resources Department (OWRD) hydrologic modeling. The data was specific for each tributary and each month, and was calibrated to stream gage on measurements, to the extent that measurements had been taken. Stream flow data has been collected at seven places in Fifteenmile Watershed, at various times and for various periods of time from 1918 to 1984. The most recent data was collected on Fifteenmile Creek at Rice, where a stream gage was in operation from 1946 to 1953 and again from 1970 to 1984. All other sites were in operation for less than five years.[126] OWRD models flows both prior to water withdrawals and flows after water withdrawals. These figures were used for presettlement and current conditions. Thus, the presettlement figures represent the modeled flows if there were no water withdrawals. The presettlement figures do not take into account any runoff changes.

Peak Flow

The frequency and magnitude of peak flows have been increased in Fifteenmile by changes in soil and vegetation characteristics of the uplands, and increases in road surfaces. Fifteenmile Watershed has experienced an increase of up to 650% in peak flows since the 1850's.[127] This effect is believed to have been most marked in the 1950's, when cropland had expanded to its maximum extent, and conservation tillage had not yet been adopted. Figure 3.10 identifies the priority reaches, by EDT ratings, in which to decrease peak flows.

Impervious surfaces, such as paved or compacted roads, rooftops, and parking lots, increase peak flows. The watershed assessments conducted by Wasco County SWCD for Fifteenmile, The Dalles and Mosier Watershed Councils all analyzed road density and road placement through aerial photo interpretation. Road densities were analyzed separately for each tributary watershed and for each land use. Road densities were highest in the urban areas, where impervious surface areas can greatly increase runoff and can collect pollutants from paved surfaces, including motor oil, radiator fluid and home pesticides and chemicals. Outside of urban areas, the highest road densities were found in the rural residential areas of the Mosier Valley (22 miles per square mile over a total area of 0.87 square miles).[128] At this density, roads have a high potential to increase runoff levels due to the amount of compacted or paved surfaces. Whether these roads are also a sediment source depends on their placement, maintenance and design (see *Sediment*, above).

Effects of forestry practices and road building may have been greatest in the 1980's, when harvest levels were highest, and the majority of forest roads had been completed.

[126] Oregon Water Resources Department website 2004, http://www.wrd.state.or.us/.
[127] Wasco Co. SWCD, 2003a
[128] Wasco Co. SWCD. 2002.

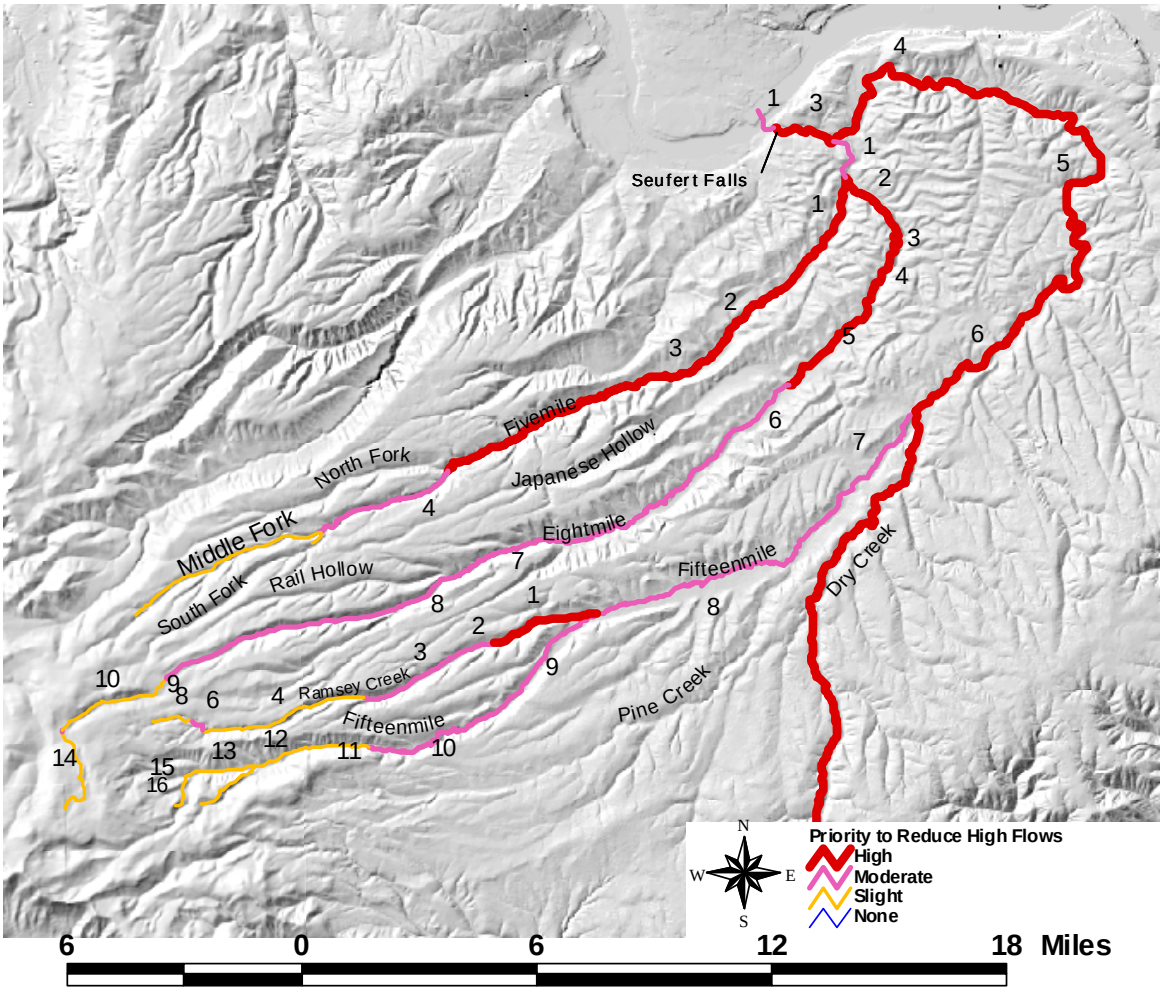
The power of peak flows have been exaggerated further by stream channel straightening and loss of floodplain function.

Today, after the adoption of minimum till, partial adoption of no-till and various forest road closures, peak flows in lower Fifteenmile Creek are modeled to be reduced 50% from the historic high in the 1950's, but remain 350% higher than in the 1850's.[129]

Because peak flows occur primarily in winter and spring, exaggerated peak flows affect egg incubation, fry colonization and overwintering juveniles. Moderation of peak flows is a **high** priority in the lower watershed.

The destructive energy of peak flows can be moderated by reducing upland runoff, reducing impervious surfaces, increasing vegetative cover, and restoring floodplain function and meanders. Methods include continued adoption of no-till farming, closure of forest roads and restoration of the length and complexity of the stream channel.

Figure 3.10. Priority Reaches in which to Decrease Peak Flows (EDT, May 2004)



[129] Wasco Co. SWCD 2003a

Confidence in the Data: The source of the ratings for peak flows was the same Water Resources Department models used as source for low flows. In addition, EDT looks at the change in intra-annual flows, described as the "flashiness" of the system. The Fifteenmile Watershed Assessment used USDA hydrologic models to document this increase in runoff levels[130]. Because of the well-documented changes in the upland hydrology due to tillage and the extensive channelization throughout Fifteenmile, this parameter was rated as a high concern throughout the watershed, and highest in the lower reaches. This parameter particularly affects spawning and egg incubation.

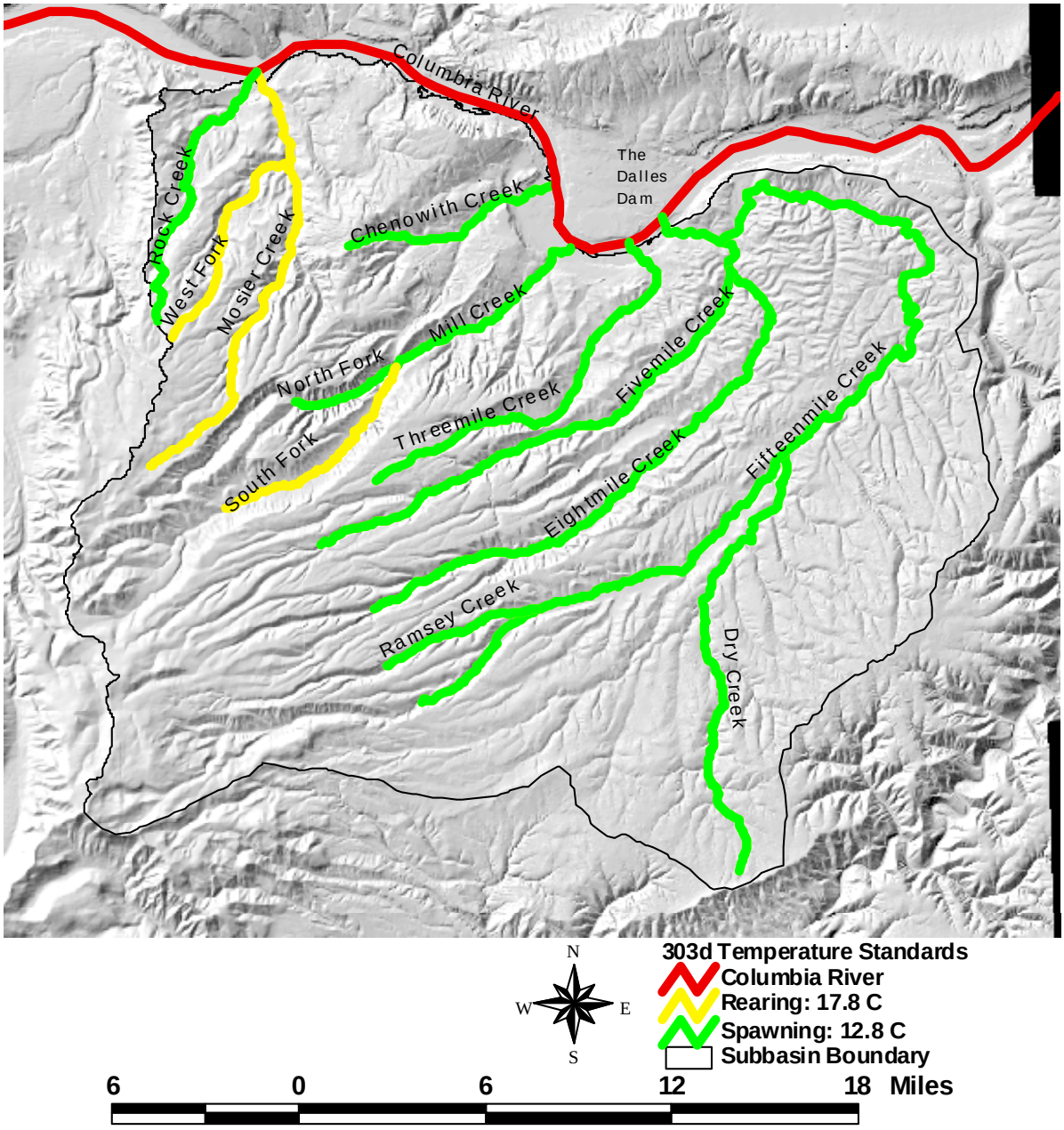
Water Temperature

Optimum temperatures for steelhead vary with lifestage. Oregon Department of Environmental Quality has recently set new temperature criteria based on biological requirements of salmonids. During spawning periods, DEQ calls for water temperatures not to exceed 13C (55.4F). During rearing and migration periods (i.e. summer), the water temperature should not exceed 18C (64.4F). Certain streams are considered core cold-water habitat areas, and are held to a temperature standard of no more than 16C (60.8F). at any time of year.

All of these standards apply to the portion of Fifteenmile Watershed in which steelhead occur (Figure 3.11). Water temperatures in parts of Fifteenmile Watershed exceed the cold water standard and the rearing standard and are believed to exceed the spawning standard as well, although most temperature monitoring has concentrated on the summer rearing period. Fifteenmile Creek and Eightmile Creek are listed for temperature on the 2002 Oregon State 303(d) list of Water Quality Limited Waterbodies.

[130] Wasco Co. SWCD 2003a

Figure 3.11. Oregon State Water Temperature Criteria exceeded in the Fifteenmile Subbasin and nearby Columbia River (303(d) List, 2002).



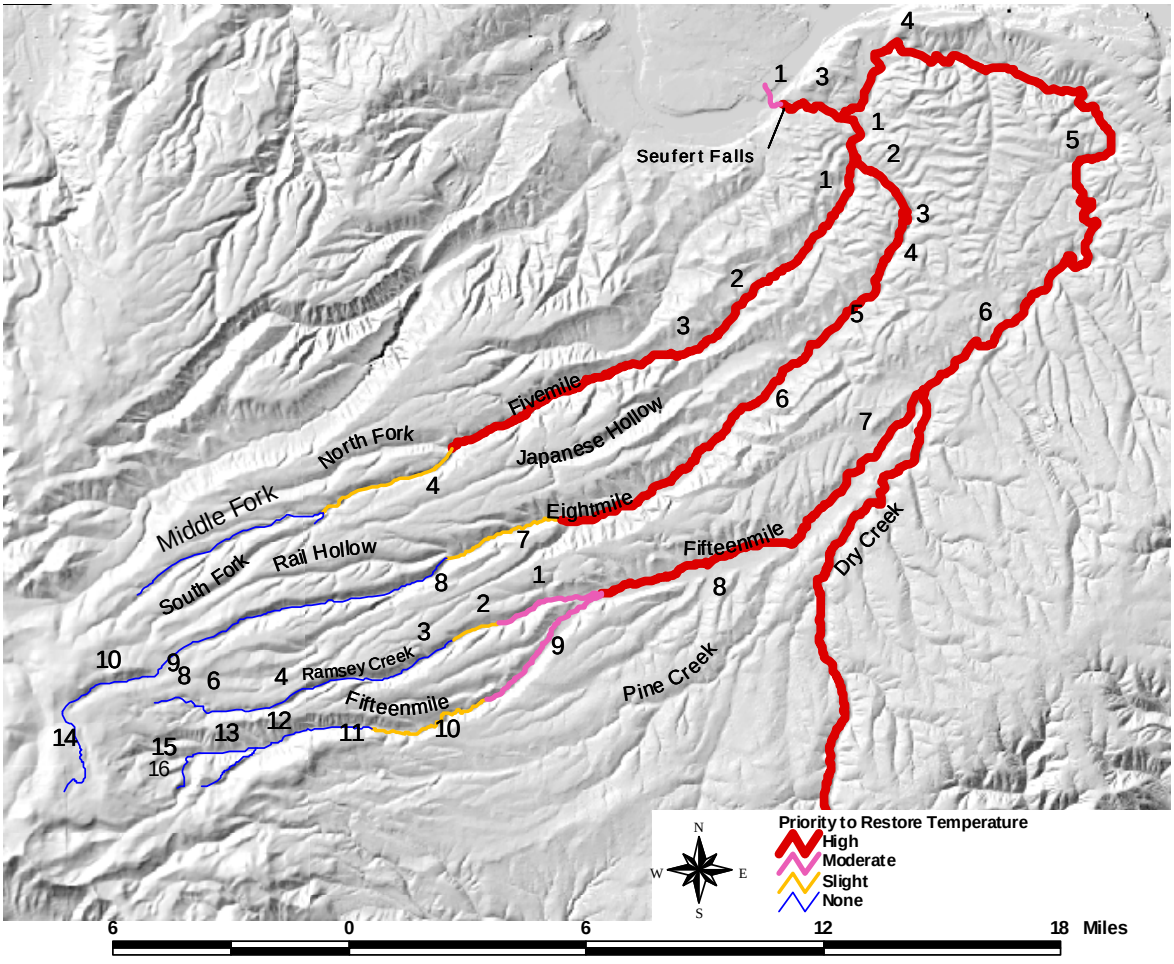
High water temperatures negatively affected spawning, egg incubation, fry colonization and rearing of all age classes. The priority to restore temperature varied from **low** to **high**, with the priority being higher in the lower watershed (Figure 3.12).

Priority reaches in which to reduce summer water temperatures corresponded closely with the priority reaches to restore low flows. Specifically, temperature restoration is a high priority in Fifteenmile Creek from Seufert Falls to Ramsey Creek, in Eightmile Creek from the mouth to the Wolf Run diversion, in Fivemile Creek from the mouth to

North Fork, in Ramsey Creek from the mouth to Olsen diversion, and in Dry Creek throughout the stream.

Water temperature is a function of flows, shade, climate and groundwater interactions, among other factors. Radiative and conductive heat exchange is proportional to the air-water surface area of the stream. At the same time, conductive heat exchange at the water-soil interface tends to moderate stream temperatures. Activities that reduce the width-to-depth ratio of the streams will reduce air-water surface and increase soil-water surface area, thereby moderating stream temperature. Activities that restore low flows, such as reduction of irrigation withdrawals, riparian buffer plantings, and improvements in upland hydrology, will all yield a corresponding reduction in summer water temperatures. Secondarily, activities that increase riparian shade will help keep temperatures low. Most activities that improve floodplain function, such as riparian buffers, will also improve shade.

Figure 3.12. Priority Reaches in which to Reduce Summer Water Temperature (EDT, May 2004)



Confidence in the Data: Water temperature has been extensively monitored in the Fifteenmile Watershed. Water temperatures have been monitored continuously for many years by Wasco County Soil and Water Conservation District, Oregon Department of Fish and Wildlife and the Forest Service in every fish-bearing tributary at multiple locations. ODFW and Forest Service records go back more than fifteen years. In addition, Wasco County SWCD and the Oregon Department of Environmental Quality contracted for an aerial infrared survey of surface temperatures in August 2002.[131] This study provided a greater understanding of geographic temperature patterns and influences.

Channel Stability

Channel stability, as used in the EDT model, refers to "the effect of channel stability (within reach) on the relative survival or performance of the focus species; the extent of channel stability is with respect to its streambed, banks, and its channel shape and location."[132] Channel stability does not refer to immobility of the channel.

A stream would be rated down for erosion or movement beyond natural levels. It would also be rated down for erosion or movement significantly below natural levels, as in a diked stream or one constricted by road construction. A stream might be rated down for channel stability either for eroding sideways or for cutting downward.

Channel stability had a **slight** to **high** effect on egg incubation, fry colonization, rearing and overwintering. Channel stability was a negative factor in all reaches with the exception of Fifteenmile 14, which is on the Forest from Cedar Creek to Deadman Gulch (Figure 3.13).

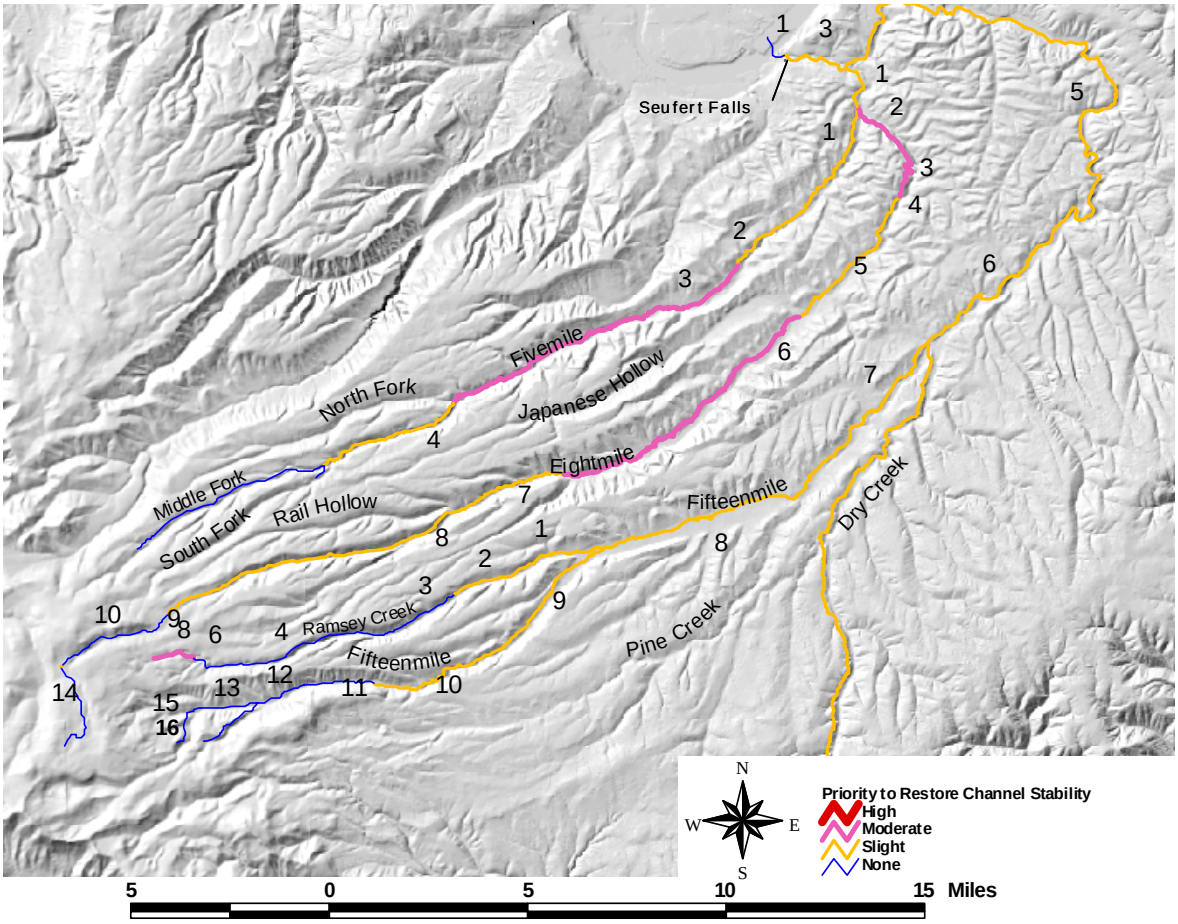
The priority to restore channel stability was **low to moderate** on private lands and gradually reduced upstream of the Forest boundary.

Channel stability can be addressed by activities that address floodplain health, such as riparian buffers and large woody debris placements, and by activities that correct peak flows, such as continued adoption of no-till farming practices. In extreme cases, where floodplain restoration is not an option, bank stabilization through bioengineering would be an option.

[131] Watershed Sciences, LLC. 2003

[132] Information Structure of EDT. Mobrand Biometrics Inc. October 2003.

Figure 3.13. Priority Reaches in which to Restore Channel Stability (EDT, May 2004)



T

Confidence in the Data: EDT bases its description of channel stability primarily on a rating of depth of bed scour during peak flow events.[133] Bed scour refers to the movement of streambed substrate. The Fifteenmile Coordinating Group did not have any data on bed scour. Ratings were based on consultation with Mark Kreiter, Forest Service Hydrologist. The Shear-Stress Equation (62.4 x depth (ft) x slope) was applied to reaches to determine the size of substrate particle movement. This was then converted into a bed scour rating, despite the fact that it does not directly measure the parameter (depth of bed scour) that the EDT model requires. Therefore, confidence in the accuracy of these ratings is low.

Other Environmental Factors

Several other environmental factors are notable in the Fifteenmile Subbasin.

[133] Information Structure of EDT. Mobrand Biometrics Inc. October 2003.

Food is modeled in EDT as a function primarily of alkalinity, with benthic invertebrates and salmonid carcasses as modifying factors.[134] Scarcity of food negatively affects rearing and overwintering in some reaches. In all cases, the priority to restore food is **low**. Activities that lead to improvements in the other key environmental correlates will theoretically lead to improvements in water quality and quantity and increases in fish populations. This would increase salmonid carcasses, which would increase benthic invertebrates.

Dissolved oxygen was a **low** to **medium** priority for restoration in Fifteenmile Creek from the mouth to the City of Dufur. Data on dissolved oxygen is lacking. The attribute was rated in EDT based on the mean monthly water temperature and nutrient enrichment ratings. Data for nutrient enrichment was also lacking. Ratings for nutrient enrichment assumed that areas of the stream with higher temperature and turbidity would likely suffer from algal growth. Because of the uncertainty in these assumptions, little confidence should be assigned to the priority ratings output by EDT for dissolved oxygen.

Harassment refers to the amount of activity on the water's edge that might disturb fish and cause them to abandon an area or key habitat. Harassment exerted a **low** to **medium** effect throughout the private lands of the Fifteenmile Watershed. Harassment ratings were based on the proximity of the stream to roads, road crossings or other human activity centers.

Five culvert barriers were recognized by EDT. In reality, a number of partial barriers may exist throughout the watershed. In March 2004, Forest Service personnel audited a culvert on Eightmile Creek at the request of Wasco County SWCD. The culvert, located at approximately RM9, was found to be a barrier to adult migration at some flows and likely a complete juvenile barrier. As spawning has been consistently documented above that point, the culvert is clearly not a complete barrier. Yet, the finding underlines the possibility that partial barriers may limit the success of steelhead spawning and reduce juvenile survival in some years.

Where human intervention can or cannot have a beneficial effect

Potential Activities

Following description of the current and assumed presettlement conditions of the Fifteenmile watershed, EDT can generate scenarios that model the results of various restoration activities or degradation events. Five restoration activities were modeled using the EDT Scenario Builder.

The first scenario modeled the effect of a 100% restoration of all habitat parameters in Fifteenmile Watershed, together with removal of all culvert barriers. This would model the effect of restoring Fifteenmile Watershed to a presettlement condition, while leaving the rest of the Columbia Basin in its current condition. This scenario, while impossible to

[134] Information Structure of EDT. Mobrand Biometrics Inc. October 2003.

achieve, was important to model, in order to determine the range of possible outcomes of any **possible** and **feasible** in-subbasin habitat restoration alternatives. It served to separate the in-basin effects from the out-of-subbasin effects. In this scenario, EDT predicted a 245% increase in adults and a 218% increase in juveniles above current levels (Table 3.12 and 3.13). This represents an adult population that is 29% less than the modeled presettlement population.[135]

The US Forest Service is currently in the process of implementing a stream and floodplain recovery effort focusing on the Fifteenmile Reaches 10 and 11. These are the reaches between Orchard Ridge Ditch and the Dufur Intake. Identified issues in these reaches include lack of large woody debris, loss of floodplain function, and the potential for the stream to undercut the Orchard Ridge Ditch, releasing a plume of sediment that would travel downstream at least to the Dufur Reservoir. The proposed project would place logs and boulders both instream and in the floodplain in order to recover instream structure and floodplain function, and also would redirect the energy of the stream away from the endangered part of the Orchard Ridge Ditch. This project is known as Fifteenmile Riverkeeper.

To model the effect of the Fifteenmile Riverkeeper Project, two scenarios were run. One modeled the beneficial effects of the restoration activities. The recovery scenario assumed 100% recovery of floodplain function, riparian function and large wood in reaches Fifteenmile 9 to 11. The Fifteenmile Riverkeeper Project results in an increase of 6% in both returning adults and smolts (Table 3.12 and 3.13).

The other Riverkeeper scenario modeled the effects of allowing the Orchard Ridge Ditch to be undercut. The degradation scenario assumed 100% degradation of sediment, embeddedness and turbidity in Fifteenmile 9, 10 and 11, from the ditch to Ramsey Creek. At the same time, it assumed 90% restoration of low flows and stream high temperature, as the diversion would become inoperative. If the Orchard Ridge Ditch fails, the result is a 6-7% decrease in adults and smolts. The positive effect of restored flows almost cancels out the negative effect of sediment delivery from the damaged ditch.

Five culverts are considered to be total barriers to adult steelhead migration: one on Middle Fork Fivemile, two at Eightmile Campground, and two on Ramsey Creek, on the National Forest. Removing these barriers resulted in an 8% increase in adult spawners and 1% increase in smolt production (Table 3.12 and 3.13).

To model the effect of converting all crop fields to no-till, a scenario was run featuring a 40% recovery of High Flows, 50% recovery of Intra-annual Flow Variation, and a 10% recovery of Low Flows compared to the current condition. This effect was applied to all reaches on private land. This action led to an increase of 13% in returning adults and 11% in smolt production (Table 3.12 and 3.13).

[135] Until 5/29/04, EDT reported a "restored" out-of-subbasin condition for presettlement (template) winter steelhead, but not for coho or Chinook. Therefore, the presettlement (template) result reported here will not be comparable to coho or Chinook template results reported in other subbasins (Mobrand Biometrics, via e-mail, 5/5/04).

To determine the maximum effect of restoring low flows, a scenario was run in which low flows were restored to modeled presettlement condition. This scenario would require both elimination of water withdrawals, complete restoration of the presettlement vegetation and virtual elimination of roads. The scenario is not believed to be technically feasible or socially desirable, but was run simply to determine the maximum effect that could be achieved by low flow restoration. This scenario led to an increase of 122% in adults and 121% in smolts (Table 3.12 and 3.13).

A scenario was run to model the effect of placing large woody debris in the ten highest priority reaches identified by EDT. These reaches were Fifteenmile 4, 5, 7, 8, 9, Eightmile 6, 8, and Fivemile 1, 3, 4. This scenario increased the adult spawner population by 40% and increased juveniles by 32% (Table 3.12 and 3.13).

To model the effect of enrolling all reaches in wide riparian buffers and actively replanting native trees and shrubs, a scenario was run featuring a 100% recovery of riparian vegetation, 70% recovery of channel length and width, 80% recovery of wood, 40% recovery of stream temperature and 70% recovery of artificial confinement. These effects were applied to all reaches on private lands. This action led to an increase of 84% in returning adults and 78% in smolt production (Table 3.12 and 3.13).

To model the effects of implementing a suite of restoration actions, a scenario was run in which riparian buffers and no-till were implemented, large woody debris was placed, the Riverkeeper project was completed, all culvert barriers were fixed and water withdrawals were reduced by 50%. This scenario yields a 111% increase in spawners and 78% increase in smolts (Table 3.12 and 3.13).

Table 3.12. Results of Various Restoration Scenarios on Productivity and Abundance of Fifteenmile Winter Steelhead Adults (EDT 5/5/04).

Scenario	Life History Diversity	Productivity (Returns per spawner at low density)	Abundance: Percent of current (modeled by EDT)	Projected population range
Current	**34%**	**11.8**	**100%**	**127-1,077***
Modeled presettlement	**97%**	**41.3**	**346%**	**439-3,726** [a]
Orchard Ridge Ditch Failure	31%	12.2	93%	118-1,001 [a]
Riverkeeper Project	35%	13.4	106%	135-1,141 [a]
Fix all culvert barriers	38%	11.6	108%	137-1,163 [a]
Implement No-till on all cropland	42%	12.0	113%	144-1,217 [a]
Restore Low Flows	65%	11.4	122%	155-1,313 [a]
Strategic LWD Placements	48%	14.3	140%	178-1,507 [a]
Riparian buffers	88%	16.9	184%	234-1,982 [a]
All proposed actions (no-till, LWD, riparian buffers, Riverkeeper and reduce water withdrawals by 50%)	95%	22.2	211%	268-2,272 [a]
100% Habitat Restoration, all parameters, all reaches	**97%**	**29.1**	**245%**	**311-2,638** [a]

* See section 3.2.3.

[a] Current population estimates times percent increase modeled for this action.

Table 3.13. Results of Various Restoration Scenarios on Productivity and Abundance of Fifteenmile Winter Steelhead Juvenile Outmigrants (EDT 5/5/04).

Scenario	Productivity (Outmigrants per spawner at low density)	Abundance: Percent of Current	Projected population range
Current	**207**	**100%**	**4,559-10,504***
Modeled presettlement	**483**	**225%**	**10,256-23,634** [a]
Orchard Ridge Ditch failure	214	94%	4,285-9,874 [a]
Riverkeeper Project	232	106%	4,833-11,134 [a]
Fix all culvert barriers	201	101%	4,614-10,609 [a]
Implement No-till on all cropland	210	111%	5,042-11,659 [a]
Restore Low Flows	208	121%	5,532-12,710 [a]
Strategic LWD Placements	243	132%	6,032-13,865 [a]
Riparian buffers	281	164%	7,498-17,227 [a]
All proposed actions (no-till, LWD, riparian buffers, Riverkeeper and reduce water withdrawals by 50%)	366	178%	8,125-18,697 [a]
100% Habitat Restoration, all environmental parameters, all reaches	**477**	**218%**	**9,939-22,899** [a]

* See section 3.2.3.

[a] Current population estimates times percent increase modeled for this action.

Consistency of EDT Predictions

The staff of Mobrand Biometrics Inc. cautions that EDT is not a population model, but rather a habitat and restoration model. It should not be used to predict fish runs, but can be used to predict the response of the fish population to changes in habitat. This position is consistent with what was observed in the course of the Fifteenmile Subbasin Assessment.

In the process of the Fifteenmile Subbasin Assessment, EDT was run more than a dozen times with various modifications of habitat and population parameters intended to improve the description of the watershed and the steelhead run. Specific population predictions were relatively insensitive to minor variations of habitat parameters, but were very sensitive to changes in the juvenile age distribution and out-of-subbasin assumptions.

On the other hand, the relative value of restoration alternatives remained perfectly consistent throughout all model runs. While specific predictions of fish numbers changed, the ratio of the scenario abundance to the current abundance remained stable. For this reason, tables 3.12 and 3.13 describe scenario output as percentage change from current population, rather than as specific population numbers. This convention will be used throughout this document.

Furthermore, EDT consistently noted the same reaches as high priorities for restoration, regardless of how the habitat inputs were modified, although midlevel and low priorities would shift from one run to another.

3.4.2. The Dalles and Mosier Watersheds

Qualitative Habitat Analysis (QHA) was used to analyze all stream reaches for which there was insufficient data to run EDT. QHA was conducted on December 17th and 18th, 2003 by a team consisting of Rod French (Oregon Department of Fish and Wildlife), Gary Asbridge (US Forest Service), Steve Pribyl (ODFW), and Jennifer Clark (Wasco Co. Soil and Water Conservation District). Megan Prine (Wy'East Resource Conservation & Development) collected data.

All stream reaches in Threemile Creek, Mill Creek, Chenowith Creek, Mosier Creek and Rock Creek Watersheds were analyzed using QHA. In addition, QHA was used on several smaller tributaries in Fifteenmile Watershed for which not enough data existed to run EDT. The only reaches in Fifteenmile Watershed that were ranked using QHA were North Fork Fivemile, Japanese Hollow, Rail Hollow (tributary of Eightmile), Pine Creek, and Deadman Gulch.

Qualitative Habitat Analysis is not a model, but rather a procedure for ranking streams based on riparian condition, channel stability, habitat diversity, fine sediment, low flow, high flow, oxygen, low temperatures, high temperatures, pollutants, and obstructions. It is based on data, where available, as well as professional judgement. It can be applied to any species of fish, or even, with some adjustment, to more than one species. In this case, steelhead were used as focal species on reaches with potential for anadromy, and rainbow-type or cutthroat trout were considered the focal species in the nonanadromous reaches.

The output from QHA consisted of a ranking of restoration and protection priorities. Restoration priorities are based on the difference between the current condition and the assumed presettlement condition. Protection priorities are based on the difference between the current condition and complete degradation. Results are summarized and analyzed below. Complete results and notes regarding rationale are included in appendix X.

Steelhead Priorities in The Dalles and Mosier Areas

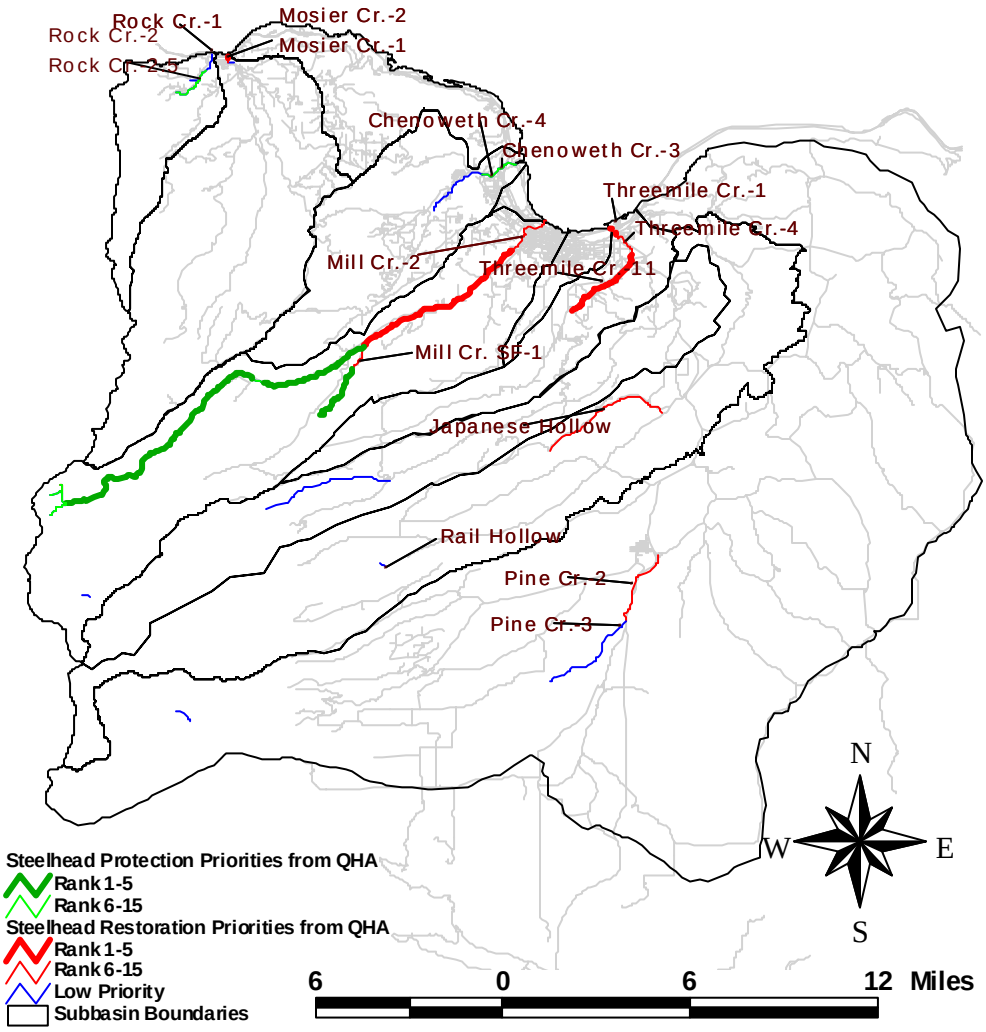
The highest priorities for restoration activities in reaches accessible by steelhead were in Threemile Creek and in Mill Creek downstream of the forks (Figure 3.14).

In particular, the reaches that run through orchard and pastureland have been degraded in terms of channel form, habitat diversity, summer flows and temperature, and agrichemical contamination. In both these streams, these reaches have the potential to be more productive steelhead spawning reaches. Orchards and pastures crowd the streams on both sides, and riparian vegetation is limited to a narrow strip. The stream is incised, and numerous manmade structures reduce fish passage in both streams. The reaches of Threemile and Mill Creek that run through urban habitat ranked lower for restoration priority, because they are considered primarily migration corridors, rather than spawning reaches.

In addition to the environmental factors noted above, Threemile Creek suffers from manmade fish passage barriers. Specifically, the culvert under Interstate 84 has been impassible at all life stages since 1996, if not earlier. Several other culverts upstream may be partial or complete barriers as well.

Other streams that appeared as relatively high priorities for restoration were Mosier Creek, Pine Creek, South Fork Mill Creek, and Japanese Hollow, in that order.

Figure 3.14. Restoration and protection opportunities in steelhead streams of the Fifteenmile Subbasin, as determined by Qualitative Habitat Analysis, December 18th to 19th, 2003.



The highest protection priorities were North Fork Mill Creek and South Fork Mill Creek, between the Wick's Water Treatment Plant and Mill Creek Falls. These streams are generally upstream of the majority of the population base. South Fork Mill Creek is managed for water quality by the City of The Dalles. The Forks are upstream of the majority of the population base. North Fork parallels Mill Creek Road, which comes very

close to the stream in some locations. South Fork Mill Creek also parallels a road, which is rarely used, due to its location within a restricted access area.

Other streams with relatively high protection values are Rock Creek and the lower portion of Chenowith Creek. Again, these streams received high protection values, because they were judged to be relatively unchanged from presettlement conditions in all environmental parameters.

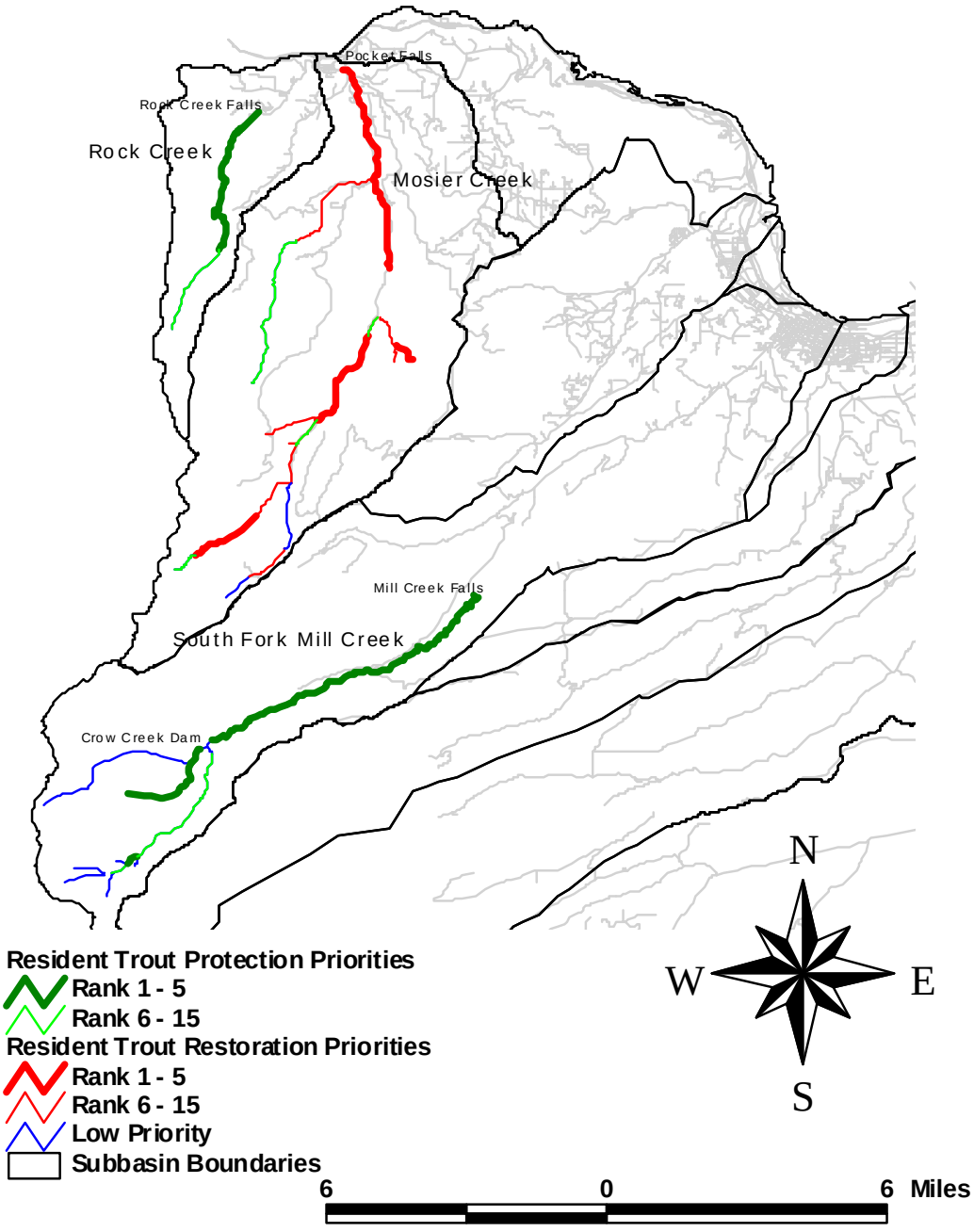
Resident Fish Priorities in The Dalles and Mosier Areas

South Fork Mill Creek, Mosier Creek and Rock Creek each have natural fish passage barriers that prevent the migration of steelhead. These creeks each have resident populations of cutthroat trout upstream of the passage barriers.

The highest priorities for restoration of resident fish reaches are all within the Mosier Creek Watershed (Figure 3.15), which has the highest human population density, and the most intensive land use. Key environmental factors affecting fish populations in Mosier Creek include changes in channel form, loss of habitat diversity, low summer flows and consequent high temperature, and potential agrichemical contamination. Data is lacking on chemical pollutants in Mosier Creek. Mosier Creek Road follows the stream for nearly its first eight miles, and riparian vegetation is interrupted by rural residential development. Groundwater overdraft has been shown to have an effect on stream flows, but that effect may vary in different parts of the stream corridor.

Rock Creek and South Fork Mill creeks are high priorities for protection. Rock Creek is sparsely populated and heavily forested. South Fork Mill Creek upstream of Mill Creek Falls is entirely unpopulated and heavily forested. The watershed is managed by the Forest Service and City of The Dalles to maximize water quality.

Figure 3.15. Restoration and protection opportunities in streams of the Fifteenmile Subbasin with Resident Fish Populations (Qualitative Habitat Analysis, 12/18&19/03).



3.4.3. Major Data Gaps

Water Quality and Habitat

Bed scour has never been collected in the Subbasin.

Alkalinity has never been collected in the Subbasin.

Pesticides have been measured in Mill Creek for two years. Malathion and chlorpyrifos were found to exceed state standards. A single sample was collected in 2003 from Threemile Creek and one from Fifteenmile Creek. Malathion was found in both samples. Further testing is needed in all creeks.

Dissolved oxygen has not been directly measured in the Subbasin.

Habitat inventories have not been conducted in the streams outside of Fifteenmile Watershed.

Sediment and embeddedness have been studied in Fifteenmile Watershed by ocular estimate through the Aquatic Inventory Project. More accurate measurements (pebble counts) were collected at 29 sites in 2000. None of these measurements included Dry Creek or the forks of Fivemile. Limited pebble counts have been collected in Mosier Creek and Chenowith Creek, but not in Mill Creek or Threemile.

Lamprey

Nothing is known about the population status of lamprey in the Fifteenmile Subbasin, except that the Tribal fishery at Seufert Falls is still active. It is not known whether lamprey migrate into Threemile, Mill, Chenowith or Mosier creeks.

Steelhead

No counts exist of returning adult steelhead to Fifteenmile Watershed. Juvenile counts exist for only three years.

In the other creeks within the subbasin, there are no fish counts, no juvenile counts and - no redd counts with the exception of two years of redd counts on North Fork Mill Creek on the National Forest. Habitat inventories are lacking on private lands.

Five culvert barriers were recognized by EDT. In reality, a number of partial barriers may exist throughout the watershed. In March 2004, Forest Service personnel audited a culvert on Eightmile Creek at the request of Wasco County SWCD. The culvert, located at approximately RM9, was found to be a barrier to adult migration at some flows and likely a complete juvenile barrier. As spawning has been consistently documented above that point, the culvert is clearly not a complete barrier. Yet, the finding underlines the possibility that partial barriers may limit the success of steelhead spawning in some years.

Cutthroat and Rainbow-type Trout

Population estimates and trends are lacking for these species in this subbasin, though electroshock measurements have been conducted from time to time.

3.5. Terrestrial Focal Species and Habitats

3.5.1. Wildlife Focal Species Selection, Population Delineation and Characterization

The wildlife assessment will describe the species' life histories, historic and current distributions, threat to the species, limiting factors, and relationships to salmonid fish.

ODF&W biologists Scott Ziegenhagen and Keith Kohl and US Forest Service biologist Rich Thurman began with a preliminary list of 47 species (Table 3.14) created from the Deschutes Subbasin all-species list (250 species). The preliminary list of 47 species was based on the Oregon State Sensitive species list, US Forest Service Region 6 sensitive species list, game animals, Partners in Flight[136] list (Table 3.15), Threatened and Endangered Species–Federal (Table 3.16) and State lists, known or suspected to occur in the Fifteenmile Subbasin.

[136] Partners In Flight is a cooperative effort involving partnerships among federal, state and local government agencies, philanthropic foundations, professional organizations, conservation groups, industry, the academic community, and private individuals. Partners In Flight was launched in 1990 in response to concerns about declines in the populations of many land bird species, and in order to emphasize the conservation of birds not covered by existing conservation initiatives. The initial focus was on neotropical migrants, species that breed in the Nearctic (North America) and winter in the Neotropics (Central and South America), but the focus has spread to include most landbirds and other species requiring terrestrial habitats. Further information is available at http://www.partnersinflight.org.

Table 3.14. Preliminary Wildlife Focal Species for Fifteenmile Subbasin

SPP ID	Common Name	State and Federal Status
20200	Oregon Slender Salamander	State Sensitive –Forest Service Region 6 sensitive
20030	Long-toed Salamander	Critical function link species
20040	Cope's Giant Salamander	State Sensitive –Forest Service Region 6 sensitive
20220	Tailed Frog	State Sensitive – V
20280	Cascades Frog	State Sensitive – V
20320	Northern Leopard Frog	State Sensitive – C
30020	Painted Turtle	State Sensitive – C, Forest Service Region 6 –sensitive
30030	Western Pond Turtle	State Sensitive – C, Forest Service Region 6 – sensitive
41000	Bald Eagle	Federally Threatened, State Threatened
41040	Northern Goshawk	State Sensitive – C
41150	Peregrine Falcon	SE, Forest Service Region 6 – sensitive
41240	Blue Grouse	Game, Partners In Flight
41270	Mountain Quail	Game, State Sensitive – US
42450	Flammulated Owl	State Sensitive – C
42500	Northern Pygmy-owl	State Sensitive – C
42520	Spotted Owl	Federally Threatened, State Threatened
42720	Lewis's Woodpecker	State Sensitive – C, Partners In Flight
42740	Williamson's Sapsucker	State Sensitive – US, Partners In Flight
42810	White-headed Woodpecker	State Sensitive – C, Partners In Flight
42830	Black-backed Woodpecker	State Sensitive – C, Partners In Flight
42850	Pileated Woodpecker	State Sensitive – V
42860	Olive-sided Flycatcher	State Sensitive – V, Partners In Flight
43000	Ash-throated Flycatcher	Partners In Flight
43060	Loggerhead Shrike	State Sensitive – V, Partners In Flight
43220	Clark's Nutcracker	Partners In Flight
43330	Bank Swallow	State Sensitive – US
43450	Pygmy Nuthatch	State Sensitive – V, Partners In Flight
43460	Brown Creeper	Partners In Flight
43580	Western Bluebird	Partners In Flight
43640	Hermit Thrush	Partners In Flight
43710	Sage Thrasher	Partners In Flight
43880	Nashville Warbler	Partners In Flight
44320	Brewer's Sparrow	Partners In Flight
50190	Western Small-footed Myotis	State Sensitive – US
50200	Yuma Myotis	State Sensitive – US
50220	Long-legged Myotis	State Sensitive – US
50230	Fringed Myotis	State Sensitive – V
50250	Long-eared Myotis	State Sensitive – US
50260	Silver-haired Bat	State Sensitive – US
50320	Pallid Bat	State Sensitive – V
50410	White-tailed Jackrabbit	State Sensitive – US
50660	Western Gray Squirrel	State Sensitive – US, Game
50810	American Beaver	Fur bearer, Critical function link species
51240	Fisher	State Sensitive – C
51280	Wolverine	State Threatened, Forest Service Region 6 – sensitive
51395	Rocky Mountain Elk	Game
51405	Mule Deer	Game

Table 3.15. Land Birds listed in the US Fish and Wildlife Service Partners in Flight Program identified by Interactive Biodiversity Information System IBIS as possibly occurring in the Fifteenmile Subbasin:

Shrub-steppe		
Sage Sparrow	Swainson's Hawk	Prairie Falcon
California Quail	Long-billed Curlew	Black-chinned Hummingbird
Gray Flycatcher	Sage Thrasher	Brewer's Sparrow
Wetlands/grasslands		
Western Grebe	Trumpeter Swan	Sandhill Crane
Tricolored Blackbird		
Coniferous Forest		
Mountain Quail	Flammulated Owl	Black Swift
Calliope Hummingbird	Lewis's Woodpecker	Williamson's Sapsucker
White-headed Woodpecker	Black-backed Woodpecker	Hermit Warbler

Table 3.16. Federally Listed Endangered Species:

Species Name	Common Name	State Listing	Federal Listing
Strix occidentalis caurina	Northern spotted owl	Threatened	Threatened
Haliaeetus leucocephalus	Bald Eagle	Threatened	Threatened

Managed wildlife species: Mule Deer, Black-tailed Deer, Elk, Wild Turkey, Western Gray Squirrel, Pheasant, Chukar, Valley Quail, Mountain Quail, Blue Grouse, Ruffed Grouse, Mourning Doves, Ducks, Geese

The Confederated Tribes of Warm Springs retained the right to hunt, fish, and gather within the lands ceded to the United States government. Species of significance to the Warm Springs Indians for subsistence and for cultural and spirtual purposes include elk, deer, steelhead, cutthroat trout, and lamprey.(Table 3.17)

Table 3.17. Wildlife Species Recognized by Tribes[137]

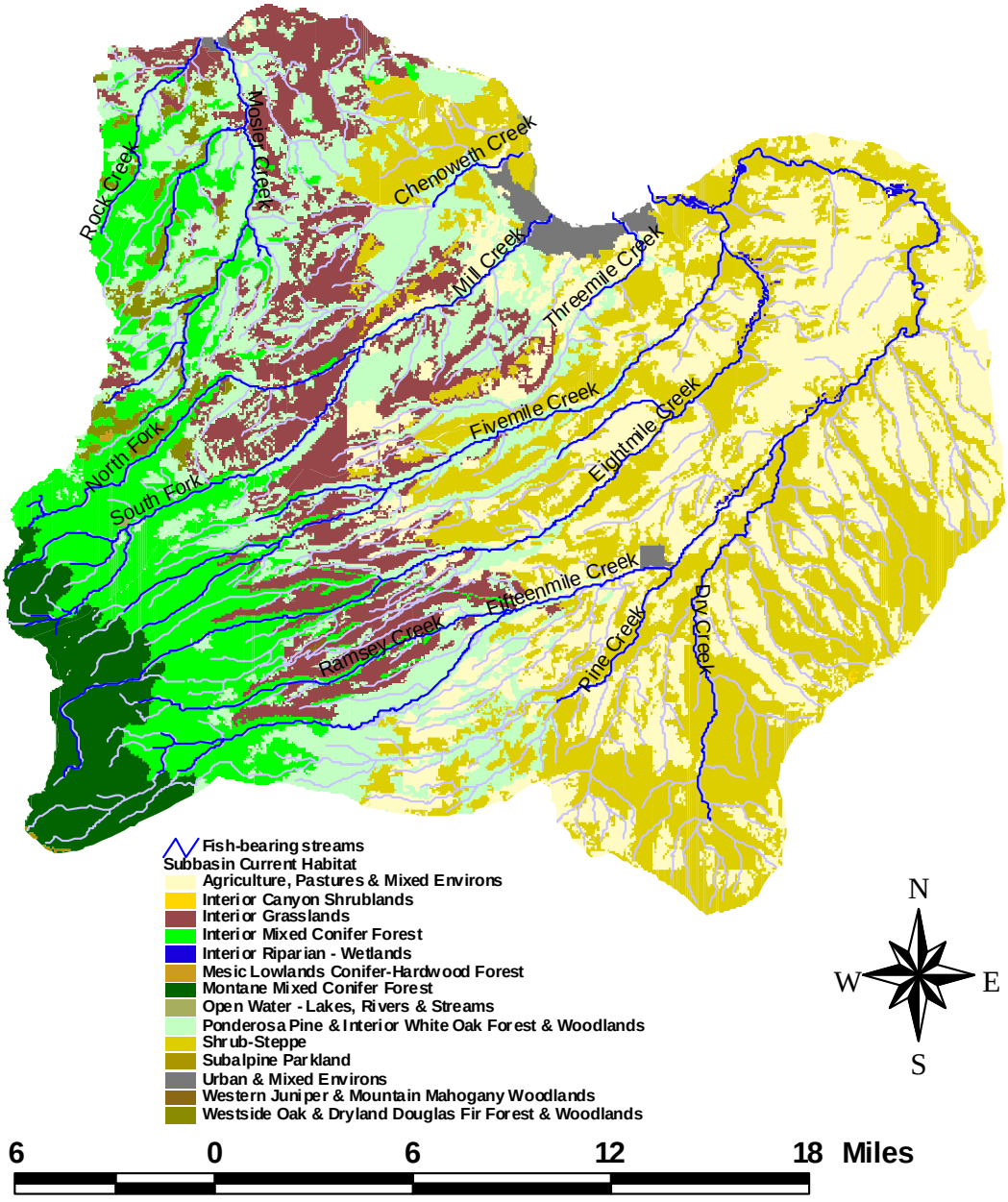
Animals:	Deer, Elk, Otter, Eagles (bald and golden), Bear, Cougar, Beaver, Frogs, Porcupine, R[illegible]snakes, Hawks, Owls, Bobcat, Grouse, Waterfowl,
Plants:	Serviceberry, Hawthorne, White Oak, Elderberry, Great Basin Wild Rye, Arrowleaf Balsamroot, Biscuit root, Bitter root, Blue Camas, Indian carrot, Yellow bells, Wild onion, Mariposa lily, Indian celery, Chokecherry, Yarrow, Skunk cabbage, Mule's ear, Bracken fern, Tule reeds, Cattails, Indian paintbrush, Willows, Sagebrush, Bitterbrush, Wild Rose, Alder, Juniper, Conifers, Cottonwood,

[137] Currim, Fara Ann. Confederated Tribes of the Warm Springs Reservation, Natural Resources Department. Personal Communication via e-mail. 2004.

	Desert parsley, Mushrooms

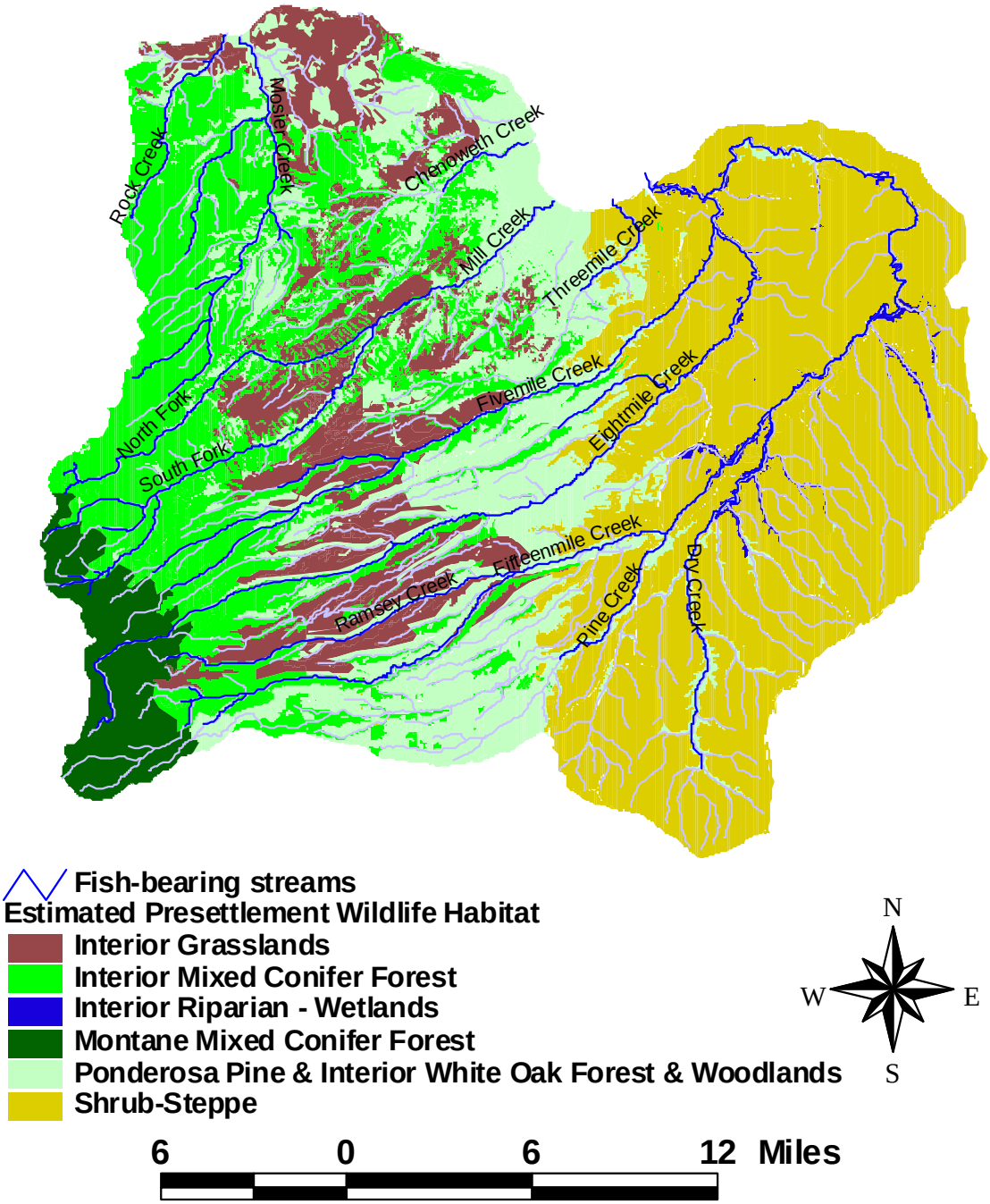
Current (Figure 3.16) and pre-settlement wildlife habitat types (Figure 3.17) were mapped and compared to note changes. Current and historic habitat types were sent to the Northwest Habitat Institute, who analyzed the species for their relationships with habitat types that had changed markedly. Using this analysis, focal species were narrowed to seven, most of which are associated with specific habitat types that have been reduced in acreage in the past 150 years.(Table 3.18)

Figure 3.16. Current Wildlife Habitat in the Fifteenmile Subbasin[138]



[138] IBIS. 2003.

Figure 3.17. Estimated Presettlement Wildlife Habitat in Fifteenmile Subbasin [139]



[139] Fifteenmile Watershed Assessment. Fifteenmile Watershed Council. 2003.

Table 3.18. Estimated Major Changes to Wildlife Habitat

	1850 acres	Current acres	Change	% Reduction
Shrub-Steppe	131,743	97,297	34,446	26%
Interior Mixed Conifer	87,224	46,210	41,014	47%
Riparian	3,924	584	3,340	85%
Urban	0	3,739	3,739	--
Pine-Oak	83,525	69,272	14,263	17%
Agriculture and Pastures	0	100,000+	100,000+	--

The most heavily impacted wildlife habitats in the subbasin were shrub-steppe, interior grasslands, and interior riparian habitat, in that order. Much of the shrub-steppe habitat and riparian habitat have been converted to agriculture, pasture and urban areas. Interior grassland habitats have been converted to forested habitats due to fire suppression.

3.5.2. Wildlife Focal Species and Associated Habitat Types

Seven focal species were chosen to represent the habitats that have undergone the most change over the past 150 years.

Bald eagle, although a threatened species, was not included as a focal species, because the potential habitat band is a very narrow strip along the Columbia River, and there are only two known nests in the subbasin.

Several bird species were considered as riparian habitat indicators, but were rejected in favor of beaver, because beaver use riparian habitat throughout the subbasin.

[140] IBIS. 2003.

Table 3.19. Wildlife Focal Species in the Fifteenmile Subbasin and Reasoning for Choice

Wildlife Focal Species	Associated Habitat Type	Reasoning
Mountain Quail	Open shrub habitats in timbered areas	Locally sensitive species, reduced habitat; Partners in Flight Species
Spotted Owl	Old growth timber	Federally listed species
Western Grey Squirrel	Pine-oak	State game species, listed as sensitive in Washington State, closely associated with a reduced habitat
Brewer's Sparrow	Shrub-steppe	More of a generalist than loggerhead shrike, indicative of condition of shrub-steppe in general; Partners in Flight species
Loggerhead Shrike	Specific niches within Shrub-steppe	Locally sensitive species, associated with specific niches within greatly reduced habitat
Mule Deer	Winter Range in several habitats	Managed game species, culturally important to Tribes; Historic winter range impacted by development
American Beaver	Riparian	Indicative of riparian conditions throughout watershed

Focal Species: Mountain Quail

Cover Types: Interior grasslands, Interior riparian – wetlands, Interior mixed conifer forest

Justification: ODF&W Game Species, Oregon State Sensitive Species – status is unknown. Populations have persisted but appear to be declining in NE Oregon and may have declined in NW Oregon. There is a potential for transplanting and reintroduction into some areas in the Subbasin. The created openings associated with timber harvest activities are becoming less frequent in the forested area.

This is an early seral species associated with grass, shrub and sapling/pole communities. Mountain quail are often observed foraging along logging roads and open, shrubby mountain slopes and ridge tops. Mountain quail is not to be confused with Valley quail, which is an introduced species. There is the possibility of a reintroduction program for this species.

Populations have persisted but appear to be declining in NE Oregon.[141] They appear to be stable and abundant in SW Oregon. Mountain quail may have declined in NW Oregon.[142]

[141] Oregon Department of Fish & Wildlife, 1999a

They are rare or absent in SE Oregon. They are hunted in western Oregon and parts of eastern Oregon. Mountain Quail can be found scattered throughout the forested portions of the sub basin based on occasional sightings. There are no routes set up to exclusively monitor Mt. quail populations in the subbasin. Sightings and numbers of mountain quail have increased over the last few years. Mountain quail are classified as a game bird and are hunted within the sub basin.

This bird is mainly associated with early successional vegetation composed of a diverse array of shrubs, often associated with early seral plantations or openings. With timber harvest activities being reduced over the last 10 years and fire suppression for the last 100 years, the created openings have been reduced. The majority of this habitat is on USDA Forest Service land.

This bird can also be found in some of the riparian areas within the pine/oak habitat zone. Birds have been observed in Ramsey Creek, North Fork Fivemile Creek, South Fork of Mill Creek, Mosier Creek and Rock Creek. The observations for Ramsey, SF Mill and NF Fivemile creeks were all on USDA Forest Service lands. The observations on Mosier and Rock creeks were on private land. The majority of riparian areas on public lands have been restored and all are protected with buffers when considering future activities. The private riparian areas are afforded some protection under current county and state zoning regulations. Overall the riparian areas on public land have been improved over the last 20 years. The riparian areas on private land have been improved (Fifteenmile, Fivemile, Ramsey creeks) in some areas or decreased in value (more residents, increased number of pets, less vegetation etc.) in other areas (Mosier and Rock creeks) over the last 20 years.

Working Hypotheses: This bird has an association with 37 different Key Environmental Correlates (KECs). This is a very high number, which may mean that this species may not be as vulnerable to habitat or environmental alterations as those species with only a few KECs.

The mountain quail has two aquatic KECs. The habitat type for this species that has changed the most from presesttlement to current conditions is the interior riparian. Currently there are 583 acres (0.16% of sub basin), while the presttlement estimate is 3,924 acres (1% of sub basin).[143] Riparian habitat, when associated with a medium or tall shrub-open shrub overstory, is used for breeding and feeding. The majority of this habitat loss has gone to agriculture, livestock grazing and residents. Habitat improvement projects for riparian areas will increase the acres available to the quail and help stabilize or increase populations.

The interior mixed conifer zone also shows a large change from a historical of 87,224 acres (24% of sub basin) to a current 46,210 acres (13% of sub basin). That is a loss of 41,014 acres. The majority of this loss can be attributed to a mapping error of the historical layer (the major portion of this loss is currently mapped as pine/oak or interior grasslands). This vegetation zone has had a lot of timber harvest during the 60s' through

[142] Marshall, et. al., 2003
[143] 15 Mile Subbasin Planning Team, GIS analysis

the 80s'. Currently, created openings from timber harvest are starting to fill in and less early seral open-brush habitat is available for the quail. Habitat improvement projects (e.g. timber harvest and underburns) that increase the number of acres of openings in this conifer zone would be beneficial to mountain quail. The brush/shrub component within these openings appears to be necessary for nesting and foraging.[144]

The mountain quail is associated with 8 Key Ecological Functions (KEFs). This bird is not a functional specialist.

The mountain quail is much less tolerant of human presence than is the California quail, though clear-cutting has expanded its habitat in many areas. It typically avoids agriculture areas.[145] The increasing numbers of residents within the subbasin has had a negative impact on this species by reducing and altering the habitat. This has been most evident in the riparian areas of the pine/oak and shrub steppe zones. These residents also bring pets such as house cats, which prey on this species especially in the winter at feeders.[146] Other prey species such as opossums, skunks and raccoons may prey on these quail when nesting.

Opportunities and Recommendations: Create or restore shrub-openings within the mixed conifer zone via timber harvest or prescribed fire. Restore the shrub component within the riparian areas and increase the amount of riparian habitat outside of residential areas.

There is an opportunity to re-introduce mountain quail into under-utilized habitat. This would help stabilize and increase the overall quail population in the subbasin.[147] Transplanting mountain quail into under utilized habitat such as Ramsey Creek (Three miles of riparian habitat restoration was completed in 2003) would improve the genetic diversity and increase numbers of quail in those areas.

Focal Species: Spotted Owl

Cover Types: Interior mixed conifer forest, Montane mixed conifer forest

Justification: Federal, OR, WA Threatened Species; Mt. Hood National Forest Management Indicator Species. There has been a loss of late seral habitat due to timber harvest in comparison to historical times.

Mixed-conifer forest cover types with late-succession structure types is the preferred habitat. Nesting occurs in platform structures (e.g., mistletoe brooms) with a preference for Douglas fir trees in this subbasin. As of 1995, there are 19 spotted owl activity centers (2 resident singles and 17 pairs) in the 15-Mile Subbasin. The number of spotted owl activity centers is thought to be stable, however some habitat loss has occurred over

[144] Thurman personal observation, Marshall et al 2003
[145] Gilligan et al. 1994.
[146] Thurman, Rich. Personal Observation.
[147] Kohl, Keith. ODFW. Personal Communication. 2004.

the last 15 years. Each activity center has been protected with a minimum of 100 acre Late Successional Reserves (LSR) or are within the Surveyor's Ridge LSR. These LSRs' allow for the protection of existing and future nest sites. All of the activity centers are on public land (Forest Service or City of The Dalles property).

The habitat is preserved for future spotted owls, however inter-species competition from the barred owl may impact future numbers of spotted owls. The barred owl was originally an east coast species. It crossed the Great Plains and arrived on the West coast in the 1940s.[148] The barred owl is 20 percent larger and seems to win out in every encounter between the two species. In Oregon, Eric Forsman and his student Elizabeth Kelly found an average of 60 new barred owl pairs every year from 1989 to 1998. Forsman says "It probably was going to happen whether people were here or not, as a result of warming climate and gradual changes in forests."[149]

As of 1995, there are 19 spotted owl activity centers (2 resident singles and 17 pairs) in the 15-Mile Subbasin. The number of spotted owl activity centers is thought to be stable, however some habitat loss has occurred over the last 15 years. Each activity center has been protected with a minimum of 100 acre Late Successional Reserves (LSR) or are within the Surveyor's Ridge LSR. These LSRs' allow for the protection of existing and future nest sites. All of the activity centers are on public land (Forest Service or City of The Dalles property). The Northwest Forest Plan emphasizes protection of large blocks of habitat (LSRs) to provide for clusters of breeding pairs of owls that are connected by habitat (Matrix) to support survival and movement across the landscape between reserves. The NWFP reserve network is designed to protect late-successional forest species, such as the owl[150].

Working Hypotheses: This bird has an association with 23 different Key Environmental Correlates (KECs). This is a medium number, which may mean that this species is less vulnerable to habitat or environmental alterations compared to species with only a few KECs. Late seral habitat (medium to large trees) is one of the key habitat components for the spotted owl. Within this sub basin, all the known nest sites are within 0.25 miles of water, which shows a strong preference for riparian habitat. This may be an indication that the majority of large trees are in riparian areas or that more prey species are present there.

The spotted owl is associated with 6 KEFs. Interbreeding with barred owls is of concern for this species. There is some debate as to why the barred owl moved from the east coast to the west coast of the United States. Eric Forsman, a biologist with the USDA Forest Service's Pacific Northwest Research Station in Corvallis, Oregon says, "My personal gut feeling is that this has nothing to do with humans". "It probably was going to happen whether people were here or not, as a result of warming climate and gradual changes in

[148] Levy 2004
[149] Levy 2004
[150] Biological Opinion 1-7-03-F-0008. USF&WS.
[151] Levy 2004
[152] Levy 2004

forests". "It's tough to watch my favorite species going to pot," says Forsman, "but I believe there's nothing we can do about it. This range expansion is going to happen, and all we can do is sit back and watch and see how the two species work it out. The only way you could even attempt to manage it would be to start shooting barred owls every chance you got. Even if you wanted to do that, it's a physical impossibility to do it on a large enough scale and for long enough time to have a real impact.[153]

Rocky Gutierrez, who has studied spotted owls for years, believes human actions made the barred owl's western movement possible. As cities and farms sprouted up on the plains, people planted shelterbelts of trees in what had been open prairie. The patchwork of small woodlands that resulted may have given the barred owl enough cover to cross the plains.

In an analysis of range expansions of 24 North American birds, Ned Johnson, of the Museum of Vertebrate Zoology in Berkeley, California, argues that many birds, including the barred owl, were responding to shifts in climate, not to human-wrought habitat change.

The Late Successional Reserve (LSR) system established in the Northwest Forest Plan has been adopted as sufficient to maintain the spotted owl in the long term. This sub basin includes parts of the Surveyors Ridge LSR and nineteen 100-acre LSRs. Maintaining this habitat for the long term is critical for Spotted owl survival. The Surveyor's Ridge LSR Plan allows for those treatments (i.e. tree thinnings, insect and disease protection, re-introduction of fire etc.) that would have a positive effect on the long term health and maintenance of this LSR.

Timber harvest of mature late seral habitat (medium and large trees) may reduce nesting, roosting and foraging habitat for spotted owls in the sub basin. The Northwest Forest Plan was established in part to allow timber harvest activities to occur and still maintain the spotted owl population over the long term.

Opportunities and Recommendations: The exclusion of fire from the ecosystem has created spotted owl nesting, roosting and foraging habitat in lowland fire ecosystems that are not sustainable over the long term (next 100 years). The US Fish and Wildlife Service is aware of this concern and has accepted the re-introduction of fire back into these ecosystems as necessary to maintain those ecosystems. Reducing the crown fire potential within the fire ecosystems would potentially reduce spotted owl habitat in the upland but reduce the risk of habitat loss in the riparian areas (where most of the activity centers are located).

The Surveyor's Ridge LSR Plan identifies some habitat areas of concern and some possible restoration and protection projects. Implementing the LSR Plan would help reduce the risk of a catastrophic loss of spotted owl habitat within the subbasin.

[153] Levy. 2004

Focal Species: Western Gray Squirrel

Cover Types: Ponderosa Pine & Interior White Oak Forest & Woodlands, Oak & Dryland Douglas Fir Forest & Woodlands

Justification: ODF&W Game Species, listed as sensitive in Washington; the amount of pine-oak habitat has been reduced from historical times.

This species is associated with ponderosa pine and dry, Douglas fir zones where Oregon white oak is a major feature. Population density in Oregon seems to fluctuate dramatically. In southern Oregon, an index to density (number seen/distance traveled) obtained along established routes ranged from 0.05 to 0.44/km with three peaks and three lows during 1960-1968.[154] Although no surveys are conducted for western gray squirrels, anecdotal observations have indicated that western gray squirrels are found throughout the subbasin in suitable habitat, a mixture of oak, pine and fir forests. Populations have increased near rural residential areas. On well traveled roads that run through the squirrel habitat, squirrels are frequently run over by vehicles.

The pine/oak habitat is estimated to have been reduced by 14,263 acres from presttlement conditions. The presettlement estimate is 83,525 acres of pine/oak habitat. Currently, there are 69,262 acres of this habitat. The major changes to this habitat have gone to residential and agricultural use.

Working Hypotheses: Western Gray squirrel is associated with 20 KECs. It utilizes mainly the pine/oak habitat and some of the mixed conifer area that has white oak. The pine/oak habitat has lost 14,263 acres from historical time. Currently, there are 69,262 acres (19% of sub basin) of pine/oak habitat. This habitat loss has gone mainly to agriculture (mainly orchards) and residential dwellings.

Western gray squirrels are associated with 9 KEFs. This is a relatively high number meaning that this species is not a functional specialist. Analysis of nest trees and their surroundings in the Friend Area south to Rock Creek (straddling the southern boundary of the subbasin) revealed that nests are most likely to be located in mature trees that have well-developed crowns and occur in stands with a high degree of canopy closure.[155] Nest trees were usually located within approximately 180 meters of permanent water and on sites with a south-southeastely exposure.

In the sites studied, western gray squirrels have two seasons of reproductive activity annually. Some individuals mate from January through March; their young emerge from the nest in May and June. Other individuals mate in May and June; their young emerge in August and September. The latter matings are usually the most productive

Home ranges of squirrels examined in this study were usually large compared to home ranges reported for this species elsewhere in its range. Given the cost of having large

[154] Cross, 1969
[155] Fostor. 1992.

home ranges, it seems possible that squirrels at these study sites exist in less than optimal ecological circumstances.[156] It is also possible that we are at the outside edge of the squirrels range.

Human factors that have negatively affected squirrel populations are timber harvest, timing of hunting seasons, and residential development. Limiting factors other than human activities may include competition with other mast-consuming animals (mule deer, elk, wild turkeys, and three other species of squirrels) for limited and variable mast crops.

Opportunities and Recommendations: On National Forest land promote oaks where conifers have encroached into its' habitat zone. Restoring fire back into this ecosystem will also improve habitat in the long term by reducing tree densities, which may also increasing mast production.

On private lands, encourage the retention and restoration of pine/oak habitat.

Focal Species: Brewer's Sparrow

Cover Type: Shrub-Steppe

Justification: Oregon Partners-in-Flight Focal Species, significant loss of shrub-steppe habitat from presettlement.

Brewer's Sparrow is a sagebrush obligate where sagebrush is abundant. It prefers a mean cover of sagebrush 10-30% and in patches rather than evenly distributed, mean height sagebrush > 24 inches, high foliage density in sagebrush shrubs, mean native herbaceous cover >10% with <10% cover of non-native annual grasses, mean open ground cover > 20%.

From the Breeding Bird Survey[157]: Columbia Plateau Region has a highly significant ($p<0.01$) long term (1966-1998) declining trend of 4.8%/year, and significant short-term (1980-1998) declining trend of 3.4%/year. The population is expected to continue to decline until habitat is stabilized and/or increased.

In the Interior Columbia Basin the source habitats considered are 2 structural stages of big sagebrush and mountain big sagebrush; open canopy, low-medium shrub, and closed canopy, low-medium shrub; the closed herbaceous structural stage of big sagebrush; juniper sagebrush; and mountain mahogany.[158]

Shrub-steppe habitat has been converted to agriculture. The majority of shrub-steppe habitat is on private land. Currently there are 97,297 acres (26.58 % of sub-basin) of shrub-steppe habitat within the sub-basin, while the presettlement estimate is 131,743

[156] Fostor. 1992.
[157] Sauer et al. 1999
[158] Wisdom et al.in press

(35.93 % of sub-basin) acres of habitat. In the Columbia Basin, shrub-steppe habitat has decreased by 20%.

From the Breeding Bird Survey:[159] Columbia Plateau Region has a highly significant ($p<0.01$) long term (1966-1998) declining trend of 4.8%/year, and significant short-term (1980-1998) declining trend of 3.4%/year. The population is expected to continue to decline until habitat is stabilized and/or increased.

Working Hypotheses: This bird is associated with 7 KECs. This is the lowest number of all the focal species for the subbasin. This species is more vulnerable to habitat and environmental alterations than those species with many KECs. The main habitat type associated with this species is shrub steppe. Historically, there was 131,743 acres (36% of sub basin) of shrub steppe habitat within the sub basin. Currently, there are 97,297 acres (27% of sub basin) of shrub steppe habitat, a reduction of 34,446 acres. The majority of this change went to agriculture, grazing and residential development.

The Brewer's sparrow is associated with 7 KEFs. This species is not a functional specialist.

Conservation Issues include:[160]

- Removal of sagebrush below 10% cover adversely affects populations, although species is persistent where incomplete loss of sagebrush creates patchy islands of habitat.[161] thus not as sensitive to fragmentation as sage sparrows (i.e., will occur in smaller patches but most abundant in larger patches),[162] but sensitive to cover of sagebrush (i.e., will use small patches of sagebrush if cover and height are adequate).
- Vulnerable to trampling of nest by cattle.
- Needs tall sagebrush with high shrub cover, low grass and litter cover; thus continuous cheatgrass cover detrimental.
- Patchy interspersion of clumped sagebrush with small openings preferred over contiguous dense sagebrush, which probably provides too much cover.

Opportunities and Recommendations:

Biological Objectives:

Habitat:

[159] Sauer et al. 1999
[160] Altman and Holmes 2000
[161] Peterson and Best. 1987.
[162] Knick and Rotenberry 1995

Where ecologically appropriate, initiate actions in sagebrush habitat to maintain or provide the following conditions:

1. Mean cover sagebrush 10-30% and in patches rather than evenly distributed.
2. Mean height sagebrush >60 cm (24 in).
3. High foliage density in sagebrush shrubs.
4. Mean native herbaceous cover > 10% with <10% cover of non-natives annual grasses.
5. Mean open ground cover (includes bare and/or cryptogamic crust) >20%.

Where ecologically appropriate at the landscape level, provide suitable habitat conditions described above in patches >8 ha (20 ac).

Population:

Columbia Plateau Breeding Bird Survey Region: In conjunction with conservation efforts described in the Idaho Landbird Conservation Plan (Ritter 2000) and Nevada Bird Conservation Plan (Neel 1999), reverse long-term declining trends to achieve stable populations (non-significant trends of <2%) or increasing populations in the next six years (by 2010).

Conservation Strategies:

1. Maintain conditions in areas relatively free from cheatgrass by minimizing soil disturbance from grazing.
2. Fire suppression should occur where there is potential loss of sagebrush.

Focal Species: Loggerhead Shrike

Cover Type: Shrub-Steppe

Justification: Oregon Partners-in-Flight Focal Species, Oregon State Sensitive list, significant loss of shrub-steppe habitat from historic times.

Loggerhead shrike uses some very specific habitat niches within the shrub-steppe habitat type – an open habitat with interspersions of tall woody shrubs (e.g., sagebrush, bitterbrush) or trees (e.g., juniper) for nesting and open ground for foraging, late-seral, big sagebrush or bitterbrush with patches of tall shrubs (mean height of shrubs > 39 inches, <15% tall shrub cover (non-rabbitbrush), herbaceous cover <20% and dominated by native species, mean open ground cover >30%. ODFW monitors for them. By contrast, Brewer's sparrow uses shrub-steppe habitat more generally.

From the Breeding Bird Survey[163] : Columbia Plateau Region has a highly significant ($p<0.01$) long term (1966-1998) declining trend of 2.7%/year, and non-significant short-

[163] Sauer et al. 1999

term (1980-1998) declining trend of 1.8%/year. The population is expected to continue to decline until habitat is stabilized and/or increased.

Its habitat is generally open with interspersions of tall woody shrubs (e.g., sagebrush, bitterbrush) or trees (e.g., juniper) for nesting and open ground for foraging. Foraging sites, particularly for young birds, need to have open ground or little vegetation cover;[164] invasion of exotic annual grasses, particularly cheatgrass, has been detrimental. Shrub-steppe habitat has been converted to agriculture. The majority of shrub-steppe habitat is on private land. Currently there are 97,297 acres (26.58 % of sub-basin) of shrub-steppe habitat within the sub-basin, historically there were 131,743 (35.93 % of sub-basin) acres of habitat. In the Columbia Basin, shrub-steppe habitat has decreased by 20%.

Working Hypotheses: This bird has an association with 20 KECs. This is a medium number, which may mean that this species has a medium vulnerability to habitat or environmental alterations. The main habitat type associated with this species is the shrub steppe. Historically, there was 131,743 acres (36% of sub basin) of shrub steppe habitat within the sub basin. Currently, there is 97,297 acres (27% of sub basin) of shrub steppe habitat. This shows a reduction of 34,446 acres. The majority of this change went to agriculture, grazing and residential development.

The Loggerhead Shrike is associated with 4 KEFs. This is the fewest of all the focal species, suggesting that the species is a functional specialist.

Conservation issues include:[165]

- Habitat loss from conversion to agriculture.
- Habitat loss from frequent fires in cheatgrass dominated sites.
- Long-term heavy grazing may ultimately reduce prey habitat and degrade the vegetation structure for nesting and roosting.
- Foraging sites, particularly for young birds, need to have open ground (bare and/or cryptogamic crusts) or little vegetative cover (Leu 1995); invasion of exotic annual grasses, particularly cheatgrass, has been detrimental.
- May suffer sublethal effects (e.g. reduced reproductive output) from certain insecticides.[166]
- Use of insecticides (e.g., for grasshopper control) may reduce prey base.

Opportunities and Recommendations:

Biological Objectives:

[164] Leu 1995
[165] Altman and Holmes 2000
[166] Anderson and Duzan. 1978.

Habitat:

Where ecologically appropriate, initiate actions in steppe-shrubland habitat to maintain or provide the following conditions:

1. Late-seral big sagebrush or bitter brush with patches of tall shrubs (mean height of shrubs > 1 m (39 in).
2. <15% tall shrub cover (non-rabbitbrush).
3. Herbaceous cover < 20% and dominated by native species.
4. Mean open ground cover (includes bare and/or cryptogamic crusts) >30%.

Population:

Columbia Plateau BBS Region: In conjunction with conservation efforts described in the Idaho Landbird Conservation Plan[167] and Nevada Bird Conservation Plan,[168] reverse long-term declining trends to achieve stable populations (non-significant trends of <2%) or increasing populations in the next six years (by 2010).

Conservation Strategies:

1. Maintain sites with patches of tall shrubs and patches of open ground.
2. Avoid insecticide spraying during breeding season in shrike nesting habitat (March 21 –August 15).
3. Light to moderate grazing may provide open foraging habitat, but sustained grazing will reduce habitat suitability.
4. Where habitat degradation is extensive and cheatgrass cover is dominant, light grazing may provide open foraging habitat and reduce fuel loads at risk from fire, which would severely reduce sagebrush cover.[169]

Focal Species: Mule Deer

Cover Types: All habitat types except Open Water – lakes, rivers, streams and urban environments.

Justification: ODF&W Game Species; Mt. Hood National Forest Plan Management Indicator Species; ODF&W & Forest Service Monitoring Species.

This species is generally associated with the edge of cover and forage. Currently within the shrub-steppe community, cover equals topography breaks and forage equates to agriculture crops. The shrub-steppe and pine-oak communities were the historic winter range areas.

[167] Ritter 2000
[168] Neel 1999
[169] Holmes and Geupel 1998

Mule deer are generally recognized to occur east of Oregon State Highway 197. The deer west of 197 are a cross between black-tailed deer and mule deer. For this planning effort, we are using mule deer as the descriptor for this whole sub-basin. The current White River Management Unit has an estimated 8000 deer. The management objective for this unit is 9000 deer.

Mule deer occupy a wide range of habitat types from shrub-steppe to conifer forest. Human development has had the greatest impact on reducing the amount of winter range available for deer. Approximately 15 percent of the sub-basin is publicly owned and the remaining 85 % privately owned.

Mule deer have been able to adapt to human presence over time. The population seems to fluctuate depending on the severity of winters and the quality/quantity of summer forage[170].

Working Hypotheses: Mule deer are associated with 40 KECs. This is a very high number, which may mean that this species may not be as vulnerable to habitat or environmental alterations as those species with only a few KECs. Mule deer are associated with 6 aquatic KECs. Winter range is generally associated with pine/oak and shrub steppe habitat. These habitat types have lost 48,709 (13% of sub basin) acres of habitat since historical time. Most of this habitat loss has gone to agriculture, grazing and residential dwellings. Deer are adaptable, and utilize the agriculture and grazing areas for winter range and summer range. This can present some conflicts with agriculture and grazing pastures, and the need for population control. One option is to improve winter range habitat on National Forest land, which would reduce animal damage complaints on private land. Projects such as underburning and timber harvest activities that create openings both improve forage on winter and summer ranges. Water developments can disperse animals into underutilized areas.

Mule deer are associated with 14 KEFs. This species ranks second highest among the focal species for KEFs. This shows that mule deer are not functional specialists but most likely functional generalists.

Opportunities and Recommendations: Improve winter range habitat on National Forest land by underburning and thinning dense tree stands (increase the amount of forage). Try to minimize the fragmentation of winter range habitat on private land by retaining current zoning laws, which limit fragmentation from 80 to 200 acres on agriculture and forestlands. Encourage restoration of shrub-steppe habitat on private land.

Focal Species: Beaver

Cover Type: Interior Riparian

[170] Thurman, Rich. US Forest Service. Personal Communication. 2004.
[171] Holmes and Geupel. 1998.

Justification: Critical Functional Link Species, riparian habitat has been reduced from historic times.

Beaver is almost always associated with riparian or lacustrine habitats bordered by a zone of trees, especially cottonwood and aspen, willow, alder, and maple. Beavers live in colonies composed of family groups. Small streams with a constant flow of water that meander through relatively flat terrain in fertile valleys and are subject to being dammed seem especially productive to beavers.[172]

Beaver are found in all major drainages with perennial water within the sub basin. Beavers are classified as a furbearer, with 28 beavers being harvested in the 2002-03 season in Wasco County. In suitable habitat, beavers will form a colony and gradually remove trees surrounding the stream to create a pond. This pond creates habitat for fish and other wildlife. Beaver ponds also act as basins to catch eroding soil, and prevent rapid runoff that might lead to downstream flooding and streambank erosion.

The current trend is for improving riparian habitat conditions throughout the sub-basin. If conservation incentives to the farmers were to stop, the private riparian areas may not continue to improve. Approximately 85 percent of the riparian areas are located on private land within the sub-basin.

Working Hypotheses: The beaver is associated with 61 KECs. This animal is associated with 28 aquatic KECs'. These are the highest number of all the focal species. The beaver is associated with all the habitat types associated with riparian areas. The habitat type for this species that has changed the most from historic to current conditions is the interior riparian. Currently there are 583 acres (0.16% of sub basin) and historically there were 3,924 acres (1% of sub basin).[173] The majority of this habitat loss has gone to agriculture, livestock grazing, timber harvest and residential dwellings. Habitat improvement projects for riparian areas (that encourage trees) will increase the acres available to the beavers.

This animal is associated with 16 KEFs. This again is the highest number of all the focal species for the sub basin. It is not a functional specialist. The beaver supplies a critical functional link for the steelhead by creating aquatic structures. These aquatic structures create pools, which become important rearing areas for juvenile steelhead.

Opportunities: Restoring the riparian habitat on National Forest land (15% of subbasin) and restoring the riparian habitat on private land (85% of subbasin) would increase the amount of habitat available for beavers. The beaver population will continue to fluctuate depending on the fur market and social tolerance. Increasing the amount of habitat would allow for an increase in population up to the social limit. Educating the public as to the important role beavers play within the riparian ecosystem may reduce animal damage complaints. This would allow more beavers to survive.

[172] Hill, 1982

[173] Determined by analysis of 15 Mile Subbasin Geographic Information System data

Locally extirpated and introduced species

Sharp-tailed Grouse were abundant in the grasslands and foothills east of the Cascade Mountains prior to the late 1800's.[175] They were considered extirpated from the state by the 1970s, but recent reintroduction programs give a glimmer of hope that sharp-tails may once again hold their own in NE Oregon.[176] They were formerly found in grasslands and shrub-steppe. Enhancing and increasing the amount of shrub-steppe habitat in the subbasin would possibly allow the reintroduction of this species.

Merriam's Wild Turkeys were introduced into this area in early 1960's. This release resulted in a viable population primarily in the pine/oak habitat. Rio Grande Turkeys were released in the late 1990's, which will likely result in an area of intergradation. Since then, turkey populations have substantially increased, chiefly because of a continued translocation program with Rio Grande subspecies and natural expansion. Wild Turkeys are primarily seed eaters, but consume a variety of greenery, berries, and insects if available.[177] The wild turkey may compete for food with Western Gray Squirrels.

Chukars were first released in this area between 1955–1970.[178] Their annual population fluctuates depending on nesting success and winter survival rates. Chukars appear to be opportunistic in their foraging habits. Habitat loss is not a factor, because most range is on public lands, but invasive weeds such as yellow starthistle may be detrimental[179], as well as replacement of shrub and bunchgrass cover types with large homogeneous expanses of annuals including cheatgrass or medusahead. Chukars fill a habitat niche that few other wildlife species use. This introduced species does not compete with any of our focal species.

Gray Partridge were introduced to eastern Oregon in the 1900s. Oregon population numbers are unknown.[180] Gray partridge can be primarily found along the margins of cultivated fields, especially wheat, grasslands, meadows, and pastures. They are occasionally found in sagebrush or grasslands several miles from agriculture areas.[181] The gray partridge's habitat preferences do not appear to compete with any of the local native wildlife species.

Ring-necked Pheasants were first introduced to Oregon in the 1880. Oregon population numbers are unknown[182], however the local population appears to be declining over the last 10 years. The pheasant is associated primarily with agricultural areas such as wheat fields, which provide cover in the form of tall vegetation. It avoids deserts, high

[174] Thurman, Rich. US Forest Service. Personal Communication. 2004.
[175] Olson 1976
[176] Marshall et al.2003
[177] Gutierrez and Delehanty 1999
[178] Marshall et al. 2003
[179] Lindbloom 1998
[180] Marshall et al. 2003
[181] Evanich 1986a, Gilligan et al. 1994
[182] Marshall et al. 2003

mountains and dense forests.[183] The pheasant does not appear to directly compete with any native wildlife species.

California Quail are native to SW Oregon and were transplanted statewide in the late 1800s. It is the most heavily hunted game bird in the State of Oregon with an annual harvest of 70,000 birds.[184] California quail are highly adaptable to a variety of habitat types. In this subbasin, California quail can be found in the shrub-steppe, grass lands, agriculture, pine/oak, and urban areas. California quail do not appear to compete directly with any native wildlife species.

3.5.3. Out-of-Subbasin Effects on Terrestrial Species

The mountain quail, western gray squirrel, beaver and mule deer are non-migratory year round residents in the subbasin.

The spotted owl, Brewer's sparrow and loggerhead shrike may migrate outside the subbasin in the winter, but all nest within the subbasin. None of these birds migrate great distances. The spotted owls most likely spend the entire year within the subbasin. The Brewer's sparrow and loggerhead shrike may migrate south but most likely do not leave sagebrush habitat and probably do not leave Oregon.

The loss of habitat range-wide is contributing towards the population decline for spotted owls, Brewer's sparrows and loggerhead shrikes. Stabilizing and increasing the amount of habitat within the subbasin could stabilize the local populations. However, if the trend in loss of habitat were not addressed range wide for these species, the overall populations would continue to decline[185].

3.5.4. Interspecies Relationships

Protection of upland wildlife habitat will support the proper hydrologic function of the watershed, thereby minimizing the negative effects of runoff and erosion from upland sources.

The loggerhead shrike and Brewer's sparrow both utilize shrub-steppe habitat. They both need patches of sagebrush for cover and some open ground cover. There is some overlap in habitat preferences. Both species are lacking detailed nest site descriptions.[186]

Mule deer compete with western gray squirrels for mast within the pine/oak habitat.[187]

Beaver, spotted owl and mountain quail all require healthy riparian areas. The beaver is a key player in developing pools utilized by fish, such as the steelhead.[188] Beaver and

[183] Gilligan et al. 1994
[184] Oregon Department of Fish & Wildlife. 1999a
[185] Altman and Holmes, 2000
[186] Altman and Holmes. 2000.
[187] Fostor. 1987.
[188] Verts and Carraway, 1998.

spotted owls both benefit from intact riparian corridors, which are also beneficial to fish. Protected riparian buffers are specified as part of the City of The Dalles' Habitat Conservation Plan for the spotted owl. Mountain quail is found in shrub-steppe areas, but only in the riparian corridors.

3.6. Synthesis and Interpretation

3.6.1. Subbasin-wide Working Hypotheses for Aquatic Focal Species

EDT results suggest that the steelhead population has been suppressed due to loss of habitat diversity and key habitat quantity, changes in the flow regime, increased temperatures, loss of floodplain function and riparian vegetation, and sediment input from land use changes.

Steelhead life history diversity and spatial structure have been severely restricted (Table 3.9), as the negative effects of activities throughout the watershed concentrate in the lower half to two-thirds of the watershed. Currently, the most productive reaches are near the headwaters of Fifteenmile, Ramsey and Eightmile Creeks, whereas the lower reaches of the watershed have been hit hard by habitat degradation. Geographic restoration priorities are on the private land reaches of Fifteenmile, Fivemile, Eightmile and Ramsey Creeks.

Life history diversity can be almost completely recovered by implementation of wide riparian buffers, placement of large woody debris, reduction of water withdrawals, replacement of five culverts, and implementation of no-till farming practices. Productivity would nearly double with this suite of actions, but would remain at approximately half of the presettlement productivity (Table 3.20). Even at the current level of productivity, the Fifteenmile steelhead population should respond rapidly to improved conditions.

Table 3.20. Predicted Abundance of Adult and Juvenile Steelhead in Fifteenmile Watershed.

Scenario	Predicted % of Current Adult Population (modeled by EDT, 5/5/04)	Adult Abundance	Predicted % of Current Juvenile Population (Modeled by EDT, 5/5/04)	Juvenile Abundance
Current	100%	127-1,077	100%	4,559-10,504
Modeled Presettlement	346%	439-3,726	225%	10,256-23,634
All proposed actions (no-till, LWD, riparian buffers, Riverkeeper and reduce water withdrawals by 50%)	**211%**	**268-2,274**	**178%**	**8,125-18,697**
100% Habitat Restoration, all	245%	311-2,638	218%	9,939-22,899

[189] Until 5/29/04, EDT reported a "restored" out-of-subbasin condition for presettlement winter steelhead, but not for coho or Chinook. Therefore, the presettlement result reported here will not be comparable to coho or Chinook reported in other subbasins (Mobrand Biometrics, via e-mail, 5/5/04)

environmental parameters, all reaches				

According to EDT, if all in-basin habitat factors were restored to modeled presettlement conditions, juvenile populations would be largely restored, but the adult steelhead run would be notably less than the modeled presettlement potential. The difference between the two is due to out-of-subbasin effects, including harvest rates, dam mortality, reservoir mortality, predation, etc.[190]

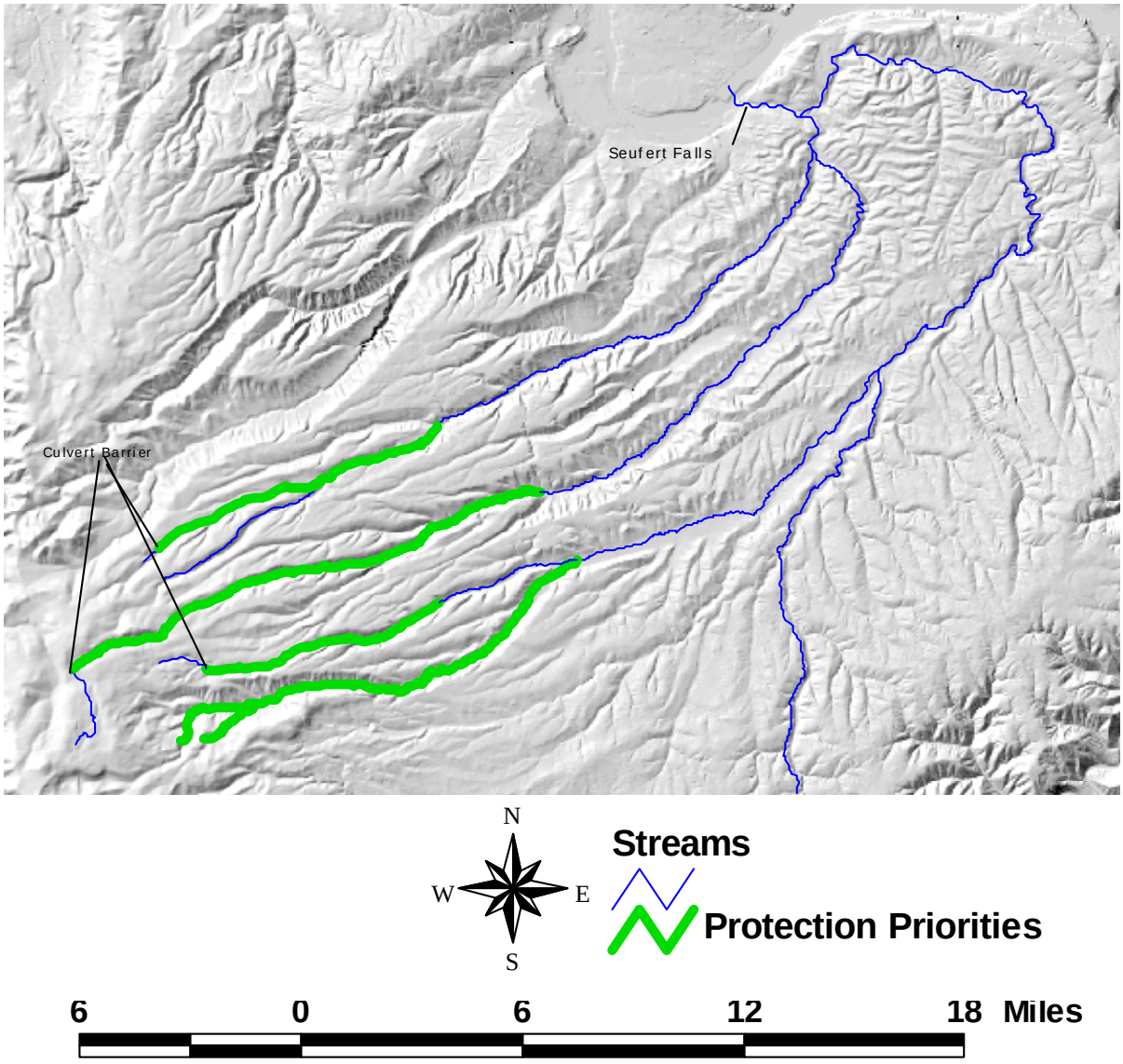
In reality, 100% restoration is not possible, given the current population level and development of the watershed. The combination of all proposed restoration actions produced a model abundance that was 211% of the current population. This corresponds to a population that could vary between 268 and 2,300 adults, depending on climatic conditions, weather events and other variables.

Priorities by Reach

EDT identified certain reaches as priorities for protection. These are reaches which are relatively productive in the current condition, but which are vulnerable to degradation. Protection priorities are assigned to those reaches in which further degradation has the most potential to lower overall life history diversity, productivity and abundance of steelhead in the Fifteenmile Watershed. Because the life history diversity in Fifteenmile is already reduced to 33%, further degradation in the remaining productive reaches puts the population at severe risk of extinction. The priority reaches for protection are shown in Figure 3.18.

[190] Until 5/29/04, EDT reported a "restored" out-of-subbasin condition for presettlement winter steelhead, but not for coho or Chinook. Therefore, the presettlement result reported here will not be comparable to coho or Chinook reported in other subbasins (Mobrand Biometrics, via e-mail, 5/5/04)

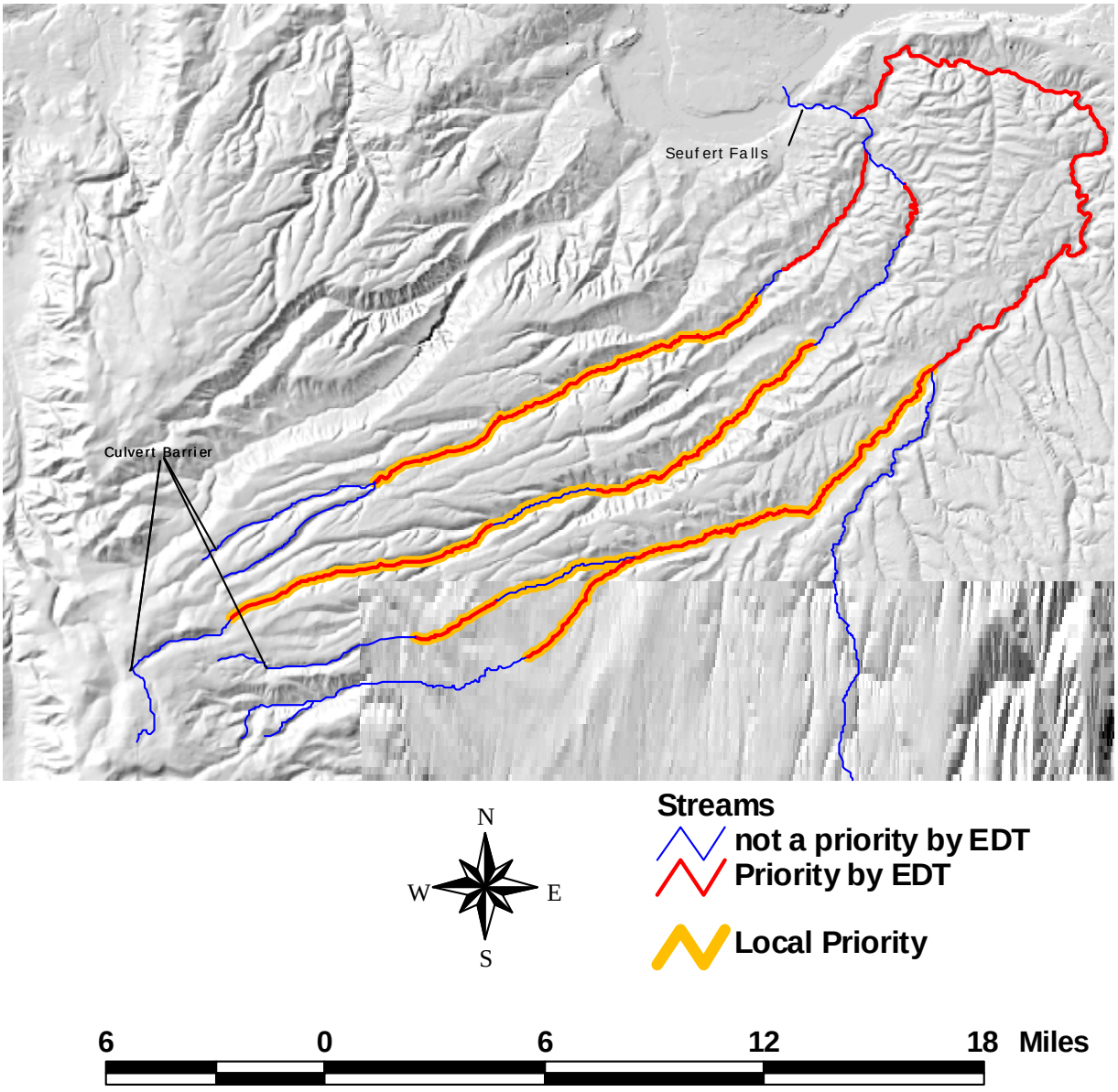
Figure 3.18: Priority Reaches for Protection (EDT, May 2004)



Choosing priorities for restoration is a more involved question. EDT ranks restoration priorities based on the difference between modeled presettlement conditions and current conditions for life history diversity, productivity and abundance. It looks at each reach in isolation, without considering the watershed context. The Fifteenmile Coordinating Group took a different approach. The Coordinating Group noted the reaches that currently have viable life histories (figure 3.5; compare also figure 3.18) and thought that the most logical approach would be to begin efforts immediately downstream, where environmental degradation begins to build up. This approach would immediately begin to build up the current viable population in the headwaters, and increase life history diversity. Furthermore, this approach would have a multiplier effect that would be felt downstream. As water quality and watershed function improved in the priority reaches,

water quality (temperature, sediment, flow, etc) would also improve downstream. Removal of culverts in the headwaters is not a priority because these culverts appear to be above the presettlement spawning range and have minimal effect on the steelhead population (see tables 3.12 and 3.13). The priority reaches as determined by EDT and by the Fifteenmile Coordinating Group are mapped on Figure 3.19.

Figure 3.19: Priority Reaches for Restoration, showing EDT's top 13 priority reaches, and Fifteenmile Coordinating Group Priorities.



3.6.2. Desired Future Conditions for Aquatic Focal Species

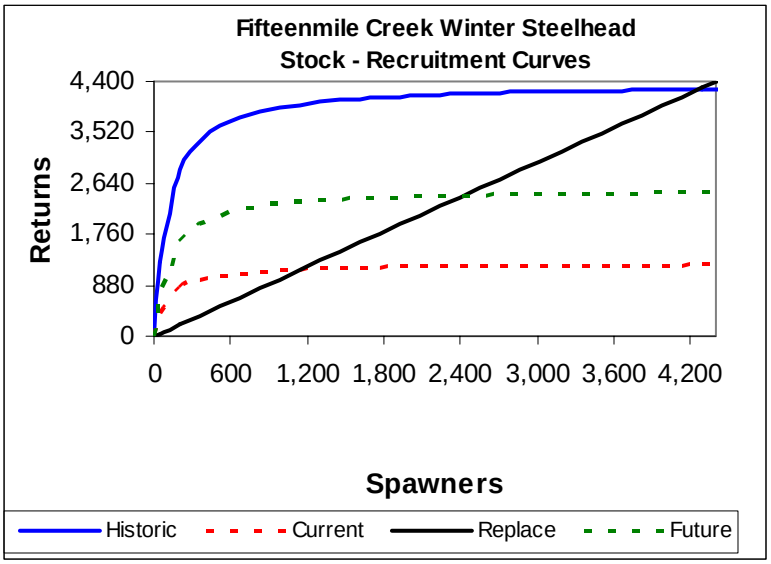
Fifteenmile Watershed

The thought process described under subbasin hypothesis leads to a restoration goal of 8,125-18,697 smolts per year and 268-2,274 returning spawners per year. This restoration goal will be elaborated further in the Fifteenmile Subbasin Management Plan.

It would be desirable to once again have angling opportunities within the Fifteenmile Subbasin. This would provide recreational opportunities to the local population, provide potential tribal harvest at Seufert Falls and potentially improve the local economy by bringing in recreation. Some level of harvest could be sustainable if the *productivity* of the habitat were improved. Productivity, as used by EDT, refers to the steelhead survival rate, from redds to a particular life stage, when density-dependent factors are not in play—i.e. when competition for resources is not a factor. On-the-ground, a high productivity means a population that bounces back quickly after a disturbance. EDT models the current productivity at 11.2 returns per spawner (Table 3.12), whereas the proposed restoration alternative increases productivity to 22.1 returns per spawner, and the presettlement productivity was modeled at 41.5 returns per spawner.

The stock production curves generated by EDT suggest that escapement of about 1,200 would be sufficient to provide a stable population, either under current conditions or under projected restored conditions (figure 5.1). In-basin harvest goals have not been discussed among the co-managers. However, it could be tentatively suggested that returning adults in excess of 1,200 could be harvested in-basin with little or no effect on the next generation of returns.

Figure 3.20: Stock Recruitment Curves for current conditions, modeled presettlement conditions and restoration goal (EDT 5/5/04).



The Dalles and Mosier Area Watersheds

Management goals for steelhead in The Dalles and Mosier area watersheds can not be set until the habitat and population in these streams is better understood.

It is known that steelhead spawn in both forks of Mill Creek, which also supports coho salmon. Steelhead are also believed to spawn in the lower parts of Chenowith Creek, Mosier Creek and Rock Creek, but their level of success in these creeks is unknown. Steelhead are also believed to have spawned in Threemile Creek until recent flood events cut off access.

Certain issues with water quality and passage are known to exist and were documented in the Qualitative Habitat Assessment process. Certain water quality data has been collected over the last few years. Water quality data is particularly abundant for South Fork Mill Creek at the Wick's Water Treatment Plant.

The following additional information (at a minimum) would be needed to determine management goals for steelhead in Mill Creek and the other streams:

- Habitat Surveys (habitat types, stream widths, LWD, etc.)
- Flow
- Temperature
- Spawning Counts/Redd surveys
- Toxic Chemicals
- Other water quality parameters
- A comprehensive survey of potential passage barriers

3.6.3. Opportunities

Fifteenmile

The high productivities generated by EDT indicate that steelhead populations in Fifteenmile Watershed would rebound rapidly in response to habitat restoration, and would subsequently be fairly resistant to disturbances (figure 3.17).

Landowners in Fifteenmile are currently quite willing to participate in voluntary incentive programs to protect and restore fish habitat in the Fifteenmile Watershed. High participation rates in buffer programs and other environmental incentive programs proves that these approaches are successful in the Fifteenmile Watershed.

Other Streams in Subbasin

Relatively pristine habitat conditions are found in both forks of Mill Creek, and in the upper part of Rock Creek. These reaches represent the highest priorities for protection. North Fork Mill Creek is accessible to steelhead and is currently used by steelhead for spawning. South Fork Mill Creek and Rock Creek are both primarily cutthroat habitat.

The mainstem of Mill Creek and the South Fork below Wick's Water Treatment Plant represent degraded habitat that is currently accessible to steelhead and other anadromous fish. These areas represent the highest priority for restoration in the subbasin outside of Fifteenmile Watershed. For cutthroat trout, the highest restoration priority in the subbasin is in Mosier Creek, which is impacted by falling aquifers, road runoff, and potential pesticide contamination.

Known Passage Barriers

Culverts at the following locations are 100% passage barriers:

Middle Fork Fivemile Creek—one culvert, would open up 875 feet of headwater habitat—unknown whether that habitat would be used for spawning or rearing

Ramsey Creek on Forest— two culverts, would open up 2,357 feet of headwater habitat—unknown whether that habitat would be used for spawning or rearing

Above Eightmile Creek Campground— two culverts, would open up 4,391 feet of headwater habitat—unknown whether that habitat would be used for spawning or rearing.

Threemile Creek—I84 (Upgrade planned for 2005.) Would open up 4.5 miles of habitat in fair condition.

Mill Creek—Various structures, city pipeline crossings, etc. threaten to become partial fish passage barriers at certain times of year. For instance, a city sewer pipeline underneath the Ninth Street bridge became nearly a complete barrier to coho passage in October 2003. The problem was discovered toward the end of the spawning season, and a temporary solution was found. The City of The Dalles is currently (March 2004) in discussion with Oregon Department of Fish and Wildlife for a permanent solution at that site.

Many other structures on all creeks may be partial barriers to some lifestages at in some flows.

Literature Cited

Altman, Bob, and Aaron Holmes. 2000. Conservation Strategy for Landbirds in the Columbia Plateau of Eastern Oregon and Washington. Prepared for Oregon-Washington Partners in Flight.

Andersen, W.L. and R.E. Duzan. 1978. DDE Residues and eggshell thinning in Loggerhead Shrikes. Wilson Bull. 90 (2): 215-220.

Anderson Jim, J. Hayes, R. Zabel 1996. Columbia River Salmon Passage Model, CriSp 1.5, Theory, Calibration and Validation.

Bouwes, Nick; Schaller, Howard; Budy, Phaedra; Petrosky, Charles; Kiefer, Russ; Wilson, Paul; Langness, Olaf; Weber, Earl, and Tinus, Eric. An analysis of differential delayed mortality experienced by stream-type chinook salmon of the Snake River: a response by State, Tribal and USFWS technical staff to the 'D' analyses and discussion in the Anadromous Fish Appendix to the U.S. Army Corps of Engineers' Lower Snake River Juvenile Salmonid Migration Feasibility Study. 1999.

Corning, Howard McKinley, ed. 1956. *Dictionary of Oregon History*. Binford and Mort Publishing, Portland OR. Reprinted in 1989.

Cross, S.P. 1969. Behavioral Aspects of Western Grey Squirrel Ecology. Ph. D. dissertation. University of Arizona, Tucson, AZ. 168.pp.

CTC 1998.

Dufur Historical Society. 1993. *Fifteen Mile Crossing, A History of Dufur*. Dufur Historical Society, Dufur, OR.

Evanich, J.E. Jr., 1986a. Introduced Birds of Oregon. Oregon Birds 12: 156-186

Finney, B. P. et al. 2000. Impacts of climatic change and fishing on Pacific salmon abundance over the past 300 years. Science. 290: 795-798.

Fish Passage Center of the Columbia Basin Fish & Wildlife Authority. 1999. Fish Passage Center Annual Report 1998. Columbia Basin Fish & Wildlife Authority, Portland, Oregon.

Foster, Susan Ann. 1992. Studies of Ecological Factors that Affect the Population and Distribution of the Western Gray Squirrel in North Central Oregon. Dissertation for Doctor of Philosophy. Portland State University. Portland, OR

Francis, R.C. and N. J. Mantua. 2003. Climatic influences on salmon populations in the Northeast Pacific. *In* Assessing Extinction Risk for West Coast Salmon, Proceedings of a workshop November 13-15, 1996 in Seattle, WA. NOAA Technical Memorandum NMFS-NWFSC-56.

Gilligan, J., M. Smith, D. Rogers, and A. Contreras. 1994. Birds of Oregon: Status and Distribution. Cinclus Publ. McMinnville, OR

Gregg, R. and F. W. Allendorf. 1995. Systematics of Oncorhynchus Species in the Vicinity of Mt. Hood: Preliminary Report to Oregon Department of Fish and Wildlife. University of Montana, Missoula, Montana. 13 pp. with attachments.

Gutierrez, R.J. and D.J. Delehanty. 1999. Wild Turkeys. In the Birds of North America, No. 457. (A. Poole and F. Gill, eds.) The Birds of North America, Inc., Philadelphia, PA

Hare, S.R., N. J. Mantua, and R.C. Francis. 1999. Inverse production regimes: Alaska and west coast Pacific salmon. Fisheries v 24. 6: 6-14.

Hill, E.P., 1982. Beaver: *Castor canadensis*. Pp. 256-281, in Wild Mammals of North America: biology management and economics (J.A. Chapman and G.A. Feldhamer, eds.) The Johns Hopkins University Press, Baltimore MD. 1147 pp.

Holmes, A.L. and G.R. Geupel. 1998. Avian population studies at Naval Weapons System Training Facility Boardman, Oregon. Unpubl. rept. Submitted to the Dept. of Navy and Oregon Dept. Fish and Wildlife, Point Reyes Bird Observatory, Stinson Beach, CA.

Howell, Erle. 1966. *Methodism in the Northwest*. Parthenon Press, Nashville TN.

Interior Columbia Basin Technical Recovery Team (NOAA Fisheries), July 2003. Independent Populations of Chinook, Steelhead and Sockeye for listed Evolutionarily Significant Units Within the Interior Columbia River Domain.

Knick, S.T. and J.T. Rotenberry. 1995. Landscape characteristics of fragmented shrubsteppe habitats and breeding passerine birds. Conserv. Biol. 9(5) 1059-1071

Leu, M. 1995. The feeding ecology and the selection of nest shrubs and fledgling nest sites by loggerhead shrikes. (*Lanius ludovicianus*) in the shrub steppe habitat. M.S. Thesis, University of Washington, Seattle, WA

Levy, S. 2004. Native Incursions: Avian Range Expansions Imperil Threatened and Endangered Species. Bio Science. February 2004. Vol. 54 No. 2

Lindbloom, A. 1998. Habitat use, reproduction, movements and survival of chukar partridge in western-central Idaho. M.S. Thesis, University of Idaho, Moscow, ID

Mantua, N.J. et al. A Pacific interdecadal climate oscillation with impacts on salmon production. Bulletin of the American Meteorological Society.

Marcot, B. G., W. E. McConnaha, P. H. Whitney, T. A. O'Neil, P. J. Paquet, L. E. Mobrand, G. R. Blair, L. C. Lestelle, K. M. Malone, and K. I. Jenkins. 2002. A multi-species framework approach to the Columbia River Basin. Northwest Power Planning Council, Portland, OR. http://www.edthome.org/framework/default.htm

Marshall, D.B., M.G. Hunter and A.L. Contreras, eds. 2003. Birds of Oregon: A General Reference. Oregon State University Press, Corvallis, OR. 768 pp.

McNeal, William H. 1953. *History of Wasco County, Oregon*. Self-published.

Mobrand Biometrics. 2003. Out of subbasin survival factors in Ecosystem Diagnosis and Treatment. Available at: http:/www.nwppc.org/fw/subbasinplanning/admin/guides/oose.htm.

Mote, P. et al. Impacts of climate variability and change in the Pacific Northwest. The JISAO Climate Impacts Group, University of Washington. Seattle. Available at: http://www.jisao.washington.edu/PNWimpacts/Publications/Green1999.pdf

Neel, L.A. 1999. Nevada Partners in Flight Bird Conservation Plan. March 19, 1999.

NOAA Fisheries, April 4, 2002. Interim Abundance and Productivity Targets for Interior Columbia Basin Salmon and Steelhead Listed under the Endangered Species Act (ESA). Interior Columbia Basin Technical Recovery Team.

NMFS/Northwest Fisheries Science Center. 2000. Passage of juvenile and adult salmonids past Columbia and Snake River dams. White Paper. National Marine Fisheries Service, Seattle, Washington.

Olsen, E. A., R. B. Lindsay and W. A. Burck. February 1991. Summer steelhead in the Deschutes River, Oregon. Oregon Department of Fish and Wildlife Information Report, Oregon Department of Fish and Wildlife, Corvallis OR. Unpublished Draft.

Olson, B. 1976. Status Report, Columbia Sharp-tailed Grouse. Oregon Wildlife 3:10.

Oregon Department of Fish and Wildlife. 1999a. Game and Bird Hunting Statistics. Oregon Department of Fish and Wildlife. Portland, OR

Oregon Department of Fish and Wildlife. 1999b. Unpublished Report: Fifteenmile Screw Trap Migrant Fish Study, 1998-1999. The Dalles OR.

Oregon Department of Fish and Wildlife. 2001. Hood River/Pelton Project Annual Report.

Oregon Department of Fish and Wildlife. Mid-Columbia District Office. June, 1994. Fishery Assessment of Crow Creek Reservoir

Oregon Department of Fish and Wildlife. 2003. Unpublished Draft Report: Fifteenmile Screw Trap Migrant Fish Study, 1998-2003. The Dalles OR.

Park, D.L. 1993. Effects of marine mammals on Columbia River salmon under the Endangered Species Act Recovery Measures for Threatened and Endangered Snake River Salmon: Technical Report 3 of 11. Under contract DE-AM79-

93BP99654, Bonneville Power Administration. Don Chapman Consultants, Inc., for S.P. Cramer and Associates, Portland, Oregon.

Pearcy, W.G. 1992. Ocean ecology of North Pacific salmonids. (Washington Sea Grant Program, Seattle), 179 pp.

Peters, Calvin N., David R. Marmorek, and Ian Parnell., editors. 1999. PATH decision analysis report for Snake River fall chinook. ESSA Technologies Ltd., Vancouver, BC. (is this one of the PATH reports cited?)

Petersen, K.L., and L.B. Best. 1987. Brewer's Sparrow Nest-site Characteristics in a Sagebrush Community. J. Field Ornithology. 56(1): 23-27

RASP (Regional Assessment of Supplementation Project). 1992. Supplementation in the Columbia Basin. Project Number 85-62. summary report series - Final Report. Bonneville Power Administration, Portland, Oregon.

Ritter, S. 2000. Idaho Bird Conservation Plan, Version 1.0. Idaho Partners in Flight.

Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian predation on juvenile salmonids in the Columbia River basin. Annual Report prepared for Bonneville Power Administration, Contract No. 97BI33475, Portland, OR.

Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon and G. Gough. 1999. The North American Breeding Bird Survey: Results and Analysis. Version 98.1. Patuxent Wildlife Resource Center, Laurel, MD

Service, Robert F. 20 February 2004. "News Focus: As the West Goes Dry." Science Vol. 303.

Spruell, P., J. W. Pearce Smithwick, K. L. Knudsen, and F. W. Allendorf. 1998. Genetic Analysis of Rainbow and Cutthroat Trout from the Lower Columbia River. Progress Report WTSGL98-103 to the Oregon Department of Fish and Wildlife. University of Montana, Missoula, Montana. 21 pp.

USDA Forest Service. 2004. Pacific Northwest Research Station Science Update: Western Forests, Fire Risk, and Climate Change. Issue 6.

Verts, B.J. and L.N. Carraway. 1998. *Land Mammals of Oregon*. U. of California Press.

Wagenblast, Joan Arrivee. *Whispers in the Wind, The Story of Petersburg*. Unpublished, available at The Wasco County Historical Society Library, Columbia Gorge Discovery Center.

Wasco Co. SWCD 2002. Mosier Watershed Assessment.

Wasco Co. SWCD 2003a. Fifteenmile Watershed Assessment.

Wasco Co. SWCD 2003b. The Dalles Watershed Assessment.

Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife 2002. Status Report, Columbia River fish runs and fisheries, 1938-2000.

Watershed Sciences, LLC. February 26, 2003. *Aerial Surveys in the Fifteenmile Creek Basin*, Report to Oregon Department of Environmental Quality.

Wisdom, M.J., R.S. Holthausen, D.C. Lee, B.C. Wales, W.J. Murphy, M.R. Eames, C.D. Hargis, V.A. Saab, T.D. Rich, F.B. Samson, D.A. Newhouse and N. Warren. 2000. Source habitats for terrestrial vertebrates of focus in the Interior Columbia Basin: Broad-scale trends and management implications. U.S. Dept. of Agric., For. Serv., Pacific Northwest Res. Stat. Gen. Tech. Rep. PNW-GTR-485, Portland, OR

Wydoski. Richard S and Whitney, Richard R. 1979. *Inland Fishes of Washington State*. University of Washington Press.

Zabel, R. W. and J. J. Anderson. 1997. A model of the travel time of migrating juvenile salmon, with an application to Snake River spring chinook salmon. North American Journal of Fisheries Management 17(1): 93-100.