CHAPTER 3. AFFECTED ENVIRONMENT

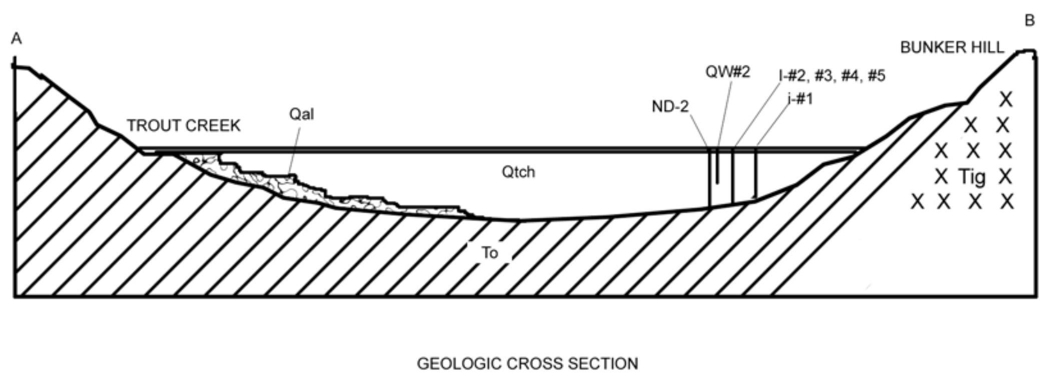
This Chapter summarizes the physical, biological, social, and economic environments of the project area. The existing conditions as well as the projected future effects are found in Chapter 4 under Alternative A – No Action.

Geology

Geology Surrounding the Hemlock Dam area

The area in the vicinity of Hemlock Dam has been influenced by various geologic processes including widespread volcanism dating back to around 27 million years ago to recent deposition by glaciations and alluvium as well as erosion by water. Volcanism in the Northwest was very active from 35 million years ago to 20 million years ago. During the period around 27 million years ago numerous volcanic centers erupted lava flows and ejecta creating the base for the southern Cascade Range.

What we see today was probably started around 340,000 years ago when lava flows occurred out of Trout Creek Hill. Numerous flows occurred with some of the flows reaching and blocking the Columbia River. Fig. 3-1 shows a schematic cross section of the materials. These flows filled in the valley and probably pushed Trout Creek and Wind River back and forth to what it is today. Materials were intruded through the older volcanism creating features such as Bunker Hill, Wind Mountain and other peaks in the area.



Qal – Alluvial material
Qtch – Trout Creek Hill Basalts
To – Ohanapacosh
Tig – Bunker Hill intrusive gabbro
ND, OW, I are drill locations

Figure 3-1. Geologic cross-section of area between Trout Creek Hill and Bunker Hill.

Over the last few hundred thousand years erosional and depositional processes worked the area. The advancing and retreating alpine glacial periods provided much of the material that was transported down the valley. In the upper nursery fields deposits as thick as 40 feet have been mapped. These soils have been transported from areas higher in the drainage by melting waters. Some of this material may also have been deposited from volcanic activity from Mt. Saint Helens. These ash deposits have probably been mixed in with the other soils brought down by water erosion.

Soils

The Planning Area was delineated specifically for the soils analysis only, and is a rough approximation of the area affected by the project. Delineated as a GIS layer (Figure 3-2), the boundary was to evaluate standards and guidelines by measuring area in a detrimental condition.

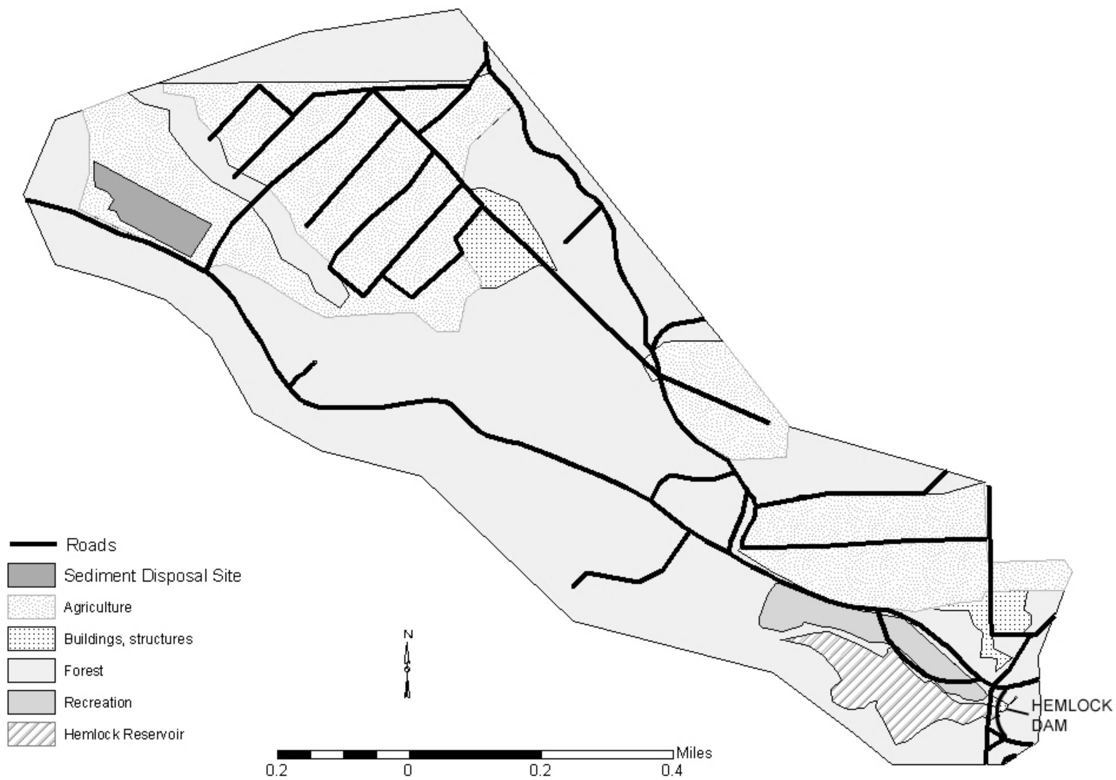


Figure 3-2. Planning area for soils analysis.

Physiographic Setting

The project area is covered by a number of mapping surveys of different scales, including large-scale geologic mapping by Paul Hammond (Hammond 1980), Gifford Pinchot National Forest Landtype Association mapping, and Gifford Pinchot National Forest Soil Resource Inventory

(Wade, et. al., 1992). Table 3-1 summarizes the interpretations by these sources. This information is available at the Gifford Pinchot National Forest Headquarters.

Gifford Pinchot National Forest Landtype Association mapping is a combination of information including the Gifford Pinchot National Forest's Soil Resource Inventory, Geology maps by Paul Hammond (Hammond 1980) and Washington State Department of Natural Resources geology maps.

The proposed activities are in the Western Hemlock Zone (Topik 1986), in the frigid (relatively cool) soil temperature regime and udic (relatively moist) soil moisture regime.

Table 3-1. Soil Mapping Interpretations

Map source and delineated unit	Extent	Landform	Bedrock composition	Soil characteristics/ notes
SRI (Wade, et. al., 1992) Unit *43*	All area affected by proposed action	Sideslopes, terraces, and basins	Andesite & basalt	*High compaction potential,* moderate displacement potential
Landtype Association Unit *84*	All area affected by proposed action	Gently sloping upland bench	Quatnerary basalt Lava	Young soils derived from residuum, colluvium, volcanic tephra
Paul Hammond (1980) *Qtch*	All area affected by proposed action	Intracanyon lava flow	Trout Creek Hill Basalt: a Quaternary olivine basalt	Lava descended Wind River valley and temporarily dammed the Columbia more than 30,000 years ago.
Paul Hammond (1980) *To*	Transition from upslope of Pacific crest fields, also upslope of Hemlock Reservoir		Ohanapecosh Formation: layers of metamorphic volcanic rocks	Dated at about 31 to 45 million years old.

Hydrology

Stream flow

Watershed-Scale Conditions

The Wind River watershed has a temperate marine climate with cool, moist winters and dry summers. Mean annual precipitation is 110 inches as measured at the Wind River nursery located in the Trout Creek subwatershed near Hemlock Lake. Annual precipitation ranges from less than 60 inches per year in the southeast portion of the watershed to over 120 inches per year in the west and northwest. Approximately 75% of the annual precipitation falls between November and March.

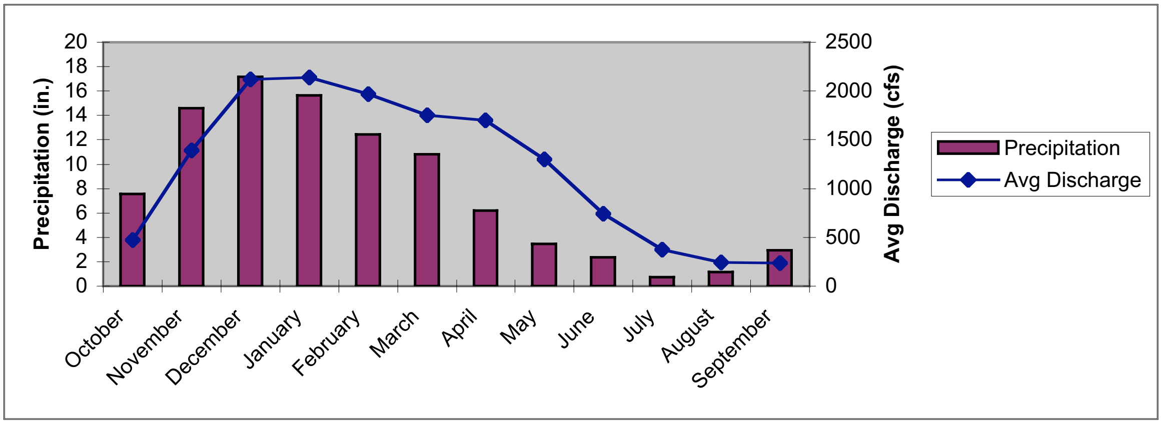


Figure 3-3. Average monthly precipitation (from Carson National Fish Hatchery) and discharge on the Wind River near Carson.

With elevations ranging from less than 100 feet to nearly 4,000 feet, both rain and snow are common in the watershed during the winter months. Average daily flows are greatest during the winter, peaking in January at a mean of 2,168 cubic feet per second (cfs). The largest peak flows similarly occur in winter, often in response to a combination of rainfall and snowmelt during warm, marine-influenced storms. The peak flow of record on the Wind River occurred on February 8, 1996, when discharge reached 53,600 cfs at the U.S. Geological Survey (USGS) gauge near Carson. The USGS estimated the recurrence interval for a flood of this magnitude to be in the neighborhood of 125 years on the Wind River. Summer flows on the river are typically lowest in September, when average daily discharge drops to a mean of 236 cfs. The source of summer flows in the Wind River and Trout Creek include subsurface recharge and water stored in the wetlands, wet meadows and other retention areas of the watershed.

Subwatershed-Scale Conditions

Mean annual discharge on Trout Creek is 250 cubic feet per second (cfs). Discharge levels commonly range from less than 20 cubic feet per second (cfs) during the lowest flows of late summer months, to over 2,000 cfs during bankfull floods that occur during winter runoff (Table 3-2). Monthly mean discharges for the period of 1945-1948 are shown in Table 3-4, and range from a low of 13.2 cfs in August to a high of 363 in January.

Table 3-2. Mean monthly discharge on Trout Creek near Hemlock, 1945-1948.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean of monthly stream flows 1945-1948	363	342	261	285	246	96	43	13	19	164	385	356

In August of 1992, one of the lowest water years in the recent past, discharge on Trout Creek was measured at less than 5 cfs at the Forest Service baseline monitoring station on lower Trout Creek (just upstream of Hemlock Lake). The largest flood recorded on Trout Creek occurred in February 1996, and measured 5,660 cfs just downstream of the confluence of Layout Creek with

Trout Creek. A flood of this magnitude is an infrequent occurrence on Trout Creek, and would be expected to occur on average only once every 100 years or more.

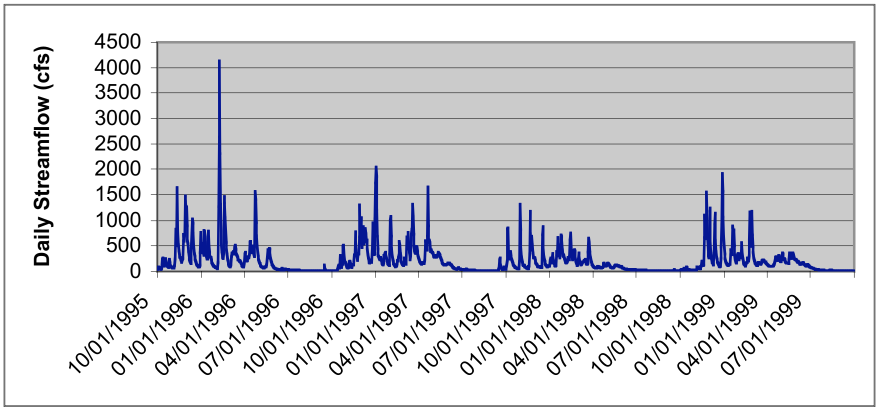


Figure 3-4. Daily stream flows on Trout Creek below the Flats, from October, 1995 through September, 1999.

Channels/Sediment

Watershed-Scale Conditions

The Wind River begins in McClellan Meadows, at an elevation of approximately 3,000 feet. It is a fifth order stream that drains an area of approximately 225 square miles. From the headwaters to its mouth on the Columbia River, the Wind River travels over 31 miles and drops nearly 3,000 feet in elevation. Joined by a series of high gradient tributaries, the Wind River flows through a narrow valley from near Paradise Creek to the confluence with Falls Creek. Gradients drop from over 15% near the headwaters to near 2% at the mouth of Falls Creek. As the river flows through the middle reaches from Trapper Creek to the community of Stabler, the valley width increases and channel gradients continue to drop. Near Stabler, the river enters a bedrock-confined channel, and begins a long, high gradient descent to the mouth, through a steep, high-walled canyon. Trout Creek enters the Wind River near the upper end of this canyon.

Figure 3-5. Wind River watershed and location of Hemlock Dam on Trout Creek.

Subwatershed-Scale Conditions

The Trout Creek subwatershed ranges in elevation from approximately 850 feet at the mouth of Trout Creek to over 3,800 feet at the upper northwestern boundary of the subwatershed. Trout Creek Hill and Bunker Hill, two past active volcanic vents, form portions of the eastern boundary, and a lava flow from the upper northern slopes of the drainage further emphasizes the volcanic history of the area.

For characterization purposes, the Trout Creek subwatershed can be roughly broken into an upper and lower drainage. The upper drainage is a bowl-shaped catchment rimmed on the west and north by a high ridge and steep, dissected slopes associated with Cougar Rock, Twin Rocks, West Crater, and Soda Peaks. To the east, the upper drainage is bounded principally by Trout Creek Hill and its flanks, which have poorly developed drainage patterns. At the base of the slopes and near the center of the upper drainage is Trout Creek Flats, a broad, alluvial valley bottom characterized by a series of wetlands, beaver ponds, and broad meandering stream channels.

Trout Creek originates in springs along the lava flow associated with West Crater. Gradients in Trout Creek drop sharply as the river approaches and crosses the Trout Creek Flats. Most of the significant tributaries to Trout Creek (Crater, Compass, East Fork Trout, Layout Creeks) enter the Creek as it crosses the Trout Creek Flats. Following extensive logging in riparian areas of the

Flats and removal of woody debris from streams in the area during the mid and late 1900's, these channels have widened, downcut, and shallowed, and currently form a network of very low gradient highly exposed channels.

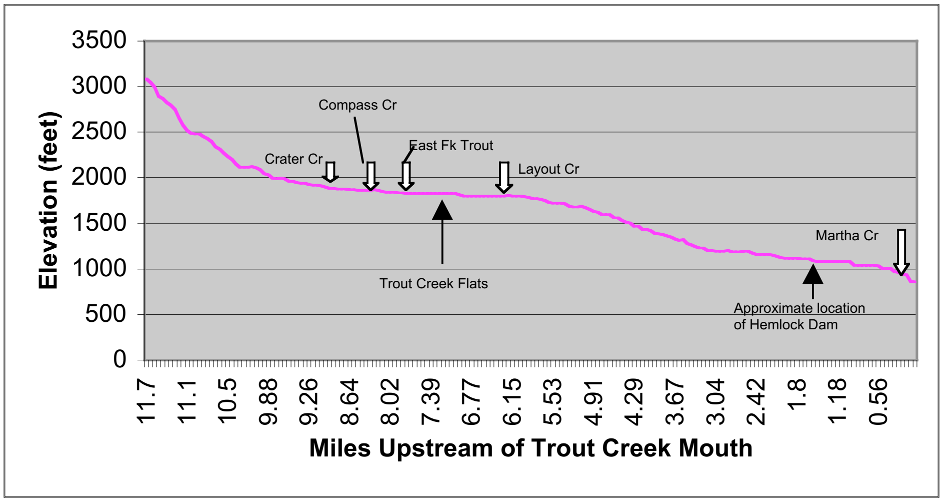


Figure 3-6. Longitudinal profile of Trout Creek.

The lower portion of the Trout Creek subwatershed is longer and narrower in shape, trending from northwest to southeast. This portion of the subwatershed is bounded on the south and west by a ridge extending from Mowich Butte to the southeast through Sedum Point. The northeastern border is formed by Trout Creek Hill, Bunker Hill, and the gentle slopes surrounding these two volcanoes. Small tributaries joining Trout Creek from the north drain relatively gentle slopes between Trout Creek and the mainstem of the Wind River. On the south side of Trout Creek, topography is much steeper and drainages are more incised. Hemlock Dam is located approximately 1.8 river miles upstream of the mouth of Trout Creek. Figure 3-6 shows the general longitudinal profile of Trout Creek and the Wind River.

Once leaving the upper drainage and Trout Creek Flats, Trout Creek flows through a steep canyon and high gradient bedrock and boulder-controlled reaches (Rosgen A and B channels) before reaching Hemlock Lake. The only major tributary in the lower drainage is Martha Creek, which joins Trout Creek below Hemlock Dam and just upstream of the mouth of Trout Creek. Stream flow through the lower watershed is relatively rapid with the exception of the reach that flows through Hemlock Lake. The lake has been substantially filled with sediment deposits through the years, and it now presents an area of very slack, shallow water during the summer months.

Water Temperature

The Forest Service has measured water temperatures in the Wind River and its major tributaries since the 1970's. Based on monitoring results from the early and mid-1990's, Trout Creek, Bear Creek, and Eightmile Creek were included on the Washington State Department of Ecology's 303(d) list of water bodies that did not meet state water quality standards. In 2001 and 2002, the Forest Service worked with the Department of Ecology to develop a Water Quality Restoration

Plan (WQRP) for the Wind River watershed, with a focus on improving water temperature conditions throughout much of the watershed. As a result of completing the WQRP and the State's completion of the Total Maximum Daily Load (TMDL) for the watershed, none of the streams within the watershed is on the proposed 303(d) Category 5 list, even though a number of streams there continue to regularly exceed state standards for temperature.

Watershed-Scale Conditions

Water temperatures in the Wind River show a general warming in a downstream direction. From headwaters to mouth, the Wind River measures over 30 miles in length. During a two-year monitoring period (1999-2000), the total increase in maximum water temperature from the uppermost monitoring station (Wind River above Pete's Gulch) to the lowermost monitoring station (Wind River near the mouth of the Wind River) averaged just 1.7°C. Figure 3-8 illustrates how water temperatures change along the course of the Wind River. The figure reflects data from the summer of 2000. Headwaters of the Wind River are to the left of the chart, and the data are arrayed in a downstream direction going to the right.

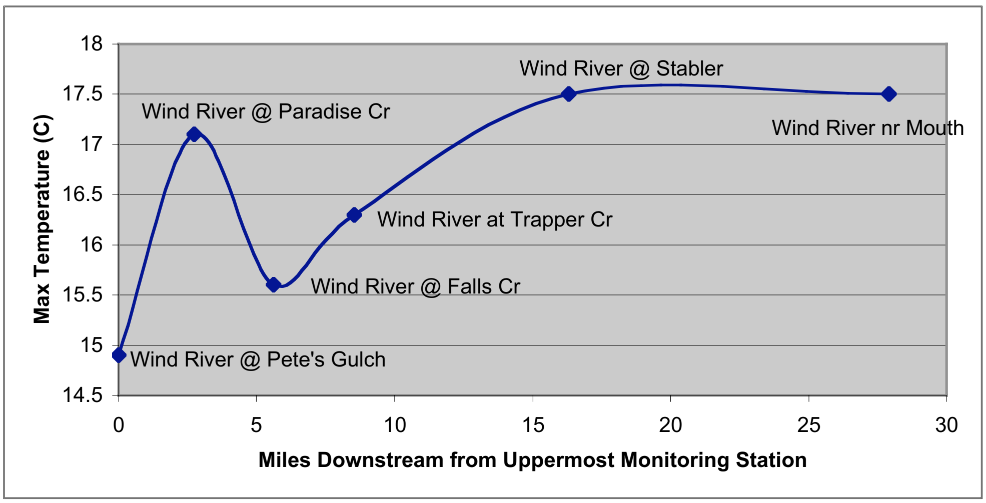


Figure 3-8. Maximum water temperatures at monitoring stations along the Wind River, year 2000. Data are arranged in a downstream direction from left to right.

Water temperatures within the Wind River are affected by a combination of conditions on the mainstem, along with inputs of water contributed by various tributaries and other seeps or springs along the channel. Headwaters of the Wind River originate in McClellan Meadows and from a large number of springs and seeps in the gently sloping ground that forms a saddle between the Wind River watershed and the Lewis River watershed to the north. The large open expanse of McClellan Meadows allows water temperatures even high up in the watershed to be somewhat elevated (Figure 3-8). As the Wind River flows downslope, it is joined by a combination of both warmer and cooler inputs from its tributaries.

Subwatershed-Scale Conditions

Over the past decade of monitoring, Trout Creek has consistently had the highest water temperatures of any major tributary to the Wind River. Water temperature standards have been exceeded in every year of monitoring, commonly exceeding 20°C, and at times exceeding the standard for over two months of the year (Table 3-5).

Table 3-5. Annual water temperature peaks in Trout Creek, and the number of days water temperature standards were exceeded per year, 1993-2003. (Data is from the monitoring station just upstream of Hemlock Lake.)

Year	Maximum Recorded Water Temperature	Number of Days Water Temperatures Exceed the Washington State Standard
1993	20.8	33
1994	No data	No data
1995	22.6	69
1996	20.2	49
1997	20.8 (truncated file)	19+(truncated file)
1998	23.2	75
1999	19.1	27
2000	20.8	42
2001	No data	No data
2002	21.0	56
2003	20.6	79
Average	21.0	54

Causes of high water temperatures in Trout Creek include: 1) wide, shallow, and poorly shaded channels in the upper watershed (a result of channel widening caused in part by past logging of riparian areas and removal of large woody debris from stream channels); 2) large areas of shallow, slow moving or still water in the Trout Creek Flats area, created by natural ponds, wetlands and beaver impoundments; 3) warm water inputs from tributaries which were logged, and/or burned, and cleared of woody debris; 4) heating in the mainstem of Trout Creek below the Flats; and 5) heating occurring in Hemlock Lake (heating that occurs in Hemlock Lake would not affect the temperatures described in Table 3-5 because data in that table was collected upstream of the lake.

While some of the heating in Trout Creek occurs within the mainstem, tributaries play a significant role as well. Figures 3-6 and 3-7 illustrate the water temperature trends in Trout Creek and throughout the subwatershed during the summer of 2003.

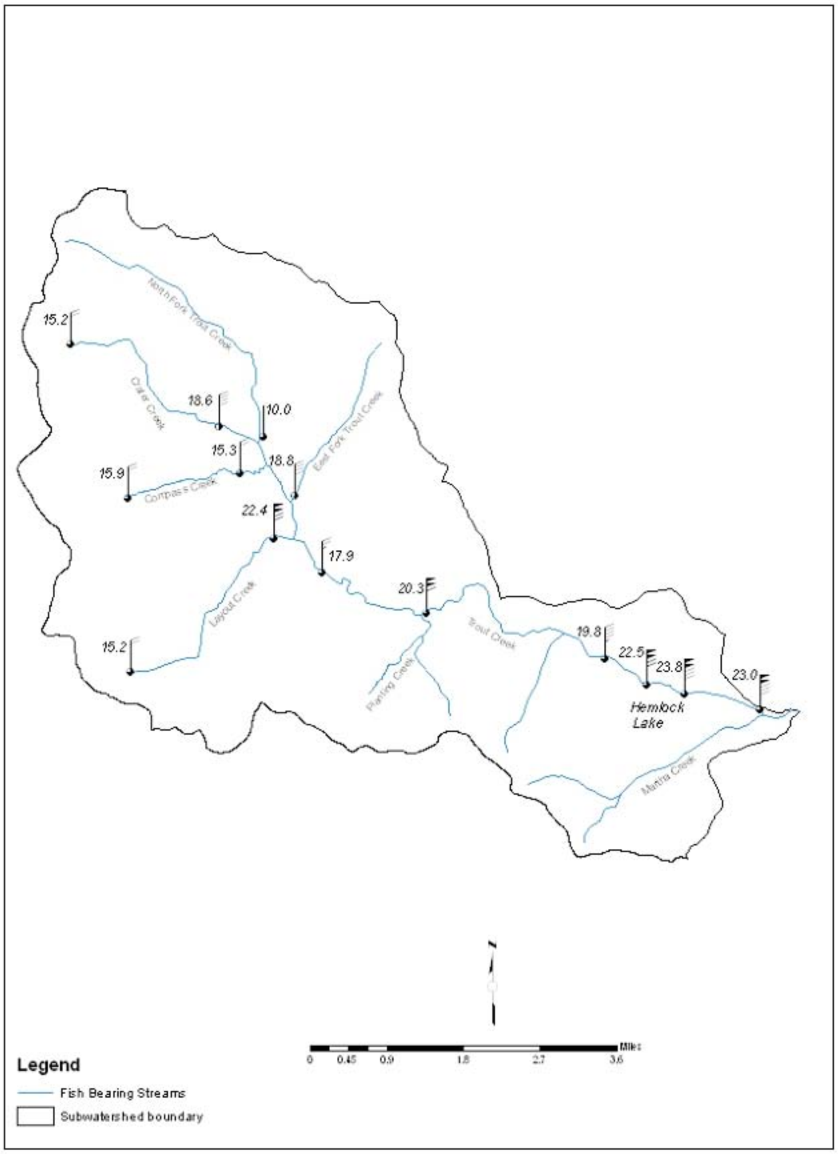


Figure 3-6. Peak summer water temperatures throughout the Trout Creek subwatershed, 2003.

Figure 3-6 depicts the maximum water temperatures throughout the Trout Creek subwatershed during the summer of 2003, illustrating the areas of heating within both Trout Creek and its tributaries. Figure 3-7 shows the spatial water temperature trends along the mainstem of Trout Creek for the same year. Each point on the chart represents the peak water temperature at a different location on Trout Creek. The chart is organized so that upstream is to the left, and downstream is to the right.

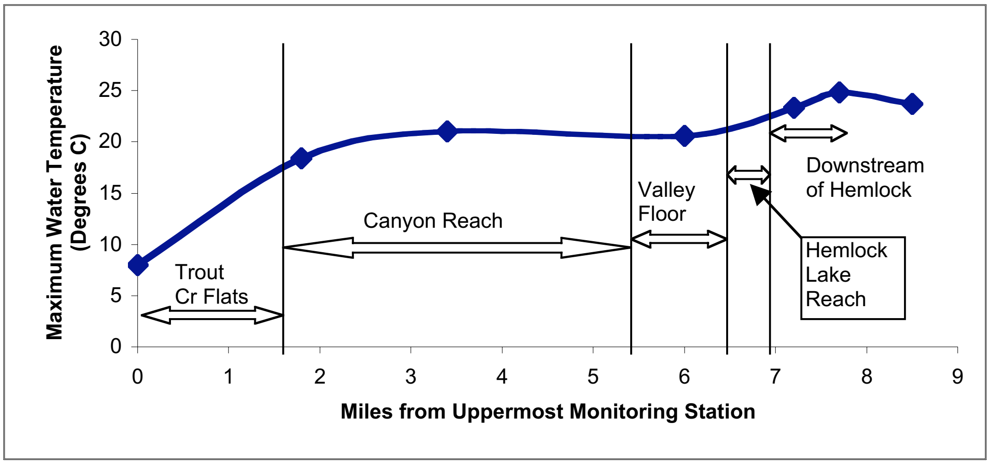


Figure 3-7. Peak water temperatures at seven locations on Trout Creek in 2003. Upstream is to the left, downstream is to the right.

Temperature increases dramatically in the upper watershed, where Trout Creek flows across the Trout Creek Flats. Through this reach, the rate of heating in Trout Creek approaches 6°C per river mile, resulting from a combination of persistent effects of past logging activities, and inherent geomorphic conditions of the upper watershed. As Trout Creek approaches and passes through the upper canyon, temperature increases decline, and then the stream actually begins to cool slightly. As Trout Creek exits the canyon and enters the valley floor, water temperatures again begin to climb, peaking in the reach that includes Hemlock Lake. Rates of temperature increase in the reaches below the canyon begin at 2.25°C per river mile, and reach 3.0°C per river mile in the Hemlock Lake reach. Downstream of Hemlock Dam, maximum water temperatures begin to decline, as Trout Creek flows through the lower canyon toward the Wind River.

Turbidity/Suspended Sediment

Measurement of turbidity or suspended sediment levels in the Wind River watershed has been sporadic over time, but limited data exists from Forest Service, Underwood Conservation District, and Department of Ecology monitoring.

Watershed-Scale Conditions

Envirovision summarizes the studies done by each of these agencies over the past few decades (Envirovision 2002). Essentially, the data show that turbidity levels throughout the watershed are highly variable over time. During the summer months, turbidities tend to be quite low across the watershed, ranging from XX to XX in XX Creek. During the winter months, turbidity levels are generally higher, and typically correlated with stream discharge levels.

In the mainstem of the Wind River, turbidity levels tend to increase in a downstream direction, such that the mouth of the Wind River has the highest turbidities. Table 3-6 summarizes turbidities taken by the UCD during six sampling events at three locations on the Wind River (Envirovision 2002).

Table 3-6. Turbidities measured on the Wind River, 1999-2001 (as reported in Envirovision 2002).

Station	Range of Measured Turbidity (NTU's)	Mean	Number of Samples
Mouth of Wind River	0.4-12	4.2	6
Wind River at Stabler	0.4-7.1	2.5	6
Wind River below Falls Cr	0.3-2.2	1.3	6

The station on the Wind River below Falls Creek is the farthest upstream station, and shows the lowest value for turbidity, and the lowest average turbidity. The mouth of the Wind River had the highest measured turbidity and the highest average turbidity over a range of seasons and flow conditions.

Turbidity levels are often correlated strongly with discharge, so seasonal patterns often show a general increase in winter and decrease in summer. Table 3-7 summarizes seasonal results from two years of water quality monitoring conducted at the mouth of the Wind River by the Washington Department of Ecology (1994-1995) (Envirovision 2002).

Table 3-7. Summary of WDOE's Turbidity Monitoring Data for the Wind River (October 1994-September 1995).

	Summer(1)		Winter(2)	
Parameter	**Range**	**Mean**	**Range**	**Mean**
Turbidity (NTU)	0.7 – 3.0	1.3	0.5 - 19	4.8

(1)Summer range calculated using July and August data for 1995 (N = 6).
(2)Winter range calculated using November through March data for water year 1994-95 (N = 18).

Average winter turbidities measured during this effort were over three times as high as the average in summer months. The winter average is strongly influenced by a few very high values. The lowest turbidity measured during the entire 2-year effort occurred during the winter months as well, illustrating that there is not always a direct correlation between season and turbidity levels.

Although these measurements only give a brief snapshot of the turbidity in the Wind River, some of the general trends are apparent. In each sampling, turbidity at the mouth of the river was the greatest, and during periods of higher turbidity, the concentrations at the mouth of the Wind were significantly higher than at the next upstream station on the Middle Wind River.

Subwatershed-Scale Conditions

In a very small sample of four events, Trout Creek had one of the highest turbidities of any station in the Wind River watershed. The largest and most consistent inputs of sediment within the Trout Creek subwatershed appear to be from channel erosion occurring in the Trout Creek flats. Roads throughout the watershed are another known source of turbidity.

Measured turbidity levels in Trout Creek generally have shown an increase in a downstream direction, and it is noteworthy that although the channels in the Trout Creek Flats are probably the most active and consistent source of sediment input to the Trout Creek system, turbidity levels have been highest near the mouth of Trout Creek in 2 years of monitoring by the UCD (Table XX).

Water Quantity

Water withdrawal

The USDA Forest Service had an instream water right to extract up to 548 acre-feet per year. The USFS has discontinued the Wind River Nursery operation and is not using any water surface withdrawal from Hemlock Lake at this time. Historically, when the nursery used the irrigation system, the reservoir would at times draw down below the elevation of the fish ladder entrance and produce a total migration block. In addition, flow below the dam was substantially decreased

Water was withdrawn from the reservoir for irrigation of the Wind River Nursery (195X-1997). Though the intake was screened juvenile steelhead and crustaceans were entrained in the system and documented plugging sprinklers. At the peak of water withdrawal during the summer months, flow below the dam was greatly reduced and at times nearly dewatering the two mile reach from the dam to the mouth. In 1997 the Wind River nursery closed and water withdrawal, irrigation and associated mortality soon thereafter ceased. Future use of the facility for irrigation by Skamania County has been suggested as an option for county owned nursery fields.

Fish and Fish Habitat

Since the late 1800's the predominant land management activity within the Wind River watershed has been timber harvest. Historically, "splash dams" were constructed on the main stem Wind River and tributaries to stockpile and transport logs down stream to the mills along the Columbia River. Riparian areas were initially logged due to the large quantities of old growth timber and proximity to the stream that served as the primary mode of transportation.

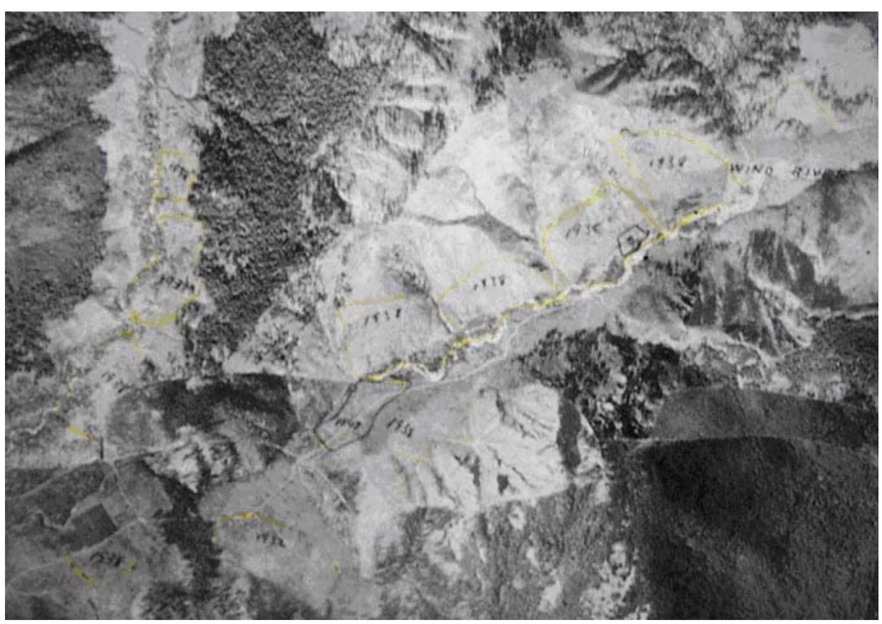


Figure 3-8. 1944 aerial photo of Dry Creek and the upper Wind River (river mile 20-25), Skamania County, WA. Logging in the early part of the century focused on the main stem Wind River and major tributaries due to historic logging methods (splash dams and railroad logging) and the old growth timber along the streams.

Figure 3-9. 1902 Photo of the Trout Creek splash dam under construction, Skamania County, Washington. The man in foreground is holding a large fish presumably a steelhead caught at the base of the dam.

Although logging was the primary commercial resource within the watershed, steelhead trout have culturally been an integral part of the Wind River. Early managers recognized the importance of the fishery and built wooden fish ladders around at least one of the splash dams.

The Trout Creek splash dam was taken out and replaced with a concrete dam in 1935 by the CCC to generate electrical power to the Wind River Ranger District. A concrete fish ladder was constructed in 1936 to maintain steelhead immigration to the spawning habitat in Trout Creek Flats six river miles up-stream. The ladder is one of the first concrete fish ladders built in the Pacific Northwest predating the ladder on Bonneville dam and is still functional today (Mack, 1995).

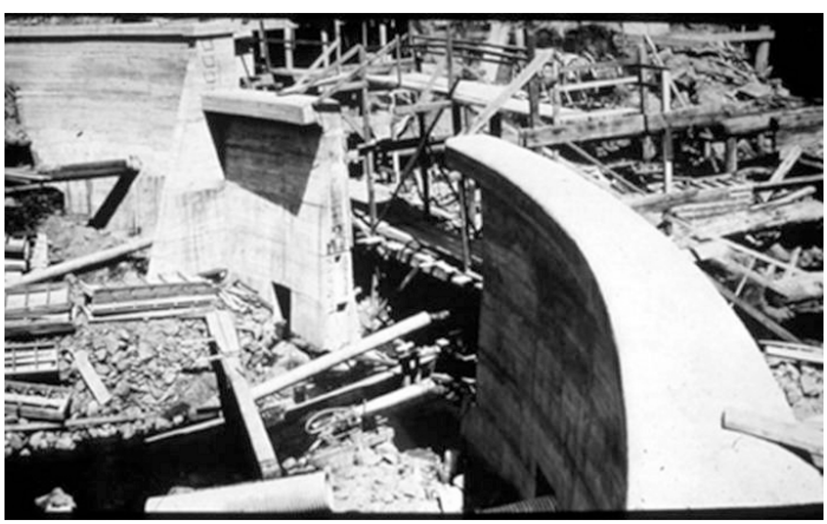


Figure 3-10. 1935 Photo of Hemlock Dam under construction, Skamania County, Washington.

Trout Creek could not maintain adequate discharge to generate electricity through the summer months and the facility was converted to irrigate the Wind River Tree Nursery in 1958. Irrigation withdrawal from the reservoir ended in 1997 after the Wind River Nursery closed. Currently the reservoir and surrounding land are managed as a recreational swimming and picnicking facility.

Figure 3-11. 2001 Photo of Hemlock Dam looking downstream from the reservoir, note the fish ladder on the right side of the photograph. Skamania County, Washington.

The total length of the dam is 183 feet and the spillway length is 112 feet. The height of the dam from the streambed to the crest of the spillway is 26 feet, with the north and south abutments rising six feet above the spillway crest. The radius across the face of the dam is 100 feet.

The upper entrance of the fish-way has a submerged 2’x2’ opening located immediately behind a metal trash rack. Four chambers or control pools with slots are located at the head of the fish-way. These chambers are approximately five feet in length, and five feet width. Below the eighth weir the fish ladder makes a turn of almost 180 degrees and the lower part of the fish-way contains ten weirs. Behind each notched weir there is a chamber, which range in length from 5 to 11.2 feet.

The fish ladder does not meet current NOAA Fisheries standards for passage facilities. Water flow and screening facilities are not condusive to effectively pass fish and have resulted in fish mortality. Video cameras have been installed in the ladder to evaluate adult steelhead movement and fish trap efficentcey during the 2003 – 2004 run.

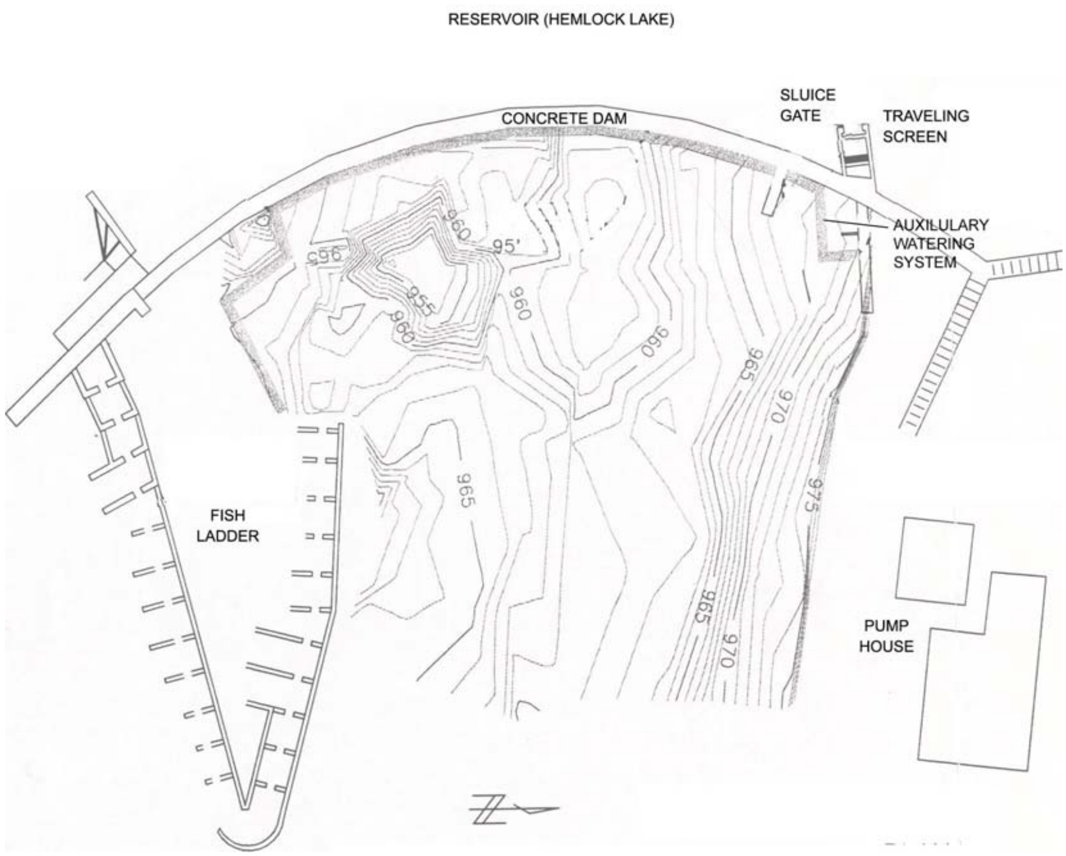


Figure 3-12. Plan view schematic drawing of Hemlock Dam, Skamania County, Washington.

The Wind River enters the Bonneville pool of the Columbia River at river mile (RM) 154. Bonneville dam inundated the alluvial fan at the mouth of the Wind River flooding 1.1 river miles in 1938. There are a series of stair-step waterfalls at RM 2 that total 45 feet in height. Historically, summer steelhead were the only anadromous fish species that could negotiate the falls. Winter steelhead, spring chinook, fall chinook, coho and chum salmon were relegated to the mouth and lower three river miles. In 1951 a fish ladder was installed to allow passage of salmon. Today, wild summer and winter run steelhead and hatchery spring chinook occur above the falls/fish ladder and occupy approximately 120 river miles of mainstem and tributary habitat. A fall run of chinook and a small run of coho thought to be composed of primarily strays and sea-run cutthroat occupy the reach below the falls.

Federally Listed Fish Species

Steelhead; Onchorychus mykiss

Status: Federal Threatened, Lower Columbia ESU, 3/98

Steelhead are rainbow trout that migrate to the ocean. There are two major genetic groups of *O. mykiss*, the inland and coastal groups, are presently recognized and are separated by the Cascade Mountains (Huzyk and Tsuyuki 1974, Allendorf 1975, Okazaki 1984, Parkinson 1984, Schreck et al. 1986, Reisenbichler et al. 1992). Both resident, inland and coastal anadromous *O.mykiss* life history types occur in British Columbia, Washington, and Oregon. Among anadromous populations, two major life-history types are found: 1) summer-run (summer steelhead), and 2) winter-run (winter steelhead). While both summer and winter run steelhead spawn in the late winter/early spring, these sub-populations are differentiated primarily by run timing, duration of spawning migration, and sexual maturity at the time of freshwater entry. Summer steelhead enter fresh water between May and October with immature gonads. After spending several months migrating and holding in fresh water, these fish mature and spawn in the spring. In contrast, winter steelhead enter fresh water between November and April, with well-developed gonads, and spawn shortly thereafter (Schreck et al. 1986). The demarcation between coastal and inland resident and anadromous forms in the Columbia River Basin occurs between the Hood River and Fifteenmile Creek in Oregon, and between the Klickitat River and Rock Creek in Washington (i.e., in the vicinity of the White Salmon River; Schreck et al. 1986).

Historic steelhead habitat is extremely variable as these fish are adept at migrating through steep gradient stream segments and over waterfalls of moderate height. Steelhead trout fry and parr can be found in very steep mountain stream habitat and in interior and coastal unconstrained valley streams.

Generally, steelhead remain in freshwater for one to three years and then emigrate to the ocean where they spend the next one to three years before returning to their natal stream. Steelhead trout are oviparous and can return to spawn more than once. Ocean migration is highly variable for steelhead trout, generally following the north and south migration strategies of coho salmon and Chinook salmon. Steelhead are less gregarious than salmon in their ocean phase and individuals can range as far as offshore of the Aleutian Island area.

Lower Columbia River Steelhead

In 1998 the National Marine Fisheries Service (NMFS) listed steelhead trout (*Onchorhynchus mykiss*) as a threatened species under the Endangered Species Act within the Lower Columbia River ESU (evolutionary significant unit, a "distinct" population of Pacific salmon).

The Lower Columbia River ESU encompasses all steelhead runs in tributaries between the Cowlitz and Wind Rivers on the Washington side of the Columbia River, and the Willamette and Hood Rivers on the Oregon side. The populations of steelhead that make up the Lower Columbia River ESU are distinguished from adjacent populations by genetic and habitat characteristics. The ESU consists of summer and winter coastal steelhead runs in the tributaries of the Columbia River as it cuts through the Cascades. These populations are genetically distinct from inland populations (east of the Cascades), as well as from steelhead populations in the upper Willamette River Basin and coastal runs north and south of the Columbia River mouth. The major runs in the ESU, for which there are estimates of run size, are the Cowlitz River winter runs, Toutle River winter runs, Kalama River winter and summer runs, Lewis River winter and summer runs, Washougal River winter and summer runs, Wind River summer runs, Clackamas River winter and summer runs, Sandy River winter and summer runs, and Hood River winter and summer runs.

Wind River Steelhead

The Wind River, enters the Columbia River at river mile 154. Bonneville dam inundated the alluvial fan at the mouth of the Wind River flooding 1.1 river miles in 1938. There are a series of stair-step waterfalls at RM 2 that total 45 feet in height. Historically, summer steelhead were the only anadromous fish species that could negotiate the falls. Winter steelhead, spring chinook, fall chinook, coho and chum salmon were relegated to the lower river. In 1951 a fish ladder was installed to allow passage of salmon. Today, wild summer and winter run steelhead and hatchery spring chinook occur above the falls/fish ladder and occupy approximately 120 river miles of main stem and tributary habitat. A fall run of chinook and a small run of coho thought to be composed of primarily strays and sea-run cutthroat occupy the reach below the falls.

Anadromous fish losses within the Wind River watershed have been attributed to adverse ocean conditions, construction of Bonneville Dam, timber harvest, road building and rural development (WDW et al. 1990). These activities in the upper watershed have severely impacted riparian areas and stream channels in several key steelhead sub-basins. This is evidenced by maximum water temperatures exceeding 24°C (75°F), risk of increased peak flows and increased sedimentation (USFS 1996). There is also concern about the ecological and genetic risks posed by the anadromous hatchery programs (NMFS 1996). Carson National Fish Hatchery was constructed in 1938 to mitigate for the construction of Bonneville Dam and currently produces 1.2 million spring chinook smolts. A fish ladder at Shipherd Falls was constructed to allow salmon access to the hatchery at river mile 18. Hatchery steelhead smolts were released in the basin from the 1960's until 1998 when WDFW stopped stocking due to the risk of hybridization.

Timber harvest, road building, and other land use activities within the Wind River watershed have reduced the quality and quantity of salmonid habitat in the subbasin. In 1992, the American Fisheries Society rated summer and winter steelhead at a moderate and high risk of extinction respectively, and they listed the Wind River sea-run cutthroat trout as extinct (Nehlsen 1991). In 1997 Washington Department of Fish & Wildlife (WDFW) rated the Wind River summer run steelhead as critical. Wind River steelhead were listed as threatened under the Endangered Species Act (ESA) on May 18th, 1998. Due to the status of this stock, the Wind River summer steelhead has the highest priority for restoration in the State of Washington's Lower Columbia Steelhead Conservation Initiative.

Most populations of salmonids that historically occupied the Wind River watershed are considered depressed (WDF et al. 1993). Because Shipherd Falls was a natural barrier to all anadromous fish except steelhead (Bryant 1949), summer steelhead were dominant and numerous above this barrier. USFWS (1951) estimated the summer steelhead run size was 3,250 with an escapement of 2,500 spawners. The current number of wild summer steelhead spawning in the Wind River subbasin was reduced to approximately 200 adults in late 1990's (Rawding 1997b). More recently, the 2003 and 2004 runs have rebounded to estimated runs of over 1,000 adults (Cochran 2003). A fall race of chinook that dominated the lower reach of the Wind River is depressed and primarily composed of stray hatchery fish (WDF et al 1993).

Trout Creek Steelhead

It is estimated that Trout Creek historically produced 350 to 700 adult steelhead or approximately 10-20% of total Wind River spawning (personal communication with Dan Rawding). The annual adult return to Trout Creek has declined from a high of 450 adults (range: 162-464) in the 1980's to less than 30 and below 10 adults in the early 1990's (WDFW Redd Surveys and Adult Trap Data, 1980-2004). In addition to the previously mentioned factors, steelhead declines within the Trout Creek watershed have been attributed to historic splash damming, the construction of Hemlock Dam, riparian timber harvest and in-stream large woody debris removal (USDA Wind River Watershed Analysis, 2001). Maximum water temperatures have exceeded 24°C (75°F) in the upper watershed and have reached temperatures >27°C (80°F) in the reservoir of Hemlock Dam. Timber harvest, road construction and removal of log jams and instream woody debris within the upper watershed (late 1940's through the early 1990's) increased the risk of peak flows and instigated severe bank erosion and sedimentation (USFS 1996). Rehabilitation efforts focused on restoring riparian areas, bank stability, stream shade, large wood and flood plain connectivity began in earnest in 1992.

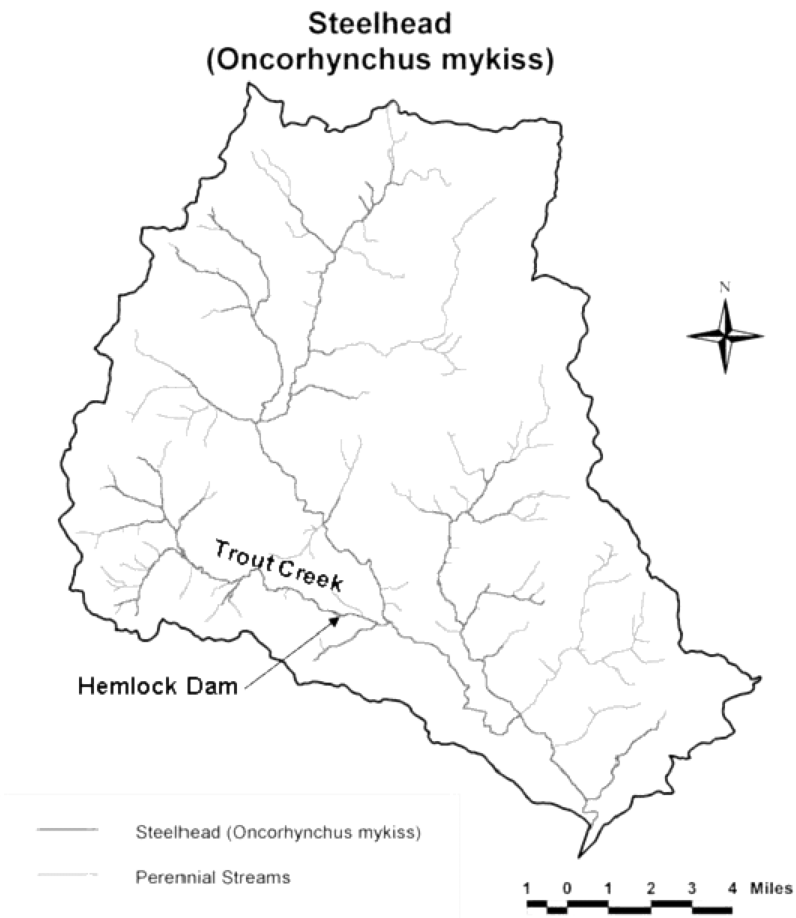


Figure 3-13. Steehead distribution for the Wind River watershed in relation to Trout Creek and Hemlock Dam, Skamania County , Washington.

Chinook salmon; Oncorhynchus tshawytscha

Status: Threatened, Lower Columbia ESU, 3/99

Natural spawning of spring chinook in the upper Wind River did not occur until passage facilities were built at Shipherd Falls in 1956. After passage was provided, a spring chinook run was established at the Carson National Fish Hatchery (CNFH), and natural spawning began in habitats above and below the hatchery. Most juvenile chinook have been found in the main-stem Wind River above the hatchery but occasionally in tributaries including Compass, Crater, Planting, Trout, and Trapper creeks. In two years of smolt trapping below one of primary spawning areas (above the CNFH) only four unclipped chinook smolts have been observed, which equates to approximately 16 naturally produced smolts. WDFW believes the majority of naturally spawning fish are hatchery strays, and that this population is not self-sustaining. Currently, spring chinook salmon in the Wind River are managed for hatchery production.

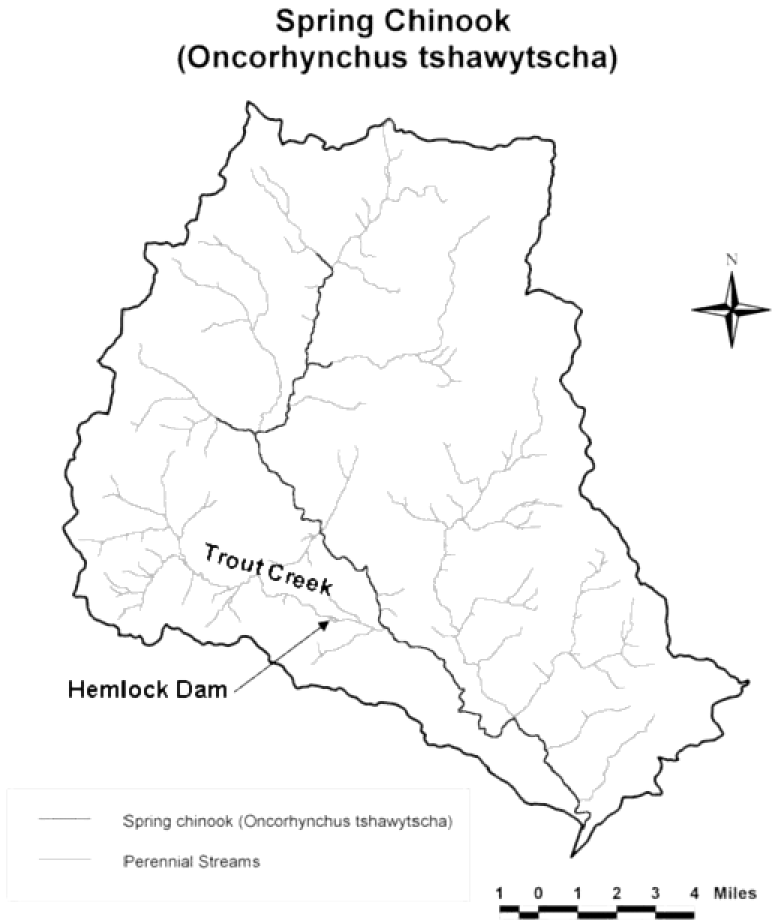


Figure 3-14. Hatchery Spring Chinook Salmon distribution for the Wind River watershed in relation to Trout Creek and Hemlock Dam, Skamania County , Washington.

Natural spawning of tule fall chinook in the Wind River occurs in the main-stem below Shipherd Falls. Spawning also may occur in the Little Wind River, but surveys have not been completed for this tributary. Completion of Bonneville Dam inundated the primary habitat in the lower Wind River. Naturally production is likely composed of naturally produced adults and hatchery strays. Naturally produced fry are observed each year in the lower Wind River smolt trap indicating that fall chinook are successfully spawning. Tule fall chinook in the Columbia Basin has primarily been managed for hatchery production. Bight fall chinook salmon originated from the Columbia River above McNary Dam. These fish have been reared at Bonneville and Little White Salmon hatcheries to mitigate for chinook salmon lost due to the construction and operation of mainstem Columbia River dams. Strays brights from these facilities have been observed in the Wind River and natural production of bright fall chinook occurs in the Wind River. Bright fall chinook salmon tend to spawn later than tule fall chinook and the abundance of bright fall chinook salmon has been enumerated since 1988 in the lower Wind River.

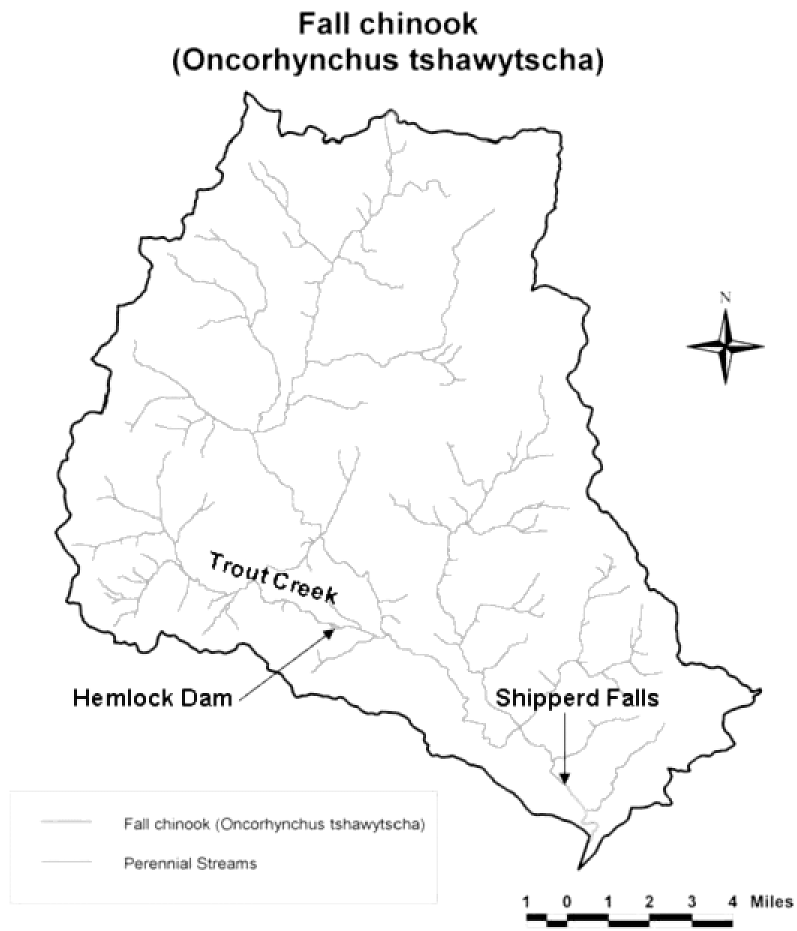


Figure 3-15. Lower Columbia River Fall Chinook Salmon distribution for the Wind River watershed in relation to Trout Creek and Hemlock Dam, Skamania County , Washington.

Bull Trout; Salvelinus confluentus

Status: Threatened, 1998

The status of bull trout in the Wind River is unknown. Bull trout have been observed in the lower river below Shipherd Falls and managers believe that it is likely that these fish are part of an adfluvial population, which uses the Bonneville Pool. WDFW initiated a bull trout-sampling project in the Columbia Gorge Province to more accurately determine the distribution of bull trout in the Wind River and other Washington tributaries. The objective of the project was to determine distribution, assess population status, and develop a recovery plan for these fish. No bull trout were observed within the Wind River watershed above or below Shiperd Falls.

Chum Salmon; Oncorhynchus keta

Threatened, Lower Columbia ESU, 3/99

The status of chum salmon within the Wind River is unknown. Historically, chum salmon were abundant in the lower reaches of the Columbia River, but currently are primarily limited to the tributaries downstream of Bonneville Dam. Known natural chum salmon production (less than a thousand annually) occurs in Grays River (Gorley Creek), Hamilton Creek (including Hamilton Springs), and Hardy Creek. Annually, a small number of chum are counted passing Bonneville Dam as well; nothing is known about the behavior of these fish.

Other Species

Coho; Oncorhynchus kisutch

Status: ESA candidate, Lower Columbia ESU, 7/95

The primary spawning grounds for coho were inundated by the Bonneville dam pool in 1938 yet a small spawning population of coho persists in the Wind River. WDFW believes that upstream adult coho distribution was limited to the area below Shipherd Falls. Although hatchery coho are not released in the basin, a few hatchery coho were observed at the Shipherd Falls adult trap in the fall of 1999 during the first year of adult trapping. Smolt trapping in the lower Wind River during the last five years has produced few wild coho smolts. This indicates that current natural production for coho is low and hatchery strays are a likely a source of any natural production.

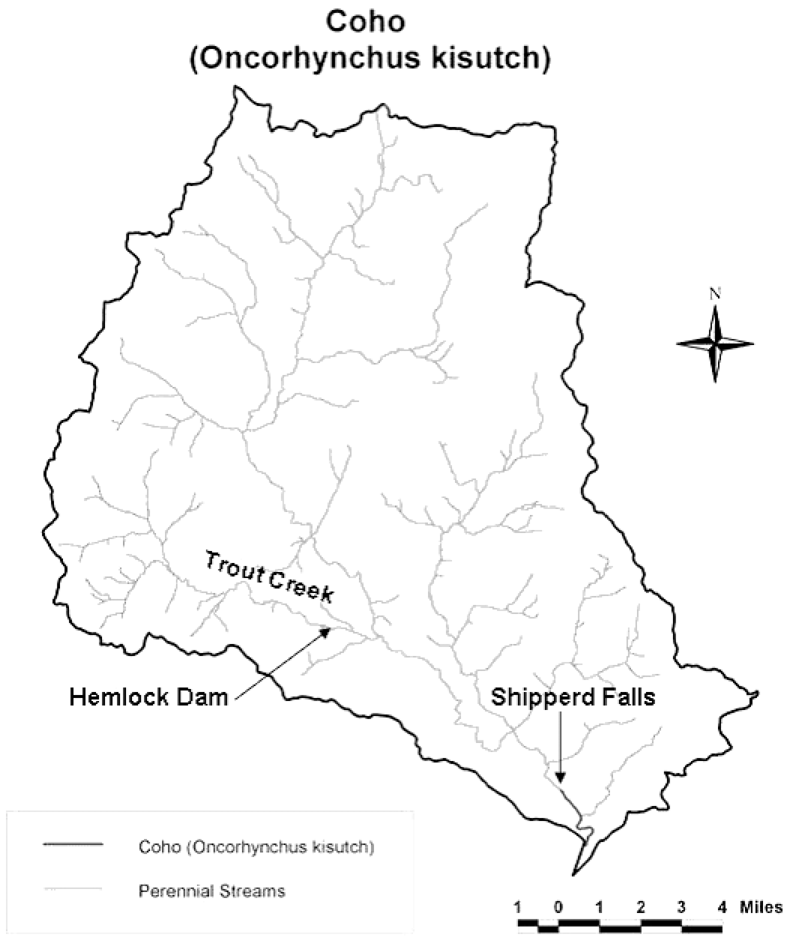


Figure 3-16. Lower Columbia River Coho Salmon distribution for the Wind River watershed in relation to Trout Creek and Hemlock Dam, Skamania County , Washington.

Coastal cutthroat trout; Oncorhynchus clarki clarki

Coastal cutthroat trout occur in the watershed, but the historic and recent distribution and status of this species are unknown. Historical distribution may have been limited to below Shipherd Falls, with the Little Wind River likely providing suitable habitat. Reports of cutthroat trout occurring above Shipherd Falls do exist, but they appear to be after hatchery cutthroat had been released into the watershed above Shipherd Falls. Hatchery cutthroat releases occurred at least as early as the 1930s, but were discontinued at least three decades ago. Personnel from USGS-CRRL have not observed any cutthroat trout during their extensive recent (1996-99) surveys in first and second order tributaries accessible to anadromous fish throughout the watershed above Shipherd Falls. WDFW personnel have observed three coastal cutthroat in five years of smolt out migration monitoring at the lower Wind River trap located below Shipherd Falls. Because of the limited information and the lack of sampling that specifically targeted cutthroat trout, the status of coastal cutthroat trout in the watershed is unknown, but, if present, the population number appears to be very low, the distribution appears to be very limited, and the sea-run form may be extirpated.

Life Histories of Steelhead in the Wind River Watershed

Immigration

The presence of dams results in some migrational delay (Raymond 1969, 1979), thereby influencing migration speed and timing of juvenile salmon and steelhead. Dams impede the safe passage of juvenile and adult salmon and steelhead. Some juvenile mortality is associated with all routes of passage at dams, with the highest mortality occurring through electric generator turbines (Whitney et al. 1997) and lowest direct mortality through spillways (NMFS 2000e). Hemlock Dam discontinued electric generation in the mid 1950's, therefore fish mortality associated with turbines has not been an issue since then.

In addition to altering or blocking the natural migration routes of fish, they degrade habitat downstream by cutting off the rivers natural sediment and wood supply and alter flow and temperature regimes to which native fish and biota have adapted. Upstream of the dams, reservoirs significantly alter flows, water temperature and sediment processes, flood historic riparian areas and wetlands, and often create habitat for exotic or introduced species.

Adult steelhead enter the Wind River watershed every month of the year, with the bulk of the run entering in the late spring and summer months. Steelhead enter Trout Creek in two distinctive time periods; March – June and September - November (see Figure 3-17).

Figure 3-17. Numbers of adult steelhead trapped by month at the Hemlock dam fish ladder 1992 – 2003, Skamania County, Washington.

The run timing of steelhead into Trout Creek appears to be dictated by water volume and/or water temperature (Figure 3-18).

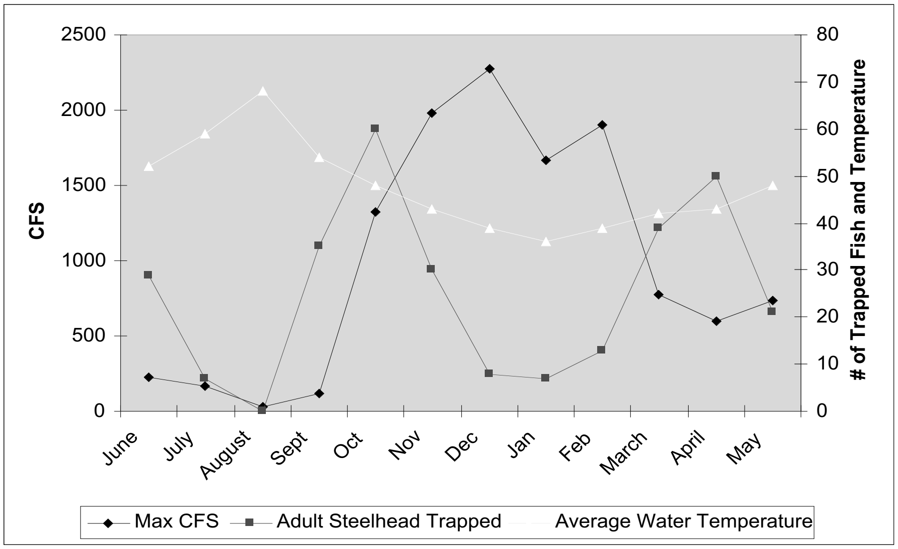


Figure 3-18. Number of adult steelhead trapped by month at the Hemlock dam fish vs. discharge in cubic feet per second (CFS) and average monthly water temperature in farehieght 1992 – 2003, Skamania County, Washington.

Fish trap

In the late 1970's a fish trap was installed to collect brood stock for an artificial production program. Eggs were taken from the adults, fertilized and raised at Skamania Hatchery. Fertilized eggs, fingerlings and parr were out planted throughout the watershed in the late 1970's and early 1980's.

Another adult steelhead trap was installed in the top of the Hemlock Dam fish ladder in 1992 to evaluate population status and prevent hatchery steelhead from entering the watershed and potentially hybridizing with wild fish. Recreational fisheries are often established in reservoirs above dams as an attempt to mitigate project effects and are often maintained by the stocking of non-natives fish species. It has been widely shown that hatchery fish can interbreed or hybridize with wild populations (Behnke 1992). Introgression has been documented between hatchery rainbow trout and the native rainbow trout of the upper Sacramento Basin (*Oncorhynchus mykiss stonei*; Behnke 1992). Such hatchery/wild introgression can dilute the native fish gene pool and reduce the genetic fitness of the population (Chilcote, 2002).

There is some evidence that steelhead may avoid the Hemlock Dam trapping operations. In 1994 trapping was discontinued due to suspected trap rejection. A new trap design was installed in 1995. Trap efficiencies were tested with hatchery steelhead and chinook in 1999. This evaluation showed that five of six fish captured in the trap were able escape within 48 hours. However the trap is typically checked two to three times per day during the peak run periods and escape from the trap was thought to be low. Modifications were made to a one-way gate and are thought to improve trap retention of adult steelhead (Rawding personal communication).

Emigration

Estimates of the direct survival rate of juvenile salmon and steelhead through bypass systems include mortality rates associated with water intake screens, gatewells, orifices, and sampling facilities such as fish traps and holding tanks. Although direct survival over spillways and through bypass systems are lower than through turbines, fish transiting spillways/bypasses often exhibit increased signs of stress (compared to control groups) as measured by blood chemistry, increased descaling, and possibly delayed mortality (NMFS 2000e). Estimates of direct mortality of juvenile salmon and steelhead passing through spillway/bypass systems of Federal hydroelectric dams on the Snake and lower Columbia rivers suggest that the direct mortality of wild yearling steelhead and chinook salmon is generally less than 1% (Martinson et al. 1997; Spurgeon et al. 1997; summarized in the 1998 FCRPS Supplemental Biological Opinion). However some level of physical stress or injury may occur during migration through the bypass and result in mortality later in the life cycle. Bypass survival may be indirectly affected by predation at outfall sites or by delayed mortality associated with injury or stress caused by passing through one or more bypass systems.

Whitney et al. (1997) reviewed 13 estimates of salmon and steelhead spill mortality published through 1995 (three for steelhead and 10 for salmon) and concluded that the most likely range in mortality for spill bays is 0% to 2%. However, the presence of local conditions such as back-eddies or other features that provide refuge for predators may lead to higher spillway passage mortality. Relative to other passage routes, direct juvenile survival is highest through spillbays (NMFS 2000e).

Muir et al. (1995, 1996, 1998) reported that mortality through bypass systems at Snake River dams ranged from 4.6% to 0.6% for yearling chinook and from 7.1% to 1.7% for steelhead. Estimated mortality was 4.7% for steelhead that passed through the entire bypass system at Little Goose Dam in 1997 (Muir et al. 1998). The Biological Effects Team and NMFS used the SIMPAS model to calculate juvenile passage mortality rates through the Columbia River dams. Mortality rates ranged from 10% to nearly 1% for yearling chinook, 12% to 2% for subyearling chinook, and 10% to 2% for steelhead migrants [NMFS (2000e), Marmorek et al. (1998), Ledgerwood et al. (1990), and Smith et al. (2000)].

Dam Influence on Predation

Dams and reservoirs can increase the incidence of predation over historical levels (Poe et al. 1994). Impoundments created by dams in the Columbia River basin increase the availability of microhabitats in the range preferred by northern pikeminnow and other predators (Faler et al. 1988, Beamesderfer 1992, Mesa and Olson 1993, Poe et al. 1994). Reservoirs and impoundments also can increase local water temperatures, which increases digestion and consumption rates of predators (Falter 1969, Steigenberger and Larkin 1974, Beyer et al. 1988, Vigg and Burley 1991, Vigg et al. 1991); decrease turbidity, which may increase predator efficiency (Gray and Rondorf 1986); favor exotic or introduced competitors, which could cause some predators to shift to a diet composed largely of juvenile salmonids (Poe et al. 1994); and increase stress and disease of juvenile salmonids, which could increase susceptibility to predation (Rieman et al. 1991, Gadomski et al. 1994, Mesa 1994). In addition, reduced river discharge and/or increased water residence time behind impoundments can affect the availability, distribution, timing, and aggregation of migrating salmonids, thereby increasing exposure time to predation (Raymond 1968, 1969, 1979, 1988; Park 1969, Van Hyning 1973, Bentley and Raymond 1976). In particular, dams can increase exposure time later in the season, when predator consumption rates are high (Beamesderfer et al. 1990, Rieman et al. 1991). Mortality rates of juvenile salmon and steelhead associated Columbia River Dams have been as high as 8% (NMFS 2000f).

Habitat

Sediment and Organic Regimes and Routing

When streams or watersheds are disturbed by fire, logging, dams or road construction, the quantity, composition and spatial distribution of the substrate can be altered. This shift in the sediment and organic composition can directly and indirectly affect aquatic organisms by altering water quality, incubation, larval development, and juvenile rearing habitat (WTFW, 1993).

The upper Trout Creek watershed "Trout Creek Flats" (river mile 6.5 to 9.0) was tractor logged in the late 1940's. Re-vegetation efforts after logging failed apparently due to compacted soils. In the late 1960's the majority flats area was "ripped" with heavy equipment to de-compact the soils and restore percolation (Personal Communication with John Forsberg, 2000). In the 1970's log jams were thought to be migration barriers to steelhead. Log jams and other wood was removed or "cleaned" from stream channels. The removal of LWD eliminated the natural water velocity modification and sediment storage that the stream needed to function properly. The removal of wood from within the channel instigated serious channel degradation. The channel degradation or "down-cutting" instigated severe bank erosion within Trout Creek Flats. The bank erosion within the upper watershed directly delivers coarse and fine sediment into the stream which is consquently transported and deposited behind Hemlock Dam. The cumulative effect of removing streamside vegetation in Trout Creek Flats and in-stream LWD have produced maximum water temperatures >24ϒC. Bank full channel width to depth ratios exceeded 60 on average with undisturbed reaches within the basin containing similar morphology possessed width to depth ratios of 25 on average. Stream shade was reduced to <27%, bank erosion rates were >40% and in-stream LWD levels were <40 pieces per river mile while undisturbed channels averaged 120 pieces per river mile within the watershed and loss of flood plains and side channel habitat.

Water temperature – effects to steelhead

Water temperature conditions have a complex array of effects on salmon and steelhead. Water temperatures directly affect the rate of embryonic development of eggs and emergence of fry (Weatherley and Gill 1995). Water temperatures have been shown to affect survival of migrating juvenile salmon (Connor et al. 1998, Smith et al. 1998, Muir et al. 1999). Water temperature effects juvenile migration timing and increases mortality of juvenile fall chinook in the Lower Granite Reservoir from mid-July through mid-September (NMFS 200x).

Adult salmon and steelhead can be delayed by excessively warm water temperatures (Karr et al. 1998). In addition, spawning is inhibited by temperatures above 61°F (16°C) and can also reduce the ability of adult fish to survive to spawning and vigor and fecundity during spawning (McCullough 1999).

Water temperature also indirectly affects steelhead and salmon survival by increasing the rates of disease infection and mortality. Several diseases are known to be directly related to temperature. The operation of storage reservoirs such as Hemlock Dam affects both the thermal characteristics of the river and the thermally regulated aspects of steelhead and salmon survival. Water temperature also negatively affects the physiological development in smolts. Zaugg and Wagner (1973) and Zaugg (1981) found that exposure of steelhead smolts to water temperatures greater than 12/C reduced ATPase activity and migratory behavior. Delayed migration of smolts caused by dams and exposure to increased in water temperature increases the rate of residualism for steelhead.

Lower Trout Creek & Wind River Habitat and Fisheries

Spawning habitat and Rearing habitat

Down stream spawing habitat and substrate within the inundated reach has been limited and altered by the estimated 192,000 cubic yards of sediment stored behind Hemlock Dam. Most of the reservoir bottom (>90 %) is covered with sediment too fine to serve for spawning substrate or aquatic invertebrate production. Downstream reaches of Trout Creek and the Wind River are being starved of gravels that are trapped in the reservoir.

After the completion of Bonneville in 1938 the alluvial fan and lower 2-3 miles of the Wind River were inundated and backwatered. The lower reach is believed to have been an extremely productive area for fall chinook, coho salmon, coastal cutthroat trout, winter steelhead and potentially bull trout, chum and pink salmon. A hatchery was established on the lower Wind River in 1902. Fall chinook eggs were taken from the Wind River stock and reared to supplement the commercial fisheries.

Since the inundation of the mouth and alluvial fan, chinook and coho have limited spawning gravel below Shiperd Falls. The mouth has begun to rebuild its alluvial fan, however development and dredging near the mouth has impeded the process.

Figure 3-19. 1902 photo of chinook taken at the mouth of the Wind River for the Wind River Fish Hatchery, Skamania County, Washington.

Figure 3-20. Aerial photograph of the mouth of the Wind River in 1930, before the construction of Bonneville Dam, Skamania County, Washington.

Figure 3-21. Aerial photograph of the mouth of the Wind River depicting the extent of backwater inundation of Bonneville Dam and loss of alluvial fan habitat, Skamania County, Washington.

Recreation

An Overview

The public has used the Hemlock Lake area for recreation purposes since the Civilian Conservation Corp (CCC) constructed the facilities shortly after dam construction was completed in 1936. Referred to as "Trout Creek" at that time, the CCC created a picnic and camping area on the north side of the lake for public use; and a separate day-use site on the south side of the lake for exclusive use by Forest Service employees and the CCC members. Today, only facilities on the north side of the lake exist. Now officially named the Hemlock Lake Day-Use Picnic Area, it is managed as a day-use site.

The 16-acre "lake" (impoundment behind the dam) was and continues to be the big attraction to this site. It is also an important recreation resource for Skamania County, being the only shallow, warm water swimming opportunity in the County. Though the management emphasis and recreational uses have evolved over time, it is important to understand the long-standing connection that the community has had with the lake to understand the impacts that future management options may have on the users

Evolution of Facilities and Services

1930-1940's

The CCCs constructed a picnic and camping area for public use on the north side of the lake at the existing day-use area that included a beach, a small boat launch area, a boat dock and swimming float (USDA 1986). A picnic and swimming area with a floating dock were maintained on the south side of the lake for exclusive use for the Forest Service employees and the CCCs. The existing Forest Service historic files do not contain complete records or photographs of these areas that clearly depict all of the facilities that were present in the early years. A "Project Work Budget and Inventory" from 1946 does list the "recreation improvements" present at that time and most likely represents the facilities present from the 1930s:

Table 3-8. Trout Creek 1946 Project Work Budget and Inventory

Item	Quantity
Road Surfaced	200 feet
Bulletin Board	1
Signs, small	2
Camp lots	5
Car Parking	10
Pipe	100 feet
Hydrants	1
Lakes, artificial	1
Toilets, pit	2
Garbage cans	1
Stoves, 1 party	5
Stoves, combination	5
Tables, family	10
Beach Improvement	1
Rafts	2
Dock	1
Bathhouse	1

From the list, one can deduce that there were five day-use picnic sites and five camping sites. The "stoves" most likely refer to rock fireplaces constructed by the CCC in the public area. During a 199x Forest Service archaeological excavation within the site, a rock base of a stone fireplace was "discovered".

1950's – 1960s

In an effort to provide additional recreational facilities for the Stabler community youth in the 1950s, the "Youth Benefit Society", the Skamania County Road Department, the local school district, and local residents combined efforts to make improvements to the day-use facilities at Hemlock Lake in the vicinity of the "frog pond" (Misner, 2004). The lake was drained, sediment removed, and sand hauled in for a beach. Other improvements included new picnic tables, a changing house, flush toilets, a lifeguard tower, floating dock, diving board, sunning platform and a beach. An area was roped off and designated as a controlled swimming area with a life guard present daily.During this time?? an agreement was made between the Forest Service, the school district and the local citizens group (Youth Benefit Society??) for the latter two entities to manage the facilties.(I need to talk to Marilyn.) This arrangement continued through the mid 1960s. After management reverted back to the Forest Service, the area was closed to overnight camping.

1980's

In 1981, the county-funded lifeguard service was discontinued due to the increase in lake sediment in the swimming area and the decline of available funds; the floating dock, diving board and lifeguard tower were removed at that time. In 1986,the bath house and diving board platform were removed from the shoreline (USDA 1986), The picnic area was extended and 10 additional picnic sites were added; these were later removed.

1990's to Present

The latest improvements to the picnic area were made in 1994 through a grant from the IAC (Interagency Committee for Outdoor Recreation) with an emphasis on providing barrier-free recreation opportunities. Two barrier-free viewing decks were constructed along the lake. A shoreline barrier-free trail was built along the entire length of the day-use area and the eroding sections of the shoreline were stabilized; new sand was added at the beach. The old toilet building was removed and new water lines and new flush toilet facilities were constructed; new barrier-free tables and table pads and fire stands were installed; a picnic shelter, with power, was constructed along with a barrier-free boat landing area and boat ramp.

Evolution of Use and Users

Initially, the residents of Stabler were the primary day-use visitors; residents from the communities of Carson and Stevenson were primary users of the camp sites; there were few non-local visitors. In the 1960's local businesses held potluck picnics at the lake on Sundays throughout the summer. In the early 1980s the County Parks Department used the area for summer youth outings and bussed the children to the area for a supervised outing twice a week during the summer. The Girl Scout camp at Wind Mountain used the lake for canoeing classes during the 1980s and 1990s.

The State stocked the lake with trout each spring beginning in the 1950s for the June 1 opening day of fishing and continued this practice through the mid 1994, when the area was closed to fishing because of impacts to the threatened steelhead population in Trout Creek. In the late 1980s and early 1990s the Forest Service held its annual fishing derby at the lake.

(include a picture)

Today, the area continues to be a very popular day-use area for local residents (including Stevenson, Washington) as well as for an increasing number of non-local residents from the west end of Skamania County— Skamania, North Bonneville, Camas and Washougal and beyond. In addition, the area has experienced an increase in use from visitors camping at nearby Forest Service campgrounds who bring their families to Hemlock Lake to swim for the day; and on Sundays, campers will leave the campgrounds in the morning and spend the afternoon at the lake before heading home. High use by American Indians in July and August during huckleberry harvesting in the Mowich Butte area of the Mt. Adams Ranger District has also been observed; families will stop in route at Hemlock to get drinking water and to swim. Collectively, non-local visitors now comprise close to an estimated one half of the total users of the area (Linde 2004).

Evolution of the Lake

Three key inter-related factors influence the lake conditions for swimming and boating: the use of wooden flash boards adjusted seasonally to raise and lower the depth of the lake water; the amount and location of sediment deposition; and water temperature. The bottom line is that the lake conditions are dynamic, changing from year to year, affecting the recreational experiences associated with the lake.

Flashboards

The flashboards are manually installed to raise the water level for recreation activities during the summer months. (This is the one of two methods that the Forest Service has direct control over to regulate water levels, the second the "cleanout gate" at the bottom of the dam.). Use of the boards increases the depth of the water by approximately four feet. The boards are typically installed prior to the Memorial Day weekend and remain in place until Labor Day. . Though there is water leakage through cracks between the boards, the water level typically remains near the top of the boards. The actual depth of the water depends on the depth and location of the sediment.

Sediment Deposition

The sediment deposits in the lake fluctuate from year-to-year depending on winter stream flows. Changes may occur annually, affecting the conditions for recreation, particularly the formation of "islands", and localized water depth. The Forest Service lacks documentation on the extent to whether and how sediment may have affected the use and quality of the lake-related experiences during the first 20 years following dam construction. Photographs taken during this time do show changes in the size and location of the islands. *(include photos?)* Correspondence received through scoping for this Statement (Misner 2004) is the first indication that the *quality* of the swimming area had been affected as early as the 1950s, when actions were taken to improve the area.

The 1986 USDA report, *Hemlock Lake Sedimentation Analysis,* noted that the high level of sediment in the lake was likely due to the extensive logging that occurred upstream in Trout Creek to salvage timber blown down during the 1962 Columbus Day storm. As an example of how the sediment affected the lake at that time, it cites an incidence in the fall of 1969 when the reservoir was inadvertently drained. A large amount of sediment was flushed out and down Trout Creek; by the following spring, the desilted area had filled in.

The same report sites a 1977 study that was done to determine the depth of the sediment in the lake. The water was deepest at the bridge—about seven feet— but this area also had the deepest sediment deposit. The average depth of the sediment was estimated to be five feet in the six acres of lake surveyed. By 1986, it was estimated that the water depth at the bridge was about four to five feet and that the sediment depth had increased several feet since the 1977 study. In 2004, it was approximate 6 feet just east of the bridge.

The objective of the 1986 USDA report was to evaluate options for removing sediment from Hemlock Lake to enhance swimming opportunities. It concluded that benefits from sediment removal would be short-term for the six options considered; that the cleared areas would fill in during peak stream flow; and that the probably was high that that would happen within the first year after removal. It recommended that only the "swimming area" be cleared (east of the picnic site). This was not done. The 'swimming area" is mostly used now by teens who jump off of the adjacent viewing platform.

In 2004, the lake area immediately adjacent to the picnic area was 6 feet in depth, an increase of approximately 2 feet from the previous year.

Water Temperature

The water temperature of the lake is affected, in part, by the depth of the water, which in summer is affected by the depth and location of the sediment. Comments from local citizens who swam in the lake in the 1940s and 1950s state that the water was "very cold". Today, the lake is commonly noted for its shallow, warm water conditions. Forest Service records lack temperature data from the earlier years to compare to today's conditions to know what the real changes have been over time.

The District's Most Used and Most Highly Developed Site

Besides being the only shallow, warm water lake attractive for swimming, the Hemlock Day Use Picnic Area is now the most developed site on the Mt. Adams Ranger District. Only one other facility on the District —Beaver Campground—has flush toilets. Hemlock is also the only highly-develop site on the District that currently does not charge a daily use fee/vehicle (Northwest Forest Pass or Washington &Oregon Recreation Pass), even though it provides the greatest number of amenities and the day-to-day costs to manage the site are among the highest on the District. The estimated annual cost to maintain and operate the site, include law enforcement, is approximately $8,200.

For comparison, Goose Lake, another popular site on the District for fishing and boating, requires a pass to park at the site; the only "notable" improvement there for day-use is a vault toilet. The Goose Lake toilets are cleaned an average of once/day and garbage is picked up once/week. At Hemlock, the weekend use alone generally requires cleaning the toilets twice/day and three daily garbage runs; it is not uncommon to fill a dumpster each weekend. Minor law enforcement issues occur there almost daily.

Patterns of Site-Use

Use of the site typically begins in late spring when locals picnic at the site—the water is typically too cold to swim in at that time of year. As the season progresses, one can expect to see heavy use of the area on any given warm summer day. The grassy area by the beach and picnic shelter draws families with children and extended family groups. This area experiences a very large turnover of users on most days; double to triple turnovers are not uncommon. The area up-stream from the picnic area tends to draw drop-ins and short-term users without children, though it does receive use by families when the lower area is crowded.

The large deck, originally built as a barrier-free fishing deck, is now a gathering spot used primarily by teens and young adults who like to jump off the deck into the lake. It is not uncommon for groups as large as 40 to congregate on the deck. Use tends to be highest in the late afternoon and evenings. This area is the primary spot where law enforcement issues arise; drugs and alcohol use by minors are the biggest issues.

The users of these three distinct areas seldom mix into the other areas. Overall use is dependent on weather conditions. Typically, visitor use at the picnic area starts around 9 AM and is occupied until closing; use of the upper area begins around noon and is used until 6PM; use of the large deck area starts around noon and is occupied until closing. Official closing is 10PM but seldom enforced. The area overall experiences few law enforcement issues; dogs off leash and minors-in-possession of alcohol are the two most common problems.

Sense Of Place/Place Attachment

In recent times, land managers have begun to recognize the importance of identifying and acknowledging connections between forest visitors and specific places in the forests when making land management decisions. A plethora of research papers, particularly within the past 10-15 years, have focused on describing and analyzing these connections, utilizing terms and concepts such as "place attachment", "place bonding", and " sense of place", though there is no standardized formula or methodology. These concepts provide an appropriate way to articulate the impacts that dam removal and the alternatives, including No Action, would have on different communities and groups. Explanations and applications of how social scientists and the research community define and apply these concepts are provided below:

USDA, PNW-GTR-462, 1999.

> Sense of place refers to the perception people have of a physical area with which they interact, whether for a new minutes or a lifetime, that gives that area special meaning to them, their community, or their culture.
>
> Sense of place is a combination of elements, that according to cultural geographer Ryden (1993), includes four essential qualities: personal memory, community history, physical landscape appearance, and emotional attachment.
>
> Place definitions often differ from individual to individual and from family to family. One location often becomes "several places." …Yet there are broad experiential patterns expressed in a collective sense by the members of a community. Thus people frequently share a communal interpretation of place.
>
> Two different way of perceiving a place exist: one obtained from their personal experiences and the other a shared perception with other people in their community, business, family or group.
>
> Places are almost always multi-faceted, serving as several places for several different people or communities, often with different meaning to each.

USDA GTR 184, Schroeder 1996

> Tuan (1974) defines sense of place as 'an emotional or affective bond between an individual and a particular place' which 'may vary in intensity from immediate sensory delight to long-lasting and deeply rooted attachment.' People may hold strong personal attachments to specific places, which over time have become unique and irreplaceable to them (Mitchell et al. 1993, Williams et al. 1992).

Williams and Stewart, 1998.

> Sense of place, for most people, refers to the rich and varied meanings of places and emphasizes people's tendency to form strong emotional bonds with places"

> A sense of place that at one time may have been largely shaped and maintained by community insiders is now increasingly subject to more distant market and political forces.
>
> As they develop their own sense of place, the newcomers may become strongly attached to the natural landscape of an area without being socially and historically rooted in the place or community (McCool and Martin 1994).
>
> People become attached to particular places for a variety of reasons. People and groups can be attached to the same place but for different reasons.
>
> Competing senses of a place can be invoked by diverse and conflicting groups—local commodity interests seeking to maintain a way of life, environmentalists embracing Leopold's land ethic, Native Americans focusing on the spiritual or transcendent qualities inherent in a place, recreation and wilderness enthusiasts voicing concerns about new or nonconforming uses, and heritage preservationists trying to maintain landscape character: Those various sentiments are all legitimate, real and strongly felt and an important source of political conflict. Competing place meanings should not be dismissed because they do not conform to some expert's technical sense of place.

(Eisenhauer, Krannich and Blahna 2000).

> Emotional attachments to place represent a unique sense of place, one that involves unusually strong sentiments about places and heightened concerns about their management. Emotional attachments to place are a type of sense of place that is based on an appreciation for the land that goes beyond its use value.
>
> "..geographic boundaries segmenting that natural world are of special concern for land managers and sense-of-place studies, because geographic proximity of a locale may affect the meanings and bonds associated with places (Brandenburg and Carroll 1995)"
>
> Emotional attachments to special places are most often based on leisure time pursuits but are not substitutable based solely on the nature of these activities. Specific environmental features and a history of significant social interactions are the primary reasons underlying emotional attachments with special places. In addition, convenience/ownership of a place is also an important reason why places are regarded as special.

Cultural Resources

In compliance with Section 106 of the National Historic Preservation Act, a heritage resource survey of the proposed project was completed in 2001. A number of heritage resources were identified within the project area. These include the Trout Creek Dam and Fish Ladder, the Trout Creek Archaeological Site, and the Wind River Administrative Site Historic District.

The Trout Creek Dam (also known as Hemlock Dam) and Fish Ladder were constructed between 1935 and 1936 by enrollees of Civilian Conservation Corps (CCC) Company 944, stationed at Camp Hemlock. These structures have been determined eligible to the National Register of Historic Places, based on their association with the federal government's response to the Great Depression.

The Trout Creek site (45SA222) is a multi-component archaeological site which extends for approximately 400 meters along the north bank of Trout Creek at the Wind River Work Center administrative complex. It contains both prehistoric and historic components. The Wind River Lumber Company operated a logging camp at the site as early as 1903, and built the first dam across Trout Creek, a log splash dam. Timber was harvested in the area, and logs were skidded to the pond behind the splash dam. Historic components within the current project area include remains of their lumber camp, which was occupied between 1903 and 1910, along with remains of early Forest Service use (ca. 1906 to the present). A large Civilian Conservation Corps camp was located at the site between 1933 and the early 1940's. Hemlock Lake Picnic Area has been developed and utilized for recreational purposes since 1936.

The Wind River Administrative Site Historic District occupies the south bank of Trout Creek within the project area, and includes six pre-Depression-era structures, eighteen Depression-era structures, three historic landscapes, and the historic archaeological remains of numerous structures. The site has served as a Ranger District headquarters since 1906. The Wind River Nursery began operations at the site in 1909, developing previously logged-over areas as nursery fields. The Wind River Experiment Station and arboretum developed at the site beginning in 1912.

Prehistoric Use

The Trout Creek site most likely functioned as a seasonal base camp for people as they were traveling to upland locations to harvest available resources. Its location at a natural constriction along an anadromous stream indicates that the fish resource was likely an important one for the people who camped there. The site occupies an area of 16 acres. Artifacts have been recovered from the surface to a depth of 120 cm. Historic components of the site were built on top of prehistoric components, and analysis of stratigraphy indicates considerable disturbance throughout the site.

Historic Period Use

Historic Euro-American use of the site began in 1898, when Bernard Erikson filed a homestead claim for 160 acres on the north bank of Trout Creek, a parcel which included the present site of the Wind River Work Center. It is likely that Mr. Erikson filed the claim with timber speculation in mind, since by 1901, prior to issuance of a patent, he sold the entire 160 acres to the Storey and Keeler Lumber Company. This company, which had incorporated in LaCrosse, Wisconsin in 1899, had been buying out settler's claims in the Wind River valley since May of 1900. Since Mr. Erickson himself was from LaCrosse, it is likely that he served as one of several "dummy" entryman sent from Wisconsin by the Storey and Keeler Lumber Company to claim timber land under the homestead laws.

In January of 1902 the Storey and Keeler Lumber Company changed its name to the Wind River Lumber Company. Through the purchase of homestead claims, they owned most non-federal land in the upper Wind River valley. Their subsidiary corporation, the Skamania Boom Company, had acquired a state charter in 1901 permitting the artificial flooding of the Wind River and its tributaries for the purpose of transporting logs (Tolfree 1984:4). The Wind River Lumber Company controlled the means of transporting timber, giving it a virtual monopoly on harvest of lands in the Wind River drainage.

The only way to feasibly transport logs from the upper Wind River valley in the early 1900's was to float them down the river, and this was accomplished through the use of large splash dams. Splash dams were constructed on the Wind River, Trout Creek and Panther Creek between 1901 and 1903. The splash dam on Trout Creek was built within the project area, immediately upstream of the present concrete dam and bridge. These splash dams were substantial hewn log structures, featuring flood gates which were operated by a windlass. The logs were contained in ponds behind the dams and released as water rushed through the floodgates. Release of the water behind the dams was coordinated in order to provide sufficient volume of water to flush logs to the Columbia, where they were then rafted to the Company's mill at Cascade Locks.

In 1903 the Wind River Lumber Company built logging Camp 3 at the site of the splash dam on Trout Creek. Company land in the vicinity of Camp 3 (the site of the present Wind River Work Center) was logged between 1903 and 1905. At least a portion of this area had burned in the Yacolt Fire of 1902

At the time that Camp 3 was built, the land on the south side of Trout Creek in the vicinity of the project area was under the jurisdiction of the Mount Rainier Forest Reserve. The Ranger in charge at that time was Elias J. Wigal. In 1907 Wigal constructed a Ranger Station cabin on the south side of Trout Creek, near the Wind River Lumber Company's splash dam, directly across the creek from Camp 3. This would place it near the southern approach to the present concrete bridge. This one-room cabin, sided with cedar shakes, was the first ranger station constructed on the Mount Rainier Forest Reserve. The area was designated the Hemlock Ranger Station, due to the large number of hemlock trees in the vicinity. The site was chosen to enable Wigal to effectively administer the first federal timber sale sold to the Wind River Lumber Company in 1906.

The Wind River sale of May 10, 1906 (referred to as the May Timber Sale) was one of the first large commercial timber sales on Forest Reserve lands in the Pacific Northwest. It involved an area of 280 acres, from which 14.6 MMBF of timber was cut. This sale included the land on the south side of Trout Creek within the present project area. The total value of the timber sale was $12,921. This low value was attributed to the fact that the sale included a portion of the Yacolt burn of 1902, and the fire-killed timber had deteriorated to a marked degree. A second sale was sold to the company on November 21, 1906 (referred to as the November Timber Sale), estimated at 23 MMBF. This included a parcel at the far upstream end of the log pond on Trout Creek.

In the period between 1903 and 1912, Camp 3 contained at least eleven buildings, including an office, three bunkhouses, a barn, blacksmith shop, filing shed and a cookhouse/dining hall. Early photographs provide information on the layout of the camp and the architecture of the buildings. The company office, barn, and two buildings identified from photographs as bunkhouses were of log construction with shake covered gable roofs. The cookhouse/dining hall was of frame construction with exterior walls of vertical boards and a gable roof covered with shakes. A third large bunkhouse was also of frame construction. The cookhouse and at least one of the bunkhouses were situated within the immediate project area.

Camp 3 served as the base for both the May and November timber sales, and between the years of 1903 and 1910 served as home for crews of up to 50 men between the months of April through November. Due to their isolation, these logging camps were self-sufficient, and resembled small settlements. A number of sources were consulted for information on the people who occupied Camp 3, and the 1910 census provided a number of details. There were 34 people living at Camp 3 in April of 1910, occupying seven buildings. Occupations included logger (7), saw filer (1), hook tender (4), bucker (5), sniper (2), chaser (2), rigging rustler (1), donkey engine fireman (4), stationary engineer (1), donkey engine engineer (1), watchman (1), bookkeeper (1), blacksmith (1), teamster (1), cook (1) and waitress (1). The cook and waitress were the only women present. Fourteen of the residents were foreign-born. Two of the loggers spoke only Norwegian. Seven of those born in the United States were from Wisconsin. Only one man was from the local Carson area (he was also the only person from the state of Washington). Ages ranged from 18 to 47. These demographics emphasize the point that the majority of people working for large timber companies in Oregon and Washington at the turn of the century did not necessarily integrate into local communities. These companies, many of which were from the Midwest, often brought their workers with them, moving them from job to job.

Ranger Wigal constructed a second Ranger Station cabin at Hemlock between 1908 and 1909, next to the first one. It was two stories high and built entirely of hewn cedar logs. The sides were covered with split and shaved shingles. This building was situated along the edge of Trout Creek, at what is now the southern approach to the concrete bridge. The cabin built in 1907 was then being used as a tool house, and also as an extra bunkhouse for loggers working for the Wind River Lumber Company. Since the only access to Hemlock Ranger Station was across the Wind River Lumber Company's splash dam, Ranger Wigal constructed a log bridge across the top of the dam in 1910. These two cabins were the only Forest Service structures on the south side of the creek until 1911, and it is apparent from examination of ranger diaries and internal memos that the Wind River Lumber Company's barn, cookhouse, blacksmith shop, filing shed and root cellar at Camp 3 were being used jointly by the lumber company and the Forest Service.

The Wind River Lumber Company shifted its operation further north by June of 1910, and abandoned Camp 3. They continued to use their splash dam on Trout Creek to provide additional water to flush logs down the Wind River, however. Between the years of 1910 and 1912, the Forest Service used buildings at Camp 3, in particular the cookhouse and barn (where they kept their animals and stored their hay). They hired a cook in May of 1910, but this person cooked in the Wind River Lumber Company cookhouse. In 1912 they were still using the company's bunkhouses to accommodate shipping and transplanting crews at the newly established nursery. By 1913 the Forest Service finally constructed its own barn and messhouse on the south side of Trout Creek, and it is likely that Camp 3 was truly abandoned. By 1919 the majority of buildings at Camp 3 were gone. The only structure remaining on the north side of the creek in the 1920's was the log office building, which the Forest Service used as a bunkhouse (even though it was on Wind River Lumber Company land).

In 1923 the Forest Service converted the Wind River Lumber Company's splash dam to hydroelectric use, and a power house was built on the north side of Trout Creek, downstream from the splash dam. The power plant was built on what was then Wind River Lumber Company land. The Forest Service operated the hydroelectric plant and the dam under a long-term lease with the Company. In 1924, all Ranger District buildings were wired for light from the Trout Creek hydroelectric plant.

The Wind River Lumber Company began to struggle financially in the 1920's, and a 1925 forest fire south of Falls Creek, probably started by sparks from one of the company's donkey engines, ultimately led to the company's bankruptcy. Mortgage foreclosure led to the sale of all company lands in 1926, and in 1929 the Forest Service purchased the parcel containing the former site of Camp 3 and the splash dam (the current Wind River Work Center). The desire to acquire the bridge and the hydroelectric plant were the primary catalysts for the purchase.

As a response to the economic hardships of the Great Depression, president Franklin D. Roosevelt created the Civilian Conservation Corps in 1933. Company 944, organized at Fort Lewis, Washington, arrived at Hemlock in May of 1933, and began construction of a 200-person CCC camp near the former site of Wind River Lumber Company's Camp 3. With the construction of Camp Hemlock, the stress on the power plant had increased to the point where it was clearly inadequate. A new power house was constructed on Trout Creek in 1934. Since the Wind River Lumber Company's splash dam was also in poor condition following a flood, the decision was made to replace it with a concrete dam.

The dam and fish ladder on Trout Creek was the single biggest construction project undertaken by the CCC at Camp Hemlock. Built between 1935 and 1936, the dam is a concrete arch dam 183 feet across, with a 112 foot-wide spillway. The height of the dam is 26 feet to the crest of the spillway, and 32 feet to the tops of the abutments. A total of 440 cubic yards of concrete was used in its construction. It is one of the few CCC-era dams still serving a functional existence in a relatively unmodified state (Horn 1983). Photos taken during dam construction show cement being hauled in wheelbarrows by CCC enrollees, as well as a three-yard cement mixer, purchased for the project, set in various locations on platforms with the cement being transported to forms by means of a chute.

A weir and stall-type concrete fish ladder, 155 feet long, was completed in 1936 along the south bank of the creek. The dam and fish ladder embody the utilitarian design characteristic of CCC architecture, in that they were intended to blend with the surrounding landscape. The use of native bedrock as part of the wall of the fish ladder is an example of this design. After the dam and fish ladder were completed, the CCC constructed a three-hinged wooden arch bridge across the creek, to replace the Wind River Lumber Company's log bridge. This 1936 bridge was replaced by a concrete bridge built in approximately the same location in 1975.

Aside from generating electricity for the compound, the dam provided recreational opportunities in Hemlock Lake. In 1936 the CCC began development of a picnic area along the north shore of Hemlock Lake, which included a boat launch, boat dock, swimming float, and picnic and beach facilities.

In 1940 the D.C. generator at the power plant was replaced by an A.C. generator, capable of supplying electricity to the entire compound at Wind River. By the 1950's, however, Bonneville Power Administration began supplying electricity to the administrative site, and the power plant was shut down and eventually removed. A new intake and screening system for irrigation was completed on the dam in 1954, utilizing the outlet that formerly supplied the powerhouse with water. A pumphouse was installed below the dam in 1958, providing water to irrigate newly-developed nursery fields.

Historic components of the Trout Creek site were built on top of prehistoric deposits, resulting in considerable disturbance. During the period of splash dam logging in the area, large diameter logs were skidded across what is now the picnic area into the pond behind the splash dam. It is estimated that up to 15% of the area within the boundaries of the Trout Creek site was cleared and graded during construction of CCC Camp Hemlock in 1933. Construction of the Trout Creek Dam and bridge, and of the subsequent concrete bridge in 1975, undoubtedly disturbed portions of the site, in particular the remains of Wind River Lumber Company's cookhouse/dining hall, which was situated immediately above the present dam. Forest Service use of the site for nursery development and general administration began in the 1950's, and this included building construction, drainfield installation, installation of buried fuel tanks, field clearing and leveling, and cultivation. At a minimum, there are 2,600 linear meters of buried water, sewer, and phone lines in current use within the boundaries of the Trout Creek site. During the past ten years, three projects were undertaken within the site's boundaries which were determined to have an adverse effect on the site, including picnic area development in 1995, removal of modular buildings and walkway installation in 1995, and a legislated land conveyance, which included a portion of the Trout Creek site, in 1999.

The dam and fish ladder was modified in 1995, with the addition of a concrete wall extending out from the downstream end of the fishway, towards the face of the dam. The lowest weir of the fish ladder had its weir wall replaced with a wall and slot. A waterline was installed to transport water to the base of the fish ladder. This consisted of an 24" polyethylene pipe, originating at the concrete enclosure for the traveling screen. A 26" diameter hole was drilled in the enclosure wall downstream of the screen, and the waterline was attached to the upstream face of the dam. Another 26" diameter hole was drilled near the south end of the dam, and the waterline was taken through the dam at this point, where it can spill out over the end of the fishway. The traveling screen was also modified. These modifications were determined to have an effect on the dam and fish ladder that was not adverse.

Wildlife

Wildlife Habitat and Species

Habitat surrounding the Hemlock Lake includes residential buildings and yards, old nursery fields currently covered with herbaceous plant species, deciduous riparian stands adjacent to the lake and Trout Creek, second-growth conifer stands that are approximately 90 years old, and old-growth conifer stands that are about 300 years old. There are over 260 fish and wildlife species that are federally listed or state listed as threatened, endangered, or sensitive, or species of concern in Washington. Table 3-9 lists species that are known to occur or have potential to occur within or adjacent to the project area. Federally listed species that are not included in Table 3-9 are not present in the project area based on unsuitable habitat or the project area is clearly outside the recognized range of the species.

Table 3-9. Threatened, endangered, proposed, and sensitive species that have potential to occur within or adjacent to the project area.

Species Name	Species Status	Habitat Present?	Species Present?
Mammals			
Gray Wolf *Canis lupus*	T	No	No
Grizzly Bear *Ursus arctos*	T	No	No
Canada Lynx *Lynx canadensis*	T	No	No
Pacific Fisher *Martes pennanti pacifica*	C	No	No
California Wolverine *Gulo gulo*	S	No	No
Western Gray Squirrel *Sciurius griseus*	S	No	No
Townsend's Big-eared Bat *Corynorhinus townsendii*	S	Potential	No
Birds			
Bald Eagle *Haliaeetus leucocephalus*	T	Yes	No
Northern Spotted Owl *Strix occidentalis caurina*	T	Yes	Yes
Critical Habitat for the Northern Spotted Owl	D	Yes	Yes
Great Gray Owl *Strix nebulosa*	S *	No	No
Marbled Murrelet *Brachyramphus marmoratus*	T	No	No
Critical Habitat for the Marbled Murrelet	D	No	No
Common Loon *Gavia immer*	S	No	No
Ferruginous Hawk *Buteo regalis*	S	No	No
American Peregrine Falcon *Falco peregrinus anatum*	S	No	No
Green-tailed Towhee *Pipilo chlorurus*	S	No	No
Reptiles			
Northwestern Pond Turtle *Clemmys marmorata marmorata*	S	No	No
Striped Whipsnake *Masticophis taeniatus*	S	No	No
California Mountain Kingsnake *Lampropeltis zonata*	S	No	No
Amphibians			
Oregon Spotted Frog *Rana pretiosa*	C	No	No
Larch Mountain Salamander *Plethodon larselli*	S *	Potential	No
VanDyke's Salamander *Plethodon vandykei*	S *	Potential	No
Cope's Giant Salamander *Dicampton copei*	S	No	No
Cascade Torrent Salamander *Rhyacotriton cascadae*	S	Potential	No
Butterflies			
Mardon Skipper *Polites mardon*	C	No	No
Mollusks			

Species Name	Species Status	Habitat Present?	Species Present?
Puget Oregonian *Cryptomastix devia*	S *	Potential	No
Burrington's Jumping Slug *Hemphillia burringtoni*	S *	Potential	No
Warty Jumping Slug *Hemphillia glandulosa*	S *	Potential	No
Malone's Jumping Slug *Hemphillia malonei*	S *	Potential	No
Panther Jumping Slug *Hemphillia pantherina*	S *	Potential	No
Columbia Duskysnail *Lyogyrus n. sp. 1* *(Amnicola sp. 4 - G2)*	S *	No	No
Blue-gray Taildropper *Prophysaon coeruleum*	S *	Potential	No
Dalles Sideband *Monadenia fidelis minor*	S *	Potential	No

T = Threatened
C = Candidate for federal listing
D = Designated habitat
S = Sensitive
S * = Sensitive, former Survey and Manage species

Habitat in the vicinity of Hemlock Lake is unsuitable for many federally listed species such as mountain goat. If otherwise suitable, the amount of human use of the area, including residential and recreation use, makes the habitat unsuitable for many species that require relative solitude, such as gray wolf, grizzly bear, and wolverine. These species will not be analyzed further in this statement.

Federally Listed Wildlife Species

Bald Eagle

Status: Federal threatened species, Washington State threatened species.

The bald eagle is a resident along the Columbia River. Winter range includes parts of the lower and middle sections of the Wind River. Feeding areas and perches are located along streams and lakes. Bald eagles are seen feeding in the Wind River during the Chinook salmon spawning season in August and September. No nests have been located within the Wind River watershed; however, winter communal roosts are highly suspected to occur along the ridges surrounding the Trapper Creek and Wind River confluence. Winter surveys were conducted in 1998 without successfully finding communal roosts. It is possible that bald eagles occasionally forage at the reservoir, and a bald eagle was seen in 1997 foraging on carrion in one of the nursery fields.

Actions that result in an increase in the steelhead population in the Wind River and Trout Creek would likely benefit bald eagles by increasing the available prey base.

Northern Spotted Owl

Status: Federal threatened species, Washington State endangered species, Gifford Pinchot Forest Plan management indicator species.

The northern spotted owl (*Strix occidentalis caurina*) was listed as a threatened species throughout its range in Washington, Oregon and northern California effective July 23, 1990 (USDI, 1990a). Loss of late-successional forest habitat from timber harvest was the primary reason for the listing.

Spotted owl surveys have not been conducted for this project, but previous surveys in the area did not detect a nest site within 1.5 miles of the dam. Barred owls have been detected in recent years in the vicinity of the canopy crane (refer to Figure 2-2), and in mature stands near the reservoir. There is a stand of suitable nesting habitat approximately 150 yards southwest of the reservoir, and about 450 yards from the dam. This stand is about 66 acres in size. There is no other nesting habitat within one-half mile of the reservoir. The other conifer stands in the vicinity of the reservoir are mapped as either spotted owl foraging habitat or dispersal habitat. There is mapped foraging habitat adjacent to the west half of the reservoir.

Nesting habitat surrounds the old nursery field where the dredge spoils would be stored on three sides. However, only a very minor amount of the nesting habitat (less than 5 acres) is within 35 yards of the nursery field. This portion of nesting habitat is edge habitat that is not likely to contain a spotted owl nest. The closest known historic nest is about 0.7 mile north of the nursery field. Figure 3-22 shows the location of spotted owl nesting habitat in the project area.

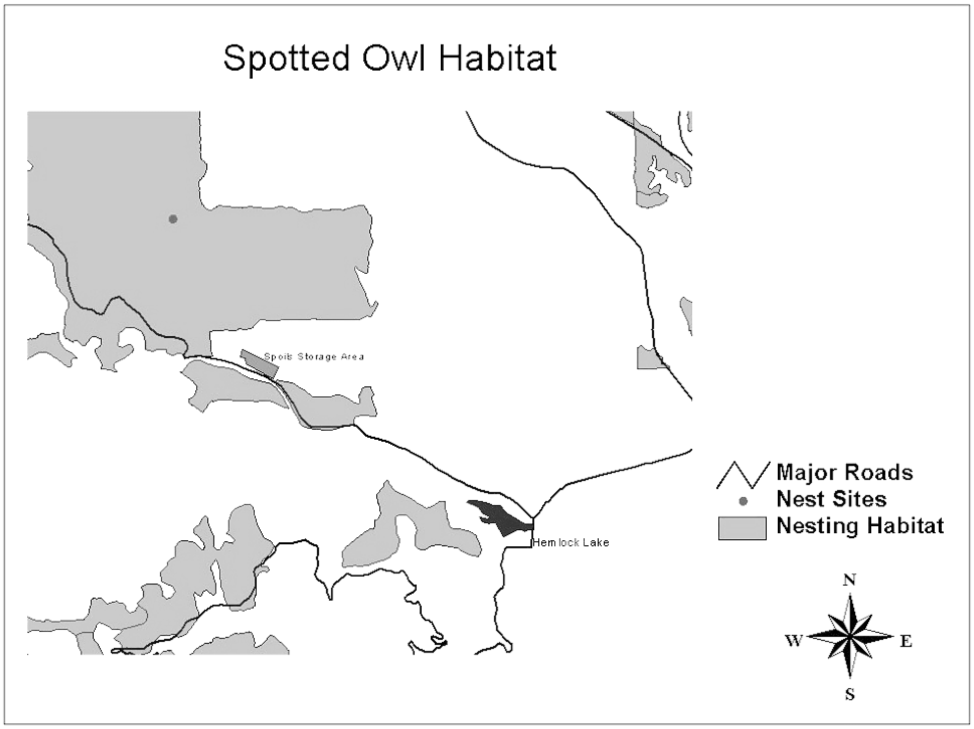


Figure 3-22. Northern Spotted Owl.

Northern Spotted Owl Critical Habitat Unit (CHU) WA-41

CHU WA-41 was designated with the expectation that the CHU would support at least 33 spotted owl pairs by providing essential nesting, roosting, foraging and dispersal habitat. The CHU was also designated to provide habitat connectivity between CHU WA-42 along the Yakama Nation lands to the east and CHU WA-40 and the Lewis River corridor to the west, and connectivity south to the Columbia River. Spotted owl surveys, completed in the 1980s to mid-1990s, located 31 spotted owl pairs and 12 single spotted owls within the CHU, and an additional 14 spotted owl activity centers within a 0.7-mile radius of the CHU boundary.

CHU WA-41 covers approximately 169,421 acres, all within the administrative boundary of the Gifford Pinchot National Forest. Due to a history of intensive timber harvest in the area prior to its designation as critical habitat, only about 52 percent of the CHU is currently suitable as spotted owl habitat. Analysis of the physiographic features within the CHU indicates that approximately 7 percent (12,127 acres) of the CHU is naturally unsuitable in the form of water, lava beds, etc. Currently, about 43 percent of the area within the CHU is early-seral forest that has the potential to develop into suitable spotted owl habitat over the next 50 to 150 years.

In the 1994 FSEIS baseline assessment, CHU WA-41 was estimated to contain approximately 88,099 acres of suitable spotted owl habitat, which represents about 18 percent of the spotted owl habitat on the GPNF. An additional 20,784 acres within the CHU provides dispersal habitat. Since 1994, the Fish and Wildlife Service has authorized the removal or downgrading of 1,042 acres of suitable spotted owl habitat in the CHU, thus the current baseline for the CHU is 87,057 acres of suitable habitat.

Region 6 Regional Forester's Sensitive Species

Cascade Torrent Salamander, Cope's Giant Salamander

The cascade torrent salamander is found in very cold, clear springs, seepages, headwater streams, or splash zones of waterfalls (Leonard, et.al. 1993). It is a species that can be located in high numbers within appropriate habitat. Adults may also be found under debris on stream banks or in streamside forests and talus during rainy periods (Corkran & Thoms 1996). This species was found in Trout Creek above Hemlock Lake during surveys for other projects. It was not found in the vicinity of the reservoir.

Cope's giant salamander is almost always neotenic, and few metamorphosed adults have ever been documented. They live in small, steep-gradient, permanent streams with clear cold water. In suitable habitat, the streambed is composed of large gravel to small boulders with some large logs, and has no silt. As such, this species is likely to be found in the same streams as Van Dyke's and torrent salamanders, and it is not likely to be found in lake habitat. This species has not been documented on the Forest.

Townsend's Big-Eared Bat

This species feeds on moths and is an obligate to cave habitat resulting from open basalt tubes (Nagorsen and Brigham 1993). No known caves occur within the vicinity of the project. Bridges also serve as foraging sites and as protected roosts for big-eared bats to consume prey.

Studies of this species have shown that it forages preferentially along edges of streams and intermittent water courses, and in edge habitats of deciduous and mountain forests. Indications are that this species gleans moths and other insects off of vegetation while in flight. As such, it probably would not forage over the reservoir surface.

There are no known Townsend's big-eared bat populations in the vicinity of the reservoir. The bridge over the creek at the dam is not known to be a roost site.

Common Loon

The minimum habitat requirement for breeding pairs is thought to be one 10-acre lake. The lake must support a population of small fish that make up approximately 80 percent of the loon's diet. Loons prefer to nest on islands or the tips of promontories, and along bays sheltered from waves.

Loons are easily disturbed during the nesting season and prefer to nest on lakes with little human activity. The small size of Hemlock Lake and the high amount of human activity during the summer months, both currently and historically, limit its suitability as nesting habitat for loons. In addition, the reservoir my not be long enough for loons to be able take off, or currently deep enough for them to escape predators.

Larch Mountain and Van Dyke's Salamanders

Van Dyke's salamander is considered to have a close association with variable forest conditions, montane lakes, twilight zones of caves, intermittent and perennial streams, river banks, and seeps. The Larch Mountain salamander also lives in variable forest conditions, areas dominated by rocky substrates, gravelly soils with large interstitial spaces, cave systems, and occasionally in or around seeps. Area searches were completed for both species in the area around Hemlock Lake.

Neither of these species was found in the project area, and the habitat is not typical of where these salamanders are found on the Forest.

Mollusks

Terrestrial mollusks currently on the Regional Forester's Sensitive species list for the Gifford Pinchot National Forest are: *Cryptomastix devia, Hemphillia burringtoni, H. glandulosa, H.*

malonei, H. pantherina, Monadenia fidelis minor, and *Prophysaon coeruleum*. Surveys for terrestrial mollusks have been completed for this project. Special habitat features found in the proposed project area include leaf litter from deciduous trees and shrubs, needle litter, bark, down trees, and mosses. No Sensitive (formerly Survey and Manage) mollusk species were found during surveys.

One aquatic mollusk on the Regional Forester's Sensitive species list for the Forest (*Lyogyrus n.* sp. 1) is found in cold, well-aerated springs and outflows. As such, the area around Hemlock Lake would not be suitable habitat for this species.

Gifford Pinchot National Forest Management Indicator Species

Deer and Elk Biological Winter Range (BWR)

Biological winter range was evaluated at the watershed, sub-watershed, and Forest-Allocated (Gifford Pinchot Forest Plan allocation "ES") scales to determine optimal cover distribution and percent. BWR generally occurs at elevations <2,200 feet except when local knowledge includes other areas where herds are known to over winter

Thermal cover is lacking overall in both ES and BWR; it provides thermal protection and hiding cover for deer and elk. Open canopy cover (40-70%) is more common than closed (>70%). Extensive salvage logging (1980s) in this area created stands in 40-70% canopy cover which meet hiding cover conditions. Many stands are not fully functioning as thermal cover at this time.

Open forage conditions are not limiting within ES and BWR.

Wood Duck

In the Gifford Pinchot Forest Plan, wood duck represents species requiring mature and old-growth deciduous riparian habitat. Wood ducks have not been known to use Hemlock Lake, although they have been seen at the ponds near the canopy crane. They nest in the backwaters of rivers and streams and in woodland lakes.

Botany

Environmental Justice

Demographics Of Skamania County

Skamania County encompasses 1672 square miles within Southwest Washington, along the Columbia River. The majority of the County lies within Federal land ownership, containing portions of the Gifford Pinchot National Forest, the Columbia River Gorge National Scenic Area, and the Mount Saint Helens National Volcanic Monument. State Highway 14, along the Columbia River, is the major driving route; the metropolitan areas of Vancouver, Washington and Portland, Oregon can be reached in less than an hour's drive.

Include State map with Skamania County if not already elsewhere in the document

For this analysis, 2000 Census data are used as a basis to describe racial and ethnic composition and poverty levels within Skamania County in order to evaluate the impacts of the alternatives on low income and minority groups (Environmental Justice, Executive Order 12898). The County demographics are described using U.S. Census Bureau data as well as 2000 Census data compiled by the Sonoran Institute; the Sonoran Institute, in conjunction with the Bureau of Land Management, used the Economic Profile System (EPSC) to compile census profiles.

Some data are available on a county-wide basis; other data are compiled on smaller geographic areas, referred to as a "census county division" or CCD. The CCD is a relatively permanent area established cooperatively by the Census Bureau and state and local governments. For Skamania County, the 2000 Census data was compiled for four CCDs: Wind River, Stevenson, Bonneville, and Gifford Pinchot. For this Statement, data from the Wind River and Stevenson CCDs are used.

(include map of CCDs)

Population by Race

Total population of Skamania County in 2000 was 9872. Table 3-10 shows the population of Skamania County in year 2000 by race. Ninety two percent of the population is White, followed by "Hispanic or Latino (4%); the remaining population is a diversity of other races. (Race and Ethnicity are broken out separately because Hispanics can be of any race.)

Table 3-10. Population of Skamania County by race in 2000.

Total Population of Skamania County by Race in 2000				
	County	**% of Total**	**State**	**% of Total**
White	9,093	92.1%	4,821,823	81.8%
Black or African American	30	0.3%	190,267	3.2%
American Indian & Alaska Native	217	2.2%	93,301	1.6%
Asian	53	0.5%	322,335	5.5%
Native Hawaiian & Other Pacific Islander	17	0.2%	23,953	0.4%
Some other race	240	2.4%	228,923	3.9%
Two or more races	222	2.2%	213,519	3.6%
Hispanic or Latino (of any race)	398	4.0%	441,509	7.5%
Not Hispanic or Latino	9,474	96.0%	5,452,612	92.5%

Table 3-11 identifies the total population of the Wind River subdivision by race. The largest number of residents is "White" (90.5%). The second largest group of residents is "Some other race" (3.3%), followed by American Indian and Alaska Native (2.9%).

Table 3-11: Total population of Wind River CCD by race in 2000

Total Population by Race		% of Total
White	4,087	90.5%
Black or African America	9	0.2%
American Indian & Alaska Native	133	2.9%
Asian	21	0.5%
Native Hawaiian & Other Pacific Islander	12	0.3%
Some other race	147	3.3%
Two or more races	106	2.3%

Table 3-12 shows the total population by race for the Stevenson subdivision. The largest number of residents are "White" (91.8%). The second largest group is "Two or more races (3.1%), followed by American Indian & Alaska Native (2.7%).

Table 3-12: Total population of Stevenson CCD by race

Total Population by Race		% of Total
White	1,641	91.8%
Black or African American	2	0.1%
American Indian & Alaska Native	49	2.7%
Asian	7	0.4%
Native Hawaiian & Other Pacific Islander	0	0.0%
Some other race	33	1.8%
Two or more races	56	3.1%

Poverty By Race

Persons and families are classified as "below poverty" if their total family income or unrelated individual incomes were less than the poverty threshold specific for the family size, age of householder, and number of related children under 18 present. Poverty thresholds are the same for all part of the country—they are not adjusted for regional, state or local variation in the cost of living (U.S. Census Bureau, 2004).

The 2000 Census asked people about their previous year's income. Skamania County as a whole had 1281 individuals, or 13.1percent of the county population, below poverty in 1999 (US Census 2000). This is higher than the State of Washington, which as a whole had 10.6 percent of the population below poverty in 1999. Welfare payments, one expression of poverty, represented 9 percent of "transfer payments" made in 2000 within Skamania County, representing a total of 1.2 percent of total personal income (Sonoran Institute). For comparison, welfare payments represented 8 percent of total transfer payments the State of Washington during 2000. (Transfer payments are characterized as payments by governments to individuals for which they have not "rendered current services", i.e. retirement, disability, insurance, Medicare.)

The Sonoran data profiled the poverty levels by race for each CCD. The data is presented by percent of race below the poverty line. In both subdivisions, the “White” race had the highest total *number* of individuals below the poverty line, but other races had higher *percentages* below the line.

Table 3-13 illustrates the numbers of individuals by race with income below the poverty level within the Wind River CCD. Fifteen percent of individuals had income that was below the poverty line in 1999. The race with the highest poverty rate is "American Indian And Alaska Native" (37%.)The race with the lowest poverty rate is "Black" (0%.)

Table 3-13. Poverty by race, Wind River CCD, 1999.

Poverty by Race (Individuals)		
	Number	% of Total
White	573	14%
Black	-	0%
American Indian And Alaska Native	57	37%
Asian	-	0%
Native Hawaiian & Other Pacific Islander	-	0%
Other Race	7	15%
2 or more races	20	21%
Hispanic Or Latino	56	24%
White not Hispanic	542	14%

Within the Stevenson CCD, the race with the highest poverty rate is "Black" (100%). The race with the lowest poverty rate is "Asian" (0%.)

Table 3-14. Poverty by race, Stevenson CCD, 1999.

Poverty by Race (Individuals)		
	Number	% of Total
White	326	21%
Black	2	100%
American Indian And Alaska Native	22	28%
Asian	-	0%
Native Hawaiian & Other Pacific Islander	-	
Other Race	2	12%
2 or more races	7	11%
Hispanic Or Latino	2	7%
White not Hispanic	324	21%