Okanogan and Wenatchee National Forests Road Analysis: Wenatchee Sub-Basin

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Introduction

Over the past decade, because of a national shift in environmental awareness, roads and road issues have become points of controversy. Roads are being scrutinized for their impact on ecosystems. Also, the funding available to maintain roads has decreased significantly. There is an urgent need to find a balance between the need for access and the potential environmental risks of a deteriorating road system. To meet this goal, the Okanogan and Wenatchee National Forests conducted a forest-wide road analysis.

The objective of the road analysis was "to provide line officers with critical information to develop road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions." (U.S.D.A. Forest Service, August 1999) This analysis is not a decision-making process. It will develop strategies and recommendations that will be incorporated into future project-level decision-making analysis.

The following analysis is a science-based interdisciplinary process using existing information and inventories. The analysis addresses the effects of roads on biological, social, and economic factors. The condition of the current road system was analyzed in terms of desired conditions, which includes amount and type of access, and impact and risks to the ecosystem. This analysis identifies opportunities and strategies for moving toward the goal of an affordable, efficient road system that meets the needs of the public and the U.S.D.A. Forest Service with minimal impact to the environment. The analysis includes previously completed plans, analysis and decisions.

This analysis is based on the objectives and guidelines in "Road Analysis: Informing Decisions about Managing the National Forest Transportation System," developed by the Forest Service Chief's Office in Washington, D.C. (U.S.D.A. Forest Service, August 1999). The guidelines present six steps that each analysis should complete. The six steps are:

Step 1: Setting up the analysis
Step 2: Describing the situation
Step 3: Identifying issues
Step 4: Assessing benefits, problems and risks
Step 5: Describing opportunities and setting priorities
Step 6: Reporting of recommendations to the Line Officer

The analysis of the Wenatchee Sub-Basin is a modified version of a process developed by the Umpqua National Forest and presented in "Upper Steamboat Creek Watershed Analysis: Access and Travel Management Planning Process and Results." The process was modified to reflect characteristics and situations present on the Okanogan and Wenatchee National Forests and incorporates the six steps listed above.

This is the first of a three-phase process to analyze all the roads on the Okanogan and Wenatchee National Forests. The second phase will be at the watershed scale: all roads within the watershed will be considered. The third, final phase will be at the specific project scale. The first two phases (sub-basin level and watershed level) develop recommendations, and are not decision

documents. The final phase, at the project scale, will be at the decision-and-implementation level.

The analysis process examines the major arterial and collector roads within the sub-basin. The roads were segmented according to their maintenance level and the watershed in which they are located. After the roads were segmented, they were rated on criteria in three modules: Human Use, Aquatics, and Wildlife. The Aquatic and Wildlife modules document the effects of roads on biological factors; the Human Use module addresses the effects of roads on the social and economical factors. The specific criteria in each module are described in the appendices; the five maintenance levels are described in Appendix F.

Each module developed a “High,” “Moderate,” or “Low” rating for each road segment. The three ratings were used to develop a recommended management strategy for that road segment. The management strategy options ranged from major improvements to some form of decommissioning.

Each watershed within the sub-basins was given an overall rating for each module. This rating was used to develop the recommended priorities and sequence for conducting the watershed scale of the roads analysis process.

1. Information from the completed sub-basin road analysis will be used in several ways: The compilation of the sub-basin level analyses will contribute to the comprehensive forest-wide road management strategy.
2. More detailed watershed-scale analyses will tier to the sub-basin data and recommendations.
3. Scheduled Land and Resource Management Plan (Forest Plan) revisions will use the analyses results in setting long-term management direction for the road system across the three forests. The forest plan revision is scheduled to begin in the spring of 2003.

Wenatchee Sub-Basin Analysis Area

This analysis focuses on the major arterials and collectors (roads opened and maintained for passenger car use) within the Wenatchee River Sub-Basin. The sub-basin boundaries closely correspond to the boundaries of the Lake Wenatchee and Leavenworth Ranger Districts on the Okanogan and Wenatchee National Forests. For more information, see the vicinity map (Figure 1) and the analysis area map (Figure 2).

The Lake Wenatchee and Leavenworth Ranger Districts have seven fifth-field watersheds: the Main Stem Wenatchee, Mission, Peshastin, Icicle, Nason, Little Wenatchee/White, and Chiwawa. All five watersheds contain roads with maintenance levels 3, 4, or 5, and were included in this analysis. Approximately 79.1 miles of maintenance level 2 roads were also included because they serve as major collector roads despite their maintenance level.

The area of the sub-basin analyzed is 792,871 acres, of which 483,334 acres (61%) are in wilderness and inventoried roadless areas. The area of the sub-basin contains approximately 1,409 miles of classified Forest Service roads (FSRs), of which 170 miles were analyzed. These 170 miles are the main arterial and collector roads that are maintained for passenger cars within the sub-basin. The remaining miles within the sub-basin are roads maintained for high clearance

vehicles (maintenance level 2 roads) or are closed roads (maintenance level 1). Unclassified roads were not considered in this analysis, but will be included in future watershed scale analyses. The remainder of the system roads and known unclassified roads will be analyzed during the second phase of roads analysis, to be completed through project planning.

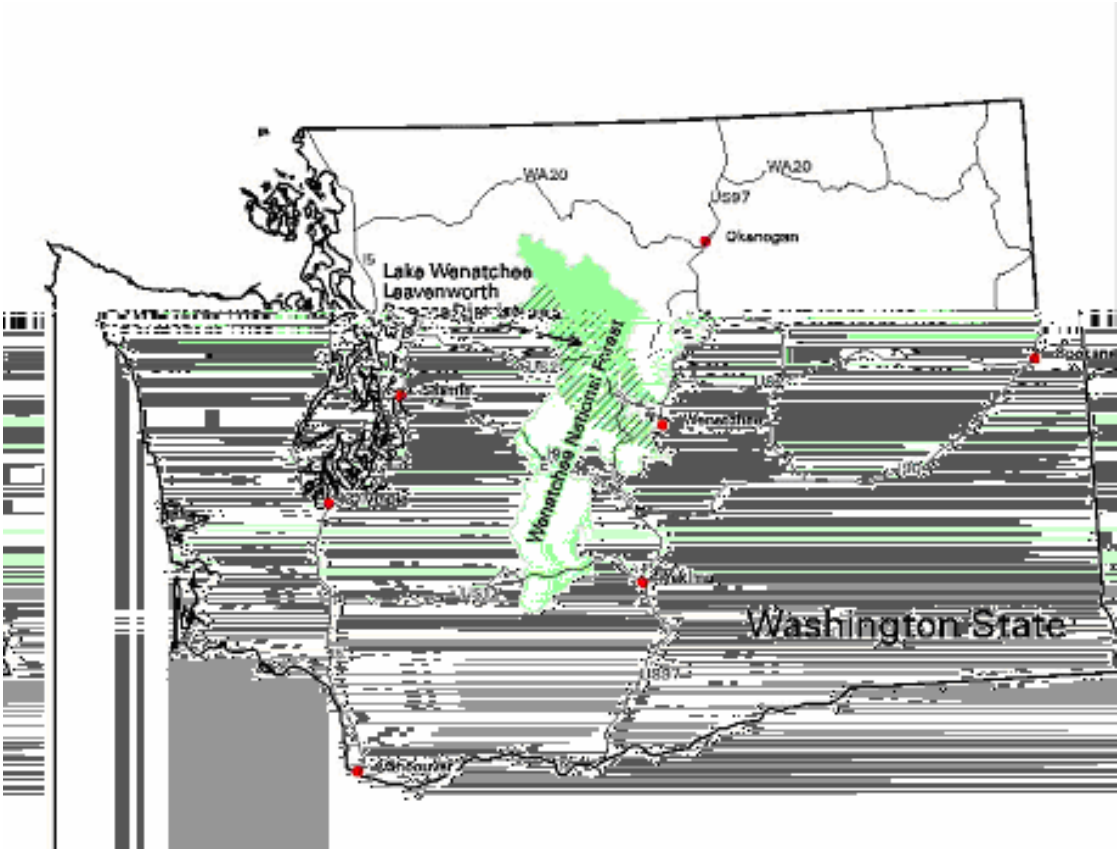

Figure 1: Lake Wenatchee-Leavenworth District vicinity map

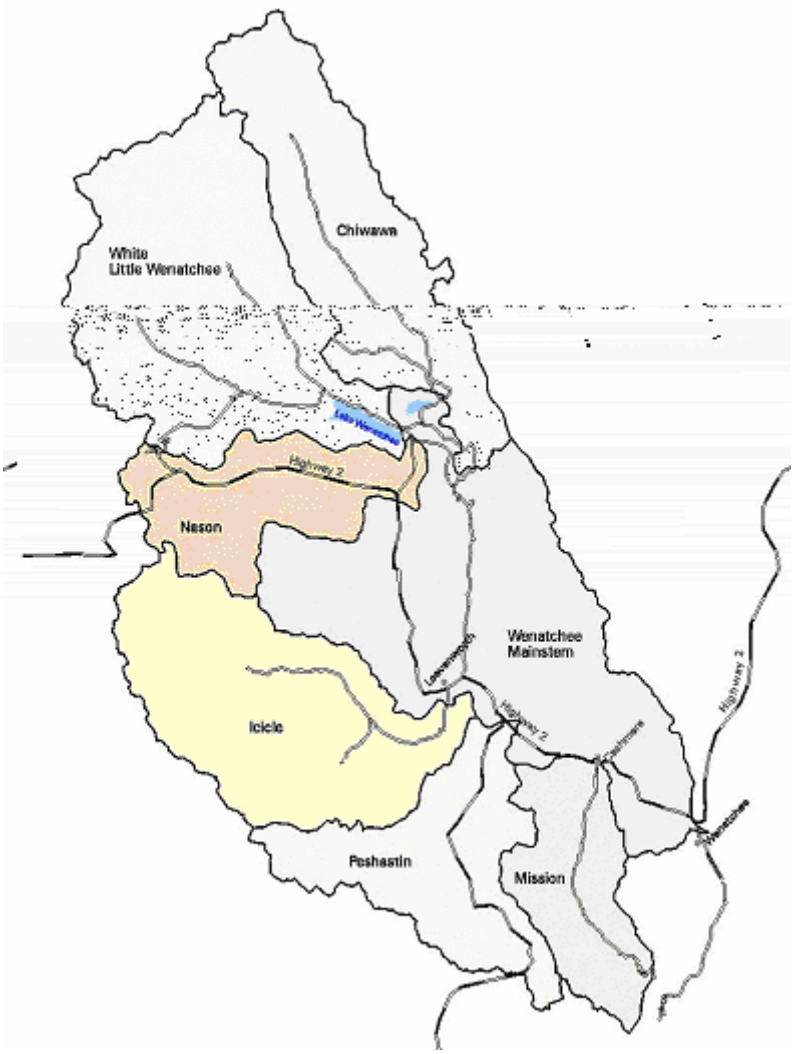

Figure 2: Geographic area analyzed on the Lake Wenatchee-Leavenworth District

I. Existing Conditions and Situation

General Conditions: Wenatchee Sub-Basin

A. Roads

The entry of non-indigenous peoples to the Wenatchee River Sub-Basin before the late 1800s was largely related to exploration and the fur trade. Travel was by foot or horseback and probably followed established native trails. When a railroad was constructed, towns in the area began to grow. By the late 1800s, a switchback railroad track crossed the North Cascades. The service road for the track was used by some automobiles, and eventually a state highway was constructed to follow portions of this service road and pieces of the railroad track that were abandoned.

By the 1950s new roads were being constructed for timber harvest. In time, the demand for forest products increased, as did the need for additional roads. Equally as important as an economic element was the increasing interest in recreation and the recreation opportunities forest roads provided. Among these recreation opportunities are access to trails, boating activities, developed campgrounds, dispersed camping sites, and access to motorized recreation opportunities for off-highway vehicles, motorcycles, ATVs, and snow machines. Access to the area was increased by roads constructed by the public ("user-built roads") and termed "unclassified" by the U.S.D.A. Forest Service.

Today, State Route 2 passes through the sub-basin, following the Wenatchee River through the lower elevations, then over the crest of the North Cascades. Many campgrounds are located along the route. The main routes providing access to the watersheds on the district are the following.

> Chiwawa River Road (6200), White River Road (6400), and Little Wenatchee Road (6500) provide the access into the Lake Wenatchee area.
> Rainy Creek (6700) provides access between Highway 2 and the upper end of Lake Wenatchee.
> Derby Canyon (7400) is the main access route to the forest from the Peshastin area.
> Mission Creek Road provides access to Mission Ridge Ski Area from the Wenatchee area.
> Icicle Road (7600) provides access to many campgrounds and trailheads and to a pristine wilderness outside the Leavenworth area.

Road-associated effects to the environment are also included in this analysis. Throughout the sub-basin the combination of road location, road surface type, and high public use patterns in the wetter times of the year, produces a higher potential for increased road surface damage and sediment production. This is particularly evident on the native-surfaced roads that are extensively used during hunting season. In many cases, this combination of conditions results in rutted or wheel-track damaged roads.

For the purposes of roads analysis for the Wenatchee River Sub-Basin, the Forest Transportation Management System (INFRA Roads database) describes each system road or road segment by assigning values that describe the way the road serves resource management needs and the specific maintenance required, consistent with management objectives and maintenance criteria. In the past few years, the emphasis has been on gathering road-related data within projects, such as inventorying and mapping unclassified roads, identifying the backlog of deferred maintenance work, and surveying road culverts which may be a problem for fish passage. Information provided by these and other projects will be included at some level of the roads analysis process. A summary of the forest road miles in each watershed by road type and maintenance level is available in the analysis file. For a description of the five maintenance levels, see Appendix F.

B. Aquatics

The Wenatchee Sub-Basin includes the Wenatchee River and all tributaries from the headwaters to the confluence of the Wenatchee River with the Columbia River at the city of Wenatchee. Fish species protected under the Endangered Species Act of 1973 inhabiting the sub-basin are: upper Columbia steelhead (endangered), upper Columbia spring chinook salmon (endangered), and Columbia River bull trout (threatened). Other native salmonid species that are a management emphasis but not considered threatened or endangered are: summer chinook salmon, sockeye salmon, redband/rainbow trout, and west slope cutthroat trout. The Yakama Nation, in cooperation with the other fish management agencies, is exploring the feasibility of reintroducing coho salmon into the sub-basin. Introduced non-native rainbow trout and brook trout are also present. The Leavenworth National Fish Hatchery, located on Icicle Creek, raises spring chinook salmon, but the hatchery population is not considered to be part of the Endangered spring chinook salmon population. The term “at-risk population,” as used in the roads analysis, refers to the spring chinook, summer steelhead, and bull trout populations protected under the Endangered Species Act. One or more of the at-risk populations are found in each watershed within the sub-basin.

The watersheds that make up the Wenatchee Sub-Basin are the Mainstem Wenatchee, Mission, Peshastin, Icicle, Nason, White-Little Wenatchee, and Chiwawa. The White and Little Wenatchee will be separated into separate watersheds because they are large drainages with different watershed and fish habitat conditions.

Significant sub-watersheds for a species are as defined in MacDonald et al. (1996). The original mapping in MacDonald et al. (1996) has been updated periodically with new information, and as part of this project. Sub-watersheds are defined in MacDonald et al. (1996) as significant if they meet any one of the following criteria:

1. The sub-watershed was identified as a stronghold in the Interior Columb

population.

For the road analysis process, those sub-watersheds significant for spring chinook salmon, steelhead or bull trout in the Wenatchee Sub-Basin have the greatest influence on the ranking of a road segment because these species are protected under the Endangered Species Act and therefore priority for consideration. However, depending upon the watershed, significant sub-watersheds for west slope cutthroat trout, summer chinook salmon, and redband trout may influence the ranking as well. The range of most the salmonid species greatly overlap and therefore road management activities that have a positive or negative impact on habitat for at-risk species should, in general, have a similar effect on habitat for other native salmonids.

Current conditions are described and watershed scores developed using the following roads analysis rating factors (See the Aquatic Assessment):

1. Geologic hazard
2. Fine sediment
3. Floodplain function, off-channel habitat, and riparian reserves
4. Flow effects
5. At-risk fish populations

Because the Wetland and Wet Meadows rating factor is used only at the road segment level it is not discussed in the watershed condition section.

Section 7(a)(2) of the Endangered Species Act requires all federal agencies to review actions authorized, funded, or carried out by federal agencies to ensure such actions do not jeopardize the continued existence of listed species. Furthermore, federal agencies must consult with the National Marine Fisheries Service (pertaining to anadromous fish) and the U.S. Fish and Wildlife Service (pertaining to inland fish) on on-going and new activities that may affect a listed species. The Okanogan and Wenatchee National Forests prepare biological assessments to assess potential impact of management activities. The biological assessments and subsequent consultation are conducted at the watershed scale. The basis for the biological assessment is “A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale,” prepared by U.S. Fish and Wildlife Service (adapted from the National Marine Fisheries Service), February 1998. An important portion of the biological assessment is establishing the environmental baseline for the watershed. In the baselines, various habitat and watershed features are rated as functioning appropriately, functioning at risk, or functioning at unacceptable risk. The fine sediment, floodplain function, off-channel habitat, riparian reserve, and flow effects ratings in the roads analysis are based on the latest watershed biological assessment for a watershed, which is cited at the beginning of each watershed section. When available, new information from monitoring was also used. T

prioritize watersheds for further analysis at the watershed scale based upon potential restoration needs for wildlife habitats, identify issues within watersheds, and establish the context for watershed scale roads analysis.

Roads definitions are from the grizzly bear core analysis process and have been in use for wildlife analyses for several years. These analyses can be used to address wide-ranging carnivores, late-successional associated species, riparian-dependent species, ungulates, and unique habitats. Table 1 summarizes road-associated factors that affect wildlife habitats or populations (Wisdom et al. 1999). The analyses address the terrestrial wildlife (TW) roads analysis questions, TW-1, TW-2, TW-3, TW-4, and ecosystem functions (EF) question EF-2 identified in "Roads Analysis: Informing Decisions about Managing the National Forest Transportation System," published by the U.S.D.A. Forest Service in 1999. The analyses described in this document are an adaptation of the TW questions to better address the issues and conditions on the Okanogan and Wenatchee National Forests.

The following discussion describes the five elements of the wildlife analysis and then presents specific descriptions of important aspects within each watershed in the Lake Wenatchee-Leavenworth Sub-Basin.

C1. Wide-Ranging Carnivores

The wide-ranging carnivores covered in this assessment that are known or suspected to occur within the sub-basin include the gray wolf (endangered), wolverine (petitioned for listing), lynx (threatened) and grizzly bear (threatened). The entire Lake Wenatchee-Leavenworth Sub-Basin is located within the North Cascades Grizzly Bear Recovery Zone. Several studies have documented the effects of road-associated factors on carnivores; these are summarized in Table 1. No conservation strategies or recovery plans currently exist for wolverines or gray wolves. A conservation strategy for lynx has been completed (Ruediger et al. 2000) but does not address potential indirect effects of roads on habitat quality. For all of these species, areas that are relatively free of human access provide refugium that is important for their long-term viability (Weaver et al. 1996). The availability of these areas is based on the amount of core area using the assessment process and definitions provided in Puchlerz and Servheen (1998).

C2. Late-Successional Associated Wildlife Species

Over 100 wildlife species on the Okanogan and Wenatchee National Forests are associated with late-successional forest (USDA FS 1997). The road-associated factors that have been identified to affect these species are shown in Table 1. These species include the northern spotted owl (threatened) and are managed through a network of late-successional reserves (LSRs) and managed late-successional areas (MLSAs) (USDA FS 1997). The Wenatchee National Forest's Late-Successional Reserve Assessment (USDA FS 1997) identified a goal of providing a high level of habitat effectiveness within LSRs and MLSAs.

Levels of habitat effectiveness:

High: open road densities <1 mile/square mile of habitat and >70% security habitat (areas >500 miles from an open road or motorized trail)

Moderate: open road densities of 1-2 miles/square mile of habitat and 50-70% security

habitat
Low: open road densities >2 miles/square mile of habitat and <50% security habitat.

C3. Riparian Dependent Wildlife Species

This group of wildlife species includes about 285 vertebrate species that are either directly dependent on riparian habitat or use these habitats far more than others (Thomas et al. 1979). Current management direction includes managing riparian areas and influence zones through a network of riparian reserves (USDA FS 1994). Riparian reserves provide habitat for wildlife species and are also important in providing habitat connectivity between areas managed for late-successional habitats. The road-associated factors that can affect riparian-dependent wildlife species are summarized in Table 1.

C4. Ungulates

These species include mule deer, elk, big horn sheep, and mountain goats. Current management is focused on maintaining or restoring habitat effectiveness within areas designated as winter range (Northwest Forest Plan Land Allocation EW-1). The road-associated factors that affect these species are summarized in Table 1. An important issue addressed in this assessment is the access that roads provide on winter ranges for snowmobiling and other winter activities. Winter is an important time for ungulates because food resources are limited and energy reserves are at or below maintenance levels (McCorquodale 1991). This analysis was based on the assumption that the road density on the winter ranges provides an index to the amount of winter human activity occurring. Should there be discrepancies between Forest Plan mapped winter range and actual winter range, this portion of the analysis will be conducted based on actual known winter range.

C5. Unique Habitats

Unique habitats include wetlands, talus slopes, caves, cliffs, snag patches, hardwood forests, meadows, etc., which provide important habitat for a wide variety of wildlife species. Unique habitats such as wetlands have special protection under the Northwest Forest Plan (USDA FS 1994) and are managed by retaining buffers around them. Other unique habitats are managed on a site-specific basis through project design. The road-associated factors that can affect unique habitats are summarized in Table 1.

Road-associated factors that negatively affect habitat or populations of wildlife species (based on Wisdom et al. 1999) and the wildlife species group for which effects of the road-associated factor has been documented.

Table 1a. Road-associated factors negatively affecting habitat or wildlife species populations

Road-associated factor	Effect of the factor	Wildlife group affected
Hunting	Non-sustainable or non-desired legal harvest by hunting facilitated by road access.	Wide-ranging carnivores; Ungulates
Poaching	Increased illegal take of animals, as	Wide-ranging carnivores;

Road-associated factor	Effect of the factor	Wildlife group affected
	facilitated by roads.	Ungulates
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Chronic negative human interactions	Increased mortality of animals (e.g. euthanasia or shooting) due to increased contact with humans, as facilitated by road access.	Wide-ranging carnivores
Movement barrier	Interference with dispersal or other movements posed by a road itself or by human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to the establishment of roads, road networks, and associated human activities.	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats

Mainstem Wenatchee Watershed

The Wenatchee Mainstem Watershed is an extremely diverse and complex landscape with many travel routes, scenic viewsheds, and communities. The scenic quality ranges from the common landscape character typical of the Northeast Cascade area, such as the rolling foothills on the southern end, to the unique and dramatic scenery of Tumwater Canyon, Alpine Lakes Wilderness, and Lake Wenatchee on the north end.

The Mainstem Wenatchee Watershed includes 4.2 miles of maintenance level 4 roads, and 7.8 miles of maintenance level 3. There are no maintenance level 5 roads in the watershed. The major roads and travel routes in the watershed are listed in the following table.

Table 1b. Major roads and travel routes within the Mainstem Wenatchee Watershed

Road name	Road #	Maint. level	Description	Length
Entiat Ridge Road	5200	2	Major route over Entiat Ridge & into the Entiat Watershed	Approximately 5.5 miles are within the Main Stem Wenatchee Watershed
Big Meadow	6300	4	Branches off the Chiwawa	4.2 miles

Road name	Road #	Maint. level	Description	Length

Ingalls Creek, the progression from low to high elevation includes western hemlock, silver fir, mountain hemlock, and alpine meadow and parkland with whitebark pine.

The existing condition of the vegetation of the Wenatchee River area can be generalized as relatively healthy. The major disruptions to the function of the natural processes are: U.S. Highway 2, the Public Utility District (PUD) and Bonneville Power Administration (BPA) power lines, railroad grades, and logging on private land. The exclusion of fire from its natural role has had a major influence on the development of the ecosystem, as has the past "high grade" logging in the Natapoc Ridge and Fish Lake areas.

Past logging activities within the drainage have affected the vegetation. The previous practice of logging high-valued tree species is disruptive to forest health. Removing the larger Douglas-fir and ponderosa pine, which are fire tolerant, and leaving the smaller trees and fire-susceptible species like grand fir, greatly increases the fire susceptibility of the area. This practice was common in many of the easily accessed areas. Also, the extensive logging that has occurred on private land has significant effects on the Upper Wenatchee River drainage.

The Upper Wenatchee River area can be characterized as a transitional zone between areas in which fire has played a major and frequent (20 to 30 years) role in the development of vegetation patterns, and zones in which fire can play a major role but at very long and infrequent intervals of 50 to 100 or more years. Noxious weeds grow along all the major roads in the watershed. The most common species are *Centaurea diffusa* (common knapweed), *Chrysanthemum leucanthium* (oxeye daisy), *Linaria dalmatica* (dalmation toadflax), and *Hypercium perforatum* (St. John's wort). These species are persistent and may displace native species indefinitely.

Information was taken from the Mainstem Wenatchee River Watershed Analysis, 1999, Leavenworth Ranger District and Lake Wenatchee Ranger District, Wenatchee National Forest.

B. Aquatics

The Mainstem Wenatchee River flows southeasterly from Lake Wenatchee for 53 miles before entering the Columbia River at the city of Wenatchee. The upper river is meandering, only moderately confined, with an occasional adjacent wetland. The banks have been substantially altered by rural residences, and the floodplain is predominately developed. Below this meandering section the river enters Tumwater Canyon, a higher gradient bedrock canyon. Downstream from Tumwater Canyon, the lower watershed and the lower portions of tributary watersheds have private development along the entire valley bottom (orchards, housing ranging from scattered rural homes to towns, roads, power lines, and railroads) with National Forest Lands in the upper elevations. Sub-watersheds included within the Mainstem Wenatchee Watershed are Lower Wenatchee, Middle Wenatchee, Tumwater Canyon, Upper Wenatchee, Nahahum, Olalla, Derby, Upper and Lower Chumstick, Eagle, Beaver, Chiwaukum, and Cabin-Fall.

The existing habitat conditions information was obtained from the most recent environmental baseline established in "Biological Assessment for Steelhead, Spring Chinook, Bull Trout and Cutthroat in Mainstem Wenatchee Watershed. Baseline Conditions and Effects Included the On-going Activities of Recreation" (Rife & Haskins, 1999).

B1. Geologic Hazard – Score 6

The Wenatchee Mainstem Watershed falls within two subsections of the Wenatchee Highlands and Wenatchee/Swauk Sandstone Hill. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, shist, tonalite, and granodiorite, respectively. These rock units are highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial trough landforms. The Wenatchee/Swauk Sandstone Hills are composed almost entirely of continental sediments that include the Swauk and Chumstick Formations (thinly-bedded mica and feldspar-rich sandstone). These rock units are not resistant to accelerated weathering. The primary geomorphic process has been fluvial erosion, creating very narrow V-shaped valleys framed by steep dissected mountain slopes. Both of these subsections efficiently deliver sediment.

The Wenatchee/Swauk Sandstone Hills formation is very efficient at delivering soil material to first-order drainages and emphiral systems where the sediment accumulates and fills in these types of drainage systems. During high intensity storm events, this stored sediment can be delivered to higher order stream systems.

The major sources of hill slope sediment are generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first-order tributary streams and a few deep-seated landslides. Coarse sediment is generally delivered from the Wenatchee Highlands, while fine sediment is predominant from the Wenatchee/Swauk Sandstone Hills.

The major source areas for hill-slope sediment are felt to be delivered from: glacial trough landforms totaling 9,333 acres; deep-seated landslides totaling 6,950 acres; and structurally-controlled mountain slopes totaling 48,850 acres. The structurally-controlled mountain slopes are responsible for contributing naturally high levels of fine sediment. However, roads can accelerate the natural rate of fine sediment delivery. Table 2 lists the miles of road in each landform type.

Table 2. Mainstem Wenatchee: Total miles of road within naturally high sediment sources

Glacial trough landforms	.76
Deep-seated landslides	2.95
Valley bottom landforms	8.9

B2. Road-Related Fine Sediment–Score 6

The Wenatchee Watershed is functioning at risk for fine sediment, although the Chumstick drainage and Derby sub-watersheds are functioning at unacceptable risk, and roads are likely contributing to accelerated sediment delivery.

B3. Floodplain Function, Off-Channel Habitat and Riparian Reserves - Score 10

Riparian reserves, floodplain connectivity are rated as functioning at unacceptable risk, and off-channel habitat is rated as functioning at risk. While portions of the watershed have a well-connected floodplain and off-channel habitat, in many reaches roads and railroads have confined the channel and isolated off-channel habitat. Development and agriculture have had further impact on off-channel habitat, floodplains, and riparian habitat. Most of the effects are not within the National Forest.

B4. Flow Effects – Score 6

Road density and location are functioning at unacceptable risk. This is due to high road densities (2.8-4.1 miles/square mile) in the Beaver Creek, Derby Creek, Lower Chumstick, Upper Chumstick, Eagle, Upper Wenatchee, Middle Wenatchee, and Lower Wenatchee sub-watersheds. These road densities do not include all roads on private land. The watershed is rated as functioning at risk for change in peak/base flows because of irrigation withdrawals (base flows) and a concern that the level of development and past forest management may have had an impact on flow.

B5. At-Risk Fish Populations – Score 10

The Wenatchee provides habitat for all anadromous species in the watershed, bull trout, resident redband trout, and, to a lesser degree, west slope cutthroat trout. Summer chinook salmon spawn throughout the Wenatchee River from near Lake Wenatchee to the confluence with the Columbia. Summer steelhead spawn and rear throughout the mainstem with the Middle Wenatchee, Tumwater Canyon, and Upper Wenatchee considered significant for summer steelhead. The Wenatchee River is the migratory corridor for the Wenatchee River sockeye population. Some limited spring chinook salmon spawning occurs in the Wenatchee near Lake Wenatchee but the river is primarily a migration corridor and rearing habitat for spring chinook. Adult bull trout reside in and migrate throughout the Mainstem Wenatchee.

C. Wildlife

The Mainstem Wenatchee Watershed, the largest watershed in the Wenatchee Sub-Basin, consists of 171,393 acres surrounding the smaller Chumstick Watershed (31,775 acres). These watersheds provide access to substantial multiple-use/mixed ownership lands and experience extremely high human use year round. Road densities are high and quality habitat is limited, allowing for great potential for improvement.

C1. Wide-Ranging Carnivores

The open road density in the Mainstem Wenatchee Watershed is high: 2.32 mi/mi^2. Approximately 57,881 acres (33.8%) of the watershed are core habitat. The open road density in the Chumstick Watershed is also high, 2.83 mi/mi^2. Core habitat is limited. Only 17.8% of the watershed is core, for a total of 5,644 acres. Portions of several Lynx Analysis Units (LAUs) are found in these watersheds. Tables 3 and 4 describe the road density of those portions within each watershed. For descriptions of each LAU, see Appendix I.

Table 3. Road density of Lynx Analysis Units (LAUs) within the Mainstem Wenatchee Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density (mi/mi^2)
Chumstick Mtn.	4.4	4.3	1.8
Cougar	18.8	8.4	2.3
Icicle Ridge	9.6	60.5	0.2
Nason	0	<0.1	0

Mean Road Density = 1.1 mi/mi^2

Table 4. Road density of Lynx Analysis Units (LAUs) within the Chumstick Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density (mi/mi^2)
Chumstick Mtn.	6.3	1.9	3.3
Cougar	0	<1	0

Mean Road Density = 1.1 mi/mi^2

C2. Late-Successional Associated Wildlife Species

Portions of several LSR/MLSAs are located in the Mainstem Wenatchee River/Chumstick Watersheds. Habitat effectiveness information is summarized in Tables 5 and 6.

Table 5. Mainstem Wenatchee Watershed: Habitat effectiveness

LSR/MLSA	Acreage (% watershed)	Security habitat rating	Habitat effectiveness rating
Chiwawa LSR	6,680 (3.9)	Low	Moderate
Deadhorse LSR	13,144 (7.8)	Moderate	High
Eagle MLSA	5,255 (3.1)	Low	Moderate
Icicle LSR	5.9 (<0.1)	Moderate	Moderate
Natapoc MLSA	1,045 (0.6)	Low	Low
Tumwater MLSA	3,964 (2.3)	Moderate	High

Table 6. Chumstick Watershed: Habitat effectiveness

LSR/MLSA	Acreage (% watershed)	Security habitat rating	Habitat effectiveness rating
Chiwawa LSR	10,954 (34.5)	Low	Moderate
Deadhorse LSR	5,156 (16.2)	Moderate	High
Tumwater MLSA	115 (0.4)	Moderate	High

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 25,752 acres (15.0%) of the Mainstem Wenatchee Watershed and 3,386 acres (10.7%) of the Chumstick Watershed. The open road density within the riparian reserves is very high, at 3.6 mi/mi^2 and 4.0 mi/mi^2, respectively.

C4. Ungulates

The Mainstem Wenatchee Watershed provides the greatest amount of mapped ungulate winter range habitat (EW-1) within the Lake Wenatchee-Leavenworth Sub-Basin. This watershed contains 19,956 acres (11.6%) of mapped winter range with a moderate open road density of 1.3 mi/mi^2. There are also 5,168 (16.3%) winter range acres mapped within the Chumstick Watershed. The road density within winter range is moderate as well, at 1.6 mi/mi^2. Other areas within both watersheds function as important deer migration routes.

C5. Unique Habitats

Unique habitats are moderately diverse and abundant in the Mainstem Wenatchee Watershed, covering 19,523 acres (11.4%). Table 7 provides a summary of the availability of unique habitats in the Mainstem Wenatchee Watershed.

Table 7. Availability of unique habitats in the Mainstem Wenatchee Watershed

Unique habitat	Acres	% of watershed
Brushfield	2,081	1.2
Cliff/bedrock	6,004	3.5
Deciduous forest	661	0.4
Ice/snow	142	0.1
Lodgepole	130	0.1
Mesic open park-like	80	<0.1
Natural created openings in Wilderness	1,295	0.8
Subalpine/open/park-like	3,115	1.8
Talus/scree	1,972	1.2
Upland meadow	1,895	1.1
Water	1,644	1.0
Wet meadow	503	0.3
Wet park-like	1	<0.1

Within the Chumstick Watershed, unique habitats are not diverse and cover only 192 acres (0.6%). Table 8 summarizes the availability of unique habitats.

Table 8. Availability of unique habitats in the Chumstick Watershed

Unique habitat	Acres	% of watershed
Brushfield	16	<0.1
Cliff/bedrock	14	<0.1

Unique habitat	Acres	% of watershed
Deciduous forest	17	0.1
Subalpine/open/park-like	10	<0.1
Talus/scree	118	0.4
Upland meadow	8	<0.1
Water	3	<0.1
Wet meadow	6	<0.1

Chiwawa River Watershed

The Chiwawa Road (6200) begins off County Road 22, the Chiwawa Loop road, and comes into the Chiwawa watershed area shortly after passing Fish Lake. Land ownership is primarily by the National Forest System, except for the lower south end, which is more developed with summer and primary residential homes located along the Chiwawa Loop and Schugart Flat. In addition to this, some private pieces are mixed in around the lower 1/3 of the watershed and at the upper end where old mining claims still exist. The Chiwawa road is a scenic travel route that ends at Trinity trailhead, a destination area for people accessing the Glacier Peak Wilderness. The Chiwawa road is popular for pleasure driving and for viewing spectacular fall color of larch, vine maple, and the hardwoods along the river. The road is 23 miles long with the first 9.5 miles paved. The first 9.5 miles is a maintenance level 5 road, the next 2.2 miles are maintenance level 4, and the last 11.0 miles are maintenance level 2.

The Meadow Creek Road (6300), approximately 9.5 miles, attracts people who are interested in dispersed recreational use and provides access to the Twin Lakes area, which is in the Glacier Peak Wilderness. There is a trailhead at the end of the road. The first half of this road is maintenance level 4; the remainder is level 3.

Lower Chiwawa Road (6100) provides access to Goose Creek campground and is a shortcut route to the community of Plain and rural summer homes along the Chiwawa River. This road is approximately 4 miles long and is maintenance level 3 the full length.

Maverick Saddle Road (6101) is an important connector route that crosses over the Entiat mountain range and provides access to the Entiat Ranger District. Sugarloaf Lookout is a popular destination point from the Maverick Saddle Road, with spectacular panoramic viewpoints seen from the Sugarloaf Peak. Many people drive the road for sight seeing. The route is 3.2 miles long and a maintenance level 2 road.

A. Human Use

A1. Public Use

The developed recreation facilities are clustered along the Chiwawa road and river corridor. Numerous campgrounds, trailheads, and trails are located in the roaded natural zone. There is an extensive network of trails located throughout the north half of the watershed that cross over to the Entiat Ranger District, Chelan Ranger District, and Glacier Peak Wilderness. Many trails

combine to provide loop opportunities.

The south half of the watershed has developed recreational facilities and has an off-road vehicle (ORV) hub at Goose Creek Campground. In the winter, snowmobile trails are groomed on Maverick Saddle. The lower end is more rural in development, with more summer homes and communities located throughout the area.

A2. Resource Management

The dominant vegetation groups present in the watershed are those in the dry forest, the mesic forest, moist forest, valley bottom mixed conifer, subalpine fir, and the subalpine larch/whitebark pine groups.

The geology and climate of the area have a direct influence on vegetation composition, structure, and successional stage. The maritime influence at the Cascade Crest gives way to a drier continental climate near the Wenatchee River, and the transition provides habitat for a wide array of forest and non-forest environments. Important climatic factors are the amount, timing, and form of precipitation, thunderstorms that bring lightning ignitions, and flood events. Snow loads contribute to the breakage of individual trees and to the establishment and maintenance of avalanche chutes.

These ecosystems have evolved with periodic fire, including lightning and native ignitions. Fire exclusion policies practiced within the past century have altered stand structure, species composition, and patch size across the landscape, most notably in the inherent short fire return interval ecosystems in the lower elevations. The naturally long fire return intervals of mid and high elevation forests appear to have insulated them from most of the detectable ecological effects of the fire exclusion policy.

Fire at the urban/rural/wildland interface has become a concern in the southern portion of the watershed. Heavy recreational use accounts for approximately 60% of the ignitions within the watershed in the past 25 years.

Noxious weeds grow along many of the roads in the watershed. There are populations of Scot's broom, spotted knapweed, diffuse knapweed, dalmation, toadflax, oxeye daisy, St. John's wort, and common tansy.

The information for this section was obtained from the Chiwawa River Watershed Assessment, 1997, Lake Wenatchee Ranger District, Wenatchee National Forest.

B. Aquatics

The Chiwawa watershed is a large tributary to the Wenatchee River. Originating in five small glaciers on the east side of the Cascade Crest, the Chiwawa flows approximately 37 miles before joining the Wenatchee River near the community of Plain, about five miles downstream of Lake Wenatchee. The largely unmanaged Chiwawa watershed provides important habitat for spring chinook salmon, probably steelhead, bull trout, and west slope cutthroat trout.

Sub-watersheds are the Lower Chiwawa, Middle Chiwawa, Upper Chiwawa, Headwaters Chiwawa, Meadow-Brush, Raging, Chikamin, and Rock.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in the "Fisheries Biological Assessment Chiwawa Watershed Baseline Condition and Effects of On-Going Activities" (Haskins 1998).

B1. Geologic Hazard - Score 6

The Chiwawa Watershed falls primarily within the Wenatchee Highland Subsection to the north and west and valley bottoms to the south and east. The Wenatchee Highland is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite, and granodiorite respectively. These rock units are highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial troughwalls. The valley bottom subsections consist of valleys and low lying rolling hills with veneers of glacial till over Continental Sediment (Swauk and Chumstick thinning bedded mica and feldspar rich sandstone).

The glacial trough landforms are the dominant landforms within the Chiwawa Watershed. The upper ridges of these troughs are composed mostly of exposed bedrock, which collect a large amount of precipitation but have little potential to store or regulate runoff. Runoff from upper troughwalls is concentrated into the dense pattern of first-order streams. Shallow landslides (debris flows) are a significant source of sediment delivery and often originate from these first order drainages along the interface between glacial till deposits and scoured bedrock. These debris flows have deposited numerous debris fans/cones in the valley floor. As these fans coalesce, usually in the upper watersheds, they cause stream confinement and streams become bounded by these fans altering stream alignment and gradient. Debris flows can deliver sediment directly into stream systems. Likely a more important sediment delivery mechanism is the degree of stream scour along fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured.

The major sources of hill slope sediment delivery are generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first order tributary streams. Another major source of sedimentation is stream scour of channels and banks as stream adjust to the types of confinement discussed in the previous paragraph.

Fairly large localized deep seated landslides are another source of hill slope sediment is generated from. These landslides occur along troughwalls often associated with faults or major planes of weakness such as from schist bedrock units or glacial till sandstone interfaces.

The major source areas for hill slope sediment are felt to be delivered from: Glacial trough landforms totaling 24,225 acres; deep-seated landslides totaling 1,912 acres; and valley bottom landforms totaling 11,290 acres. Roads can accelerate the natural rate of coarse sediment delivery.

Table 9. Chiwawa Watershed: Total miles of road within naturally high sediment sources

Overall the Chiwawa watershed is functioning appropriately for road density and location. Rock, Chikamin sub-watersheds and the Chiwawa upstream of the confluence with Rock Creek have road densities less than 1 mile/square mile. Road densities are higher in the lower Chiwawa. The lower Chiwawa, below Brush Creek and including Brush and Big Meadow Creeks have road densities exceeding 3.7-miles/square mile.

The Chiwawa watershed was rated as at risk for change in peak/base flows primarily due to heavy roading and past timber harvest in the lower watershed. Thirty-five percent by area of Meadow-Brush Creek watershed has been harvested, and 25 percent of Lower Chiwawa has been harvested and road densities are high. However, only 2 percent of the remainder of the watershed has been harvested and road densities are low. Thirty percent is in wilderness. Overall, impacts due to roads and timber harvest are minimal in most of the watershed. The Chiwawa River, especially above Chikamin Creek is judged to be a good example of a functioning watershed, stream channel system.

B5. At-Risk Fish Populations – Score 10

The Chiwawa watershed has a number of significant sub-watersheds. The Middle Chiwawa, Upper Chiwawa, Headwaters Chiwawa, Chikamin, and Rock sub-watersheds are significant for bull trout. Lower Chiwawa, Middle Chiwawa and Upper Chiwawa are significant for spring chinook salmon. There are also significant sub-watersheds for west slope cutthroat trout. The number of significant sub-watersheds, combined with high quality habitat, makes the Chiwawa watershed an important anchor and refugia for bu2.80002 Tm(B5. At-Ri468.55438 468.1245s1j11.97729 0 0 12

habitat and habitat effectiveness ratings for the Twin Lakes MLSA are high.

Table 10. Road density of Lynx Analysis Units within the Chiwawa Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density (mi/mi^2)
Chiwawa	17.7	95.7	0.2
Copper Peak	0.0	<1	0
Cougar	32.3	14.3	2.3
Garland	28.2	43.8	0.6
Upper Entiat	0.0	<1	0
White River	13.0	8.0	1.6

Mean Road Density = 0.8 mi/mi^2

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 16,840 acres (14.0 percent) of the Chiwawa Watershed. The open road density within the riparian reserves is moderate, 1.02 mi/mi^2.

C4. Ungulates

The Chiwawa Watershed contains no mapped ungulate winter range (EW-1). However, the Chiwawa River drainage is especially important for fawning and other areas have been identified as important migration corridors.

C5. Unique Habitats

Unique habitats are diverse and abundant in the Chiwawa Watershed, covering 48,935 acres (40.8 percent). Table 11 provides a summary of the availability of unique habitats in the Chiwawa Watershed.

Table 11. Availability of unique habitats in the Chiwawa Watershed

Unique habitat	Acres	% of watershed
Avalanche origin openings	11,184	9.3
Brushfield	7,521	6.3
Cliff/bedrock	8,654	7.2
Deciduous forest	55	0.0
Ice/snow	387	0.3
Lodgepole	1,238	1.0
Mesic open park-like	1,183	1.0
Natural created openings in Wilderness	126	0.1
Riparian forest/valley bottom	4,083	3.4
Subalpine/open/park-like	5,128	4.3
Talus/scree	5,447	4.5
Upland meadow	3,289	2.7
Water	110	0.1
Wet meadow	461	0.4
Wet park-like	69	0.1

White and Little Wenatchee Rivers Watersheds

There are 11.6 miles of maintenance level 4 roads in the White and Little Wenatchee Watersheds, and 20.1 miles of maintenance level 3. There are no maintenance level 5 roads. The major roads and travel routes in the watershed are described below.

White River Road (6400) is the main road up White River. It follows the north shore of Lake Wenatchee and continues up the White River. It is 3.6 miles long, with a maintenance level of 2. There are three developed campgrounds, a trailhead, and private in-holdings along the road.

Little Wenatchee Road (6500) branches off White River road just west of Lake Wenatchee and is the main road up the Little Wenatchee River. The first 11.6 miles are a maintenance level 4, and the last 2.8 miles are a maintenance level 2. There are four developed campgrounds and three trailheads along the road.

Rainy Creek Road (6700) is a travel route between the Little Wenatchee River and Nason Creek. Approximately 8.6 miles of this road are in the Little Wenatchee Watershed, at maintenance level 3. Labyrinth Mountain Road (6701) branches off the Little Wenatchee road and follows the south side of the Little Wenatchee River for 7.9 miles at maintenance level 3. Two trailheads are accessed by roads branching from Labyrinth Mountain road.

A. Human Use

A1. Public Use

The Little Wenatchee and White River Watersheds offer a variety of year-round recreational opportunities. The developed recreation facilities are clustered along the Little Wenatchee and White River road corridors. There are seven campgrounds within the watershed. Most of the campgrounds are small with minimal facilities or development. Dispersed camping occurs throughout the watershed, but is concentrated in sites along the Little Wenatchee River. Areas of moderate use include Hidden Creek, Snowy Creek, and the old Riverside Campground area.

All trails within the watershed are in, or lead to, wilderness with the exception of the Snow and Lake Creek trails. There are 136 miles of system trails in the watershed, with 112 of the miles maintained. Seven trailheads provide direct access to the wilderness portions of the watershed.

Other recreation uses include gathering forest products, hiking, rock hounding, picnicking, camping, and driving for pleasure. Recreation use can best be described as moderate, with heaviest use occurring on weekends.

There is limited rural private property and development in this watershed. Private property is confined mostly to the lower five miles of the White River and the lower two miles of the Little Wenatchee. This property consists of summer homes, year-round residences, Tall Timbers Camp, and two rock quarries in the Little Wenatchee drainage. Much of this land dates back to the original homesteaders in the late 1800s. Private property in the lower river drainages has

been highly modified.

There are numerous mining claims in both watersheds.

A2. Resource Management

The dominant vegetation groups in the Little Wenatchee and White River Watersheds are primarily those in the wet forest, moist grand fir, brushfields, upland meadows, subalpine fir, valley bottom mixed conifer/deciduous, and some whitebark pine on exposed ridges.

The geology and climate of the area have a direct influence on vegetation composition, structure, and successional stage. The maritime influence of the Cascade Crest gave way to drier continental climate near lower Lake Wenatchee. Annual precipitation ranges from ~34" at Lake Wenatchee, to 100+' at the crest. These amounts, as well as other important climatic factors, such as timing and form of precipitation, thunderstorms with consequent lightning ignitions, and rain on snow and other flood events, provide for a wide array of forest and non-forest environments and habitats.

The existing condition of forested ecosystems in the two watersheds is relatively healthy and vigorous with exceptions being the whitebark pine type due to pathogens and fire suppression, and increasing potential for insect and pathogen attack within the moist grand fir type and valley bottomland vegetation conversion through past grazing and timber harvest.
These ecosystems have evolved with periodic fire, including lightning and human caused ignitions. Fire exclusion policies practiced within the past century have altered stand structure, species composition, and patch size across the landscape, most notably on ridgetops with whitebark pine and in the shorter fire return interval ecosystems in the lower elevations. The naturally long fire return intervals of mid and high elevation forests appear to have insulated them from most of the detectable ecological effects of the fire exclusion policy.

Fire at the urban-rural-wildland interface is a concern in the lower White River area, with residential growth, and in both watersheds with increasing developed and dispersed recreation.

Noxious weeds grow along roads 6400000, 6500000, and 6700000. The species present include diffuse knapweed, spotted knapweed, St. John’s wort, oxeye daisy, and dalmation toadflax.

The information for this section was obtained from the White and Little Wenatchee Rivers Watershed Assessment, (Lake Wenatchee Ranger District, Wenatchee National Forest, 1998).

B. Aquatics

B1. Little Wenatchee River Watershed

The Little Wenatchee River is a major tributary to Lake Wenatchee. Heading at the Cascade Mountain crest, the Little Wenatchee River flows southeast roughly 25 miles into Lake Wenatchee. Little Wenatchee Falls, at approximately river mile 6.8, is a barrier to migratory fish. Sub-watersheds are Lower Little Wenatchee, Upper Little Wenatchee, Headwaters Little Wenatchee, Rainy, and Lake.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in the Biological Assessment for Steelhead, Spring Chinook Bull Trout and Cutthroat Trout in the White-Little Wenatchee Watershed (U.S. Fish and Wildlife Service, December 1998).

Little Wenatchee: Geologic Hazard – Score 2

The Little Wenatchee Watershed falls primarily within the Wenatchee Highland Subsection. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite, and granodiorite, respectively. These rock units are essentially highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial troughwalls.

The glacial trough landforms are the dominant landforms within the Little Wenatchee Watershed. The upper ridges of these troughs are composed mostly of exposed bedrock, which collect a large amount of precipitation but have little potential to store or regulate runoff. Runoff from upper troughwalls is concentrated into the dense pattern of first-order streams. Shallow landslides (debris flows) are a significant source of sediment delivery and often originate from these first-order drainages along the interface between glacial till deposits and scoured bedrock. These debris flows have deposited numerous debris fans/cones in the valley floor. As these fans coalesce usually in the upper watersheds, they cause stream confinement and streams become bounded by these fans altering stream alignment and gradient. Debris flows can deliver sediment directly into stream systems. Likely a more important sediment delivery mechanism is the degree of stream scour along fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured

Shallow rapid landslides (debris flows) are the major sources of sediment that originate from the dense pattern of first order tributary streams. However, a major source of sedimentation is also stream scour of channels and banks as stream adjust to the types of confinement discussed in the pervious paragraph.

Large, localized deep-seated landslides (>100 cubic meters) is another source of hill slope sediment is. . These landslides occur in areas of underlying bedrock weaknesses such as, along troughwalls which are often associated with faults and major plains of weakness

The major source areas for hill-slope sediment are believed to be delivered from: glacial trough landforms totaling 27,332 acres; deep-seated landslides totaling 2,694 acres; and valley bottom landforms totaling 4,714 acres. Roads and river confinement by roads have accelerated the natural rate of coarse sediment delivery.

Table 12. Little Wenatchee: Total miles of road within naturally high sediment sources

Glacial trough landforms	31.14
Deep-seated landslides	1.4

Valley bottom landforms	3.0

Little Wenatchee: Road Related Fine Sediment – Score 3

There is no quantitative fine sediment data for the Little Wenatchee Watershed. Stream surveyors noted that gravels appeared to be embedded and suggested there may be evidence of pools filling with fines, so the watershed is rated at risk for fine sediment. Roads are likely contributing to fine sediment but are not a major contributor.

Little Wenatchee: Floodplain Function, Off-Channel Habitat and Riparian Reserves – Score 3

near and at the Cascade Crest. The watershed provides important habitat for spring chinook salmon, bull trout, sockeye salmon, west slope cutthroat trout, resident rainbow trout and possibly steelhead. Anadromous and migratory fish access to the watershed is blocked by White River Falls. Much of the watershed is in wilderness or has had little land management. The lower river, with its broad floodplain, flows through private lands. Sub-watersheds are Lower White River, Upper White River, Headwaters White River, Napeequa, Panther, and Indian.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in the Biological Assessment for Steelhead, Spring Chinook Bull Trout and Cutthroat Trout in the White-Little Wenatchee Watershed (U.S. Fish and Wildlife Service, December, 1998).

White River: Geologic Hazard – Score 2

The White River Watershed falls primarily within the Wenatchee Highland Subsection. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite and granodiorite respectively. These rock units are essentially highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial troughwall.

The glacial trough landforms are the dominant landforms within the White River Watershed. The upper ridges of these troughs are composed mostly of exposed bedrock, which collect a large amount of precipitation but have little potential to store or regulate runoff. Runoff from upper troughwalls is concentrated into the dense pattern of first-order streams. Shallow landslides (debris flows) are a significant source of sediment delivery and often originate from these first-order drainages along the interface between glacial till deposits and scoured bedrock. These debris flows have deposited numerous debris fans/cones in the valley floor. As these fans coalesce, usually in the upper watersheds, they cause stream confinement and streams become bounded by these fans which alter stream alignment and gradient. Debris flows can deliver sediment directly into stream systems. Likely a more important sediment delivery mechanism is the degree of stream scour along fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured.

The major sources of sediment delivery are generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first-order tributary streams. Another major source of sedimentation is stream scour of channels and banks as stream adjust to the types of confinement discussed in the pervious paragraph.

Another source of hill slope sediment is generated from fairly large localized deep-seated landslides. These landslides occur along troughwalls often associated with faults or major planes of weakness such as from schist bedrock units.

The major source areas for hill slope sediment are felt to be delivered from: Glacial trough landforms totaling 49,005 acres; deep-seated landslides totaling 3975 acres; and valley bottom landforms totaling 6,383 acres. Roads can accelerate the natural rate of coarse sediment delivery; however, the low level of road miles likely has not had a lot of effect on sediment acceleration.

Table 13. White River Watershed: Total miles of road within naturally high sediment sources

Glacial trough landforms	1.7
Deep-seated landslides	--
Valley bottom landforms	2.1

White River: Road Related Fine Sediment – Score 1

The White River and the Napeequa River are glacial, transporting glacial flour in the summer. In 1993 a McNeil Core sample recorded 21% fines (<1.0mm) in the White River below the Napeequa confluence and 15% above the confluence with the Napeequa. Because both the White River and the Napeequa River watersheds are either in wilderness or largely unmanaged, it was felt that sediment levels are close to natural and therefore the watershed was judged to be functioning appropriately for fine sediment.

White River: Floodplain Function, Off-Channel Habitat, and Riparian Reserves – Score 9

Off-channel habitat is judged to be functioning appropriately with abundant off channel habitat.

Floodplain function and riparian reserves are rated functioning at risk, however. The main White River Road, 6400, is located in the floodplain, as is the small Napeequa campground. Near the campground and just upstream of the confluence with the Napeequa River the road is inhibiting channel migration. However, overall, the effects of the road on the floodplain are minor because the floodplain is extensive and the road impact is localized. The primary reasons for the functioning at-risk determination are housing development and potential housing development within the floodplain and riparian reserve in the lower White River.

The White River is functioning at risk for riparian habitat conditions primarily due to past management from the Panther Creek confluence downstream. The watershed has had relatively light management and little timber harvest overall. Turn of the century and early 1990's riparian logging and land clearing from the Nepeequa confluence downstream has altered the riparian vegetation. Sixty-one percent of the riparian reserve acres in the Lower White River sub-watershed, and 20% in the Upper White River sub-watershed, have been affected, specifically a vegetation conversion from old-growth cedar to pasture and cottonwood forest. The conversion has reduced, but not eliminated, potential, future large wood input to the channel. So, while the White River is providing excellent fish habitat, there have been impacts and continue to be potential threats to the habitat. The score for the White River is a 9 because of the potential threats including the need to keep the White River Road for access, and the importance of the White River as potential habitat refugia.

White River: Flow Effects – Score 3

Due to the lack of vegetation management in the watershed, other than the past riparian management discussed above, it is not believed flows have been altered. While overall road densities are low, there are almost two miles per square mile of road downstream of the wilderness boundary much of which is in the floodplain.

White River: At-Risk Fish Populations – Score 10

Steelhead are assumed to be present in the White River downstream of White River falls, although presence has not been recently confirmed. The Douglas County Public Utility District radio telemetry study in 1999 recorded no tagged fish entering the White River. Spring chinook salmon are present in the White River. The Lower White River and Upper White River sub-watersheds are considered significant for spring chinook because the White River is an important spawning stream for the Wenatchee River spring chinook population.

The upper White River is significant for bull trout. In each of 1999 and 2000, over 40 bull trout redds were counted in the White River (U.S.D.A. Forest Service, Wenatchee National Forest, unpublished data). Panther Creek sub-watershed is also significant for bull trout spawning and rearing.

While not an at-risk species, sockeye salmon are highly dependent on the White River. The White River and Napeequa Rivers are significant for sockeye because the majority of the Lake Wenatchee sockeye salmon population spawn in these two streams.

While there are habitat concerns, for the most part the White River provides high quality habitat for at-risk fish species.

C. Wildlife

These two watersheds cover a large area (Little Wenatchee 64,783 acres, White 100,013 acres) that provides quality habitat with low road densities. They also provide access to wilderness areas and therefore experience high human recreational use. There are moderate opportunities for improvement, and, as with the Chiwawa Watershed, maintenance of current habitat quality is the foremost concern.

C1. Wide-Ranging Carnivores

The open road densities on the Little Wenatchee and White Watersheds are low, at 0.94 mi/mi^2 and 0.23 mi/mi^2, respectively. Approximately 51.4% of the Little Wenatchee Watershed is core habitat, for a total of 33,267 acres. The White Watershed provides the highest proportion of core habitat within the Lake Wenatchee-Leavenworth Sub-Basin. Approximately 80.2% of the White Watershed is core habitat, for a total of 80,222 acres. Portions of several LAUs are located within the boundaries of the Little Wenatchee/White Watersheds. Tables 14 and 15 provide details regarding the low road densities of those portions within each watershed. For a description of each LAU, see Appendix I.

Table 14. Road density of Lynx Analysis Units (LAUS) within the Little Wenatchee Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density* (mi/mi^2)
Little Wenatchee	33.0	67.4	0.5
Nason	14.0	18.1	0.8
White River	0	0.1	0

*Mean Road Density = 0.4 mi/mi^2

Table 15. Road density of Lynx Analysis Units (LAUs) within the White Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density* (mi/mi^2)
Garland	0	<0.1	0
Little Wenatchee	7.1	21.7	0.3
White River	5.5	121.2	0.1

* Mean Road Density = 0.1 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A portion of the Little Wenatchee late successional reserve (LSR) occupies 31,299 acres (48.3%) of the Little Wenatchee Watershed. The security habitat rating is moderate, while the habitat effectiveness rating is low. Small portions of several LSR/MLSAs are located in the White Watershed. Table 16 summarizes habitat effectiveness information.

Table 16. Little Wenatchee Watershed: Habitat effectiveness

LSR/MLSA	Acreage (% watershed)	Security habitat rating	Habitat effectiveness rating
Chiwawa LSR	6 (<0.1)	Low	Moderate
Little Wenatchee LSR	6,853 (6.9)	Moderate	Low
Twin Lakes MLSA	4,598 (4.6)	High	High

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 10,376 acres (16.0%) of the Little Wenatchee Watershed and 18,561 acres (18.6%) of the White Watershed. The open road density within the riparian reserves is low, at 0.9 mi/mi^2 and 0.3 mi/mi^2, respectively.

C4. Ungulates

No mapped ungulate winter range (Management Prescription EW-1) exists on the Little Wenatchee/White Watersheds. However, both watersheds provide excellent deer fawning habitat

and migration corridors.

C5. Unique Habitats

Unique habitats are diverse and abundant in the Little Wenatchee Watershed, covering 16,895 acres (26.1%). Table 17 summarizes the availability of unique habitats in the Little Wenatchee Watershed.

Table 17. Availability of unique habitats in the Little Wenatchee Watershed

Unique	Acres	% of watershed
Brushfield	5,222	8.1
Cliff/bedrock	1945	3.0
Deciduous forest	460	0.7
Ice/snow	8	< 0.1
Lodgepole	135	0.2
Mesic open park-like	75	0.1
Natural created openings in wilderness	3	0.5
Riparian forest/valley bottom	354	0.3
Subalpine/open/park-like	214	0.3
Talus/scree	901	1.4
Upland meadow	2929	4.5
Water	479	0.7
Wet meadow	871	1.3
Wet park-like	3300	5.1

Unique habitats are also extremely diverse and abundant in the White Watershed, covering 59,159 acres (59.2%). Table 18 summarizes the availability of unique habitats in the White Watershed.

Table 18. Availability of unique habitats in the White River Watershed

Unique	Acres	% of watershed
Avalanche origin openings	3,291	3.3
Brushfield	13,853	13.9
Cliff/bedrock	18,523	18.5
Deciduous forest	1,515	1.5
Ice/snow	2,430	2.4
Lodgepole	695	0.7
Natural created openings in Wilderness	560	0.6
Riparian forest/valley bottom	249	0.2
Subalpine/open/park-like	797	0.8
Talus/scree	4,894	4.9
Upland meadow	9,350	9.3
Water	618	0.6
Wet meadow	685	0.7
Wet park-like	1,701	1.7

Nason Creek Watershed

There are four miles of maintenance level 3 roads in the Nason Creek Watershed, and no maintenance level 4 or 5 roads. The major roads and travel routes in the watershed are described below.

Rainy Creek Road (6700) is the travel route between Highway 2 and the upper end of Lake Wenatchee. It leaves Highway 2 at Nason Creek. The four miles of this road within the Nason Creek Watershed are a maintenance level 3.

Three roads—Merritt Lake Trailhead (6900657), Gill Creek (6940), and Butcher Creek (6910)—branch off Highway 2 west of Coles Corner, and access trailheads. They are 1.6 miles, 4.3 miles, and 1 mile respectively, all at maintenance level 2. White Pine Road (6950) also branches off Highway 2, and accesses private in-holdings (Cascade Meadows Church Camp) and a trailhead. It is 3.8 miles long, with a maintenance level of 2.

A. Human Use

A1. Public Use

Recreational use within the Nason Creek Watershed is high because of a number of features. Of most importance is the close proximity to the Puget Sound metropolitan area, and the major east/west travel rout of U.S. Highway 2 (1,250,000 vehicles per year). This highway is part of the Cascade Loop and the National Forest Scenic Byway System.

Much of the drainage, particularly the upper elevations, receives considerable amounts of snow. Steven's Pass, Inc., maintains and operates a downhill ski area at the pass and a Nordic center in the Mill Creek drainage. These are highly successful operations. Proposals have been made to expand facilities at both areas.

There are two campgrounds in the watershed: White Pine and Nason Creek. Nason Creek Campground is a highly developed, popular campground near the Lake Wenatchee State Park.

Eleven trails are located within the drainage, with a total of 72.5 miles.

Development of the Nason Creek watershed as a transportation/utility corridor has been ongoing and extensive. The Burlington Northern Railroad was completed across Steven's Pass in the early 1890s. Highway 2 was completed in the 1920s. Two powerline corridors are associated with the Bonneville Power Administration and the Chelan County Public Utility District.

A2. Resource Management

The vegetation in the Nason Creek Watershed is a transition zone, stretching from the high elevation subalpine forests at the crest of the Cascade Mountains at approximately 5500 feet elevation, to dry forest environments around 2000 feet in elevation. While over 80% of the watershed is occupied by coniferous forests, the broad range of elevation and vegetation types contains many unique habitats. High, rocky peaks and alpine meadows are intermixed with high

elevation forests, and lower elevations are populated by groves of aspen near rivers and streams. Fire has played a key role in shaping the vegetation patterns through time, especially in the eastern half of the watershed.

The Nason Creek Watershed Analysis, (Lake Wenatchee Ranger District, Wenatchee National Forest 1996) was the information source for this section.

B. Aquatics

The headwaters of Nason Creek lie in the eastern slopes of the Cascade Mountains in central Washington. Nason Creek flows east approximately 21 miles and then turns north for another 5 miles before emptying into the Wenatchee River just below Lake Wenatchee. Nason Creek contributes approximately 18% of the low flow of the Wenatchee basin. The highest elevation is approximately 5500 feet at Snowgrass Mountain; the mouth of the watershed is at 1865 feet. Precipitation and forest vegetation vary substantially along this elevational gradient. Annual precipitation ranges from 30 to 90 inches; 84% of the basin receives 50-80 inches annually. Vegetation ranges from subalpine to dry forest. Coho salmon historically occurred in Nason Creek, were extirpated, but are currently being reintroduced by the Yakama Nation. Spring chinook, steelhead, bull trout, cutthroat and redband trout spawn and rear in Nason watershed. Whitefish, dace, and sculpin species also occur in the watershed.

Sub-watersheds include Headwaters Nason, Upper Nason, Lower Nason, Butcher-Kahler, Gill-Roaring-Coulter, and Whitepine.

The existing habitat conditions was obtained from the most recent environmental baseline. The baseline was established in “A Biological Assessment for Steelhead, Spring Chinook Bull Trout and Cutthroat Trout, in Nason Watershed. Baseline Conditions and Effects of On-going Activities, Including Recreation,” for 1999” (U.S.D.A. Forest Service, 1998).

B1. Geologic Hazard – Score 6

The Nason Watershed falls primarily within the Wenatchee Highland Subsection. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite, and granodiorite respectively. These rock units are essentially highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial troughwall.

The glacial trough landforms are the dominant landforms within the Nason Watershed. The upper ridges of these troughs are composed mostly of exposed bedrock, which collect a large amount of precipitation but have little potential to store or regulate runoff. Runoff from upper trough walls is concentrated into the dense pattern of first order streams. Shallow landslides (debris flows) are a significant source of sediment delivery and often originate from these first order drainages along the interface between glacial till deposits and scoured bedrock. These debris flows have deposited numerous debris fans/cones in the valley floor. As these fans coalesce usually in the upper watersheds, they cause stream confinement and streams become bounded by these fans, altering stream alignment and gradient. Debris flows can deliver sediment directly into stream systems. Likely a more important sediment delivery mechanism is

the degree of stream scour along fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured.

The major sources of sediment delivery are generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first order tributary streams. However, stream alignment adjustment to confinement is also a major source of sediment input. Another source of hill slope sediment is generated from small localized deep-seated landslides. These landslides occur along troughwalls. Faults are often found along contacts of weaker rock formations, such as schistostic units.

The major source areas for hill slope sediment are felt to be delivered from: Glacial trough landforms totaling 46,833 acres; deep-seated landslides totaling 5,377 acres; and valley bottom landforms totaling 2,547 acres. The historic watershed scale fires in Wildhorse and Whitepine accelerated the natural rate of sediment delivery from debris flows. The rate of debris flows has subsided but the Nason Watershed is still in the process of redistributing this increased coarse sediment. Also, roads and river confinement by roads have accelerated the natural rate of coarse sediment delivery.

Table 19. Nason Watershed: Total miles of road within naturally high sediment sources

Glacial trough landforms	27.3
Deep-seated landslides	2.7
Valley bottom landforms	16

B2. Road-Related Fine Sedi5351 0 0 13.98238549871 1 10.0875ni5351 0 0 13.98238549875

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functioning at unacceptable risk.

B3. Floodplain Function, Off-Channel Habitat and Riparian Reserves – Score 10

Nason Creek has been cut off from extensive floodplain areas and off-channel habitat by the railroad, highways/roads, and private development. Although off-channel loss has been most severe in the lowest 15 miles of Nason Creek, it has been significant in all areas of unconfined channel, including Nason Creek headwaters. Nason Creek below Smith Brook is functioning at unacceptable risk for off-channel habitat, and Nason Creek above Smith Brook is functioning at risk for off-channel habitat. Floodplain function and off-channel habitat has been impact in a similar manner on many of the tributaries.

Due to extensive floodplain development, much of it on private land, riparian reserves are functioning at unacceptable risk in Nason Creek below Whitepine, and in Kahler, Gill, Roaring, and Coulter Creeks. Nason above Whitepine is functioning at risk due to stream bank and floodplain impact on private land, for example, alteration of bank within bankfull with heavy machinery, as well as floodplain/bank impact of railroad, highway, and power lines.

B4. Flow Effects – Score 10

All sub-watersheds except Whitepine (primarily wilderness) and headwaters Nason (Nason above Mill) are functioning at unacceptable risk for road density.

Continuous stream flow data is not available in Nason watershed. Based on increased drainage network, road densities, and timber harvest, there may be pronounced changes in timing of flows within the watershed. Therefore, Nason watershed is judged functioning at unacceptable risk for peak/base flows. Channel confinement due to state Highway 2 the railroad and development confine the mainstem Nason and tributaries prevent the channel from accessing the floodplain and creating an unstable channel, compared to similar more naturally functioning watersheds.

B5. At-Risk Fish Populations – Score 6

The only known bull trout spawning in Nason watershed is in Mill Creek and in mainstem Nason in the vicinity of Mill Creek. Until recently the bull trout population in Mill Creek and upper Nason was believed to be resident. Large adult bull trout have been observed migrating up Nason Creek, and may be originating in Lake Wenatchee. A migratory-sized (>20 inches in length) adult bull trout has been observed in Nason Creek above Cascade tunnel. Headwaters Nason are considered significant for bull trout because the sub-watershed(s) provide the only identified spawning and rearing area for bull trout in Nason Creek.

Steelhead have been observed in Roaring Creek and above the confluence with Whitepine. Steelhead have access to habitat in Nason Creek up to a natural passage barrier of a series of bedrock falls at the Bygone Byways trailhead between Mill Creek and Smith Brook. The lower portions of Kahler, Butcher, Coulter, Roaring, Gill, Whitepine, Henry, and Mill Creeks offer potential steelhead habitat, but the amount of steelhead spawning and rearing is unknown. Radio telemetry data from 1999 (Douglas County Public Utility District, unpublished data) revealed a small number of steelhead using the lower reaches of Nason only, at least that year.

Spring chinook salmon spawn in lower Nason and the lower 15.8 miles of Nason Creek. The lower Nason sub-watershed is considered significant for spring chinook. Habitat problems, briefly discussed above, keep Nason Creek from being secure refugia for steelhead, bull trout, or spring chinook at this time. The Nason watershed is important because of its size. If habitat problems can be improved, it may be important for the recovery of bull trout and steelhead, as well as important for the persistence of spring chinook; therefore, the score is 6.

C. Wildlife

Nason Watershed is a smaller (68,321 acres) watershed centrally located within the Lake Wenatchee-Leavenworth Sub-Basin. Road density and habitat quality are moderate, as is the potential for improvement opportunities. Highway 2 bisects the watershed.

C1. Wide-Ranging Carnivores

The open road density in the Nason Watershed is moderate at 1.36 mi/mi^2. Core habitat occupies 43.0% of the watershed, for a total of 29,352 acres. This watershed contains portions of three Lynx Analysis Units: Icicle Ridge, Nason and Upper Icicle. The following table describes the range of road densities of those portions within the Nason Watershed. For a description of each LAU, see Appendix I.

Table 20. Road density of Lynx Analysis Units (LAUs) within the Nason Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density (mi/mi^2)*
Icicle Ridge	0.6	0.2	3.8
Nason	78.9	85.3	0.9
Upper Icicle	0	0.1	0

*Mean road density = 1.6 mi/mi^2

C2. Late-successional Associated Wildlife Species

Portions of several LSR/MLSAs are located in the Nason Watershed. Habitat effectiveness information is summarized in Table 21.

Table 21. Nason Watershed: Habitat effectiveness

LSR/MLSA	Acreage (% watershed)	Security habitat rating	Habitat effectiveness rating
Deadhorse LSR	19.5 (0.03)	Moderate	High
Little Wenatchee LSR	14,357 (21.0)	Moderate	Low
Natapoc MLSA	26.5 (0.04)	Low	Low

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 10,031 acres (14.7%) of the Nason Watershed. The open road density within the riparian reserves is moderate, 1.8 mi/mi^2.

C4. Ungulates

No mapped ungulate winter range (EW-1) exists on the Nason Watershed; however, limited winter range habitat is present. The watershed also provides access to mountain goat spring and summer range and some high quality deer fawning habitat.

C5. Unique Habitats

Unique habitats are very diverse and abundant in the Nason Watershed, covering 24,598 acres (36.0%). Table 22 summarizes the availability of unique habitats in the Nason Watershed.

Table 22. Availability of unique habitats in the Nason Watershed

Unique habitat	Acres	% of watershed
Brushfield	5,158	7.6
Cliff/bedrock	5,018	7.3
Deciduous forest	673	1.0
Ice/snow	3	0.0
Lodgepole	1,199	1.8
Mesic open park-like	1,607	2.4
Natural created openings in Wilderness	952	1.4
Riparian forest/valley bottom	1,322	1.9
Subalpine/open/park-like	1,776	2.6
Talus/scree	1,479	2.2
Upland meadow	2,176	3.2
Water	549	0.8
Wet meadow	368	0.5
Wet park-like	2,316	3.4

Peshastin Watershed

There are two main roads within the Peshastin Watershed. Both are maintenance level 2 roads.

Camas Land Road (7200) branches off Highway 97, and follows Camas Creek. The first 3.2 miles of this road are in the Mission Creek Watershed, and 1.8 miles are in the Peshastin Watershed. The entire road is maintenance level 2. Mountain Home Ranch Road (7300) is a travel route between Leavenworth and Highway 97, around the west side of Boundary Butte. There are 3.3 miles of the road within Peshastin Creek Watershed.

A. Human Use

A1. Public Use

A variety of distinct human uses occur in the Peshastin Watershed. First is the travel route of the Highway 97, which goes over Blewett Pass. Pleasure-driving and viewing fall colors are major draws of the highway. The highway is primarily a through route where people generally do not stop along the corridor, but are traveling to other destinations. The second level of use is related

to the many dispersed recreational opportunities available throughout the landscape on a year-round basis. Developed sites are not abundant and are located along the foreground of Highway 97. These include the Arrastrata Interpretive Site and Swauk Forest Discovery Interpretive Trail. The Tronsen campground was closed in 1994 due to vegetation management issues and safety. The majority of recreational use is dispersed camping, off-road vehicle (ORV) use, driving forest roads, hiking, hunting, winter sports, and going into the Alpine Lakes Wilderness, Teanaway Recreation Area, and Table Mountain area. Near Blewett Pass, snowmobile use, and cross country skiing are major uses in the winter.

A variety of water bodies including marshes, lakes, and streams are in the landscape. Peshastin Creek adds distinct variety in vegetation, fall colors, and presence of water. Tronson Creek flows into Peshastin Creek at the Old Blewett Road intersection. Several creeks feed into Peshastin Creek. There are numerous high mountain lakes up Ingalls valley, sitting in cirques, which are pristine and spectacular.

There is one main travel route, U.S. Highway 97, and five secondary travel routes and viewsheds; Mountain Home Road (7300), Camas Road (7200) loop to Ruby Creek road (7204), Old Blewett Road (7320), Scotty Creek Road (7324), and a segment of Table Mountain Road (9716).

A2. Resource Management

Vegetation in the Peshastin Watershed reflects the influence of maritime and continental climates. The mouth of the watershed receives roughly 20 inches of precipitation, while the headwaters of Ingalls Creek around Ingalls Lake is in a precipitation zone of roughly 100 inches. The topography, geology, and soils are quite varied as well, further influencing the vegetation pattern. A simplified description of the dominant vegetation encountered from low to high elevation in the lower half of the watershed would be ponderosa pine, and Douglas-fir, grand fir, subalpine fir, and alpine meadows or parkland with subalpine larch. In the upper portion of Ingalls Creek, the progression from low to high elevation would be western hemlock, silver fir, mountain hemlock, an alpine meadow, and parkland with whitebark pine.

Forests in the dry vegetation group in the watershed have changed over the past century. The most significant change has been the dense colonization of a fire-protected age class of trees, particularly ponderosa pine and Douglas-fir. In the Douglas-fir and dry grand fir association, fire exclusion has not only changed tree density, but caused a major shift to more shade-tolerant species. Now, rather than low intensity underburns being the normal fire regime in this dry vegetation group, moderate to high-severity fires have the potential to occur. In addition, the potential for wide-spread insect or disease epidemics has greatly increased.

Mistletoe, especially in Douglas-fir, also appears to be widespread and increasing within the watershed. Frequent ground fires would inhibit the spread of mistletoe. Ground fires would have pruned lower branches, which are often the most infected, or would have consumed entire trees with low hanging witches’ brooms. The open stand structure with widely spaced trees, the result of a frequent fire regime, is also not conducive to the spread of mistletoe as are dense layered stands. Douglas-fir mistletoe has also become more abundant simply because its host has become more abundant due to fire suppression.

The watershed has a number of weed species along the roadways. Most notable and widespread are diffuse knapweed, oxeye daisy, and Dalmatian toadflax.

The information for this section was obtained from the Peshastin Watershed Assessment, (Leavenworth Ranger District, Wenatchee National Forest 1999).

B. Aquatics

Peshastin Creek flows into the Wenatchee River just downstream of the town of Peshastin. The watershed generally flows north off the Wenatchee Mountains. While it is a relatively large drainage area, the watershed contributes only about four percent of the low flow in the Wenatchee. Irrigation withdrawal, State Highway 97, agriculture, and mining have impacted fish habitat in the watershed. Sub-watersheds include Lower Peshastin, Camas, Upper Peshastin, Ingalls, Negro, and Headwaters Peshastin.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in the Lower Peshastin Ecosystem Restoration Project. Leavenworth Ranger District, Wenatchee National Forest. Fisheries Biological Evaluation (U.S. Fish and Wildlife Service, August 18, 1999).

B1. Geologic Hazard - Score 6

The Peshastin Watershed falls within two subsections: the Wenatchee Highland and Wenatchee/Swauk Sandstone Hill. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite, and granodiorite respectively. There are some isolated inclusions of serpentinite along the southeast margin of the subsection. These rock units are essentially highly resistant to weathering except for the serpentine member. The primary geomorphic process was alpine glaciation, which carved out fairly broad U-shaped valleys framed by steep glacial trough landforms. The Wenatchee/Swauk Sandstone Hills is composed almost entirely of continental sediments that include the Swauk and Chumstick Formations (thinly bedded mica and feldspar rich sandstone). These rock units are subject to accelerated weathering. The primary geomorphic process has been fluvial erosion creating very narrow V-shaped valleys framed by steep dissected mountain slopes. Both of these subsections are efficient at delivering sediment.

The Wenatchee/Swauk Sandstone Hills is very efficient at delivering soil material to first-order drainages and ephemeral systems where the sediment accumulates and fills in these types of drainage systems. During high intensity storm events, this stored sediment can be delivered to higher-order stream systems.

The major sources of hill slope sediment is generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first order tributary streams and a few deep seated landslides. Coarse sediment is generally delivered from the Wenatchee Highlands, while fine sediment is the rule from the Wenatchee/Swauk Sandstone Hills.

The major source areas for hill slope sediment are felt to be delivered from: Glacial trough landforms totaling 3,337 acres; deep-seated landslides totaling 7,205 acres; and structurally-controlled mountain slopes totaling 43,244 acres. The structurally controlled mountain slopes are responsible for contributing naturally high levels of fine sediment. However, roads can accelerate the natural rate of fine sediment delivery. The miles of road in each landform type are listed below.

Table 23. Peshastin Watershed: Total miles of road within naturally high sediment sources

Glacial trough landforms	--
Deep-seated landslides	1.1
Structurally-controlled mountain slope	2.32

B2. Road-Related Fine Sediment – Score 10

Information on sediment in the watershed is limited to ocular estimates of embeddedness during stream surveys and McNeil core samples from three reaches, Peshastin downstream of Ingall's Creek, Peshastin Creek near Shazer Creek, and Tronsen Creek just upstream of the confluence with Peshastin Creek. Fine sediment in gravel exceeded 20% fines, <1.0 mm at all three sites with the average of 24.5%. Ocular estimates determined all streams except Ingall's Creek (which drains predominately wilderness) to be embedded. The watershed is judged to be functioning at unacceptable risk for fine sediment. Suction-dredged mining and high road densities may be contributing factors. Roads have been observed delivering sediment to streams during precipitation events.

B3. Floodplain Function, Off-Channel Habitat and Riparian Reserves – Score 10

Floodplain function, off-channel habitat and riparian reserves are all judged to be functioning at unacceptable risk. Roads and road fill occupy much of the floodplain, potential off-channel habitat, and have confined channels. Highway 97 has cut off much of the mainstem Peshastin Creek and straightened the channel. Past and possibly present mining, roads, agriculture, timber harvest and housing development have impacted riparian reserves contributing to a loss of shade, woody debris, and altered channels.

B4. Flow Effects – Score 6

Road density and location are considered functioning at unacceptable risk with an overall road density of 2.4-miles/square mile. Four of the six sub-watersheds have road densities of 2.9-miles/square mile or greater with only the Ingall's and Negro sub-watersheds with low road densities.

The change in peak/base flows element is functioning at risk partially due to irrigation withdrawal but also because of road densities and location, and 18% of the watershed has had

timber harvest. Roads and the highway parallel the stream system cutting off potential water storage in the floodplain.

B5. At-Risk Fish Populations – Score 6

The Ingall's Creek sub-watershed is considered significant for bull trout. Anectodal accounts report migratory bull trout in Ingall's Creek. An irrigation diversion in lower Peshastin Creek may have impacted the migratory population but bull trout are believed to still persist in Ingall's Creek, though the status of the population is unknown. Small, <12-inch bull trout were observed in lower Peshastin Creek in 1996 by U.S. Fish and Wildlife personnel. The Ingall's sub-watershed is considered significant for distribution of the Wenatchee River bull trout because it is the most downstream population in the sub-basin and may be somewhat isolated due to distance from the main population areas in the upper Wenatchee and the passage problems in Lower Peshastin.

Lower Peshastin and Upper Peshastin sub-watersheds are significant for steelhead. Based upon radio telemetry data (Douglas County Public Utility District, unpublished data), a substantial number of steelhead appears to spawn in Peshastin Creek, primarily downstream of Ingall's Creek. It should also be noted that genetic analysis has found potentially essentially pure and good (genetically) redband trout in upper Peshastin Creek and Shazer Creek. Negro Creek has a pure population of west slope cutthroat trout. Watershed restoration should be incorporated into dry forest restoration to secure habitat on national forest land but much of the habitat degradation where steelhead appear to be currently utilizing the watershed is on private land or associated with Highway 97.

C. Wildlife

The Peshastin Watershed (86,445 acres) provides access to multiple-use lands, including wilderness. Highway 97 bisects this watershed. Road density and human use are high year round, creating a high potential for improvement.

C1. Wide-Ranging Carnivores

The open road density in the Peshastin Watershed is high, at 2.14 mi/mi^2. A moderate proportion of the watershed is core habitat, consisting of approximately 30,026 acres (34.7%). Three Lynx Analysis Units (LAUs) are located in the Peshastin Watershed, including: Enchantment, Table Mountain and Teanaway. Table 24 describes the road densities of those portions within the Peshastin Watershed. For a description of each LAU, see Appendix I.

Table 24. Road density of Lynx Analysis Units (LAUs) within the Peshastin Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density* (mi/mi^2)
Enchantment	14.9	40.4	0.4
Table Mountain.	17.3	6.5	2.7
Teanaway	100.0	38.9	2.6

*Mean Road Density = 1.9 mi/mi^2

C2. Late-Successional Associated Wildlife Species

Small portions of several LSR/MLSAs are located in the Peshastin Watershed. Habitat effectiveness information is summarized in table 25.

Table 25. Peshastin Watershed: Habitat effectiveness

LSR/MLSA	Acreage (% watershed)	Security habitat rating	Habitat effectiveness rating
Boundary Butte LSR	6,887 (8.0)	Moderate	Low
Camas MLSA	1,545 (1.8)	Low	Low
Sand Creek MLSA	225 (0.3)	Low	Moderate
Swauk LSR	3,955 (4.6)	Low	Low
Teanaway LSR	8.2 (0.01)	Moderate	High

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 12,062 acres (14.0%) of the Peshastin Watershed. The open road density within the riparian reserves is high, 3.4 mi/mi^2.

C4. Ungulates

The Peshastin Watershed does not provide mapped ungulate winter range habitat (EW-1). However, certain areas may be important to elk and deer for winter range and migration.

C5. Unique Habitats

Unique habitats display a moderate level of diversity and abundance in the Peshastin Watershed, covering 13,272 acres (15.4%). Table 26 summarizes the availability of unique habitats in the Peshastin Watershed.

Table 26. Availability of unique habitats in the Peshastin Watershed

Unique habitat	Acres	% of watershed
Brushfield	255	0.3
Cliff/bedrock	7,230	8.4
Deciduous forest	51	0.1
Ice/snow	147	0.2
Mesic open park-like	48	0.1
Natural created openings in Wilderness	493	0.6
Subalpine/open/park-like	687	0.8
Talus/scree	2,893	3.3
Upland meadow	1,242	1.4
Water	66	0.1
Wet meadow	159	0.2

Icicle Watershed

There are 9.2 miles of maintenance level 5 roads, and 5.1 miles of maintenance level 4 roads in the Icicle Creek Watershed. There are no maintenance level 3 roads. The two major roads and travel routes in the watershed are described below.

Mountain Home Ranch Road (7300) is the travel route between Leavenworth and Highway 97, around the west side of Boundary Butte. A portion of the road is in the Peshastin Creek Watershed. The portion within the Icicle Watershed is 2.5 miles long, maintenance level 2. And the Icicle Road (7600), which branches off Highway 2 on the west side of Leavenworth, is the main road in the Icicle Watershed, and accesses 8 campgrounds, 4 trailheads, and many dispersed sites. The first 9.2 miles are maintenance level 5, and the remaining 5.1 miles are maintenance level 4. Eightmile Road is 3.8 miles in length and is a maintenance level 3 road. It accesses two trailheads.

A. Human Use

A1. Public Use

The Icicle Watershed is a premiere destination area for the Leavenworth Ranger District, offering a variety of recreation opportunities and tremendous scenery. The Icicle is scenically outstanding, with cascading white water of the Icicle River running through the valley bottom, dramatic fall colors, unique rock outcrops and steep canyon walls, and a natural-appearing landscape setting. It is known nationally as a rock climber's paradise, is surrounded by Alpine Lakes Wilderness on three sides, and is linked to the Leavenworth community. Leavenworth is a major tourist town, attracting many day users to the area. The Pacific Crest Trail comes through the upper end of the Icicle, and is a national attraction. Icicle Ridge provides the scenic backdrop for the town of Leavenworth. The Icicle drainage is linear with dramatic relief and is dissected by several drainages; the most significant is the Eightmile drainage, which provides access to the Alpine Lakes Wilderness.

Over 70% of the Icicle Watershed lies within the Alpine Lakes Wilderness. The watershed is the most popular recreation area on the entire Lake Wenatchee-Leavenworth District. People come to the Icicle for a variety of reasons: sightseeing, camping, rock climbing, hiking, picnicking, and to build homes on private land. The summer season is the heaviest use season of the year. Winter activities contribute only a fraction of the total yearly recreation use up the Icicle.

The Icicle has eight campgrounds totaling 170 campsites. In 1993, 31,698 people camped in these campgrounds.

There are about 80 dispersed campsites in the watershed. Six trailheads, Icicle Creek, Eightmile Lake, Chatter Creek, Colchuck Lake, Fourth of July Creek, and Jack Creek, four of which receive 86% of the trailhead use in the watershed.

A2. Resource Management

Vegetation in the Icicle Watershed reflects the influence of maritime and continental climates.

The mouth of the watershed receives roughly 20 inches of precipitation while the headwaters around Lake Josephine is in a precipitation zone of roughly 100 inches. The topography, geology and soils are quite varied as well, further influencing vegetation pattern. The vegetation pattern consists of 18% non-vegetated, 7% non-forest, 8% dry group, 7% moist grand fir, 13% subalpine fir, 40% wet group, and 7% whitebark pine/subalpine fir/lodgepole pine.

The Hatchery and Rat Creek Fires of 1994 were the largest fires in the watershed since before 1920. These 1994 fires became one and spread over 17,080 acres in the Icicle Watershed. Much of this fire exhibited moderate to high fire intensity. Such widespread fire in the drainage was also documented during the period of 1908 to 1920 when a fire of approximately 40,000 acres occurred at the lower end of the watershed. It is interesting to note that the pattern of this fire is quite similar to the pattern of fire spread of the 1994 fires. Based on the age of the trees present in the watershed, it can be reasonably assumed that the intensity was, for the most part, less than the 1994 fires. Many of the older and larger trees that had survived previous fire in the watershed were killed by the 1994 fire.

Noxious weeds grow along the major roads in the watershed. Most notable and widespread are diffuse knapweed, oxeye daisy, and dalmation toadflax. Two sites, one near Bridge Creek Campground, and the other just east of Johnny Creek, have had Scotch broom. The heavy influx of people from the west side of the Cascades is likely responsible for the introduction of Scotch broom.

The information for this section of the Human Uses was obtained from the Icicle Creek Watershed, (Leavenworth Ranger District, Wenatchee National Forest1995).

B. Aquatics

Icicle Creek is an important tributary to the Wenatchee River. From the headwaters at Lake Josephine near the Cascade crest, Icicle Creek flows approximately 32 miles to the confluence with the Wenatchee River at the town of Leavenworth. Icicle Creek contributes up to 19% of low season flows in the Wenatchee. The lower reaches of Icicle Creek near the mouth flows through private land where most of the current habitat degradation due to development has occurred. Approximately 87% of the watershed is within the National Forest, and 74% of the watershed is within the Alpine Lakes Wilderness. Sub-watersheds are Lower Icicle, Middle Icicle, Upper Icicle, Headwaters Icicle, Enchantments, Eightmile, Jack, and French.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in Draft Icicle Biological Assessment 4-19-01, (U.S. Fish and Wildlife Service, 2001).

B1. Geologic Hazard – Score 6

The Icicle Watershed falls within the Wenatchee Highland. The Wenatchee Highlands is composed predominately of metamorphic and igneous crystalline bedrock units that include gneiss, schist, tonalite, and granodiorite respectively. These rock units are essentially highly resistant to weathering. The primary geomorphic process was alpine glaciation, which carved out

Floodplain function and riparian habitat has similarly been impacted in the lower Icicle and both elements are considered to be functioning at unacceptable risk.

Floodplain function and riparian reserves are functioning appropriately on the National Forest, especially above Eightmile Creek. There are areas where the road has confined the channel and reduced linkages to the floodplain but combined these only add up to approximately one and one-half miles. Above the confluence with Eightmile Creek, riparian reserves are more than 80% intact. There are site-specific areas where the roads are adjacent to streams (previously mentioned) on the National Forest; riprap has been used to protect facilities, noxious weeds have accumulated and banks have high erosion potential. The most severe problems are on private lands. If the problems on private lands are not considered, the score would be lower.

B4. Flow Effects – Score 3

The lower Icicle is functioning at unacceptable risk primarily due to water withdrawals. While there are some problems with roads located within the floodplain (especially on private lands in the Leavenworth area) overall road densities are low; 0.4 miles per square mile with individual sub-watershed having road densities ranging from 0 to 1.2 miles/square mile. Most of the watershed is wilderness so natural flow regimes are maintained at least downstream to the diversions. A score of three is assigned due to the location of some road segments impacting floodplain function.

provides the largest area of core habitat within the Lake Wenatchee-Leavenworth Sub-Basin, consisting of 98,205 acres (71.6%). Large portions of several Lynx Analysis Units (LAUs) fall within the Icicle Watershed. Table 28 describes the low road density of those portions within the Icicle Watershed. For a description of each LAU, see Appendix I.

Table 28. Road density of Lynx Analysis Units (LAUs) within the Icicle Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density* (mi/mi^2)
Enchantment	15.6	78.8	0.2
Icicle Ridge	0	17.3	0
Upper Icicle	0	89.4	0
Waptus	0	1.5	0

*Mean Road Density = 0.05 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A very small part, 1,856 acres (1.4%), of the Boundary Butte LSR is located in the Icicle Watershed. Approximately 14,283 acres (10.4%) of the Icicle LSR are also located within the Icicle Watershed. The overall security habitat rating for the Boundary Butte LSR is moderate, while the habitat effectiveness rating is low. Both the security habitat and habitat effectiveness ratings for the Icicle LSR are high.

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy only 23,021 acres (16.8%) of the Icicle Watershed. The open road density within the riparian reserves is low, 0.6 mi/mi^2.

C4. Ungulates

There is no mapped ungulate winter range on the Icicle Watershed, but deer do use some of the eastern portion of the watershed as winter range. Icicle River basin provides important fawning habitat.

C5. Unique Habitats

Unique habitats are fairly diverse and abundant in the Icicle Watershed, covering 33,410 acres (24.4%). Table 29 summarizes the availability of the unique habitats in this watershed.

Table 29. Availability of unique habitats in the Icicle Watershed

Unique habitat	Acres	% of watershed
Brushfield	2,897	2.1
Cliff/bedrock	1	

Unique habitat	Acres	% of watershed
Riparian forest/valley bottom	214	0.2
Subalpine/open/park-like	813	0.6
Talus/scree	1,160	0.8
Upland meadow	5,180	3.8
Water	1,140	0.8
Wet meadow	1,176	0.9
Wet park-like	6,438	4.7

Mission Creek Watershed

There are 2.3 miles of maintenance level 3 roads in the Mission Creek Watershed, and no maintenance level 4 or 5 roads. The major roads and travel routes in the watershed are described below.

Mission Creek Road (7100) is the main road in the Mission Creek Watershed. It is maintenance level 3. It intersects Liberty Beehive (9712) near Beehive Reservoir. Liberty Beehive continues over Tronsen Ridge into the Cle Elum Ranger District through Lion Gulch and Table Mountain and meets Highway 97 near Liberty. It is 6.1 miles long, and maintenance level 3. Sand Creek Road (7104) branches off Mission Creek road and accesses private land.

Road 7200 (Camas Land) branches off Highway 97, and follows Camas Creek. The first 3.2 miles of this road are in the Mission Creek Watershed, and 1.8 miles are in the Peshastin Watershed. The entire road is maintenance level 2.

A. Human Use

A1. Public Use

Within the Mission Watershed are several large blocks of private land. There are no developed campgrounds or trailheads in the watershed. Mission Ridge Ski Area is a large developed recreation facility within the watershed.

A2. Resource Management

Currently, there are high tree densities in vegetation communities within the dry series. Under a frequent fire regime, these communities would have been more open and park-like. This current condition is primarily the result of fire suppression, but logging and grazing have also influenced densities. High tree densities influence water flow, change wildlife habitats, provide opportunities for widespread insect and disease epidemics, and set the stage for catastrophic wildfire events.

In Mission Creek, the past history of grazing, logging, and road building has contributed to noxious weed spread.

The information for this section was obtained from the Mission Creek Watershed Assessment, (Leavenworth Ranger District, Wenatchee National Forest 1995).

B. Aquatics

Mission Creek is a tributary to the lower Wenatchee River entering the Wenatchee near the town of Cashmere. Sub-watersheds include Lower Mission, Brender, East Fork Mission Sand, and Devil's Gulch. Heading near Mission Peak the watershed drains the north side of the Wenatchee Mountains and Tronsen Ridge. The upper portions of the watershed are on primarily national forest; lower Mission Creek flows through agricultural lands and the town of Cashmere. Major impact to the Mission Creek drainage includes timber harvest, roads, conversion of riparian habitat to orchards, irrigation withdrawal, historic grazing, and housing development. Soils within the watershed are naturally erosive and periodic mudflows occur, usually in conjunction with summer convective storms.

The existing habitat conditions information was obtained from the most recent environmental baseline. The baseline was established in the "Sandman/Dreggs Timber Sale Projects Biological Assessment for Steelhead, Spring Chinook, and Bull Trout," (U.S. Fish and Wildlife Service, September 25, 2000).

B1. Geologic Hazard – Score 6

The Mission Creek Watershed falls within the Wenatchee-Swauk Sandstone Hills Subsection. The Wenatchee-Swauk Sandstone Hills is composed almost entirely of continental sediments, which include the Swauk and Chumstick Formations. These formations are thinly-bedded mica and feldspar-rich sandstones and are often steeply inclined or folded. These rock units weather rapidly and are subject to accelerated surface erosion. The primary geomorphic process has been fluvial erosion creating very narrow V-shaped valleys framed by steep dissected mountain slopes. Slope shape is controlled by the orientation of the underlying sedimentary bedrock creating hogbacks, dip, scarp slopes, or complexes. This subsection is very efficient at delivering soil material to first-order drainages and ephemeral systems where the sediment accumulates and fills in these types of drainage systems. During high intensity storm events, this stored sediment can be delivered to higher order stream systems.

One of the major sources of hill slope sediment is generated from shallow rapid landslides (debris flows) that originate from the dense pattern of first order tributary streams and a few deep-seated landslides. Accelerated surface erosion is also exceptionally high from these structurally controlled landforms. Sediment is predominately fine textured.

The major source areas for hill slope sediment are felt to be delivered from structurally controlled mountain slopes totaling 40,110 acres a few deep-seated landslides totaling 1,356 acres. The structurally controlled mountain slopes are responsible for contributing naturally high levels of fine sediment. However, roads can accelerate the natural rate of fine sediment delivery. Listed below are the miles of road in each landform type.

Table 30. Mission Creek Watershed total miles of road within naturally high sediment sources

Deep-seated landslides	1.14

Structurally-controlled mountain slope	8.5

B2. Road-Related Fine Sediment – Score 10

Mission Creek is considered to be functioning at unacceptable risk for fine sediment. Fine sediment within the Mission Creek stream system is naturally high due to the natural erosion potential of the surrounding geology. With the increase in roads, grazing, timber harvest, and develop0 Ts 100 Tz 0 Tr 10.1.9.70030.3007tgle re.10004 Tm(sedim)Tj11.97192 0872910.1.9.70030.300 Tm(

Road densities range from 0.48 miles/square mile in the Devil's Gulch sub-watershed to 3.69 miles/square mile in Brender Creek sub-watershed. The remaining sub-watersheds have road densities between 1.0 and 2.4 miles/square mile. Overall, Mission Creek would be functioning at risk for road density, except in the Brender sub-watershed where it is functioning at unacceptable risk, and in Devil's Gulch, which is functioning appropriately. Mission Creek watershed is given a score of 6 due to road densities and road-related impact on floodplain function and water delivery.

B5. At-Risk Fish Populations – Score 6

Bull trout have not been seen in the Mission Creek drainage. Due to a variety of habitat factors, including high fine sediment loads (>20%) and relatively high temperatures in mid- to late-summer, they are not considered to be inhabitants of the Mission Creek drainage. Spring chinook salmon were historically inhabitants of the Mission Creek drainage, but have not been observed upstream of Cashmere since 1988 due to migration barriers (low water and/or irrigation withdrawals). There is some rearing by chinook juveniles that occurs in the lowest reaches of Mission Creek near Cashmere and in Brender Creek (tributary to Mission), downstream of the National Forest.

Hook and line sampling and four years of electroshocking have not produced any fish species other than steelhead, redband, and rainbow trout. Genetically "pure" or good representatives of interior redband and rainbow have been documented in the watershed. Steelhead have been observed spawning in both Mission Creek and Sand Creek within the national forest. Lower Mission, Devil's Gulch and Sand sub-watersheds are considered to be significant for steelhead due to the known spawning and rearing. There has been no recent stocking of rainbow trout or steelhead in the system, so, combined with the presence of interior redband, the Mission Watershed may support wild, native steelhead. Habitat problems, especially below the national forest, keep the watershed from being considered secure refugia; however, the national forest currently provides the only potential refugia for steelhead in the watershed. Dry Forest restoration should be coordinated with watershed restoration to secure habitat within the national forest so the score is 6.

C. Wildlife

The Mission Watershed is a smaller watershed (59,602 acres) found on the southern end of the Wenatchee Sub-Basin. This watershed is surrounded by multiple-ownership lands and experiences high motorized-vehicle use. Therefore, the potential to improve habitat is also high, primarily at the watershed scale.

C1. Wide-Ranging Carnivores

The current open road density on the Mission Creek Watershed is moderate at 1.67 mi/mi^2. Approximately 32.9% of the watershed is core habitat, for a total of 19,579 acres. Small areas of the Table Mountain and Teanaway LAUs are located within the boundaries of the Mission Watershed. Table 31 describes the road densities of those portions within the Mission Watershed. For a description of each LAU, see Appendix I.

Table 31. Road density of Lynx Analysis Units (LAUs) within the Mission Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density* (mi/mi^2)
Table Mountain	14.2	17.6	0.8
Teanaway	7.7	1.5	5.2

*Mean Road Density = 3.0 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A large, 20,027-acre (33.6%) portion of the Swauk LSR is located within the Mission Watershed. A small, 9,000-acre (15.1%) portion of the Sand Creek MLSA is also located within this watershed. The security habitat and habitat effectiveness ratings are both low for the Swauk LSR. The Sand Creek MLSA has a low security habitat rating and a moderate habitat effectiveness rating.

C3. Riparian Dependent Wildlife Species

Riparian reserves occupy approximately 7,574 acres (12.7%) of the Mission Watershed and have a very high open road density of 3.8 mi/mi^2.

C4. Ungulates

A large amount of ungulate winter range is located within the Mission Watershed. The watershed contains 13,207 acres (22.2%) of mapped winter range with a low open road density of 0.8 mi/mi^2. This watershed is also used for ungulate migration.

C5. Unique Habitats

Unique habitats are not diverse or abundant in the Mission Watershed; they cover only 1,462 acres (2.5%). Table 32 summarizes the availability of unique habitats in the watershed.

Table 32. Availability of Unique Habitats in the Mission Watershed

Unique habitat	Acres	% of watershed
Brushfield	62	0.1
Cliff/bedrock	1,363	2.3
Talus/scree	15	<0.1
Wet meadow	23	<0.1

II. Analysis

Human Use

The human use portion of the roads analysis identifies the level of importance of the road system to the human use activities in the particular sub-basin or watershed and to further identify the primary activities or combination of activities the road system is used for. Social values vary greatly among users. Further, users with similar interests will have differing opinions of what constitutes appropriate access. It is not possible to satisfy every individual or group of individuals, and also to identify what people will desire tomorrow or into the next decade. It is possible to observe trends and make some qualitative estimates of what the future needs may be. We generally have data to make categories of human use that exist today on a broad scale, but lack sufficient information to attempt to make any quantitative predications of future needs.

Because there is a great deal of overlap in social needs, it is important to keep in mind the scale of population of users being considered: is it small scale/local community, medium scale/multiple community, large scale/regional, or very large scale/national importance? This consideration will help the decision-maker determine whether the management of a particular road segment will have a direct or indirect effect on the user.

The human use factors are grouped into broad categories relating to the amount of flexibility the decision-maker has, whether the value is expected to be of local, regional, or national scale, the current use pattern, and desired future condition. The rating criteria are described in detail in Appendix A. In this analysis, segments with scores of 42 and above were given a high priority, or a high need to maintain some type of passenger car access, 34 to 41 received a moderate priority or need and 33 and below a low priority. All road segments in the analysis received a high score for the ROS Class criteria and all but two segments received a high score for the Level of Use Criteria. For this reason, these criteria are not noted in the discussions for the individual road segment scores.

Aquatics

Road segments were placed into high, medium, or low priority for treatment based on the aquatic analysis. The priorities were determined based upon the aquatic score for the segment and then verified by local knowledge of the road segment (see Appendix B). High priority segments had severe erosion problems, were constraining the floodplain, were at a high risk to fail because of location within unstable or debris flow prone land types glacial troughs and drainage features, or had failed. These roads had potential to cause serious impact to streams with at-risk fish, or were not allowing natural stream channel/floodplain interaction. High priority road segments scored above 29.

Moderate priority roads scored between 19 and 28. These roads may have erosion problems delivering sediment to streams, be located on unstable slopes but, because of location, were felt to have less potential impact to at-risk fish. Some of these roads have potential impact to aquatic habitat but at-risk fish were not present in the watershed. Several moderate and high priority road segments were adjacent to streams where there is a concern about poaching or incidental harvest

of at-risk fish. A recommendation for these segments is to have a public information program to inform people about the at-risk fish.

Low priority road segments scored less than 19 and were judged to have little impact to aquatic habitat. The following is a brief description of the high priority road segments by watershed. No roads within the Nason watershed were rated as a high priority. Roads, primarily State Highway. 2, which are not under national forest management, have had serious impact on fish habitat in Nason Creek.

The high priority road segments are discussed in this narrative. Scores and notes for all road segments are in Appendix B.

Wildlife

This section of the analysis summarizes the results for the major arterials and collector roads in the Wenatchee Sub-Basin. The wildlife categories that were addressed included: wide-ranging carnivores, late successional species, riparian-dependent species, ungulates, and unique habitats. Road segment priority ratings were determined by summing the category scores derived from the Wildlife Roads Analysis Procedure (Appendix C).

High-rated road segments generally scored moderate to high in all five categories. These segments usually offered the greatest potential for improving security habitat and habitat effectiveness in LSRs, restoring riparian habitat and connectivity, and enhancing habitat effectiveness of ungulate winter ranges, young rearing areas, and migration routes. Opportunities to improve core habitat and restore unique habitats contributed as well. High priority segments scored greater than 30 points.

Moderately-rated road segments usually had one or two elements of strong potential, generally restoration of riparian habitats or protection of ungulate habitat, and moderate to low potential in the remaining categories. Moderate priority segments scored 16 to 30 points.

Low priority segments were often characterized by either excellent habitat conditions or very limited restoration opportunities, due to current road conditions, such as pavement and high human use. These road segments scored less than 16 points. There are very few roads in this category because of high watershed road densities.

Restoration of riparian habitat and connectivity and protection of ungulate habitat tend to drive the ratings within the Wenatchee Sub-Basin. Because the roads cover a large area and a variety of habitats, the overall ratings are frequently various combinations of categories. The following discussion gives a general description of those roads with the greatest potential for improvement within each watershed. More detailed information is available in Appendix I, Table I-1.

Mainstem Wenatchee Watershed

A. Human Use

The following roads received a high human-use rating mainly because of high scores in required

access and resource management needs:

Entiat Ridge: 5200
Big Meadow Creek: 6300
South Shore Lake Wenatchee: 6607
Derby Canyon: 7400
Hatchery Creek: 7905
Chiwaukum Creek: 7908

These recommendations reflect the human use issues and concerns. The 7908 road is at an appropriate maintenance level, and needs no repairs. The 5200, 6607, 7400, and 7905 roads are at appropriate maintenance levels, but need repairs for resource protection. The 6300 road could be reduced in maintenance level, and needs no repairs.

B. Aquatics

Road 7400. The road is adjacent to Derby Creek and has severe erosion delivering sediment directly to Derby Creek. Steelhead have been reported in Derby Creek, which flows into significant habitat for steelhead and summer chinook salmon.

C. Wildlife

The road density in the Mainstem Wenatchee Watershed is high at 2.32 mi/mi^2. The road density of the Chumstick Watershed is also quite high at 2.83 mi/mi^2. Of the nine road segments in the Mainstem Wenatchee Watershed and the Chumstick Watershed; two (22%) received a high rating for potential improvement, five (56%) received a moderate rating for potential improvement, and two (22%) received a low rating.

Road 5200. This road is located along a ridge in a high road density area. Modifying this road could positively affect wide-ranging carnivores throughout the year. Modifications to this road also have potential to improve habitat effectiveness for ungulates, primarily relative to transition areas, and to restore riparian areas and connectivity.

Road 7400. This road is currently in very poor condition. High potential exists to improve habitat effectiveness and security habitat in the Eagle MLSA and to restore riparian habitat and connectivity.

In summary, the ratings within the Mainstem Wenatchee and Chumstick Watersheds tend to be divided among all categories. Roads densities are very high in these watersheds and habitat quality/quantity has been diminished.

Chiwawa Watershed

A. Human Use

The following roads received a high human-use rating predominately due to high scores in required access and resource management needs:

Entiat Ridge: 5200
Lower Chiwawa: 6100
Maverick Saddle: 6101
Chiwawa River: 6200
Big Meadow Creek: 6300

The following roads received a moderate human use rating predominately due to lower scores in economics and resource management needs:

Chikamin Creek: 6210
Phelps Creek: 6211

These recommendations reflect the human use issues and concerns. The 5200 and 6211 have appropriate maintenance levels, and do not need repairs. The 6100, 6101, and 6200 roads have appropriate maintenance levels, but do need repairs for resource protection. The 6300 road could be reduced in maintenance level, and needs no repairs. The maintenance level for 6210 should be increased to a 3.

B. Aquatics

Road 6200. This segment is the main Chiwawa River Road from Finner Creek to Trinity. Approximately four miles of the road is within lands naturally prone to debris slides with numerous small tributary crossings. When debris flows occur the culverts are plugged and flows diverted down roads. May be possible to design rolling dips or other structures so debris flows can flow across the road. Road is within a significant sub-watershed for spring chinook salmon and bull trout.

C. Wildlife

The road density in the Chiwawa Watershed (CW) is moderate at 1.02 mi/mi^2. Of the nine road segments in the CW; five (56%) received a high rating for potential improvement, three (33%) received a moderate rating for potential improvement and one (11%) received a low rating.

Road 6200 (3 segments). This is the main road in the Chiwawa Watershed; it receives high levels of human use throughout the year. Two segments (middle and upper end) of this road received maximum scores for all analysis categories. The road bisects high-quality core habitat, especially toward the northern end of the road. It also runs through the Chiwawa LAU and the Chiwawa LSR. The road follows, often closely, the Chiwawa River and is the site of dispersed camping. It is also an important area for deer fawning. Unique habitats include aspen stands, substantial wetlands, and dry meadows.

Road 6211. Modifying this road provides potential to join numerous islands of core habitat and to restore riparian habitat near the Phelps Creek Trailhead.

Road 6300 (maintenance level 3 segment). Modifications to the maintenance level 3 segment of Road 6300 provide excellent opportunities to improve habitat in all categories. Modifications to the last 2.5 miles have high potential for connecting core fragments in high quality grizzly bear habitat. The road is located within the Twin Lakes MLSA and potentially affects resident spotted owls in high quality owl habitat. Riparian issues also exist along this road. The road accesses

mountain goat habitat and areas important for deer fawning. Several different types of unique habitats are also located along Road 6300.

In summary, the ratings and potential within the Chiwawa Watershed tend to be driven by all categories because of the excellent habitat available within the Chiwawa Watershed.

White and Little Wenatchee Rivers Watersheds

A. Human Use

No roads in this watershed rated "high" for human use. A portion of the Little Wenatchee road - 6500 received a moderate human use rating, mostly due to a low score in resource management needs.

These recommendations reflect the human use issues and concerns. The following roads are at the appropriate maintenance levels, but need repairs for resource protection: 6400, 6500, 6700, and 6701400. The 6701 and 6701500 roads are at appropriate maintenance levels, and do not need repair. The 6705 road should be reduced in maintenance level.

B. Aquatics

B1. White River Watershed

Road 6400. From Tall Timbers to the trailhead crosses numerous small tributary streams subject to debris flows, needs drainage improvement and the lower section encroaches on the White River. Bull trout poaching is a concern. The White River is significant for spring chinook salmon, bull trout, as well as sockeye salmon.

B2. Little Wenatchee River Watershed

Road 6500. This is the paved portion of the road past the 115 spur. Road crosses first-order tributaries subject to debris flows. Culverts are under-sized to route debris. The lower, turn-piked portion of the road constrains the lower White River and associated floodplain.

Road 6700-A. The Rainy Creek Road from the Little Wenatchee River up Rainy Creek to Rainy Pass intercepts ground water throughout and has surface erosion problems. The road is in close proximity to Rainy Creek; it needs improved drainage, including ditch-relief culverts.

C. Wildlife

The road density in the Little Wenatchee Watershed is low at 0.94 mi/mi^2. The road density in the White Watershed is exceptionally low at 0.23 mi/mi^2. Of the eight road segments in the Little Wenatchee Watershed and White Watershed; six (75%) received a high rating for potential improvement and two (25%) received a moderate rating.

Road 6400. This road influences spotted owl habitat and connectivity within the Little Wenatchee LSR. Modifying this road could provide high potential to restore riparian habitat and connectivity, including habitat for anadramous fish and Pacific Giant Salamanders.

Modifications also provide an opportunity to enhance ungulate habitat for fawning and migration.

Road 6500 (2 segments). This road bisects high-quality core habitat and allows potentially destructive human access to important spring emergent habitat for grizzly bears and other species in fragile wet meadows. The road is located within the Little Wenatchee LSR and has potential to affect resident spotted owls. Deer would benefit from protection during the spring fawning period. (See Road 6701.)

Road 6700. Modifications of this road have high potential to improve habitat in all categories. Altering this road could connect fragmented areas of high quality core habitat, improve security habitat within the Little Wenatchee LSR, protect deer fawning areas, and restore riparian areas with high habitat value.

Road 6701. This road parallels Road 6500, and so provides very similar habitat restoration potential. As parallel road systems, Roads 6500 and 6701 compound the habitat issues for each road individually.

Road 6701400. This road presents several opportunities to improve habitat, however, heavy human use and a parallel road, Road 6701500, may limit practical alterations.

In summary, the ratings within the Little Wenatchee and White Watersheds tend to be driven by potential for improvement in all categories. These watersheds provide excellent habitat worthy of protection and restoration.

Nason Creek Watershed

A. Human Use

No roads received a moderate rating. The following roads received a high human-use rating predominately due to high scores in required access and economics:

Butcher Creek: 6910
Gill Creek: 6940
White Pine: 6950

These recommendations reflect the human use issues and concerns. The portion of the 6700 road in this watershed, in addition to the 6910 and 6950 roads, have appropriate maintenance levels, but need repairs for resource protection. The 6900657 and 6940 are at appropriate maintenance levels, and do not need repairs.

B. Aquatics

None of the roads analyzed in the Nason Watershed were rated as a high priority.

C. Wildlife

The road density in the Nason Watershed is moderate at 1.36 mi/mi^2. Of the five road segments in the Nason Watershed, two (40%) received a high rating for potential improvement, one (20%) received a moderate rating, and two (40%) received a low rating.

Road 6700. Road 6700 received a maximum score across all categories. This road segment runs north from Highway 2 into high-quality habitat. Altering this road has high potential to improve habitat in all categories.

Road 6950. Modification of this road segment has the greatest potential to improve habitat effectiveness for ungulates, especially with regard to fawning, and to protect and restore unique habitats.

Although there are several opportunities for improvement in the Nason Watershed, at the sub-basin level of analysis, practical application may be limited because of high human use and proximity to Highway 2.

Peshastin Watershed

A. Human Use

The two roads in the Peshastin Creek Watershed, Camas Lands 7200 and Mountain Home Ranch 7300, received a high human-use rating primarily because of high scores in required access and resource management needs. Both have appropriate maintenance levels, but the 7300 road needs repairs for resource protection. These recommendations reflect the human use issues and concerns.

B. Aquatics

Road 7300-A. The segment of the Mountain Home road from four-corners down the Mill Creek drainage crosses large landslides. The road intercepts ground water from the slides and routes the water down ditches, which, with road failures, accelerates sediment delivery to Mill Creek. Culvert crossing on Mill Creek is a barrier to steelhead passage. Mill Creek is in the Lower Peshastin sub-watershed, which is significant for steelhead.

C. Wildlife

The road density in the Peshastin Watershed is high at 2.14 mi/mi^2. Only one (50%) of the two road segments in the Peshastin Watershed received a high rating for potential improvement, while the other segment received a moderate rating.

Road 7300. Modifying this road could affect numerous road tributaries, thereby improving core habitat. However, the greatest potential exists in protecting good habitat in the heavily burned Boundary Butte LSR, and in protecting deer migration routes.

Icicle Watershed

A. Human Use

All the roads rated in the Icicle Creek Watershed, Mountain Home Ranch (7300), Icicle (7600), and Eight Mile (7601), received a high human-use rating due to high scores in required access and resource management needs. A portion of the 7600 road should be increased to a maintenance level 4 (accessible to passenger cars with some comfort). The remaining portion is at an appropriate level. The maintenance level for the 7601 road should be increased to a level 3 or 4 from the current level 2 (maintained for high clearance vehicles). These recommendations reflect the human use issues and concerns.

B. Aquatics

Road 7600. The Icicle road from Ida Creek to the end of the road delivers sediment to Icicle Creek. An approximately 1.5 mile stretch is located within the Icicle floodplain.

C. Wildlife

The road density in the Icicle Watershed is low at 0.37 mi/mi^2. Of the four road segments in the Icicle Watershed, two (50%) received a high rating for potential improvement, one (25%) received a moderate rating for potential improvement, while one (25%) road segment received a low rating.

Road 7600 (2 segments). Road 7600 is the main access road in the Icicle Watershed. The two segments of road 7600 received high ratings because of the influence of the road east from the junction with Road 7601. From this point, the road bisects high-quality core habitat and high-quality habitat in the Icicle LSR. The road runs close to the Icicle River, where road modifications provide potential for restoration of riparian areas and connectivity. The road is also in areas heavily used by ungulates for fawning and winter range. This road potentially impacts numerous unique habitats.

In summary, there is great potential to improve habitat in the Icicle Watershed, within all categories, through activities on a single road. However, human use in this area is high year round and may limit opportunities.

Mission Creek Watershed

A. Human Use

All the roads rated in the Mission Creek Watershed received a high human-use rating: Mission Creek (7100), Sand Creek (7104), Camas Lands (7200), and Liberty Beehive (9712) for the high scores in required access and resource management needs.

All the roads have appropriate maintenance levels, but need repairs for resource protection. These recommendations reflect the human use issues and concerns.

B. Aquatics

Road 7100. Mission Creek road, from Sand Creek junction to Devil’s Gulch trailhead, further constrains Mission Creek within a naturally confined valley. Erosion of the road surface is

delivered directly into Mission Creek. The road is located within a significant sub-watershed for steelhead.

Road 7104. The problems with the Sand Creek road are very similar to those associated with the Mission Creek road. Sand sub-watershed is significant for steelhead.

C. Wildlife

The Mission Creek Watershed has a moderate road density of 1.67 mi/mi^2. All four (100%) road segments in the Mission Creek Watershed received a moderate rating for potential improvement.

High human-use and lower habitat values resulted in the moderate ratings within this watershed. For more information about the road segments in the Mission Creek Watershed, see Appendix C.

III. Recommendations

The range of recommended treatments or strategies fit into five general categories ranging from major improvements to decommissioning. The five categories are:

1. Major repair or improvement
2. Minor repair or improvement
3. Leave as is, lower maintenance requirements
4. Stabilize then eliminate maintenance requirements
5. Decommission

Major repairs can include but are not limited to: relocation, replacing a major culvert, or seasonal closure. Minor repairs can include but are not limited to: minor surfacing or grading work, drainage improvements (such as adding cross drains or drain dips), or seasonal closures. "Leave as is" means the current maintenance standards would be maintained with no change. The "lower maintenance requirements" strategy would reduce the current maintenance standard to the next lower standard. For example, a maintenance level 3 road, maintained for passenger cars would be reduced to a road with a maintenance level 2, which is maintained for high clearance vehicles. The "stabilize then eliminate maintenance" strategy would involve stabilizing the road, for example by out-sloping, installing water bars, removing culverts where possible, then inspecting the road periodically to monitor for any damage. Users will notice little change in the short term on the roads with recommended strategies of "lower the maintenance requirements" or "eliminate maintenance after the road is stabilized." The road will be allowed to reach the new standard over time. The decommissioning strategy can involve a range of treatments from ripping and seeding the surface to full obliteration. These categories are described in greater detail in Appendix D.

Some type of change in management strategy was recommended for 27 of the 41 road segments that were analyzed. The recommended changes in strategy ranged from improvements to lowering maintenance levels. Of the 27 recommended changes, five are to make a major improvement of some type to mitigate resource impact while maintaining passenger car access. This accounts for approximately 30 miles; however, in many cases the repair or treatment is at a specific location and not the full length of the road. Minor improvements, such as installing additional cross drains, or seasonal closures, are the recommended strategy on 18 segments. Four segments had the recommended strategy to preserve access but reduce the level of maintenance applied to the road. No segments were identified with the recommendation of decommissioning or putting in a self-maintaining state. Only the roads with a recommended change in treatment or strategy are listed in the following tables. Appendix D, Table 1D, shows a listing of all roads analyzed with recommended strategies.

If all the recommended strategies were fully implemented, the cost to maintain these roads to full standards would decrease about $31,300 per year for the Lake Wenatchee and Leavenworth Ranger District, from $386,000 to $354,000 per year. In addition, a substantial amount would be needed to make all the repairs, improvements, and decommissioning recommended to fully implement all the strategies. At this time, the specific projects needed to implement these strategies are not known in enough detail to develop cost estimates. On roads which have Cost

Share Agreements, the cost share partner must be consulted and agree to any changes in road management. It is important to note that these dollars reflect the needs to maintain only the roads analyzed to the standards defined in the Forest Service Manual. This is not the amount that is currently being spent. The Ranger Districts received a total of approximately $210,000, which was used to maintain all the roads on the system, not just the major arterials and collectors. This discrepancy of funds needed versus funds received indicates the need to determine the minimum affordable road system.

Minimum Affordable Road System

The Forest Service defines the minimum affordable road system as the miles of road by maintenance level that can be maintained to full standard with the anticipated maintenance funding. Based on forest average maintenance costs, it would require approximately $1,370,000 annually to maintain all of the system roads in the Wenatchee Sub-Basin. These values do not include the costs for the identified deferred maintenance, the maintenance needed to bring the road back up the standard described in the Forest Service Manual, or the funds needed to improve fish passage by repairing or replacing barrier culverts. In Fiscal Year 2000 approximately $210,000 (15% of the estimated annual need) was expended for maintenance on the roads in the Wenatchee Sub-Basin. However, rather than maintaining a small percentage of the roads to full standard, the work was distributed over a greater mileage to address high priority needs.

Budget projections indicate that funding for road maintenance will continue at current levels for the foreseeable future. Consequently, $210,000 was selected as the planned amount for the minimum affordable road system for the sub-basin. Based on that funding level and the average costs per mile by maintenance level, the following table shows the extremes in the range of potential road management scenarios. In Table 33, Option A shows the number of miles of road that can be maintained to standard, starting with the level 2 (high clearance vehicle) roads. The number in parenthesis is the percent of the total system roads in the sub-basin that would be maintained to standard. Option B shows the number of miles of road that can be maintained to standard starting with the level 3-5 (passenger vehicle) roads first. From a practical standpoint, the minimum affordable system would likely be a combination of arterials and collectors maintained for passenger cars, and local roads maintained for high clearance vehicles.

Table 33. Minimum affordable road system options

Maint. level	Option A	Option B
	mi. (% of total)	mi. (% of total)
ML 2 (high cl.)	208 (15)	0 (0)
ML 3-5 (pass.)	0 (0)	55 (4)

This analysis demonstrates there are many more miles of roads than can be fully maintained with the expected funding. However, a rapid reduction in accessible road mileage is not acceptable to a large segment of forest users, would not meet agency management access needs, and would incur significant expenses to properly implement.

As stated above, this analysis does not recommend any road segments be decommissioned. Future studies that will analyze the local roads (those maintained for high clearance vehicles) have the potential to recommend decommissioning some roads in an effort to adjust the size of the road system.

Mainstem Wenatchee Watershed

One road received a recommendation strategy of major repair or improvement. Four roads received a recommendation strategy of minor repair, improvement or seasonal restrictions, and one road received a recommendation strategy of lower maintenance standard. All other roads analyzed in the drainage received leave as is recommendations.

Derby Canyon Road (7400) has several aquatic and wildlife concerns. The recommendation for the upper ten miles is first to consider an in-depth road study to look at needs and potential mitigation measures. The road produces a large amount of sediment that enters Derby Creek. The study should consider surface type and seasonal closures. Also, consider installing more cross drains and other methods to reduce the erosion leaving the road.

The recommendation for the Entiat Ridge Road (5200) ernsis tonthe Entiat RDitricti

Chiwawa Watershed

One road received a recommendation of “major repair or improvement” strategy. Four roads received a recommendation of “minor repair, improvement or seasonal restrictions” strategy, and decommissioning should be looked at a portion of one road. One road received a recommendation of “lower maintenance standard” strategy. All other roads analyzed in the drainage received “leave as is” recommendations.

The recommendation for the lower segment of the Chiwawa River Road (6200) is to provide fish passage structures at Alder Creek and Goose Creek; however, these are a lower priority than other locations. Also evaluate the impact caused by the dispersed sites and consider relocating or hardening the sites to improve riparian habitat. On the Lower Chiwawa Road (6100), and Maverick Saddle Road (6101), the strategy recommended is minor drainage work to improve the ditches and culverts along the road. A spring season closure along with minor road improvements including drivable dips and spot surfacing improvements are the recommendations for the upper portion of the Chiwawa River Road (6200). The recommendation for the Chikamin Creek road is to increase the maintenance level from a level 2 (accessible to high clearance vehicles) to a level 3 (passable by passenger car) to improve the access for recreation users. This will increase the maintenance costs to the district and may require being offset by reducing another road. Finally, the recommendation for Big Creek Road (6300) is to lower the maintenance level from a level 3 (passable by passenger car) to level 2 (accessible to high clearance vehicles). In addition, consider closing the last 2 miles of the road. This will require working with the Washington Fish and Wildlife Service because they currently use this road to Twin Lakes which has a westslope cutthroat trout broodstock collection facility.

Table 35. Chiwawa Watershed recommendations

Road name	FS Rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft Recom. mgmt.	Final Recom. mgmt.
Chiwawa River Road	6200000	9.5	M	H	H	Major repair	Major repair
Entiat Ridge	5200000	2	L	M	H	Leave as is	Minor repair
Lower Chiwawa	6100000	4	M	L	H	Minor repair	Minor repair
Maverick Saddle	6101000	3.2	M	M	H	Minor repair	Minor repair
Chiwawa River Road	6200000	11.2	H	H	H	Minor repair	Minor repair
Chikamin Creek	6210000	0.5	L	M	M	Minor repair	Minor repair
Big Meadow Creek	6300000	5.2	L	H	H	Lower maint.	Lower maint.

White River and Little Wenatchee River Watersheds

One road received a recommended strategy of “major repair or improvement.” Three roads received a recommendation of “minor repair, improvement or seasonal restrictions” strategy and two roads received a recommended strategy of “lower maintenance standard.” All other roads

analyzed in the drainage received “leave as is” recommendations.

The recommendation for the first eleven miles of the Little Wenatchee Road (6500) is to return the surface back to gravel after the Rainy Creek Road junction, and reduce the maintenance requirements on that portion from a level 4 (accessible to passenger cars with some comfort) to a level 3 (passable by passenger car). It is also suggested to maintain the winter/spring closure to preserve wet meadows. On the White River Road (6400) the recommendation is to consider relocation to reduce flood plain function and poaching concerns. There are also wildlife concerns because the county plows the road into private home units which results in increased snowmobile use. A natural snow melt closure (ie. no plowing) on the road beyond the private units would help to protect wildlife. The recommendation for the upper two miles of the Little Wenatchee Road (6500) is to increase the maintenance level from a level two (accessible to high clearance vehicles) to a level 3 (passable by passenger car) to improve the access for recreation users. This will increase the maintenance costs to the district and may require being offset by reducing another road. In addition, minor drainage work is needed to improve runoff flows. The recommendation for Heather Lake Road (6710400) is to relocate the trailhead to reduce impact to a nearby owl nest. The recommendation for Snowy Creek Road (6705) is to lower the maintenance level from a level 3 (passable by passenger car) to level 2 (high clearance vehicles). The predominant use of the road is to access the grazing allotment.

Table 36. White and Little Wenatchee Watersheds recommendations

Road name	FS Rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Little Wenatchee	6500000	11.6	H	H	M	Major repair/ Lower maint.	Leave as is
White River	6400000	3.6	H	H	L	Minor repair	Minor repair
Little Wenatchee	6500000	2.8	M	H	L	Minor repair	Minor repair
Heather Lake	6701400	2.3	L	H	L	Minor repair	Minor repair
Top Lake	6701500	1.5	L	M	L	Leave as is	Minor repair
Snowy Creek	6705000	3.6	L	M	L	Lower maint.	Lower maint.

Nason Creek Watershed

Two roads received a recommendation of “minor repair, improvement or seasonal restrictions” strategy. All other roads analyzed in the drainage received “leave as is” recommendations. Drainage improvements are needed on both roads with significant work needed on Butcher Creek (6910). Consider options to reduce the moisture in the slide area to stabilize the slopes.

Table 37. Nason Creek Watershed recommendations

Road name	FS Rd #	Segment length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.

Merritt Lake TH	6900657	1.6	L	L	L	Leave as is	Minor repair
Butcher Creek	6910000	4.3	M	M	H	Minor repair	Minor repair
White Pine	6950000	3.8	M	H	H	Minor repair	Minor repair

Peshastin Watershed

One road received a recommendation of “major repair or improvement” strategy. All other roads analyzed in the drainage received “leave as is” recommendation. The Mountain Home Ranch road (7300) needs some major improvements in the surface drainage, such as adding cross drains and reshaping the road to drain correctly.

Table 38. Peshastin Watershed recommendations

Road name	FS rd #	Segment length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Mountain Home Ranch	7300000	3.3	H	H	H	Major repair	Major repair

Icicle Watershed

One road received a recommendation of “major repair or improvement” strategy, and one road received a recommendation of “minor repair, improvement or seasonal restrictions” strategy. All other roads analyzed in the drainage received “leave as is” recommendations. There are two recommendations for the Icicle Road (7600), first consider some method of dust abetment to reduce the dust entering the stream. Second, consider relocating a two mile portion of the road which is directly adjacent to the stream, to reduce over topping of the road and runoff entering the stream during high flows. On the Mountain Home Ranch Road (7300) consider a geotechnical study to identify way to stabilize the major slide on the road. In addition, consider a spring and fall closure to improve the deer and elk migration.

Table 39. Icicle Watershed Recommendations

Road name	FS rd #	Segment length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Icicle	7600000	5.1	H	H	H	Major repair	Major repair
Mountain Home Ranch	7300000	2.5	M	L	H	Minor repair	Minor repair
Eightmile	7601	3.8	M	M	H	Leave as is	Minor repair

Mission Creek Watershed

Three roads received a recommendation of “minor repair, improvement or seasonal restrictions.”

All other roads analyzed in the drainage received “leave as is” recommendations. Improving drainage, by increasing cross drains and improving ditch lines, and improving surfacing as needed to reduce erosion is the recommendation for all three roads. In addition, consider a spring closure on the Camas Lands Road (7200) to improve deer calving and fawning habitat.

Table 40. Mission Creek Watershed recommendations

Road name	FS rd #	Segment length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Mission Creek	7100000	2.3	H	M	H	Minor repair	Minor repair
Sand Creek	7104000	1.1	H	M	H	Minor repair	Minor repair
Camas Land	7200000	3.2	M	M	H	Minor repair	Minor repair
Liberty/Beehive	9712000	6.1	L	M	H	Leave as is	Minor repair

Watershed Analysis Priority

During the analysis process the team reviewed the condition and uses of the watersheds as a whole to determine a priority recommendation for the completion of the watershed scale analyses. The team looked at the existing conditions and impact within the watershed, types of use, anticipated future projects (such as dry site management or fuels planning), and the ability or opportunity to make changes. Table 41 shows the priorities.

Table 41. Watershed prioritization

Watershed	Human use rank	Wildlife rank	Aquatic rank	Composite rating
Chiwawa	4 M	H - 2	H	1
Little Wenatchee/ White	3 M	M - 4	H	3
Nason	6 L	L - 6	M	4
Wenatchee Mainstem	1 H	H - 1	L	2
Icicle	2 H	M - 5	M	3
Mission	7 L	L - 7	M	4
Peshastin	5 M	H - 3	H	1

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Appendices

Appendix A: Human Use Rating Criteria and Assessment

Appendix B: Aquatic Rating Criteria and Assessment

Appendix C: Wildlife Rating Criteria and Assessment

Appendix D: Recommended Management Actions

Appendix E: Public Input Summary

Appendix F: Definitions

Appendix A: Human Use Rating Criteria & Assessment

The human use portion of the roads analysis identifies the importance of the road system to the human use activities in the particular sub-basin or watershed and to further identify the primary activities or combination of activities the road system is used for. Social values vary greatly among users. Further, users with similar interests will have greatly differing perceptions of what constitutes appropriate access.

It is not possible to satisfy every individual or group of individuals, nor is it possible to identify what people will desire tomorrow or into the next decade. It is possible to observe trends and at least make some qualitative estimates of what the future needs may be. However, we generally lack sufficient data to make accurate quantitative predictions. This exercise attempted to show the major categories of human use that exist today on a broad scale, but did not attempt to make quantitative predictions of future needs.

There is a great deal of overlap in social needs, so it is important to keep in mind the scale of population of users being considered; is it small scale/local community, medium scale/multiple community, large scale/regional, or very large scale/national importance? This consideration will help the decision maker determine whether the management of a particular road segment will have a direct or indirect effect on the user.

The human use factors are grouped into broad categories relating to the amount of flexibility the decision maker has, whether the value is expected to be of a local, regional or national scale, the current use pattern, and desired future condition.

Water Production (WP-1)

Rating

1. Identify roads and segments to which Public Laws such as ANILCA, RS 2477, or treaty requirements apply.
2. Identify roads or segments that have active permits, cost share agreements, easements or binding agreements.
3. Identify roads or segments that have special use permits involved.
4. Relative ranking is based on the above information:
   a. High (10) public law requires the road access be provided. These include roads that have Cost/Share agreements and long term easements in place.
   b. Medium (7) agreements or permits exist, but there are alternatives or options available to meet identified needs.
   c. Low (3) there are short-term commitments, which will expire or can be replaced with suitable alternatives.

Data Sources

Special Uses Data System (SUDS)
Forest Land Use Report (FLUR)
INFRA
District files of Agreements and Easements

Factor Number 2: Resource Management

This factor addresses the importance of the road system for the administration, management, or protection of forest resources. The forest manager has the flexibility to analyze options and select the one that provides the best balance of resource, social, and economic needs. At a sub-basin scale, definitions or classifications would be identified by broad groupings such as the percent of a watershed, the percent of a dry site, or an FMAZ zone.

Examples of sub-elements include:

Value of the road for implementation of desired future condition strategies, such as the Dry Site Strategy or Fire Management Plans
Administrative Use needs (AU-1)
Value of the road for Forest Service and cooperator to suppress wildland fires. Fire risk can be based on a combination of fire intensity mapping and knowledge of past fire occurrence. Fire intensity mapping is based on current vegetation, slope, aspect, elevation, and landform. This factor is considered highly important and is given a heavy numerical weighting. (PT-2)
Value of the road for management of insect, disease, or noxious weed infestations.
Does the road system address public health and safety (GT-4)?
Does the Forest have the necessary easements and rights on the road?

Rating

1. Identify roads which are needed for access to protect forest resources, facilities, or property.
2. Identify roads that are important for implementation of management strategies.
3. Roads covered within this analysis provide primary access to wildfires occurring on the district, either directly to the fire or to connecting roads, trails, and/or drop-off points. Roads can also serve as primary control lines, fuel breaks, or firefighter escape routes.
4. Vehicle travel on roads is a primary contributor to fugitive dust on the forest. Vehicle speed on any given road surface is the primary factor in determining the amount of dust or particulate matter introduced into the air shed. Of greatest concern is particulate matter less than 10 microns in diameter (PM10) and particulate matter less than 2.5 microns in diameter (PM2.5). Refer to individual watershed assessments for further discussion on the effects and importance of particulate matter.
5. Identify the roads that are important for research, monitoring, or inventory.
6. Relative ranking is based on the above information:
    a. High (10): Life or property is at-risk or a history of severe resource damage occurring in this area. Road is necessary for protection of life and property. Access to private or leased property and/or structures and access must be retained. A road ranked high if it is considered important for protection of resources and there are few or no alternative ways to access the area. Road serves developed recreation site or administrative sites. Road is part of a designated or informal, but well recognized, auto tour.
    b. Medium high (7): Access is necessary for resource protection for long term. Roads within the Low Fire Regime (naturally occurring as high frequency/low intensity) or roads that access pre-attack facilities. Road is needed for access to an active range allotment. Important for silvicultural treatments in dry and mesic sites. Road is important for treatment of existing noxious weed infestations in dry and mesic sites.
    c. Medium low (5): Roads within the Moderate Fire Regime with a high occurrence (also referred to as Dry Mesic) or roads that provide a mid-slope fire break.
    d. Low (3): Access is needed for implementation of management strategies for the near future. Roads within the Moderate Fire Regime with a moderate or low occurrence. Needed for silvicultural treatment in wet sites. Noxious weeds present in wet sites and road access will be needed for treatment. Paved or rock surface; not a significant source of fugitive dust and particulate matter. On a short-term basis, this may also refer to roads treated with dust suppressant such as water, lignin, or oil-based products.
    e. Low (2) Gravel: fugitive dust and particulate matter will largely depend on vehicle speed and road condition.
    f. Very Low (1): Fires within the High Fire Regime, (naturally occurring as low frequency and high intensity. Native surface; significant source of fugitive dust and particulate matter.
    g. Not needed (0): road does not serve a range allotment. Road is not necessary for fire protection. No noxious weed infestations present.

Data Sources

Analysis files for timber sales and other projects
Past harvest layer - 5 year action plan
Fire ignition layer in GIS

Urban interface mapping in GIS – natural vs. human caused fires
Infestation maps for insect and disease surveys
Past activity layer for weeds in GIS
Archeological probability maps (H/M/L)
Public scoping

Factor Number 3: Public Access and Level of Use

The factor includes both active and passive use by the public for all forms of outdoor recreation where people are actually present on the Forest.

It also includes elements that do not necessarily involve active participation, but knowing these elements are in place or available has significant value. The forest manager will need to involve large numbers and diverse groups in any decisions associated with this factor.

The most common public needs are generally associated with some form of recreation or leisure activity. Because this factor by definition involves actual access and use of the road, it is most important on a local and regional scale. There would be a lesser degree of importance on a national scale for stakeholders who come from other regions or states and use the Forest.

The Recreation Opportunity Spectrum (ROS) classification is used in the Land and Resource Management Plan (Forest Plan) to arrange the possible experience opportunities across a spectrum. ROS land delineations identify a variety of recreation experiences in six classes along a continuum from primitive to modern-urban. Each class is defined in terms of the degree to which it satisfies certain recreation needs based on area size, the extent to which the natural environment has been modified, the type and development of facilities available and the degree of outdoor skills needed to enjoy the area. The seven ROS classes are: Primitive, semi-primitive non-motorized, semi-primitive motorized, roadbed natural, and roadbed modified, rural, and urban.

Question Addressed

Unique physical or biological characteristics (PV-1)
Unique cultural or spiritual value (PV-2)
People's perceived needs and values for the road (SI-1)
Value to local community social and economic health (SI-6)
Effect on people's sense of place (SI-10)
Unloaded recreation values (UR-1 through 5)
Roadbed recreation values (PR-1 through 5)
Access to developed sites
Access to undeveloped sites
Consistency with Recreation Opportunity Spectrum (ROS) classifications in the Forest Plan

Rating

1. Identify road or segments that serve developed sites, popular dispersed sites, or that are

popular for recreation activities.

2. Identify the predominant ROS classification served by the road or segment.
3. Identify areas where the predominant recreation use is enhanced by lower road density. Leaning toward more primitive recreation activities.
4. Identify roads or segments that stakeholders have an expressed interest in keeping open for general Forest travel or exploring.
5. Identify roads or segments that stakeholders have expressed interest in reducing to a lower standard, converting to trail, or obliterating.
6. Relative rankings are based on above elements:
    a. High (10) road is needed to access developed facilities and activities toward the developed end of the ROS scale.
    b. Medium (6) activities are semi-primitive motorized or semi-primitive non-motorized portion of the ROS scale. Low standard roads are preferred and/or low density is preferred to enhance the recreation activity.
    c. Low (3) semi-primitive non-motorized or primitive ROS classification. Activities in this area are characterized as more challenging and more secluded. The degree of skill needed to participate is greater.

Data Sources

Scoping for specific projects
Frontline contacts
Comment boxes and comment cards
Personal contacts
Travel cost surveys

Factor Number 4: Economics

This factor includes the relationship of the road system to local and regional economic values. The stakeholders in this group would be individuals and businesses that receive direct or indirect economic benefit from the Forest. Though there are direct economic benefits from commodity production, such as mining, grazing, and wood products manufacturing, economic benefits are also derived from providing services through contracts or permits. Permitted uses could include such things as mushroom gathering, posts, poles, floral greenery, boughs, Christmas trees, and other miscellaneous forest products, as well as the services provided along the route either privately or by permit. The indirect benefits from people visiting the forest for business or pleasure are also important to communities at a local and regional scale. Economic values are market-based, involving supply and demand.

The Interior Columbia Basin Ecosystem Management Project scientists concluded, "…that recreation use generates far more jobs than other uses of Forest Service- and BLM administered lands. Recreation provided by these public lands contributed about 15 percent of total jobs, area-wide." The geographic scale for this factor is primarily local and regional.

Questions Addressed

Recreation and tourism (EC-3)

Commodity production (TM-3), MM-1), (RM-1)

Rating

1. Identify roads or segments that access developed sites, fee sites, concession, or commercial permit operations, and that are necessary to directly support these services.
2. Identify roads or segments that are important for activities, which provide revenue to local communities and businesses.
3. Relative rankings are based on above:
   a. High (10): Access is essential for commodity production or area business. Area served by road is in Matrix land allocation in Forest Plan and is important for timber production.
   b. Medium (6): Tourism or local businesses benefit indirectly; other access points or forms of access could replace this road and businesses would not be severely affected. Road access is desirable to draw users into the communities. Area is allocated as Managed Late Success ional Reserve (MLSR) and will have some timber management activities. Includes areas that are in Matrix and are important for firewood gathering. Provides access to a range allotment.
   c. Low (3): Economic dependency on access is either low or short term. Land allocation is Late Success ional Reserve (LSR) and will have limited timber treatment. Area is used for special forest products including products, such as boughs, cones, bear grass, and transplants. Area is allocated MLSA and receives some use for firewood gathering.
   d. Very Low (1): Land is administratively withdrawn or in a LSR and will have only incidental timber treatment, and will occasionally produce some firewood as a byproduct of another activity.

Data Sources

Sales tax
Costs for police, ambulance, and fire services
SCORP report
Permits

Table G-1. Human uses, Wenatchee Sub-Basin

Road seg #	FS rd. #	Seg lgth	Access required by law/agree	Resource mgmt.	ROS class	Level of use	Economics	Human use total	Human use rating
1	5200000	5.5	9	10	10	10	7	46	H
2	5200000	2	9	10	10	10	7	46	H
3	5200000	3.6	9	10	10	10	7	46	H
4	6100000	4	9	10	10	10	10	49	H
5	6101000	3.2	9	10	10	10	7	46	H
6	6200000	9.5	9	10	10	10	7	46	H
7	6200000	2.2	9	10	10	10	3	42	H

Road seg #	FS rd. #	Seg lgth	Access required by law/agree	Resource mgmt.	ROS class	Level of use	Economics	Human use total	Human use rating
8	6200000	11.2	9	10	10	10	3	42	H
9	6210000	0.5	9	7	10	10	3	39	M
10	6211000	2.4	9	7	10	10	3	39	M
11	6300000	4.2	9	7	10	10	10	46	H
12	6300000	5.2	9	7	10	10	10	46	H
13	6400000	3.6	0	3	10	10	3	26	L
14	6500000	11.6	9	3	10	10	7	39	M
15	6500000	2.8	0	3	10	10	3	26	L
16	6607000	1.3	9	10	10	10	10	49	H
17	6700000	8.6	0	10	10	10	7	37	M
18	6700000	4	0	10	10	10	7	37	M
19	6701000	7.9	0	10	10	10	3	33	L
20	6701400	2.3	0	10	10	10	3	33	L
21	6701500	1.5	0	10	10	10	3	33	L
22	6705000	3.6	0	3	10	10	3	26	L
23	6900657	1.6	0	10	10	10	10	40	M
24	6910000	4.3	9	10	10	10	10	49	H
25	6940000	1	9	7	10	10	10	46	H
26	6950000	3.8	9	7	10	10	10	46	H
27	7100000	2.3	6	10	10	10	7	43	H
~~28~~	~~7100000~~	~~9.3~~	-	-	-	-	-	~~0~~	-
29	7104000	1.1	9	10	10	10	7	46	H
30	7200000	3.2	9	10	10	10	10	49	H
31	7200000	1.8	9	10	10	10	10	49	H
32	7300000	2.5	9	10	10	10	3	42	H
33	7300000	3.3	9	10	10	10	3	42	H
34	7400000	2.1	9	10	10	3	10	42	H
35	7400000	9.7	9	10	10	3	10	42	H
36	7520000	5.7	9	10	10	10	10	49	H
37	7600000	9.2	9	10	10	10	3	42	H
38	7600000	5.1	9	10	10	10	3	42	H
39	7601000	3.8	9	10	10	10	10	49	H
40	7905000	2.4	9	10	10	10	10	49	H
41	7908000	0.7	9	10	10	10	3	42	H
~~42~~	~~9712000~~	~~2.9~~	-	-	-	-	-	~~0~~	-
43	9712000	6.1	9	10	10	10	10	49	H

Appendix B: Aquatic Rating Criteria and Assessment

The aquatic assessment characterizes how the transportation system may be influencing watershed processes and aquatic habitat at the sub-basin and site scale. The assessment at the sub-basin and watershed scale is basically the same, the primary difference being the scale of road segment to be analyzed. The basic units of assessment at the sub-basin scale are the watersheds within the sub-basin and road segments of arterial and collector roads within the watersheds. The sub-basin scale analysis will help prioritize watersheds for further analysis based on aquatic resources and potential restoration needs, identify issues within watersheds, establish context for the watershed or project scale analysis and identify potential management of the arterials and collectors. Analysis of local roads at the watershed or project level is basically the same while the segment length may be different. Ratings for the sub-basin scale analysis include overall watershed condition ratings and segment specific ratings. It is hoped that after the sub-basin scale assessment is completed only information specific to the smaller segments will be needed as part of project analysis. The watershed condition ratings are based upon the watershed BAs with further information provided by completed watershed analysis and existing GIS layers. The watershed condition ratings establish a context for the road segment ratings. The segment ratings are based upon stream survey data, road logs, culvert surveys, and local knowledge.

Development of the Aquatic Impact, At-Risk Criteria

Aquatic criteria were developed to capture key processes associated with roads as they link to aquatic environments.

Criteria include:

1. Geologic hazard
2. Road-related sediment
3. Floodplain off-channel habitat riparian reserve function
4. Flow effects
5. At-risk fish populations and wetlands.
6. Wetlands and wet meadows

In the “Questions Addressed” section for each factor an alphanumeric code that corresponds to Appendix 1 in the “Roads Analysis Handbook” is listed for each bullet item. This code is linked to an ecological consideration that has been formulated as a question. Each risk factor being evaluated addresses one or more of these questions. The appendix should be consulted for more information on the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor. The term “at-risk fish” in this document refers to fish listed as threatened or endangered under the Endangered Species Act.

Criterion Number 1: Geologic Hazard

This criterion was developed to incorporate the natural risk of mass wasting as an effect on roads or potential for roads to accelerate mass movement events. Three forms of mass movement were identified: debris slides (shallow rapid landslides); earth slumps (fairly deep land slides); and

deep-seated landslides. On the Okanogan and Wenatchee National Forests, debris slides are often associated with coarse textured sediment, earth slump medium textured sediment, and deep seated fine and very fine sediment.

The interpretation of mass wasting was taken from the Landtype Associations of North Central Washington's preliminary report. These interpretations were based on observations of landslide features, Landtype Association site features, and literature references. The interpretations are based upon geomorphic mapping, bedrock weathering properties, geologic structural features, slope gradient, drainage characteristics and patterns, and regolith features.

Geologic Hazard was considered to be a highly important factor relating to aquatic conditions. The numerical weighting however was restricted, weighted heavily toward the high and very high hazards. Each road segment will receive a rating for Geologic Hazard.

Questions Addressed

Mass wasting (AQ –3)

Rating

1. Low risk = 0
2. Moderate risk = 2
3. High risk = 6
4. Very high risk = 9

Criterion Number 2: Road-Related Fine Sediment

Surface erosion occurs on forest roads due to erosion of the road surface, cut and fill slopes, and accelerated mass failures. Erosion of the road is sensitive to road design, road maintenance and geologic hazard. Road surface, design and maintenance of drainage structures can also influence the amount of road surface erosion. Insufficient drainage structures, culverts, including ditch-relief culverts, can also be sources of sediment.

Roads crossing areas of high geologic hazard or with unstable fill slopes may contribute to accelerated mass wasting initiated by the failure of the fill slope. Culverts at stream crossings can be a sediment source if the culvert is under-sized and the hydraulic capacity is exceeded or the culvert inlet is plugged causing stream flow to overtop the road. Large amounts of sediment or mass wasting can also be generated if the plugged culvert results in failure of the crossing resulting in a debris flow, when the culvert is overrun resulting in the stream flowing down the road, eroding the surface and fill. Ditch relief culverts that erode fill material directly into streams is another sediment source.

Questions Addressed

Generated Surface Erosion (AQ – 2)
Mass Wasting (AQ – 3)
Stream crossing influence local stream channels and water quality (AQ – 4)

Ratings

1. Fine Sediment -Watershed condition
   1 = Watershed is rated as Functioning Appropriately for fine sediment; transportation system consistent with the Aquatic Conservation Strategy (ACS).
   3 = Watershed is rated as At risk for fine sediment; road system is a contributor to fine sediment but is not felt to be a major contributor and road system is generally consistent with ACS.
   6 = Watershed is rated as at risk for fine sediment; roads are felt to be a major source of fine sediment and road system is inconsistent with ACS.
   10 = Watershed is rated as Functioning at Unacceptable Risk for fine sediment; road system is felt to be a major contributor of fine sediment, and road system is inconsistent with the ACS.

Fine Sediment – Segment

a. 1 = Road segments with a paved surface, crossings are bridged or sufficient to pass the 100-year flood and associated debris. Cut and fill slopes are vegetated and not eroding. Crossings are not impacting channel morphology downstream.
b. 3 = Road segment is native or gravel surfaced but no visible erosion, ditch relief culverts are not causing erosion of fill into streams, crossings are perpendicular to the stream and sufficient to pass the 100-year flood, or designed so that if they do fail only the prism at the crossing fails. Crossings are not impacting channel morphology downstream or causing downstream bank erosion. There is no evidence of accelerated mass wasting due to the road segment.
c. 5 = Road segments not meeting the above criteria to some degree but have potential impact to at-risk fish habitat that appears to be minor due to the amount of erosion, potential sediment delivery if a crossing failure or fill slope failure were to occur, changes to channel morphology due to a crossing is confined to the site or does not alter the channel type.
d. 10 = Road segments with high potential impact to at-risk fish habitat. Road surface and/or fill slopes exhibit either erosion into streams, visible ditch erosion, or cut slope erosion into ditches. Sediment directly enters fish-bearing stream from ditch, fill slopes begin to fail, and evidence of accelerated mass wasting due to the sediment becomes prevalent. Crossings with high potential for failure where failure of the prism will result in a large amount of sediment into at-risk fish habitat or the culvert is over-topped it is highly likely the stream will travel down the road and deliver sediment to at-risk fish habitat, crossing are altering stream channel type downstream and/or causing downstream bank erosion.

Criterion Number 3: Flood Plain Function, Off-Channel Habitat and Riparian Reserves

This criterion addresses how the road segment has altered the function of a stream's floodplain and/or off-channel habitat. Flood plains are important regulators of stream flow and water quality. They absorb over-bank floodwaters, allowing water to soak through vegetation/organic mat, and into the ground. Here water can be stored and released more slowly into streams. In

doing so, functioning floodplains can provide more water in late summer and reduce peak floods in winter and spring.

Roads can affect flood plains by:

- Limiting the frequency of over-bank flows and concentrates greater volumes of water within stream banks
- Interfering with the ability of the stream to migrate across its flood plain
- Preventing slope runoff from recharging flood plain aquifers
- Intercepting runoff and floodwaters thereby eroding and degrading water quality
- Indirectly degrading flood plain function by encouraging off-road motorized access from roads onto flood plains.

Indicators of direct and indirect flood plain or riparian reserve degradation include:

- Soil compaction
- Noxious weed introduction
- Evidence of soil erosion or mass wasting of road fill during peak runoff
- Water quality changes
- Artificial confinement of streams
- Stream bank erosion
- Interruption of hill slope delivery of water onto floodplain
- Loss of downed or standing woody debris that is both an energy dissipater and a habitat component.

Similar impact occurs if roads are within or provide vehicle access to the portion of a riparian reserve that affects aquatic habitat. Effects include loss of bank vegetation with associated loss in cover and accelerated bank erosion, reduction in large wood from the channel or potential large wood due to wood cutting or hazard tree removal, soil compaction, and accelerated surface erosion.

Off-road access provided by roads onto flood plains or riparian reserves is influenced by factors that include:

- Proximity of road to flood plain
- Slope of ground leading from road onto floodplain
- Desirability of flood plain determined by its width and demands for dispersed use. With more alteration the likelihood increases that stream systems will not function properly and those road segments within the flood plain will be at higher risk of damage.

Off-channel habitats provide important rearing habitat and refuge habitat during high flows. Roads in flood plain may isolate these off-channel areas so they are no longer accessible to fish or completely fill them. A road system may not isolate or fill an off-channel area but, by providing access to vehicles, result in loss of vegetation, bank stability, large wood input, cover, and a loss of overall habitat quality.

Questions Addressed

- Changes in physical channel dynamics (AQ – 9)

Affects to shading, litterfall and riparian plant communities (AQ – 11)
Affects of fishing, poaching, and direct habitat loss for at-risk aquatic species (AQ – 12)

Rating

1. Flood plain function – Watershed condition:
   a. 1 = Main arterials and collectors are not located in valley bottoms or if located in valley bottom are neither constricting the channels nor providing dispersed recreation access which is diminishing flood plain function or off-channel habitat quality. Flood plain connectivity, off-channel habitat and riparian reserves are rated as Functioning Appropriately.
   b. 3 = Some arterial and collector roads are located in the valley bottoms and are causing minor stream confinement. Dispersed recreation access is not resulting in adverse impact to the flood plain, riparian function that affects aquatic habitat, or off-channel habitat. Flood plain connectivity, off-channel habitat and riparian reserves are rated as Functioning Appropriately. If riparian reserves are rated as Functioning At-Risk the rating is not primarily due to the road system or dispersed recreation. While riparian reserves may be at risk, off channel habitat and flood plains are functioning appropriately.
   c. 9 = Main arterial and/or collectors are constricting streams so that floodplain connectivity and/or off-channel habitat are rated At Risk and/or Riparian Conservation Areas are rated as At Risk due to dispersed recreation, or if there is concern over potential dispersed use, even if Riparian Conservation Areas are currently Functioning Appropriately. Dispersed use is not consistent with ACS or appears to be moving towards being inconsistent with ACS.
   d. 10 = Flood plain connectivity or off-channel habitat and/or Riparian Conservation Areas are considered to be Functioning At Unacceptable Risk due to road system and or dispersed recreation. Generally dispersed recreation would currently be inconsistent with ACS.
2. Flood plain function – Road segment:
   a. 1 = Road segment is not located in valley bottom or is located on toe slope in confined valley bottom outside the 100 year floodplain and not interfering with floodplain function.
   b. 6 = Road segment located on moderately confined valley or unconfined bottoms with localized areas of road encroachment on stream channel. Road location may be providing motorized off-road access onto flood plain or within riparian reserve such that flood plain or riparian habitat conditions which affect aquatic habitat showing signs of degrading in localized areas (see indicators above).
   c. 9 = Road segment located on unconfined valley bottom which frequently or continuously restricts channel migration, off-channel habitat and riparian habitat conditions affecting vegetation, altering movement of water, accelerating erosion processes, interfering with recruitment of large woody debris (LWD), and/or is providing access for motorized off-road dispersed use within the flood plain or riparian reserve to the point riparian habitat conditions affecting riparian habitat are being degraded.

Criterion Number 4: Flow Effects

Criterion 4 addresses if road segments a) intercept surface runoff and near surface ground water, along cut slopes and ditch lines, converting subsurface flows to surface flows, and b) increase delivery efficiency of these flows by diverting them directly to streams. Where these combined flows are continuous between roads and stream systems, there is hydrologic connectivity.

Hydrologic connectivity is the condition under which a road segment, during runoff, has a continuous surface flow between any part of the road prism and a natural stream channel. Water moves from hill slopes to valley bottom via surface and subsurface paths. Roads affect flow when they cut across hill slopes and/or require fill material through depressions that interrupt these natural paths. Road-cut slopes or ditches intercept surface runoff and groundwater, accelerating their movement toward stream crossings. This action frequently increases soil erosion risks and routing efficiencies, which deliver road-derived sediments and contaminants to streams and can alter peak flows and channel characteristics downstream. Precipitation runoff mechanisms, including rain-on-snow, spring snowmelt and convectional storms should be considered when evaluating a road segment's hydrologic connectivity. Indicators of these effects include water interception on road surfaces and ditch lines, absences of ditch line relief culverts or cross drains, or interruption and detention of flows by road fill.

Questions Addressed

Affects to surface and subsurface hydrology (AQ – 1)
Affects to water quality, quantity, and hydrologic connectivity (AQ – 6)

Rating

1. Flow affects – Watershed condition:
   a. 1 = Roads are not greatly impacting watershed function. Road Density and Location, changes in peak/base flows are Functioning Appropriately.
   b. 3 = Road Density and Location are Functioning At Risk but Change in Peak/Base Flows is Functioning Appropriately
   c. 6 = Road Density and Location are Functioning At Risk or Unacceptable Risk and Change in Peak/Base Flows is Functioning At Risk
   d. 9 = Road Density and Location is Functioning At Risk or Unacceptable Risk and Change in Peak/Base flows is Functioning At Unacceptable Risk
2. Flow Effects – Segment:
   a. 0 = Road segment is not intercepting concentrating runoff or groundwater in ditch lines. Runoff is cross-drained through a vegetative filter prior to reaching stream channels. Natural flow paths are maintained uninterrupted.
   b. 3 = Road segment is occasionally intercepting runoff, especially during peak events, but generally not groundwater. Delivery efficiencies are low due to combination of landform slope and weakly developed stream networks. Some additional ditch relief is necessary for routing surface runoff through vegetative filter. Downstream stream reaches may be susceptible to damage from increase peak flows.
   c. 9 = Road segment frequently intercepting both surface runoff and/or groundwater in sufficient volumes to influence flow downstream and delivering waters directly to streams. Landform slopes are steep and drainage densities high, providing increased delivery efficiency to stream channels. Downstream channels are unstable and

susceptible to damage from increased peak flows. Road prisms may be interrupting and detaining water preventing it from recharging floodplain aquifers. Road has high hydrologic connectivity to the stream system.

Criterion Number 5: At-Risk Fish Populations

This criterion addresses the relative importance of a sub-watershed to the conservation and recovery of at-risk fish and to help weigh the potential for adverse impact to at-risk fish or their habitat. Roads not only have the potential to impact aquatic habitat; they can increase the potential for poaching or introduction of exotic species.

Questions Addressed

Downstream beneficial uses of water and demands (AQ – 7)
Affects to migration and movement of aquatic organisms (AQ – 10)
Affects to fishing, poaching and direct habitat loss for at-risk aquatic species (AQ – 12)
Affects to areas of exceptionally high aquatic diversity or rare or unique species (AQ – 14)

Rating

1. At-risk fish populations:
   These criteria address whether fish listed for protection under the Endangered Species Act are present in the watershed and the relative importance to recovery within the sub-basin.
   a. 0 = No at-risk fish present in the sub-basin or watershed
   b. 1 = At-risk fish are present but there are no significant sub-watersheds.
   c. 3 = At-risk fish are present but there are no significant sub-watersheds because populations are depressed preventing identification of significant sub-watersheds or significant sub-watersheds have been identified but populations are very low and habitat is fragmented or severely degraded.
   d. 6 = At-risk populations are present with significant sub-watersheds for one or multiple species; habitat connectivity exists within the watershed. Habitat conditions are such that with relatively low investment in restoration the watershed could be a refugia from a habitat standpoint or management emphasis on restoration for other resources can be coordinated with aquatic/watershed restoration (i.e., “dry site or 303d.”)
   e. 9 = Multiple significant sub-watersheds exist for multiple species or watershed represents a refugia within the sub-basin for one or more species
2. At-risk fish populations – road segment (AQ - 7, 10, 12, 14)
   a. 1 = Road segment with the following set of conditions: road segments located in 6th field watershed with no listed fish species; stream crossings are not migration barriers (any life stage) for other fish species.
   b. 3 = Road segment is in a sub-watershed with at-risk fish or tributary to a watershed with at-risk fish, but neither the sub-watershed is within nor the sub-watershed downstream is a significant sub-watershed for an at-risk species. Stream crossings are not barriers to at-risk fish, but may be barriers to other species.

c. 5 = Road segment is in a sub-watershed with at-risk fish or tributary to a watershed with at-risk fish, but neither the sub-watershed is within nor the sub-watershed downstream is a significant sub-watershed for an at-risk species, but one or more crossings are present that present a barrier to at-risk fish at some life stage.
d. 6 = Road segment is in a significant sub-watershed for an at-risk species or is a tributary to significant sub-watershed, no road crossings are barriers to any life stage of an at-risk species, poaching is not a major concern.
e. 8 = Road segment is in a significant sub-watershed for an at-risk species or is tributary to a significant sub-watershed, no road crossings are barriers to any life stage of an at-risk species, but poaching due to access from the road segment is a concern though not necessarily documented.
f. 10 = Road segment is in a significant sub-watershed for an at-risk species or is tributary to a significant sub-watershed. The road segment is or has potential, based upon the previous factors, to have serious adverse impact to at-risk fish habitat; and/or there are road crossing barriers to some life stage of at-risk species and/or there is known poaching of at-risk fish occurring.

Criterion Number 6: Wetlands and Wet Meadows

These criteria address whether wetlands are present along road systems and do road segments interfere with wetland condition and function, including ground water movement or wetland vegetation.

A road segment's influence on the condition and function of adjacent wetlands can be a result of:

a direct impact such as, a road location relative to the wetland.
an indirect impact related to the roads effect on the wetland supporting hydrology.
a change in vegetative community and soil characteristics.

The most notable effects include

converting productive wetlands to compacted road surfaces.
providing motorized off-road access into these areas.
constraining and diverting both surface and subsurface flows that support the water table.
intercepting runoff which can accelerate

1. Listed below is a summary of hazard rating for road segments:
    a. 0 = Road segment is either not near or adjacent to wetlands/wet meadows, or road design characteristics are providing for the uninterrupted movement of surface and groundwater necessary to support the wetland's vegetation and soil characteristics.
    b. 3 = Road segment is adjacent to or crosses small localized wetlands or wet meadows. Road design characteristics, particularly crossings of surface and near surface water paths are limiting the available water necessary to inundate and saturate the landform and support the wetland's vegetation and soil characteristics. Initiation of wetland degradation, including noxious weed establishment, increased sediment loading, and decreased area of saturation, is occurring.
    c. 6 = Road segment is adjacent to or crosses landscape scale wetlands or wet meadows. The road's location and design have displaced or degraded the wetland

Table H-1. Aquatic impact, at-risk, Wenatchee Sub-Basin

Road seg. #	Road #	Seg. length	Geol. hazard	Road-related fine sediment	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating
1	5200000-C	2	2	3	1	0	1	3	10	L
2	5200000-B	5.5	0	3	1	0	1	3	8	L
3	5200000-A	3.6	0	3	1	0	6	3	13	L
4	6100000	4	2	5	6	3	6	3	25	M
5	6101000	3.2	6	5	6	3	3	3	26	M
6	6200000	9.5	2	1	6	0	10	3	22	M
7	6200000	2.2	0	1	1	0	6	0	8	L
8	6200000	11.2	6	10	6	9	10	3	44	H
9	6210000	0.5	0	3	1	0	6	0	10	L
10	6211000	2.4	2	3	1	3	6	0	15	L
11	6300000	4.2	2	1	1	3	3	3	13	L
12	6300000	5.2	0	3	1	3	3	3	13	L
13	6400000	3.6	6	5	6	3	8	3	31	H
14	6500000	11.6	6	3	6	9	8	3	35	H
15	6500000	2.8	6	5	1	9	1	0	22	M
16	6607000	1.3	6	5	1	3	10	0	25	M
17	6700000-A	8.6	6	10	1	9	3	3	32	H
18	6700000-B	4	2	3	1	3	1	3	13	L
19	6701000	7.9	6	5	6	3	3	0	23	M
20	6701400	2.3	6	3	1	3	3	0	16	L
21	6701500	1.5	0	3	1	3	1	0	8	L
22	6705000	3.6	2	5	1	3	3	3	17	L
23	6900657	1.6	2	3	1	0	3	0	9	L
24	6910000	4.5	6	5	1	9	1	3	25	M
25	6940000	1	0	3	1	3	3	0	10	L
26	6950000	3.8	2	5	6	3	8	3	27	M
27	7100000	2.3	2	10	9	3	10	0	34	H
28	7104000	1.1	2	10	9	3	10	0	34	H
29	7200000	3.2	2	5	6	3	6	1	23	M
30	7200000	1.8	2	5	1	3	1	6	18	L
31	7300000-A	2.5	6	5	1	3	3	3	21	M
32	7300000-B	3.3	6	10	1	9	10	3	39	H
33	7400000	2.1	2	5	6	3	5	0	21	M

Road seg. #	Road #	Seg. length	Geol. hazard	Road-related fine sediment	Floodplain function	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating
34	7400000	9.7	2	10	6	3	5	3	29	H
35	7520000	5.7	0	5	6	3	1	0	15	L
36	7600000	9.2	6	3	1	0	3	0	13	L
37	7600000	5.1	6	5	9	3	3	3	29	H
38	7601000	3.8	6	3	1	3	3	3	19	M
39	7905000	2.4	6	5	1	3	6	0	21	M
40	7908000	0.7	0	3	6	3	3	0	15	L
41	9712000	6.1	2	3	1	3	1	3	13	L

Appendix C: Wildlife Rating Criteria and Assessments

The objective of this portion of the roads analysis is to characterize the wildlife/road interactions that occur within each watershed within a sub-basin. The sub-basin analysis will identify major arterial and collector roads for management, prioritize watersheds for further analysis at the watershed scale based upon potential restoration needs for wildlife habitats, identify issues within watersheds, and establish the context for watershed scale roads analysis.

The analyses described below can be used to address wide-ranging carnivores, late-successional associated species, riparian-dependent species, ungulates, and unique habitats. Table C-1 provides an approach to rank watersheds based on the wildlife issues within each watershed and the potential to provide benefits to the restora

Table I-1. Relative ranking scheme to determine the priority of watersheds for watershed scale analysis within each sub-basin for each species group or habitat

Species group/Habitat	High	Moderate	Low
Wide-ranging carnivores	9	5	1
Late-successional species	10	6	2
Riparian dependent	10	6	2
Ungulates	9	5	1
Unique habitats	10	6	2

Table I-2. Road-associated factors that negatively affect habitat or populations of wildlife species (based on Wisdom et al. 1999) **and the wildlife species group for which effects of the road-associated factor has been documented**

Road-associated factor	Effect of the factor	Wildlife group affected
Hunting	Non-sustainable or non-desired legal harvest by hunting facilitated by road access	Wide-ranging carnivores; Ungulates
Poaching	Increased illegal take of animals, as facilitated by roads	Wide-ranging carnivores; Ungulates
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Chronic negative human interactions	Increased mortality of animals (e.g. euthanasia or shooting) due to increased contact with humans, as facilitated by road access	Wide-ranging carnivores
Movement barrier	Interference with dispersal or other movements as posed by a road itself or by human activities on or near a road or road network	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network	Wide-ranging carnivores Late-successional Riparian dependent Ungulates Unique Habitats
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to the establishment of roads, road networks, and associated human activities	Wide-ranging carnivores; Late-successional; Riparian dependent; Ungulates; Unique Habitats

Criterion Number 1: Wide-Ranging Carnivores

This group of species includes the grizzly bear (threatened), gray wolf (endangered), wolverine, and Canada lynx (threatened). Several studies have documented the effects of road-associated factors on carnivores and have included hunting, poaching, collisions, chronic negative human interactions, movement barriers, displacement/avoidance, habitat loss and fragmentation (Thiel 1985, McLellan and Shackleton 1988, Mech et al. 1988, Kasworm and Manley 1989, Mace et al. 1996, Singleton and Lehmkuhl 1998). Several questions remained unanswered about the relationship between lynx and roads. McKelvey et al. (1999) found no evidence that narrow, forest roads at relatively low road densities affected habitat use by lynx. However, their analyses did not address potential indirect effects of roads on habitat quality for lynx. There is some additional speculation that roads used during the winter for snowmobile routes may increase the interactions between lynx and other competitors such as bobcat and coyotes (Buskirk et al. 1999). Therefore, to err on the conservative side, road-associated factors and lynx are considered in this analysis.

Questions Addressed

Direct effects on terrestrial species habitat (TW-1)
Affects to habitat by facilitating human activities (TW-2)
Affect to legal and illegal human activities, i.e. trapping, hunting, poaching (TW-3)

Rating

1. Analysis area: The watershed (5th Field) within the sub-basin (4th Field).
2. Follow the process described in the Interagency Grizzly Bear Committee Task Force Report (1998) to develop maps of core areas and road densities within each watershed in the sub-basin.
3. Identify issues and priorities for further watershed level roads analysis and for habitat restoration of major arterial and collector roads in each watershed within the sub-basin based on the following:
   a. Amount and location of core areas in the watershed.
   b. Road density within the watershed, defined as: high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.
   c. Proportion of the watershed affected by winter use of road in a Lynx Analysis Unit.
4. Relative Ranking. Based on the above information rank the watershed and the major arterial and collector roads as follows:
   a. Low (1) – low potential to improve conditions for the target species.
   b. Moderate (5) – moderate potential to improve conditions for the target species.
   c. High (9) – high potential to improve conditions for the target species.

Criterion Number 2: Late-Successional Associated Species

Over 100 wildlife species identified on the Wenatchee National Forest were associated with some type of late-successional forest type (USFS 1997). A review of the available literature on these species showed that approximately one-third could be affected by roads or road-related activities (USFS 1997). Road-associated factors that could affect these species include collisions,

movement barriers, displacement/avoidance, habitat loss and fragmentation (USFS 1997, Singleton and Lehmkuhl 1998, Wisdom et al. 1999).

Questions Addressed

Direct effects on terrestrial species habitat (TW-1)
Affects to habitat by facilitating human activities (TW-2)
Affect to legal and illegal human activities, i.e., trapping, hunting, poaching (TW-3)

Ratings

1. Analysis area: The watersheds within the sub-basin.
2. Follow the process outlined in the "Wenatchee National Forest Late-Successional Reserve Assessment" (USDA Forest Service 1997, p. 107). Refer to the LSRA to determine the current condition of security habitat within the LSR.
3. Identify the issues and priorities for further analysis, and major arterial and collector roads restoration opportunities for each watershed within the sub-basin based on the following:
   a. Juxtaposition of late-successional habitat to road or road segment.
   b. Road density (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.) and security habitat conditions within the LSR.
   c. Potential of the road to enhance security habitat within the LSR.
4. Relative ranking. Based on the above information rank the watershed and the major arterial and collector roads as follows:
   a. Low (2) – Low potential to improve the security habitat and habitat effectiveness in the LSR.
   b. Moderate (6) – Moderate potential to improve the security habitat and habitat effectiveness in the LSR.
   c. High (10) – High potential to improve the security habitat and habitat effectiveness in the LSR.
   d. If none of the watershed is within an LSR, score as 0.

Criterion Number 3: Riparian-Dependent Species

This group of wildlife species includes about 285 vertebrate species that are either directly dependent on riparian habitat or use them more than other habitats (Thomas et al. 1979). Road-associated factors that could affect these species include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (U.S.D.A. Forest Service 1997, Singleton and Lehmkuhl 1998, Maxwell and Hokit 1999, Wisdom et al. 1999).

Questions Addressed

Affects of unique communities or special features (TW – 4)

Rating

1. The analysis area: The watersheds within the sub-basin.
2. Determine the area within riparian reserves and density of roads within riparian reserves.

3. Identify the issues and priorities for further analysis, and major arterial and collector road restoration opportunities for each watershed within the sub-basin based on the following:
   a. Proportion and area of the watershed in riparian reserves.
   b. Road density within the riparian reserves (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2).
   c. Proportion of major arterial and collector roads that occur in the riparian reserve.
4. Relative ranking. Based on the above information rank the watershed and major arterial and collector roads as follows:
   a. Low (2) – Low potential to restore riparian habitat and habitat connectivity.
   b. Moderate (6) – Moderate potential to restore riparian habitat and habitat connectivity.
   c. High (10) – High potential to restore riparian habitat and habitat connectivity.
   d. None (0) – Road not located in a riparian reserve.

Criterion Number 4: Ungulates

This group of species includes mule deer, elk, mountain goats, and bighorn sheep. Road-associated factors that could affect these species include hunting, poaching, collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (U.S.D.A. Forest Service 1997, Singleton and Lehmkuhl 1998, Canfield et al. 1999, Wisdom et al. 1999).

Questions Addressed

Direct effects on terrestrial species habitat (TW-1)
Affects to habitat by facilitating human activities (TW-2)
Affect to legal and illegal human activities i.e. trapping, hunting, poaching (TW-3)

Ratings

1. Analysis area: The watersheds within the sub-basin.
2. Determine the proportion and area of winter ranges, young rearing areas, and migration routes for these ungulate species within each watershed.
3. Identify the issues and priorities for further analysis and major arterial and collector roads restoration opportunities based on the following:
   a. Proportion and area of the winter range, young rearing areas, and migration routes in each watershed.
   b. Density of roads (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2) within these areas, based on the assumption that road density is a good indicator of snowmobile/winter use.
   c. Potential of the major arterial and collector roads to enhance winter range, based on actual winter range and not EW-1, young rearing areas and migration routes through a management action.
4. Relative ranking. Based on the above information rank the major arterial and collector roads and watershed as follows:
   a. Low (1) – Low potential to enhance habitat effectiveness of winter ranges, young rearing areas, and migration routes.
   b. Moderate (5) – Moderate potential to enhance the habitat effectiveness of winter ranges, young rearing areas, and migration routes.

c. High (9) – High potential to enhance habitat effectiveness of winter ranges, young rearing areas, and migration routes
d. None (0) - Not located within winter range, young rearing area, or on migration route for ungulates.

Criterion Number 5: Unique Habitats

Unique habitats include wetlands, talus slopes, caves, cliffs, snag patches, hardwood forests, etc. These habitats tend to be used disproportionate to their availability on a landscape, making them particularly important for wildlife and greatly enhancing biodiversity. Road-associated factors that could affect the wildlife species associated with these habitats include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (U.S.D.A. Forest Service 1997, Singleton and Lehmkuhl 1998, Wisdom et al. 1999).

Questions Answered

Affects of unique communities or special features (TW-4)

Rating

1. The analysis area: the watersheds within the sub-basin.
2. Identify the unique habitats within each watershed.
3. Identify the issues and priorities for further analysis, and major arterial and collector roads restoration opportunities based on the following:
   a. The density of unique habitats (acres/mile road within 100m of major arterial and collector roads) within the watershed.
   b. The quantity of unique habitats (number of unique habitat types/road segment or road within 100m of Level 3-5 roads).
   c. Rating of unique habitats will be based on the following formula and then applied to relative ranking below:
      1) Low density + low quantity = low
      2) Low/moderate density + moderate quantity = moderate
      3) Moderate density + low/moderate quantity = moderate
      4) High/moderate density + high quantity = high
      5) High density + high/moderate quantity = high
      Determination of low/mod/high density and quantity will be a function of statistical distribution and ecological situation specific to each sub-basin.
4. Relative ranking. Based on the above information rank the watershed as follows:
   a. Low (2) – low density/quantity of unique habitats and low potential to restore unique habitats.
   b. Moderate (6) – moderate density/quantity of unique habitats and moderate potential to restore unique habitats.
   c. High (10) – high density/quantity of unique habitats and high potential to restore unique habitats.
   d. None (0) –Roads do not affect unique habitats.

Table I-3. Wildlife impact, at-risk, Wenatchee Sub-Basin

Road seg. #	FS rd. #	Seg. length	Wide range carnivores	Late success species	Riparian dependent	Ungulates	Unique habitats	Wildlife total	Wildlife rating
1	5200000	5.5	9	6	6	9	2	32	H
2	5200000	2	9	6	2	9	2	28	M
3	5200000	3.6	9	6	2	9	2	28	M
4	6100000	4	1	6	2	5	0	14	L
5	6101000	3.2	5	6	6	5	2	24	M
6	6200000	9.5	5	6	10	9	10	40	H
7	6200000	2.2	9	10	10	9	10	48	H
8	6200000	11.2	9	10	10	9	10	48	H
9	6210000	0.5	1	2	10	5	0	18	M
10	6211000	2.4	9	6	6	5	6	32	H
11	6300000	4.2	1	2	10	1	2	16	M
12	6300000	5.2	9	10	10	9	10	48	H
13	6400000	3.6	5	10	10	5	10	40	H
14	6500000	11.6	9	10	10	9	6	44	H
15	6500000	2.8	9	10	10	9	6	44	H
16	6607000	1.3	1	0	6	5	0	12	L
17	6700000	8.6	9	10	10	9	6	44	H
18	6700000	4	9	10	10	9	10	48	H
19	6701000	7.9	9	10	10	9	10	48	H
20	6701400	2.3	9	10	10	9	6	44	H
21	6701500	1.5	9	10	2	5	0	26	M
22	6705000	3.6	5	10	6	5	2	28	M
23	6900657	1.6	1	0	2	5	0	8	L
24	6910000	4.3	5	0	2	9	2	18	M
25	6940000	1	1	0	6	1	10	18	M
26	6950000	3.8	5	6	6	9	10	36	H
27	7100000	2.3	1	6	10	9	2	28	M
~~28~~	~~7100000~~	~~9.3~~						0	
29	7104000	1.1	1	6	10	9	0	26	M
30	7200000	3.2	1	0	6	9	6	22	M
31	7200000	1.8	1	0	2	9	6	18	M
32	7300000	2.5	1	6	2	5	0	14	L
33	7300000	3.3	5	10	6	9	2	32	H
34	7400000	2.1	1	0	10	9	2	22	M
35	7400000	9.7	5	10	10	5	2	32	H
36	7520000	5.7	5	0	10	5	2	22	M
37	7600000	9.2	9	10	10	9	6	44	H
38	7600000	5.1	9	10	10	9	2	40	H

Road seg. #	FS rd. #	Seg. length	Wide range carnivores	Late success species	Riparian dependent	Ungulates	Unique habitats	Wildlife total	Wildlife rating

Table I-4. Results of roads analysis, rating and notes, for wildlife habitat on Wenatchee Sub-Basin

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
1	5200000	Main Stem Wenatchee	5.5	9	6	6	9	2	32	H	W-Surrounded by roads, currently not much core, lynx sighting nearby, good lynx hab., ABLA2, burn, good denning hab., wolf obs. along stretch (Sugarloaf to Mad Lakes), snowmobile could affect prey base, snowmobile in lynx hab.; L-in Chiwawa LSR, in burn, last bit of good hab. in Sec. 11; R-put barrier on dispersed camping site or move out of reserve.; U-heavy deer migration (M).; UH-impt. wetland at Miner's Diversion.
2	5200000	Chiwawa	2	9	6	2	9	2	28	M	W-Core hab. on Cougar Ck. side w/motorized trail, not much core overall, lynx sightings, snowmobile use along ridge.; L-in Chiwawa LSR; R-none; U-same as above.
3	5200000	Main Stem Wenatchee	3.6	9	6	2	9	2	28	M	W-not much core, but in LAU, heavy snowmobile use, could affect lynx in winter.; L-same as above; R-few crossings.; U-same.
4	6100000	Chiwawa	4	1	6	2	5	0	14	L	W-near a tiny island of core, island in major development.; L-along edge of Chi. LSR, dry, owls, modified hab.; R-only thru a few crossings.; U-a little fawning (F), some M.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
5	6101000	Chiwawa	3.2	5	6	6	5	2	24	M	W-in snowmobile country, very little core, pvt. land, meadows w/ spring emerg. but on pvt., less human develop.; L-fragmented but high owl use.; R-goes by meadows, high priority, Ducks Unlimtd. right next to creek, redesigning, work on crossings.; U-M; UH-Morrow Meadow's wetlands at lower end.
6	6200000	Chiwawa	9.5	5	6	10	9	10	40	H	W-high human develop. below Chiwawa R. from Shi. R. up N-better griz hab., motorized trail parallels road, not much core, salmon spawning (paved).; L-in Chi. LSR, owls, frag.; R-right along E side of R, move dispersed camping out of rip.; U-great F, M, fawns on road.; UH-substantial wetland.
7	6200000	Chiwawa	2.2	9	10	10	9	10	48	H	W-good spawning hab. bisects core.; L, R, U, UH-same as above.
8	6200000	Chiwawa	11.2	9	10	10	9	10	48	H	W-bisects core, very good hab., groomed snowmobile use thru LAU, could pull Phelps Ck. TH down.; L-marten, great old growth.; R-same.; U-same, poss. spring closure.; UH-same and aspen, dry meadows.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Rip dep	[redacted]	[redacted]	Wildlife total	Rat	[redacted]	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
9	6210000	Chiwawa	0.5	1	2	10	[redacted]	[redacted]	18	M	[redacted]	W-accesses motorized trails, some opportunity to carry thru addressing closure at watershed level, on pvt. land.; L-

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
											©, upper end, accesses goat hab., year round closure?; UH-beaver ponds, mead., ava. chutes.
13	6400000	Little Wenatchee/ White	3.6	5	10	10	5	10	40	H	W-bisects core, closed in winter (snow), in LAU-don't want snowmobiles, leaves Tall Timber Camp, accesses developed CG, spawning, berries, movement for lynx.; L-In Little Wenatchee LSR, in finger of LSR, STOC, pretty good hab., impt. for connect.; R-impt. rip., getting washed away, anadramous, Pacific Giant Salamander, move road?.; U-M,F, spring closure?
14	6500000	Little Wenatchee/ White	11.6	9	10	10	9	6	44	H	W-paved, very little snowmobile use, bisects core, accesses CG, high human use, accesses PCT, parallel road system, spawning hab., asked to gate in watershed assess., ?fall/spring closure, prevent trucks destroying wet mead. in spring.; L-in Little Wen. LSR, lots of STOC, frag., 1st part not in LSR.; R-lots, opp. to move Rd. by Cedar Ck.; U-F, minor C, seasonal spring closure?

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
15	6500000	Little Wenatchee/ White	2.8	9	10	10	9	6	44	H	W-runs thru lots of ava. chutes, lynx sighting, whole road = high griz hab. value, very pristine.; L-same; R-lots.; U-same.
16	6607000	Main Stem Wenatchee	1.3	1	0	6	5	0	12	L	W-accesses CG, very high human use, homes.; L-not in LSR.; R-mod. to high in Rip. area, bald eagles, loons, by CG.; U-F. Ask to maintain buoys in lake.
17	6700000	Little Wenatchee/ White	8.6	9	10	10	9	6	44	H	W-bisects core, lots of good hab., seasonal closure?; L-good hab., big trees, in Little Wen. LSR, STOC.; R-very high value, Pacific Giant Salam., tailed frogs, dispersed camping.; U-F, possible spring closure?
18	6700000	Nason	4	9	10	10	9	10	48	H	W-want to gate fall/spring ie. 6500, same reasons as 6500, 6700.; UH-wetlands, alpine mead., ava. chutes.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
19	6701000	Little Wenatchee/ White	7.9	9	10	10	9	10	48	H	W-parallels 6500, could be gated, same reasons as 6500.; L-STOC, good hab. connect., Little Wen. LSR.; R-good rip.; U-F,M.
20	6701400	Little Wenatchee/ White	2.3	9	10	10	9	6	44	H	W-bisects core, parallel to 6701500, goes to Heather Lk., high use TH, could move N, but good kid trail.; L-owls, Little Wen. LSR.; U-same as 6701.; UH-wet mead., geologic features-garnets, waterfalls.
21	6701500	Little Wenatchee/ White	1.5	9	10	2	5	0	26	M	W-to Top Lk., bisects core, high use TH, could move TH.; L-owls, Little Wen. LSR.; R-not in rip.; U-out of stream.
23	6900657	Nason	1.6	1	0	2	5	0	8	L	W-in HWY corridor, accesses high use trail, very steep country, powerline, RR, not much core.; L-no LSR.; U-access Mtn. goats spring/summer range.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
24	6910000	Nason	4.3	5	0	2	9	2	18	M	W-in core, adj. to pvt. land, could connect 2 islands of core, lots of hunters, lots of black bears.; R-papilose taildroppers, retain area around stream crossing in 1st 1.5 mile-exclude woodcutting.; U-mtn. goat summer range, M-deer.
25	6940000	Nason	1	1	0	6	1	10	18	M	W-behind RR, Lake Ethel TH, not much core, non-hab.; R-crosses wetlands that need restoration.; U-not good.
26	6950000	Nason	3.8	5	6	6	9	10	36	H	W-some homes lower, accesses Longview land, TH which goes into core, along RR.; L-not in LSR, but connect from Deadhorse to Little Wen. LSRs.; R-ends in rip.; U-very good F, M, elk.
27	7100000	Mission	2.3	1	6	10	9	2	28	M	W-not great hab. for griz., not in lynx hab., very high use.; L-Sand Ck. MLSA, STOC, hab. marginal, motorized access.; R-up the gut.; U-F, winter range(WR). ?From Devil's Gulch to Beehive, why not in Level 3: From East Fk. Mission to Beehive, could decrease maint. level. Confine snowmobile use to main route.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
~~28~~	~~7100000~~	~~Mission~~	~~9.3~~						0		
29	7104000	Mission	1.1	1	6	10	9	0	26	M	same as 7100.
30	7200000	Mission	3.2	1	0	6	9	6	22	M	W-lots of roads, not much core, high use.; R-some wetlands.; U-C, rut, possible spring seas. close.?
31	7200000	Peshastin	1.8	1	0	2	9	6	18	M	W-not much core, accesses Bible Camp, lots of roads.; R-state land.

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
32	7300000	Icicle	2.5	1	6	2	5	0	14	L	W-heavy human use, pvt. land.; L-very burned, pvt.; R-pvt.; U-M, elk WR.
33	7300000	Peshastin	3.3	5	10	6	9	2	32	H	W-grizzly bear sighting, marten, not lynx, could add fair amt. of core, would close a lot of tribs, heavily burned.; L-Boundary Butte LSR, burned, still some hab., STOC?(not lately).; R-crossings that need work.; U-M, poss. spring/fall closure (also road is so muddy).; UH-wetland, aspen.
34	7400000	Main Stem Wenatchee	2.1	1	0	10	9	2	22	M	W-accesses pvt, some core.; R-up the gut.; U-winter range.
35	7400000	Main Stem Wenatchee	9.								

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
36	7520000	Main Stem Wenatchee	5.7	5	0	10	5	2	22	M	W-in small islands of core, lots of use year-round, accesses lookout, lot of wolf sightings on upper end of ridge.; L-0; R-right along bottom, but hab. qual. not great.; U-along WR, bighorn sheep summer range.
37	7600000	Icicle	9.2	9	10	10	9	6	44	H	W-bisects core, ava. chutes, pvt. land, from 8 Mile Rd. east not as impt.; L-west 1/3 of 1st section in Icicle LSR.; R-up gut.; U-WR for deer and elk, impt. F.
38	7600000	Icicle	5.1	9	10	10	9	2	40	H	W-bisects core, ava. chutes, pvt. land, very good hab., wolverines.; L-good hab., in Icicle LSR.; R-up gut, proposed to move section between Ida & Chatter Ck.; U-same as above.
39	7601000	Icicle	3.8	5	0	10	1	2	18	M	W-bisects core, hab. not as good.; L-in Icicle LSR.; R-~~pull trail back & rehab~~. (bridge already purchased.)

Seg#	Road #	Watershed	Length	Wide range carniv.	Late success species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Rating	Notes (W=Wide range carnivores | L=LSR | R=Riparian dependent | U=Ungulates | UH=Unique hab.)
40	7905000	Main Stem Wenatchee	2.4	5	0	10	1	6	22	M	W-accesses some pvt. land at beginning, could pull TH down toward HWY, wetland, goes into core.; R-in rip., pull back road & rehab.; UH-wetlands, pond.
41	7908000	Main Stem Wenatchee	0.7	1	0	10	1	2	14	L	W-accesses pvt., would get very small amt. of core.; R-in rip.
~~42~~	~~9712000~~	~~Mission~~	~~2.9~~						0		
43	9712000	Mission	6.1	9	6	2	5	6	28	M	W-to Beehive in L, in LAU-good hab.; L-in Swauk LSR, treated, not much owl hab., little good hab.; R-not much to do.; U-some WR, gets snowmobile use in WR, M

Table I-5. Lynx Analysis Units (LAUs) within Lak

*Portions of these

Appendix D: Recommended Management Actions

Recommended management actions are alternatives that are possible options to meet the needs of the resources and the public. Any single action or combination of actions could be used. This analysis will give the broad category and the district will need to decide which actions are appropriate for each project.
The possible management actions that were considered are:

Action A: Access needs to be maintained due to public needs; however, some major work or restrictions are needed to mitigate the resource impact. Options include but are not limited to: relocation, major rehabilitation such as raising grade, surfacing, installing a large CMP or bridge, major storm-proofing (investment needed, time, and money).

Action B: Access needs to be maintained due to public needs; however, some minor work or restrictions are needed to mitigate the resource impact. Options include but are not limited to: seasonal restrictions or gating entrance, minor ditch work, adding small CMP, improved or more frequent maintenance, minor storm proofing (only enough work to address critical rating element).

Action C: Due to limited access needed and minimal resource impact, these are candidates to leave as is, maintenance continues as is.

Action D: Access needs to be maintained due to limited public or resource needs; there is little or no resource impact, so it would be possible to reduce the maintenance level.

Action E: Access may be available but due to budget constraints and minimal resource impact, these are candidates to stop maintaining after putting in a self-maintaining status.

Action F: Access does not need to be maintained and some form of decommissioning to provide ecosystem restoration would mitigate resources impact. Options include but are not limited to: blocking the entrance (includes gating for other than annual type seasonal use), rip & seed, removing culverts, partial or full obliteration.

Quandary: This is for segments when there are conflicting management recommendations. Resolve all possible recommendations within the team. All quandaries: write up why it is a quandary and present to line officer. Also provide short write-up for each priority project, include: description, location, short and long term alternatives if needed.

Table J-1. Ratings and recommended management actions, alternatives

Aquatic rating	Wildlife rating	Human use rating	Recommended mgmt.
High	High	High	A
High or Moderate	High or Moderate	Low	E
Moderate	Moderate	Moderate	Quandary
Low or Moderate	Low or Moderate	High	B or D
Low	Low	Moderate	C
Low	Low	Low	D or E
High	Low or Moderate	High	A
Low or Moderate	High	High	A

Table J-2. Roads analysis recommended management actions, Wenatchee Sub-Basin

Road seg #	Watershed	FS rd #	Road name	Seg length	Aqua. rat.	Wild. rat.	Human use rat.	Draft rcmd mgmt	Curr. maint level	Curr. maint cost	Prop maint level	Cost to maint	Final rcmd mgmt	Priority - remarks
1	Main Stem Wenatchee	5200000	Entiat Ridge	5.5	L	H	H	B	2	5555	3	5555	B	** see notes sheet
2	Chiwawa	5200000	Entiat Ridge	2	L	M	H	C	2	2020	3	2020	B	
3	Chumstick	5200000	Entiat Ridge	3.6	L	M	H	C	2	3636	3	3636	B	
4	Chiwawa	6100000	Lower Chiwawa	4	M	L	H	B	3	15200	3	15200	B	** see notes sheet
5	Chiwawa	6101												

Road seg #	Watershed	FS rd #	Road name	Seg length	Aqua. rat.	Wild. rat.	Human use rat.	Draft rcmd mgmt	Curr. maint level	Curr. maint cost	Prop maint level	Cost to maint	Final rcmd mgmt	Priority - remarks
13	Little Wenatchee/ White	6400000	White River	3.6	H	H	L	B	2	3636	3	13680	B	** see notes sheet
14	Little Wenatchee/ White	6500000	Little Wenatchee	11.6	H	H	M	A/D	4	26680	4	26680	C	ml 4/3 ** see notes sheet
15	Little Wenatchee/ White	6500000	Little Wenatchee	2.8	M	H	L	B	2	2828	3	10640	B	drainage/ditch work upgr. to ml 3
16	Main Stem Wenatchee	6607000	South Shore Lake Wenatchee	1.3	M	L	H	B	3	4940	4	2990	B	I&E for poaching @ CG
17	Little Wenatchee/ White	6700000	Rainy Creek	8.6	H	H	M	B	3	32680	3	32680	C	** see notes sheet
18	Nason	6700000	Rainy Creek	4	L	H	M	C	3	15200	3	15200	C	** see notes sheet
19	Little Wenatchee/ White	6701000	Labyrinth Mtn.	7.9	M	H	L	C	3	30020	3	30020	C	keep nat. snow melt pattern
20	Little Wenatchee/ White	6701400	Heather Lake	2.3	L	H	L	B	2	2323	3	2323	B	** see notes sheet
21	Little Wenatchee/ White	6701500	Top Lake	1.5	L	M	L	C	2	1515	3	1515	B	** see notes sheet

Road seg #	Watershed	FS rd #	Road name	Seg length	Aqua. rat.	Wild. rat.	Human use rat.	Draft rcmd mgmt	Curr. maint level	Curr. maint cost	Prop maint level	Cost to maint	Final rcmd mgmt	Priority - remarks
22	Little Wenatchee/ White	6705000	Snowy Creek	3.6	L	M	L	D	3	13680	2	3636	D	only need is grazing camps; after grazing terminated, close road
23	Nason	6900657	Merritt Lake TH	1.6	L	L	L	C	2	1616	3	1616	B	
24	Nason	6910000	Butcher Creek	4.3	M	M	H	B	2	4343	3	4343	B	** see notes sheet
25	Nason	6940000	Gill Creek	1	L	M	H	C	2	1010	2	1010	C	acquire rd. easement
26	Nason	6950000	White Pine	3.8	M	H	H	B	2	3838	3	3838	B	drainage/ ditch relief work
27	Mission	7100000	Mission Creek	2.3	H	M	H	B	3	8740	3	8740	B	** see notes sheet
~~28~~	~~Mission~~	~~7100000~~	~~Mission Creek~~	-	-	~~0~~	~~0~~	-	-	-	-	-	-	
29	Mission	7104000	Sand Creek	1.1	H	M	H	B	2	1111	3	1111	B	** see notes sheet
30	Mission	7200000	Camas Land	3.2	M	M	H	B	2	3232	2	3232	B	** see notes sheet

32	Icicle	7300000

3c

Road seg #	Watershed	FS rd #	Road name	Seg length	Aqua. rat.	Wild. rat.	Human use rat.	Draft rcmd mgmt	Curr. maint level	Curr. maint cost	Prop maint level	Cost to maint	Final rcmd mgmt	Priority - remarks
40	Main Stem Wenatchee	7905000	Hatchery Creek	2.4	M	M	H	B	2	2424	3	2424	B	** see notes sheet
41	Main Stem Wenatchee	7908000	Chiwaukum Creek	0.7	L	L	H	C	2	707	3	707	B	
~~42~~	~~Mission~~	~~9712000~~	~~Liberty Beehive~~	-	~~0~~	~~0~~	~~0~~	-	-	-	-	-	-	
43	Mission	9712000	Liberty Beehive	6.1	L	M	H	C	3	23180	3	6161	B	

Table J-3. Wenatchee Sub-Basin: Comments/Recommendations to road recommendations

Seg. #	Comments: Abbreviations: (WL) = wildlife concern, (AQ) = aquatic concern, (HU) Human Use
1	Evaluate and consider relocation of disp sites and miners diversion.
4	Ditch and culvert work needed, need sign at Deep Creek about ORV use.
6	Evaluate disp campsites for riparian habitat - (WL), consider open bottom arch on Alder & Goose creeks, lower priority than others (AQ)
7	Evaluate disp campsites - consider hardening
8	Consider spring season or natural snow melt closure- (WL), consider drivable dips, armoring fill slopes, and surfacing on steep grade sections
10	Consider relocation of Phelps Cr. TH - would provide more core area- (WL), parking concerns at main TH epically for horse use
11	Consider turning back to gravel, drainage needs to be reviewed
12	Minor drainage work needed- (AQ), Consider ending road 2 mi sooner, only need is for state access for fish stocking, consider other methods - (AQ)& (WL)
13	Consider relocation, ditch work and drainage relief particularly in flood plain - (AQ), poaching concerns - (AQ), concerned about increased snowmobile use because county plowing to private summer home unit, would like natural snow melt closure- (WL)
14	Maintain spring/winter closure with natural snow melt, turn back to gravel surface after Rainy Cr. Junction & reduce to Maint. Level 3 - (HU) slope stability, flood plain function and OHV access concerns - (AQ)
17	Would like natural snow melt closure - (WL), dispersed camp access issues - (WL), ditch relief and surface drainage concerns - (AQ)
18	Dispersed camp access issues - (WL) consider harding sites
20	Consider moving trailhead down existing road approximately ½ mile due to owl nest site - (WL), culvert on road is possible fish barrier - (AQ)
21	Consider relocating approx. 1 mile of roadway due to limited parking - (HU)

Seg. #	Comments: Abbreviations: (WL) = wildlife concern, (AQ) = aquatic concern, (HU) Human Use
24	Major drainage work needed, consider options to dry slide area - (AQ), recognize road within core habitat - (WL)
25	Acquire needed road easement - (HU)
26	Drainage and ditch relief work needed - (AQ)
27	Surfacing, erosion and cross drainage concerns - (AQ)
29	Surfacing, erosion and cross drainage concerns - (AQ)
30	Improve drainage and spot surfacing needed - (AQ), consider seasonal closure for deer calving and fawning—i.e., natural snow melt closure - (WL)
32	Need to stabilize major slide - (AQ), consider spring/fall closure for deer and elk migration -(WL)
34	Drainage improvements needed - (AQ)
35	Surfacing, erosion and cross drainage concerns - (AQ) consider wet season closure for surface drainage concerns- (AQ), consider in depth road study
38	Consider increasing maint level for dust abetment to Rock Island - (AQ), consider relocation of approx 2 mile segment that is right along river - (AQ)
40	Consider moving trailhead but need to evaluate wetlands -(AQ)

Appendix E: Public Input Summary

Two public meeting were held on the district. Approximately ten people attended the meetings. No written comments were received from the participants. The district also sent scoping letters to interested parties. No written comments were received in response. In addition, information about the Roads Analysis process was posted on the Forest Web page.

Appendix F: Definitions

Classified Road: Roads, wholly or partially within or adjacent to National Forest System lands, that are determined to be needed for long-term motor vehicle access, including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service.

Road: A vehicle travel-way more than 50 inches wide unless designated and managed as a trail. A road may be classified, unclassified, or temporary.

Road Decommissioning: Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Road Maintenance: The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective.

Road Maintenance Levels:

1 - Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed one year. Basic custodial maintenance is performed to keep damage to adjacent resources to an acceptable level and to perpetuate the road to facilitate future management activities.
2 - Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration.
3 - Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities.
4 - Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Dust abatement is a consideration.
5 - Assigned to roads that provide a high degree of user comfort and convenience.

Road Reconstruction: Activities that result in improvements or realignment of an existing classified road.

Roads Subject to Highway Safety Act: National Forest System roads that are open to use by the public for standard passenger cars. This included roads with access restricted on a seasonal basis and roads closed during extreme weather conditions or for emergencies, but which are otherwise open for general public use.

Temporary Roads: Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be part of the forest transportation system and not necessary for long-term resource management.

Unclassified Roads: Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travel-ways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorized and were not decommissioned upon the termination of the authorization.

Unroaded Areas (Roadless): Areas that do not contain classified roads.

Watershed Scale: A watershed is the area drained by a distinct stream or river system and separated from other similar systems by ridge top boundaries. Watersheds catch and store precipitation, releasing the stored water to the stream channel.

Watershed Hierarchy: The terms "watershed," "basin," "sub-basin," "sub-watershed," and "sub-drainage" are used to describe a hierarchy of "watershed." Areas that have been established by the Forest Service and other agencies. The hierarchy is as follows:

BASIN example: Upper Columbia River

SUB-BASIN example: Wenatchee River

WATERSHED example: Icicle Creek

SUB-WATERSHED example: Eightmile Creek

SUB-DRAINAGE example: Mountaineer Creek

Terms Used in Wildlife Rating Criteria

Impassable road: Roads that are not reasonably or prudently passable by conventional four-wheeled passenger vehicles, motorcycles, or all terrain vehicles.

Open road: Roads open to motorized use during any portion of the season of concern for the particular species being addressed. If information is not available concerning the effectiveness of a gate or berm it may be best to assume it is open.

Restricted road: Roads that are legally restricted, typically with gates or berms and for which information is available showing that use does not exceed 14 days.