Okanogan and Wenatchee National Forests Roads Analysis: Upper Yakima Sub-Basin

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Contents

Okanogan and Wenatchee National Forests Roads Analysis: Upper Yakima Sub-Basin i
Contents ii
List of Figures v
List of Tables v
Introduction 1
Upper Yakima Sub-Basin Area 2
I. Existing Conditions & Situation 5
General Conditions 5
A. Roads 5
B. Aquatics 6
C. Wildlife 8
Manatash Watershed 10
A. Human Use 11
B. Aquatics 12
C. Wildlife 15
Taneum Watershed 16
A. Human Use 17
B. Aquatics 17
C. Wildlife 20
Naneum Watershed 21
A. Human Use 22
B. Aquatics 24
C. Wildlife 26
Upper Yakima Watershed 27
A. Human Use 29
B. Aquatics 30
C. Wildlife 34
Cle Elum Watershed 36
A. Human Use 36
B. Aquatics 38
C. Wildlife 42
Swauk Watershed 43
A. Human Use 44
B. Aquatics 45
C. Wildlife 49
Teanaway Watershed 50
A. Human Use 51
B. Aquatics 52
C. Wildlife 55
II. Analysis 58
A. Human Use 58
B. Aquatics 58

High Priority Roads by Watershed 59
Moderate Priority Roads by Watershed 60
C. Wildlife 60
Manatash Watershed 61
A. Human Use 61
B. Aquatics 61
C. Wildlife 61
Taneum Watershed 61
A. Human Use 61
B. Aquatics 61
C. Wildlife 62
Naneum Watershed 62
A. Human Use 62
B. Aquatics 62
C. Wildlife 62
Upper Yakima Watershed 63
A. Human Use 63
B. Aquatics 63
C. Wildlife 64
Cle Elum Watershed 65
A. Human Use 65
B. Aquatics 65
C. Wildlife 66
Swauk Watershed 67
A. Human Use 67
B. Aquatics 67
C. Wildlife 68
Teanaway Watershed 69
A. Human Use 69
B. Aquatics 69
C. Wildlife 70
III. Recommendations 71
Minimum Affordable Road System 72
Manatash Watershed 72
Taneum Watershed 73
Naneum Watershed 73
Upper Yakima Watershed 74
Cle Elum Watershed 75
Swauk Watershed 76
Teanaway Watershed 77
Watershed Analysis Priorities 78
Works Cited 79
Appendices 82
Appendix A: Human Use Rating Criteria 83
Criterion 1: Required by law, agreements and permits 83
Questions addressed 83

Rating 84
Data sources 84
Criterion 2: Resource Management 84
Questions addressed 84
Rating 85
Noxious weeds 85
Fire and fuels 85
Air quality 86
Silvicultural treatments 86
Commercial harvesting and special forest products 86
Range administration 87
Data sources 88
Criterion 3: Public Access and Level of Use 88
Questions addressed 89
Data sources 89
Criterion 4: Economics 89
Questions addressed 90
Rating 90
Data sources 90
Appendix A Works Cited 91
Appendix B: Aquatic Rating Criteria 95
Development of the Aquatic Impact, At-Risk Criteria 95
Criterion 1: Geologic Hazard 95
Questions Addressed 96
Criterion 2: Road-Related Fine Sediment 96
Questions addressed 96
Rating 97
Criterion 3: Flood Plain Function, Off-Channel Habitat and Riparian Reserves 98
Questions addressed 99
Rating 99
Criterion 4: Flow Effects 100
Questions addressed 100
Rating 100
Criterion 5: At-Risk Fish Populations 101
Questions addressed 101
Rating 101
Criterion 6: Wetlands and Wet Meadows 102
Questions Addressed 103
Rating 103
Appendix B Works Cited 104
Appendix C: Wildlife Rating Criteria 113
Definitions 113
Criterion 1: Wide-Ranging Carnivores 115
Questions addressed 115
Rating 115
Criterion 2: Late-Successional Associated Species 115

Questions addressed 116
Ratings 116
Criterion 3: Riparian-Dependent Species 116
Questions Addressed 117
Rating 117
Criterion 4: Ungulates 117
Questions Addressed 117
Rating 117
Criterion 5: Unique Habitats 118
Questions Answered 118
Rating 118
Appendix C Works Cited 120
Appendix D: Recommended Actions 137
Appendix E: Public Comment 143
Summary of Public Comments from Roads Analysis 143
Access to Subdivisions and Developments 143
Why and Where Access is Important 144
Safety and Speed Issues 146
General Comments 146
Road Closure Comments 148
Appendix F: Definitions 149
Terms Used in Wildlife Rating Criteria 150

List of Figures

Figure 1. Vicinity map 3
Figure 2. Analysis area 4

List of Tables

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. 9
Table 2. Manastash Watershed: Total miles of road within naturally high sediment sources .. 14
Table 3. Road density of Lynx Analysis Units within the Manastash Watershed 15
Table 4. Availability of unique habitats in the Manastash Watershed 16
Table 5. Taneum Watershed total miles of road within naturally high sediment sources 19
Table 6. Road density of Lynx Analysis Units within the Taneum Watershed 21
Table 7. Availability of unique habitats in the Taneum Watershed 21
Table 8. Naneum Watershed total miles of road within naturally high sediment sources 25
Table 9. Availability of unique habitats in the Naneum Watershed 27
Table 10. Upper Yakima Watershed total miles roads within naturally high sediment source . 32
Table 11. Road density of Lynx Analysis Units within the Upper Yakima Watershed 34
Table 12. Availability of unique habitats in the Upper Yakima Watershed 35
Table 13. Cle Elum Watershed total miles of road within naturally high sediment sources 40

Table 14. Road density of Lynx Analysis Units within the Cle Elum Watershed 42
Table 15. Availability of unique habitats in the Cle Elum Watershed 43
Table 16. Swauk Watersheds total miles of road within naturally high sediment sources..... 47
Table 17. Road density of Lynx Analysis Units within the Swauk Watershed 49
Table 18. Availability of unique habitats in the Swauk Watershed 50
Table 19. Teanaway Watershed total miles of road within naturally high sediment sources .. 54
Table 20. Road density of Lynx Analysis Units within the Teanaway Watershed 56
Table 21. Availability of unique habitats in the Teanaway Watershed 56
Table 22. Minimum affordable road system options 72
Table 23. Management recommendation Manastash Watershed 73
Table 24. Management recommendation Taneum Watershed..... 73
Table 25. Management recommendations Naneum Watershed 74
Table 26. Management recommendations Yakima Watershed..... 75
Table 27. Management recommendations Cle Elum Watershed..... 76
Table 28. Management recommendations Swauk Watershed..... 77
Table 29. Management recommendations Teanaway Watershed 77
Table 30. Watershed ratings 78
Table A-1. Noxious weed rating 85
Table A-2. Fire and fuels rating 85
Table A-3. Air quality rating factors 86
Table A-4. Silviculture rating factors 86
Table A-5. Commercial Harvest and Forest Products ratings factors..... 86
Table A-6. Special forest products rating factors 87
Table A-7. Range rating factors 88
Table A-8. Level of public use 89
Table A-9. Economics rating factors 90
Table A-10. Human uses: Yakima Sub-Basin, Cle Elum 92
Table B-1a. Aquatic impact and risk: Yakima Sub-Basin, Cle Elum Ranger District 105
Table B-1b. Comments: Aquatic risk and impact, Yakima Sub-Basin, Cle Elum Ranger District 108
Table C–1. A relative ranking scheme to determine the priority of watersheds for watershed scale analysis within each sub-basin for each species group or habitat 113
Table C-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 114
Table C-3. Results of roads analysis, rating and notes, for wildlife habitat on Methow Sub-Basin 122
Table C-4 Results of roads analysis, rating and notes, for wildlife habitat on Yakima Sub-basin 125
Table D-1. Ratings and recommended management actions, alternatives 137
Table D-2. Roads analysis recommended management actions, Methow Sub-Basin 139

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 roads analysis.

The objective of the roads 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" (USDA FS August 1999). This analysis is not a decision-making process. Strategies and recommendations developed with the analysis 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 USDA FS 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. (USDA FS 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

The analysis of the Yakima Sub-Basin will be 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.

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.

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.

In addition, each watershed within the sub-basin was given an overall rating for each module. This rating was used to develop the recommended priorities for order of conducting the watershed scale of the Roads Analysis process.

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.

After information from the completed sub-basin road analysis is completed, the information will be used in several ways:

1. The compilation of all of the sub-basin level analyses will form the comprehensive forest wide road management strategy.
2. More detailed watershed scale analyses will tier to the sub-basin data and recommendations.
3. Scheduled forest plan revisions will utilize the results in setting long-term management direction for the road system across the forests. The forest plan revision is scheduled to start in the spring of 2003.

Upper Yakima Sub-Basin Area

This analysis focuses on the major arterials and collectors (roads open and maintained for passenger car use) within the Upper Yakima River Sub-Basin. The sub-basin boundaries closely correspond to the boundaries of the Cle Elum Ranger District on the Okanogan and Wenatchee National Forests. For more information, see Figure 1.

The Upper Yakima Sub-Basin is made up of 7 watersheds: Manastash, Taneum, Naneum, Yakima, Cle Elum, Swauk and Teanaway. The area of the sub-basin that is being analyzed is 375,531 acres, of which 221,787 acres (59%) are in wilderness and inventoried roadless areas. The area contains approximately 1300 miles of classified Forest Service Roads (FSRs) of which 343 miles will be analyzed. Unclassified roads are not being considered in this analysis, but will be included in the future watershed scale analyses.

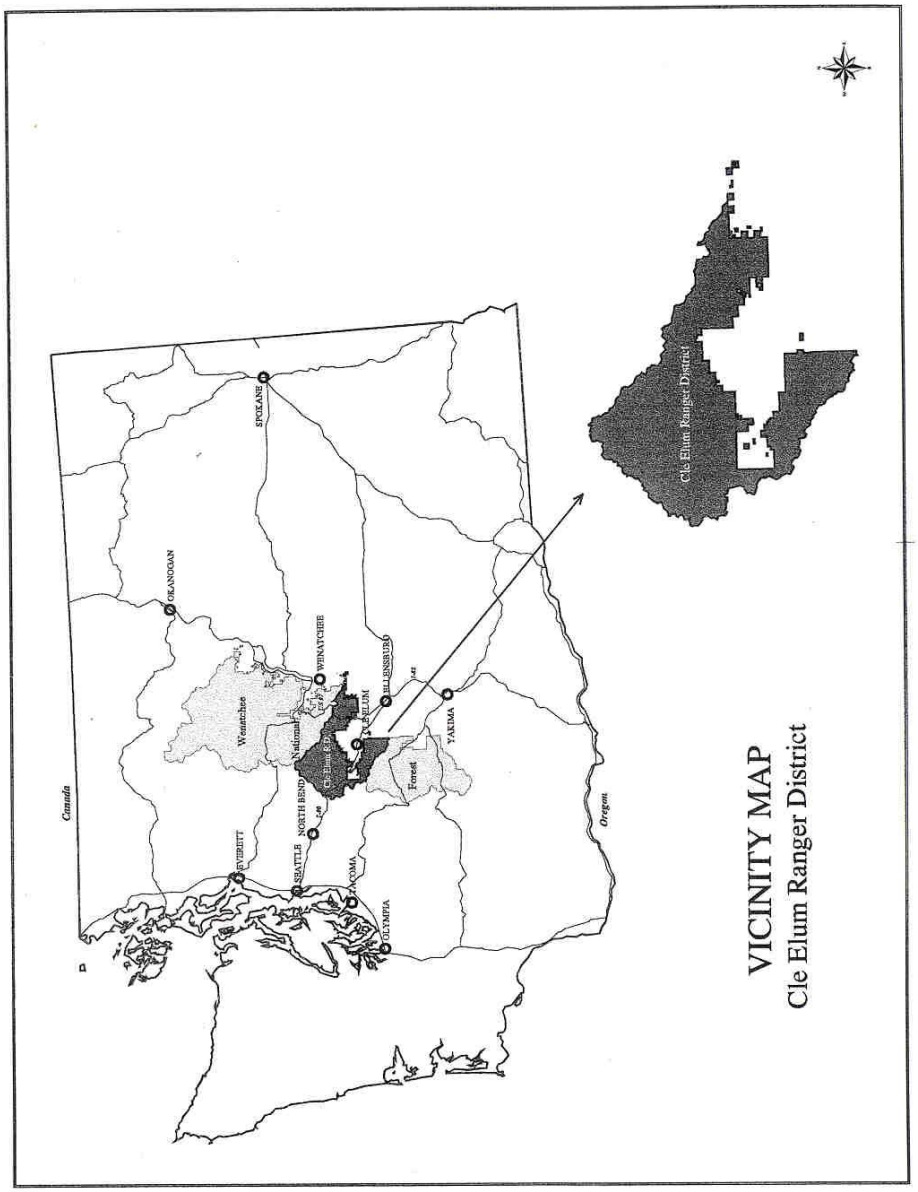

Figure 1. Vicinity map

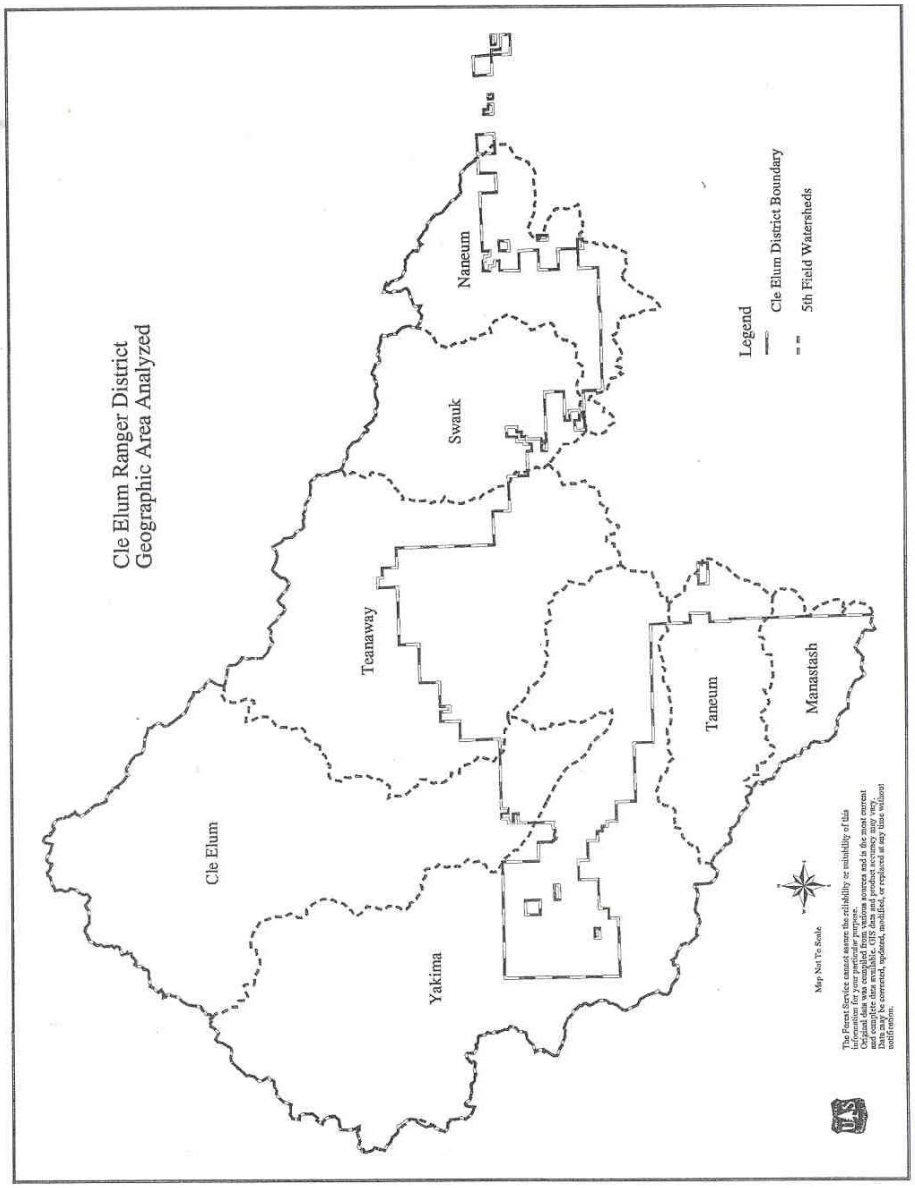

Figure 2. Analysis area

I. Existing Conditions & Situation

General Conditions

A. Roads

The entry of non-indigenous peoples to the Methow Valley before the early 1900s was largely related to exploration and the fur trade. Travel was by foot or horseback and probably followed established native trails. Roads were constructed as settlement continued. By the mid 1800s interest in developing an intermountain route linking eastern Washington to the Puget Sound area in the vicinity of Snoqualmie Pass was gaining momentum. The first wagons crossed over Snoqualmie Pass in 1865. The route did not become a permanent trail until 1899. Two rail routes also crossed the Cascades, the Northern Pacific crossed by tunnel near Stampede Pass, and the Milwaukee Road by way of a tunnel at Snoqualmie Pass. Although the route over the Cascades crossing at Washington Pass was surveyed in the 1930s, construction was not completed until 1972.

Today the Upper Yakima Sub-Basin has two major access routes: Interstate 90 (I-90) and State Route 97 (S.R. 97). Interstate 90 follows the Yakima River from Snoqualmie Pass eastward to Ellensburg. State Route 97 follows Swauk Creek, generally northeast, from Ellensburg toward Wenatchee. These roads provide the main access into the heart of the Yakima Sub-Basin and are the beginning points of numerous forest roads.

Many early forest roads were established as stock driveways or for mineral extraction. By the 1950s most new roads were being constructed for timber extraction. As time went on and the demand for forest products increased so did the need for additional roads. Just as important as the economic element was the shift toward recreation and the 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 including high clearance 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.

This roads analysis also includes road-associated effects to the environment. 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.

The Cle Elum Ranger District has seven fifth-field watersheds with varying degrees of road access. For the purpose of this roads analysis, for the Cle Elum Ranger District, the Forest Transportation Management System (INFRA Roads Database) describes each system road or segment. It describes the way that the road services the resource management needs and the

degree of service it provides, as well as specific maintenance required to meet management objectives. In the past few years the emphasis has been to gather road-related data with projects such as the inventory and mapping of unclassified roads, identifying the backlog of deferred maintenance work, and surveying of road culverts to determine if they are a problem for fish passage. Information provided by these other projects will be included at some level of the roads analysis process. A synopsis of road access and issues, concerns, or opportunities for each watershed is addressed below.

There are approximately 1300 miles within the sub-basin. The major arterials and collectors will be analyzed in this report. That will equate to approximately 343 miles or 26% of the miles within the drainage.

B. Aquatics

The Upper Yakima Sub-Basin is that portion of the Yakima Basin from the headwaters downstream to the confluence with the Naches River. Fish species protected under the Endangered Species Act inhabiting the sub-basin are: mid-Columbia steelhead (threatened) and Columbia River bull trout (threatened). Other native salmonid species that are a management emphasis include spring chinook salmon, redband/rainbow trout, and westslope cutthroat trout. The Yakama Nation and the Washington Department of Fish and Wildlife have a large spring chinook supplementation program implemented under the auspices of the Yakima-Klickitat Production Project. Spring chinook salmon and summer steelhead populations in the sub-basin are very depressed. The term “at-risk” fish populations, as used in this report, refers to steelhead and bull trout populations as they are protected under the Endangered Species Act. The native salmonid species are found in all watersheds within the sub-basin. Dams have eliminated anadromous fish access and isolated migratory bull trout populations in the Upper Yakima Watershed (Kachess and Keechelus dams) and in the Upper Cle Elum River (Cle Elum dam).

Five watersheds on the Okanogan and Wenatchee National Forests are included in the Upper Yakima Sub-Basin: Cle Elum, Upper Yakima, Teanaway, Swauk-Naneum and Taneum-Manastash. However, the Naneum Watershed will be discussed separately from the Swauk because the two watersheds are very different geologically, hydrologically, and in terms of management issues. The Taneum and Manastash Watershed will also be discussed separately because of their differences in geology, hydrology, and management issues.

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:

- The sub-watershed was identified as a stronghold in the Interior Columbia Basin Ecosystem Management Plan Assessment.
- The sub-watershed provides the primary spawning or rearing habitat for the species within the sub-basin.
- The sub-watershed represents the only known occupied habitat within a fifth-field watershed and is fairly isolated from populations in other watersheds, and thus is significant from a distribution standpoint.

The sub-watershed contributes toward the genetic integrity of a species.
The sub-watershed is known, or strongly suspected, to support a stable, strong population.

For the roads analysis process, those sub-watersheds significant for steelhead or bull trout in the Upper Yakima sub-basin have the greatest influence on the ranking of a road segment since these two species are Threatened and therefore priority for consideration. However, depending on the watershed, significant sub-watersheds for westslope cutthroat trout, spring Chinook salmon and redband trout may influence the ranking as well. The ranges of most of the salmonid species greatly overlap; 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 by watershed, and an overall watershed score is developed using the following rating factors:

1. Fine Sediment
2. Floodplain Function, Off-Channel Habitat, and Riparian Reserves
3. Flow Effects
4. At-risk Fish Populations

The number is shown in the parentheses at the beginning of the discussion for each factor. The score ranges from 0 for no impact or risk to 10 for high impact or risk. The rating factors are described in detail in Appendix B.

The Wetland and Wet Meadows rating factor is only used at the road segment level so 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 (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 the potential impact of management activities. The biological assessment and subsequent consultation is 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 the U.S. Fish and Wildlife Service (adapted from the National Marine Fisheries Service) in 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. The watershed score for each rating element is shown next to the element; the narrative gives the rationale for the score.

C. Wildlife

This section describes the current conditions on the Upper Yakima Sub-Basin in order to develop an information base for making decisions about road management and their effect of roads on wildlife. The sub-basin analysis will identify the 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.

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" (USDA FS 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 Methow Sub-Basin.

C1. Wide-Ranging Carnivores

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). Sections of this sub-basin are located within the North Cascades Grizzly Bear Recovery Zone. Several studies have documented the effects of road-associated factors on carnivores and these are summarized in Table 1. No conservation strategies or recovery plans currently exist for wolverine 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). Table 1 shows the road-associated factors that have been identified to affect these species. 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) (U.S.D.A.1994). Specific direction and recommendations for road management are contained in the analysis documents (USDA FS 1998).

The Wenatchee National Forest Late-Successional Reserve Assessment (USDA FS 1997) identified a goal of providing a "high" level of habitat effectiveness within LSRs. 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.

These definitions will be used for the Upper Yakima Sub-Basin analysis.

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. Table 1 summarizes the road-associated factors that can affect riparian-dependent wildlife species.

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.

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	Wide-ranging carnivores;

Road-associated factor	Effect of the factor	Wildlife group affected
	individual animals away from a road or road network in relation to human activities on or near a road or road network.	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

C4. Ungulates

These species include mule deer, elk, and mountain goats. Current management is focused on maintaining or restoring habitat effectiveness within areas designated as winter range (Northwest Forest Plan Allocation EW-1). Table 1 summarizes the road-associated factors that affect these species. 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 assessment was based on the assumption that the road density on the winter ranges provides an index to the amount of winter human activity that occurs. Should discrepancies exist 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. Table 1 shows the road-associated factors that can affect unique habitats.

Manatash Watershed

The Manastash Watershed has a long history of importance to area residents. Production of commodities such as grazing and timber led settlers to access the area with trails and roads. People describe the hunting and fishing opportunities that became popular almost as soon as access was available. Other recreation opportunities were recognized and have grown steadily in popularity.

Major road construction in the Taneum and Manastash Watershed began in the 1960s. Currently there are approximately 107 miles of road within the watershed. Most of the roads were built during the 30-year period from 1960 thru the late 1980s. The road network is mainly used for timber harvest, post harvest stand maintenance, and recreation use. Currently forty-one miles of road are maintained for Maintenance Level 3 or higher, 45 miles at Maintenance Level 2, and 22 miles at Maintenance Level 1 (closed road). Road densities indicate highest use in the South

Fork Manastash drainage and the Tamarack Springs area. All Forest Service roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA roads database).

Road 31 (Manastash Drive) provides the main access to and travel in the watershed. This road accepts all classes of vehicles and provides access for all multiple use travel in the area. Other roads within the watershed accessing localized areas include road 3104 (Manastash Divide), road 3111112 (North Fork Manastash), and road 3111115 (Walter Springs). In addition, off-road vehicle roads (OHV), single tread, multi-use (motorized) system trails, and hiker trails (Taneum Lake Trail) also provide access and travel throughout the watershed.

Many roads in the watershed have been built by Forest users. Most of these roads access undeveloped or dispersed camping areas; others are motorized single-tread trails and used for recreational riding purposes. The location of all existing user built roads and trails is not known and a thorough road inventory should be completed. For the purpose of motor touring, all Maintenance Level 3 and 4 roads (forty-one miles) will accept vehicles designed to transport the physically challenged.

The road system also provides for commercial access for logging trucks and heavy equipment for timber harvest on both private and Forest Service lands.

A. Human Use

A1. Public Use

This watershed has a long history of human use. Grazing began in the 1850s and continues to this day. In the 1930s recreation in the form of camping, logging, and mining for gold and coal were taking place in the area. There is evidence that Native Americans had been using this area for a long time.

Timber harvest was a prominent activity from the 1930s through the 1970s. Harvest activities accounted for most of the current road network. Though most of the current harvest activities occur on private industrial forest lands today, some work will continue on public lands. One sheep-grazing allotment is active in this area. There are also a few mining claims, though activity is quite limited.

The road access created by past timber harvesting started attracting recreation use in the 1930s and has grown dramatically. Following World War II, this area became popular for jeep travel and eventually motorcycle travel. This added significantly to the area's popularity as people throughout the state discovered the opportunities. It has also been popular for hunting, horseback riding, camping, fishing, and other typical forest activities.

Today recreation is the predominant human use. Commodity production slowed in the 1990s and is no longer a major activity in the area. The road network developed for timber harvest has become the access network for a variety of recreation activities. By far the most popular human use of the watershed is public travel, also referred to as "driving for pleasure." Public travel in passenger cars or high clearance vehicles takes place year-round, except when a road is closed to

permit snowmobiling or some other activity. In the summer months, dual tread 4x4 routes and single tread ORV trails attract large numbers of visitors. The Manastash and Taneum have been recognized in the Pacific Northwest as having the premier motorized trail opportunities.

Because of the diverse terrain and the abundant habitat for big game, this area has also been popular for hunting. The L.T. Murray Game Range adjoins this area on the east and probably contributes significantly to the attractiveness of this area. Horseback riding had been popular but eventually was displaced by the heavy amount of motorized use. In recent years the horse use seems to be coming back in spite of continued heavy motorized use. Mountain bike riding is also gaining in popularity. During winter months this area is very popular with snowmobilers. The largest visitor group consists of users traveling by car or pickup truck. Motorcycles, ATV's and 4-wheel drive users are the next largest group. Snowmobile users travel many routes in winter.

Currently there are approximately 25 miles of dual tread 4x4 trail and 22 miles of single tread multi-use motorized system trails. There is another 1.1 miles of hiker-only trail to Taneum Lake. There are approximately 46 miles of groomed snowmobile trail in this watershed. Though much of this system is located in the Taneum watershed, it is accessible from the Manastash and is discussed in detail in the Taneum-Manastash Watershed Analysis document. There are four developed campgrounds in the Manastash: Watershed, Riders Camp, Manastash Camp, Tamarack Springs, and Quartz Mountain.

A2. Resource Management

Vegetation in this watershed has been subjected to disturbance in the form of wind, fire, insects, and disease. Meadows are encroached upon by other vegetation, brush, trees, etc. Grasslands are becoming forest as encroachment proceeds.

Approximately 61% of the watershed is in a mature forest condition, 26% in the early successional stage and the remaining 13% non-forest. Nearly all stands are in the closed canopy arrangement.

There are six forest zones: Douglas-fir, western hemlock, grand fir, Pacific silver fir, ponderosa pine, and western larch. The most common is Douglas-fir (64%), western hemlock (16%), grand fir (5%), Pacific silver fir (3%), ponderosa pine (2%), western larch (2%), hardwoods (2%), and mixed species (6%).

Noxious weeds are found along roadways, in plantations, and in other areas of disturbance.

B. Aquatics

Manastash Creek is a tributary to the Yakima River. The stream originates at approximately 6,500 feet and is fed primarily by snowmelt and ground water flow. Manastash Creek flows in an easterly direction, entering the Yakima River south of the city of Ellensburg. Average annual precipitation ranges from approximately 70 inches at the headwaters to 25 inches at the mouth. Much of the lower portion of the watershed is privately owned.

At the time the environmental baseline was established, future harvest activities, including road

construction by Plum Creek Timber Company (PCTC) as covered under their Cascade Habitat Conservation Plan (HCP) FEIS, March 1996, were included. This baseline assumed that all harvestable lands owned by PCTC within the watershed had been harvested and are in an immature stand condition. Since that time, some of these lands have been exchanged to the Forest Service. Plum Creek also acquired land from the Forest Service.

Information about existing habitat conditions was obtained from the most recent environmental baseline established in the "Taneum-Manastash Watershed Aquatic Species Biological Assessment for New and Ongoing Projects," (USDA FS 1999b). When available, new information from monitoring was also used.

B1. Geologic Hazard (Score 0)

The Manastash Watershed is within the Cascades Mountains, Non Glaciated Subsection (USFS 1994b). These mountains are composed of very thick basalt flows predominately of the Grande Ronde and related units of the Columbia River Basalt Group. Inter-beds of weakly cemented sedimentary and pyroclastic deposits of the Ellensburg formation are common between basalt flows. Several geomorphic processes have been functioning to create a variety of landforms. The primary geomorphic processes that have influenced landscape development include fluvial erosion and mass wasting. The dominant landforms within the watershed are gently rolling plateaus and deep-seated landslides.

Approximately 3,123 acres of large and small deep-seated landslides occur in the Manastash Watershed, primarily in the South Manastash Creek. Most of these deep-seated landslides are due to the inter-bedded nature of the bedrock. Often along the inter-beds or contact between differing bedrock, planes of weakness have accounted for slope failures. Most of these landslides occur along the margins of basalt flows that form Gnat Mountain.

These deep-seated landslides occasionally slide into streams delivering sediment directly into stream systems and causing stream confinement and stream scour of adjoining channel banks. Once landslide toe slopes are within the channel, streams can undermine the toe, creating unstable slope conditions and triggering additional failure into the channel perpetuating the process. During this stream adjustment, accelerated levels of sediment are being routed and delivered due to the initial landslide.

The gently rolling plateaus of Grasshopper and Gnat Mountain are weakly dissected with low gradient stream systems. Due to the slope gradients and amount of stream dissection, these plateau landforms are not significant sources of sediment delivery.

Sediment delivery from the deep-seated landslides is responsible for contributing fine sediment input.

Roads can accelerate the natural rate of sediment delivery by:

1. Reducing slope strength triggering slope failures.
2. Canalizing or concentrating runoff on road prisms/cutslopes/fillslopes.
3. Adding to the amount of material composed in debris slides.
4. Causing confinement of channels forcing streams to erode channels and banks.

Table 2. Manastash Watershed: Total miles of road within naturally high sediment sources

Large deep-seated landslides	33.1
Small deep-seated landslides	--
Landforms prone to shallow landslides (debris flows)	--
Valley bottom main stem stream channels	--

B2. Road-Related Fine Sediment (Score 10)

The Manastash Watershed is functioning at unacceptable risk. Native surface roads in the watershed are believed to be contributing to high sediment levels.

B3. Flood Plain Function, Off-Channel Habitat and Riparian Reserves (Score 9)

Flood Plain Connectivity, Off-Channel Habitat, and Riparian Reserves are functioning at risk. The watershed has a long history of land management, which has impacted flood plains, off channel habitat and riparian habitat. Roads, timber harvest, grazing and recreation have contributed to the at-risk conditions. Recreation continues to slightly degrade habitat conditions and may retard attainment of Aquatic Conservation Strategy (ACS) objectives; however, recent improvement projects are improving conditions. Continued monitoring and maintenance of completed projects and further restoration work will be needed to improve conditions.

B4. Flow Effects (Score 9)

The watershed is functioning at unacceptable risk due to road densities approaching three miles/sq. mi. and roads within riparian areas. Change in peak/base flow is functioning at unacceptable risk. The functioning at unacceptable rating is partially because of irrigation withdrawal and assuming all Plum Creek lands have been harvested, which is not the case. However, Plum Creek has acquired several more sections of land in this watershed from the land exchange, some of which have been recently harvested; therefore the score is 9.

B5. At-Risk Fish Populations (Score 0)

The Manastash drainage historically supported anadromous fish runs, including steelhead. The 1936 Bureau of Fisheries River System Stream Survey stated that salmon had not been observed in the Manastash for over 25 years. The historic range for steelhead in the Manastash was thought to be up to the confluence of the North and South Forks of Manastash Creek below the Forest boundary. Irrigation development before the turn of the nineteenth century had almost completely withdrawn all the water in the lower Manastash. Three factors are currently limiting access to Manastash Creek: adult migration barriers, unscreened ditches, and low stream flows. Four diversion dams present total or partial barriers to migrating fish. All eight ditches currently

diverting flow on Manastash Creek are unscreened. The creek can become dry between river mile 1.5 and 3 and between river miles 3.3 and 4.9 during late summer irrigation months. Remaining flows below the uppermost diversion at river mile 5.7 are below natural discharge levels. All of the ditches and other barriers mentioned above are located several miles below the National Forest boundary on privately owned land. Essentially, any access from the Yakima River to Manastash Creek for migrating salmonids has been eliminated.

Bull trout have not been documented in the Manastash drainage. Bull trout were not identified during a stream survey conducted by Cle Elum Ranger District personnel in 1990 and were not found during snorkeling and electro-shocking surveys conducted during the summer of 1994. Night snorkeling was done during 1994.

C. Wildlife

The Manastash Watershed is a small watershed located at the southern end of the Upper Yakima Sub-Basin. Road densities are extremely high and create unsatisfactory habitat conditions and numerous opportunities for improvement. (Note: Throughout this discussion, numbers presented in (%) are a percentage of the corresponding watershed acreage.)

C1. Wide-Ranging Carnivores

The open road density in the Manastash Watershed is high, at 2.21 mi/mi^2. Core habitat is extremely limited. Only 3.6% of the watershed is core, for a total of 797 acres. The entire Manastash Ridge Lynx Analysis Unit (LAU) and a portion of the Taneum Ridge LAU are found in this watershed. The following table describes the road density of those portions within the Manastash Watershed. For a description of each LAU in its entirety, see Appendix C.

Table 3. Road density of Lynx Analysis Units within the Manastash Watershed

LAU	Miles of open road	Area w/in watershed (mi^2)	Road density (mi/mi^2)
Manastash Ridge	22.3	18.1	1.23
Taneum Ridge	55.1	15.9	3.47

Mean Road Density = 2.35 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A 9,033-acre portion of the Manastash Ridge LSR occupies about 40.2% of the Manastash Watershed. However, the security habitat and habitat effectiveness of this LSR both received low ratings.

C3. Riparian Dependent Wildlife Species

Riparian Reserves occupy approximately 3,262 acres (14.5%) of the Manastash Watershed. The open road density within the Riparian Reserves is high, at 2.4 mi/mi^2.

C4. Ungulates

The Manastash Watershed is a site of migration, fawning, and calving areas for ungulates, but is

not important as winter range.

C5. Unique Habitats

Within the Manastash Watershed, unique habitats are not as diverse or abundant and only cover 3,205 acres (14.3%).

Table 4. Availability of unique habitats in the Manastash Watershed

Unique habitat	Acres	% of watershed
Bedrock	67	0.3
Brushfield	57	0.3
Meadow	1,800	8.0
Talus/Scree	677	3.0
Treed Talus	49	0.2
Wet Meadow	554	2.5

Taneum Watershed

The Taneum Watershed has a long history of importance to area residents. Production of commodities such as grazing and timber attracted settlers to access the area with trails and roads. People describe the hunting and fishing opportunities that became popular almost as soon as access was available. Other recreation opportunities were recognized and have grown steadily in popularity.

Major road construction in the Taneum Watershed began in the 1960's. Currently there are approximately 134 miles of road within the watershed. Most of the roads were built during the 30-year period from 1960 thru the late 1980s. The road network is mainly utilized for timber harvest, post-harvest stand maintenance and recreation use. Currently 33 miles of road are maintained for Maintenance Level 3 or higher, 52 miles at Maintenance Level 2, and 54 miles at Maintenance Level 1 (closed road). Road densities indicate highest use in the main stem Taneum drainage and the Gnat Flat area. All Forest Service roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA Roads database).

Road 33 (Taneum) provides the main access to and through the watershed. This road accepts all classes of vehicles and provides access for all multiple use travel for the area. Other roads within the watershed, accessing localized areas include: road 3300133 (Miners Point), road 3350119 (Lankin Loop), road 3352 (Cedar Creek) and road 4510 (Spex Arth). Off-road vehicle roads (OHV), and single tread, multi-use (motorized) system trails and hiker trail (Taneum Lake Trail) also provide access and travel throughout the watershed.

Numerous roads and trails within the watershed have been built by forest users. Most of these roads access undeveloped or dispersed camping areas, while others are motorized single-tread trails used for recreational riding purposes. The locations of all existing user built roads are not known and a thorough road inventory should be completed.

The road system currently provides commercial access for logging trucks and heavy equipment for timber harvest on both private and Forest Service lands. For the purpose of motor touring, all Maintenance Level 3 and 4 roads (33 miles) will accept vehicles designed to transport the physically challenged.

A. Human Use

A1. Public Use

The history of human use and development in the Taneum Watershed is much the same as described for the Manastash above. Both the road system and the network of trails connect these two watersheds, so use is similar to that in the Manastash and is interconnected.

Recreational user preferences for the road system vary greatly depending upon each individual's recreational or commercial interests. The largest visitor group consists of users traveling by car or pickup truck. Motorcycles, ATVs, and 4-wheel drive users are the next largest group. Snowmobile users travel many routes in winter.

There are three developed campgrounds in the Taneum watershed: Icewater and South Fork Meadows. Taneum Junction is another developed camping facility, though it is not a full service campground. There are many opportunities for dispersed camping. Areas near water, meadows, logging spurs, and plateaus that offer sufficient room for parking are all used for dispersed camping. The road and trail systems offer plenty of access but there are also unroaded areas that offer seclusion and an added challenge for the more adventurous. There are approximately 78 miles of groomed snowmobile trails in this drainage to serve the winter visitors. There are 65 miles of single tread motorized, and 0.5 miles of dual tread motorized trail.

A2. Resource Management

Vegetation in this watershed has been subjected to disturbance in the form of wind, fire, insects, and disease. Meadows have begun to be encroached upon by other vegetation, brush, trees, etc. Grasslands are becoming forest as encroachment proceeds.

Approximately 61% of the watershed is in a mature forest condition, 26% in the early successional stage and the remaining 13% non-forest. Nearly all stands are in the closed canopy arrangement.

There are six forest zones: Douglas-fir, western hemlock, grand fir, Pacific silver fir, ponderosa pine, and western larch. The most common is Douglas-fir (64%), western hemlock (16%), grand fir (5%), Pacific silver fir (3%), ponderosa pine (2%), western larch (2%), hardwoods (2%), and mixed species (6%).

Noxious weeds are found along roadways, in plantations, and in other areas of disturbance.

B. Aquatics

Taneum Creek is a tributary to the Yakima River. The stream originates at approximately 6,500 feet and is fed primarily by snowmelt and ground water flow. Taneum Creek flows in an easterly

direction, entering the Yakima River near the community of Thorp at approximately river mile 166 of the Yakima. Average annual precipitation ranges from approximately 70 inches at the headwaters to 25 inches at the mouth. Much of the lower portion of the watershed is owned by the Washington Department of Fish and Wildlife or is private land.

At the time the environmental baseline was established, future harvest activities, including road construction by Plum Creek Timber Company (PCTC), as covered under their Cascade Habitat Conservation Plan (HCP) FEIS, March 1996, were included. This baseline assumed all harvestable lands owned by PCTC within the watershed had been harvested and are in an immature stand condition. Since that time, a small portion of these lands has been exchanged to the Forest Service and lands were also acquired by Plum Creek Timber Company.

Sub-watersheds in the Taneum Watershed are the Taneum, North Fork Taneum, and South Fork Taneum.

Information in this section was taken from existing habitat conditions were obtained from the most recent environmental baseline established in the "Taneum-Manastash Watershed Aquatic Species Biological Assessment for New and On Going Projects," (USFS 1999b). When available, new information from monitoring was also used.

B1. Geologic Hazard (Score 2)

The Taneum Watershed is within the Upper Yakima Basin Subsection (USFS 1994b). The Upper Yakima Basin is composed predominately of pyroclastic, sedimentary, and metamorphic rock units. The metamorphic rocks include phyllite, schist, and gneiss. The pyroclastic and sedimentary rocks include volcanic flows (basalt flows), breccia and tuff interbedded with volcanic sandstones, siltstones, shales, and conglomerates. Some increase in rock hardness of pyroclasitic and sedimentary units is due to the heat from intrusions of the metamorphic batholith. Several geomorphic processes have been functioning to create a variety of landforms. The primary geomorphic process in the upper segments of the watershed is alpine glaciation, which carved out and over-steepened stream valleys. In the mid and lower segments fluvial down cutting and mass wasting have been responsible for landform development. The major landforms in the upper portion of the watershed are glacial trough walls and trough valleys and in the mid and lower segments steep volcanic flows and deep-seated landslides predominate.

The major sources of sediment delivery are generated from shallow rapid landslides (debris flows) in the upper watershed and mass wasting in the lower section of the watershed. Another major source of sedimentation is stream scour of channels and banks in the down stream segments of main stem reaches.

The glacial trough landforms total 2,774 acres. 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.

A few deep-seated landslides are localized primarily along the eastern part of South Cle Elum Ridge. These landslides were stratified during the watershed analysis procedures. Approximately 713 acres of small and 2,607 acres of large deep-seated landslides occur in the watershed. These deep-seated landslides occasionally slide into the streams delivering sediment directly into stream systems causing stream confinement and stream scour of adjoining channel banks.

All of these forms of sediment delivery are responsible for contributing a naturally high level of coarse sediment input. However, roads can accelerate the natural rate of fine sediment delivery by:

1. Having drainage facilities (culverts) plugged causing streams to wash out road prisms.
2. Inadequate drainage facilities on alluvial fans not being able to deal with streams diverting to new channels causing road washouts.
3. Road cuts intersect subsurface groundwater from glacial till deposits which gets channelized in road side ditches causing ditch erosion and cut bank sloughing.
4. Upper to mid slope roads located at glacial till scoured rock interface triggering debris flows.
5. Roads within the active flood plain of stream reaches that tend to naturally migrate in response to high flows.

Table 5. Taneum Watershed total miles of road within naturally high sediment sources

Large deep-seated landslides	19.6
Small deep-seated landslides	--
Landforms prone to shallow landslides (debris flows)	8.6
Valley bottom main stem stream channels	--

B2. Road-Related Fine Sediment (Score 6)

Sediment sampling from 1990 to 2000 shows substrate fine sediment to average between 12% and 20%, with some reaches exceeding 20%. Taneum Watershed is functioning at risk for sediment, but given the sediment values, the watershed is bordering functioning at unacceptable risk. Recreation uses, past road and trail construction, and past timber harvest are believed to be contributing to the observed fine sediment levels.

B3. Flood Plain Function, Off-Channel Habitat and Riparian Reserves (Score 9)

Flood Plain Connectivity, Off-Channel Habitat and Riparian Reserves are functioning at risk. The watershed has a long history of land management, which has affected floodplains, off channel habitat and riparian habitat. Roads, timber harvest, grazing and recreation have

contributed to the at-risk conditions. While recreation continues to slightly degrade habitat conditions and may retard attainment of Aquatic Conservation Strategy Objectives, recent improvement projects are improving conditions. Continued monitoring and maintenance of completed projects, and further restoration work will be needed to improve conditions.

B4. Flow Effects (Score 9)

The watershed is functioning at unacceptable risk overall due to road densities and location, with lowest road densities in the South Fork Taneum, which is functioning at risk. Change in Peak/Base flow is functioning at unacceptable risk. The functioning at unacceptable rating is partially because of irrigation withdrawal and assuming all Plum Creek lands have been harvested. Plum Creek acquired several sections of land in this watershed from the Forest Service. These lands have since been harvested; therefore, the score is 9.

B5. At-Risk Fish Populations (Score 3)

Taneum Creek historically supported several anadromous fish runs, including steelhead. A 1936 Bureau of Fisheries river system stream survey reported the Taneum Ditch as a complete barrier to upstream migrants. The report also stated that it had been reported that a large run of chinook salmon used Taneum Creek but with the completion of the diversion in 1910 they soon became extinct. The Taneum Ditch diversion continued to be a barrier to fish passage until 1994 when a ladder was installed and water flows regulated to insure fish passage. In 1994 steelhead were trapped by Washington Department of Fish and Wildlife personnel above the Taneum Ditch diversion.

The status of bull trout in the Taneum Watershed is unknown. Presumably, the Taneum ditch would have been a barrier to bull trout as well as to chinook salmon and steelhead. In August 1989, a Yakama Nation survey crew conducting fish population inventories in North and South Fork Taneum Creeks collected a single fish identified as a Dolly Varden, currently referred to as bull trout, in eastern Washington. Plum Creek Timber Company conducted bull trout presence/absence surveys on North and South Fork Taneum Creeks in August 1993. These surveys were done during daylight hours; no night snorkels were done. No bull trout were identified during this effort.

C. Wildlife

The Taneum Watershed is another smaller watershed found on the southern end of the Upper Yakima Sub-Basin. This watershed has a high road density and is surrounded on three sides by high use lands. Therefore, the potential to improve habitat is also very high.

C1. Wide-Ranging Carnivores

Core habitat is very limited in the Taneum Watershed. The current open road density is high at 2.14 mi/mi^2. Only 12.2% of the watershed is core habitat, for a total of 5,124 acres. Portions of the Mount Clifty and Taneum Ridge LAUs are located within the boundaries of the Taneum Watershed. The following table describes the road densities of those portions within the Taneum Watershed. For a description of each LAU in its entirety, see Appendix C.

Table 6. Road density of Lynx Analysis Units within the Taneum Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Mt. Clifty	12.8	6.9	1.84
Taneum Ridge	113.4	48.4	2.34

Mean Road Density = 2.09 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A large 32,598-acre portion of the Manastash Ridge LSR is located within the Taneum Watershed. This LSR covers a large portion (77.9%) of the watershed, as well. Again, the security habitat and habitat effectiveness ratings are low.

C3. Riparian Dependent Wildlife Species

Riparian Reserves occupy approximately 5,963 acres (14.2%) of the Taneum Watershed and have a high open road density of 2.0 mi/mi^2.

C4. Ungulates

The Taneum Watershed provides ungulate winter range areas. The watershed contains only 885 acres (2.1%) of mapped winter range with a high open road density of 3.0 mi/mi^2. There are additional unmapped acres important for winter range, as well as areas important for calving and fawning.

C5. Unique Habitats

Unique habitats are diverse but not abundant in the Taneum Watershed, covering 1,991 acres (4.8%).

Table 7. Availability of unique habitats in the Taneum Watershed

Unique habitat	Acres	% of watershed
Bedrock	147	0.4
Brushfield	55	0.1
Cliff	3	0.01
Grass/Shrub	23	0.1
Meadow	1,129	2.7
Riparian Forest	14	0.03
Talus/Scree	271	0.6
Wet Meadow	350	0.8

Naneum Watershed

The Table Mountain area was first accessed in the mid-1800s by numerous stock driveways. This system of wide trails was used to move cattle and sheep from the Kittitas Valley to the high mountain summer pastures of the Cascade foothills. Road access to Table Mountain through

Reecer Creek and Green Canyon was accomplished by the late 1920s.

There are 136.4 miles of Forest Service System Roads within the watershed. Road construction began in the early 1900s. By 1957 the emphasis on road construction was associated with timber harvest activities. Currently, the road network is mainly used for recreation access, access to private lands within the Forest, timber harvest, and post-harvest stand maintenance.

Of the 136.4 miles of Forest Service System Roads within the watershed, 49.9 miles are maintained as Maintenance Level 3 and above, 65.2 miles at Maintenance Level 2, and 21.3 miles at Maintenance Level 1 (closed road). All Forest Service roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA Roads database). Road 3500 (Table Mountain) is the main access to and within the Table Mountain area. Roads within the analysis area that access localized areas include 3507 (Pole Patch), 3517 (Wilson Creek), and 9712 (Liberty Beehive).

An undetermined number of miles of unclassified roads are managed as seasonally closed by the Table Mountain Area Closure, which is in effect between October 15 and June 15. Although access is restricted with this area closure, a thorough road inventory and road specific management objectives should be completed at sub-watershed scale.

For the purpose of motor touring, all maintenance level 3, 4, and 5 roads (49.9 miles) will accept vehicles designed to transport the physically challenged. The largest visitor group for roaded recreation consists of users traveling by passenger car or pickup trucks.

A. Human Use

A1. Public Use

It is not known when human use of this area first began, but early habitation in what is known today as Kittitas County dates back to around 4600 B.C. Native Americans may have grazed horses and set fires to improve forage in parts of this watershed. By the mid-1800s settlers began to arrive. Among the documented uses were grazing, mining, timber harvest, road and trail construction, homesteading, trapping, irrigating, and construction of numerous cabins. Logging was probably the most significant activity in terms of developing access and opening the way for other activities to follow. Logging began in the late 1880s when power poles were harvested. Then in the 1930s logging began. The most active harvesting occurred between 1956 and 1993. Since that time, harvest activities have continued at a reduced rate. Livestock grazing is permitted on one allotment in the watershed.

This area is rather unique; it ranges from the high plateau on Table Mountain to the desert shrub steppe on the east slopes. The area is accessible from several directions, though it does not have a major travel route passing through it like many watersheds do. There are only two campgrounds: Lion Rock and Wilcox Horse camp. On the other hand, there are many dispersed camping opportunities. Dispersed use is spread widely throughout the watershed. Traditionally it was mostly during the fall hunting season, but more people are dry camping to avoid the crowds in other locations, and this area offers many locations that are both scenic and less crowded. There are approximately 8.5 miles of 4x4 route and 45.7 miles of single tread trail

(44.5 miles area open to motorized). There are approximately 32 miles of groomed snowmobile trail and about 5 miles of cross-country ski trail for winter use. In both summer and winter visitors take advantage of the gentle terrain to travel cross-country, or use old travel ways that take them far beyond the existing road and trail network.

Driving for pleasure is again the most prevalent activity. 4x4s, ORVs, snowmobiles, horses, bicycles, skiers, and hikers use the trails. There are 40 miles of single tread motorized, 4.47 miles of single tread non-motorized, and 7 miles of dual tread motorized trail. This area is known statewide as a destination for non-wilderness horse riding. Hunting is very popular, primarily for elk and deer, but for other game animals and birds as well. There are some fishing opportunities. Wildlife viewing is also very popular. There are 32 miles of snowmobile trail and 6 miles of cross-country ski trail in the Naneum area.

A2. Resource Management

The typical vegetation zones found within this watershed are shrub-steppe, ponderosa pine, Douglas-fir, grand fir, subalpine fir, and alpine meadows/parklands.

Grazing influenced vegetation composition, as has fire suppression, insects, disease, and harvesting activities.

Forty-one percent of the acres found in this watershed are in the subalpine fir series. This high elevation forest has experienced the least significant changes of any east side type. Fire exclusion in this forest has had little effect because of the long fire return intervals.

Moist grand fir series makes up 4% of this watershed. It is normally intermingled with the dry series. Fire exclusion has altered this forest type somewhat due to its normal moderate fire return interval.

The dry series is found in 29% of the watershed. The current plant composition reflects grazing history. Understory tree growth is encouraged by fire exclusion through suppression actions. The higher rate of grand fir in these stands is a product of fire suppression. Mistletoe is more prevalent in this series with fire exclusion. The number of trees per acre would likely be less historically than currently. Fuel loadings have increased over time as a result of suppression. Management has changed the landscape patterns more than species composition.

Upland meadow makes up about 6% of the watershed. Vegetation varies widely due to climatic variables. The acreage producing forage is shrinking quickly as the associated plant communities re-occupy the sites.

Wet meadows make up less than 1% of the moist sites. Grazing has altered the plant composition and productivity of nearly all the sites.

Grasslands make up 12% of the watershed. It is made up of bunch grass and sage brush community, typified as arid to semi-arid with low precipitation, warm to hot dry summers and cold winters. Grazing and fire suppression have caused an increase in shrubs and a decrease in grasses.

Non-forested areas make up 7% of the watershed.

Noxious weeds are found mainly along roadways, in plantations, and other areas of disturbance.

B. Aquatics

The headwaters of Naneum Creek are on Table Mountain. The watershed drains in a southerly direction entering the Yakima River near the city of Ellensburg. Grazing, timber harvest, road construction and agriculture, including irrigation, have affected the watershed and aquatic habitat. The stream no longer flows directly into the Yakima River. When Interstate Highway 82 was constructed in the early 1970s the creek was diverted into Fiorito Pond. Numerous irrigation ditches have existed on lower Naneum Creek, below the National Forest boundary, since early settlement times. Sub-watersheds within the Naneum watershed are Upper Naneum and Lower Naneum.

Included in this roads assessment are several small tributaries to the Yakima River, which have not been included in previous discussions. These include Reecer Canyon and Green Canyon, which are in the Yakima Tributaries sub-watersheds.

Because there are no Threatened or Endangered fish in the Naneum Watershed, an environmental baseline has not been established through the consultation process. Watershed scores and risk ratings are interpreted from information contained in "Table Mountain Watershed Analysis," September 25, 1995, updated with new information where available.

B1. Geologic Hazard (Score 2)

The Naneum Watershed is within the Cascades Mountains, Non-Glaciated Subsection (Davis et al 1994). These mountains are composed of very thick basalt flows predominately of the Grande Ronde and related units of the Columbia River Basalt Group. Inter-beds of weakly cemented sedimentary and pyroclastic deposits of the Ellensburg formation are common between basalt flows. Several geomorphic processes have been functioning to create a variety of landforms. The primary geomorphic processes that have influenced landscape development include fluvial erosion and mass wasting. The dominant landforms within the watershed are gently rolling plateaus and deep-seated landslides.

Approximately 11,726 acres of large and small deep-seated landslides occur in the Naneum Watershed. Most of these deep-seated landslides are due to the interbedded nature of the bedrock. Often along the inter-beds or contact between differing bedrock, plains of weakness have accounted for slope failures. Most of these landslides occur along the margins of basalt flows that form Table Mountain.

These deep-seated landslides occasionally slide into streams, delivering sediment directing into stream systems and causing stream confinement and stream scour of adjoining channel banks. Once landslide toe slopes are within the channel, streams can undermine the toe, creating unstable slope conditions and triggering additional failures into the channel perpetuating the process. During this stream adjustment, accelerated levels of sediment are being routed and

delivered due to the initial landslide.

The gently rolling plateaus of Table Mountain are weakly dissected with low gradient stream systems. Due to the slope gradients and amount of stream dissection, these plateau landforms are not significant sources of sediment delivery.

Sediment delivery from the deep-seated landslides is responsible for contributing fine sediment input. Roads can accelerate the natural rate of sediment delivery by:

1. Reducing slope strength triggering additional slope failures.
2. Channelizing or concentrating runoff.
3. Maintaining road facilities following landslide or flooding events.
4. Causing confinement of channels forcing streams to erode channels and banks.

Table 8. Naneum Watershed total miles of road within naturally high sediment sources

Large deep-seated landslides	25.0
Small deep-seated landslides	9.8
Landforms prone to shallow landslides (debris flows)	--
Structural landforms with some shallow landslides	8.0
Valley bottom main stem stream channels	.21

B2. Road-Related Fine Sediment (Score 6)

No quantitative fine sediment data is available for the Naneum. Stream surveys on Howard, High, Wilson and West Fork Naneum Creeks recorded high levels of embeddedness. Grazing, past timber harvest, and roads and trails are believed to be contributing to accelerated fine sediment delivery to streams. Poor drainage has been observed and cited as a sediment source to streams. Naneum Creek should be considered at a minimum to be functioning at risk for road related fine sediment and roads are a sediment source; therefore, the score is 6.

B3. Flood Plain Function, Off-Channel Habitat, Riparian Reserves (Score 3)

Stream channel morphology (including Flood Plain function, Off-Channel Habitat, and Riparian Reserves) are believed to be adversely impacted by grazing, past timber harvest, roads, and dispersed recreation. The watershed has been grazed heavily since the turn-of-the century. Current grazing by both domestic cattle and elk may be retarding recovery. Past riparian timber harvest has removed wood and reduced potential woody debris recruitment to channels. Some channels are exhibiting accelerated down cutting and flood plain abandonment. There are 110

road-stream crossings and approximately 19 miles of road within riparian reserve. Most of the road-associated impacts to stream channels are due to sediment delivery and intercepting ground and surface runoff. Dispersed recreation may also be impacting riparian and stream habitat but the extent of the effects is not known. While problems with flood plain function, off-channel habitat and Riparian Reserves exist, they are localized; therefore, the habitat elements are rated at-risk. Past and current grazing, including trespass grazing are the biggest problems.

B4. Flow Effects-Score 6

Road density and location are functioning at risk in the Naneum Watershed as the road densities in the sub-watersheds range between 1.17 and 2.15 miles/sq.mi. The Yakima tributary sub-watershed is functioning at unacceptable risk with road densities of 4.5 miles/sq.mi. in Reecer Canyon and 3.23 miles/sq.mi. in Green Canyon.

Change in Peak/Base Flows is functioning at risk. Several road systems in the watershed have been observed to have a significant affect on shallow aquifer flow during spring and early summer. Roads are capturing subsurface flow, collecting the flow in ditches, and transporting the concentrated flow to culvert outlets. In some locations the flow is consolidated for over 1,000 feet. Specific locations where this situation has been observed are roads 3521000, 3521644, 3521646, and associated spur roads.

B5. At-Risk Fish Populations (Score 0)

Interstate Highway 82 and numerous irrigation diversions block anadromous fish access into the Naneum Watershed. It is not known if bull trout ever inhabited the watershed, but they are not currently present. Neither steelhead nor bull trout are found in Reecer or Green Canyons. Cutthroat trout are the most widely distributed salmonid.

C. Wildlife

The Naneum Watershed covers a relatively small area and the habitat is in poor condition. The Naneum Watershed is a site of high human use, throughout the year. There is potential for improvement within the watershed, especially with regard to important ungulate areas.

C1. Wide-Ranging Carnivores

The open road density in the Naneum Watershed is high at 2.4 mi/mi^2. Only 8.3% of the watershed is core habitat, for a total of 4,334 acres. A large portion of the Table Mountain LAU falls within the Naneum Watershed. There are 122.8 miles of open road within this part of the LAU, resulting in a high road density of 2.1 mi/mi^2. For a description of this LAU in its entirety, see Appendix C.

C2. Late-Successional Associated Wildlife Species

A portion of the Swauk LSR is found within the Naneum Watershed. The LSR covers approximately 19,558 acres (37.3%) of the watershed. The rating for security habitat and habitat effectiveness are both low.

C3. Riparian Dependent Wildlife Species

Riparian Reserves are limited and occupy only 4,861 acres (9.3%) of the Naneum Watershed. The open road density within the Riparian Reserves is high, 2.6 mi/mi^2.

C4. Ungulates

The Naneum Watershed contains the greatest amount of mapped winter range within the Upper Yakima Sub-Basin. There are 5,249 acres (10.0%) of winter range with a moderate open road density of 1.8 mi/mi^2.

C5. Unique Habitats

Unique habitats are fairly diverse and abundant in the Naneum Watershed, covering 12,056 acres (23.0%).

Table 9. Availability of unique habitats in the Naneum Watershed

Unique habitat	Acres	% of watershed
Bedrock	5	0.01
Cliff	101	0.2
Grass/Shrub	5,582	10.6
Hardwood	68	0.1
Meadow	2,794	5.3
Talus/Scree	3,109	5.9
Treed Talus	130	0.2
Wet Meadow	266	0.5

Upper Yakima Watershed

The Upper Yakima Watershed is made up of the Box Canyon drainage area and the Upper Yakima drainage area. Each area is discussed separately. Though it was unroaded until the mid-1950s, Box Canyon has long been a favorite destination for backcountry visitors. Box Canyon Creek from Kachess Lake to the upper falls was popular for fishermen. Road construction in the Box Canyon Creek Watershed began in the mid-1950s. The high-country lakes, namely Rachel and Lila, were also popular backcountry destinations for hikers.

There are approximately 12.6 miles of road within the Box Canyon portion of the Upper Yakima Watershed. The road network is used mainly for recreation access, timber harvest, and post-harvest stand maintenance. Of the 12.6 miles of road, 3.6 are maintained for passenger car use, 7.0 miles are maintained for high clearance vehicle use, and 2.0 miles are maintained as a closed facility. All Forest Service roads in the watershed are inventoried Forest Transportation Management System (INFRA Roads database). Road 4930 (Box Canyon) is the main access to the Box Canyon drainage area. It is aggregate surfaced for the first 3.1 miles, accepts all classes of vehicles and provides access for all multiple use traffic in the watershed. Rachel Lake trailhead is accessed from road 4930. Other roads within the watershed such as road 4930118 and road 4930127 access localized areas for dispersed camping activities.

The heavy recreation use on road 4930 to Rachel Lake trailhead is a concern. Due to the recurrent natural impacts such as flood and ice from Box Canyon Creek, aggregate surfacing

should be considered from the junction of road 4930118 to Rachel Lake trailhead (0.8 miles). Another option is to relocate the Rachel Lake trailhead to the junction with road 4930118 and convert the road system beyond that point to a trail to connect the new trailhead to the existing Rachel Lake trail.

The Upper Yakima River Basin was first accessed by road in the late 1800s and early 1900s. The first wagons crossed Snoqualmie Pass in 1865, but this route did not become a permanent wagon trail until 1899. The first automobiles crossed Snoqualmie Pass in 1905. This route did not become a year-round travel route until the winter of 1931-1932. Construction began on the first four-lane section in 1954 and Interstate 90, as we know it today, was completed in the late 1960s.

The Forest Service road system began to develop in the 1930s and 1940s with the construction of access roads to South Cle Elum Ridge (CCC), Stampede Pass, and recreation sites at Kachess and Keechelus Lakes. Major road construction for timber harvest activities began in the 1950s. Currently there are approximately 856 miles of road within the Upper Yakima Watershed. There are approximately 436 miles of Forest Service system roads, 37 miles of interstate, and 30.2 miles of county road. The remaining roads belong to a variety of private landowners, including Plum Creek Timber Company.

Of the 436 miles of Forest Service roads, the majority of this mileage was constructed in the 1960s (151.4 mi.), 1970s (64.0 mi.), and 1980s (49.4 mi.). The road network is used mainly for recreation access, timber harvest, post-harvest stand maintenance, and public access to private lands within the Forest. The 135.9 miles of Forest Service roads are maintained for passenger car use, 220.2 miles are maintained for high clearance vehicle use and 80.4 miles are maintained as a closed facility. All Forest Service roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA Roads database).

Main access for travel in the Yakima Drainage is provided by Interstate 90, the County Road System and Forest Service Roads 54 (Stampede Pass), 49 (Kachess), and 41 (Cabin Creek). Interstate 90 and the County Road System are public roads that are open and maintained year round.

Roads within the watershed accessing localized areas include: road 3350 (South Cle Elum Ridge), 4110 (Log Creek), 4600 (Cooper), 4818 (East Kachess), 4832 (Keechelus Frontage), 4934 (Keechelus Ridge), 4936 (Thetis Creek), 4948 (Gale Creek), 5480 (Yakima Pass), and 5483 (Meadow Creek). These roads are maintained for passenger car use. For the purpose of motor touring, all maintenance level 3, 4, and 5 roads (131.4 mi.) will accept vehicles designed to transport the physically challenged.

On the Forest Road System, the largest visitor group is users traveling by passenger car or pickup truck. The road system also provides access for logging trucks and heavy equipment for timber harvest on Forest Service land and private lands within the forest.

High road density is an issue because some regions within the watershed have been identified with high road densities, such the following Fish Productivity Units (FPUs): Upper Yakima, Keechelus, Cabin Creek, and Gale-Thetis. Road Management Objectives should consider

obliteration, gating, or other restrictions on some of the local roads in the future to reduce road densities. Also, the following FPUs have a high risk of road-related sediment problems: Kachess, Gold Creek, Big Creek, Box Canyon, and Gale-Thetis. There is a need to improve road drainage patterns on open roads with the addition of more ditch relief pipes. Road obliteration and removal of drainage structures should be considered for some closed facilities. Most of the earlier-era logging roads have successfully rehabilitated themselves. However, maintaining high road densities may have long-term impacts.

A. Human Use

A1. Public Use

The first major trails date back to fur trading during the 1870s. The first wagon trails appeared in the late 1800s, and most of the current transportation system was developed for logging between the 1940s and about 1990. Livestock and grazing were introduced around 1840. Clearing started around 1909 for irrigation impoundments at Lake Kachess and later at Lake Keechelus. In 1886, the Northern Pacific Railroad completed its route over Stampede Pass. These activities opened the area up to access and a variety of other human uses. Today Interstate 90 bisects the valley and provides access for thousands of people to and through the valley.

Roads on the National Forest still provide access for many uses. Commodity production such as mining, grazing, and timber production has declined significantly from earlier levels, while leisure activities and outdoor recreation activities have increased dramatically. Other uses have remained relatively stable, or increased at a slower rate. These would include communication sites, the Bureau of Reclamation irrigation project and the various utilities. Much of the drainage remains in mixed ownership, which makes it critical to provide access to private parcels as well as to provide for fire protection and weed treatment. Use of this area for outdoor recreation has grown steadily. This is primarily a function of population growth in western Washington and access provided by I-90. Plantations are reaching the age where silvicultural treatments may be needed to create stand diversity for wildlife, or to improve stand vigor.

Legal obligations will continue when private lands are involved and when easements and Rights of Way exist to serve utility corridors, electronic sites, dams, and similar uses. Forest management and protection needs, such as fire protection, silvicultural treatment, special forest products, timber harvest, and weed treatment, will continue the need for access. Public use of the Forest for leisure activities will put the greatest pressures on the agency when decisions are made regarding which roads to improve and which to reduce or eliminate. This area is recognized as a critical connective link for wildlife, which increases the importance of determining the proper road system to serve human uses and meet resource needs.

There is a great deal of recreation in this watershed. The popular Kachess and Crystal Springs campgrounds are located here. Five sno-parks serve both snowmobilers and cross-country skiers. The Snoqualmie summit area has downhill skiing, cross-country skiing, mountain bike trails, and boating-related activities. Kachess campground is the largest on the Forest. Crystal Springs sno-park is the most heavily used in Washington. There are 88 miles of single tread motorized trail, and 88 miles of dual tread motorized trail. There are also 70 miles of single tread non-motorized trail and 16 miles of cross-country ski trail in this drainage.

A2. Resource Management

The Cascade mountain range is an important landform that produces an orographic rain shadow directly affecting the vegetation type and composition. Maritime influences provide the temperature and moisture required by the individual plant communities unique to this watershed. Moving east from this temperate zone, the amount of precipitation is reduced. Consequently, the plant communities on the eastern landscape are different than those near the crest.

The wet vegetation series comprises 63% of the watershed. The plant associations found in this series are western and mountain hemlock and Pacific silver fir. The plant series and association in this group have similar fire regimes and vegetation patterns.

Eleven percent of the watershed is in the moist grand fir vegetation patterns. Grand fir favors the moderate environmental regime where neither moisture nor temperature conditions are extreme. This series is usually found between the cooler wet series and the grand fir series.

Six percent of the watershed is in the mesic Douglas-fir series. Douglas-fir is the climax species, and is the dominant or co-dominant species in the stand. The mesic series differs from the dry series in having lower temperatures, higher precipitation and soil moisture conditions.

Two percent of the watershed is in the dry series. The series includes ponderosa pine, Douglas-fir and dry grand fir plant associations. This is found in the far eastern boundaries.

One percent of the watershed comprises the subalpine fir series. This series ranges from 4900 feet to the upper timberline. It is the coolest and most moist series.

Seventeen percent of the watershed is non-forest. It includes agricultural lands, water, cliffs, bedrock, talus, scree, upland meadow, wet meadow, brush field, grasslands, and I-90.

Both noxious weeds and aggressive invaders have been found along roadways, in plantations, and within other areas of disturbance.

Past vegetation manipulation has increased the number of overstocked saplings and poles.

The natural fire regime is infrequent to more frequent as one moves west to east and north to south along the eastern fringes. High intensity stand replacement fire is the norm to the west and because of fire suppression the potential for stand-replacing events has increased along the eastern fringes.

B. Aquatics

The primary focus of this assessment is the Upper Yakima watershed as the Lower Yakima watershed encompasses primarily private lands. The Yakima watershed consists of one major river (Yakima River) and several major streams. The major streams include Kachess River, Gold Creek, Meadow Creek, Cabin Creek, Box Canyon Creek, Gale Creek, Mineral Creek, Big Creek, and Little Creek. The watershed also includes two major storage reservoirs. Kachess and Keechelus lakes are natural lakes with dams constructed in the early 1900s to increase their

storage capacity and to regulate flows for irrigation. Lake Easton contains a diversion dam for the Kittitas County irrigation canals. Passage for migratory fish is provided around Easton dam but Kachess and Keechelus block migratory fish access and have isolated fish populations above the lakes. The watershed supports a large and diverse number of salmonids and non-salmonids.

At the time the environmental baseline was established, future harvest activities including road construction by Plum Creek Timber Company (PCTC) as covered under their Cascade Habitat Conservation Plan (HCP) FEIS, March 1996, was included. This baseline assumed that all harvestable lands owned by PCTC within the watershed had been harvested and are in an immature stand condition. A total of 65,965 acres of lands are under PCTC ownership in the Yakima watershed, of which 51,955 acres can be considered harvestable. Since that time, a few thousand acres of these lands have been exchanged to the Forest Service.

Existing habitat conditions were obtained from the most recent environmental baseline established in the "Yakima Watershed Steelhead, Bull Trout, Westslope Cutthroat Trout Watershed Biological Assessment," (USDA FS 1999c). When available, new information from monitoring was also used.

B1. Geologic Hazard (Score 6)

The Yakima Watershed is within the Upper Yakima Basin Subsection (USDA FS 1994b). The Upper Yakima Basin is composed predominately of pyroclastic, sedimentary, and metamorphic rock units. The metamorphic rocks occur in the northern tip of the watershed and include phyllite, schist, and serpentinite. The pryoclastic and sedimentary rocks occur in the southern part of the watershed and include volcanic flows, breccia and tuff interbedded with volcanic sandstones, siltstones, shales, and conglomerates. Some increase in rock hardness of pyroclasitic and sedimentary units due to the heat from intrusions of the Snoqualmie batholith. The primary geomorphic process is alpine glaciation, which carved out and over steepened stream valleys over much of the watershed north of I-90. South of I-90 the relief is more subdued. The major landforms in the northern portion of the watershed are glacial troughs and trough valleys with glacial-fluvial reworking of morainic deposits in the lower portions of the watershed creating outwash terraces and plains.

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. These landslides often occur at the interface between glacial till and scour rock. Debris flows normally run out into the valley floor producing debris fans or alluvial fans on the lower slopes of the glacial troughs. Such fans or glacial till deposits on lower trough walls create benches or lower slope gradients that confine main stem stream systems. How these surficial deposits affect stream morphology and sediment routing will be discussed below. Another major source of sedimentation is stream scour of channels and banks in the down stream segments of main stem reaches

The glacial trough landforms total 50,220 acres within the Yakima 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 in the valley floor. As these fans coalesce, they cause stream confinement and streams become bounded by alluvial 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 lower fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured.

A few deep-seated landslides are localized primarily in the southern part of the Yakima Watershed. These landslides were stratified during the watershed analysis procedures. Approximately 3,252 acres of small isolated deep-seated landslides occur in Cabin Creek, and upper tributaries of Little Creek. These deep-seated landslides occasionally slide into the valley floor stream, delivering sediment directly into stream systems and causing stream confinement and stream scour of adjoining channel banks. Once landslide toe slopes are within the channel, streams can undermine the toe creating unstable slope conditions and triggering additional failures into the channel perpetuating the process. During this stream adjustment, accelerated levels of sediment are being routed and delivered due to the initial landslide.

Glacial-fluvial deposits totaling 6,767 acres have widened the lower valley segments of main stem reaches. Stream down cutting has elevated most of these deposits creating a number of terraces that are not currently in the active flood plain. At the present time, stream migration is a significant source of sediment delivery in the lower segments of Yakima Watershed. This form of sediment delivery is common during storm events, spring runoff, and if channels have been artificially confined.

Table 10. Upper Yakima Watershed total miles roads within naturally high sediment source

Large deep-seated landslides	--
Small deep-seated landslides	13.3
Landforms prone to shallow rapid landslides (debris flows)	210.7
Valley bottom main stem stream channels	53.6

All of these forms of sediment delivery are responsible for contributing a naturally high level of coarse sediment input. However, roads can accelerate the natural rate of fine sediment delivery by:

1. Having drainage facilities (culverts) plugged causing streams to wash out road prisms. Inadequate drainage facilities on alluvial fans not being able to deal with streams diverting to new channels causing road washouts.
2. Road cuts intersect subsurface groundwater from glacial till deposits which channelized in road side ditches causing ditch erosion and cut bank sloughing.

3. Upper to mid slope roads located at glacial till scoured rock interface triggering debris flows.
4. Roads within the active flood plain of stream reaches that tend to naturally migrate in response to high flows.

B2. Road-Related Fine Sediment (Score 6)

Fine sediment sampling in streambeds, conducted from 1991 through 1994 indicates that in the following streams fine sediment levels were greater that 15 % by volume: Cole, Gold, Cabin, Little, and Big Creeks. These streams are functioning at risk for species of concern. Because no other information is available, the watershed is considered to be functioning at risk. Roads are believed to be a major source of accelerated sediment delivery and the road system was considered to be inconsistent with the Aquatic Conservation Strategy.

B3. Flood Plain Function, Off-Channel Habitat and Riparian Reserves (Score 10)

Flood Plain Connectivity and Off-Channel Habitat are considered to be functioning at risk, while Riparian Reserves are functioning at unacceptable risk. Roads and developments along the Main Stem Yakima River and along portions of tributaries have reduced the connectivity of flood plains and wetlands resulting in a functioning at risk rating for flood plain connectivity and off channel habitat. The reach of the Yakima River between Lakes Easton and Keechelus has abundant side channel habitat and may be an important habitat refugia.

Riparian Reserves are functioning at unacceptable risk due to roads within Riparian Reserves, past riparian timber harvest, and 21 miles of power line within Riparian Reserves. Riparian habitat was also altered with construction of Easton, Kachess and Keechelus reservoirs. At the time the environmental baseline was established, 44 % of the Riparian Reserves in the watershed were managed by the Forest Service and 56 % by private and state landowners. Dispersed recreation is generally consistent with the Aquatic Conservation Strategy but monitoring and maintenance of the Box Canyon restoration project needs to continue.

B4. Flow Effects (Score 9)

Construction of Kachess and Keechelus dams and subsequent flow regulation has had the greatest influence on flow in the Yakima River. Change in peak/base flows are considered to be functioning at unacceptable risk due to the flow regulation and watershed conditions. Eight of 21 sub-watersheds in the Yakima watershed are exhibiting a combination of factors (such as hydrologic immaturity in rain-on-snow zones, soil disturbance, etc.) that increase the likelihood that both indirect and cumulative effects (flooding and reduced low flows) to the hydrologic regime may be occurring. Some alteration of peak flow magnitude and timing is evident.

There are almost 900 miles of existing roads in the watershed and a road density of 3.6 mi/mi^2. Based on these numbers, it is assumed that the high road density and stream crossings have increased the drainage network significantly. Road density is functioning at unacceptable risk. The following sub-watersheds are of particular concern: Cabin, Keechelus, Lower Yakima, and Upper Yakima with road densities greater than 2.0 mi/mi^2. Cabin Creek stream channel is showing signs of a possible increase in peak flow due to timber harvest and roading. Big,

Kachess, and Little Sub-Watersheds are functioning at risk with road densities of between 1.0 and 2.4 mi/mi^2. Silver Sub-Watershed is functioning appropriately with a road density of less than 1.0 mi/mi^2.

B5. At-Risk Fish Populations (Score 6)

Steelhead are believed to be present in the Main Stem Yakima River up to Keechelus dam. The steelhead population in the sub-basin is very depressed. While not an at-risk species, spring Chinook are an important management emphasis species. The Lower Yakima, Upper Yakima and Cabin sub-watersheds are significant for spring chinook.

The Kachess and Keechelus Lake Sub-Watersheds are considered significant for bull trout as the lakes provide adult habitat for the migratory populations above the dams. Gold Sub-Watershed is considered significant for bull trout as the sub-watershed provides the only habitat currently used for spawning and rearing by the Keechelus population. Box Canyon Creek is considered significant for bull trout because until 2000 the stream was believed to be the only stream used by the migratory population in Kachess Lake. Migratory bull trout were observed spawning in the Kachess River–Mineral Creek area above the Lake (Anderson 2000), so the Mineral Sub-watershed is now considered significant. The Upper Yakima Sub-Watershed is also considered significant for bull trout for spawning, although the numbers of redds they observed in the Yakima River between Easton and Keechelus lakes, was low (Anderson 2001). This is the only known spawning area for bull trout in the Yakima River.

The Yakima Watershed is scored 6 for at-risk fish. Although dams have fragmented habitat, sub-watersheds provide important habitat for isolated populations. The Upper Yakima above Easton dam has good habitat conditions that provide potential refugia for bull trout and spring chinook salmon, especially if more “fish-friendly” flows can be established. Also of note, the Big and Silver Sub-Watersheds are considered significant for westslope cutthroat trout.

C. Wildlife

The Yakima Watershed is a very large watershed that provides access to wilderness and multiple use lands. This watershed experiences high-level human use year round. The potential for improvement and restoration is high.

C1. Wide-Ranging Carnivores

The open road density in the Yakima Watershed is high, at 2.77 mi/mi^2. A small proportion of the watershed is core habitat, consisting of approximately 26,037 acres (13.1%). Numerous Lynx Analysis Units are located in the Yakima Watershed, including: Cascade Crest, Keechelus Ridge, Mount Clifty, Silver, and Taneum Ridge. The following table describes the road densities of those portions within the Yakima Watershed. For a description of each LAU in its entirety, see Appendix C.

Table 11. Road density of Lynx Analysis Units within the Upper Yakima Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Cascade Crest	282.5	72.7	3.89
Keechelus Ridge	205.2	77.6	2.64
Mt. Clifty	24.8	23.8	1.04
Silver	46.3	31.7	1.46
Taneum Ridge	31.6	8.9	3.53

Mean Road Density = 2.51 mi/mi^2

C2. Late-Successional Associated Wildlife Species

A large portion of the Manastash Ridge LSR is located within the Yakima Watershed. This portion covers approximately 27,230 acres (13.7%). The security habitat and habitat effectiveness ratings are low.

C3. Riparian Dependent Wildlife Species

Riparian Reserves occupy approximately 38,228 acres (19.3%) of the Yakima Watershed. The open road density within the Riparian Reserves is high, 2.7 mi/mi^2.

C4. Ungulates

The Yakima Watershed provides a small amount of mapped ungulate winter range habitat. This watershed contains 298 acres (0.2%) of mapped winter range that does not contain roads. Certain areas may be important to mountain goats for summer or winter, or both, range and kidding.

C5. Unique Habitats

Unique habitats display a moderate level of diversity and abundance in the Yakima Watershed, covering 15,849 acres (8.0%).

Table 12. Availability of unique habitats in the Upper Yakima Watershed

Unique habitat	Acres	% of watershed
Avalanche Chute	5	0.01
Bedrock	3,937	2.0
Brushfield	2,832	1.4
Cliff	1,200	0.6
Grass/Shrub	346	0.2
Hardwood	37	0.02
Landslide	20	0.01
Meadow	1,760	0.9
Riparian Forest	1,908	1.0
Scour	315	0.2
Talus/Scree	2,467	1.2
Treed Talus	1	<0.01
Wet Meadow	1,019	0.5

Cle Elum Watershed

The Cle Elum Valley was first accessed by road in the late 1800s and early 1900s. Early road construction up the Cle Elum Valley to Fish Lake and Fortune Creek to Van Epps Pass was for mineral extraction. Major road construction for timber harvest activities began in the 1960s.

There are approximately 198.6 miles of Forest Service roads within the watershed. The road network is currently used for recreation access, public access to private lands within the forest, timber harvest, and post harvest stand maintenance.

Of the 198.6 miles of Forest Service System Roads within the watershed, 60.9 miles are maintained for passenger car use, Maintenance Levels 3, 4 and 5; 96.8 miles for high clearance vehicle use, Maintenance Level 2; and 40.9 miles as closed roads, Maintenance Level 1. All Forest Service roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA Roads Database). Of the 61 miles of level 3-5 roads, 22% are asphalt surfaced and the remainder is surfaced with crushed aggregate.

State Route 903, Salmon La Sac road, and Forest Service roads 4330 and 4600 provide the main access to the Cle Elum Valley. Roads within the watershed accessing localized areas include roads 4305 (Corral Creek), 4308 (French Cabin Creek), 4315 (Little Salmon La Sac), and 4613 (Stave Creek).

As previously mentioned, 40.9 miles of Forest Service roads in the watershed are managed as closed roads. Of this total, permanent gates close 20.7 miles and earthen barricades close the remaining 20.2 miles.

There are 12.7 miles of 4x4 trails in this watershed. They are located in the Fortune Creek and Camp Creek areas of the Upper Cle Elum drainage.

In addition to Forest Service System roads, there are an additional 69 miles of public and private roads.

A. Human Use

A1. Public Use

The Cle Elum valley was known to be an important area long ago because of the rich supply of salmon in the streams and because it was one of few valleys where both camas and kouse (bread root) was found. The south end of Lake Cle Elum was the site of a summer camp where salmon was processed. The first non-indigenous peoples in this area were fur trappers. Settlers are thought to have started arriving by the late 1800s.

In approximately 1909 the Bureau of Reclamation started clearing for the dam at Lake Cle Elum.

It is not known exactly when this valley was first used for grazing. Records suggest that sheep were being introduced around the 1870s. The Cle Elum grazing district eventually became one of the largest, with 14,400 sheep thought to have been in the drainage.

The entire watershed is used for recreation in one form or another. Developed and dispersed camping are the dominant activities in the lower and mid elevations of the basin. Trailheads and access points are located here, as well. The mid-elevation trails provide day trip opportunities, while the high elevation routes provide more isolated backcountry opportunities. There are also opportunities for mountain bike, motorbike, and limited jeep use in the non-wilderness areas of this watershed. In the winter, snowmobiling and cross-country skiing are popular throughout the lower and mid-elevation zones. Snowshoeing, and, to a lesser extent, dog sledding are also pursued as winter activities.

Although camping and trail activities dominate the recreation use here, many other activities are pursued in conjunction with camping, or as separate forms of recreation. Some of the more popular activities include berry picking, mushroom picking, bird watching, fishing, boating, swimming, picnicking, hunting, jet skiing, exploring, gold panning, and photography.

Today the need for access to private ownerships is becoming more complex with the sale and development of small lots. Legal obligations for access in the form of Rights-of-Way and easements exist throughout this watershed. Private ownership occurs throughout the watershed. Private land is being developed for homes and there is still substantial acreage in industrial timber management. The level of commercial harvest has declined on both public and private forestlands, but the road access that was developed for timber harvest has made the area very appealing for the outdoor recreation boom that followed.

There are also special use permits for public utilities and snow monitoring stations and other uses. Forest management and protection needs also continue. They include timber harvest, silvicultural treatment of plantations and second growth stands, access needs for fire suppression, weed management, and recreation facilities.

Currently most of the human use and the most significant impacts are from recreation and recreation related activities that take place in the Cle Elum valley. Roads, trails and campgrounds are used throughout the year. People seek access to all parts of the watershed in the summer months. During the winter season the heaviest use is confined to the valley bottom and primary groomed snowmobile trails, though snowmobiles are now capable of taking riders to many of the backcountry areas. The entire Cle Elum watershed is used for one form of recreation or another. Developed and dispersed camping is the dominant activity in the lower and mid elevations of the basin. Trailheads and access points are located here, as well. The mid-elevation trails provide day trip opportunities for hikers and horseback riders. There are also opportunities for mountain biking, motorbike riding, and some limited opportunities for 4x4 travel in these non-wilderness areas. The wilderness provides opportunities for day trips on foot and horseback, and there are numerous places for overnight and extended trips. In some cases the road system is the mechanism for the recreation activity, such as driving for pleasure or snowmobile trails. In other cases, the road provides access to facilities such as Wilderness trailheads and the activity is conducted elsewhere. Collectively, the current level of recreation use covers nearly all of this watershed.

A2. Resource Management

Vegetation occurring within this watershed is influenced by maritime weather, snow, rock avalanches, fire, and human activities.

Fire suppression activities in the previous century have been a major contributor to the vegetative shift to later seral communities within grand fir and wet series.

Before human intervention, the southern portion of the watershed, head of Cle Elum Lake and south, was more open and park-like with a high fire frequency. Low intensity natural fires maintained this arrangement.

Human activities, harvesting in particular, have allowed grand fir to dominate the series. Past vegetation manipulation has also increased stands of overstocked poles and posts.

The upper portion of the watershed is dominated by the wet series, with the fire regime being moderate to high intensity fires with return intervals of 100-300 years.

Sixty percent of the watershed is found in the wet series. Due to length of time between disturbances, this forest has become dense, layered and built up with fuels. Most often, fires here have been high intensity stand replacement events. Grand fir moist series comprises 11%, sub alpine fir 4% and Douglas-fir 1% of this watershed. This watershed has 27 known plant associations.

Noxious weeds are present in the watershed as they occur along roadsides, in plantations, and in other areas of disturbances.

B. Aquatics

The Cle Elum River head is at Deception Pass on the Cascade Crest. The watershed has a north-south orientation flowing into the Yakima River just west of the town of Cle Elum. The Waptus and Cooper River are two major tributary drainages.

Virtually all the National Forest land within the Cle Elum Watershed drains into the Cle Elum River above the dam. The dam is a complete barrier to fish migration and buffers any potential affects to fish habitat from being transferred downstream. Since virtually all National Forest lands in the watershed are upstream of the dam; and the dam essentially prevents upstream watershed conditions from impacting habitat conditions downstream of the dam, the Cle Elum Watershed Environmental Baseline was established only for that portion above the dam. Historically, anadromous fish were found in the watershed but anadromous populations have been eliminated upstream of Cle Elum dam. The watershed is very popular for recreation.

Information in this section was taken from existing habitat conditions were obtained from the most recent environmental baseline established in the “Cle Elum Watershed Aquatic Species Environmental Baseline,” (USDA FS 1999d). When available, new information from monitoring was also used.

B1. Geologic Hazard (Score 6)

The Cle Elum Watershed is within the Upper Yakima Basin Subsection (USDA FS 1994b). The Upper Yakima Basin is composed predominately of pyroclastic, sedimentary and metamorphic rock units. The metamorphic rocks occur in the northern tip of the watershed and include phyllite, schist, and serpentinite. The pyroclastic and sedimentary rocks occur in the southern part of the watershed and include volcanic flows, breccia and tuff inter-bedded with volcanic sandstones, siltstones, shales, and conglomerates. Some increase in rock hardness of pyroclastic and sedimentary units is due to the heat from intrusions of the Snoqualmie batholith. The primary geomorphic process is alpine glaciation, which carved out and over steepened stream valleys over much of the watershed. The major landforms are glacial troughs and trough valleys with glacial-fluvial reworking of morainic deposits in the extreme southern tip of the watershed creating outwash terraces and plains.

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. These landslides often occur at the interface between glacial till and scour rock. Debris flows normally run out into the valley floor producing debris fans or alluvial fans on the lower slopes of the glacial troughs. Such fans or glacial till deposits on lower trough walls create benches or lower slope gradients that confine main stem stream systems. How these surficial deposits affect stream morphology and sediment routing will be discussed. Another major source of sedimentation is stream scour of channels and banks in the down stream segments of main stem reaches

The glacial trough landforms total 87,052 acres within the Cle Elum 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 in the valley floor. As these fans coalesce, they cause stream confinement and streams become bounded by alluvial 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 lower fan margins as streams adjust to the confinement. Most of the generated sediment from these shallow landslides (debris flows) is coarse textured.

Glacial-fluvial deposits totaling 6,270 acres have widened the lower valley segments of the main stem reaches. Stream down cutting has elevated most of these deposits creating a number of terraces that are not currently in the active flood plain. At the present time, stream migration is a significant source of sediment delivery in the lower segments of Cle Elum Watershed. This form of sediment delivery is common during storm events, spring runoff, and if channels have been artificially confined.

All of these forms of sediment delivery are responsible for contributing a naturally high level of coarse sediment input. However, roads can accelerate the natural rate of fine sediment delivery in the following ways:

> Drainage facilities (culverts) can become plugged, causing streams to wash out road prisms.

Inadequate drainage facilities on alluvial fans can be unable to handle streams diverting to new channels causing road washouts.
Road cuts intersect subsurface groundwater from glacial till deposits, which get channelized in road side ditches that cause ditch erosion and cut bank sloughing.
Upper to mid-slope roads located at glacial till scoured rock interface trigger debris flows.
Roads within the active flood plain of stream reaches tend to naturally migrate in response to high flows.

Table 13. Cle Elum Watershed total miles of road within naturally high sediment sources

Large deep-seated landslides	--
Small deep-seated landslides	10.0
Landforms prone to shallow rapid landslides (debris flows)	171.5
Valley bottom main stem stream channels	32.4

The degree of roading and vegetation manipulation in the Cle Elum Watershed raises the question whether increases of coarse instream sediment has generated downstream channel morphologic changes.

B2. Road-Related Fine Sediment (Score 3)

Percent fine sediment was measured in the Cle Elum River between the reservoir and Fortune Creek in 1991. Three reaches of the stream were sampled. Three riffle areas in each of the three reaches were sampled. Reach 1 averaged 6.7, 5.5, and 8.3 percent fines; reach 2 averaged 7.1, 8.7 and 13.5 percent fines and reach 3 averaged 7.9, 5.3, and 3.7 percent fines by volume of streambed substrate. Three riffles were also sampled in the Cooper River with 7.1, 8.7, and 13.5 percent fines recorded. During a stream survey of the Cle Elum River in summer of 1998, no concerns for sediment deposition or embeddedness were noted. Cle Elum Watershed is therefore considered to be functioning appropriately.

However, there is a concern about fine sediment in localized areas, primarily due to increasing recreational use in Riparian Reserves and roads. Areas of concern are along the Main Stem Cle Elum River, particularly on tributary alluvial fans, Fortune Creek, and the Cooper River below Pete Lake and Cooper Lake. There is also a concern for accelerated sediment delivery in Silver Creek. The concern in Fortune Creek and in Silver Creek is more for accelerated delivery of coarse sediment to the Cle Elum River. Timber harvest and roading are the reasons for concern in Silver Creek. This section was recently acquired in the land exchange with Plum Creek Timber Company. The existing roads in this drainage remain a concern. However, concerns for additional roading and timber harvest are no longer an issue at this time. Although the watershed is functioning appropriately, the watershed is scored a 3 due to the localized concerns for sediment and the road system which is a concern.

B3. Flood Plain Function, Off-channel Habitat and Riparian Reserves (Score 9)

Flood Plain connectivity, Off-channel Habitat and Riparian Reserves are all functioning at risk. Flood plains are intact throughout the watershed but this element is considered to be functioning at risk as dispersed camping in the lower reaches of the Cle Elum River and ORV use in lower Fortune Creek have resulted in extensive soil compaction with potential loss of water storage; loss of wetlands and side channels; loss of wood and vegetation within the flood plain. The ability of the flood plain to dissipate flood flows may be compromised due to isolation of the flood plain and loss of wood and vegetation.

Available side channel habitat in Reach 1 of the Cle Elum River has been impacted by past timber harvest and active dispersed recreation. These activities have led to soil compaction and associated loss of groundwater upwelling, a loss of large conifers in riparian areas, and stream bank instability. This loss of side channel habitat may also contribute to increased water temperatures in side channel areas decreasing available cold-water refugia and increased sedimentation in the side channels. Recreation impacts also contribute to functioning at risk rating for Riparian Reserves. Restoration and education through the Respect the River program is moving towards reducing the impacts due to recreation.

B4. Flow Effects (Score 6)

Overall, the watershed is considered to be functioning at risk for road density and location with high road densities in the lower portions of the watershed and low road densities in the upper watershed. Middle Cle Elum River, Lower Cooper River and Thorp/French Cabin sub-watersheds are functioning at an unacceptable risk with road densities greater than 2.4 miles per square mile. Cle Elum Lake, Upper-Mid Cle Elum River and the Upper Cle Elum River sub-watersheds are functioning at risk with road densities between 1.0 and 2.4 miles per square mile. The remainder of the watershed is functioning appropriately with less than 1.0 mile per square mile of roads in their watersheds.

The watershed is considered to be functioning at risk for Peak/Base flow. Part of the reason for the at-risk rating is past timber harvest and roading in the Cle Elum Lake, Thorp/French Cabin, and Lower Cooper Subwatersheds. These sub-watersheds along with Middle Cle Elum are the same sub-watersheds with high road densities. Conditions in these sub-watersheds may be contributing to increased flows, bed load movement, accelerated bank erosion and loss of wood in the lower Cle Elum River.

B5. At-Risk Fish (Score 6)

Steelhead are assumed to use the Cle Elum River below the dam but to what extent is unknown. Steelhead numbers in the whole sub-basin are very depressed. Spring Chinook also use the Cle Elum River below the dam. The bull trout population appears to be very depressed above the dam and adult bull trout are assumed to be present below the dam. Migratory and/or resident bull trout populations in the Cle Elum above the dam must be extremely small. Until recently the only bull trout observed in the Cle Elum, other than in the Waptus River, were occasional fish trapped in Lake Cle Elum by the National Marine Fisheries Service during the Sockeye Salmon Reintroduction Feasibility Study between 1987 and 1994 (Flagg). In 1996, students

working under the supervision of Dr. Paul James (Central Washington University) observed two adult, apparently migratory bull trout in the Cle Elum River upstream of Lake Cle Elum. In 2000 three juvenile bull trout were observed in the lower portion of Fortune Creek and seven bull trout redds were observed just downstream of Tucquala Lake. The Upper Cle Elum subwatershed is therefore considered significant since it is the only known subwatershed with spawning. The Fortune Creek area needs further investigation.

C. Wildlife

The Cle Elum Watershed covers a large area and provides high-level human use with access to numerous trailheads and wilderness. This watershed has moderate potential for improvement.

C1. Wide-Ranging Carnivores

The open road density in the Cle Elum Watershed is moderate at 1.43 mi/mi^2. Only 19.2% of the watershed is core habitat, for a total of 27,209 acres. The Waptus Lynx Analysis Unit (LAU) and portions of several other LAUs are located within the Cle Elum Watershed. The following table describes the road density of those portions within the Cle Elum Watershed. A description of each LAU in its entirety is available in Appendix C.

Table 14. Road density of Lynx Analysis Units within the Cle Elum Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Sasse Ridge	104.9	40.8	2.57
Silver	95.1	54.1	1.76
Teanaway	1.4	1.4	1.0
Waptus	25.4	94.6	0.27

Mean Road Density = 1.41 mi/mi^2

C2. Late-Successional Associated Wildlife Species

Fifteen acres (0.01%) of the Teanaway LSR are located in the Cle Elum Watershed. The majority of the Teanaway LSR lies within the Teanaway Watershed. The overall security habitat rating for the Teanaway LSR is moderate, while the overall habitat effectiveness rating is high.

C3. Riparian Dependent Wildlife Species

Riparian Reserves occupy approximately 27,455 acres (19.4%) of the Cle Elum Watershed. The open road density within the Riparian Reserves is moderate, 1.4 mi/mi^2.

C4. Ungulates

The Cle Elum Watershed contains no mapped ungulate winter range (EW-1). However, many areas within the watershed are used by deer, elk and mountain goats for spring and summer range, and for fawning/calving/kidding.

C5. Unique Habitats

Unique habitats are diverse and abundant in the Cle Elum Watershed, covering 25,862 acres (18.3%).

Table 15. Availability of unique habitats in the Cle Elum Watershed

Unique Habitat	Acres	% of Watershed
Avalanche Chute	9	<0.01
Bedrock	8,851	6.3
Brushfield	3,800	2.7
Cliff	5,100	3.6
Grass/Shrub	76	0.1
Meadow	2,098	1.5
Riparian Forest	356	0.3
Scour	19	0.01
Talus/Scree	4,927	3.5
WBP/SAL	81	0.1
Wet Meadow	545	0.4

Swauk Watershed

The Forest Service Road System in the Swauk Watershed began to develop in the 1800s and early 1900s as mining exploration in the Liberty area began to expand. The road system did not expand dramatically until timber harvest activities began to increase in the 1950s.

Highway 97, Liberty County Road, Old Blewett Pass Highway (FS Road 7320), Liberty Beehive Road (FS Road 9712), Swauk Meadows Road (FS Road 9716) and Blue Creek Road (FS Road 9738), provide access to the Swauk Watershed. Currently, there is approximately 312 miles of road within the Swauk Watershed. There are 262.4 miles of Forest Service System Roads, 15.7 miles of State roads, and 5.0 miles of county roads. These roads accept all classes of vehicles and provide access for all multiple use traffic in the watershed. The remaining roads belong to a variety of private landowners or are unclassified roads on National Forest lands. Of the 262.4 miles of Forest Service roads, records indicate that the majority of this mileage was constructed in the 1960s (34.3 miles), 1970s (58 miles) and the 1980s (44.9 miles). The road network is mainly utilized for recreation access, timber harvest, post harvest stand maintenance and public access to private lands within the Forest. 82.9 miles of Forest Service roads are maintained at Maintenance Level 3 or above, 100.9 miles at Maintenance Level 2, and 52.4 miles at Maintenance Level 1. There are also 26.2 miles of inventoried 4x4 trail routes. All Forest Service system roads in the watershed are inventoried and documented in the Forest Transportation Management System (INFRA Roads database).

Roads within the watershed accessing localized areas include:

9702 (Red Top)
9705 (Durst Creek)
9711 (Hurley Creek)
9714 (Iron Creek)

9718 (Cougar Gulch)
9726 (Deer Gulch)

These roads are maintained for passenger car use during the summer and fall. Forest Service roads 9738, 9716, 9712 and 9705 are groomed for over the snow travel in the winter.

Roads 9702, 9712, and 9738 have been identified with recurrent problems (rutting, slumps, washouts, failures) due to road locations in sensitive soil types. These problems could be mitigated if road use was confined to the dry season with seasonal restrictions.

A. Human Use

A1. Public Use

The first non-indigenous peoples to come into the Swauk are thought to be trappers. Little specific information is available to confirm exactly when these activities began. In 1867 a small amount of gold was found but it was not until 1873 that a true discovery was made. From that time on, a variety of activities took place in the valley, including: trapping, grazing, homesteading, farming, logging, recreation, utilities, town sites, fire control, Civilian Conservation Corps (CCC), and Forest Service administrative sites.

Although human use of this area dates back many hundreds of years, the first significant signs of road access started with early mining, grazing and homesteading. The timing of trails, roads, the development of irrigation reservoirs, and other significant ground disturbing activities is similar to the Upper Yakima Valley described above.

Mining remains a popular activity in the Swauk and Liberty area. In terms of travel and access, mining activities are among the most important considerations for this area. Grazing is another important consideration. The current allotment permits 1000 ewes with lambs to be grazed in the Swauk. The Forest Dry Site Strategy will require some timber stand treatment to be completed before the eventual reintroduction of fire can occur. The Swauk is also important for communications and electrical utilities. Telecommunications and power lines are situated along Highway 97, old Blewett Pass Highway, Liberty and Lion Gulch roads. The Forest Service maintains a radio repeater on Red Top Lookout site and a remote automated weather station (RAWS) station near the Liberty heliport.

There are currently three developed campgrounds in the Swauk. The system of developed trails includes 11 miles of single tread motorized and 40 miles of dual tread motorized trail. There are also 4.3 miles of single tread non-motorized, 25.9 miles of cross-country ski trail, and 67 miles of snowmobile trail. The area is used extensively for outdoor recreation year round.

A2. Resource Management

The geology, weather patterns and soils create a complex mosaic of vegetation communities comprised of ponderosa pine, Douglas-fir, grand fir, moist grand fir, mesic Douglas-fir and subalpine fir.

The dry forest group is the largest vegetation group within the Swauk watershed (approx. 70% of

the area); of this, 61% is considered dense, 5% created openings, and 34% mapped as open park-like. Stands are not all multi-layered within this group.

The moist grand fir group consists of 10% of the area; 58% mapped dense, 7% created openings, 1% single layered and 34% open park-like. This group has gone through many changes due to past management activities. This harvesting led to the removal of many of the seral species.

The subalpine fir group composes 7% of the area; 68% is dense/layered, 28% single layered, 2% openings, and an additional 2% as park-like and scattered trees in talus.

The remaining area is lumped into vegetative non-forest.

Both noxious weeds and aggressive invaders have been found along roadways, in plantations, and within other areas of disturbance.

Historically, over 70% of the stands were open park-like areas where high frequency, low intensity fire was the norm. Presently, due to fire suppression efforts, stand densities and fuel loadings have increased, creating a situation in which stand replacement fire is more common.

B. Aquatics

Swauk Creek is a tributary to the Yakima River, the confluence located approximately 12 miles northwest of Ellensburg, Washington. The watershed has a long history of management, starting with mining and grazing in the 1800s, timber harvest, and agriculture in the lowest reaches below the National Forest boundary, and most recently recreation. State Highway 97 runs up much of the Swauk Creek valley bottom. The headwaters consist of the Teanaway Ridge to the west (5,361 ft.), Table Mountain to the east (6,359 ft.) and the Wenatchee Mountains to the north (5,489 ft.). The upper approximately one-third of the main stem flows westerly to the confluence with Hovey Creek where it proceeds on a southerly course to the Yakima.

Average annual precipitation ranges from between 30 and 40 inches in the headwaters to 20 inches at the confluence with the Yakima. Approximately one-half of the main stem and all of the headwaters and most tributaries lie within the boundary of the Wenatchee National Forest. The lower approximately one-half of the main stem flows through predominately private land.

Information about existing habitat conditions were obtained from the most recent environmental baseline established in the “Swauk Watershed fish biological assessment on-going activities, April 1999” and as updated in “final biological assessment of the proposed five-year plan of operation for the Repin Mine (2000 – 2005) Cle Elum Ranger District, Wenatchee national forest June 9, 2000.” When it was available, new information from monitoring was also used.

B1. Geologic Hazard (Score 6)

The Swauk Watershed is within the Upper Yakima/Swauk-Sandstone Hills Subsection (USDA FS 1994b). These hills are composed predominately of the Swauk Formation, which is comprised primarily of inter-bedded sandstone, siltstone and lesser shale beds. These beds are medium grained and rich in mica and feldspar mineralogy. Once exposed, this bedrock weathers

rapidly to form “sandy soils.” Individual beds are steeply inclined to the south and are nearly vertical. Numerous basalt dikes are present. Several geomorphic processes have been functioning to create a variety of landforms.

The primary geomorphic processes that have influenced landscape development include fluvial down cutting and mass wasting. Differential erosion has formed landforms where the underlying orientation of the bedrock is controlling the surface terrain. The predominant landforms form a complex pattern of hogbacks, dip slopes, and scarp slopes. Approximately 25,802 acres of these structural controlled slopes occur in the Swauk Watershed. These structural landforms have V-shaped narrow valleys where exposed bedrock often controls channel gradient and alignment. Furthermore, due to shallow soils and orientation of the underlying bedrock, these landforms are very efficient in concentrating runoff rapidly into first order drainages.

The mass wasting processes have created deep-seated landslides, which are localized throughout the Swauk Watershed. These landslides were stratified during the watershed analysis procedures. Approximately 17,106 acres of small isolated deep-seated landslides occur in the watershed. Most of these deep-seated landslides are due to the inter-bedded nature of the bedrock. Often along the inter-beds or contact between differing bedrock, planes of weakness have accounted for slope failures. Most of these landslides occur along the margins of basalt flows.

These deep-seated landslides occasionally slide into streams delivering sediment directly into stream systems and causing stream confinement and stream scour of adjoining channel banks. Once landslide toe slopes are within the channel, streams can undermine the toe creating unstable slope conditions and triggering additional failure into the channel perpetuating the process. During this stream adjustment, accelerated levels of sediment are being routed and delivered due to the initial landslide.

Stream scour of channels is also a significant source of sediment delivery in the lower segments of the Swauk Watershed. This form of sediment delivery is common during storm events, spring runoff, and if channels have been artificially confined.

The major sources of sediment delivery within the watershed are likely from deep-seated landslides and stream scour of channel beds and banks. Predominately this sediment consists of fine and coarse textures.

All of these forms of sediment delivery are responsible for contributing fine sediment input. Roads can accelerate the natural rate of sediment delivery by:

- Reducing slope strength triggering additional slope failures (landslides).
- Channelizing or concentrating runoff.
- Maintaining road facilities following landslide or flooding events.
- Causing confinement of channels forcing streams to erode channels and banks.

Table 16. Swauk Watersheds total miles of road within naturally high sediment sources

Large deep-seated landslides	--
Small deep-seated landslides	101.3
Shallow landslides (debris flows)	--
Structural landforms with some shallow landslides	131.0
Valley bottom main stem stream channels	38.9

B2. Road-Related Fine Sediment (Score 10)

A limited amount of sediment data has been collected in 2000 for the Swauk (Wolman 1954, McNeil 1960), although stream surveys indicate that cobble and gravel are the dominant substrate in Swauk Creek, Iron Creek, Boulder Creek, and First Creek. Fine sediment levels for Swauk Creek averaged 31% in samples collected between First Creek and Hurley Creek. Roads and trails are presently the largest contributor of sediment to stream channels. The majority of roads are native surface. Erodability and sediment delivery potential are high. A large amount of transported fines are produced in the system from roadbeds, cuts and fills. Ditch flow and captured streamflow on road surfaces due to insufficient cross-drains and inadequately sized crossings have been observed in several locations. Many roads and skid trails are in valley bottoms. Roads located within Riparian Reserves, and within the floodprone elevation, have experienced severe erosion after capturing flood flows. Hovey, Medicine, and Iron Creeks provide examples of this situation. Past timber harvest and grazing have contributed to stream bank instability and stream bank erosion, further accelerating sediment delivery.

Motorized trails and cross-country travel by ORVs have contributed to accelerated erosion and stream channel entrenchment in Pine Gulch, Deer Gulch, First Creek, Baker Creek, Medicine, and Hovey Creeks. ORV crossings at fords are potential sediment sources given the erodible sandstone soils. Log landings and skid trails within Riparian Reserves also are contributing to accelerated sediment delivery to streams.

Turbidity measurements were taken in Swauk Creek and many of its tributaries during the 1996 flooding. Turbidity values ranged from 7 nephelometric turbidity units (NTU) (upper North Fork Swauk Creek) to 80 NTUs (at Blewett Pass) in the main stem Swauk Creek and from 20 NTUs (Blue Creek) to 129 NTUs (Medicine Creek) in its tributaries. Undisturbed watersheds with similar geology would be expected to have turbidity measurements in the range of 10-15 NTUs during runoff.

Based on geological conditions in the watershed, sediment levels may be naturally high,

however, given the amount of disturbance from a variety of management activities (livestock grazing, roading, mining, timber harvest) sediment delivery has likely been accelerated. The watershed is considered functioning at unacceptable risk.

B3. Flood Plain Function, Off-Channel Habitat and Riparian Reserves (Score 10)

Flood Plain Connectivity and Off-channel Habitat are functioning at unacceptable risk. Highway construction, road encroachment on the flood plain combined with mining, loss of wood and beavers have isolated flood plains and off-channel habitat and contributed to accelerated down cutting of channels. Highway 97 has confined Swauk Creek, resulting in the loss of 1.5 miles of stream.

Roads, skid roads, logging, mining, recreation, and past livestock grazing have all impacted Riparian Reserves and function. Riparian Reserves are functioning at unacceptable risk. Off road vehicle use and dispersed camping in riparian areas, particularly along Williams Creek, Lion Gulch, Medicine Creek, Iron Creek and the main stem Swauk is causing soil compaction, damage to riparian vegetation and stream banks, woody debris removal and sediment delivery. Dispersed recreation without continuing restoration efforts will remain inconsistent with the Aquatic Conservation Strategy.

B4. Flow Effects (Score 6)

The Swauk Watershed is considered to be functioning at unacceptable risk for road density and location. Within the boundary of the National Forest there are approximately 262 miles of road, most of which was constructed in the 1960's and 1980's. The road network is mainly used for recreation access, timber harvest, post harvest timber stand maintenance, and to provide access to private land within the Forest boundary. One hundred twenty-seven miles of the system is maintained for high clearance vehicles, 26 miles of which are inventoried 4x4 trails carried on the road system. No sub-watersheds can be considered to be functioning appropriately, due to road density and riparian roads. Only Iron Creek road densities fall within the functioning at risk range but there are six miles of riparian road. In addition, there are a number of user-built and unclassified roads in the watershed. Ditch flow and captured stream flow on road surfaces, due to insufficient cross-drains have been observed in the watershed. Roads within the flood prone area have experienced severe erosion stemming from the capture of flood flows. Road surfaces entrenched up to six feet have been observed.

The watershed is functioning at risk for Changes in Peak/Base Flows. Among the reasons is excessive soil compaction from skid roads, roads and trails that may be increasing runoff. Loss of flood plain due to roads and diking, loss of in-channel woody debris and loss of beaver have reduced the capacity for the watershed to store and dissipate flood flows.

B5. At-Risk Fish Populations (Score 3)

Bull trout have not been observed in the watershed except for an occasional adult observed near the confluence with the Yakima River. Steelhead have been observed in Swauk and Iron Creek. The Lower and Upper Swauk are considered to be significant for steelhead. The Lower and

Upper Swauk sub-watersheds are also considered significant for redband trout. The "rainbow" trout in Swauk Creek have been found to be native redband. In the upper Columbia River the native redband and steelhead may in fact be the same population. The native redband in the Swauk may provide a genetic reservoir for maintaining a remnant of the native steelhead population.

Spring Chinook have been observed in the lower reaches of Swauk Creek and westslope cutthroat trout are found in tributary streams. The Swauk is rated a 3 because although significant sub-watersheds have been identified, steelhead populations are very low, bull trout do not appear to be present and habitat is degraded.

C. Wildlife

The substantial number of roads in the Swauk Watershed provides high-level motorized human use with potentially great effects on wildlife. The Swauk Watershed is moderately sized for the Upper Yakima Sub-Basin and is bisected by a major highway.

C1. Wide-Ranging Carnivores

The Swauk Watershed is in very poor condition with regard to core habitat. The open road density is extremely high at 3.69 mi/mi^2. Only 7.4% of the watershed is core habitat, for a total of 3,933 acres. Portions of the Teanaway and Table Mountain LAUs are located within the boundaries of the Swauk Watershed. The following table provides details regarding the high road densities of those portions within the Swauk Watershed. A description of each LAU in its entirety is available in Appendix C.

Table 17. Road density of Lynx Analysis Units within the Swauk Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Table Mtn.	121.5	32.7	3.72
Teanaway	63.9	21.5	2.98

Mean Road Density = 3.35 mi/mi^2

C2. Late-Successional Associated Wildlife Species

The Swauk LSR occupies 48,214 acres (90.7%) of the Swauk Watershed. The security habitat and habitat effectiveness ratings are low.

C3. Riparian Dependent Wildlife Species

Riparian Reserves are strongly influenced by the road system in the Swauk Watershed. Riparian Reserves occupy approximately 8,648 acres (16.3%) of the Swauk Watershed. The open road density within the Riparian Reserves is exceptionally high, at 6.6 mi/mi^2.

C4. Ungulates

The Swauk Watershed provides areas important to ungulates for calving, fawning and summer

range. The average elevation within the Swauk Watershed is high and excludes winter range.

C5. Unique Habitats

Unique habitats are diverse but lack abundance in the Swauk Watershed, covering 6,535 acres (12.3%).

Table 18. Availability of unique habitats in the Swauk Watershed

Unique habitat	Acres	% of Watershed
Bedrock	131	0.2
Brushfield	361	0.7
Cliff	98	0.2
Grass/Shrub	1,027	1.9
Hardwood	208	0.4
Landslide	7	0.01
Meadow	1,127	2.1
Talus/Scree	3,048	5.7
Treed Talus	43	0.1
Wet Meadow	486	0.9

Teanaway Watershed

Currently there are approximately 182 miles of roads within the Teanaway Watershed. Of that, approximately 81 miles are Forest Service System roads. The remaining miles include the county road system, which provided access to lands outside the forest boundary, and private roads accessing private lands within the watershed.

Main access to the Teanaway Watershed is provided by Kittitas County Roads (Teanaway Road, M. Fork Teanaway Road, and W. Fork Teanaway.) This road system provides access to Forest Service Roads 9793 (North Fork Teanaway) and 9738 (Blue Creek). These two roads provide the main access to Forest Service lands within the watershed. Both roads are long term, constant service collector roads with crushed aggregate surfacing. The following roads provide access to localized areas within the drainage: FS Road 9701 (Jungle Creek), FS Road 9703 (Stafford Creek), and FS Road 4305 (Corral Creek). These roads are all local, long term, constant roads with native surfacing.

Of the 81 miles of Forest Service roads in the watershed, 33 miles are classified Maintenance Level 3, suitable for passenger car use, 37 miles are Maintenance Level 2 useable by high clearance vehicles, and the remainder (11 miles) are Maintenance Level I (closed roads). Dickey Creek is an area that has a particularly high proportion of open motorized roads in riparian areas. There is a goal to reduce the road density of system and unclassified roads where possible without placing unreasonable restrictions on recreation or public access.

The Forest Service road system is mainly utilized for post harvest stand maintenance and recreation activities. All Forest Service roads are inventoried and documented in the transportation management system (INFRA Roads database.)

A. Human Use

A1. Public Use

Some of the more identifiable activities that have taken place in the Teanaway include: grazing, timber management, recreation, road construction and management, mining, fire control and prevention, CCC work, communications, summer homes and game preserve. There are 13 summer homes under special use permit within the Teanaway.

There are approximately 13,000 acres of privately owned lands within the Forest boundary. The private land is a mixture of private industrial forestland and housing developments. Most of the necessary access is in place, though some additional needs may develop over time.

Recreation activities tend to be oriented more toward primitive and semi-primitive. There are several Wilderness access points. Other backcountry points are also accessed from this area. Beverly and DeRoux are the only developed campsites on National Forest lands. There are two private and one state operated campgrounds. The Teanaway is considered one of the prime deer hunting areas in the state. It is important for both pedestrian and motorized winter recreation. Though it does not receive high numbers of users, it provides an opportunity for more solitude than other places on the District. There are about 87 miles of motorized and 41 miles of non-motorized trail. Winter trails include 4.4 miles of cross-country ski and 22 miles of snowmobile trail.

A2. Resource Management

Most of the timber harvesting that has taken place was done within the past 70 years. However, most of the watershed (about 85%) has had no harvesting. Mining activity dates back to the 1880's when there was a substantial amount of work being done. Several roads were developed to serve the mining and associated activities. These roads are most important for their historical significance. There is some modern day exploration taking place.

Thirty-two percent of the watershed is made up of the dry series. Douglas-fir and ponderosa pine are primarily found on the west and south aspects. Here, plant growing is limited to lack of moisture. Multi-layered forest stands have now developed. Fire return intervals previously were 7-11 years constituting a high frequency, low intensity fire regime. Now due to fire exclusion, it has changed to a moderate to high fire intensity regime where stand replacement fire is more common.

Mesic Douglas-fir series comprises 3% of the watershed. These sites are found mainly along riparian areas and north slopes. Fire return intervals are variable, moderate to high fire intensities. Disturbances occurring within these stands are usually initiated by flood, fire and wind.

Moist grand fir comprises 34% of the watershed. Warm, moderately dry, forest habitat is characteristic of this series and it is usually found between the cooler wet series and the warmer dry series, widely distributed below 5000 feet. Few understory species occur across all plant associations. Fire return intervals are 30-100 years. Low to moderate intensity fires were typical

of natural stands. However, a shift to moderate to high intensity fires is more common today. Effective fire suppression has shifted series toward climax as more multi-storied stands are developing.

Subalpine series comprises 7% of the watershed, found mainly in the mid-elevation to upper timberline regions. This is considered the moist and cool series. This series is well represented in the watershed and has fire return intervals of 100-200 years. Fires are normally severe and mortality is high.

The wet series comprises 1% of the watershed. Tree species are western hemlock, Pacific silver fir and mountain hemlock. Fire return intervals are 100-300 years. Fires are normally high intensity stand replacing events.

Noxious weeds are normally found along roadways, landings, and in other disturbed sites within the watershed.

B. Aquatics

The Teanaway Watershed is approximately 134,260 acres in size, approximately 70,000 of which are National Forest land. The aquatic habitat in lower portions of the watershed has been heavily impacted by irrigation withdrawal, timber harvest and rural development. The Teanaway River is on the state 303(d) list for stream temperature. The watershed is bounded on the north by the Wenatchee Mountains, on the east by Teanaway Ridge and on the south and west by Cle Elum Ridge. The Teanaway River coalesces from three main forks, the West Fork, the Middle Fork and North Fork flowing with a general north to south orientation to the Yakima River. The headwaters originate from approximately 5,000 feet elevation on the West Fork to 6,800 feet on the North Fork. The hydrograph is predominately snowmelt driven. However, summer lightning storms are fairly common in the watershed. Average annual precipitation in the drainage ranges from approximately 20 inches at the southern boundary up to 70 plus inches at the headwaters.

At the time the environmental baseline was established, future harvest activities including road construction by Plum Creek Timber Company as covered under their Cascade Habitat Conservation Plan (HCP) FEIS, March 1996, was included. This baseline assumed that all harvestable lands owned by PCTC within the watershed had been harvested and are in an immature stand condition. There are a total of 5,742 acres of lands under PCTC ownership in the Teanaway watershed of which 4,308 acres can be considered harvestable. Since that time, a large portion of these lands have been exchanged to the Forest Service.

Information about existing habitat conditions were obtained from the most recent environmental baseline established in the “Teanaway Watershed Aquatic species Biological Assessment” (USDA FS 1999f). When available, new information from monitoring was also used.

B1. Geologic Hazard (Score 2)

The Teanaway Watershed is within the Upper Yakima/Swauk-Sandstone Hills Subsection (USDA FS 1994b). These Hills are composed predominately of the Swauk Formation, which is comprised primarily of interbedded sandstone, siltstone and lesser shale beds. These beds are

medium grained and rich in mica and feldspar mineralogy. Once exposed, this bedrock weathers rapidly to form "sandy soils". Individual beds are steeply inclined to the south and are nearly vertical. Numerous basalt dikes are present. Several geomorphic processes have been functioning to create a variety of landforms. Limited alpine glaciations occurred in the upper segments of the Teanaway Watershed creating over steepened glacial trough walls and fairly broad valleys. These trough walls total 5,566 acres.

Fluvial down cutting has been a major land forming process in a bulk of the watershed. Differential erosion has formed landforms where the underlying orientation of the bedrock is controlling the surface terrain. The predominant landforms form a complex pattern of hogbacks, dip slopes, and scarp slopes. Approximately 34,296 acres of these structural controlled slopes occur in the Teanaway Watershed. These structural landforms have V shape narrow valleys where exposed bedrock often controls channel gradient and alignment. Furthermore, due to shallow soils and orientation of the underlying bedrock, these landforms are very efficient in concentrating runoff rapidly into first order drainages. This concentration of runoff incorporated with the accelerated weathering properties of the bedrock has been responsible for significant surface erosion from these structural landforms. This erosional material has been responsible for significant valley infilling which has widened valleys in the lower segments of the watershed.

A few deep-seated landslides are localized throughout the Teanaway Watershed. These landslides were stratified during the watershed analysis procedures. Approximately 2,234 acres of small isolated deep-seated landslides occur in Jungle, Indian, and Dickey Creeks and south of Yellow Hill. These deep-seated landslides occasionally slide into streams delivering sediment directly into stream systems and causing stream confinement and stream scour of adjoining channel banks. Once landslide toe slopes are within the channel, streams can undermine the toe creating unstable slope conditions and triggering additional failure into the channel perpetuating the process. During this stream adjustment, accelerated levels of sediment are being routed and delivered due to the initial landslide.

The major sources of sediment delivery are from shallow landslides (debris flows) and stream scour of channel beds and banks. Sediment consists predominately of fine to coarse textured sands.

Stream scour of channels is a major source of sediment delivery in the lower segments of the main stem Teanaway Watershed. This form of sediment delivery is common during storm events, spring runoff, and if channels have been artificially confined.

All of these forms of sediment delivery are responsible for contributing a naturally high level of fine sediment input. Roads can accelerate the natural rate of sediment delivery by:

- Reducing slope strength triggering additional slope failures
- Channelizing or concentrating runoff
- Maintaining road facilities following landslide or flooding events
- Causing confinement of channels forcing streams to erode channels and banks.

Table 19. Teanaway Watershed total miles of road within naturally high sediment sources

Large deep-seated landslides	--
Small deep-seated landslides	7.7
Landforms prone to shallow landslides (debris flows)	9.8
Structural landforms with some shallow landslides	21.5
Valley bottom main stem stream channels	2.5

B2. Road-Related Fine Sediment (Score 3)

Sediment monitoring data was collected on the North Fork Teanaway in 1990 and in 2000, and on the Middle Fork Teanaway and West Fork Teanaway for the past several years. The 1990 and 2000 data for North Fork Teanaway indicates that the river is averaging less that 20% fines. Reaches 1 through 3 of the North Fork Teanaway in 2000 had mean percent fines less than 1.0mm of 17%, 16% and 12%. The 1996 data also indicates that Middle Fork Teanaway River is averaging less than 20% fines in all reaches. The Middle Fork Teanaway had mean percent fines of 12% in reach 1, 13% in reach 2 and 9% in reach 3. In 2000 data indicates that the West Fork Teanaway is still averaging less than 20% fines. The West Fork Teanaway had 23% fines in reach 1, 16% in reach 2 and 14% in reach 3. Reaches 1 and 2 are both located below the Forest boundary. Therefore the upper watershed above the Forest Boundary is functioning appropriately. The sandstone geology of the Teanaway can be expected to produce relatively high levels of fine sediment. The cooperators in the Yakima River Resource Management Cooperative (YRMC), which includes the Forest Service, Plum Creek Timber Company, Boise Cascade, and the Washington Department of Fish and Wildlife, believed that the fine sediment samples were probably close to the natural levels in the Upper Teanaway. The main stem below the forest boundary is considered to be functioning at risk. No quantitative data is available. However, based on visual observations this portion of the lower watershed is carrying a higher fine sediment load than would be ideal for maintaining good quality spawning habitat.

Road and trail locations and designs are presently the greatest contributor to water quality in the form of fine sediment. In addition to sediment produced from runoff from road/trail surfaces and cut/fill slopes, sediment produced from accelerated in-channel erosion has been noted in locations such as Jack and Jungle Creeks, where streams migrating on their flood plains has washed out the road fill. The Teanaway Watershed Analysis also noted erosion problems on the Upper Dickey and Corral Creek roads. The North Fork Teanaway Road frequently is washed-out at certain locations during high flow events. The road erosion problems are believed to be due to road location and design, not use. The Teanaway is rated a 3 because the portion below

the Forest boundary is functioning at risk and roads on the Forest may be contributing even though fine sediment is considered to be functioning appropriately within the National Forest.

B3. Flood Plain Function, Off-Channel Habitat and Riparian Reserves (Score 9)

Flood Plain Connectivity, Off-channel Habitat and Riparian Reserves are generally believed to be **f**unctioning at risk on the National Forest and functioning at unacceptable risk downstream of the National Forest boundary. Road construction and railroad construction combined with channelization and diking have isolated the stream from the flood plain and destroyed off-channel habitat. Most of the roads in the watershed are located within Riparian Reserves. Within the National Forest the problems are primarily in the North Fork Teanaway as the Middle and West Forks are largely unroaded on the Forest. Dispersed recreation use within the riparian reserve along the North Fork Teanaway is a growing management concern.

B4. Flow Effects (Score 9)

Road density and location are considered to be functioning at unacceptable risk due primarily to roads within the Riparian Reserves, and low road densities in the watershed. Within the National Forest, road related impacts are primarily in the North Fork Teanaway and Stafford Creek. Road densities are: Lower Teanaway (private) 3.0 mi/sq .mi.; Lower North Fork Teanaway (mostly private) 3.0 mi/sq .mi.; Upper North Fork Teanaway 0.5 mi/sq .mi.; Middle Fork Teanaway 0.5 mi/sq .mi.; West Fork Teanaway 1.9 mi/sq .mi.; Stafford 0.3 mi/sq .mi..

Changes in Peak/Base Flows are also considered to be functioning at unacceptable risk in part due to loss of beaver and wetlands from channelization and land use, including road construction. Irrigation withdrawal exacerbates naturally low base flow conditions.

B5. At-Risk Fish Populations (Score 6)

Anadromous fish and bull trout populations are very depressed in the Teanaway. Migratory bull trout spawning has recently been documented in North Fork Teanaway approximately 1.5 miles downstream of DeRoux Creek. Bull trout were also found in DeRoux Creek. The Upper North Fork Teanaway is therefore a significant sub-watershed.

The Lower North Fork Teanaway is significant for spring Chinook due to supplementation efforts. Also of note, the Stafford and Upper North Fork sub-watersheds are significant for westslope cutthroat trout.

The Teanaway is rated as a 6 because significant sub-watersheds for at-risk fish exist, and there is connectivity between the West, Middle and North Forks. Habitat in the Middle Fork Teanaway is largely unmanaged and may be habitat refugia, especially for steelhead. Habitat conditions in the main stem Teanaway are a concern, but restoration efforts linked with Clean Water Act may improve conditions.

C. Wildlife

The Teanaway Watershed has a large amount of core and generally lower road densities relative

to other watersheds within the Upper Yakima Sub-Basin. The watershed provides access to wilderness areas and experiences a moderate level of human use. Therefore, the potential to improve habitat is moderate.

C1. Wide Ranging Carnivores

The open road density in the Teanaway Watershed is low at 0.94 mi/mi^2. However, only 26.2% of the watershed is core habitat, for a total of 35,171 acres. This watershed contains two large Lynx Analysis Units: Sasse Ridge and Teanaway. The following table describes the low road densities of those portions within the Teanaway Watershed. For a description of each LAU in its entirety, see Appendix C.

Table 20. Road density of Lynx Analysis Units within the Teanaway Watershed

LAU	Miles of open road	Area w/in watershed (sq. miles)	Road density (mi/mi^2)
Sasse Ridge	16.9	36.2	0.47
Teanaway	77.1	85.3	0.9

Mean Road Density = 0.69 mi/mi^2

C2. Late-Successional Associated Wildlife Species

Portions of two LSRs are located within the Teanaway Watershed: Swauk LSR and Teanaway LSR. These LSRs cover approximately 49,665 acres (37.0%). The security habitat and habitat effectiveness ratings are low for the Swauk LSR. The Teanaway LSR is in much better condition with a moderate security habitat rating and a high habitat effectiveness rating.

C3. Riparian Dependent Wildlife Species

Riparian Reserves occupy approximately 18,872 acres (14.1%) of the Teanaway Watershed. The open road density within the Riparian Reserves is high, 2.3 mi/mi^2.

C4. Ungulates

No mapped ungulate winter range exists on the Teanaway Watershed. However, there are areas important for migration, calving and fawning within the watershed.

C5. Unique Habitats

Unique habitats are very diverse and abundant in the Teanaway Watershed, covering 25,238 acres (18.8%).

Table 21. Availability of unique habitats in the Teanaway Watershed

Unique habitat	Acres	% of Watershed
Avalanche Chute	96	0.1
Bedrock	11,832	8.8
Brushfield	1,536	1.1
Cliff	230	0.2

Unique habitat	Acres	% of Watershed
Grass/Shrub	1,251	0.9
Hardwood	304	0.2
Landslide	1	<0.01
Meadow	905	0.7
Riparian Forest	29	0.02
Scour	149	0.1
Talus/Scree	6,753	5.0
Treed Talus	47	0.03
WBP/SAL	911	0.7
Wet Meadow	1,196	0.9

II. Analysis

A. 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.

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 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 assessment, segments with scores of 32 and above were given a high priority, or a high need to maintain some type of passenger car access, 24 to 31 received a moderate priority or need and 23 and below a low priority.

The general responses from the public showed that people were most concerned about maintaining access to the National Forest. Different activities often dictate a different level of access, so the needs often varied. People were generally agreeable to changing the level of maintenance to meet resource or budget needs. In some instances people would prefer to see a higher level of maintenance, but in other instances they might prefer to see a lower level of maintenance. These preferences would depend on a variety of factors such as seeking more solitude, wanting to be able to travel with a certain type of vehicle, whether it be high or low clearance, two of four wheel drive, or having access during particular times of the year.

B. 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 generally are located adjacent to streams in a significant sub-watershed for an at-risk species, delivering sediment directly into important spawning or rearing habitat. These segments exhibit one or more of the following conditions: are currently delivering sediment to the streams, are on unstable lands or are confining the flood plain. Passage barriers to some life stage of at-risk species were often present. High priority road segments scored 27 or above and are discussed by watershed in the following section.

Moderate priority roads have some erosion problems delivering sediment into streams or were contributing to riparian degradation, but the problems were either being managed or the potential for adverse impacts was not as great as the high risk. These are segments where some work is needed and could be major work, but are a lower priority than the high priority. Moderate priority segments scored between 19 and 27. There are several moderate priority roads, which need particular attention. While comparatively the problems may not be as serious as the high priority, they do have some serious problems to address. These roads are discussed in the following section.

Low priority roads scored under 19 and were low risk because it was believed potential direct delivery of sediment and adverse impacts to at-risk species was low due to location and current conditions of the roads. Road segments were generally on lands with a low geologic hazard rating.

No high priority roads (for aquatic reasons) are identified in the Taneum, Manastash, or Naneum Watersheds. Both the Cle Elum and Yakima Watersheds have high road densities in glacial trough land types. Common problems include:

- Flood plain confinement due to the roads,
- Inadequately sized crossings,
- Erosion due to debris slides,
- Surface and ditch line erosion due to inadequate ditch relief and cross-drains
- Off road vehicle access to the floodplain.
- Interrupted groundwater movement and draining of near surface aquifers and wetland features.

While many of the above conditions apply to the Swauk, the most common problem in the watershed is severe rutting and surface erosion. In the Teanaway, flood plain confinement, motorized access to flood plains, inadequate crossings to pass water and debris flows during peak events, and localized landslide hazards are problems. Fish passage barriers are problems in all the watersheds.

High Priority Roads by Watershed

See Appendix B for a list of the specific problem descriptions.

Note that restoration recommendations are initial thoughts and are not meant to be final recommendations or exclusive of alternative measures, which may be developed at a later date.

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for “at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater. These roads are listed within the appropriate watersheds.

A second select group of moderate risk priorities has been identified as important in controlling road related non-point source sediment pollution, as measured by Washington’s Water Quality Standards for sediment. They all are located in “at-risk” sub-watersheds, and are considered cumulative sediment contributors to these watersheds. Generally, they had an overall Aquatic Risk rating of moderate, with a fine sediment criteria score of 5 or greater. These roads are listed within the appropriate watersheds.

C. Wildlife

This document summarizes the results for the major arterial and collector roads in the Upper Yakima 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 Late Successional Reserves or connectivity within the Adaptive Management Area (AMA), and for enhancing habitat effectiveness of winter ranges, young rearing areas and migration routes for ungulates. Opportunities to improve core habitat, restore riparian areas and connectivity, and restore unique habitats, contributed as well. High priority segments scored greater than 30 points.

Moderately rated road segments would usually have one element of strong potential, generally restoration of riparian and unique habitats, and moderate to low potential in the remaining categories. Moderate priority segments scored 10 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 10 points. There are very few roads in this category because of the high road densities and the emphasis on Late Successional habitat in the AMA in the Upper Yakima Sub-Basin.

Because the roads cover a large area and a variety of habitats, there is not one consistently outstanding category. Instead, various combinations contributed to the overall rating. 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 Table C-1. (Appendix C).

Manatash Watershed

A. Human Use

All arterial and collector roads in the watershed were rated high for human use except for Roads 3100 (Manastash segment #2) and 3120109 (Coal Bunker), which rated as moderate. No changes in maintenance level were recommended for human use concerns.

B. Aquatics

All roads within the watershed have a low or moderate rating.

C. Wildlife

The road density in the Manastash Watershed (MW) is high at 2.21 mi/mi^2. Of the six road segments in the MW; two (33%) received a high rating for potential improvement and four (67%) received a moderate rating for potential improvement.

Road 3100 (upper end)
This road provides high potential to improve core and security habitat as it bisects core habitat and runs through the upper end of the Manastash LSR. Mountain goats may also be influenced.

Road 3104
This road is already gated partway up. Further improvements could eliminate many miles of side roads, thereby increasing core habitat. Although most of the road is non-riparian, it does access prime bottomlands in need of restoration. Alterations would also benefit ungulates, primarily through protection of fawning and calving grounds.

In summary, the ratings within the Manastash Watershed tend to be driven by potential for core and LSR habitat improvement, and protection of ungulate habitat. This watershed's high road density suggests a high priority for attention at the watershed analysis scale.

Taneum Watershed

A. Human Use

All arterials and collector roads in the Taneum rated high for human use. No changes in maintenance level were recommended.

B. Aquatics

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for

“at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater. Road numbers include:

Road 3300 (lower 8.2 miles Taneum Creek).

See Appendix B additional problem descriptions.

C. Wildlife

The Taneum Watershed (TW) has a high road density of 2.14 mi/mi^2. Of the six road segments in the TW; four (67%) received a high rating for potential improvement, and two (33%) received a moderate rating.

Road 3300
This road presents several opportunities to improve habitat, however, heavy human use may limit practical alterations.

Road 3330
This road runs through the Taneum LSR and through areas that are heavily used for ungulate fawning, transition and mapped winter range.

Road 3350119
This road presents an opportunity to improve core within the watershed and security habitat within the Manastash LSR. The area is also used as ungulate rearing grounds.

In summary, the high road density and large area of the Taneum Watershed results in ratings that are driven primarily by habitat effectiveness for ungulates and late successional species. There is great potential for improvement and restoration, however, mixed ownership and human access needs may limit the ability to restore habitats.

Naneum Watershed

A. Human Use

Human use in this watershed varied in ratings from low to high. However, only 2 roads, Wilson Ridge 3521 and West Fork Naneum 3530, were recommended to be reduced from maintenance level 3 to maintenance level 2 standards. This watershed receives a variety of uses. The public wants access for passenger vehicles on the main roads, but lower standard roads for high clearance use is acceptable on a percentage of the roads. This is an area of the Forest where people go when seeking less crowded conditions. It is also an area popular for wildlife viewing, so less traffic on part of the road system is desirable for those visitors.

B. Aquatics

All roads within the watershed received a low priority rating.

C. Wildlife

The road density in the Naneum Watershed (NW) is high at 2.39 mi/mi^2. Five (83%) of the road segments in the NW received a high rating for potential improvement, while one (17%) road segment received a moderate rating.

Roads 3500, 3507, 3521, and 3530
All of these road segments strongly influence core and security habitat. They are also in areas heavily used by ungulates, including winter range. Only Road 3521 is not in winter range. A great deal of unique habitat is located within this watershed too.

In summary, there is great potential to improve habitat with the Naneum Watershed within all categories. However, human uses in this area will likely limit opportunities.

Upper Yakima Watershed

A. Human Use

The majority of roads in the Upper Yakima are rated high for Human Use. The exceptions are 4930, 4934, 4948, 5400311, and 5483, which are rated moderate. The patterns of use are fairly stable in this watershed so no recommendations for change were made. Public input strongly supported maintaining access. High clearance vehicle access was acceptable where some restrictions were applied. Some people expressed a preference to see Cabin Creek Road 4100 in section 21 restored. This is primarily a matter of convenience to have a loop route, because all lands behind this segment are accessible via an alternative route.

B. Aquatics

Road 4100000
The road is located in the active Cabin Creek floodplain and is over-topped during high water. The road has high connectivity with the stream system and crosses small, localized wetlands on the County section at the beginning of the Forest Service section. If the road needs to be maintained under Forest Service management, consider elevating the road with “flow through” design near the wetlands, minimizing fill within the flood plain, and adding additional cross-drains near Cole Creek.

Road 4823000
The road is frequently washed out by the Yakima River during high flows. The road frequently intercepts ground water and the culverts are barriers, preventing fish access to off-channel habitat.

Road 4930000
A portion of the road is located within a glacial trough with frequent debris slides. Additional cross drains are needed. The road provides dispersed recreation access to the riparian area and floodplain of Box Canyon Creek. Continued maintenance and monitoring of these sites is needed to meet Aquatic Conservation Strategy Objectives. Consider narrowing the road adjacent to the lower waterfalls, which will eliminate pullout parking and discourage day use and poaching of bull trout. Relocate the road segment where Box Canyon Creek is cutting into the road fill and just before crossing the large arch culvert. A larger stream-crossing structure is

needed to handle high stream flows and debris.

Road 5400000
A portion of the road parallels the Yakima River providing motorized access to the floodplain, and impeding river flow in approximately the lower 1/4 mile. Consider additional ditch relief culverts within the wet area from Crystal Springs to the Meadow Creek junction. Additional ditch relief is also needed on the segment between the Yakima River and the Snow-Park entrance to reduce sediment input to the Yakima River. Replace the concrete box culvert barriers to provide fish access between the Yakima River and Swamp Lake outflow.

Road 5480000
Severe soil compaction has occurred near the Lost Lake outlet due to motorized access to the floodplain. Consider restricting motorized access. Additional ditch relief is needed in some locations due to groundwater interception.

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for “at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater.

A second select group of moderate risk priorities has been identified as important in controlling road related non-point source sediment pollution, as measured by State of Washington’s Water Quality Standards for sediment. They all are located in “at-risk” sub-watersheds, and are considered cumulative sediment contributors to these watersheds. Generally, they had an overall Aquatic Risk rating of moderate, with a fine sediment criteria score of 5 or greater. Road numbers include:

Road 4948000 (Gale Creek)
Road 5483000 (Meadow Creek)

See Appendix B for additional problem descriptions.

C. Wildlife

The road density in the Yakima Watershed (YW) is high at 2.77 mi/mi^2. Of the 20 road segments in the YW; ten (50%) received a high rating for potential improvement and ten (50%) received a moderate rating.

Roads 3350, 4100, 4110, 4826, 4930, 4948, 5400, 5480, 5483, and 9070
In general, all of the high rated roads in the YW have high potential to improve core habitat through elimination of high density tributary roads, improve security habitat in the Manastash LSR, improve habitat effectiveness for ungulates, primarily relative to young rearing grounds and transition areas, restore riparian areas and connectivity, and restore unique habitats.

Road 3350

This road is also important as larch mountain salamander (PLLA) are located in talus slopes.

In summary, the ratings within the Yakima Watershed tend to be driven by all categories. It is important to note human access needs may limit habitat restoration opportunities at the sub-basin scale.

Cle Elum Watershed

A. Human Use

The main access roads in the Cle Elum valley also serve most of the developed sites and private holdings. These roads are being maintained at level 3 and above. There are a number of roads that served as timber haul roads, that are still important for recreation, fire and other access needs, but which can be managed for high clearance vehicles. Road 4330 will be submitted for capital improvement work. The Cooper trailhead will be evaluated for relocation on Road 4600. Several other segments were recommended for lowering the maintenance level, and these recommendations were consistent with human uses and with public input received during the process.

B. Aquatics

Road 4300112
The road is providing off-road vehicle access to the Bear Creek floodplain and Cle Elum Lake resulting in damaged wetland and riparian vegetation.

Road 4300126
This road provides access within a campground. The low-lying road is located within the Cle Elum River floodplain and is annually inundated for about 0.1 mile. The road interrupts flood flows across the floodplain. Potential restoration includes determining if the campsites within the floodplain can be relocated, relocating the road, revegetating the road shoulder toward the river to stabilize the fill and “floating” the road so flood flows can access the floodplain.

Road 4308000
Road crosses glacial troughs with high stream densities. Debris flows in first order drainages frequently plug culverts. The upper reaches of the road cross localized wetlands. Need to consider improved drainage to pass debris flows without damaging the road and to allow natural debris fan processes to function, and increase the number of culverts to move captured ground water through the road prism without concentrating the flow into a single culvert, and increase ditch relief culverts to reduce sediment transport from the road surface.

Road 4330000
This road has several problem areas. The China Point segment captures run-off and routes the water over the road delivering sediment directly into the Cle Elum River. Road crossings at Scatter, Little Boulder, and Silver Creeks are on alluvial fans. The crossings prevent natural stream migration across the fans, the culverts frequently are plugged by debris causing road scour. The road also provides vehicle access to meadows and wetlands. In order to accommodate streams shifting across the alluvial fans and the debris transport, consider rolling

the road grade with drivable dips. Consider relocating the road segments that impinge on the floodplain and wash out during floods.

Road 4600000
Debris flows are common and the road is a high risk due to slope instability above the road. Approximately the last ¼ mile of the road is within the Kachess River floodplain. Consider adding ditch relief culverts and obliterating the portion of the road within the floodplain accompanied with relocating the trailhead out of the floodplain. Near Cooper Pass the road fill crosses a wetland. Consider installing additional culverts to reduce the current concentrated flow through a single culvert.

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for “at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater.

A second select group of moderate risk priorities has been identified as important in controlling road related non-point source sediment pollution, as measured by State of Washington’s Water Quality Standards for sediment. They all are located in “at-risk” sub-watersheds, and are considered cumulative sediment contributors to these watersheds. Generally, they had an overall Aquatic Risk rating of moderate, with a fine sediment criteria score of 5 or greater. Road numbers include:

Road 4312000 (Thorp Creek)
Road 4316000 (Salmon la Sac C.G.)

See Appendix B for additional specific problem descriptions.

C. Wildlife

The road density in the Cle Elum Watershed (CEW) is moderate at 1.43 mi/mi^2. Of the 15 road segments in the CEW; 9 (60%) received a high rating for potential improvement, five (33%) received a moderate rating for potential improvement and one (7%) received a low rating.

Road 4305
This road runs through large portions of heavy deciduous riparian areas of Corral Creek. It is also an important area for ungulates with regard to transitional areas and deer fawning, and to mountain goat kidding grounds.

Road 4308
This road has very high potential for improvement in all categories. (see table C-1 in Appendix C.)

Road 4312
This road provides a good opportunity to improve core habitat by connecting two small core

fragments.

Road 4315
This road presents an opportunity to improve core habitat and increase habitat security and connectivity with the Teanaway LSR.

Road 4330
Although Road 4330 is a major human access route, alteration of this road could affect access into five major sub-drainages, thereby greatly increasing core habitat. This road also provides a prime opportunity to benefit ungulates, including mountain goats, and to restore riparian habitat.

Road 4600
Alteration of the upper end of Road 4600 could greatly increase core and security habitat, by eliminating one-way access to numerous tributary roads. This area is also used by ungulates, especially mountain goats.

In summary, the ratings within the Cle Elum Watershed tend to be driven by restoration of riparian areas, and security habitat and habitat effectiveness for Late Successional Species. Ratings are also influenced by core availability for wide-ranging carnivores and habitat effectiveness for ungulates.

Swauk Watershed

A. Human Use

The public generally wanted to see roads in this watershed maintained to the current standard. Mining interests in this watershed strongly favor maintaining access. However, in some cases the claimants favor reducing the maintenance level to reduce the amount of traffic into their claims. The watershed is also popular for 4x4 use and again these users felt that maintenance level 2 was fine for some roads. However, they too do not want to lose access. The Liberty town site, campgrounds and administrative sites in this watershed are readily accessed by the main trunk roads and people wanted to see these roads maintained for passenger vehicles.

B. Aquatics

Road 970200
Erosion of the road surface is resulting in severe rutting and sediment delivery to streams. There is a concern over the road location across a landslide-prone area in the headwaters of Blue Creek. Improved drainage and surfacing is needed.

Road 9712000
The road prism becomes saturated and slumps in localized areas. Approximately the lower 2.5 miles of the road is adjacent to Lion Gulch. Motorized access to the floodplain is causing damage to and preventing recovery of riparian vegetation. Access to the floodplain needs to be managed so vegetation can recover, and improved drainage is needed along portions of the road.

Road 9714000

This road needs additional ditch relief and a “permeable fill” to connect subsurface flows to the adjacent floodplain and reduce hydrologic connectivity between the road and Iron Creek. Severe flood related erosion occurs at the end of the road. Consider obliterating approximately the last 0.2 miles and relocate the trailhead. Also consider relocating the road out of the floodplain for the first two miles and last mile.

Road 9738000
Located in the Blue Creek drainage the road crossing at milepost 0.1 is a barrier, preventing fish from moving into Blue Creek from Swauk Creek. The road intercepts groundwater where it crosses several old slumps and landslides. Improved drainage is needed, possibly with “flow-through” design. Improved ditch relief is needed, especially near stream crossings to reduce sediment input to streams and reduce hydrologic continuity with the stream system.

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for “at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater. Road numbers include:

Road 9726000 (Deer Gulch/Williams Creek)

A second select group of moderate risk priorities has been identified as important in controlling road related non-point source sediment pollution, as measured by State of Washington’s Water Quality Standards for sediment. They all are located in “at-risk” sub-watersheds, and are considered cumulative sediment contributors to these watersheds. Generally, they had an overall Aquatic Risk rating of moderate, with a fine sediment criteria score of 5 or greater. Road numbers include:

Road 9726121 (Pine Gulch/Williams Creek)

See Appendix B for additional specific problem descriptions.

C. Wildlife

The road density in the Swauk Watershed (SW) is extremely high at 3.69 mi/mi^2. Of the 11 road segments in the SW, five (46%) received a high rating for potential improvement and six (54%) received a moderate rating.

Road 7320
This road provides a high potential to enhance ungulate habitat for spring, summer and fall ranges and for fawning and calving grounds. This road is also important, as it is the lone access road to one area of Swauk LSR, thereby presenting great potential for improving security habitat and habitat effectiveness.

Road 9702

This road has great potential to enlarge and connect three isolated core areas. There are also opportunities to improve habitat security and connectivity in the Swauk LSR. This area would also benefit from altering this road because of heavy use by deer and elk for summer range, migration, calving and fawning.

Road 9714
This road accesses a roadless area and has high potential to improve all categories. Altering this road could connect fragmented areas of core habitat, improve security habitat, enhance habitat effectiveness for deer, elk and possibly mountain goats, and restore riparian areas.

Road 9718
This road impacts Riparian Reserves, the Swauk LSR and deer and elk fawning and calving grounds.

Road 9738
This road presents an opportunity to greatly improve core and security habitat in the Swauk LSR. Altering this road could greatly improve habitat for deer and elk with regard to fawning, calving and migration. Restoration of numerous unique habitats is also feasible.

In summary, the ratings within the Swauk Watershed tend to be driven by enhancement of security habitat and habitat effectiveness for ungulates. High road densities within this watershed suggest high potential for improvement but also limits due to high human access.

Teanaway Watershed

A. Human Use

This watershed has received the least timber harvest and has the fewest developments of any on the sub-basin. There is a well-developed network of trails providing access to the backcountry, as well as to the Wilderness. The main roads rated as moderate to high for human use. All are considered important access for recreation, though the Beverly area had less importance for other human uses and rated as moderate. No changes in maintenance level were recommended

B. Aquatics

Road 9737000
The road impinges on the North Fork Teanaway flood plain. Motorized access from the road to the riparian zone and flood plain with associated damage to vegetation and stream banks is an increasing concern. There is high hydrologic continuity between the road and stream system due to the road intercepting ground water, which is routed from the ditches to stream crossings. There is a high landslide/debris flow hazard from Camp Wahoo to the end of the road. Road needs to be designed to pass debris and water during a mass erosion event.

Road 9738000
The road confines the Jack Creek flood plain for approximately two miles. The stream is undermining the road in some locations, resulting in accelerated sediment delivery in addition to the reduced flood plain. Road relocation needs to be considered. Drainage improvements are

needed particularly in the upper portions of the road where several old landslides and slumps are crossed.

Moderate Priority Roads by Watershed

One select group of moderate risk roads includes those which do have severe localized problems in high priority fish watersheds. These watersheds are considered significant sub-watersheds for “at-risk” fish species. The overall Aquatic Risk rating was moderate with an "at-risk fish population" criteria score of 6 or greater. Road numbers include:

Road 9703000 (Stafford Creek)

A second select group of moderate risk priorities has been identified as important in controlling road related non-point source sediment pollution, as measured by State of Washington’s Water Quality Standards for sediment. They all are located in “at-risk” sub-watersheds, and are considered cumulative sediment contributors to these watersheds. Generally, they had an overall Aquatic Risk rating of moderate, with a fine sediment criteria score of 5 or greater. Road numbers include:

Road 4305000 (Corral Creek to West Fork Teanaway)

See Appendix B for additional specific problem descriptions.

C. Wildlife

The road density in the Teanaway Watershed (TW) is low at 0.94 mi/mi^2. Of the five road segments in the TW; four (80%) received a high rating for potential improvement and one (20%) received a moderate rating.

Roads 9703, 9737, 9737112, 9738
All four of these roads have issues with all five of the wildlife categories. Alterations to these roads would substantially increase core habitat, improve security habitat and habitat effectiveness in the Swauk and Teanaway LSRs, restore riparian habitat and connectivity, protect ungulate habitat used for calving, fawning, migration and summer range, and protect a high number of unique habitats.

Although there are numerous opportunities for improvement in the Teanaway Watershed, at the sub-basin level of analysis, practical application may be limited due to very high human use.

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 55 of the 69 road segments that were analyzed. The recommended changes in strategy ranged from improvements to lowering maintenance levels. Of the 55 recommended changes, 14 are to make a major improvement of some type to mitigate resource impacts while maintaining passenger car access. This accounts for 93 miles, however in many cases the repair or treatment is at a specific location and is not the full length of the road. Minor improvements, such as installing additional cross drains, or seasonal closures are the recommended strategy on 29 segments. Twenty of the recommended treatments are to preserve the access, but reduce the level of maintenance applied to the road. This would result in lowering the maintenance standard on approximately 59 miles. Of the 20 recommendations, only 10 (approximately 37 miles) are to lower the maintenance level from passenger cars to maintained for high clearance vehicles. The other 10 recommendations are to reduce the maintenance standards, but the road will still be maintained for passenger cars. Only the roads with a recommended change in treatment or strategy are listed in the following tables. A complete listing of all roads analyzed with recommended strategies is included as Table D-1 in Appendix D.

If all the recommended strategies were implemented fully, there would be an annual saving of approximately $85,000 in required maintenance across the district. There would also be a saving of the dollars not spent on the identified deferred maintenance for the roads in the "leave as is"

and “reduced maintenance” categories. However, a substantial amount would be needed to fully implement all the recommended strategies. The specific projects needed to implement these strategies are not known in enough detail at this time 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.

Minimum Affordable Road System

The Forest Service defines the minimum affordable road system as the miles of road by service level that can be maintained to standard with the anticipated maintenance funding. Based on forest averages, it would require approximately $2,295,000 annually to maintain all of the system roads in the Upper Yakima Sub-basin. In Fiscal Year 2000 just over $300,000 (13% of the estimated annual need) was expended for maintenance on these roads. However, rather than maintaining 13% of the roads to full standard, the work was distributed over a much 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, $300,000 was selected as the planned amount for the minimum affordable road system. Based on that funding level and the average costs per mile, the following table displays the extremes of the range of potential road management scenarios. 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 22. Minimum affordable road system options

Maint. level	Option A		Option B	
	mi.	(% of total)	mi.	(% of total)
ML 2 (high cl.)	298	(23)	0	(0)
ML 3-5 (pass.)	0	(0)	79	(6)

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

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

Manatash Watershed

Minor repairs are recommended for Manastash Drive (3100), Manastash Divide (3104), and Tamarack Springs (3120). On the first segment of Manastash Drive (3100), additional drainage structures and possible short segments of relocation are the recommended actions. Seasonal

spring restrictions and possible relocations for short segments are the recommended strategies for the second segment of Manastash Drive. Seasonal spring restrictions are the stratigies recommended for both Manastash Divide (31040) and Tamarack Springs (3120) to improve calving habitat.

Table 23. Management recommendation Manastash Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Manastash Drive	3100000	10.5	M	M	H	Minor repair	Minor repair
Manastash Drive	3100000	9.1	M	H	M	Minor repair	Minor repair
Manastash Divide	3104000	2.6	L	H	H	Minor repair	Minor repair
Tamarack Springs	3120000	6.4	L	H	H	Minor repair	Minor repair

Taneum Watershed

Within the Taneum Watershed major repairs are recommended for the first segment of the Taneum Road (3300), and minor repairs or seasonal restrictions for the second segment of the Taneum Road (3300), Miner Point (3300133), Gnat Flat (3330) and Larkin Loop (3351119). The recommended consideration for the lower portion of the Taneum Road (3300) is elevation the roadway or relocation portions of it. The recommendation is also to consider a winter use restriction for winter habitat. Spring and or winter seasonal restrictions are the recommended strategy for Larkin Loop, Gnat Flat and the upper portion of the Taneum Road. Some additional surface drainage structures are also part of the recommended actions for Larkin Loop and Gnat Flat Road. One final action to consider on Larkin Loop is to restrict or mitigate ORV access to the meadow area. The recommended strategy for Minor Point is to add drainage structures to improve surface drainage.

Table 24. Management recommendation Taneum Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Taneum	3300000	8.2	M	H	H	Major repair	Major repair
Taneum	3300000	12.9	L	H	H	Minor repair	Minor repair
Miner Point	3300133	1.9	L	M	H	Minor repair	Minor repair
Gnat Flat	3330000	8.5	M	H	H	Minor repair	Minor repair
Larkin Loop	3350119	2.1	M	H	H	Minor repair	Minor repair

Naneum Watershed

Spring seasonal restrictions are recommended for all roads listed in the Naneum Watershed to improve deer and elk calving habitats. In addition, winter restrictions should be considered on the lower 9 miles of the Table Mountain road (3500). On the Wilson Creek road (3521) the

recommendation also includes restricting or mitigating access to the meadow, and reducing the maintenance standard to high clearance vehicles. Included in the recommendation for the West Fork Naneum road (3530) is to replace a fish barrier culvert to provide better access to habitat and reduce the maintenance standards to high clearance vehicles.

Table 25. Management recommendations Naneum Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Table Mtn	3500000	9	L	H	H	Minor repair	Minor repair
Table Mtn	3500000	7.3	L	H	H	Minor repair	Minor repair
Pole Patch	3507000	9.1	L	H	M	Minor repair	Minor repair
Wilson Creek	3517000	3.2	L	H	M	Minor repair	Minor repair
Wilson Ridge	3521000	6.2	L	H	L	Lower maint.	Lower maint.
West Fork Nameum	3530000	6.1	L	H	L	Lower maint.	Lower maint.

Upper Yakima Watershed

A major repair or relocation is the recommended action on Cabin Creek (4100), Log Creek (4110) and Box Canyon (4930). The action for the first segment of Cabin Creek is to consider relocating the last 4 miles of the segment. This is the area that was damaged during the floods of the 1990s. The action for the second segment is to also look for relocation options. Since much of this segment goes through private lands, consider terminating the easement and turning the road management responsibilities to another agency.

On the Log Creek road the recommendation is to consider relocation options, as well as improving drainage along the roadway, and possible spring season restrictions for calving habitat. The recommendation for Box Canyon is to consider relocating the last ½ mile of the roadway and relocation of the trailhead. The recommendation is also to consider spring season restrictions for calving habitat and winter season restrictions for Mountain Goat habitat.

On the South Cle Elum Ridge road (3350) the strategy is to consider spring season restrictions to improve calving habitat. The strategy on Gale Creek (4948) and Yakima Pass (5480) is to make drainage improvements.

On Gale Creek there are concerns about the ability of the culverts to pass 100-year flood levels. The recommendation on Meadow Creek (5483) is to look at drainage improvements, consider spring and winter season restrictions, then reduce the maintenance standard to high clearance vehicles.

The strategy for Little Creek (4517), Yakima River (4823) and Cascade (4826) is to reduce the maintenance standard from passenger car to high clearance vehicles. For Keechelus Frontage (4832), Stampede (5400) for the last 3.8 miles, Crystal Springs (5400311), and Yakima Pass

(5480) the recommendation is to reduce the maintenance level from a “4” to a “3.” These roads would still be maintained for passenger cars, however the amount of dust abatement would be reduced. In addition, the Frontage road aquatics concerns are with the width of Gold Creek Bridge. Consider increasing the clearance when I-90 is reconstructed. Finally, on Kachess Rec (4900122) the recommendation is to reduce the Maintenance Level from “5” to “4.” Again, this road would still be passable by passenger car.

Table 26. Management recommendations Yakima Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom mgmt.
Cabin Creek	4100000	12.6	H	H	M	Major repair	Major repair
Cabin Creek	4100000	1.7	H	M	L	Major repair	Major repair
Log Creek	4110000	11.7	H	H	H	Major repair	Major repair
Box Canyon	4930000	4.1	H	H	M	Major repair	Major repair
So. Cle Elum Ridge	3350000	11.1	L	H	H	Minor repair	Minor repair
Gale Creek	4948000	6.7	M	H	M	Minor repair	Minor repair
Yakima Pass	5480000	5.7	H	H	H	Minor repair	Minor repair
Meadow Creek	5483000	5.7	M	H	M	Minor repair/ Lower maint.	Minor repair/ Lower maint.
Little Creek	4517000	5	M	H	M	Lower maint.	Lower maint.
Yakima River	4823000	5	H	H	M	Minor repair/ Lower maint.	Minor repair/ Lower maint.
Cascade	4826000	1.5	L	H	H	Lower maint.	Lower maint.
Keechelus Frontage	4832000	2	M	M	H	Lower Maint	Lower Maint
Kachess Rec	4900122	5.7	M	H	H	Lower maint.	Lower maint.
Stampede	5400000	4.8	H	H	H	Lower maint.	Lower maint.
Crystal Spring	5400311	0.6	M	H	M	Lower maint.	Lower maint.
Yakima Pass	5480000	1.7	L	M	H	Lower maint.	Lower maint.

Cle Elum Watershed

For the French Cabin Creek road (4308) the major repair recommended is redesign of the drainage, particularly to accommodate rain on snow events and spring melting. In addition, the action recommends mitigating or restricting OHV access to off road meadow areas, and seasonal restrictions in winter for goat habitat and spring for calving habitat. Discussions about reconstruction and restrictions will need to include Plum Creek Timber Company. Drainage and user safety are the concerns on the Cle Elum Valley road (4330), which call for a major repair. On Red Mountain CG road (4300126) the minor repair is to look at a few areas where drainage is a concern during flooding. Elevating the roadway may resolve the problem.

The recommendation for Corral Creek is to consider spring season restrictions for calving habitat, and improve surface drainage. On the lower portion of the Cooper road (4600), culvert size should be looked at for 100-year flood passage. For both Thorp Creek (4312) and Little

Salmon La Sac (4315), spring season restrictions are the recommended strategy. The strategy for Little Salmon La Sac also includes lowering the maintenance standard to high clearance vehicles. Lower the maintenance standard to high clearance vehicle is also the recommendation for Sac Snow Park (4315113).

For Wish Poosh CG (4300112), Salmon La Sac CG (4316) and the first portion of Cle Elum Valley (4330) the recommended action is to lower the Maintenance Level from a 5 to 4, which will still accommodate passenger cars and provide dust abatement. The action for Wish Poosh includes restricting the access to the lakebed. Improving drainage at the lower end of the campground is part of the strategy for Salmon La Sac CG. The recommended strategy for the last 2.5 miles of the Cooper road (4600) is to lower the maintenance standard to high clearance vehicle. While the recommendation for Cooper River (4616) is to lower the Maintenance Level from 4 to 3, this will still accommodate passenger cars.

Table 27. Management recommendations Cle Elum Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
French Cabin Cr	4308000	7.4	H	H	H	Major repair	Major repair Talk w/ PC
Cle Elum Valley	4330000	13	H	H	H	Major repair	Major repair/ Talk w/ PC
Red Mtn CG	4300126	0.4	H	H	M	Minor repair	Minor repair
Corral Creek	4305000	4.5	L	H	M	Minor repair	Minor repair
Cooper	4600000	4.8	M	H	H	Minor repair	Minor repair
Thorp Creek	4312000	3.4	M	H	H	Minor repair	Minor repair
Little Salmon La Sac	4315000	5.3	M	H	M	Minor repair/ Lower Maint	Minor repair/ Lower Maint
Sac Snow Park	4315113	0.1	L	L	L	Lower maint.	Lower maint.
Wish Poosh CG	4300112	3	M	H	H	Lower maint. Rest. access	Lower maint. Rest. access
Salmon La Sac CG	4316000	3.7	M	H	H	Minor repair Lower maint.	Minor repair Lower maint.
Cle Elum Valley	4330000	0.2	L	L	H	Lower maint.	Lower maint. Talk w/ PC
Cooper	4600000	4.8	H	H	H	Lower maint. Last 2.5 mi	Lower Maint talk w/ PC
Cooper River	4616000	0.7	L	M	H	Lower Maint	Lower Maint talk w/ PC

Swauk Watershed

The major repair recommendation for Red Top (9702) is to reconstruct the surface and improve drainage, as well as spring season restrictions to protect calving habitat. On Iron Creek (9714) the recommendation is to reconstruct or relocate the first 3 miles of the road. For Deer Gulch

(9726) the strategy recommendation is to reconstruct a portion of the road and provide for fish passage. It also includes spring season restrictions for calving habitat, and reducing the maintenance standard to high clearance vehicles. The recommendations for Liberty Beehive (9712) are to improve surface drainage and restrict or mitigate the off-road access. Drainage improvements are the recommendations for the Cougar Gulch road (9718), and Blue Creek road (9738) along with spring season restrictions. Finally, consider reducing the Maintenance Level from a 4 to a 3 on Mineral Springs CG road. The road will still be passable by passenger cars; however, dust abatement would be reduced.

Table 28. Management recommendations Swauk Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Red Top	9702000	4.5	M	H	H	Major repair	Major repair
Iron Creek	9714000	3.4	H	H	M	Major repair	Major repair
Deer Gulch	9726000	4.5	M	H	M	Major Repair Lower maint.	Major Repair Lower maint.
Liberty Beehive	9712000	10.6	H	H	H	Minor repair	Minor repair
Cougar Gulch	9718000	5.7	M	H	M	Minor repair	Minor repair
Blue Creek	9738000	6.3	H	H	H	Minor repair	Minor repair
Mineral Springs CG	9700112	0.5	L	M	M	Lower maint.	Lower maint.

Teanaway Watershed

The recommendation for Stafford Creek (9703) is to consider relocating or reconstructing a portion of the road, as well as spring season restrictions for calving habitat. The strategy for North Fork Teanaway (9737) also includes looking at relocating a portion of the road, as well as providing additional surface drainage, restricting access of OHV's, and spring and winter restrictions for habitat (9738) protection. Recommendations for Blue Creek include relocation considerations and drainage improvements. Finally, the recommendation for Beverly (9737112) is spring season restrictions for calving habitat.

Table 29. Management recommendations Teanaway Watershed

Road name	FS rd #	Seg length (mi)	Aquatic rating	Wildlife rating	Human use rating	Draft recom. mgmt.	Final recom. mgmt.
Stafford Creek	9703000	3.5	M	H	M	Major repair	Major repair
N. Fork Teanaway	9737000	10	H	H	H	Major repair	Major repair
Blue Creek	9738000	8.3	H	H	H	Major repair	Major repair
Beverly	9737112	0.7	L	H	M	Minor Repair	Minor Repair

Watershed Analysis Priorities

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 analysis. The team looked at the existing conditions and impacts within the watershed, types of use, anticipated future resource management projects (such as dry site management or fuels planning), and the ability or opportunity to make changes. The priorities are shown below. It was believed that the recreational aspect that was occurring across the district was not significantly different to justify rating that portion of the human use module.

Table 30. Watershed ratings

Watershed	Human use rank	Wildlife rank	Aquatic rank	Composite rating
Manastash	H	H	L	3
Taneum	H	H	M	3
Naneum	L	L	L	4
Yakima	M	H	H	2
Cle Elum	M	H	H	2
Swauk	H	H	M	1
Teanaway	H	M	H	1

The Swauk and Teanaway Watersheds were given the highest priority because of the greatest opportunities and possibilities to make a change, associated with the forest management strategies. Dry site management and large scale fire planning will be occurring in these watersheds over the next few years. The Cle Elum and Yakima watersheds have a lot of use and resource concerns, however at this time the opportunities and ability to make changes are a little more limited. These watersheds are in a wetter climate and will not have the same planning efforts as the Swauk and Teanaway. The Manastash and Taneum had fewer resource concerns, and again will not have the same large scale planning efforts, which produce opportunities.

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Appendices

Appendix A: Human Use Rating Criteria
Appendix B: Aquatic Rating Criteria
Appendix C: Wildlife Rating Criteria
Appendix D: Recommended Management Actions
Appendix E: Public Comments
Appendix F: Definitions

Appendix A: Human Use Rating Criteria

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.

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. See the appendix should for more information on the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor.

Criterion 1: Required by law, agreements and permits

This factor includes access needs that are necessary to meet legal requirements such as the Alaska National Interest Conservation Act (ANILCA), treaty requirements, easements, Memorandums of Agreement (MOA's), or permits of various kinds. RS 2477 (Revised Statute 2477) roads are included in this group. This factor includes the legal requirements, agreements, and commitments to other parties. Agreements can sometimes be modified, but usually they are of a long-term nature and can have significant influence on how a road is managed.

Questions addressed

Legal basis (GT-1, 2, and 3)
Special Use Permits (SU-1)

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 which have active permits, cost share agreements, easements or binding agreements.
3. Identify roads or segments that have special use permits.
4. Relative ranking, based on the above information, is:

   High (10): public law requires the road access be provided. These include roads that have Cost/Share agreements and long term easements in place.

   Medium (7): agreements or permits exist, but there are alternatives or options available to meet identified needs.

   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

Criterion 2: Resource Management

This criterion addresses the importance of the road system for 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 a FMAZ zone.

Questions addressed

Value of road for implementation of desired future condition strategies, such as the "Dry Site Strategy"
Administrative Use needs (AU-1)
Value of road for Forest Service and cooperator to suppress wild land 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 road for management of insect, disease, or noxious weed infestations.
Does road system address public health and safety (GT-4)?
Does the Forest have the necessary easements and rights on the road?

Rating

Identify roads that are needed for access to protect forest resources, facilities, or property.
Identify roads that are important for implementation of management strategies.
Identify roads that are important for research, monitoring, or inventory.

Noxious weeds

The arterial and collector roads are common entry points for weeds. Both wet and dry sites have weed infestations; only the species of weeds vary. The analysis did not reveal any sites that were significantly more or less important for weed management.

All of the arterial and collector roads will be needed for long term weed treatment. Access will be needed to get spray machinery to infestation sites as well as for removal and disposal when mechanical treatments are being used. Since the infestations are generally well established along these travel ways, restricting public use would not benefit control efforts. Treatments could be effectively conducted on any maintenance level 2 through 5. So there is no significant difference in weed management for this group of roads with the existing level of weed infestations.

Table A-1. Noxious weed rating

Noxious Weeds	
Points	Rating factors
6	Infestation in dry & mesic
3	Infestation in wet
0	No infestation

Fire and fuels

Roads covered within this analysis provide primary access to wildland fires occurring on the Cle Elum Ranger 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.

Table A-2. Fire and fuels rating

Fire and Fuels	
Points	**Rating Factors**
7	Protection of Life or Property; Access to private or leased property and/or structures.
6	Roads within the LOW Fire Regime (naturally occurring as high frequency/low intensity) with HIGH incidence of human caused fire.
5	Roads within the LOW Fire Regime (naturally occurring as high frequency/low intensity) with LOW incidence of human caused fire.
4	Roads within the MODERATE Fire Regime (naturally occurring with moderate frequency/moderate intensity) with HIGH incidence of human caused fires.
3	Roads within the MODERATE Fire Regime (naturally occurring with moderate

Fire and Fuels	
Points	**Rating Factors**
	frequency/moderate intensity) with LOW incidence of human caused fires.
2	Roads within the HIGH Fire Regime (naturally occurring with low frequency/high intensity) with HIGH incidence of human caused fires.
1	Roads within the HIGH Fire Regime (naturally occurring with LOW incidence of human caused fires.

Air quality

Vehicle travel on roads is a primary contributor of fugitive dust on the forest. Vehicle speed on any given road surface determines the amount of dust or particulate matter that is 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 (PM 2.5). Refer to individual Watershed Assessments for further discussion on the effects and importance of particulate matter.

Table A-3. Air quality rating factors

Air quality	
Points	**Rating factors**
3	Asphalt or Chip-Sealed Surface
2	Crushed Gravel Surface – fugitive dust and particulate matter will depend on vehicle speed and road condition.
1	Native Surface

Silvicultural treatments

Treatments may include fuels reduction, dry site treatments, newly acquired lands needing treatment, routine surveys, stand culturing, and non commercial thinnings.

Table A-4. Silviculture rating factors

Silvicultural treatments	
Points	**Rating factors**
6	In LSR/AMA/Matrix – Important for Commodity removal
0	Other

Commercial harvesting and special forest products

Table A-5. Commercial Harvest and Forest Products ratings factors

Commodities	
Points	**Rating ractors**
6	Matrix – Important for Commodity removal
3	LSR/AMA
1	Administratively Withdrawn
0	Non-Forest (All Allocations)

Firewood – limited gathering in Matrix lands and as part of slash treatment following some projects.

Beargrass, transplants, boughs, cones, posts, poles, etc. – these products are gathered in small quantities from throughout the sub basin. Harvest areas are moved around as the availability and accessibility changes. Much of the gathering occurs in plantations. As the plantations develop, the availability changes, so the most appropriate locations also change. Sometimes the commercial sale of Special Forest Products can be used to thin or prune or to clean up unwanted slash. Other times it is a service provided where there is an abundance of material and there is insignificant impact to any resources.

Table A-6. Special forest products rating factors

Special forest products	
Points	**Rating factors**
3	Firewood in Matrix – Important for Commodity removal and Special Forest Products throughout District
0	Administratively Withdrawn and Other

Non-commercial gathering of Special Forest Products is covered in the Resource Management section. It is primarily done through information and education as a service to the general public.

Range administration

Several watersheds within the sub-basin have active range allotments, while others do not. In those areas where active allotments do exist, the primary need for road access is for “turning on” and removing stock, for access to bedding areas, for driveways and for access to campsites for the herder. Any of these activities can be accomplished adequately on maintenance level 2-5 roads.

There are no allotments in the Upper Yakima, Teanaway or Cle Elum watersheds. The Table Mountain allotment continues to be vacant. The Taneum and Manastash sheep allotment is active, as is the Swauk sheep allotment.

Table A-7. Range rating factors

Range	
Points	**Rating factors**
6	Road provided access for range permittee
0	Road does not provide access for range permittee

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

Criterion 3: Public Access and Level of Use

The criterion 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 just 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. There would also be instances in which Forest-managed road systems would be used by persons involved with administrative or contractual activities. Their access needs could be associated with other factors such as fire protection or rehabilitation projects.

Since 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 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 of facilities developed 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.

Questions 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)
Unroaded recreation values (UR-1 through 5)
Roaded recreation values (RR-1 through 5)
Access to developed sites
Access to undeveloped sites
Consistency with Recreation Opportunity Spectrum (ROS) classifications in the Forest Plan

Table A-8. Level of public use

Level of public use	
Points	**Rating factor**
10	All elements are rated as important. Access to developed facilities; Popular drive or loop; heavily used for dispersed recreation and or camping; groomed snowmobile trail; accesses destination site; point of interest of scenic view point; access to recreation event site; popular hunting area; fishing area; berry picking area; Christmas tree gathering area; Public stated importance; Native American stated importance.
9	1 element not present or several of lesser importance.
8-6	Varying numbers of elements not present, or of lesser importance.
5	Few elements present and of moderate to low importance.
3	One element present of low importance

Data sources

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

Criterion 4: Economics

This criterion 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 by 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. 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."(USDA, USDI 1996) 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

Identify roads or segments that access developed sites, fee sites, concession, or commercial permit operations, and that are necessary to directly support these services.
Identify roads or segments that are important for activities, which provide revenue to local communities and businesses.
Identify roads or segments that are important for commodity extraction; either commercial timber or commercial sale of special forest products.

Table A-9. Economics rating factors

Economics	
Points	**Rating factors**
10	Commodities, Special Products, and Local Businesses all rank as highly important plus highly important for Recreation fee campgrounds.
9	3 of 3 elements high and 1 medium
8	2 of 3 high and 1 medium
6	All elements medium and low recreation fee importance
5	2 elements moderate and 1 low
4	1 element moderate and 2 low and no fee campgrounds
3	All elements of low importance

Data sources

Sales Tax
Costs for Police, Ambulance and Fire services
SCORP report
Permits

Appendix A Works Cited

U.S. Department of Agriculture, Forest Service; U.S. Department of Interior, Bureau of Land Management. 1996. Integrated scientific assessment for ecosystem management in the Interior Columbia Basin, and portions of the Klamath and Great Basins. Pacific Northwest Research Station, Portland Oregon. 197p.

Table A-10. Human uses: Yakima Sub-Basin, Cle Elum

Road seg. #	FS rd. #	Seg. length	Access required by law/agree	Res. mgmt.	Use level	Econ.	Public concern express	Total score	Rating H/M/L
1	3100	10.5	10	10	10	10	*	40	H
2	3100	9.1	10	4	10	6	*	30	M
3	3104	2.6	10	10	10	10		40	H
4	3111	6.6	8	8	10	10		36	H
5	3120	6.4	10	8	9	9		36	H
6	3120109	0.6	8	2	8	0		18	M
7	3300	8.2	10	9	10	8	*	37	H
8	3300	12.9	10	7	10	8	*	35	H
9	3300112	0.3	10	4	10	6		30	H
10	3300133	1.9	10	7	10	8		35	H
11	3330	8.5	10	7	10	8		35	H
12	3350	11.1	10	8	10	8	*	36	H
13	3350119	2.1	10	8	10	8		36	H
14	3500	9	10	10	10	10	*	40	H
15	3500	7.3	10	7	10	8	*	35	H
16	3507	9.1	3	7	8	6	*	24	M
17	3517	3.2	3	8	8	9	*	28	M
18	3521	6.2	0	7	8	6	*	21	L
19	3530	6.1	0	7	8	6		21	L
20	4100	12.6	10	6	7	7		30	M
21	4100	1.7	10	2	5	1		18	L
22	4110	11.7	10	7	8	7		32	H
23	4300112	3	10	4	10	8		32	H
24	4300123	0.7	10	4	10	7		31	M
25	4300126	0.4	10	4	10	5		29	M
26	4305	4.5	9	7	4	5		25	M
27	4308	7.4	10	7	8	7		32	H
28	4312	3.4	10	7	8	7		32	H
29	4315	5.3	8	7	8	6	*	29	M

Road seg. #	FS rd. #	Seg. length	Access required by law/agree	Res. mgmt.	Use level	Econ.	Public concern express	Total score	Rating H/M/L
30	4315113	0.1	5	2	3	3	*	13	L
31	4316	3.7	10	4	10	10		34	H
32	4330	0.2	10	4	10	10	*	34	H
33	4330	13	10	8	10	9	*	37	H
34	4517	5	8	8	4	6		26	M
35	4600	4.8	10	9	10	9		38	H
36	4600	4.8	10	7	9	8		34	H
37	4616	0.7	10	8	10	6		34	H
38	4616113	2	10	4	10	7		31	M
39	4823	5	10	8	6	6	*	30	M
40	4826	1.5	10	8	9	8	*	35	H
41	4832	2	10	9	10	8	*	37	H
42	4832	7.5	10	8	7	7		32	H
43	4900	2	10	9	10	10		39	H
44	4900122	5.7	10	2	10	10	*	32	H
45	4930	4.1	6	6	10	8	*	30	M
46	4934	9.3	10	7	7	7		31	M
47	4948	6.7	8	7	7	7		29	M
48	5400	4.8	10	8	10	8		36	H
49	5400311	0.6	10	4	10	7		31	M
50	5480	1.7	10	8	8	7		33	H
51	5480	5.7	9	8	8	7		32	H
52	5483	5.7	10	6	7	6		29	M
53	7320	4.1	10	8	7	6	*	31	M
54	9070	5.6	10	6	8	8		32	H
55	9700112	0.7	10	4	10	7		31	M
56	9700120	0.5	10	4	10	6		30	M
57	9702	4.5	9	8	9	8		34	H
58	9703	3.5	10	6	9	6		31	M
59	9712	10.6	9	8	9	7	*	33	H
60	9714	3.4	8	8	7	6		29	M

Road seg. #	FS rd. #	Seg. length	Access required by law/agree	Res. mgmt.	Use level	Econ.	Public concern express	Total score	Rating H/M/L
61	9716	3.8	10	8	10	8		36	H
62	9718	5.7	6	8	9	7	*	30	M
63	9726	4.5	9	8	6	5	*	28	M
64	9726121	1.3	9	8	6	6		29	M
65	9737	10	10	7	10	9	*	36	H
66	9737112	0.7	8	5	6	5		24	M
67	9737125	0.4	10	4	10	5		29	M
68	9738	14.6	8	7	9	8	*	32	H
69									

Appendix B: Aquatic Rating Criteria

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
Geologic Hazard
Road Related Sediment
Floodplain off-channel habitat riparian reserve function
Flow Effects
At-risk fish populations and wetlands.
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 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 (USDA FS 2000). 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 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)

Rating

Fine Sediment - Watershed Condition

Score 1 = Watershed is rated as Functioning Appropriately for fine sediment; transportation system consistent with the Aquatic Conservation Strategy (ACS).

Score 3 = Watershed is rated as At Risk for fine sediment; road system is a contributor to fine sediment but is not believed to be a major contributor and road system is generally consistent with ACS.

Score 6 = Watershed is rated as At Risk for fine sediment; roads are believed to be a major source of fine sediment and road system is inconsistent with ACS.

Score 10 = Watershed is rated as Functioning At Unacceptable Risk for fine sediment; road system is believed to be a major contributor of fine sediment, and road system is inconsistent with the ACS.

Fine Sediment – Segment

Score 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.

Score 3 = Road segment is native surfaced, or graveled 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.

Score 5 = road segments not meeting above criteria to some degree but potential impacts to at-risk fish habitat appear to be minor due to 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.

Score 10 = Road segments with high potential impacts 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 and it is highly likely the stream will travel down the road and deliver sediment to at-risk fish habitat, crossings are altering stream channel type downstream and/or causing downstream bank erosion.

Criterion 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 concentrating 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 effects occur 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 which 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 may 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, litter fall and riparian plant communities (AQ – 11)
Affects of fishing, poaching and direct habitat loss for at-risk aquatic species (AQ – 12)

Rating

Flood Plain Function – Watershed Condition

1 = Main arterials and collectors are not located in valley bottoms or if located in valley bottom are not 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.

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 impacts 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.

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.

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.

Flood Plain Function – Road Segment

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.

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 are showing signs of degrading in localized areas (see

indicators above).

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 4: Flow Effects

Criterion 4 addresses if road segment:

Intercepts surface runoff and near surface ground water, along cut slopes and ditch lines, converting subsurface flows to surface flows.

Increases 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 connectively" is defined as any road segment that, 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

Flow Effects – Watershed Condition

1 = Roads are not greatly impacting watershed function. Road Density and Location, changes in peak/base flows are Functioning Appropriately.

3 = Road Density and Location are Functioning At Risk but Change in Peak/Base Flows is Functioning Appropriately

6 = Road Density and Location are Functioning At Risk or Unacceptable Risk and Change in Peak/Base Flows is Functioning At Risk

9 = Road Density and Location is Functioning At Risk or Unacceptable Risk and Change in Peak/Base flows is Functioning At Unacceptable Risk

Flow Effects – Segment

Score 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.

Score 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 increased peak flows.

Score 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 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 impacts to at-risk fish or their habitat. Besides the potential impacts to aquatic habitat, roads 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

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.
Score 0 = No at-risk fish present in the sub-basin or watershed

Score 1 = At-risk fish are present but there are no significant sub-watersheds.

Score 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.

Score 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.)

Score 9 = Multiple significant sub-watersheds exist for multiple species or watershed represents a refugia within the sub-basin for one or more species

At-Risk Fish Populations – Road Segment (AQ - 7, 10, 12, 14)

Score 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.

Score 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 to other species.

Score 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.

Score 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.

Score 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.

Score 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 impacts 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 6: Wetlands and Wet Meadows

This criterion address whether wetlands are present along road systems, if segments interfere with their condition and function, ground water movement or wetland vegetation.

A road segment's influence on the condition and function of adjacent wetlands is a result of either a direct impact such as:

- A road location relative to the wetland
- Indirect impacts related to the roads effect on the wetland supporting hydrology
- 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 erosion and lower water tables
- Increasing sediment loading and delivery of toxic pollutants
- Conversions in plant species composition by introducing noxious weeds
- Reducing base flows and increasing peak flow and flood frequencies and degrade water quality

Of these effects, those that affect the areas ability to receive, store and move water will likely have the greatest impact on the wetland's condition and function.

Questions Addressed

Affects of wetlands

Rating

Listed below is a summary of hazard rating for road segments.

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.

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.

6 = Road segment is adjacent to or crosses landscape scale wetland's or wet meadows. The road's location and design have displaced or degraded the wetland's size and function. Runoff is being delivered directly to the wetland, increasing sediment and contaminant loadings. Crossings of surface and near surface water paths have severely limited the volume, timing and distribution of water necessary to saturate the landform and support the wetland's vegetation and soil characteristics. Road segment may be providing motorized off-road vehicle access into the area, further contributing to its degradation.

Appendix B Works Cited

U.S. Department of Agriculture, Forest Service. 2000. Landtype associations of North Central Washington, Wenatchee, Okanogan and Colville National Forests. Preliminary report, unpublished document. On file with Okanogan and Wenatchee National Forest Headquarters Office, 215 Melody Lane, Wenatchee, WA. 98801. 98 p.

Table B-1a. Aquatic impact and risk: Yakima Sub-Basin, Cle Elum Ranger District

Rd. seg. #	FS rd. #	Seg. lgth.	Geol. haz.	Rd-related fine sed.	Floodplain funct.	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating
1	3100000	10.5	6	3	6	3	3	3	24	Mod
2	3100000	9.1	6	3	6	3	1	6	20	Mod
3	3104000	2.6	6	3	1	3	1	3	17	Low
4	3111000	6.6	2	3	1	3	1	3	13	Low
5	3120000	6.4	2	3	6	3	1	3	18	Low
6	3120109	0.6	2	3	1	3	1	3	13	Low
7	3300000	8.2	2	1	6	3	3	6	21	Mod
8	3300000	12.9	2	3	1	3	3	3	15	Low
9	3300112	0.3	0	1	6	0	3	0	10	Low
10	3300133	1.9	2	3	6	3	3	0	17	Low
11	3330000	8.5	6	3	1	3	3	3	19	Mod
12	3350000	11.1	0	3	1	3	3	3	13	Low
13	3350119	2.1	2	3	1	3	3	6	18	Mod
14	3500000	9	0	1	1	0	3	0	5	Low
15	3500000	7.3	0	3	1	3	1	6	14	Low
16	3507000	9.1	2	3	1	0	1	0	7	Low
17	3517000	3.2	0	3	1	3	1	6	14	Low
18	3521000	6.2	2	3	1	3	1	3	13	Low
19	3530000	6.1	2	3	1	3	3	3	15	Low
20	4100000	12.6	2	5	9	9	6	0	31	High
21	4100000	1.7	2	5	9	9	6	3	34	High
22	4110000	11.7	6	10	9	9	3	0	37	High
23	4300112	3	2	1	6	0	5	6	20	Mod
24	4300123	0.7	0	3	6	0	5	0	14	Low
25	4300126	0.4	2	5	9	9	5	0	30	High
26	4305000	4.5	2	5	1	3	5	0	16	Low

Rd. seg. #	FS rd. #	Seg. lgth.	Geol. haz.	Rd-related fine sed.	Floodplain funct.	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating
27	4308000	7.4	9	5	6	9	5	3	37	High
28	4312000	3.4	9	5	1	3	3	0	21	Mod
29	4315000	5.3	6	3	1	3	5	6	24	Mod
30	4315113	0.1	2	5	1	3	5	0	16	Low
31	4316000	3.7	0	5	9	3	5	0	22	Mod
32	4330000	3.2	2	1	6	0	5	0	14	Low
33	4330000	13	6	5	6	9	5	6	37	High
34	4517000	5	2	5	6	3	3	0	19	Mod
35	4600000	4.8	9	5	1	9	1	0	25	Mod
36	4600000	4.8	6	3	6	3	6	3	27	High
37	4616000	0.7	2	3	1	0	1	0	7	Low
38	4616113	2	2	3	1	0	1	0	7	Low
39	4823000	5	2	10	6	9	10	3	40	High
40	4826000	1.5	2	3	1	3	6	3	18	Low
41	4832000	2	2	1	6	3	8	3	23	Mod
42	4832000	7.5	6	5	1	3	6	3	24	Mod
43	4900000	2	2	1	1	0	6	0	10	Low
44	4900122	5.7	2	1	9	0	10	3	25	Mod
45	4930000	4.1	6	5	6	9	10	3	39	High
46	4934000	9.3	2	3	1	3	6	0	15	Low
47	4948000	6.7	2	5	6	3	3	6	25	Mod
48	5400000	4.8	2	3	6	3	10	3	27	High
49	5400311	0.6	2	3	6	3	6	0	20	Mod
50	5480000	1.7	2	3	6	0	6	0	17	Low
51	5480000	5.7	2	5	6	3	8	3	27	High
52	5483000	5.7	6	5	6	3	3	0	23	Mod
53	7320000	4.1	2	1	6	0	3	0	12	Low
54	9070000	5.6	2	3	1	3	1	0	10	Low
55	9700112	0.7	0	1	6	0	3	0	10	Low
56	9700120	0.5	0	3	1	0	3	0	7	Low
57	9702000	4.5	6	5	1	3	3	6	29	High

Rd. seg. #	FS rd. #	Seg. lgth.	Geol. haz.	Rd-related fine sed.	Floodplain funct.	Flow effects	At-risk fish pop.	Wetlands & meadows	Aquatic total	Aquatic rating
58	9703000	3.5	2	5	9	3	5	0	24	Mod
59	9712000	10.6	6	5	6	3	1	6	27	High
60	9714000	3.4	2	5	9	3	6	3	28	High
61	9716000	3.8	2	3	1	3	1	0	10	Low
62	9718000	5.7	2	5	6	3	3	3	22	Mod
63	9726000	4.5	2	5	6	3	5	3	24	Mod
64	9726121	1.3	2	5	6	3	1	0	17	Low
65	9737000	10	6	5	9	9	10	3	42	High
66	9737112	0.7	2	3	1	0	6	0	19	Mod
67	9737125	0.4	2	3	1	0	6	0	12	Low
68	9738000	8.3	2	10	9	3	5	3	32	High
69	9738000	6.3	6	5	6	3	6	3	29	High

Table B-1b. Comments: Aquatic risk and impact, Yakima Sub-Basin, Cle Elum Ranger District

Road seg. #	FS rd #	Seg. length	Comments
1	3100000	10.5	
2	3100000	9.1	
3	3104000	2.6	
4	3111000	6.6	
5	3120000	6.4	
6	3120109	0.6	
7	3300000	8.2	
8	3300000	12.9	
9	3300112	0.3	
10	3300133	1.9	
11	3330000	8.5	
12	3350000	11.1	No visible erosion; majority or road on ridgeline; some additional ditch work for peak events on lower 4 miles; small localized seeps and springs on upper section of road.
13	3350119	2.1	
14	3500000	9	
15	3500000	7.3	
16	3507000	9.1	
17	3517000	3.2	
18	3521000	6.2	
19	3530000	6.1	

Road seg. #	FS rd #	Seg. length	Comments
20	4100000	12.6	Culverts undersized; provides floodplain access is a problem restricting channel migration locally (2-3 mi); most is in high hydrologic connectivity with stream; portion in U Yakima sig for Bull T; more than half the rd is in floodplain.
21	4100000	1.7	Road is in floodplain and is overtopped in high water; high connectivity to stream; crosses small localized wetlands on county section and on FS.
22	4110000	11.7	Debris slides onto road taking out prism; accelerating mass wasting directly into stream; 70% of distance is in floodplain; glacial trough with high stream density intercepting hillslope connectivity of water; potential steelhead access blocked by diversion, significant for cutthroat.
23	4300112	3	Access to Bear Creek floodplain; Bull Trout in Cle Elum Lake; provides motorized access into lake drawdown.
24	4300123	0.7	Located on terrace; past work to block access to Cle Elum floodplain needs to be maintained;
25	4300126	0.4	Indutated annually over 0.1 mi; interrupting flow of water across floodplain.
26	4305000	4.5	Upgrade culverts for high flow volume; intercepting peak events but not groundwater.
27	4308000	7.4	Glacial troughs with high density streams, debris flows in first order drainages; hillslope failures from Plum Cr CC above roadplug culverts; some access provided onto floodplain; Bull Trout in Cle Elum; crosses localized wetlands in upper basin.
28	4312000	3.4	Localized sed. is high but at risk spp are downstream; upper 1/3 of road intercepts groundwater over short distances.
29	4315000	5.3	Glacial trough but without high density first order drainages for debris flows; culverts sized appropriately but need more drainage work with veg filters; only localized groundwater interception; Bull Trout in main stem Cle Elum; road drains wetland in Sec 22.
30	4315113	0.1	Paved into snow park; sediment generated to outlet channel and river; borrow pit needs drainage improvement.

Road seg. #	FS rd #	Seg. length	Comments
31	4316000	3.7	Unpaved section at south end of loop needs fords, remove fills; all in floodplain;
32	4330000	0.2	Toe of fill in floodplain constraining river;
33	4330000	13	Road crossings at Scatter Cr and L Boulder, Silver Cr on alluvial fan are preventing stream diversions across fan; coarse glacial material minimizes sed. problem because of lack of fines; provides off road floodplain access in upper meadows; frequent runoff onto roads at alluvial fan crossings; upper 2 miles parallel wetland.
34	4517000	5	Localized crossings blow out because of location on fan, need more culverts;
35	4600000	4.8	Glacial trough, many first order drainages, debris flows common, coarse textured sed with little fines; paved but undersized crossings; frequent intercepting of runoff.
36	4600000	4.8	Lower density of first order drainages and debris flows; some ditch relied culverts needed; last 1/2 mile is in floodplain of Kachees R., could relocate trailhead; wetland and at risk issues due to last 1/2 mi of road and prox to Kachees R. and bogs.
37	4616000	0.7	Locally low density first order drainages and debris flows;
38	4616113	2	
39	4823000	5	Road washes out at high flows in Yakima R.; frequent interception of groundwater; culvert barriers to off-channel habitat;
40	4826000	1.5	Some localized wetlands, ground water, but culverts have been added.
41	4832000	2	Low density first order drainages that are source of debris slides; localized narrowing of Gold Cr at crossing; non-documented poaching report.
42	4832000	7.5	Need additional drainage; localized intercepting groundwater at Resort Cr.; highway crossings are a barrier to Bull T.
43	4900000	2	Kachees is significant.

Road seg. #	FS rd #	Seg. length	Comments
44	4900122	5.7	Motorized access to Box Cyn and Kachees Lake; known poaching Box Cyn Cr mouth.
45	4930000	4.1	Glacial trough with high density debris flows; additional culvert work needed; motorized access control needs continual mtce and monitoring; ditch interception of groundwater; Bull Trout poaching in Box Cyn Cr.
46	4934000	9.3	Occasional ditch relied needed.
47	4948000	6.7	Undersized culverts, surface washing; localized areas of channel encroachment interception of groundwater in head of Gale Cr.
48	5400000	4.8	Parallels Yakima floodplain in lower section, provides access to floodplain; impeding flow at first 1/4 mile; additional ditch relief at wet area from Crystal Sp to Meadow Cr junction; barriers to off-channel.
49	5400311	0.6	
50	5480000	1.7	
51	5480000	5.7	Bull trout barrier at railroad grade, access to floodplain at Lost Lake outlet, groundwater interception localized and ditch relief necessary
52	5483000	5.7	
53	7320000	4.1	
54	9070000	5.6	
55	9700112	0.7	
56	9700120	0.5	
57	9702000	4.5	Road surface ruts easily, insufficient drainage, road crosses high landslide area in headwaters of Blue Crk with several wetlands
58	9703000	3.5	
59	9712000	10.6	Localized saturated road prisms and slumping, road cutting toe of wet areas with ohv disturbance, lower 2.5 miles adjacent to Lion Gulch with motor veh. access to floodplain, cross drains and surfacing needed.

Road seg. #	FS rd #	Seg. length	Comments
60	9714000	3.4	Flow effects 9, add ditch relief for flow haz, erosion severe @ ford, more floodplain/road relocation needed. Floodplain restoration needed from 1st culv. to end to reduce flow effects.
61	9716000	3.8	
62	9718000	5.7	
63	9726000	4.5	
64	9726121	1.3	
65	9737000	10	road impinging floodplain, motorized access to f.p., interception of hillslope runoff and groundwater routed direct to ditches and culverts. Landslide/debris flow hazard from below Camp Wahoo to end (4 mi.) 3 listed spp.
66	9737112	0.7	road impinging floodplain, motorized access to f.p., interception of hillslope runoff and groundwater routed direct to ditches and culverts. Landslide/debris flow hazard from below Camp Wahoo to end (4 mi.) 3 listed spp.
67	9737125	0.4	
68	9738000	6.3	
69	9738000	8.3	

Appendix C: Wildlife Rating Criteria

This section of the roads analysis characterizes the wildlife/road interactions that occur within each watershed within a sub-basin. The sub-basin analysis will identify Level 3-5 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 upon the wildlife issues within each watershed and the potential to provide benefits to the restoration of wildlife habitats. Table C-2 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" (USDA FS 1999). The analyses described in this document are adapted from the TW questions to better address the issues and conditions on the Okanogan and Wenatchee National Forests.

In the questions addressed section an alphanumeric code corresponds to the section in Appendix 1 of the "Roads Analysis Handbook." This code is linked to an ecological consideration, which has been formulated as a question. Each risk factor being evaluated addresses one or more of these questions. For more information about the risk factor, including a list of potential indicators (tools) that may be considered to appropriately rate each factor, see the appendix.

Definitions

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

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

Open road: A road 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.

Table C-1. A 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

Species group/Habitat	High	Moderate	Low
Unique Habitats	10	6	2

Table C-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 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 1: Wide-Ranging Carnivores

This group of species includes the grizzly bear (threatened), gray wolf (endangered), wolverine, and lynx (threatened). Several studies have documented the effects of road-associated factors on carnivores and they 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)
Affect to habitat by facilitating human activities (TW – 2)
Affect to legal and illegal human activities such as trapping, hunting, poaching (TW – 3)

Rating

Analysis area: The watershed (5th Field) within the sub-basin (4th Field).

Follow the process described in the Interagency Grizzly Bear Committee Task Force Report (Puchlerz 1998) to develop maps of core areas and road densities within each watershed in the sub-basin.

Identify issues and priorities for further watershed level roads analysis and for habitat restoration of Level 3-5 roads in each watershed within the sub-basin based on the following:

Amount and location of core areas in the watershed.
Road density within the watershed, defined as: high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.
Proportion of the watershed affected by winter use of road in a Lynx Analysis Unit.
Relative Ranking. Based on the above information rank the watershed and the Level 3-5 road as follows:
Low (1) – low potential to improve conditions for the target species.
Moderate (5) – moderate potential to improve conditions for the target species.
High (9) – high potential to improve conditions for the target species.

Criterion 2: Late-Successional Associated Species

Over 100 of the wildlife species identified on the Wenatchee National Forest were associated

with some type of late-successional forest type (USDA FS 1997). A review of the available literature on these species showed that approximately one-third could be affected by roads or road-related activities (USDA FS 1997). Road-associated factors that could affect these species include collisions, movement barriers, displacement/avoidance, habitat loss and fragmentation (USDA FS 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 such as trapping, hunting, poaching (TW – 3)

Ratings

Analysis Area: The watersheds within the sub-basin

Follow the process outlined in the Wenatchee National Forest Late-Successional Reserve Assessment (LSRA, page 107 of the forest wide). Refer to the LSRA to determine the current condition of security habitat within the LSR.

Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities for each watershed within the sub-basin based on the following:

Juxtaposition of late-successional habitat to road or road segment.
Road density (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2.) and security habitat conditions within the LSR.
Potential of the road to enhance security habitat within the LSR.

Relative Ranking. Based on the above information rank the watershed and the Level 3-5 roads as follows:

Low (2) – low potential to improve the security habitat and habitat effectiveness in the LSR.
Moderate (6) – moderate potential to improve the security habitat and habitat effectiveness in the LSR.
High (10) – high potential to improve the security habitat and habitat effectiveness in the LSR.
If none of the watershed is within an LSR score as 0.

Criterion 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 (USDA FS 1997, Singleton and Lehmkuhl 1998, Maxwell and Hokit 1999, Wisdom et al. 1999).

This analysis addresses terrestrial wildlife roads analysis question TW (4) identified in “Roads Analysis: Informing Decisions about Managing the National Forest Transportation System”

(USDA FS 1999).

Questions Addressed

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

Rating

The Analysis Area: The watersheds within the sub-basin.

Determine the area within riparian reserves and density of roads within riparian reserves.

Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities for each watershed within the sub-basin based on the following:

Proportion and area of the watershed in riparian reserves.
Road density within the riparian reserves (high = >2mi/mi^2, moderate = 1-2mi/mi^2, and low = <1 mi/mi^2).
Proportion of Level 3-5 roads that occurs in the riparian reserve.

Relative Ranking. Based on the above information rank the watershed and Level 3-5 roads as follows:

Low (2) – low potential to restore riparian habitat and habitat connectivity.
Moderate (6) – moderate potential to restore riparian habitat and habitat connectivity.
High (10) – high potential to restore riparian habitat and habitat connectivity.
None (0) – road not located in a riparian reserve.

Criterion 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 (USDA FS 1997, Singleton and Lehmkuhl 1998, Canfield et al. 1999, Wisdom et al. 1999).

This analysis addresses, in part, terrestrial wildlife roads analysis questions TW (1), TW (2), and TW (3) identified in Roads Analysis: Informing Decisions about Managing the National Forest Transportation System (USDA FS 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, such as trapping, hunting, poaching (TW – 3)

Rating

Analysis Area: The watersheds within the sub-basin.

Determine the proportion and area of winter ranges, young rearing areas, and migration routes for these ungulate species within each watershed.

Identify the issues and priorities for further analysis and Level 3-5 road restoration opportunities based on the following:

Proportion and area of the winter range, young rearing areas, and migration routes in each watershed.

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.

Potential of the Level 3-5 road to enhance winter range, based on actual winter range and not EW (1), young rearing areas and migration routes through a management action.

Relative Ranking. Based on the above information rank the Level 3-5 roads and watershed as follows:

Low (1) – low potential to enhance habitat effectiveness of winter ranges, young rearing areas and migration routes.

Moderate (5) – moderate potential to enhance the habitat effectiveness of winter ranges, young rearing areas and migration routes.

High (9) – high potential to enhance habitat effectiveness of winter ranges, young rearing areas and migration routes

None (0) - not located on winter range, young rearing area or migration route for ungulates.

Criterion 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 (USDA FS 1997, Singleton and Lehmkuhl 1998, Wisdom et al. 1999).

This analysis addresses terrestrial wildlife roads analysis question TW (4) identified in “Roads Analysis: Informing Decisions about Managing the National Forest Transportation System” (USDA FS 1999).

Questions Answered

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

Rating

The Analysis Area: the watersheds within the sub-basin.

Identify the unique habitats within each watershed.

Identify the issues and priorities for further analysis, and Level 3-5 road restoration opportunities based on the following:

The density of unique habitats (acres/mile road within 100m of Level 3-5 road) within the watershed.

The quantity of unique habitats (number of unique habitat types/road segment or road within 100m of Level 3-5 roads).

Rating of unique habitats will be based on the following formula and then applied to relative ranking below:

Low density + low quantity = low

Low/moderate density + moderate quantity = moderate

Moderate density + low/moderate quantity = moderate

High/moderate density + high quantity = high

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.

Relative Ranking. Based on the above information rank the watershed as follows:

Low (2) – low density/quantity of unique habitats and low potential to restore unique habitats.

Moderate (6) – moderate density/quantity of unique habitats and moderate potential to restore unique habitats.

High (10) – high density/quantity of unique habitats and high potential to restore unique habitats.

None (0) – Level 3-5 road does not affect unique habitats.

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Table C-3. Results of roads analysis, rating and notes, for wildlife habitat on Methow Sub-Basin

Road seg #	FS rd #	Seg length	Wide range carniv.	Late success species	Riparian depend.	Ungulates	Unique habitats	Wildlife total	Wildlife Rating
1	3100000	10.5	5	0	6	1	6	18	M
2	3100000	9.1	9	10	2	5	6	32	H
3	3104000	2.6	9	10	6	9	6	40	H
4	3111000	6.6	0	0	2	9	6	17	M
5	3120000	6.4	5	6	2	9	6	28	M
6	3120109	0.6	1	2	0	5	6	14	M
7	3300000	8.2	1	6	10	9	6	32	H
8	3300000	12.9	5	6	10	9	6	36	H
9	3300112	0.3	1	2	10	5	2	20	M
10	3300133	1.9	1	2	10	5	2	20	M
11	3330000	8.5	5	10	2	9	6	32	H
12	3350000	11.1	9	10	2	9	6	36	H
13	3350119	2.1	9	10	0	9	6	34	H
14	3500000	9	9	10	2	9	10	40	H
15	3500000	7.3	9	10	6	9	10	44	H
16	3507000	9.1	9	10	6	9	10	44	H
17	3517000	3.2	6	6	2	9	6	29	M
18	3521000	6.2	9	10	10	9	10	48	H
19	3530000	6.1	9	10	6	9	10	44	H
20	4100000	12.6	9	10	6	9	6	40	H
21	4100000	1.7	1	1	10	5	2	19	M
22	4110000	11.7	9	10	6	9	6	40	H
23	4300112	3	0	6	6	5	10	27	M
24	4300123	0.7	0	6	6	5	10	27	M
25	4300126	0.4	0	6	6	5	10	27	M

Road seg #	FS rd #	Seg length	Wide range carniv.	Late success species	Riparian depend.	Ungulates	Unique habitats	Wildlife total	Wildlife Rating
26	4305000	4.5	1	6	10	9	6	32	H
27	4308000	7.4	9	10	10	9	10	48	H
28	4312000	3.4	9	10	10	5	6	40	H
29	4315000	5.3	9	10	6	9	6	40	H
30	4315113	0.1	1	6	2	5	2	16	M
31	4316000	3.7	1	10	10	9	10	40	H
32	4330000	0.2	1	1	0	0	0	2	L
33	4330000	13	9	10	10	9	10	48	H
34	4517000	5	9	10	2	5	2	28	M
35	4600000	4.8	9	6	10	5	2	32	H
36	4600000	4.8	9	10	10	9	10	48	H
37	4616000	0.7	1	2	2	5	6	16	M
38	4616113	2	9	10	10	9	2	40	H
39	4823000	5	0	2	10	5	6	23	M
40	4826000	1.5	5	10	10	9	10	44	H
41	4832000	2	0	0	6	1	6	13	M
42	4832000	7.5	1	2	6	5	6	20	M
43	4900000	2	1	2	10	1	6	20	M
44	4900122	5.7	0	2	10	5	10	27	M
45	4930000	4.1	9	10	10	9	10	48	H
46	4934000	9.3	5	6	6	5	6	28	M
47	4948000	6.7	9	10	10	5	10	44	H
48	5400000	4.8	9	10	2	9	6	36	H
49	5400311	0.6	0	2	10	1	10	23	M
50	5480000	1.7	1	2	6	5	2	16	M
51	5480000	5.7	9	10	10	5	6	40	H
52	5483000	5.7	9	10	10	9	10	48	H
53	7320000	4.1	5	10	2	9	6	32	H

Road seg #	FS rd #	Seg length	Wide range carniv.	Late success species	Riparian depend.	Ungulates	Unique habitats	Wildlife total	Wildlife Rating
54	9070000	5.6	9	10	10	9	10	48	H
55	9700112	0.7	0	6	10	5	6	27	M
56	9700120	0.5	1	2	10	1	6	20	M
57	9702000	4.5	9	10	10	9	10	48	H
58	9703000	3.5	9	10	10	9	10	48	H
59	9712000	10.6	5	6	6	5	6	28	M
60	9714000	3.4	9	10	10	9	6	44	H
61	9716000	3.8	1	6	2	5	10	24	M
62	9718000	5.7	5	6	10	5	6	32	H
63	9726000	4.5	0	2	10	5	10	27	M
64	9726121	1.3	5	6	6	5	2	24	M
65	9737000	10	9	10	10	9	6	44	H
66	9737112	0.7	9	10	10	9	10	48	H
67	9737125	0.4	0	2	6	9	10	27	M
68	9738000	8.3	9	10	6	9	10	44	H
69	9738000	6.3	9	10	6	9	10	44	H

Table C-4 Results of roads analysis, rating and notes, for wildlife habitat on Yakima Sub-basin

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
1	3100000	10.5	5	0	6	1	6	18	M	Main access road (rd) w/ numerous tribs. WRC-confirmed lynx S. of Rd., L-lower in matrix, 6 tribs of this seg. lead to only effective security habitat for lynx, R-lots of crossings & talus(leaky) fields, U-no mapped winter range (WR), maybe migration(M) but many alt. rtes, rearing area. UH-higher elev. going thru harvested matrix, high dens.
2	3100000	9.1	9	10	2	5	6	32	H	WRC-bisects core, L-upper end in Manas. LSR, high pot. to increase security hab., R-higher elev., U-mtn goats, Clifty/Quartz herd, UH-mead. for goats, lynx, high dens.
3	3104000	2.6	9	10	6	9	6	40	H	Already gated partway up. WRC-high, eliminate many miles of side rds & increase core, access heavy rec. use, trails nearby. L-heads toward Mana.LSR, R-access some prime wet bottomlands in need of restoration, although most road non-rip., U-Fawning(F), Transition(T), UH-get into talus, spruce-fir bottomland.
4	3111000	6.6	0	0	2	9	6	17	M	Steep, S. facing, lots of ORV. RD are very high. WRC-high road density (RD), L-not in LSR, but remnant LS hab. avail. R-a few crossings, U-high pot. to restore rearing, M.
5	3120000	6.4	5	6	2	9	6	28	M	High elev. RD very high. Major connection. Rel. flat country, WRC-increase core, mod because of RD, L-up. end runs along edge of Mana. LSR, R-high elev. few crossings, U-tons of elk, UH-

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
										shrub-steppe scattered in ABLA2.
6	3120109	0.6	1	2	0	5	6	14	M	Rds. all around it. Such a short stretch doesn't buy much on its own. In heart of ungulate country.
7	3300000	8.2	1	6	10	9	6	32	H	"Gateway to Taneum" Priv./State heavy in rip., going up lg. flat rip. valley, paved, lots of camping. WRC-repts of wolf. L-thru heart of Mana. LSR, LS hab. there. R-road on 1 side of mainstem, concern is below forest boundary. U-EW1, heavy deer, winter range, mead., UH-meadows avail.
8	3300000	12.9	5	6	10	9	6	36	H	From Sec. 28 west. WRC-mod., core would improve but very high use, access to priv. & high use, L-adjoins core (Mole Mtn.-would enlarge) in Man. LSR, R-sig. section of rip. right up middle of NFk. Taneum, some sloughing. U-F/calving(C), UH-not many
9	3300112	0.3	1	2	10	5	2	20	M	There's a guard station there, main rd. connect. Gets people across creek. L-In Man. LSR, R-in rip area, U-C/F/T
10	3300133	1.9	1	2	10	5	2	20	M	Sim. to 3350119, WRC-closing rd. would not increase core because of parallel high use motorcycle rails on each side. R-in rip., U-only mod. pot. because of motorcycle trail. UH-not much there.

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
11	3330000	8.5	5	10	2	9	6	32	H	Heavily roaded, access to priv. WRC-only 1 because of priv. access, high use, lots of switchbacks in short distance. L-maj. of rd in Man. LSR, built for timber sale, most LS hab. been entered, lost owls, like to remove off site pine so PSME can return. R-lots of crossings, 1/2 rd is extremely high, U-heavy use F/T, WR, mapped EW1, UH-mod.
12	3350000	11.1	9	10	2	9	6	36	H	Access from Cle Elum over Taneum Ridge, lots of priv. land, high elev., heavily cut, old growth forest assoc., WRC-high main. access, lots of deer for wolves. L-1/2 in Man. LSR, R-very little, U-high T/F/C, UH-PLLA (Larch Mtn. salamander) found in talus slopes
13	3350119	2.1	9	10	0	9	6	34	H	L-great hab., R-none, U-young rearing areas, some S. facing
14	3500000	9	9	10	2	9	10	40	H	1/2 paved to Lion Rock. WRC-frags & isolates core, hi pot. to increase core in LSR, L-hi pot. to increase security hab., 1/2 in Swauk LSR, lower 1/2 in matrix, R-hi elev. dryside, U-WR, summer, M, UH-sage mead., Lithosols
15	3500000	7.3	9	10	6	9	10	44	H	not paved, WRC-increase core, L-increase sec. hab. in Swauk LSR, R-few crossings, some wet forested area along N 1/2, U-C/F, summer, UH-talus, cliff, whitebark pine.
16	3507000	9.1	9	10	6	9	10	44	H	WRC-hi pot. to increase core, L-Tean. LSR, part in matrix, R-hydrol. of talus, seeps, rd is high & dry, U-extremely hi elk use, C/T/etc. possible unmap. WR, UH-talus, decid., lots of stuff

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
17	3517000	3.2	6	6	2	9	6	29	M	WRC-enlarge Wilson Ck. core, L-flat ground so hi people use. but is alt. access to priv. land, could be accessed from below. R-very little, U-elk WR, dry spring/fall trans./M, UH-shrub-steppe mead, at begin. & end.
18	3521000	6.2	9	10	10	9	10	48	H	Dead end, built for timber sale access. WRC-would sig. increase core in Naneum. L-hi sec. in Swauk LSR, R-along Drop Ck. in lower part, many crossings, U-deer and elk, C/F, year round except WR, UH-lots
19	3530000	6.1	9	10	6	9	10	44	H	Dead end, lots of trails around it. WRC-bisects Pearson Ridge Core, moving rd could eliminate hi trail use. L-in Swauk LSR, R-mod, adjoins wet meadows. U-hi, lots of deer & elk, C/F/M. UH-hi, wet mead.
20	4100000	12.6	9	10	6	9	6	40	H	Major access, mixed owner, access Green R. & Big Ck., extremely high RD, WRC-would create new core, L-accesses Man. LSR, scare. hab but increase sec., R-up mid. of Cabin Ck., & crossings, so steep rd has to be in rip., U-lots of forage, great increase in hab. effectiveness if decrease RD, high use, UH-mod., young plantation, old growth.
21	4100000	1.7	1	1	10	5	2	19	M	Road slide between 2 sections. No USFS land involved, heavily disturbed, major access to private land. Buried rail car full of fermented grain.
22	4110000	11.7	9	10	6	9	6	40	H	Extreme. heavy RD, harvested, pot. for LS on upper 3rd, lots of trib., mixed owner. WRC-great pot. to increase core, L-upper 1/2 in M LSR, R-lots of crossings, stretch of rd thru priv. goes up

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
										mid. rip., in FS = stream crossing & out of rip. reserve. U-interrupts goat migr.path, accesses Blow Out Mtn., tremend. help to goats if close rd., also deer, elk C/F.
23	4300112	3	0	6	6	5	10	27	M	Wish Poosh loop, lg., flat, modified old growth, accesses CG, priv., UH-adjoins beaver, wet mead, L-AMA, R-prox. to rip firewood cutting in rip area, prox. to wet mead. U-mod
24	4300123	0.7	0	6	6	5	10	27	M	same as Wish Poosh
25	4300126	0.4	0	6	6	5	10	27	M	same as Wish Poosh
26	4305000	4.5	1	6	10	9	6	32	H	Heavily roaded, summer homes, hi RD comes off, WRC-low, L-mod, R-upper 1/2 prox. to Corral Ck., U-T/F/kidding(K), UH-riparian, lots of decid.
27	4308000	7.4	9	10	10	9	10	48	H	WRC-/L-hi pot. to increase, R-hi RD in riparian, U-access, tons of deer & elk, C/F/T/K, goat WR, UH-lots of bedrock used by goats, lots of mead.
28	4312000	3.4	9	10	10	5	6	40	H	Access to lookout, narrower, decreased diversity WRC-could increase core, connect 2 small fragmented cores to 1 lg. core, griz reports, L-hi sec. hab. increase, R-hi RD in rip. UH-prox. to rip., berries
29	4315000	5.3	9	10	6	9	6	40	H	WRC-high pot. for increasing core in Salmon La Sac Ck., L-increase security connect. to Tean. LSR, R-mod., U-goats up hi., UH-some cliffs up hi.
30	4315113	0.1	1	6	2	5	2	16	M	goes to gravel pit
31	4316000	3.7	1	10	10	9	10	40	H	All rip. forest, accesses CG, WRC-lo, L-hi security, U-lots of deer use, F, water in summer, UH-hi rip. forest.

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
32	4330000	0.2	1	1	0	0	0	2	L	major access to priv. etc. Extreme pt. to increase core because would eliminate access to whole system.
33	4330000	13	9	10	10	9	10	48	H	WRC/L-could improve core, elim. access into 5 major subdrainages & would make 1 huge megacore. R-in places on ck, much parallels, U-high, goats WR, deer/F, elk/C/summer, UH-ava. chutes, berry fields, cliffs, etc.
34	4517000	5	9	10	2	5	2	28	M	extremely steep, crisscrosses forest boundary, only access, WRC-high pot., L-in Man. LSR, R-some wet areas, spring, U-mod, C/F/T, historically mtn. goat habitat?
35	4600000	4.8	9	6	10	5	2	32	H	Paved, access priv., crosses R., WRC-could create huge core area, L-increase security, R-lots of crossings, U-not great deer hab., No. face, steep, trail on other side of river.
36	4600000	4.8	9	10	10	9	10	48	H	WRC/L-could add greatly to core and security, would elim. 1-way access to lots of tribs. (nearby side drain.) R-access Kachees R. bottomland and Mineral Ck. ford. U-deer, mtn. goat summer use, K/T possible, UH-swamp, berries.
37	4616000	0.7	1	2	2	5	6	16	M	priv. res, so low pot. for WRC/LSR, R-major bridge, U-mod. use, UH-cliffs, av. chute, rip. decid.
38	4616113	2	9	10	10	9	2	40	H	Accesses Owhi CG. WRC-hi, low elev. core, L-sec. at low elev., U-hi, increase hab., UH-hi, lots of berries, old growth.
39	4823000	5	0	2	10	5	6	23	M	Fiber optics to be maintained, resid. develop., so all are lot to mod, lots of deer in there, R-goes thru cottonwood forest.

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
40	4826000	1.5	5	10	10	9	10	44	H	Accesses priv., very flat, would elim. access to side rds, resid. develop. WRC-could greatly enlarge core area but near I-90, L-increase security hab., R-hi due to prox. to Swamp Lk., U-goats on Amabilis, but harvested right now, UH-Swamp Lk.
41	4832000	2	0	0	6	1	6	13	M	Accesses summer homes, lots of recc, very close to I-90. WRC/L-0, R-ltd. rip, what is there is highly valuable, U-prox. to I-90, UH-high shrub, Gold Ck. rip area.
43	4900000	2	1	2	10	1	6	20	M	Right along Kachess Lk., accesses 3rd largest CG in region, >2000 people on wkends. WRC-won't gain a lot of core. R-crosses Thetis and Gale Ck., low lying, UH-true old growth, lake shore.
44	4900122	5.7	0	2	10	5	10	27	M	WRC-too close to main road., L-some connect., U-lots of deer, UH-hammered but could be restored.
45	4930000	4.1	9	10	10	9	10	48	H	Major thoroughfare, WRC-increase core, L-increase sec., could connect 2 large core areas., R-major Bull trout pool next to rd., U-deer & goats, F/K, pot. WR for goats, UH-lots of cliffs, rip., berries
46	4934000	9.3	5	6	6	5	6	28	M	Road gets up hi, side roads to access wilderness, hi dens, radio tower, hi use. WRC-don't create much core due to high dens., would enlarge Kechless core, L-could increase sec. in AMA, R-lots of crossings, U-mod. use, no WR, all deer, maybe elk, UH-not much except lot of berry producing fields
47	4948000	6.7	9	10	10	5	10	44	H	WRC/L-High pot. for core & security, create &

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
										add both, lg. amt.. Road is failing in places. U-mod., no WR, UH-high
48	5400000	4.8	9	10	2	5	10	36	H	Major access, power lines, weather st., micro-towers, cold eliminate many tribs., major connector. WRC-could create core, L-increase connectivity, R-lots of crossings, U-closing tribs would benefit ung., C/F, UH-low dens., swamp near Crystal Springs CG.
49	5400311	0.6	0	2	10	1	10	23	M	Accesses Crystal Springs CG, WRC-w/in 1/2 mile of I-90, L-AMA land, but managed for connectivity between 2 LSRs, R-in rip., U-low, UH-cool swamp, rip forest, old growth.
50	5480000	1.7	1	2	6	5	2	16	M	Private development, home & rec., heavy use, along RR, WRC/L-low because of human use. R-along some riparian flat, prox. to forested bottom land near Kachess, U-C/F/T, UH-some
51	5480000	5.7	9	10	10	5	6	40	H	Major access to side rds., WRC-in GB Rec. Zone, could create core because elim. side rds. L-increase security, R-up the gut of rip. area, U-mod. deer use, F, UH-not much there, lot of clearcuts.
52	5483000	5.7	9	10	10	9	10	48	H	WRC-if eliminate rd, elim. access, increase core, lots of side rds, wolf reports, L-AMA but good old growth or plantation, R-almost entirely rip. reserve, up gut of ck. tons of crossings, "leaky", U-deer, mtn. goat (possibly), C/F/T, elk, UH-hi unique on Meadow Mtn., talus, old growth
53	7320000	4.1	5	10	2	9	6	32	H	Old Blewett Pass Hwy, 9715 on Cle Elum, WRC-not much gain, L-only access to area in Swauk LSR, U-hi spring/summ/fall, F/C, heavily hunted,

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
										UH-mod., lots of scree, bedrock, cliff.
54	9070000	5.6	9	10	10	9	10	48	H	Goes under Snoq. Ski Area, WRC-high pot. to create core & LSR sec. by closing upper 1/2 of rd., access PCT, R-goes through talus, crosses efem. streams., U-goats, maybe WR, could benefit from winter closure, some deer. UH-incredible old growth, talus.
55	9700112	0.7	0	6	10	5	6	27	M	Swauk CG, paved, right next to HWY. R-up Swauk drain. at jct of 2 rip areas, U-deer, elk, F/C, UH-some bedrock.
56	9700120	0.5	1	2	10	1	6	20	M	Mineral Spring CG, WRC-0 next to 97, L-low, U-low, all because right next to HWY 97, R-right along Swauk Ck., UH-possible seep.
57	9702000	4.5	9	10	10	9	10	48	H	WRC-currently no core, could greatly enlarge & connect 3 isolated chunks. Core is needed on Teanaway Ridge. L-increase connect in Swauk LSR, R-crosses numerous wet areas, U-hi due to extremely hi RD, elk & deer C/F/M/summer
58	9703000	3.5	9	10	10	9	10	48	H	Lots of dispersed camping, WRC-hi., elim. access to 3 side drain, currently frag. core., L-increase sec. in Swauk/Tean. LSR, R-up gut of Rip. area, U-lots of use, F/M, UH-lots of meadow, brushfield, bedrock.
59	9712000	10.6	5	6	6	5	6	28	M	Lots of mining activity, tons of snowmobile, WRC-could create some core, L-in Swauk LSR, R-edge of rip. U-C/F/M
60	9714000	3.4	9	10	10	9	6	44	H	Accesses roadless. WRC- fragments core up high. L-hi security, only flat ground, R-hi, up the gut., U-deer/elk, summer, C/F/poss M

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
61	9716000	3.8	1	6	2	5	10	24	M	Paved partway, access to major I&E site. WRC-currently no ore, L-Swauk LSR, increase sec. R-few wet crossings, U-mod., C/F, UH-get near talus, rd contst. has affected hydrology of talus.
62	9718000	5.7	5	6	10	5	6	32	H	WRC-closer to core, L-in Swauk LSR, R-great deal in reserve, U-deer, elk, C/F, UH-not much.
63	9726000	4.5	0	2	10	5	10	27	M	CG. WRC-0, R-gets abused, UH-hardwood forest.
64	9726121	1.3	5	6	6	5	2	24	M	Priv. land. WRC-some core to be gained, R-parallels rip., U-deer, elk, C/F, UH-not much there.
65	9737000	10	9	10	10	9	6	44	H	WRC-frag. core, L-one of few rds that would help if knock off 3-5 miles on end, R-maj. of rd. seg. is in rip. right up middle on 1 side, 1 side is pristine, does come out, deal with disp. camp, not as much connectivity driven due to good cond. on 1 side., compacted soil, U-no WR, some young, C/F/M, UH-open S. facing slope on N side, prone to brush.
66	9737112	0.7	9	10	10	9	10	48	H	WRC-could connect 3 core areas but cores good in these but steep, L-in Tean. LSR. R-hi rip area, up the gut, U-mig. corridor, deer T/F, elk C.,
67	9737125	0.4	0	2	6	9	10	27	M	Darue CG., WRC-0, next to 9737, L-lo sec. in Tean. LSR, R-mod, been rehabbed. U-accesses rip, deer F/M, UH-bogs.
68	9738000	8.3	9	10	6	9	10	44	H	Extremely high human use, orig. on priv. land, could curtail motoring, access & tribs., WRC-would create a lot of core, L-increase security in Swauk L, R-mod., some crossings, stays out for most part., U-hi, increased hab., deer/elk, C/F/M,

Road seg. #	FS road #	Seg. lgth.	Wide-rang. carniv.	Late-succ. species	Riparian depend.	Ungul.	Unique habitats	Wildlife total	Wildlife rating	Notes and Abbrev.: Wide Ranging Carnivores=WRC Late-successional reserve=LSR Riparian Depend=R Ungulates=U Unique Hab=UH
										UH-maj. below Forest. lots of meadows, seeps, talus.
69	9738000	6.3	9	10	6	9	10	44	H	Same as segment 68

Appendix D: Recommended 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 D-1. Ratings and recommended management actions, alternatives

Aquatic rating	Wildlife rating	Human use rating	Recommended mgmt.

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 D-2. Roads analysis recommended management actions, Methow Sub-Basin

Rd. sg. #	Watershed	FS rd #	Road name	Cost share	Seg. lgth.	Aqua. rat.	Wild. rat.	Human use rat.	Draft rec. mgmt.	Current maint. level	Current maint. cost	Prop. maint. level	Cost to maint.	Remarks
1	Manastash	3100000	Manastash Drive	Y	10.5	M	M	H	B	4	24150	4	24150	add ditch relief and surface drainage -
2	Manastash	3100000	Manastash Drive	Y	9.1	M	H	M	B	3	34580	3	34580	add ditch relief and surface drainage - consider relocation
3	Manastash	3104000	Manastash Divide		2.6	L	H	H	B	3	9880	3	9880	consider seasonal restriction – spring
4	Manastash	3111000	Cow Camp	Y	6.6	L	M	H	C	3	25080	3	25080	
5	Manastash	3120000	Tamarack Springs	Y	6.4	L	M	H	B	3	24320	3	24320	consider seasonal restriction - spring
6	Manastash	3120109	Coal Bunker	Y	0.6	L	M	L	C	3	2280	3	2280	
7	Taneum	3300000	Taneum	Y	8.2	M	H	H	A	4	18860	4	18860	consider seasonal restriction - winter, elevate or relocate 2 areas
8	Taneum	3300000	Taneum	Y	12.9	L	H	H	B	3	49020	3	49020	consider seasonal restriction – spring & winter
9	Taneum	3300112	Taneum C.G.		0.3	L	M	H	C	4	690	4	690	
10	Taneum	3300133	Miner Point	Y	1.9	L	M	H	B	3	7220	3	7220	consider additional drainage
11	Taneum	3330000	Gnat Flat	Y	8.5	M	H	H	B	3	32300	3	32300	consider seasonal restriction - spring, cross drains
12	Yakima	3350000	So. Cle Elum Ridge	Y	11.1	L	H	H	B	3	42180	3	42180	consider seasonal restriction - spring
13	Taneum	3350119	Larkin Loop		2.1	M	H	H	B	3	7980	3	7980	
14	Naneum	3500000	Table Mtn		9	L	H	H	B	4	20700	4	20700	consider seasonal restriction spring & winter
15	Naneum	3500000	Table Mtn		7.3	L	H	H	B	3	27740	3	27740	consider seasonal restriction - spring
16	Naneum	3507000	Pole Patch		9.1	L	H	M	B	3	34580	3	34580	consider seasonal restriction - spring, public suggested lowering to ML2

Rd. sg. #	Watershed	FS rd #	Road name	Cost share	Seg. lgth.	Aqua. rat.	Wild. rat.	Human use rat.	Draft rec. mgmt.	Current maint. level	Current maint. cost	Prop. maint. level	Cost to maint.	Remarks
17	Naneum	3517000	Wilson Creek		3.2	L	M	M	B	3	12160	3	12160	consider seasonal restriction - spring, mitigate meadow access
18	Naneum	3521000	Wilson Ridge		6.2	L	H	L	D	3	23560	2	6262	consider seasonal restriction - spring
19	Naneum	3530000	West Fork Nameum		6.1	L	H	L	D	3	23180	2	6161	consider seasonal restriction -spring, replace fish barrier CMP
20	Yakima	4100000	Cabin Creek	Y	12.6	H	H	M	A	4	28980	4	28980	consider relocating last 4 miles
21	Yakima	4100000	Cabin Creek	Y	1.7	H	M	L	A	3	6460	3	6460	consider giving up easement or relocating
22	Yakima	4110000	Log Creek	Y	11.7	H	H	H	A	3	44460	3	44460	consider seasonal restriction - spring, relocation & drainage
23	Cle Elum	4300112	Wish Poosh C.G.		3	M	M	H	B/D	5	6900	4	6900	consider restricting lake bed access
24	Cle Elum	4300123	Cle Elum River C.G.		0.7	L	M	M	C	3	2660	3	2660	
25	Cle Elum	4300126	Red Mtn C.G.		0.4	H	M	M	B	3	1520	3	1520	consider elevating roadway & drainage
26	Cle Elum	4305000	Corral Creek	Y	4.5	L	H	M	B	3	17100	3	17100	consider seasonal restriction - spring, drainage
27	Cle Elum	4308000	French Cabin Creek	Y	7.4	H	H	H	A	3	28120	3	28120	consider seasonal restriction - spring & winter, redesign drainage, mitigate OHV access
28	Cle Elum	4312000	Thorp Creek	Y	3.4	M	H	H	B	3	12920	3	12920	consider seasonal restriction - spring, drainage
29	Cle Elum	4315000	Little Salmon La Sac	Y	5.3	M	H	M	B/D	3	20140	2	5353	consider seasonal restriction - spring
30	Cle Elum	4315113	Sac Snow Park		0.1	L	M	L	D	3	380	2	101	look at ditch outlet
31	Cle Elum	4316000	Salmon La Sac C.G.	Y	3.7	M	H	H	B/D	5	8510	4	8510	look at drainage on lower end and ford
32	Cle Elum	4330000	Cle Elum Valley	Y	0.2	L	L	H	D	5	460	4	460	talk with PC
33	Cle Elum	4330000	Cle Elum Valley	Y	13	H	H	H	A	3	49400	3	49400	reconstruct for drainage and safety

Rd. sg. #	Watershed	FS rd #	Road name	Cost share	Seg. lgth.	Aqua. rat.	Wild. rat.	Human use rat.	Draft rec. mgmt.	Current maint. level	Current maint. cost	Prop. maint. level	Cost to maint.	Remarks
34	Yakima	4517000	Little Creek	Y	5	M	M	M	D	3	19000	2	5050	consider cross drains, talk with Plum Creek
35	Cle Elum	4600000	Cooper	Y	4.8	M	H	H	B	4	11040	4	11040	look at culvert size
36	Cle Elum	4600000	Cooper	Y	4.8	H	H	H	C/D	3	18240	3/2	11265	consider relocating Trailhead ~ 1/4 mi, seasonal restriction - spring
37	Cle Elum	4616000	Cooper River	Y	0.7	L	M	H	D	4	1610	3	2660	
38	Cle Elum	4616113	Owhi C.G.		2	L	H	M	C	3	7600	3	7600	
39	Yakima	4823000	Yakima River	Y	5	H	M	M	A/D	3	19000	3/2	12025	consider relocation, upgrade CMP
40	Yakima	4826000	Cascade	Y	1.5	L	H	H	D	3	5700	2	1515	consider seasonal restriction - spring
41	Yakima	4832000	Keechelus Frontage	Y	2	M	M	H	D/B	4	4600	3	7600	considering increasing span at Gold Creek
42	Yakima	4832000	Keechelus Frontage	Y	7.5	M	M	H	C	3	28500	3	28500	
43	Yakima	4900000	Kachess	Y	2	L	M	H	C	5	4600	5	4600	
44	Yakima	4900122	Kachess Rec		5.7	M	M	H	D	5	13110	4	13110	
45	Yakima	4930000	Box Canyon	Y	4.1	H	H	M	A	3	15580	3	15580	Consider seasonal restriction - spring, winter, relocate road & trailhead
46	Yakima	4934000	Keechelus Ridge	Y	9.3	L	M	M	C	3	35340	3	35340	
47	Yakima	4948000	Gale Creek	Y	6.7	M	H	M	B	3	25460	3	25460	Look at culvert sizes
48	Yakima	5400000	Stampede	Y	4.8	H	H	H	B/D	4	11040	4/3	16740	Look at fish passage barriers
49	Yakima	5400311	Crystal Spring		0.6	M	M	M	D	4	1380	3	2280	
50	Yakima	5480000	Yakima Pass	Y	1.7	L	M	H	D	4	3910	3	6460	
51	Yakima	5480000	Yakima Pass	Y	5.7	H	H	H	B	3	21660	3	21660	Consider drainage improvements
52	Yakima	5483000	Meadow Creek	Y	5.7	M	H	M	B/D	3	21660	2	5757	Consider seasonal restrictions - spring, winter, additional drainage
53	Swauk	7320000	Blewett Road		4.1	L	H	M	C	3	15580	3	15580	
54	Yakima	9070000	Cold Creek	Y	5.6	L	H	H	B	3	21280	3	21280	Consider seasonal restrictions -

Rd. sg. #	Watershed	FS rd #	Road name	Cost share	Seg. lgth.	Aqua. rat.	Wild. rat.	Human use rat.	Draft rec. mgmt.	Current maint. level	Current maint. cost	Prop. maint. level	Cost to maint.	Remarks
														spring, winter
55	Swauk	9700112	Swauk C.G.		0.7	L	M	M	C	4	1610	4	1610	
56	Swauk	9700120	Mineral Spring C.G.		0.5	L	M	M	D	4	1150	3	1900	
57	Swauk	9702000	Red Top		4.5	M	H	H	A	3	17100	3	17100	Consider seasonal restrictions - spring, drainage, reconstruct surface
58	Teanaway	9703000	Stafford Creek		3.5	M	H	M	A	3	13300	3	13300	Consider seasonal restrictions - spring, reconstruct/relocate
59	Swauk	9712000	Liberity Beehive		10.6	H	M	H	B	3	40280	3	40280	Consider additional drainage, restrictions on off-road access
60	Swauk	9714000	Iron Creek		3.4	H	H	M	A	3	12920	3	12920	Reconstruct relocate first 3 miles
61	Swauk	9716000	Swauk Meadow		3.8	L	M	H	C	3	14440	3	14440	
61	Swauk	9718000	Cougar Gulch		5.7	M	H	M	B	3	21660	3	21660	Look at fish passage and consider additional drainage
62	Swauk	9726000	Deer Gulch		4.5	M	M	M	A/D	3	17100	3/2	7335	Consider seasonal rest. - spring, reconstruct fish passage,
63	Swauk	9726121	Pine Gulch		1.3	L	M	M	C	3	4940	3	4940	
64	Teanaway	9737000	N. Fork Teanaway		10	H	H	H	A	3	38000	3	38000	Consider relocation, additional drainage, OHV access & spring/winter restrictions
65	Teanaway	9737112	Beverly		0.7	L	H	M	B	3	2660	3	2660	Consider seasonal restrictions - spring
66	Teanaway	9737125	Beverly C.G.		0.4	L	M	M	C	3	1520	3	1520	
67	Teanaway	9738000	Blue Creek		8.3	H	H	H	A	3	31540	3	31540	Consider relocation and drainage
69	Swauk	9738000	Blue Creek		6.3	H	H	0	B	3	14490	3	23940	Consider seasonal restrictions - spring, additional cross drains

Appendix E: Public Comment

To obtain public comments, the Cle Elum Ranger District sent over 500 letters out, held a public meeting, and posted information on a forest web site for all interested to participate. Approximately 45 people attended the meeting and fifty written comments were received. The comments were reviewed during the analysis. From the information the following summary was developed. Additional information is included in Appendix E and returned letters and forms are available at District Ranger Stations.

The general feeling, based on comments from the public meeting and letters received to date, is that people want to see access maintained. They also want to see access for a variety of activities. Comments suggest that maintenance levels can be adjusted as long as access is not eliminated. Some comments were for a higher level of maintenance on certain roads and others stated they would like to see some roads gradually degraded to a lower maintenance standard. The common opinion is that continued access should be maintained. One comment emphasized consideration for disabled persons, another pointed out that access should not be limited to the "financially and physically elite", but should be available to all people.

Summary of Public Comments from Roads Analysis

Access to Subdivisions and Developments

Road 4600 to Cooper Lake has 26 home sites with 15 cabins and should be maintained for passenger cars.

Road 5330 has a number of cabins and several full time dwellers and should be maintained for passenger cars.

Keep 9726 and 9726-112 maintained for passenger cars for access for those of us who live at Harkness Road all year.

Leave Green Canyon Ranch road from 3500 open because of private homes that want a second emergency escape route.

Road 4826 should be given priority for maintenance at higher level as it is one of the two main routes in to the Kachess residential area off I-90. Forest Service and county consider entering into an agreement for jointly maintaining the road, or the Forest Service assigning it to the county's jurisdiction so that it could be upgraded to the standard of the county's Kachess Lake road, the other route off I-90. 4826 is a primitive link in the road system and upgrading at some point in the future seems inevitable.

Road 9712 (Liberty Beehive) is the only public road maintained to passenger car standards that gives access to our property in the Liberty Mountain area. It is critical to us that 9712 be

maintained to passenger car standards.

I own property in Liberty Mountain and want all roads within Blewett area and up to Table Mountain maintained in as good a condition as possible. This area has seen an increase in use by our members, as well as public use. Access is very important.

My main interest is road 4330 because I have a cabin near Boulder Creek and I travel on the road several times a month both in winter and summer. I was very disappointed when the road was upgraded as part of the Hawkeye Timber Sale a decade ago because it increased speed and traffic. Although the road is more convenient to use, it is not as mellow or safe. I would not mind a lower level of maintenance on this road, although I wouldn't advocate it be changed to "high clearance". I would like a slower vehicle road that would not accommodate giant trailers and motor homes.

People who have chosen to make their homes in the forest don't need a paved road to their doorstep.

Transfer South Cle Elum Ridge 3350 to county.

Road 4818 n east side of Kachess serves private ownership cabins and should be maintained for passenger cars.

Why and Where Access is Important

This is very scenic and beautiful area and must be maintained so that senior citizens and handicapped people as well as general public can enjoy the beauty and recreation experience available there

We use the roads for berry picking, mushrooming, woodcutting, bicycling, motorcycling, snowmobile riding, and use access to many connecting spur roads.

Many of the roads are used for hunting and other recreational use. They were not only initially constructed for logging and access for public multiple use, but more importantly alternate egress in case of fire.

Old Blewett highway road 7320 is important scenic historic resource. (three letters)

Maintain Old Blewett highway for slow speeds, keep vegetation next to roads and leave some shallow potholes. Bird watchers like this road. Don't plow in winter; use for winter sports.

Old Blewett (7320) is pretty rough and pot holes, so it's not a super passenger car road, however cars can use it despite the serious potholes.

9738 Blue Creek gets a lot of traffic.

My family spends at least every other weekend camping somewhere on the National Forest. Important to my family since parents moved here in the 1950s. I try often to revisit areas

traveled as a child 40 years ago. Many memories remain.

My family enjoys scenic drives to picnic or picking huckleberries on these roads: Amabalis, Stampede Pass, Cooper Road, Thorp Creek, Kachess, Keechelus Ridge.

My family enjoys driving over Table Mountain to Lion Rock and Old Blewett, Cle Elum Valley, Fish Lake, Quart, Peoh Point.

Most trailheads we use are main ones, however going down to high clearance level on many of them would be okay.

Quartz Mountain is a nice Sunday drive that lots of older folks enjoy.

Keep the main roads open for RV access

A lot of people use Pine Gulch to access Crystal Mountain agate beds.

There are important trailheads at the end of river and creek drainages and many backpackers and climbers do not have high clearance vehicles. Keeping them open to passenger cars will also give better access to those with horse trailers.
We believe it is important to have at least some trails accessible by passenger car so that families with children will have opportunity to experience the forest. If access is severely reduced some trails will be over utilized. We were fortunate to be able to take our children hiking and would like to look forward to doing the same with our grandchildren, but will be unable to do so if none of the shorter more interesting trails are within our reach.

The only roads that need to be constantly maintained are those from end of county roads and into campgrounds and the roads in campgrounds.

The only roads I am for paving are those in campgrounds.

Public has a need to occupy and enjoy the National Forest as much as any other thing you consider.

You should get off your, you know what, and take a trip up there sometime before you send letters to people. There are a lot of chuckholes in the road to Kachess campground and in the road in the campground.

Keep campground roads open to passenger cars.

Road 4330 – the undeveloped, rustic camping is a major asset of the Cle Elum valley and that could be best preserved by maintaining the rustic nature of the area in terms of road access; a slower vehicle road that wouldn’t accommodate large RVs.

Maintaining unpaved roads for high clearance vehicles would save money but still keep road open. My husband and I like to drive gravel roads to get to hiking trails, see wildlife, take

pictures and pick huckleberries

The only road I am aware of whose maintenance absolutely should be downgraded is road 3517 Pole Patch. I have spent a lot of time on it and I have never seen anyone use it. It leads to nowhere and is really kind of silly.

The main Reecer Creek road 3500 should be maintained to passenger car standards up to Lion Rock only. All side roads, including 3517, 3507, 3521, 9718, 9712, 9726 should remain open with maintenance to allow high clearance vehicles.

Due to shortage of maintenance dollars in our National Forests, my wife and I would like to see the maintenance on the following roads reduced to high clearance: 4315 Little Salmon la Sac, 4823 Yakima River, 4826 Cascade, 4832 Keechelus Frontage, 4900-122 Kachess Rec. (Two letters listed same roads)

Road 4818 on east side of Kachess should be maintained as suitable for passenger cars because it is collector road, serves access to important trails, access for fire suppression, for law enforcement, for Boeing Camp, private homes, and for camping.

Safety and Speed Issues

Need road to Haney Meadows maintained to level so horses in trailers will not be injured by drivers who shouldn't really be driving here.

Speed is an issue on road 4330.

Speed is an issue on the 4930, 4330, 9737, 3300, and 3100 roads

Reduce maintenance level on 4330 and 9737 roads just to slow drivers down.
Speed is a problem on Box Canyon road 4930.

Road speeds are too high on most forest roads. Maybe a lower maintenance level would convince them to slow down and enjoy the surroundings. Keep them safe and stable and try to keep the dust down, but BUMPS, narrow roads, may be the only solution to the speed problem.

Safety should be considered on the Fish Lake road. Going down a maintenance level there could be hazardous due to amount of traffic.

General Comments

While there may be a road here and there that needs more maintenance, it has been my experience that the road system is very durable and has little impact on the natural environment.

Rotate road maintenance levels to keep roads passable, but not in top condition

Post and map with explanation so people understand what is going on.

Please grade the 4330 road to Fish Lake when it is damp, so grading will last all summer. Dave Fudacz does a magnificent job, but the condition of the road dictates how long the grading lasts.

Three fundamental reasons to keep road open and maintained: substantial no planned harvest in foreseeable future could be closed indefinitely. Recreational values to consider are access to water activities (swimming, boating, fishing), access to hiking and scenic values, access to hunting. Fire roads could be gated and require no maintenance except to correct natural damage, such as wash-outs, slides or fallen timber.

Roads in popular recreation areas need to be maintained due to heavy usage.

The rest of the roads would be suitable for high clearance vehicles.

It is not necessary to have a road maintained for "comfort and convenience".

Maintain only paved roads for passenger cars. All of the gravel roads will meet my needs if maintained for high clearance vehicles.

Any reduction in maintenance should be based upon current usage or lack thereof.

Analysis should include sensitive wildlife and fisheries habitat and roadless and wilderness areas. This presents an opportunity to enhance other forest resources. Wilderness areas are routinely and illegally accessed by off-road vehicle, with serious impacts. There should be buffer areas and road barricades to insulate wilderness and roadless areas from abuse. Vital wildlife corridors north and south of I-90 should be enhanced with permanent and seasonal road closures. Road plans should include buffer areas and seasonal closures sufficient to protect wildlife habitat.

Even paved roads when left unmaintained can cause resource damage from erosion. Our tax dollars are well spent to keep passenger car roads maintained to high standard. We have spent a fortune building these high maintenance level roads and should not let them go to waste and ruin. And we should NOT build any more roads!

All roads need to be looked at each year to make sure drainage is still functioning.

Don't use this as excuse to start using herbicides to control roadside brush.

The forest road system is an essential significant capital investment that requires continual maintenance dollars. Reducing maintenance on mainline log haul routes should not be an outcome of this analysis. Roads have been neglected and require attention. A primary function of our forest roads is raw material transport. Further road maintenance cost reductions will severely jeopardize this critical systems operation. The highest priority should be given to protecting this valuable asset.

USFS roads have had severe negative impacts and are costly to build and maintain.

Lower elevation and main collector roads should be kept up to passenger car requirements, but once you start to climb you need a better means of transportation. For example Cle Elum Valley along the lake passenger car standard, but up to Cooper and Fish Lake questionable; and anything else out of the valley should be high clearance.

Road Closure Comments

A lot of roads could be down graded and I could still enjoy them just fine; just don't close them.

Downgrading should not lead to closures.

If we let any of these roads deteriorate, it will be used to try and justify closing them later.

Prefer that most all roads remain open.

All roads need to be open for use

Do not close roads.

Please don't close the roads.

I don't trust you. I've seen too many changes. You say one thing today and a little later you do something different.

I'm afraid to agree to any road going to lower maintenance level because when the money doesn't come down that will be the first road you will close.

Generally, I believe many forest roads could be closed to vehicles. Road may be closed for environmental reasons, put to bed. I don't feel individuals have the right or need to drive on every road. There are other modes of travel: walking, biking, horseback, etc. that may be more acceptable. I am by no means supporting a non-entry policy.

I am opposed to any and all road closures or decommissioning in the entire ranger district. If minor side roads are truly unused and unneeded, they will devolve back to nature as trees grow on the road surface, etc.

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: Columbia River

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Sub-basin example: Yakima River

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Watershed example: Cle Elum River

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Subwatershed example: Cooper River

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Subdrainage example: Stave 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.