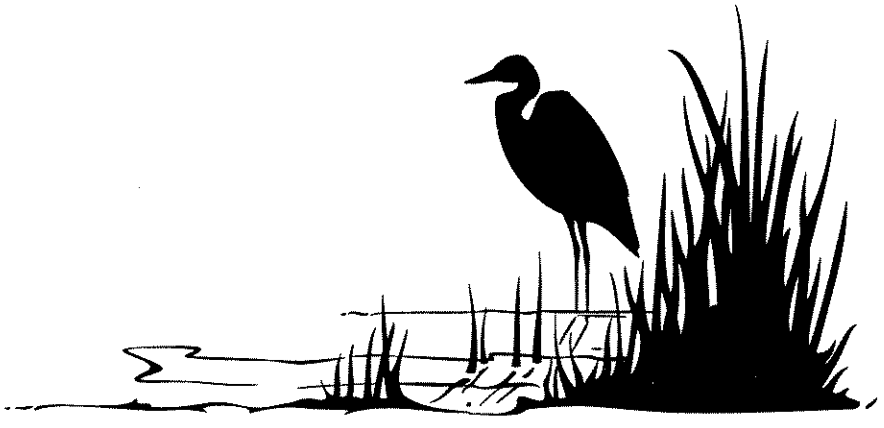
Middle Cowlitz Watershed Analysis

February 1997



Gifford Pinchot National Forest
North Skills Center

Middle Cowlitz Watershed Analysis Team Members

Team Leader	Mark Pistrang
Archaeologist	Rick McClure
Botanist	Mark Pistrang
Fire Planner	Dale Meyers
Fisheries Biologist	Terry Lawson
Geologist	Shawn Jones
GIS Specialist	John Hawkins
Hydrologist	Wendy Pistrang
Recreation Planner	Dave Olson
Silviculturalist	Ed Tompkins
Special Uses	Dick Dinkelmann
Wildlife Biologist	Jeff Momot (US Fish and Wildlife Service)
Wildlife Biologist	Tom Kogut
Writer/Editor	Mark Pistrang

Acknowledgments

The process and document format used in this watershed analysis was developed largely by Steve Kozlowski during his efforts with the Lower Cispus West Watershed Analysis. This was further refined by Brenda Smith in her work with the Lower Cispus East team. The efforts put forth by those two individuals contributed significantly to the successful and timely completion of this document. Thanks to you both, from the MIDCOW team!

Table of Contents

List of Tables i
List of Maps ii
Chapter 1 - Overview 1-1
Chapter 2 - Issues and Key Questions 2-1
Chapter 3 - Historic and Current Conditions 3-1
Terrestrial Elements 3-1
Forest Vegetation 3-1
The Role of Fire 3-8
Botanical Species of Concern 3-10
Wildlife 3-18
Geologic Processes 3-29
Aquatic Elements 3-37
Hydrology and Fisheries 3-37
Social Elements 3-63
Past Human Uses 3-63
Recreational Uses 3-72
Lands, Minerals, and Special Uses 3-75
Chapter 4 - Interpretations/Areas of Concern 4-1
Terrestrial Elements 4-1
Forest Vegetation 4-1
The Role of Fire 4-2
Botanical Species of Concern 4-2
Wildlife 4-4
Geologic Processes 4-6
Aquatic Elements 4-8
Hydrology and Fisheries 4-8
Social Elements 4-10
Past Human Uses 4-10
Recreational Uses 4-13
Lands, Minerals, and Special Uses 4-13
Chapter 5 - Sixth Field Watershed Evaluations 5-1
Fifth-Field Watershed Perspective 5-2
Sixth-Field Watershed Evaluations 5-3
Chapter 6 - Management Recommendations 6-1
Introduction 6-1
Desired Future Condition 6-1
Recommendations at the Fifth-Field Watershed Scale 6-3
Boundary Changes of Riparian Reserves 6-3
Regeneration Harvest Within Riparian Reserves 6-3
Commercial Thinning Within Riparian Reserves 6-4
Other Silvicultural Activities 6-4
Connectivity of Riparian Reserves 6-4
Roads 6-4
Developed Recreation and Trails 6-6
Dispersed Recreation 6-6
Recommendations at the Sixth-Field Watershed Scale 6-6

List of Tables

Table 1-1: Summary of Land Ownership Within the Sixth-Field Watersheds 1-2
Table 3-1: Vegetation Structure by Sixth-Field Watersheds 3-5
Table 3-2: TES Plant Species Documented or Suspected on the North Zone 3-11
Table 3-3: Acres of Habitats and Number of Known Sites by Sixth-Field Watershed 3-13
Table 3-4: Summary of Acres of National Wetland Inventory Wetland Types by Sixth-Field Watershed 3-14
Table 3-5: Summary of Acres of Late-Successional Habitat Outside Riparian Reserves by Sixth-Field Watershed 3-16
Table 3-6: Summary of Acres of Late-Successional Habitat Within Riparian Reserves by Sixth-Field Watershed 3-17
Table 3-7: Summary of Acres of Late-Successional Habitat Within the Analysis Area 3-17
Table 3-8: Noxious Weeds Likely to be Found in Large Populations Within the Analysis Area 3-18
Table 3-9: Amphibian Species Identified During Surveys in Selected Subwatersheds of the Middle Cowlitz Watershed 3-22
Table 3-10: Mollusk Species Known to or Have the Potential to Occur in the Middle Cowlitz Watershed 3-22
Table 3-11: Federally Managed, Non-Federal, and Total Acreages of Deer and Elk Biological Winter Range in the Middle Cowlitz Watershed 3-24
Table 3-12: Acreages of Federal Forest Lands Allocated to Management Area Category E in the Middle Cowlitz Watershed 3-25
Table 3-13: Acres of Deer and Elk Biological Winter Range and Open Road Density Within the Deer and Elk Biological Winter Range by Subwatershed 3-25
Table 3-14: Threatened, Endangered, Sensitive, Candidate, and Species of Concern Documented (D) or Having the Potential (P) to Occur in the Middle Cowlitz Watershed 3-27
Table 3-15: Numbers of Northern Spotted Owl Pairs or Singles by Land Allocation 3-28
Table 3-16: Road and Flood Damage Information 3-36
Table 3-17: Miles of Stream by Class and 6th-Field 3-43
Table 3-18: Peakflow Rating of Each 6th-Field by Transient Snow Zone, WAR, and ARP 3-49
Table 3-19: The Top 5 Measured Floods on the Cowlitz at the Randle USGS Station. Data Collected by the USGS From 1949 to Present 3-51
Table 3-20: Percent of Seral Stage in the Riparian Corridor 3-52
Table 3-21: Maximum Amount of Habitat for Anadromous/Resident Fish and Potential for LWD 3-56
Table 3-22: Fish Distribution Within the Middle Cowlitz Watershed 3-61
Table 3-23: Identified Faunal Remains From the Judd Peak Archaeological Site 3-66
Table 3-24: Public Use of Roads 3-73
Table 4-1: Protection Status of Known Populations of TES Plant Species 4-2
Table 4-2: Wildlife Habitat and Species Concerns by Sixth-Field Watershed 4-5
Table 5-1: Sixth-Field Watersheds 5-1
Tables 5-2 Through 5-18: Sixth-Field Watershed Evaluations 5-7
Tables 6-1 Through 6-17: Sixth-Field Management Recommendations 6-7

List of Maps

NOTE: The following maps are bound together sequentially in a separate document entitled "Middle Cowlitz Watershed Analysis Maps".

Map #1	Vicinity Map
Map #2	Sixth Field Watersheds
Map #3	Forest Stand Structure
Map #4	Special Habitats
Map #5	Habitat Fragmentation
Map #6	Murrelet and Big Game Areas
Map #7	Mass Wasting
Map #8	Erosion Potential
Map #9	Road and Stream Crossings
Map #10	Flood Damaged Sites
Map #11	Riparian Reserves
Map #12	Stream Classes
Map #13	Peak Flow
Map #14	Channel Condition
Map #15	Fish Distribution
Map #16	Special Uses

Chapter 1 - Overview

Introduction

Watershed analysis is an analytical tool designed to describe the biophysical processes and interactions that operate on a landscape at the watershed scale. The purpose of the analysis is to provide a scientifically-based understanding of ecological processes that can be used to guide future management activities within the watershed. Management direction pertinent to conducting watershed analysis is found within the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (USDA, USDI, 1994).

Analysis Process

The process used to conduct the Middle Cowlitz Watershed Analysis is a synthesis of previous efforts that have been utilized on the North Skills Center. The key tasks involve, 1) identifying issues and questions that are relevant to key management objectives, 2) characterizing the historic and current condition of the watershed's physical, biological, and human elements, 3) determining trends based upon historic and current conditions, and 4) interpreting the results in the form of recommendations that are responsive to the key watershed processes identified.

Based upon the time frame given to complete the analysis, no field data collection was attempted during the process. All data used in the analysis was extracted from existing sources. Data sources, data gaps, and any associated assumptions are clearly expressed at the front of each respective section in chapter 3.

Watershed Overview

The Middle Cowlitz watershed encompasses 84,432 acres situated in the Cowlitz River valley near the town of Randle (Map 1). The area has a long history of human use with archaeological remains dating back to the early pre-historic period (ca. 7,000 to 3,500 years ago). Historic data suggest that the watershed has experienced a range of extreme conditions, at times being almost completely forested (see page 3-3), and being devastated by the effects of the Mount Saint Helens volcano some 3,500 years ago (see section on abandonment, page 3-65).

Currently, over 50% of the watershed is in non-federal ownership (Table 1-1), and most of that land is being held in an early seral stage, in the form of pasture and rangelands. The National Forest portion is predominantly early seral as well, with approximately 52% of the forested portion in the grass/pole stage (see page 3-5).

Table 1-1: Summary of Land Ownership Within the Sixth Field Watersheds					
6th Field #	**Total Acres**	**Private Acres**	**% Private**	**Federal Acres**	**% Federal**
2	12,277	12,106	99%	171	1%
2A	8,073	8,073	100%	0	0%
2B	4,463	3,399	76%	1,064	24%
2C	1,545	663	43%	882	57%
2D	3,142	2,279	73%	863	27%
2E	3,861	2,920	76%	941	24%
2F	2,487	2,487	100%	0	0%
2G	4,541	3,774	83%	767	17%
2H	3,667	772	21%	2,895	79%
2J	7,081	202	3%	6,879	97%
2K	7,414	0	0%	7,414	100%
2L	8,002	3,513	44%	4,489	56%
2M	2,135	0	0%	2,135	100%
2P	3,955	1,369	35%	2,586	65%
2Q	8,584	2,354	27%	6,230	73%
2R	1,377	594	43%	783	57%
2T	1,828	3	0.1%	1,825	99.9%
Total	**84,432**	**44,508**	**53%**	**39,924**	**47%**

Major roads, in and out of the watershed, are US Highway 12 and Forest Roads 23, 25, and 47. These roads provide access to numerous developed and dispersed recreational sites and other destinations within the watershed. Complete descriptions of the historic and current conditions for the major terrestrial, aquatic, and social elements found within the watershed are presented in chapter 3 of this document.

Chapter 2 - Issues and Key Questions

Within any given land area there are many issues that must be considered prior to the implementation of management activities. The following list of issues and associated questions focus this analysis on those issues that were deemed most pertinent to management within the Middle Cowlitz watershed. The issues and key management questions were developed by the interdisciplinary team in association with the line officer on the North Skills Center. The analysis questions represent the fundamental information needs necessary to answer the key management questions. This document does not contain enumerated answers to all the questions listed below. Rather, answers are provided throughout chapters 3-6 in the form of narratives, tables, and ratings.

Issue 1 - Water Quality and Quantity

The issue to be addressed by this analysis is to determine whether changes to vegetation, soils, and aquatic features in the middle Cowlitz watershed are having notable or cumulative effects on water quality and quantity. Resources and processes relevant to evaluating these conditions include channel migration and widening, presence of amphibians, condition of fish habitat, amount and frequency of soil disturbance, rates of human caused sediment input as compared to natural rates, and continuity of late structural forest in riparian areas.

Water Quality and Quantity - Key Management Questions

Are cumulative human impacts preventing the attainment of ACS objectives anywhere in this watershed?

Are there road crossings needing reconstruction for repair or prevention of flood damage?

Which roads have restoration needs?

Where is restoration of streams needed to improve aquatic habitat?

Water Quality and Quantity - Analysis Questions

How does the existing landscape compare to the historic/reference landscape with regard to forest vegetation patch sizes, shapes, and distribution?

What is the extent of past construction and use of crossings, campsites, diking, channelization, and floodplain isolation in riparian reserves?

Are road crossings affecting the distribution of aquatic species?

What is the history of flooding and changes in peak flows and what is the influence of land use on water available for runoff?

How have channels changed from historic/reference conditions?

How, when, and where have management activities caused or contributed to mass wasting or surface erosion?

How does sediment delivered to streams naturally compare to sediment caused by management activities?

Are Policy Implementation Guidelines (PIG) desired conditions being met?

Are habitat conditions adequate for resident species of fish?

What are the dominant channel and habitat forming processes in the channel network?

Are there any known water quality problems such as temperature or turbidity?

Issue 2 - Economic Outputs (Timber, Recreation, Mining, Fish and Wildlife, etc)

The issue of economic outputs from the middle Cowlitz watershed is analyzed in the context of the sensitivity of resources required to support the economic demands. Water quality conditions, existence of TES species, amount and distribution of forest vegetation seral stages, and the ability of the ecosystem to function normally will be evaluated relative to potential timber harvest, recreational developments, mining activities, fishing and hunting, etc.

Economic Outputs - Key Management Questions

In riparian reserves, where and under what circumstances is regeneration harvest appropriate?

Outside of riparian reserves, where and under what circumstances is regeneration harvest appropriate?

In riparian reserves, where and under what circumstances is stocking manipulation, pre-commercial and commercial thinning appropriate?

Outside of riparian reserves, where and under what circumstances is stocking manipulation, pre-commercial and commercial thinning appropriate?

Are there sensitive habitats within the watershed where vegetation management or other activities should be avoided? Where are they?

What is the proportion of the various riparian reserve types (wetlands, streams, and unstable areas) within the watershed?

What standards should be developed for human uses in riparian reserves?

In riparian reserves, where or under what circumstances can roads or trails be constructed without preventing the attainment of ACS objectives?

What human use sites, dispersed or developed, are preventing attainment of the ACS objectives? How can these be addressed in the short and long term?

Are there any opportunities to improve habitat conditions for fish and wildlife?

Economic Outputs - Analysis Questions

What is the current distribution and amount of early, mid, and late successional forest vegetation seral stages?

How have the acres of different seral stages varied over time?

Do current conditions (seral stages) appear to be within an appropriate range given our management direction?

What were the results of past management activities in terms of forest types, spatial distribution, amounts, and temporal distribution?

What is the distribution and amount of non-forest vegetation and non-vegetated areas?

What is the distribution and size of the Forest Vegetation Zones in terms of Potential Natural Vegetation (PNV)?

What are the current stand stocking levels?

Where are the nutrient deficient soils located which have resulted in poor growth?

Issue 3 - TES and S&M Plant and Animal Species

The issue to be addressed by this analysis is to determine whether changes to vegetation, soils, and aquatic features in the middle Cowlitz watershed are having cumulative impacts on habitat for TES and S&M species. Resources and processes relevant to evaluating these conditions include population levels, habitat distribution and use, vegetative diversity and continuity, and riparian conditions.

TES and S&M Plant and Animal Species - Key Management Question

Are habitats for TES and S&M species adequately protected under Forest Plan and ROD standards and guidelines?

TES and S&M Plant and Animal Species - Analysis Questions

Where are there habitats present for TES and S&M species in the watershed?

What are the known and suspected sites of TES and S&M species within the watershed?

How does the current condition of this habitat affect species viability?

How much nesting, roosting, foraging, and dispersal habitat exists for spotted owls, and what is its condition?

Where are the spotted owl, goshawk, and great grey owl centers?

Have 100 acre spotted owl core area been delineated? And if so where are they?

Where is the summer/winter range for the prey species of wolves, grizzly bears, and other forest carnivores?

How well are late-structural habitats linked within the watershed?

What are the road densities within the watershed and how do they affect big game, TES species etc?

What is the current level of coarse woody debris and snags in the uplands?

How much spawning and rearing habitat exists for TES fish species?

Issue 4 - Ecosystem Function

One of the primary issues affecting forest land managers is the necessity of maintaining a properly functioning, self-sustaining ecosystem. This includes ensuring that all native plant and animal species are retained, distribution of the species is adequate, and suitable habitat is abundant enough to maintain populations across the landscape. The issue to be addressed by this analysis is to determine the role of this watershed as it fits into the larger landscape and whether impacts to vegetation, soils, and aquatic features in the middle Cowlitz watershed are having notable or cumulative effects on overall ecosystem functions. Resources and processes relevant to evaluating these conditions include changes in aquatic condition, loss of populations, presence of riparian and overland migration corridors, amount and frequency of soil disturbance, continuity of late structural forest in riparian areas, and rates of human caused sediment input.

Ecosystem Function - Key Management Questions

Where are there particularly sensitive or special areas which need protection beyond Forest Plan or ROD standards and guidelines?

Does there appear to be a natural cumulative effects problem anywhere in the watershed?

Given adjacent land ownership, what can we assume about future management of private lands within the watershed?

What are the unique functions of National Forest lands?

Which riparian corridors need protection from human use such as road and trail construction?

What are the necessary riparian reserve widths needed to maintain or restore ecosystem function?

Ecosystem Function - Analysis Questions

Have any plant or animal species been lost from this watershed? If so, what is the cause?

Have any non-native or exotic plant or animal species become established within the watershed? If so, what is the cause?

Where are areas of key aquatic habitat in need of protection?

What were historical peak flows?

Has channel widening occurred?

What past natural conditions would suggest a need for standards and guidelines beyond current direction?

Where is there evidence of dam-break floods within the watershed?

Are changes in the sediment regime apparent in this watershed, and if so what effect does this have on ecosystem function?

What are the landscape conditions on adjacent private lands?

What major issues are being faced on adjacent private lands?

Within the riparian corridors, what is the degree of canopy closure, large woody debris recruitment, shading, and stream bank stability?

What is the current distribution of structural stages within riparian corridors, and how does this compare to historic or reference conditions?

Currently, how well are riparian corridors functioning with regard to connectivity of late-successional refugia and late successional reserves?

Are there any forest health concerns within the watershed?

Chapter 3 - Historic and Current Conditions

Purpose

The purpose of this chapter is to describe what we currently know about the historic and current conditions of the various physical, biological, and social components of the watershed. In previous watershed analyses, the difference between historic and current conditions has been used synonymously with the concept of a "range of natural variability". In most cases, we do not have sufficient data to accurately describe an "historic" condition for the entire watershed. Thus, it would be erroneous to conclude that these differences constitute the "range of natural variability". Landres, et. al (1997) states that "natural variability is a complex temporal and spatial property of all ecosystems that is best described with several metrics, not just range."

What we do have, and present in this document, are scattered historic data for small areas, small pieces of the puzzle or discreet snapshots in time, that are better described as "reference" conditions. The historic or reference data are compared to the current condition to determine trends within the watershed. Our understanding of these trends allows us to prescribe appropriate management activities within the watershed that are designed to lead us toward desired future conditions.

Reference (historic) and current conditions are presented for the major terrestrial, aquatic, and social elements known from the Middle Cowlitz watershed in the following narratives. Each topic begins with a statement of the data sources used, data gaps, and any major assumptions that are important to the interpretation of the data.

Terrestrial Elements

Forest Vegetation

Data Sources/Data Gaps

The source of all current vegetation descriptions is the IVEG database, which is less than fully accurate. The maps and reports are generated from a database which has not been updated for at least a year. However, the general description of the vegetation is accurate enough for large area analysis, like this watershed analysis.

Reconstruction of historic vegetation conditions relied on known stand conditions as observed on old aerial photographs and on personal observations of stand conditions prior to old regeneration harvests.

Assumptions

The Forest Stand Structure map (Map #3) displays the vegetation in four broad classes for analysis - Non-Forest, Grass/Pole, Small Tree, and Large Tree. **Non-Forest** includes any area which is incapable of growing a forest due to rock, shallow soil, standing water, etc., or is being managed permanently for non-forest objectives (private agriculture land). The **Grass/Pole** class includes all forested land which presently has trees which range in size from seedlings (less than four feet tall) to poles (less than or equal to 8.9 inches average stand diameter). The **Small Tree** class includes all forested stands which presently have trees which range in size from nine to 20.9 inches average stand diameter. The **Large Tree** class includes all forested stands which presently have trees which range in size from 21 inches and larger average stand diameter.

Potential vegetation zones have been mapped for this project, and the three zones used in this project are the western hemlock, Pacific silver fir, and mountain hemlock zones. The concept of potential vegetation zones comes from the classification of plant associations as described in the Gifford Pinchot National Forest Plant Association and Management Guides (1983, 1986), which describe the relative differences in site conditions along temperature and moisture gradients. In general, the western hemlock zone (low elevation) has longer growing seasons and higher productivity than the mountain hemlock zone (very high elevation). The Pacific silver fir zone lies between these two extremes, and is characterised by cool and moist conditions, but moderate productivity.

Site productivity, the relative ability of the land to grow vegetation, specifically trees, has been summarized for the planning area. **Low** productivity is defined as land which averages less than 100 cubic feet per acre per year; **Medium** productivity is between 100 and 129; and **High** is land which averages 130 or more cubic feet per acre per year. The database for vegetation has estimates for site productivity, based on the potential vegetation classification and on specific stand exams.

A report of the number of acres by productivity class shows the following totals for Forest Service lands.

High Productivity	24,229 acres	63%
Medium Productivity	7,493 acres	20%
Low Productivity	6,410 acres	17%

Some of the sixth-field watersheds which show the highest percentages of land in the high productivity class are 2D, 2L, 2P, 2Q, and 2R.

Reference (Historic) and Current Conditions - Vegetation

The following is a description of this watershed area at a single point in time - 1900, and is

not a reflection of a range of variation. The source of the information which was used to reconstruct the vegetation is several sets of aerial photographs which show the planning area at different points in time - 1938-39, 1942, 1958-59, 1973, and 1989-90. Year of origin from the vegetation database was used to determine the timing of some fire events in the past. Some of this information was obtained from stand exams.

From observations of historic photos, most of the watershed which flows into Silver Creek was in a contiguous forest of large trees in 1900. This forest extended from the northern-most boundary of the watershed to the National Forest boundary along the Cowlitz River valley. The western boundary of this large tree forest was approximately the western edge of the Range 7 East tier, and the eastern boundary extended at least to the east boundary of the watershed. This was a very large block of large trees, interupted by occassional stands of small trees and non-forest openings associated with meadows, avalanche chutes, or rocky ground. There apparently were very few stands of grass/pole-sized trees at this time. The age of these large tree stands is estimated to be 200 years or older at that time.

The southern portion of the analysis area (south of Cowlitz River) within the National Forest was in a similar condition. From aerial photo analysis, about two-thirds of this area - from Woods Creek in the west to Cougar Creek in the east - was a large tree forest. There is a large area along the north side of Siler Creek and east to about Cougar Creek that completely burned about 1920. There is no evidence of what size trees were present before the fire in 1920, but it can be assumed that they were large trees, because the fire left some blocks of large trees within the burned area. For more information on historic fires in the analysis area see page 3-9.

In summary, it is estimated that at least 75% of the planning area within the National Forest was in a large tree forest. The remainder may have had any combination of non-forest, small tree, and grass/pole allocations. The portion on private land is more difficult to estimate, but from aerial photo analysis, it is clear that there was much more large tree component in 1900 than there is today, especially in the western end of the Cowlitz valley (subwatershed 2).

Today, the Middle Cowlitz analysis area is dominated by land which is classified as the **grass-pole** stage of development (52%). Most of the acres in this category are currently on private land, or is on land which was formerly private. The stands in this category originated from clearcut harvests, and are now fully stocked plantations. Some have been managed with young stand thinnings (precommercial), and many more are in need of this kind of treatment. At the lower elevations, Douglas-fir is the most abundant tree species in these plantations, however, many other tree species are present, such as western hemlock, western redcedar, big leaf maple, and red alder. At the higher elevations, plantations were planted with a mix of species - usually Douglas-fir and noble fir. These higher elevation sites also naturally develop into mixed stands of various species like Pacific silver fir, mountain hemlock, subalpine fir, western white pine, and lodgepole pine.

The following is a summary of timber harvesting which produced the above plantations.

National Forest Lands Only
1940's.....117 acres
1950's.....766 acres
1960's.....4,585 acres
1970's.....5,784 acres
1980's.....negligible
1990's.....1,982 acres
Total.....13,234

The rest of the plantations (approximately 31,500 acres) were mostly harvested in the 1970's on private lands. This summary shows the relative order in which these lands, especially Forest Service lands, will become available for commercial thinnings in the future. Add 40 to 50 years to the decade, and that is approximately when those acres will be ready.

Many of the young plantations listed above are scheduled for precommercial thinnings within the next ten years. A review of planned thinnings shows that there are about 3,200 acres scheduled in the northern part of the analysis area, especially in subwatersheds 2G, 2H, 2J, 2K, and 2T. In addition, there are about 1,300 acres scheduled in the southern half, mostly in subwatershed 2Q. This is an important activity for long term health of the watershed.

The **small tree** stage represents about 20% of the analysis area, and it is characterized by stands which have a dominant overstory layer with greater than 90% canopy closure. Some of these stands have just one canopy layer, but most of them have a second layer of seedlings and saplings, plus varying levels of herbs and shrubs. These stands are mostly in the age range of 80 to 150 years, but some may be as young as 50 years. Some of these stands have been managed with thinnings, or are planned to be thinned.

The **large tree** component represents about 19% of the analysis area, and includes stands which have very large trees in the overstory, possibly more snags than the small tree stage, and usually a more developed understory of shade tolerant trees. Large down logs are also more likely to be found in these stands. Most of these stands are at least 200 years old, and are in blocks fragmented by past timber harvests.

Most of the **non-forest** area (9%) is located in the Cowlitz River valley, associated with farmlands. The parcels within the National Forest are located near rock ledges, meadows, avalanche chutes, or bodies of water.

In summary, the structural stages within this analysis area for both National Forest and private lands are as follows:

Large Trees.....16,160 acres 19%
Small Trees.....17,058 acres 20%
Grass/Poles.....45,941 acres 52%
Non Forest.....7,454 acres 9%

Table 3-1: Vegetation Structure By Sixth Field Watersheds

Sixth Field	Non Forest Acres (%)	Grass/Pole Acres (%)	Small Tree Acres (%)	Large Tree Acres (%)
2	1,289 (10)	7,607 (62)	3,114 (25)	265 (2)
2A	220 (3)	5,038 (63)	2,779 (34)	0
2B	882 (20)	2,643 (59)	497 (11)	439 (9)
2C	112 (7)	574 (37)	406 (26)	449 (29)
2D	884 (28)	1,279 (41)	406 (13)	570 (18)
2E	115 (3)	2,587 (67)	861 (22)	293 (8)
2F	0	2,068 (83)	390 (16)	0
2G	0	3,425 (75)	648 (14)	467 (11)
2H	5 (1)	3,019 (82)	142 (4)	498 (13)
2J	402 (5)	3,925 (55)	453 (6)	2,301 (32)
2K	210 (3)	3,681 (50)	161 (2)	3,360 (45)
2L	1,834 (23)	2,035 (25)	2,431 (30)	1,692 (22)
2M	185 (9)	273 (13)	406 (19)	1,270 (59)
2P	305 (8)	1,084 (27)	1,652 (42)	903 (23)
2Q	888 (10)	2,817 (33)	2,319 (27)	2,548 (30)
2R	124 (9)	381 (28)	361 (26)	503 (37)
2T	8 (0)	1,186 (65)	32 (2)	602 (33)
Totals	7,454 (9)	43,662 (52)	17, 058 (20)	16,160 (19)

88,032 58,872 53756

For ease of discussion, similar sixth fields will be grouped by similarities in percentages of vegetation structure.

Group I: Subwatersheds 2, 2A, 2B, 2E, 2F, 2G, 2H, and 2T

This group is characterized by the highest percentages of vegetation in the grass/pole size. Each of these 6th field watersheds has at least 60% in the grass/pole stage. Geographically, these are all located in the western half of the analysis area, and most of it is on private land. Most of these young plantations were created in the 1970's, and they are growing rapidly, and they will soon move into the small tree size class (within 10 years). There are large blocks of these plantations on national forest land in 2E, 2F, and 2G which have not been precommercially thinned, and they will develop into very slow growing overstocked stands. These watersheds are the least likely to be opportunities for regeneration harvesting for the forseeable future. However, they will provide a large amount of commercial thinning opportunity in about 20 years.

Group II: Subwatersheds 2C, 2L, 2M, 2P, and 2Q

This group is characterized by sixth-field watersheds which have the highest percentages of their land in small and large trees, combined, and relatively small percentages of the grass/pole stage. Geographically, these watersheds are located along the south and southeast edges of the analysis area. These might be considered the best opportunities for regeneration harvest timber sales in this analysis area.

Group III: Subwatersheds 2D, 2J, 2K, and 2R

This group is characterized by sixth-field watersheds which have more balanced weightings between the grass/pole stage and the small and large tree stages combined. However, 2D is heavily weighted with small and large tree classes, if only National Forest land is considered. 2R is located along the southern edge of the analysis area, 2J and 2K are located in the northeast corner, and 2D is located in the center. Like Group I, many of the grass/pole stands in these 6th field watersheds will become candidates for commercial thinnings in about 20 years, especially in 2J and 2K, each of which presently has about 50% in the grass/pole stage.

Reference (Historic) and Current Conditions - Forest Health Assessment (Nutrient Deficiency, Insects, Disease, Blowdown)

This discussion focuses on the National Forest lands because there is little available data concerning the condition of the private lands within the analysis area.

Generally, the overall health of forest stands in this analysis area is very good with regard to the above topics. The site productivity is medium to high across most of the area, eliminating nutrient deficiency as a concern. There is a history of Douglas-fir bark beetles attacking isolated pockets of weakened trees. These pockets were treated in the past with aggressive regeneration harvesting. We can expect periodic outbreaks of these insects in the future, especially in stands

which are overstocked or very old. These stands are more susceptible to stress during climatic extremes, like drought. One of the most effective ways of minimizing a large problem with bark beetles is to keep the stands managed (thinned) at a stocking level that provides minimal stress during extremes of drought.

Beetle mortality is typically limited to isolated pockets and their role can be beneficial to forest ecosystems by creating gaps in an otherwise uniform stand canopy, if that is considered an objective. But if conditions are suitable, these insects can cause widespread damage and contribute to dangerous fire hazard.

A more common pathogen in this planning area which has a much larger impact on mortality than bark beetles is root rot disease. *Phellinus weirii* is present throughout the planning area to different degrees, but is known to be more common in the following locations. *P. weirii* has been observed as very active in the National Forest portions of subwatersheds 2B, 2C, and 2D, as well as the National Forest portions of 2L, 2P, and 2Q which are north of Lone Tree mountain and east to Kilborne Creek. These are generally lower elevations which seem to be where the disease is more active, as is generally observed in other parts of the National Forest. Bark beetle attacks are often in stands which are weakened by root rots.

In the past, some stands have been treated for root rot by clearcutting, and planting more resistant or immune tree species to grow for a rotation. This was done with the objective of eradicating the disease, but that objective is not common today. Short of eradicating the disease, the only alternative is to manage the huge amounts of wood which accumulate on the forest floor as trees die and fall down. In young stands, we should manage for a mix of tree species, so that the damage from the pathogen is slowed or limited.

These root rots generally serve to accelerate the process of converting a stand from early successional to late successional conditions. As the disease advances, more of the shade-intolerant species are killed, and more of the shade-tolerant species are released, because the latter are more tolerant of the disease, in general. However, left unmanaged, this situation creates huge amounts of wood, which can be a fire hazard.

Blowdown occurs in unpredictable places and amounts across the forest. However, at least one area has been observed to be susceptible to it in this analysis area along the edges of regeneration harvest units. In the southern portion of subwatershed 2J, just west of Whaleshead ridge, there have been some recent salvage sales of this kind. Large blowdown events, in which whole stands are blown over in a single wind storm are rare, but they can happen anywhere. These events can be the cause of very large bark beetle population increases, if the downed wood is not removed promptly. Past treatments have successfully limited additional mortality in adjacent stands of live trees when the blowdown was removed quickly. This approach to future large blowdown events should continue.

In summary, some practices which should be considered for maintaining the health of this planning area include: managing for a diverse species mix, managing the density of stands to reduce climatic stress, and treating large mortality events to minimize the spread of pathogens and the risk of large fires.

The Role Of Fire

Data Sources/Data Gaps

Only high severity fires (stand replacement) can be mapped. Low to moderate severity fires cannot be traced through stand-age analysis or other methods for this fire regime. Age-class analysis also needs to compensate for a "lag time", that is an additional amount of time for stands to become established. These recruitment periods may be from 50-75+ years at higher elevations and more harsh environments. A large portion of this analysis area has been logged within the last 40 years. Much of the historic fire data was lost when the vegetation was set back to an early seral stage by logging. Historic stand vegetation was only classified as Early (0-50yrs.), Mid (50-170), and Late seral (170 yrs., +). Fire history must be placed in a 500+ year context in order to account for the majority of fire events. Data or research in this context is minimal, and analysis by necessity is highly extrapolative. Although little is known about fire frequencies, live successional pathways, and the amounts of dead fuel loadings over time in the western hemlock zone, even less known about these characteristics in the Pacific silver fir and mountain hemlock zone.

Assumptions

Catastrophic disturbances permit the establishment of an identifiable, more or less even-age class of early seral species. Historic large-scale disturbance (fires) are not desired, and their effects can only be replicated on small scales. The effects which can most easily be managed include the maintenance of certain stand structure characteristics such as large down woody debris, snags, and a diversity of stand age classes for each of the vegetative zones. The designation of a land allocation (i.e. an LSR), is a management issue and/or decision, and the resultant Desired Future Condition and in most cases does not reflect historic natural fire conditions. Only designated Wilderness areas with approved Prescribed Natural Fire plan most closely approach fire disturbance effects. The scales needed to more accurately draw conclusions about past fire history and their effects are quite large and should be made only for entire Cowlitz Watershed area. No assumptions, interpretations, or recommendations could or should be made about historic fire disturbance at the sixth-field watershed scale. Potential Natural Vegetation can only be reached in the absence of fire or other disturbances. In most cases the frequency and extent of natural fires precludes the attainment of this potential.

Reference (Historic) and Current Conditions

Historically, fire has been the most significant disturbance mechanism in the watershed. Fires were low in frequency but high in severity, and had the potential to be quite large. Suppression activities since the 1930's has virtually eliminated potential natural wildfire effects for this watershed. Historic fire events tend to be either very small or very large. In the pre-suppression era, whether fires were natural or man-caused, the fire events which can be traced are very large. Large events probably mask scores of smaller events.

Riparian areas, especially in the western hemlock zone, tend to have microclimates which somewhat protect them from many wildfire events and tend to have older or late-seral stands associated with them. This effect is pronounced in steeper drainages. The Middle Cowlitz watershed in general is subject to greater marine climatic conditions than watersheds to the east which are influenced by more continental (colder and drier) conditions (all the way to the Cascade crest).

Three fires of 1,000 acres or larger burned in the Middle Cowlitz watershed analysis area between approximately mid to late 1800 to 1920. The first was a fire of approx. 6,000 acres that burned from the Cowlitz valley floor to approximately 2 1/2 miles north of the valley bottom. It runs from the forest boundary on the west to the eastern edge of the watershed analysis area. This fire burned some time between 1850 and 1900. The second fire was approximately 2,500 acres and occurred on the north flanks of Lone Tree Mountain. This fire occurred at approximately 1900, and covered an area from the valley floor to the top of the ridge separating the Cowlitz and Cispus drainages. The third fire burned in the Cunningham Creek and both forks of the Owens Creek drainage. It burned approximately 1,000 acres in the early 1920's.

The vegetative communities found within the analysis area can be classified into two general fire ecology groups within which fire follows certain characteristics. These groups and characteristics are described as follows:

Fire Ecology Group 8:

Fire ecology group 8 includes most of the western hemlock and Pacific silver fir plant associations found within the Middle Cowlitz watershed and, as such, includes a wide range of topographic positions, moisture, and temperature regimes. This group generally lacks fine fuels through most of the stand history, though fuel loadings build rapidly once the overstory begins to break up through decadence. Fire return frequencies tend to be low (on the order of 150-400 years) because of the cool, moist habitats found within these vegetative zones. Fires within this group serve to prepare mineral soil seedbeds, produce a mosaic of stand structures and age classes across the landscape, and affect within-stand species diversity.

Fire Ecology Group 9:

Fire ecology group 9 consists primarily of dry western hemlock plant associations where Douglas fir is the major seral species. Within the analysis area, these sites generally occur on north and south aspects along the Cowlitz River. Fuel loadings in this group are highly variable, depending upon individual stand and site conditions. Generally, fire ecology group 9 does not contain duff in depths as deep as are found in group 8. Fire return frequencies tend to be higher (on the order of 25-150 years) based on the drier habitats occupied.

Currently, the watershed is outside the natural condition for fire "effects". Past harvest activity in the watershed has been extensive, resulting in the loss of certain structural elements, such as snags, large down coarse woody debris, and possibly duff layers. The overall successional status of the watershed has been skewed towards an early seral condition. This has been caused by extensive logging. Significant modification of the spatial arrangement of vegetation and associated fauna that depend on it have occurred in this watershed. Logging has created large areas of uniform grass/pole stands north of the Cowlitz river drainage.

Botanical Species of Concern

Data Sources/Data Gaps

The primary data source used in determining historic and extant populations of threatened, endangered, and sensitive (TES) plant species for this project is the Biological and Conservation Database (BCD) managed by the Washington Department of Natural Resources Natural Heritage Program. No such comprehensive databases exist for survey and manage and noxious weed species, although interim databases have been developed that catalogue some location information on these species groups. Habitat information used in this report comes from maps and data produced and stored in Geographic Information Systems (GIS) and National Wetland Inventory maps.

Assumptions

In most cases, the data stored in the BCD was originally recorded as points on US Geological Survey Quadrangles and thus is only as accurate as the original mapper was. Since these data have been collected by a variety of individuals over a large timespan, it is expected that precision of individual locations will vary. It also must be understood that in some cases, individual locations were not reported as the result of a rare plant survey of that area, but were reported by an individual that came across the rare plant while in the course of some other activity. Thus, this data should only be interpreted as the status of our current knowledge, and in no way infers that intensive surveys have been completed within the analysis area unless otherwise stated.

Likewise no specific surveys have been conducted within the analysis area for survey and manage and noxious weed species. It is assumed that many undocumented sites exist for these three species groups within the analysis area.

The use of GIS layers for predicting special habitat areas is limited by the accuracy of the methods and data used in creating those layers. The GIS vegetation layer is based heavily on photo-interpretation and since small areas of special habitats are easily overlooked on aerial photographs they may not be well represented in GIS. While the methods used are considered to generate a good approximation of habitat areas, there is no substitute for actual field work to verify these locations.

Reference (Historic) and Current Conditions - TES Plant Species

No information on the historic condition of this species group was available for this report. It is assumed that viable populations existed within some areas of suitable habitat.

There are currently 51 species of Threatened, Endangered, and Sensitive (TES) plants on the Regional Forester's list for the Gifford Pinchot National Forest. Of these species, 31 are potentially found on the north zone of the forest and thus possibly within the analysis area. Those species that have been documented on the north zone (Packwood and Randle Ranger Districts) of the Forest, and those species that may occur there based on their published distributions, are listed in Table 3-2. At this time there are no federally listed (proposed, endangered, threatened) plant species known to occur on the Forest, however, one federally threatened species (*Howellia aquatilis*) is suspected.

Table 3-2: TES Plant Species Documented or Suspected on the North Zone

STATUS	SCIENTIFIC NAME	COMMON NAME	FS/GS*
Suspected	*Agoseris elata*	tall agoseris	-/s; 4/2
Known	*Botrychium lanceolatum*	lance-leaved grapefern	-/s; 5/3
Known	*Botrychium lunaria*	moonwort	-/s; 5/3
Known	*Botrychium minganense*	Mingan's grapefern	-/-;
Known	*Botrychium montanum*	mountain moonwort	-/s; 3/3
Known	*Botrychium pinnatum*	pinnate-leaved grapefern	-/s; 4?/3
Suspected	*Carex atrata var. erecta*	erect blackened sedge	-/s; 5T4/2
Suspected	*Carex densa*	dense sedge	-/s; 5/1
Suspected	*Carex interrupta*	green-fruited sedge	-/-;

Table 3-2: TES Plant Species Documented or Suspected on the North Zone			
Known	*Carex scopulorum var. prionophylla*	saw-leaved sedge	-/-;
Suspected	*Chrysolepis chrysophylla*	chinquapin	-/s; 5/2-3
Suspected	*Cicuta bulbifera*	bulb-bearing waterhemlock	-/s; 5/2
Known	*Cimicifuga elata*	tall bugbane	C/T; 2/2
Suspected	*Corydalis aquae-gelidae*	cold water corydalis	C/T; 3/2
Known	*Epipactis gigantea*	giant hellebore	-/s; 4/3
Known	*Githopsis specularioides*	common bluecup	-/s; 5/3
Suspected	*Howellia aquatilis*	Howellia	T/E; 2/1
Suspected	*Luzula arcuata*	curved woodrush	-/s; 5/1
Known	*Microseris borealis*	northern microseris	-/s; 3?/2
Suspected	*Montia diffusa*	branching montia	-/s; 3/1-2
Suspected	*Ophioglossum vulgatum*	Adder's tongue	-/T; 5/1-2
Known	*Orobanche pinorum*	pine broomrape	-/s; 4/3
Suspected	*Parnassia fimbriata var. hoodiana*	fringed-grass-of-parnassus	-/s; 3T3/1
Suspected	*Pedicularis rainierensis*	Rainier's lousewort	-/s; 2/2
Suspected	*Platanthera sparsiflora*	canyon bog orchid	-/s; 4-5/1
Known	*Pleuricospora fimbriolata*	fringed pinesap	-/s; 4/3
Suspected	*Polemonium carneum*	salmon polemonium	-/T; 4/1-2
Suspected	*Polystichum californicum*	California swordfern	-/s; 4?/1-2
Suspected	*Saxifraga debilis*	weak saxifrage	-/s; 4/3
Known	*Sisyrinchium sarmentosum*	blue-eyed grass	C/T; 2/2
Suspected	*Utricularia intermedia*	flat-leaved bladderwort	-/s; 5/2

*F/S; G/S refer to federal/state status and global/state rank respectively.
E = endangered; T = threatened; C = species of concern; s = sensitive
#'s refer to standard ranking after the Nature Conservancy

A search of the Biological Conservation Database yielded thirteen known sites of TES plants within the analysis area representing the following three species:

Githopsis specularioides
Orobanche pinorum
Pleuricospora fimbriolata

Additional sites for these species (and others listed in Table 3-2) are suspected within the analysis area within suitable habitats. Because many of these TES plant species are not confined to one specific habitat type, it is difficult to accurately delineate areas of suitable habitat for them within the analysis area. This was attempted at a broad scale by querying the existing vegetation layer GIS database for all ecoclass codes that represent unique plant habitats (i.e. meadows, red alder wetlands, rocky areas, etc.). Acres of each of these habitat types and number of known sites of TES plant species found within the analysis area are summarized below by sixth field watershed (Table 3-3). It is important to note that a large percentage of many of the sixth field watersheds is NOT in federal ownership (see Table 1-1). The special habitats listed in Table 3-3 below, are based only upon those acres that ARE in federal ownership. The distribution of special habitats within the analysis area are shown in Map #4.

TABLE 3-3: (habitat acres for federal lands only)
Acres of Habitats and Number of Known Sites by Sixth Field Watershed

6th field	Rocky Areas	Wet Meadows	Dry Meadows	Shrublands	Red Alder	Lakes, Ponds, Rivers	# of TES sites
2	0	0	0	0	0	0	0
2A	0	0	0	0	0	0	1
2B	15	0	0	2	4	0	1
2C	10	0	0	8	1	0	0
2D	0	0	0	0	0	0	1
2E	5	0	0	94	0	14	0
2F	0	0	0	0	0	0	0
2G	0	0	0	0	0	0	0
2H	4	0	0	0	0	0	0
2J	126	0	0	135	0	0	1

TABLE 3-3: (habitat acres for federal lands only) Acres of Habitats and Number of Known Sites by Sixth Field Watershed							
6th field	Rocky Areas	Wet Meadows	Dry Meadows	Shrublands	Red Alder	Lakes, Ponds, Rivers	# of TES sites
2K	56	7	32	115	0	0	0
2L	290	161	83	69	136	0	0
2M	168	4	3	10	0	0	0
2P	32	0	0	6	89	0	0
2Q	4	21	0	3	159	14	7
2R	0	0	0	0	0	0	2
2T	4	0	0	4	0	0	0
Total	714	193	118	446	389	28	13

National Wetland Inventory (NWI) maps are another useful source of information regarding special habitats. Methods and criteria used in compiling data for the GIS vegetation layer and the NWI maps are different, thus the NWI data is provided here separately from the GIS data shown above. The NWI data DOES include non-federal ownership. Table 3-4 is a summary of the NWI data.

TABLE 3-4: Summary of Acres of National Wetland Inventory Wetland Types by Sixth Field Watershed						
6th field	Palustrine Emergent	Palustrine Scrub-Shrub	Palustrine Forested	Riverine (CowlitzRiver)	Other (includes open water)	Total
2	222	47	145	234	3	651
2A	98	28	48	6	6	186
2B	261	86	50	0	1	398
2C	0	0	0	0	0	0
2D	46	41	60	188	0	335
2E	2	0	0	0	17	19
2F	0	0	0	0	0	0
2G	0	0	0	0	1	1

TABLE 3-4: Summary of Acres of National Wetland Inventory Wetland Types by Sixth Field Watershed

6th field	Palustrine Emergent	Palustrine Scrub-Shrub	Palustrine Forested	Riverine (CowlitzRiver)	Other (includes open water)	Total
2H	0	0	0	0	0	0
2J	0	3	0	18	0	21
2K	0	6	6	0	0	12
2L	377	166	83	299	11	936
2M	0	0	0	0	0	0
2P	63	45	27	75	0	210
2Q	429	89	25	0	35	578
2R	53	3	18	0	0	74
2T	0	0	0	0	0	0
Total	1,551	514	462	820	74	3,421

Reference (Historic) and Current Conditions - Survey and Manage Botanical Species

Survey and manage botanical species include those species of fungi, lichens, bryophytes, and vascular plants that are listed in Table C-3 of the President's Northwest Forest Plan. No information on the historic condition of these species groups was available for this report. It is assumed that viable populations existed within some areas of suitable habitat.

No new inventories were conducted for these species as a part of this watershed analysis, and because very little inventory or tracking has been done for these species locally, or on a regional level, a data gap exists regarding the actual distribution and location of many of these species. Many of the species listed as strategy 3 or 4, especially those in the nitrogen-fixing lichen group, are found within the analysis area, though detailed site information is lacking. Species listed as strategy 1 or 2 that have documented sites within the analysis area include the vascular plant *Allotropa virgata* and the rare, nitrogen-fixing lichen *Lobaria linita*.

Without much available data on actual species locations, evaluation of habitat conditions can be useful in predicting which species may be present. Areas that may provide suitable habitat for survey and manage species were derived from the existing vegetation layer in GIS by querying the associated database for parameters that would identify old-growth or late-successional stands. Further stratification of this habitat was achieved by overlaying a map of potential vegetation that indicates the major vegetational zones (i.e. western hemlock, Pacific silver fir, etc.) with a map that shows late-successional stands, and another that shows riparian areas. Information on the

habitat requirements for individual survey and manage species is compiled in Appendix J2 of the President's Northwest Forest Plan and is not repeated here. That information can be used in conjunction with the habitat data provided here to predict which species may be present within the analysis area.

Based upon the database query described above, acreages of potential habitat for survey and manage species within the analysis area can be summarized as follows in Tables 3-5, 3-6, and 3-7.

TABLE 3-5: Summary of Acres of Late-Successional Habitat Outside Riparian Reserves (by Sixth Field Watershed)

6th field (watershed acres)	Western Hemlock	Silver Fir	Mountain Hemlock	Total	% of WA
2 (12,277)	265	0	0	0	2%
2A (8,073)	0	0	0	0	0%
2B (4,463)	194	47	0	241	5%
2C (1,545)	141	189	0	330	21%
2D (3,142)	307	0	0	307	10%
2E (3,861)	36	153	0	189	5%
2F (2,487)	0	0	0	0	0%
2G (4,541)	15	314	0	329	7%
2H (3,667)	50	262	48	360	10%
2J (7,081)	774	568	0	1,342	19%
2K (7,414)	425	1,892	90	2,407	32%
2L (8,002)	719	209	0	928	12%
2M (2,135)	282	603	0	885	41%
2P (3,955)	321	227	0	548	14%
2Q (8,584)	1,658	213	0	1,871	22%
2R (1,377)	452	0	0	452	33%
2T (1,828)	6	248	91	345	19%
Total 84,432	5,645	4,925	229	10,799	13%

TABLE 3-6: Summary of Acres of Late-Successional Habitat Within Riparian Reserves (by Sixth Field Watershed)					
6th field (watershed acres)	Western Hemlock	Silver Fir	Mountain Hemlock	Total	% of WA
2 (12,277)	0	0	0	0	0%
2A (8,073)	0	0	0	0	0%
2B (4,463)	181	17	0	198	4%
2C (1,545)	58	61	0	119	8%
2D (3,142)	264	0	0	264	8%
2E (3,861)	53	50	0	103	3%
2F (2,487)	0	0	0	0	0%
2G (4,541)	43	94	0	137	3%
2H (3,667)	17	111	11	139	4%
2J (7,081)	677	264	0	941	13%
2K (7,414)	185	513	19	717	10%
2L (8,002)	680	85	0	765	10%
2M (2,135)	221	166	0	387	18%
2P (3,955)	211	144	0	355	9%
2Q (8,584)	601	83	0	684	8%
2R (1,377)	51	0	0	51	4%
2T (1,828)	196	43	17	256	14%
Total 84,432	3,438	1,631	47	5,116	6%

Table 3-7: Summary of Acres of Late-Successional Habitat Within the Analysis Area					
Analysis Area Acres	Western Hemlock	Silver Fir	Mountain Hemlock	Total	% of Area
84,432	9,083	6,556	276	15,915	19%

Reference (Historic) and Current Conditions - Noxious Weeds

No information on the historic condition of this species group was available for this report though it is assumed that these species have invaded the area concurrently with human

disturbance. The history of road and trail development within the analysis area would likely provide an interesting look into the historic invasion of weeds into the area.

No surveys were conducted for noxious weeds within the analysis area in conjunction with this watershed analysis. Noxious weed species commonly encountered in large populations on the north end of the Gifford Pinchot National Forest and likely to occur within the analysis area are shown in Table 3-8.

TABLE 3-8
Noxious Weeds Likely to be Found in Large Populations Within the Analysis Area

Scientific Name	Common Name
Chrysanthemum leucanthemum	oxeye daisy
Cirsium arvense	Canada thistle
Cirsium vulgare	bull thistle
Cytisus scoparius	Scotch broom
Hypericum perforatum	St. John's wort
Phalaris arundinacea	reed canary grass
Senecio jacobaea	tansy ragwort

Primary corridors for noxious weed dispersal within the analysis area include roads, trails, and riparian areas. Disturbed sites, including parking areas, log landings, trail heads, quarries, etc., provide potential population centers for these species.

Wildlife

Data Sources/Data Gaps

This report was compiled from personal knowledge of district biologists, Lower Cispus River Watershed analyses, and GIS databases and/or maps of vegetation (IVEG database), riparian reserves, roads, land use allocations, historic sightings records, and Habscape database. No field reconnaissance was done for this analysis. Population (occurrence, abundance, location) information for survey and manage amphibian and mollusk species is limited. The following data are not available:

- Density, size, distribution, and tonnage information about down logs and snags.

- Current and historical information about occurrence, distribution, and density for wildlife species on private and state lands.
- Current and historical information about occurrence, distribution, and density for most species on federal lands.

Assumptions

The following assumptions were made for this analysis:

- Habitat conditions determine wildlife distribution and abundance. Therefore, in the absence of a sighting record, a species is assumed to be present in the watershed if its habitats occur within the watershed.
- Fire, timber harvest, and roads have the greatest influence on wildlife distribution.
- Wildlife species abundance is determined by several interacting factors, including habitat conditions and human use (for example hunting and trapping). Migratory and wide-ranging species abundance may be influenced by similar factors which occur outside of the watershed boundary.
- The species that presently occur in the watershed were present prior to European settlement except for introduced species such as the bullfrog, starling, and Norway rat.
- Prior to 1940, introduced species were not present in any significant numbers.
- Forest interior and late-successional habitats and wildlife species dependent on these habitats were more common prior to 1940 than at present.
- Snag and coarse woody debris-dependent species were more abundant historically than at present.
- Opening and edge-oriented species are more common at present than they were prior to 1940.
- River otter, fisher, tailed frog and other riparian dependent species were more common prior to 1940 than at present.
- Large predators such as grizzly bear, gray wolf, and wolverine were more abundant prior to 1940 than at present.

- Indigenous people's utilization of wildlife did not limit wildlife populations.

Reference (Historic) and Current Conditions - General Wildlife and Habitats

There are 292 species of birds, mammals, amphibians, reptiles, and mollusks potentially occurring in the Middle Cowlitz watershed (Habscape database, Randle District sightings records). Of these, 82 species are known to occur in the watershed (Randle District sightings records).

Special Habitats

Special habitats occurring in the Middle Cowlitz watershed include avalanche chutes, red alder patches, shrub lands, lakes, ponds, alpine grasslands, and wet meadows. These habitats are limited but are critical for a variety of species, such as neotropical migrating birds, amphibians, mollusks, nesting raptors, and several mammals. Table 3-3 (see Botanical Species of Concern) shows the acreages of special habitats by sixth-field watershed.

Connectivity

Connectivity is defined as a measure of the extent to which conditions among late successional/old growth forest areas provide habitat for breeding, feeding, dispersal, and movement of wildlife and fish species associated with late successional/old growth forests (FEMAT, FSEIS). Connectivity is species specific and is related to each species' mobility, population size and distribution, and degree of dependence upon forest interior conditions.

For the Middle Cowlitz watershed analysis, it is assumed that stands classified as large tree are capable of providing connectivity. It is also assumed that stands classified as small tree will provide dispersal and movement corridors for wide ranging species. Map #5 shows large tree and small tree stands and riparian reserves. The riparian reserves were created to provide several functions including greater connectivity of late-successional forest habitat and travel and dispersal corridors for terrestrial animals and plants (ROD). Connectivity, as measured by the proportion of large tree stands, throughout the watershed has been reduced by rural and residential development, timber harvest and fire. It is estimated that stands classified as large tree once covered approximately 75% of the watershed, but currently cover only 19% of the watershed (Table 3-1). All but approximately 300 acres of these large tree stands are located on the National Forest. However, approximately 39% of the National Forest is classified as large tree.

The ability for many of the riparian corridors in the Middle Cowlitz watershed to provide connectivity for late-seral dependant species is compromised by gaps created by early seral

stands and non-forested lands (see Map #5). Riparian corridors (including the Cowlitz River, Kiona and Lynx Creeks) in private lands are dominated by non-forest, early seral and open conditions (DNR database) limiting connectivity for late-seral dependant species on local and broad landscape scales. On federal lands, riparian corridors south of the Cowlitz River are dominated by late and mid-seral conditions, though Siler Creek has gaps in its upper reaches (GPNF database). North of the Cowlitz, at the border of subwatersheds 2K and 2J, Silver Creek's ability to provide connectivity on a larger scale (between LSR's and across the watershed) is compromised by large gaps created by grass/pole stands located between large and small tree stands.

Ridgetops provide travel corridors for species associated with higher elevations. A limited amount of higher elevation connectivity is provided by Purcell Mountain-Whalehead Ridge-Grassy Mountain-Cockscomb Mountain on the eastern border of the Watershed (subwatersheds 2L and 2M).

Habitat Fragmentation

Fragmentation is the process of reducing size and connectivity of stands that compose a forest (FEMAT, FSEIS). Map #5 shows large and small tree stands in the Middle Cowlitz watershed. Many of the large tree stands are isolated from one another. Edge effects created by roads and grass/pole patches increase fragmentation and further reduce connectivity. Roads are further discussed below in the section on deer and elk biological winter range. Large contiguous blocks of large tree stands occur in the west-central portion of the watershed, primarily in subwatersheds 2M, the northern portions of 2L and 2C, and 2D, entending into 2B. A second block is located in subwatershed 2Q.

Isolated patches of large tree stands are located in subwatersheds 2H, 2G, 2T, 2J, 2, 2P, 2E, and 2B. Isolated, late-successional patches, especially if surrounded by mid-seral conditions, provide important refugia for some species. Local populations of these species may be able to expand when the surrounding habitat conditions become favorable.

Large tree stands in subwatershed 2K are fragmented but connected. Though the subwatershed contains 42% large tree stands and 8% small trees stands, it contains 46% grass/pole stands interspersed throughout the subwatershed. These conditions limit habitats for species associated with interior forest. Connectivity and interior habitats are further reduced by edges created by roads and adjacent grass/pole stands.

Reference (Historic) and Current Conditions - Wildlife Species of Special Management Status

Survey and Manage Wildlife Species and Amphibians and Mollusks

Four species listed in Table C-3 of the ROD as "survey and manage" species are known or suspected to occur in the Middle Cowlitz watershed. Two species are amphibian and two are mollusks.

Two survey and manage amphibian species occur or have the potential to occur in the watershed. The Larch Mountain salamander has been documented to occur in subwatershed 2A (Randle District sightings database). Protection measures for the Larch Mountain salamander are defined on page C-28 of the ROD. The Van Dyke's salamander is listed in the Habscapes database as having the potential to occur within the watershed.

Additionally, ten amphibian survey sites are located in four subwatersheds (2B, 2C, 2D, and 2K) of the watershed. The species identified during surveys conducted at those sites during 1994 and 1995 are listed in Table 3-9.

Table 3-9: Amphibian species identified during surveys conducted in selected subwatersheds of the Middle Cowlitz Watershed. X = species detected in the subwatershed.

Species	2B	2C	2D	2K
Tailed frog	X	X		X
Red-legged frog			X	
Cascade frog		X		X
Pacific giant salamander	X	X	X	X

Mollusk species likely or known to occur in the watershed are listed in Table 3-10.

Table 3-10: Mollusk species known to or have the potential to occur in the Middle Cowlitz Watershed (B. Behan, Biologist - Randle District).

Species	Documented	Potential
Ancotrema sp.	X	
Cryptomastix devia*	X	
Deroceras hesperium		X
Haplotrema vancouverense	X	
Hemphillia dromedarius		X

Table 3-10: Mollusk species known to or have the potential to occur in the Middle Cowlitz Watershed (B. Behan, Biologist - Randle District).		
Hemphillia glanduosa		X
Hemphillia pantherina		X
Megomphix hemphilli		X
Monadenia fidelis*	X	
Prophysaon coeruleum		X
Prophysaon dubium		X
Prophysaon vanattae	X	
Punctum sp.		X
Striatura pugetensis		X
Vespericola columbiana	X	

* = survey and manage species

Buffer Species

The Townsend's big-eared bat may occur in the Middle Cowlitz watershed. The ROD specifies protection measures for certain bat habitats including the Townsend's big-eared bat habitats. The ROD specifies protection buffers for four bird species. Two of these, the black-backed woodpecker and the pygmy nuthatch, have the potential to occur in the watershed (Habscape database). This section of the ROD also identifies protection measures for the lynx, a species which has the potential to occur in the watershed. The potential for the lynx or nuthatch to occur in the watershed is low because habitats for these species are marginal (Tom Kogut, Packwood District Biologist extraordinaire, personal communication).

Deer and Elk Biological Winter Range (BWR)

Subwatersheds: 2, 2A, 2B, 2C, 2D, 2E, 2G, 2J, 2L, 2M, 2P, 2Q, 2R, and 2T

The following analysis of BWR is based upon data generated from spatial analysis of IVEG and DNR seral condition data. The upper elevation for BWR was determined using the following parameters: 2,200 feet on south- and west-facing aspects; 2,000 feet on east-facing aspects; 1,800 feet on north-facing aspects.

The quantity of optimal cover on federal lands was determined from the IVEG database. When plotted, the optimal cover coincided with the large tree designations. Therefore, on private lands, late-seral or large tree designations were assumed to be optimal cover.

Deer and elk BWR occurs throughout the central portions of the watershed (Map #6). The BWR area covers approximately 39,000 acres (Tables 3-11 and 3-13). Of this total, an estimated 12,439 acres occurs in National Forest lands. Though approximately 48% of BWR on National Forest lands is considered optimal cover, the Middle Cowlitz watershed contains only 16% optimal cover within the BWR. This is well below the GPNF Land and Resource Management Plan, Amendment 11 goal of having 44% of BWR in optimal cover. To meet the GPNF Land and Resource Management Plan, Amendment 11 goal, an additional 11,000 acres of optimal cover are needed within the BWR.

Table 3-11: Federally Managed, Non-Federal, and Total Acreages of Deer and Elk Biological Winter Range (BWR) in the Middle Cowlitz Watershed

	Federal	Private	Total
BWR (acres)	12,439	26,665	39,104
BWR (% of total BWR)	32	68	-
Optimal Cover (acres in BWR)	5,970	378	6,348
Optimal Cover (% of BWR)	48	1	16
44% Goal (acres)	-	-	17,206
Acres needed to meet 44% goal	-	-	10,858

The GPNF Land and Resource Management Plan, Amendment 11, allocates approximately 8,230 acres of federal forest lands to Management Area Category E (Table 3-12). Of this acreage, 36% is estimated to provide optimal cover.

Table 3-12:
Acreages of Federal Forest Lands Allocated to Management Area Category E in the Middle Cowlitz Watershed

Allocation	Matrix	AMA	Total
EM (acres)	2,400	755	3,155
Optimal Cover in EM (acres)	600	90	690
Optimal Cover in EM (%)	25%	12%	22%
ES (acres)	2,730	1,920	4,650
Optimal Cover in ES (acres)	1,820	315	2,135
Optimal Cover in ES (%)	67%	16%	46%
Total EM + ES (acres)	-	-	7,805
Total Optimal Cover EM + ES (acres)	-	-	2,825
Total Optimal Cover EM + ES (%)	-	-	36%

Within the BWR, open road densities average 3.4 miles/square mile of BWR (Table 3-13). Road densities in the BWR should not exceed 1.7 miles/square mile of BWR (GPNF Land and Resource Management Plan, Amendment 11). These road densities also limit habitat for species such as gray wolf, grizzly and black bear, wolverine, and other predators.

Table 3-13: Acres of deer and elk biological winter range (BWR) and open road density within the deer and elk biological winter range by subwatershed.

Subwatershed	BWR (acres)	Federal Roads (mi)	Private Roads (mi)	Total Roads (mi)	Road Density (mi/mi^2)
2	11436	0	59.4	59.4	**3.3**
2A	3155	0	15.2	15.2	**3.1**
2B	2322	3.5	12.1	15.6	**4.3**
2C	875	1.5	4.4	5.9	**4.3**
2D	2963	8.2	10.4	18.6	**4.0**
2E	158	0	0	0	**0.0**
2G	365	0	5.1	5.1	**8.9**
2J	2149	0.8	1.3	2.1	**0.6**

2L	5118	8.85	14.5	23.35	**2.9**
2M	312	3.1	0	3.1	**6.4**
2P	2113	3.7	6.1	9.8	**3.0**
2Q	7005	30.4	12.4	42.8	**3.9**
2R	1034	2.6	2.5	5.1	**3.2**
2T	99	1.4	0	1.4	**9.1**
TOTAL	39104	64.05	143.4	207.45	**3.4**

Pileated Woodpecker and Pine Marten Network

Subwatersheds: 2G, 2H, 2L, 2P, 2Q

The Gifford Pinchot Forest Plan established one pileated woodpecker (LM) and four pine marten (PM and PX) land allocations within the watershed. The ROD amended individual forest plans by eliminating these allocations and establishing riparian reserves, LSRs, etc. The ROD allows for selected allocations to be retained if pine marten and pileated woodpecker management objectives will not be met through the ROD's land allocations.

The pileated woodpecker allocation is located in subwatershed 2P within the Cispus AMA. Pine marten allocations are located in subwatersheds 2G, 2H, 2L, and 2Q. Two (in subwatersheds 2H and 2L) are located in Matrix, one (2G) in LSR, and one (2Q) is half in the Ames Woods LSR and half in the Cispus AMA.

The pine marten allocation in subwatershed 2G is fully protected by the LSR land allocation. The pine marten allocation is subwatershed 2Q is protected by LSR and riparian reserve allocations. The majority of the pine marten allocation located in subwatershed 2L is protected by riparian reserve. It is recommended that these two pine marten allocations be eliminated.

The pileated woodpecker and remaining pine marten allocations should be retained. The pine marten allocation in subwatershed 2H will help provide late seral connectivity from the watershed to the Mineral Block and LSR located north of the watershed. The allocation is located at the headwaters of Lynx Creek which primarily flows through private lands. The riparian reserves in throughout the remainder of Lynx Creek are in early seral stages. This allocation is an island which may serve as a genetic center from which species may disperse to surrounding areas when conditions become suitable.

The pileated woodpecker allocation is partially protected by riparian reserve. A spotted owl activity center and deer and elk biological winter range are located adjacent to this allocation. Retention of this allocation will benefit spotted owls and other late-seral dependent species as well as pileated woodpeckers. Therefore it is recommended that the allocation be retained.

Listed Threatened, Endangered and Sensitive Species (TES)

Subwatersheds: All.

Thirteen species documented or have the potential to occur in the Middle Cowlitz watershed are listed as endangered or threatened under the Endangered Species Act, or are designated as either Sensitive, Candidate, or Species of Concern on the Regional Forester's list of Sensitive Species (Table 3-14). In addition, one federal Candidate Species and twelve federal Species of Concern are suspected or known to use the watershed. Sensitive species are those designated by the Regional Forester as requiring attention to prevent future federal listing. Candidate species are those for which enough information exists to warrant listing. Species of Concern are those which might be warranted if there were more information.

Table 3-14: Threatened, endangered, sensitive, candidate, and species of concern documented (D) or having the potential (P) to occur in the Middle Cowlitz Watershed.

Species/Occurrence		Endangered	Threatened	Sensitive	Candidate	Species of Concern
Gray wolf	D	X		X		
Peregrine falcon	D	X				
Spotted Owl	D		X	X		
Marbled murrelet	D		X	X		
Bald eagle	D		X	X		
Grizzly bear	P		X			
Common loon	P			X		
Lynx	D			X		
Cope's giant salamander	D			X		
Townsend's big-eared bat	P			X		X
Larch Mountain salamander	D			X		X
Wolverine	P			X		X
Western pond turtle	P			X		X
Spotted frog	P				X	
Long-eared Myotis	D					X
Fisher	D					X
Western small-footed bat	P					X
Olive-sided flycatcher	P					X
Long-legged Myotis	D					X
Cascades frog	D					X
Tailed frog	D					X
Northern goshawk	D					X

Northern Spotted Owl (NSO)

Subwatersheds: All.

The activity centers of nine NSO pairs and one territorial single NSO are located within the Middle Cowlitz watershed (Table 3-15). The home ranges (a home range is the area within the circle described by a 1.82 mile radius from the activity center) of seven additional pairs extend into the watershed. The activity centers for six pairs are located in Matrix, four pairs and the territorial male are located in Late Successional Reserve (LSR), and five pairs are located in Adaptive Management Area (AMA).

The amount of suitable NSO habitat has been calculated within 1.82 miles of the activity centers for 10 pairs and within 0.7 miles of the activity centers for 14 pairs and the territorial single. Thresholds for "take" on NSO are based on the quantity of suitable habitat located within the 0.7 and 1.82 mile circles. Take occurs when the amount of suitable habitat within the 0.7 acre circle falls below 500 acres and falls below 2663 acres within the 1.82 circle. The threshold for take has been exceeded for eight NSO pairs (Table 3-15).

Table 3-15: Numbers of Northern Spotted Owl Pairs or Singles by Land Allocation

	AMA	LSR	Matrix	Total
Pairs and territorial singles	5	5	6	16
Activity center located within watershed	2	3	4	9
100 acre core area established	5	0	5	10
Habitat take threshold exceeded	4	1	3	8

Of the 39,924 acres of federal land in the Middle Cowlitz watershed, 16,863 acres (42%) provide nesting, roosting, foraging, and dispersal (NRF) habitat for NSOs. An additional 2,500 acres (6%) provide foraging and dispersal habitat (FD); 3,846 acres (10%) provide only dispersal habitat.

Prior to implementation of the ROD, NSO critical habitat was federally listed under the Endangered Species Act. Two critical habitat units (CHU) overlap the Middle Cowlitz watershed. Subwatersheds 2J, 2K, 2L and 2M overlap with CHU WA-36. Subwatersheds 2, 2Q and 2R overlap with CHU WA-38. Proposed projects located within NSO critical habitat will require a biological assessment or evaluation assess the effects of the project on the CHU.

Marbled Murrelet

Subwatersheds: All of 2, 2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2J, 2K, 2M, 2R, and 2T; the southwest portions of 2Q, and 2L

Marbled Murrelets may occur within the Middle Cowlitz watershed. Two marbled murrelet sightings were reported just outside the watershed boundary. Most of the watershed lies within Zone 2, an area located between 35 and 55 miles from the Puget Sound in which marbled murrelets may occur. Map #6 shows the 55 mile limit of the Zone 2 boundary.

Lands allocated as LSR in the watershed are designated marbled murrelet critical habitat under the Endangered Species Act.

Habitat for marbled murrelets has not been surveyed in the watershed. However, potential habitat exists. All planning units and proposed project areas will require surveys for marbled murrelet habitat prior to implementation. If habitat is located, then surveys (to current federal agency protocol) to determine if the habitat is occupied will need to be completed. Occupied habitats will require that a ½ mile protective buffer be placed around the habitat before the project can be implemented.

Geologic Processes

Data Sources/Data Gaps and Assumptions - Volcanic Eruption and Seismic Activity

Infomation regarding volcanic and seismic activity was taken from the literature and from data stored in the Pacific Northwest Seismograph Network (PNSN) database housed at the University of Washington Geophysics Department, and is given a high degree of reliability at the scale of the total project area.

Reference (Historic) and Current Conditions - Volcanic Eruption and Seismic Activity

Mount St. Helens has deposited ash and pumice across the Middle Cowlitz watershed at least twice over the last 4,000 years; a cluster of times during the Smith Creek Eruptive Stage (3,900 to 3,400 years ago), which produced the Yn tephra layer, and again Spring/Summer, 1980. The eruption of 1480 AD (Yamaguchi, 1983) does not appear to have left measureable deposits in this watershed, though traces of the Wn layer are recognizable nearby to the east and southeast. Fine pumice and ash covered most of this study area to a depth of less than 1 inch (Pfeiffer and others, personal communication, 1997); the erosion of this ash into streams accounts for a substantial proportion of the fine sediment delivered to streams for several years afterward. Mount St. Helens has erupted about once every century for the last 500 years, and is expected to

follow a similar pattern into the centuries ahead (Crandell and Mullineaux, 1978).

Mt. Rainier is an active stratovolcano located about 12 miles northeast of the study area, though in river miles the distance is somewhat greater (about 20 miles). "Mt. Rainier is potentially the most dangerous volcano in the Cascade Range because of its great height, frequent earthquakes, active hydrothermal system, and extensive glacial mantle. Many debris flows and their distal phases have inundated areas far from the volcano during postglacial time." (Scott, Valance, and Pringle, 1995). According to recent hazard maps published for the area (Scott and Vallance, 1995), most of the Cowlitz River valley (floodplain) in this study area could be inundated by a mudflow, with or without an associated volcanic eruption.

Seismic activity in the form of small earthquakes (most less than 2.0 magnitude) occurs on the average of approximately 6-20 per decade underneath the planning area, with occassional larger earthquakes of magnitude 4 to 5. According to electronic records kept at the PNSN database at the University of Washington Geophysics Department, small quakes are common on the north side of the Cowlitz River, and quakes under this study area may represent a southern extension of the Western Mt. Rainier Seismic Zone. The very limited information available suggests that larger earthquakes (magnitude 6 and greater) appear to occur in Western Washington on the order of once every several centuries (Alper, 1993). It is possible that some of the large, deep-seated landslides in this study area were caused or reactivated during these larger seismic events, but this has not been confirmed for any slides in this study area.

Data Sources/Data Gaps and Assumptions - Mass Wasting

Due to time limitations, this report is primarily an office exercise, with information derived from existing data sources. Where possible, the writer's past field experience from various projects in the study area was also applied.

A major flood event occurred during 11/30/95 that initiated mass wasting events and stream channel changes; another major flood event occurred during 2/8/96 that caused severe mass wasting events and changes to stream channel conditions. Some damage occurred along the 47, 63, and 85 road systems, descriptions of which are included in this report.

Locations for mass wasting events were produced using a GIS coverage called "GeoHaz" (see Map 7 - Mass Wasting Inventory). GeoHaz is generally accurate, meaning that most landslides out on the ground have been identified by GeoHaz (prior to the 1989/90 air photo set), and most of the slides shown by GeoHaz will be found out on the ground . A known weakness of GeoHaz is that small failures along stream channels and roads are under-represented; more of these small failures exist on the ground than are shown on the coverage. Time did not allow for an air photo sequence review of the entire watershed, or actual input of corrections onto the GIS coverages. The bullet statements listed below reflect corrections of known errors where applicable.

Air photos taken in 1939 exist for portions of this study area, but only a few photos were available for this analysis. Air photos taken in 1959, 1972, 1979, 1989/90, and 1993 are available for use in determining the *timing* and *cause* of mass wasting events. Time limitations did not allow for air photo sequencing in order to compare the rate of "naturally occurring" mass wasting events to "human-caused" mass wasting events. However, an air photo sequence review of the Kiona WAU (Watershed Analysis Unit) was conducted by Lee Benda for the Kiona Creek Watershed Analysis (Murray Pacific Corp., 1995). A detailed inventory of landslides and debris flows occurring between 1939-1994 is presented in that report. The Kiona WAU contains sixth-field watersheds 2A and 2B of this report. In addition, air photo reviews for previous timber sale projects in this study area have allowed the writer to make qualitative determinations regarding the rate of human-related mass failures compared to naturally occurring mass failures throughout the rest of the watershed during the same time span. This time span, referred to below as Reference Conditions, usually refers to the 1973-1990 period of air photo coverage, and sometimes extends back to the 1959 air photos when noted. This brief time span is entirely too short to use for determining a *Range of Natural Variability* for mass wasting, so the term Reference Conditions has been used instead. When discussing the comparison of management-related mass wasting events to reference conditions, the following qualitative descriptions were used:

Slight: a few small road and harvest related failures have occurred, separated in both time and space

Moderate: several road and harvest related failures have occurred over space, with some of these being repeat failures in the same location through time.

High: numerous road and harvest related failures have occurred over space, with several of these being repeat failures in the same location through time.

Severe: numerous road and harvest related failures have occurred over space, with numerous repeat failures occurring chronically at the same location through time.

Reference (Historic) and Current Conditions - Mass Wasting

02 Private land, very little data. A large (>2 sq. mi.), ancient landslide scar is located on the north side of Huffaker Mountain; debris flows occur frequently on this steep face.

02 A Private land; (data from Benda, 1994). Several medium to large, naturally-occurring landslides and earthflows occur in this watershed. Small landslides and earthflows occur along the steeper stream banks. Bedrock dips south, same direction as common sideslopes, so area is prone to mass wasting.

During period of record (1939-94), the number of mass failures from roads and harvest were 3.5 times higher than for slides determined to have occurred "naturally" (mature forest): A determination of cause was not possible for an additional number of slides

(about 22%). Mass failures related to management activities occur at a *High/Severe* rate above the Reference Conditions in this watershed.

02 B Mostly private land; a few sections of Federal land. Several moderate and large, naturally-occurring landslides are located in this watershed. Bedrock dips south, same direction as common sideslopes, so area is prone to mass wasting.

Site of moderate-sized slide effecting Hwy 12 in 1994, reactivated following highway re-alignment. During period of record (1939-94), most mass failures have been road and harvest-related (see 02 A, above). Mass failures related to management activities occur at a *High/Severe* rate above the Reference Conditions in this watershed.

02 C About 1/2 private, 1/2 Federal. One large, naturally-occurring landslides is located in this watershed. Bedrock dips south, same direction as common sideslopes, so area is prone to mass wasting

Few management related slides are known from this watershed; mass failures related to management activities occur at a *Slight* rate above the Reference Conditions in this watershed.

02 D Most of this watershed is on flat river bottom (Pvt. Land); Federal portion is on steeper slopes. A few small debris flows along stream channels are the only naturally occurring mass wasting events known from this watershed. Bedrock dips south, same direction as common sideslopes, so area is prone to mass wasting. One large, naturally-occurring landslides is located on the east side of this watershed; it has an active component within, a deep-seated landslide that is currently disrupting the 75 Road in two places. Activity at this site has increased somewhat over the last two years; note a concern that Silverbrook Road and White Pass High School are located near the toe of this active slide.

Mass failures related to management activities occur at a *Slight* rate above the Reference Conditions in this watershed.

02 E Two small naturally-occurring landslides are located on the south side of Lake Creek, and one large (~1 sq. mile) landslide is located at the confluence of Lake and Silver Creeks that *may* be effecting channel conditions.

Portions of a few roads have seen repeated shoulder failures. Therefore, mass failures related to management activities is described as occurring at a *Moderate* rate above the Reference Conditions in this watershed.

02 F Private land; few naturally occurring slides have been mapped in the area.

Several debris flows initiated by road fill failures, culvert washouts, and timber harvest are known to have occurred. Mass failures related to management activities occur at a *High* rate above the Reference Conditions in this watershed.

02 G Mostly private land; few naturally occurring slides have been mapped in the area.

Several debris flows initiated by road fill failures, culvert washouts, and timber harvest are known to have occurred. Mass failures related to management activities occur at a *High* rate above the Reference Conditions in this watershed.

02 H Mostly Federal land, with one naturally-occurring slide mapped in the headwaters.

A couple of road-related failures are known to have occurred in this watershed. Mass failures related to management activities occur at a *Moderate* rate above the Reference Conditions in this watershed.

02 J Mostly Federal land; a large and complex watershed. Two large (>1 sq. mile) and several smaller, naturally-occurring landslides occur in this watershed. Some of these slides may be effecting the channels below the confluence of Silver and Lake Creeks, and the channel upstream from Willie Creek. Numerous smaller slides are known to occur along the incised inner-gorges of Silver Creek.

Several debris flows associated with road fill failures and timber harvest have occurred since 1973. Mass failures related to management activities occur at a *High* rate above the Reference Conditions in this watershed.

02 K Several areas of naturally-occurring rockfall and avalanches occur in this watershed. Some natural debris flows have travelled down the avalanche chutes since 1973.

Mass failures related to management activities occur at a *Slight* rate above the Reference Conditions in this watershed.

02 L The northern part of this watershed contains several naturally-occurring avalanche chutes along Surrey Creek and Cockscomb Mountain. There are also two large, ancient landslides with active portions within each; these small, active portions are currently disrupting the 47 road. These sites will require annual, or near annual; maintenance; geotechnical investigations in the past revealed that they are too deep and extensive to repair cost-effectively.

Mass failures related to management activities occur at a *Slight* rate above the Historic Conditions in this watershed.

02 M A number of naturally-occurring avalanche chutes are located on the south side of Whalehead Ridge, and two large, naturally-occurring slides are located on both sides of the East Fork Silver Creek. The landslide on the south side is actively disrupting the 47 road; it will require near-annual maintenance as it is too big and deep to fix.

Mass failures related to management activities occur at a ***Slight*** rate above the Reference Conditions in this watershed.

02 P A high rate of naturally-occurring erosion and mass wasting are located in the deeply incised stream channels of Owens and Cunningham Creeks, due in large part ot the very weathered tuffaceous bedrock and the mantle of glacial till.

Several fill failures from roads have been observed in this watershed, primarily within the incised slopes of the Owens Creek and Cunningham Creek drainages. Mass failures related to management activities occur at a ***High*** rate above the Reference Conditions in this watershed.

02 Q One small landslide has been mapped south of Lone Tree Lake; otherwise, few naturally-occurring slides are known here.

Mass failures related to management activities occur at a ***Slight*** rate above Reference Conditions.

02 R There are no mapped mass failures within the Schooley Creek drainage, naturally-occurring or management related.

02 T There are several small, naturally-occurring landslides mapped along the steep banks of Willie Creek, as well as one large landslide mapped at the confluence of Willie and Silver Creeks. Portions of this large landslide are active, and may be effecting the channel of Willie Creek.

Several road-related failures are mapped in this watershed; mass failures related to management activities occur at a ***Moderate*** rate above Reference Conditions.

Data Sources/Data Gaps and Assumptions - Hillslope Erosion

Information for hillslope erosion was taken from the forest Soil Resource Inventory (SRI) map, stored as another GIS coverage. Polygons delineating soil types are thought to be accurate at the watershed scale, although details will vary in accuracy at the site level. Interpretations of "surface soil erosion potential" were taken from the SRI handbook, and applied across the watershed as a rating of "Low, Moderate, or High" (see Map 8 - Erosion Potential).

No information on historic levels of hillslope erosion is known to exist for this watershed. It is surmised that hillslope erosion has been an important process following fires known to have burned in the area, but no data is currently available with which to quantify those changes.

Reference (Historic) and Current Conditions - Hillslope Erosion

Hillslope erosion occurs at low levels when bedrock is hard, sideslopes are shallow (less than 30%), and/or vegetative cover is dominant. Hillslope erosion increases as the sidelsopes increase, when the bedrock is weak and crumbling, when vegetative cover is removed, or when flowing water is routed onto hillsides where water does not ordinarily flow. Based on the SRI map units for this area,

> Sixth field watersheds exhibiting dominantly "Slight to Moderate" hillslope erosion potential include: 02: C,D,E,F,G,H,J,K,L,M,P,Q,R,T. Note, however, that a band of soil considered to have a Moderate/Severe erosion potential follows the course of Silver Creek (sixth-fields 02J and 02K)
>
> Sixth field watersheds displaying "Moderate/Severe" and "Severe" erosion potential include: 02: B.

Data Sources/Data Gaps and Assumptions - Road Conditions

Road Condition (Access and Travel Management, Phase II) Surveys were NOT conducted for roads on federal lands prior to this watershed analysis; such surveys are expected to occur within the next two years. Another source of information used on previous watershed analyses was a "Sediment from Roads" model run by Tom Erkert, GIS Coordinator at the Forest Headquarters in Vancouver. This information was also NOT available for this report.

Road information that IS available for this report is a listing of flood damage sites from high water events in 1994-96, and estimated costs to repair these sites to a similar standard as before. On private land in the Kiona Creek WAU (02A and 02B), a road drainage assessment was conducted for virtually all roads on land owned by the Murray Pacific Corporation (1995).

Reference (Historic) and Current Conditions - Road Conditions

Erosion and mass wasting associated with roads have been identified as a primary contributor of both coarse and fine sediments above the natural (background) rate to streams in this fifth-field watershed. Note that there is no historic equivalent for erosion or mass wasting from roads; the natural processes of erosion continue, and all road-related sediment produced is *additional* to the background rate.

Approximately 477 miles of road currently exist on private and Federally administered land within the watershed. There are 20 flood damage sites along the existing road system on Federal land in the Middle Cowlitz watershed. These sites are illustrated in Map 10, and listed by 6th field watershed in Chapter 6 - Management Recommendations. Repair costs are based on estimates made during flood damage assessments following storm events.

Table 3-16: Road and Flood Damage Information

Note: Road mileage and road density figures in this table reflect the total number of roads in a watershed, including all private and federally administered lands, regardless of whether they are considered "open" or "closed".

6th Field Watershed	WS Size (acres)	WS Size (sq. mi.)	Road Length	Rd. Density (mi./sq.mi.)	Road Crossings of Streams (#)	Flood Damage # Sites/est.$'s
2	12,277	19.2	60	3.1	60	No Data
02 A	8,073	12.6	36	2.9	114	No Data
02 B	4,463	7.0	30	4.3	128	No Data
02 C	1,545	2.4	7	2.9	20	0
02 D	3,142	4.9	22	4.5	35	3/ $48,072
02 E	3,861	6.0	26	4.3	85	No Data
02 F	2,487	3.9	25	6.4	80	0
02 G	4,541	7.1	38	5.4	113	0
02 H	3,667	5.7	29	5.1	107	2/ $11,223
02 J	7,081	11.1	43	3.9	113	3/ $62,813
02 K	7,414	11.6	42	3.6	137	4/ $26,481
02 L	8,002	12.5	26	2.1	45	0
02 M	2,135	3.3	4	1.2	14	1/ $28,736
02 P	3,955	6.2	15	2.4	39	2/ $62,733
02 Q	8,584	13.4	52	3.9	95	1/ $12,900
02 R	1,377	2.2	8	3.7	13	0
02 T	1,828	2.9	14	4.9	49	4/ $94,566
TOTALS	84,432	131.9	477	3.8 ave.	1,187	20/ $347,523

Aquatic Elements

Hydrology and Fisheries

Note: Within the following sections describing reference and current conditions, information is presented in the form of chronological bullet statements. The order of these statements is intended to illustrate change in condition over time.

Data Sources/Data Gaps for Water Quality and Channel Conditions

Data sources include previous watershed analyses done on Forest Service land and private timber company lands, stream surveys, water quality data collected by the Forest Service.

Assumptions for Water Quality and Channel Conditions

Used best available data from the data sources above. No new data was collected for this analysis.

Current habitat and channel conditions are assumed to have changed since stream surveys were conducted, due in part to the November 1995 and February 1996 floods.

Data collected for stream temperatures within this report vary from continuous gages and max- min thermometers to instantaneous readings. Widths and depths included in this report are mostly observational and not necessarily measured at bankfull.

Data Sources/Data Gaps for Peak Flow and Flooding

Flow data collected by USFS (Forest Service) and USGS (Geological Survey). ARP (Aggregate Recovery Percentage) and WAR (Water Available for Runoff) peak flow models developed by the Forest Service and the State and were run in Jan 1996.

Assumptions for Peakflow and Flooding

Two methods for predicting peakflow sensitivity for the subwatersheds in this area are utilized for this analysis. The first, entitled WAR or Water Available for Runoff is detailed in the Washington State Watershed Analysis Handbook. This method calculates predicted increases in stream flow with changes in vegetative cover based on rainfall, tree size, temperature, antecedent snow accumulation and elevation. For non-forested areas, including rock outcrops and meadows, this model assumes rapid runoff and greater snow accumulation and melt. Other specific assumptions the WAR model uses to compute the percent increase in flow: The average elevation of the rain dominated zone is 1000 feet, rain on snow zone is 2400 feet,

snow dominated zone is 3500, and highland zone is 4100 feet. It is observed that the transient snow zone is more like 1500 to 3500 feet for this area. Therefore, WAR measurements are most likely to be low.

The other method ARP (Aggregate Recovery Percentage) is detailed in the Gifford Pinchot Cumulative Assessment Process Final Report. This method calculates a predicted hydrologic recovery for a basin based on stand year of origin, species and site class assuming that a stand is 100% hydrologically recovered once it reaches an average diameter at breast height of 8 inches. This method does not rely on rainfall, temperature or antecedent snow accumulation. The ARP model uses the following specific assumptions: Productivity class of the rain dominated zone is high and eco-class is CH. For the rain on snow zone the productivity class is moderate and eco-class is CH. For the snow dominated zone the productivity class is moderate and eco-class is CF. For the Highland zone the productivity class is low and eco-class is CF. For the non-forest land, private land in the valley is assumed to be age 0; DNR grass/pole vegetation type is assumed to be age 20; and DNR small tree is assumed to be age 50 and nonforest national forest land is 100% hydrologic recovery.

Neither model accounts for soil compaction resulting from such activities as road construction and skid road use, or for the interception of subsurface flow and increased drainage density caused by road construction. Thresholds for each model are noted below.

> WAR - 10% or greater - possible downstream flood damage and scour to fish spawning and rearing areas and stream channel degradation.
>
> ARP - 70% or less - for seeing adverse effects including water quality and stream channel degradation.

Regional flood frequency regression equations, including their explicit estimated of confidence, provide a reasonable framework for evaluating the effects of forest harvest on peakflows over basin scale areas. For the purpose of this analysis, it is assumed that the regression equations predict flows under predominately hydrologically mature (pre-disturbed) conditions. The equations were based on data collected under a variety of land uses and forest patterns, including undisturbed, disturbed and mixed conditions. The effects of historically changing forest characteristics on the regional regression equations can not be evaluated.

It is assumed that the snow regression equation is derived from the measurements representing hydrologically mature conditions. Snow measurements recorded by Cooperative Snow Survey and the National Weather Service, are made under a variety of forest stands, although the climatic and topographic conditions of most stations are unknown. The US Army Corp of Engineers snow melt equation is thought to be appropriate for estimation of melt under rain on snow conditions.

Data Sources/Data Gaps for Riparian Condition and Wetlands

The source materials for riparian condition is very limited in scope, both historic and present. The information contained in this document has been gathered from watershed analyses done on Forest Service land and private timber company lands, stream surveys collected by the Forest Service, and using Forest Service SMART, Aquarun, and IVEG databases. A formal riparian inventory, including growth, age, species, and disturbance mechanism for riparian vegetation needs to be done.

Assumptions for Riparian Condition and Wetlands

Forest structural stage was used to evaluate Large Woody Debris (LWD) recruitment potential on the IVEG data base. Delineation of riparian forests is quite rough in this data base; most times the riparian area was not broken out from adjacent upland forests. Riparian tree growth rates were based on professional judgement.

Recruitment potential is based on the following:

Structure	Size	Recruitment Potential
Non-forest	Wetlands, Rock, Talus, Lakes	No foreseeable contribution
Grass/Pole	<9" diameter	No contribution for many decades
Small Tree	9" to 20.9" diameter	Near term, 1 to 7 decades
Large Tree	> 21" diameter	Can currently contribute

Data Sources/Data Gaps for Aquatic Organism Distribution

Historical fishery and habitat information is scarce for the area. Data sources include watershed analysis done on private lands, USFS Region 6 stream surveys, Washington Department of Fish and Game anadromous/resident surveys, and survey of Columbia River and its Tributaries done for U. S. Department of Interior.

Assumptions for Aquatic Organism Distribution

Fish species and distribution coincides with actual survey, or historical sources; a large amount of potential habitat and unknown populations may exist in the watershed. No field collection, or validation was done for this analysis.

Spring chinook (*Oncorhychus tshawytscha),* coho (O.*kisutch*), and winter steelhead *(O. mykiss)* are being reintroduced into the upper Cowlitz River and larger tributaries as mitigation for Cowlitz Falls Dam. Table 3-21 indicates the available habitat based on the reintroduction effort.

Cowlitz River winter steelhead *(O. mykiss)* is a fish stock proposed for listing as "Threatened" under the Endangered Species Act. As of this writing, the Upper Cowlitz watershed is being considered for inclusion to the Lower Columbia Evolutionary Significant Unit management area for steelhead. These fish or hatchery progeny of these fish are known to exist in the planning area, and are being used for reintroduction purposes.

Reference (Historic) and Current Conditions - Water Quality and Channel Conditions

Water Quality

Cowlitz River (2)

No data is available.

Kiona Creek (2A)

Dissolved Oxygen for Kiona Creek did not meet State Standards in 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.3-13)

Temperature readings for Kiona Creek (2A) exceeded state standards in 1992, 1993 and 1994 being over threshold of 16 degrees C for Class AA waters and exceeding the 20 degree Celsius threshold of being lethal to salmonid fish in 1994. Causes of increased temperature are related to forest practices and agricultural land use. (Beak Consultants Incorporated, 1995, p.3-15 to 3-22)

Peters Creek (2B)

Dissolved Oxygen for Oliver Creek (2B) did not meet State Standards in 1992, 1993 and 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.3-13)

Temperature readings for Oliver Creek (2B) exceeded state standards of being over 16 degrees C for class AA waters and reached the 20 degree Celsius threshold of being lethal to salmonid fish in 1992 and 1994. (Beak Consultants Incorporated, 1995, p.3-15)

Temperature readings for Peters Creek (2B) exceeded state standards in 1992, 1993 and 1994 being over 16 degrees C for Class AA waters and exceeding the 20 degree Celsius threshold of being lethal to salmonid fish in 1994. (Beak Consultants Incorporated, 1995, p.3-15)

Miller Creek (2C)

No data is available.

Hampton Creek (2D)

No data is available.

Lake Creek (2E)

Watch Lake (2E) did not meet dissolved oxygen standards in 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-79)

Watch Lake (2E) exceeded state temperature standards in 1994 being above 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81) The Watch Lake outflow peak stream temperature approached lethal levels for salmonids as reported by EPA (1986) exceeding 20 degrees Celsius.

Lake Creek (2E) exceeded state temperature standards in 1994. Maximum temperatures were above the threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Martin Creek (2F)

Martin Creek (2F) did not meet dissolved oxygen standards in 1994. Levels exceeded threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-79)

North Fork Martin Creek (2F) exceeded state temperature standards in 1994 being above the threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Lower Lynx Creek (2G)

Lynx Creek did not meet dissolved oxygen standards in 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-79)

Lynx Creek (2G) exceeded state temperature standards in 1994 being above the threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Arsenic Creek (2G) did not meet dissolved oxygen standards in 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-79)

Arsenic Creek (2G) exceeded state temperature standards in 1994 being above the threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Upper Lynx Creek (2H)

Lynx Creek (2H) exceeded state temperature standards in 1994 being above the threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Lower Silver Creek (2J)

Silver Creek (2J) did not meet dissolved oxygen standards in 1994. Levels were below threshold of 9.5 mg/l for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-79)

Silver Creek (2J, 2K) is identified as water quality limited for temperature and is on the Department of Ecology's section 303 (d) list as directed by the Clean Water Act.

Silver Creek (2J) exceeded state temperature standards in 1994 being above threshold of 16 degrees Celsius for Class AA waters. (Beak Consultants Incorporated, 1995, p.7-81)

Silver Creek (2J) water temperature data recorded by USFS found maximum temperatures to exceed state water quality standards on 18 days in 1991, 69 days in 1992, 3 days in 1993, 0 days in 1995 and 34 days in 1996. (Randle Ranger District, Lower Silver Creek Temperature Monitoring, 1991-1996.)

Upper Silver Creek (2K)

Silver Creek (2J, 2K) is identified as water quality limited for temperature and is on the Department of Ecology's section 303 (d) list as directed by the Clean Water Act.

Stream temperatures do not exceed state standards for Upper Silver Creek. Max temperatures in 1995 and 1996 were 11.9 degrees C. (USDA Forest Service, Upper Silver Creek Temperature Monitoring, 1995,1996.)

Surrey/Hopkins Creeks (2L)

No data is available.

East Fork Silver Creek (2M)

No data is available.

Cunningham/Owens (2P)

No data is available.

Siler Creek (2Q)

Water temperature data from 1996 in Siler Creek (2Q) found the stream to meet state standards of not exceeding the threshold of 16 degrees Celsius. The maximum temperature

reached 15.8 degrees Celsius on 3 different days during the summer. (Randle ranger District, Siler Creek Water Quality Monitoring Data, 1996)

Herbicide spraying was done in the spring of 1978 near a Class IV stream that flows into Siler Creek. No contamination was found in water samples.

Schooley Creek (2R)

No data is available.

Willie Creek (2T)

No data is available.

Channel Condition

Table 3-17: Miles of Stream by Class and 6th-Field

6th Field	Class I Stream Miles	Class II Stream Miles	Class III Stream Miles	Class IV Stream Miles	Total Stream Miles	Stream Density, mi/mi2
2	10	2	2	49	63	3.3
2A	4	1	7	57	69	5.5
2B	2	7	3	31	43	6.2
2C	0	2	1	10	13	5.4
2D	8	2	0	7	17	3.5
2E	0	1	6	24	31	5.2
2F	0	0	4	18	22	5.7
2G	0	4	5	28	37	5.2
2H	0	0	10	24	34	5.9
2J	2	7	4	38	51	4.6
2K	0	5	4	51	60	5.2
2L	14	6	2	47	69	5.5
2M	0	0	3	16	19	5.7

Table 3-17: Miles of Stream by Class and 6th-Field						
6th Field	**Class I Stream Miles**	**Class II Stream Miles**	**Class III Stream Miles**	**Class IV Stream Miles**	**Total Stream Miles**	**Stream Density, mi/mi2**
2P	4	0	2	30	36	5.8
2Q	4	5	4	36	49	3.7
2R	0	1	2	3	6	2.8
2T	0	0	3	12	15	5.3
Totals	48	43	62	481	634	

Cowlitz River: (02)

The entire reach is located in the Big Valley and is bordered by homes, farmlands, and pastures.

The river from Kiona Creek to Cowlitz Falls has a substrate of silt and sand (Bryant 1949).

Many abandoned Cowlitz River channels are filled in and presently function as farmland or pasture. It is likely that some of these channels were diked and filled in by the agricultural community sometime in the late 1800's and early 1900's. In addition, the lower portion of Kiona Creek is contained in one of the old abandoned Cowlitz River channels. (Murray Pacific, 1995, p. 7-16)

Kiona Creek: (02A)

The average width for Kiona is 12 feet, the average depth is 12 inches, the riparian cover is arboreal, and the spawning grounds are excellent (USFS 1936).

The first mile of Kiona Creek flows through swampy area and the channel is clogged with woody debris (Bryant 1949).

Portions of Kiona Creek (2A) and Dry Creek (2A) flow subsurface during summer months. (Randle Ranger District, Stream Survey 1995, And Murray Pacific, 1995, p.2-5)

Parts of the lower reaches of Kiona have been diked and dredged in the past. (Randle Ranger District, Stream Surveys, 1995 And Murray Pacific Corporation, 1995, p 2-8)

Aggradation of the stream channel has reduce the quality of the pool habitat in Kiona Creek (Randle Ranger District, Stream Survey 1995).

Apparent widening of mountain channels types and alluvial fan channel types in Kiona Creek is visible from aerial photos following debris flows and dam-break floods in 1939, 1966, 1974, 1988, 1990. (Murray Pacific, 1995, p. 7-14).

Low amounts of woody debris occur in Kiona Creek. Several factors probably attribute to this such as: 1. Debris flows or dam-break floods that have scoured woody debris from within streams, 2. Clearing riparian forests for the creation of pasture and farm land, 3. removal by historical logging, 4. Loss of recruitment from timber harvest in of the riparian zone, 5. Natural decay or attrition. (Murray Pacific, 1995, p.7-14)

For Kiona Creek (2A), lower gradient portions of the channel network, such as alluvial fans and the Cowlitz floodplain have higher proportions of wood formed pools compared to the steeper mountain channels. Part of this difference is attributable to the greater effectiveness of wood in forming pools in channels containing smaller substrate (ie. Lower gradient floodplain segments). In boulder and bedrock dominated mountain channels, wood plays lesser role in the formation of pools. Murray Pacific, 1995, P.7-16).

Peters Creek: (02B)

The first mile of Peters Creek has been channelized and is contained within a deep ditch where it flows along Peters Road and through pasture lands.

Parts of the lower reaches of Peters and Oliver Creeks have been diked and dredged in the past. (Randle Ranger District, Stream Surveys, 1995 And Murray Pacific Corporation, 1995, p 2-8)

The confluence area of Oliver Creek is a large swamp and has no defined stream channel (Randle Ranger District, Stream Survey 1995).

A three quarter mile reach of Oliver Creek flows subsurface during the summer months (Randle Ranger District, Stream Survey 1995 and Murray Pacific, 1995, p.2-5).

A portion of Peters Creek flows subsurface during the summer months (Murray Pacific, 1995, p.2-5).

Apparent widening of mountain channels types and alluvial fan channel types in Oliver Creek (2B) is visible from aerial photos following debris flows and dam-break floods in 1966 and1974. (Murray Pacific, 1995, p. 7-14)

Apparent widening of mountain channels types and alluvial fan channel types in Peters Creek (2B) is visible from aerial photos following debris flows and dam-break floods in 1939, 1966, 1974, 1988, 1990. (Murray Pacific, 1995, p. 7-14)

Low amounts of woody debris occur in Peters and Oliver Creeks. Several factors probably attribute to this such as: 1. Debris flows or dam-break floods that have scoured woody debris from within streams, 2. Clearing riparian forests for the creation of pasture and farm land, 3. removal by historical logging, 4. Loss of recruitment from timber harvest in of the riparian zone, 5. Natural decay or attrition. (Murray Pacific, 1995, p.7-14)

For Oliver and Peters Creeks, lower gradient portions of the channel network, such as alluvial fans and the Cowlitz floodplain have higher proportions of wood formed pools compared to the steeper mountain channels. Part of this difference is attributable to the greater effectiveness of wood in forming pools in channels containing smaller substrate (ie. Lower gradient floodplain segments). In boulder and bedrock dominated mountain channels, wood plays lesser role in the formation of pools. Murray Pacific, 1995, P.7-16).

Miller Creek: (02C)

Miller Creek is 14 feet wide and has a flow of 30 c.f.s. and a water temperature of 51° F (Bryant 1949).

Miller Creek has been channelized and is contained within a "concrete bed" for a quarter mile (Randle Ranger District, Stream Survey 1995).

Miller Creek is polluted with sewage and garbage from the town of Randle (Bryant 1949, Randle Ranger District, Stream Survey 1995).

Hampton Creek: (02D)

Channelization of the lower reach of Hampton Creek has taken place.

Portion of reach 1 of Hampton Creek has aggraded to the point where there is no longer a defined channel. This section of stream flows subsurface during summer months.

Lake Creek (2E)

Watch Lake: Timber around the lake has been harvested, little to no buffer was left.

Lower Lynx Creek: (02G)

Seventy-three percent of 02G is in grass/pole seral stage, this accounts for the lack of Large Woody Debris (LWD) in the stream channel.

Portion of Lynx Creek flows subsurface during the summer months (Randle Ranger District, Stream Survey 1987).

Upper Lynx Creek (02H)

Eighty-two percent of 02H is in grass/pole seral stage, this accounts for the lack of Large Woody Debris (LWD) in the stream channel.

Lower Silver Creek: (02J)

The average channel width is 30 feet, an average depth of 16 inches, riparian cover is arboreal (USFS 1936).

It is 19 feet wide, has a flow of 30 c.f.s., and water temperature of 56° F (Bryant 1949).

Resting pools are numerous throughout the stream; 18 pools/mile - reach 1, 43 pools/mile - reach 2, and 27 pools/mile - reach 3 (Bryant 1949).

There is dense growth of alder, maple, and brush along the margins of the stream, affording adequate shade and protection for fish (Bryant 1949).

There is anadromous habitat for the first 2.7 miles of stream (Bryant 1949).

Good spawning gravel is available during periods of high flow (Bryant 1949).

The average stream width is 50 feet and the estimated flow is 125 c.f.s. The stream bed is composed primarily of large rock and rubble, but some good spawning gravel is available in the lower one-half mile (Meekin 1962).

Reach 1 was reshaped (channelized) during the summer/fall of 1996. During the channelization process all wood was removed, the channel was straighten, the substrate was leveled, and rip-rap was set in place along the banks..

Water temperature in Silver Creek has been hitting higher levels since 1989 when it was measured at 53.6° F, in 1996 it hit 67° F. The highest measured to date is 69.4° F, measured in 1992 (Randle Ranger District, Stream Survey 1996).

All reaches have a lack of pool habitat and large woody debris (LWD) (Randle Ranger

District, Stream Survey 1996).

The lower one mile of stream channel is void of shade or hiding habitat (Randle Ranger District, Stream Survey 1996).

Due to aggradation of the stream at the reported anadromous barrier (Bryant) the height is no longer restricting passage and another 2.8 miles of Silver Creek and 5.3 miles of Lynx Creek is now available as anadromous habitat (Randle Ranger District, Stream Survey, 1996).

Upper Silver Creek (02K)

See Lower Silver Creek.

East Fork Silver Creek: (02M)

No data

Surrey/Hopkins Creeks: (02L)

No data

Cunningham/Owens Creeks: (02P)

Large amounts of sediment and woody debris were washed down Owens Creek during flood of February 1996. This sediment filled in the existing channel and a new channel was formed. The sediment has raised the lower section of pasture (~3 acres) by approximately three feet.

The lower reach of Cunningham Creek was channelized after the February 1996 flood.

Lone Tree Lake: Timber around the lake had been harvested and the buffer has substained wind damage is non-effective as shade or cover.

Siler Creek: (02Q)

Siler Creek flows through a swampy section in the first mile above the mouth where it has little current, no good pools or riffles, and a mud bottom. The water temperature is 50° F. The next one one-half mile has a few pools and spawning area sufficient for at least 200 pairs of salmon (Bryant 1949).

Siler Creek is 25 feet wide and flows through a swampy section in the first mile above the mouth. It has little current, no pools or riffles and the bottom is composed of silt and mud (Birtchet 1963).

Lowest reaches of Siler Creek have cattle grazing influence (Randle Ranger District, Stream Survey 1995).

Overall, Siler Creek has poor pool habitat, poor to moderate spawning gravel , and a lack of LWD (Randle Ranger District, Stream Survey 1995).

For Squire Creek, the substrate is made up of sand (70%) and small gravel. Pools occur every 20 to 50 feet with flow in between consisting of shallow riffles (Randle Ranger District, Stream Survey 1987).

Gibbs Lake is located in a pasture on private land and ground water floods the lake every year.

Schooley Creek: (02R)

The culvert at Skinner Road on Schooley Creek has a three foot jump and a six percent gradient and thus forms migration barrier (Randle Ranger District, Stream Survey 1983).

There is some cattle grazing around the confluence of Schooley Creek and Cowlitz River.

Willie Creek (2T)

No data for this 6th field watershed.

Reference (Historic) and Current Conditions - Peak Flow and Flooding

Table 3-18: Peakflow Rating of Each 6th Field by Transient Snow Zone, WAR, and ARP

6th Field Watershed Number	% of 6th field in Transient Snow Zone (1)	WAR-% Increase in Peakflow during a 2 year Unusual Event (2)	% ARP	Peakflow Rating
2	8	45.2	70	High
2A	59	17.9	60	High
2B	45	25.3	50	High
2C	53	21.3	78	High
2D	15	32.1	81	High
2E	85	12.5	38	High
2F	86	32.7	21	High

Table 3-18: Peakflow Rating of Each 6th Field by Transient Snow Zone, WAR, and ARP				
6th Field Watershed Number	**% of 6th field in Transient Snow Zone (1)**	**WAR-% Increase in Peakflow during a 2 year Unusual Event (2)**	**% ARP**	**Peakflow Rating**
2G	94	11.2	32	High
2H	55	11.3	34	High
2J	70	9.0	71	Moderate
2K	63	9.1	59	High
2L	37	22.1	89	Moderate
2M	66	8.0	90	Low
2P	54	21.2	84	High
2Q	23	18.1	84	Moderate
2R	35	27.7	82	High
2T	75	11.2	66	High

Note: (1) Transient snow zone=1500 ft to 3500 ft. (2) Comparing Current Conditions over All Mature Conditions. See Appendix A for complete WAR values.

Peakflow Rating Definitions for table 3-18 (above):

High Peakflow Rating Concern: All 6th field watersheds with a high predicted potential for adverse peakflow effects are also experiencing a "High Concern" in many reaches along the mainstem stream of that watershed. These subwatersheds should be further investigated and management activities carefully scrutinized for potential degradation before further disturbance is allowed.

Moderate Peakflow Rating Concern: All 6th field watersheds with a moderate predicted potential for adverse peakfows effects have stream reaches experiencing some degradation, but to a lesser degree than above, or for more natural reasons. These watersheds should also receive some further investigation before introducing new disturbances.

Low Peakflow Rating Concern: The 6th field watersheds with a low predicted potential for adverse peakflow effects has a few to some reaches experiencing streambank

instability, pool, LWD, width to depth ratio problems that could be connected to upstream adverse effects. Further analysis is warranted.

Table 3-19: The top 5 measured floods on the Cowlitz at the Randle USGS Station. Data collected by the USGS from 1949 to Present.

Rank	Discharge (cfs)	Year	Recurrence Interval (years)
1	Not yet available	Feb 1996	100+
2	89,300	1978	45
3	73,300	1976	23
4	66,300	1991	15
5	52,800	1974	11

About the Cowlitz River: "...there's been three big floods. There's been a lot of little ones but three big ones. One in '96 (1896), and one in 1906 and then the '33... my folks...moved up on the higher ground after the '96 flood." And, "In the flood of 1906 some of them were drowned (regarding cattle lost in the flood). Right in the barn. '96 (1896) some were drowned and I don't know how many." And, "Well, the water got up there, got into the house to where they run a canoe in to the house to get the people that was upstairs, when they finally took a notion to get out of there...down across that prairie - there's quite a stretch of open ground there, you know - and they said the whitecaps were rolling on that water down there (describing the 1906 flood)." And, "There were a lot if little ones, but the '33 was the grandaddy." From Ralph Moorcroft, oral history interview by M. Hardy & J. Garoutte, 1983.

"...hardest blow was the flood of November 10, 1896 when nearly all the stock in the valley was drowned and the hay and vegetables spoiled. This was the first flood the whites had witnessed and they were not prepared. At Nesike (sic - now under Riffe Lake) and entire family, excepting the man...was drowned." From William Sethe, former District Ranger at Packwood, 1938.

Under existing condition, peakflow problems exist in Kiona Creek and to a lesser degree Peters Creek 6th fields. (Murray Pacific, 1995, p.6-6)

The hydraulic assessment on Kiona Creek watershed (02A) indicated that high flow events are not the cause of major channel changes, but rather it is the debris avalanches, debris flows dam break floods, local slumps, etc that are associated with periods of high runoff in conjunction with degraded riparian functions (loss of root strength, loss of large woody debris recruitment and in

stream roughness loss of over bank resistance to debris flows/dambreak floods through the removal of streamside trees) along many unconstrained reaches. (Murray Pacific, 1995, 6-12)

Reference (Historic) and Current Conditions - Riparian Condition and Wetlands

It is assumed that riparian corridors in the Middle Cowlitz watershed had the following forest size-class ratios by Forest Zone during the period (pre - 1880). This was based mostly on professional judgement, relying on fire history and existing data.

Forest Zone	Large Tree	Small Tree	Grass/Pole
Western Hemlock	80%	10%	10%
Silver Fir	60%	20%	20%

Predicting the historic spatial arrangement of forest size classes in riparian reserves would be tenuous at best. Riparian structural class is based on a number of factors including, forest health, valley form, disturbance patterns, tree species, windthrow, and channel migration among others. Therefore, any activity involving vegetation manipulation, adjustments to riparian widths, or other projects proposed within riparian reserves should be done through an interdisciplinary, site specific analysis.

Table 3-20 shows a comparative ratio between subwatersheds of forest structural class currently existing in riparian reserves. Riparian condition for each sub-watershed was evaluated and summarized below. Since the last stand replacement fire was in the mid 1800's grass/pole structure occurring in sub-watersheds is a result or combination of timber harvest, mass wasting, or areas of natural non-forest. Also see the following maps: Forest Stand Structure (Map #3) and Habitat Fragmentation (Map #5).

Table 3-20: Percent of Seral Stage in the Riparian Corridor

Subwatershed Name	6th Field	Miles of Stream	Acres of Riparian Veg.	% Grass / Pole	% Small Tree	% Mature Tree	% Non-Forest
Cowlitz	2	63					
Kiona	02A	69	697	59	41	0	0
Peters	02B	43	667	55	14	30	1
Miller	02C	13	457	51	21	26	1
Hampton	02D	17	342	8	12	77	3

Table 3-20: Percent of Seral Stage in the Riparian Corridor							
Subwatershed Name	**6th Field**	**Miles of Stream**	**Acres of Riparian Veg.**	**% Grass / Pole**	**% Small Tree**	**% Mature Tree**	**% Non-Forest**
Lake	02E	31	1132	61	25	9	5
Martin	02F	22	475	82	18	0	0
Lynx/Lower	02G	37	1261	73	16	11	0
Lynx/Upper	02H	34	934	82	3	15	0
Silver/Lower	02J	51	2501	48	11	38	3
Silver/Upper	02K	60	1633	41	11	44	5
Hopkins	02L	69	1704	10	29	45	16
E. Fork Silver	02M	19	728	21	16	53	10
Owens	02P	36	731	15	35	49	2
Siler	02Q	49	1775	31	28	39	2
Schooley	02R	6	92	32	12	56	0
Willie	02T	15	599	52	4	43	1

Cowlitz River (02, 02D, 02L, 02P)

The entire reach is located in the Big Bottom Valley and is bordered by homes, farmlands, and pastures.

Kiona Creek (02A)

The first mile of Kiona Creek flows through swampy area and the channel is clogged with woody debris (Bryant 1949).

The riparian corridor is primarily early seral.

There are approximately 3.0 miles of roads within the riparian zone.

Oliver Creek (02A)

The first mile of Oliver Creek is a marsh/wetland and the dominant vegetation is grass/forb.

The remaining riparian corridor is in early seral.

Peters Creek (02B)

The vegetation type in the first mile is grass/forb where it flows through pasture/farmland. Peters Road parallels Peters Creek for about half mile.

The next mile of Peters Creek is bordered on the east by second growth timber and on the west by private homes. The remaining corridor is in early seral.

Miller Creek (02C)

The riparian setting for Miller Creek in the first mile is residental, the town of Randle.

The remaining riparian corridor is fragmented and is dominated by mid and early seral stages.

Hampton Creek (02D)

The riparian vegetation for the first mile of Hampton Creek is grass/forb, pasture.

Silverbrook Road is within the riparian zone for approximately one mile. The remaining riparian corridor is continuous mid seral.

Lake Creek (02E)

Riparian connectivity is continuous early seral to the headwall.

Martin Creek (02F)

Riparian connectivity is continuous early seral to its source.

Lynx Creek (02G, 02H)

The riparian corridor is highly fragmented late seral in the first mile with the remaining corridor in early seral. There are five road crossing (culverts) on Lynx Creek.

Silver Creek (02J, 02K)

The riparian corridor is continuous late seral to reach S-6 with the exception of the first mile

which is industial/residental. The riparian corridor from reach S-6 to its source is fragmented late/early seral.

Sethe Creek (02L)

The riparian corridor for Sethe Creek is early seral, pasture.

Hopkins and Surry Creek from the forest boundary have continuous riparian corridors of mid / late seral. In the alluvial fan the riparian corridor is early seral, pasture.

East Fork Silver Creek (02M)

The riparian corridor for East Fork is continuous late seral and has one road crossing.

Siler Creek (02Q)

Riparian conditions in general in Siler Creek are grass/pole to small tree size to the Forest boundary. The remaining corridor is fragmented late/early seral.

Squire Creek (02Q)

The adjacent vegetation is dominated by old growth douglas fir, western hemlock, and western red cedar, with dense riparian vegetation of devils club, salmonberry, vine maple, and colts foot. The channel is 80 to 100% shaded (Randle Ranger District Stream Survey 1987).

Forest Road #2305 is within the riparian buffer of Squire Creek for approximately three quarters of a mile.

Schooley Creek (02R)

The riparian vegetation from the confluence with the Cowlitz River to Skinner Road consists of hardwood, grass/forb (pasture) and from Skinner Road to the headwall, old growth douglas fir (Randle Ranger District, Stream Survey 1986).

Watch Lake (02E)

The habitat surrounding Watch Lake is mostly early seral, the north shore is non-forest.

Lone Tree Lake (02P)

The habitat surrounding Lone Tree Lake is early seral. A small buffer was left after timber

harvest, however, it has sustained wind damage and is not as effective in providing shade.

Gibbs Lake (02Q)

The habitat surrounding Gibbs Lake is marshland/pasture.

Table 3-21:
Maximum amount of habitat for anadromous / resident fish and potential for LWD.

Stream Name	6th Field	Reach Mile on Cowlitz River	Miles of Anadromous Habitat	Miles of Resident Habitat	Riparian Vegetation % Large Tree	Miles Road in Riparian Corridor
Cowlitz R.	02,02D, 02L, 02P	NA	24.7	24.7	No Data	No Data
Kiona	02A	100.4	8.0	9.3	0	2
Peters Oliver	02B	NA	1.0 1.5	2.2 2.2	30	3
Miller	02C	102.8	0.5	1.4	26	2
Hampton	02D	103.0	No Data	0.7	77	4
Lake	02E	NA	0.25	0.25	9	6
Martin	02F	NA	NA	0.25	0	4
Lynx/Lower	02G	NA	4.4	4.4	11	10
Lynx/Upper	02H	NA	No Data	0.6	15	6
Silver/Lower	02J	105.6	5.5	8.3	38	13
Silver/Upper	02K	NA	NA	2.5	44	8
Hopkins Sethe Surrey	02L	111 108.8 106.0	NA No Data No Data	No Data No Data No Data	45	6
E. Fork Silver	02M	NA	0.25	0.6	53	3
Owens Cunningham	02P	113.1 112.3	NA NA	1.1 1.3	49	2
Siler Squire	02Q	99.9	2.7	1.7 1.0	39	10
Schooley	02R	97.9	NA	1.4	56	1

Table 3-21:
Maximum amount of habitat for anadromous / resident fish and potential for LWD.

Stream Name	6th Field	Reach Mile on Cowlitz River	Miles of Anadromous Habitat	Miles of Resident Habitat	Riparian Vegetation % Large Tree	Miles Road in Riparian Corridor
Willie	02T	NA	NA	No Data	43	4

Reference (Historic) and Current Conditions - Aquatic Organism Distribution

Cowlitz River: (02, 02D, 02L, 02P)

Spring and fall chinook *(Oncorhychus tshawytscha)*, coho *(O. kisutch)*, steelhead *(O. mykiss)* and coastal cutthroat *(O. clarki)*, rainbow trout *(O. mykiss)*, German brown trout *(Salmo trutta)*, mountain whitefish *(Prosopium williamsoni)*, and less recreational species (ie sculpin) are known to inhabit this section of the Cowlitz River (Bryant 1949, Washington Department of Fisheries and Game 1959, Randle Ranger District Snorkel Surveys).

Currently, spring chinook, coho, and steelhead are being reintroduced into the upper Cowlitz River system.

Kiona Creek: (02A)

Kiona Creek has a total of 8.0 miles of fishable habitat (USFS 1936).

Historically coho used approximately 7 miles and steelhead used approximately 8.2 miles of Kiona Creek (Murray Pacific 1995).

Native populations of cutthroat and rainbow trout exist in Kiona Creek (USFS 1936).

Currently coho and steelhead fry are being released into Kiona Creek as part of the salmon reintroduction effort.

Oliver Creek: (02A)

Historically coho and steelhead used approximately 1.5 miles of Oliver Creek (Bryant 1949).

At the present there has been no effort to re-introduce anadromous species into Oliver Creek.

There is a small population of rainbow trout in this stream (Randle Ranger District, Stream

Survey 1995).

Peters Creek: (02B)

Historically Peters Creek had a anadromous run of coho and steelhead from the mouth to the current crossing on U.S. Highway 12 (Murray Pacific 1995).

Peters Creek has a small population of cutthroat trout and rainbow trout.

Miller Creek: (02C)

Coho and steelhead used the first half mile of stream for spawning and rearing (Bryant 1949).

At present there is no effort to re-introduce anadromous species into Miller Creek.

There is a small population of rainbow trout using the first 1.5 miles of Miller Creek (Randle ranger District, Stream Survey 1995).

Hampton Creek: (02D)

A small population of cutthroat trout exist in Hampton Creek.

Lake Creek (02E)

Lake Creek is the outlet stream from Watch Lake and flows into Silver Creek.

Resident populations of rainbow and west slope cutthroat trout exist in Lake Creek.

Martin Creek (02F)

No known populations of fish.

Lynx Creek (02G, 2H)

Lynx Creek in the past did not have a run of anadromous fish. However, the anadromous barrier identified by Bryant (1949) no longer exists (Randle Ranger District Stream Survey 1996). The new identified barrier is now upstream from the confluence of Lynx Creek. This has opened up 5.3 miles of potential anadromous habitat.

There is a healthy population of rainbow trout in Lynx Creek (Randle Ranger District, Stream Survey 1987).

Silver Creek (02J, 02K)

Washington State stocking records state that eastern brook trout (*Salvelinus fontinalis*) and rainbow trout were stocked in Silver Creek (USFS 1940).

Silver Creek has usable anadromous (coho, steelhead) habitat for the first 2.7 miles (Bryant 1949).

Coho fingerlings are numerous in the lower two miles and a small steelhead run also exists (Bryant 1949).

The lower 1/3 mile of Silver Creek is of value for spawning and some rearing. Silver Creek above Silverbrook Park (Mary Kiona Park) has some spawning habitat and abundant rearing habitat for steelhead and spring chinook (Easterbrooks 1980).

As part of the anadromous reintroduction effort Silver Creek has received coho, chinook, and steelhead fry.

The lower reaches of Silver Creek have resident populations of rainbow trout and mountain white fish and the upper reaches have resident population of west slope cutthroat (Randle Ranger District, Stream Survey 1996).

Bryant (1949) reported the anadromous barrier at RM 2.7. Due to aggradation of the stream channel, the height of the barrier has dropped from 20 feet to 7 feet. This chute/fall is no longer considered a barrier to steelhead and an additional 2.8 miles of stream has been opened for anadromous habitat (Randle Ranger District, Stream Survey 1996).

East Fork Silver Creek: (02J)

The East Fork enters Silver Creek below impassable falls, a few salmon are reported using the first quarter mile (Bryant 1949).

There is a small population of rainbow trout in East Fork Silver Creek (Randle Ranger District Electroshocking data 1987).

Hopkins Creek: (02L)

Hopkins Creek above Purcell slough has a flow of about 3 c.f.s. and reported to support a small run of coho (Bryant 1949).

Sethe Creek: (02L)

It is of little value to salmon (Birtchet 1963).

Owens Creek: (02P)

Is an intermittent stream of little or no value to salmon (Bryant 1949).

Owens Creek has a small population of cutthroat trout (Randle Ranger District, Electroshocking data 1987).

Cunningham Creek: (02P)

Is an intermittent stream of little or no value to salmon (Bryant 1949).

Cunningham Creek has a small population of cutthroat trout (Randle Ranger District, Electroshocking data 1987).

Siler Creek: (02Q)

Flows through a swampy section in the first mile above the mouth where it has little current, no good pools or riffles, and a mud bottom. The water temperature is 50° F. The next one, one-half mile has a few pools and spawning area sufficient for at least 200 pairs of salmon (Bryant 1949).

The anadromous barrier is located 2.6 miles above the mouth, two falls 12 and 22 feet in height (Bryant 1949)

Squire Creek: (02Q)

It is of little value to salmon although a few coho spawn near its mouth (Bryant 1949).

Small sized cutthroat trout were found throughout the entire surveyed section of the creek, to just above Forest Road #2305 (Randle Ranger District, Stream Survey 1987).

Schooley Creek: (02R)

It is of little value to salmon although a few coho spawn near its mouth (Bryant 1949).

Schooley Creek has a small population of cutthroat trout (Randle Ranger District Stream Survey, 1987).

Watch Lake: (02E)

Stocked with Montana black spot cutthroat fry (west slope cutthroat) in 1933 by the USFS and eastern brook trout were stocked the same year by Washington State (USFS stocking records covering 1921 - 1953).

Watch Lake has been stocked with a variety of fish over the last 60 years. The main species have been rainbow (1940 - 1952) and cutthroat (1958 - 1994). The lake is stocked every three years.

Gibbs Lake: (02Q)

Rainbow trout and small mouth bass *(Micropterus dolomieni)* inhabit the lake.

Lone Tree Lake: (02P)

Lone Tree Lake was stocked with cutthroat trout in 1957 (Wolcott 1973 p - 231). The timber around the lake was harvested and a small buffer was left. Wind storms have destroyed most of the buffer.

Table 3-22: Fish Distribution within Middle Cowlitz watershed

Stream	Subbasin	Anadromous	Resident	Comment
Cowlitz River	02, 02D, 02L, 02P	All Reaches	All reaches	Includes spawning index area.
Kiona Creek	02A	Mouth to barrier at RM 6.9	Mouth to RM 8.2	Anadromous spawning and rearing habitat above first mile. coho, steelhead, and rainbow
Peters Creek Oliver Creek	02B	Assumed no use Mouth to barrier at RM 1.5	Mouth to RM 3.3 Mouth to RM 1.9	Stream has been channelized from mouth to U.S. Highway 12. coho, steelhead, and rainbow

Table 3-22: Fish Distribution within Middle Cowlitz watershed

Stream	Subbasin	Anadromous	Resident	Comment
Miller Creek	02C	To barrier at RM 0.5	Mouth to RM1.4	Stream has been channelized and has a concrete bed for ½ mile. Coho, steelhead, and rainbow
Hampton Creek	02D	Assumed no use	Mouth to RM0.6	Stream has been channelized from mouth to Silverbrook Rd. Rainbow
Lake Creek	02E	No use	Mouth to RM0.2	Clear-cut both side of stream entire length, rainbow, cutthroat
Martin Creek	02F	No use	Assume use at confluence	Clear-cut both side of stream entire length, rainbow
Lynx Creek	02G, 02H	No use	Mouth to RM5.3	Clear-cut both sides of stream entire length, rainbow
Silver Creek	02J, 02K	Mouth to RM5.5, new barrier location due to aggradation of stream channel	Mouth to RM 12.5	The first mile has been channelized, chinook, coho, steelhead, rainbow, west slope cutthroat
Surrey Creek Hopkins Creek Sethe Creek	02L	Assumed no use	Unknown	
East Fork Silver	02M	Mouth to RM 0.25	Mouth to RM 0.75	Steep gradient, steelhead, rainbow
Cunningham Creek Owens Creek	02P	Assumed no use in either stream	Confluence to RM 1 Confluence to RM 1	Habitat area is on private lands, cutthroat

Table 3-22: Fish Distribution within Middle Cowlitz watershed

Stream	Subbasin	Anadromous	Resident	Comment
Siler Creek Squire Creek	02Q	Mouth to RM 3.8 Confluence area	Mouth to F.S. Road #55 Mouth to culvert on FS Road #2305	First mile is pasture/farmland, cutthroat
Schooley Creek	02R	Confluence area	Confluence to F.S. boundary	cutthroat
Willie Creek	02T	No use	No use	Clear-cut both sides of stream, entire length
Watch Lake	02E	No use	Stocked in 1933	Clear-cut full section, eastern brook, Montana black spot*, rainbow
Lone Tree Lake	02Q	No use	Stocked in 1957	Clear-cut, no buffer, cutthroat
Gibbs Lake	02Q	No use	Planted	Located in pasture, rainbow, small mouth brass

Social Elements

Past Human Uses

Data Sources/Data Gaps

Information on past human use of the analysis area was obtained from reference material on file with the Heritage Program, Gifford Pinchot National Forest. Descriptions of prehistoric human use are based on published interpretations of archaeological data from sites within the Middle Cowlitz study area, but necessarily draw upon studies developed for other sites in the entire upper Cowlitz River watershed. The characterization of regional trends is based upon temporal and spatial models of prehistoric land use in the Cascades described by Burtchard (1990) and Ellis et al. (1991).

Much of the data on Taitnapam culture comes from interviews with local native people

conducted by University of Washington anthropologist Melville Jacobs in 1927. Supplemental ethnographic data includes taped interviews with Mary Kiona (ca. 1870-1970), a former resident of Indian Trust land within the analysis area. Data on historic non-native use comes from a variety of archival source material also on file with the Heritage Program, including diary excerpts, published articles, transcripts of oral history interviews, and several atlases summarizing Forest Service management activities, including grazing permit administration.

Historic Conditions - Prehistoric Land Use Patterns

(Early Prehistoric Period: ca. 7,000 to 3,500 years ago)

Archaeological evidence from sites in the upper Cowlitz watershed suggest that initial human use of the area began around 7,000 years ago. Early residents of the area likely employed foraging subsistence strategies that required frequent shifts in residence and a broad-based economy. During the initial period of human occupation, hunting and gathering would have involved daily forays from camp to obtain food on an "encounter basis". Little use was made of storage technology. As resources close to camps were exhausted, camp locations were moved. Some subsistence activities were probably planned around locally abundant resources. Archaeological data from the upper Cowlitz area have provided little information regarding social or political organization, beliefs, cultural affiliation, or the structure of the settlement system.

Faunal remains from Early Period occupations within the analysis area indicate that deer and salmonids were probably the most important sources of food to early peoples. Some researchers (Ellis et al. 1991) have suggested that prior to 4,500 years ago the Cowlitz River flowed at a lower level. Anadromous fish runs may have been impeded by falls lower on the river. As annual precipitation increased, river levels rose, allowing salmon and steelhead to reach the upper Cowlitz and Cispus watersheds. The presence of salmonid remains in several Early Period occupations dating from 7,000 to 5,000 years ago may negate this theory. Elk, mountain sheep, snowshoe hare, mountain beaver, and grouse were also hunted or caught during this time period. Archaeobotanical remains from the Koapk site at Cowlitz Falls, and Layser Cave, south of the analysis area, suggest that elderberries and hazelnuts were gathered locally, and huckleberries were also collected by Early Period people. Samples from Layser Cave suggest higher frequencies of xeric flora, such as oak, existed during this period, a trend also apparent in the results of local pollen studies (Barnosky 1981).

Early period people engaged in trade with groups from outside the area. Exotic materials found within the area include clamshell and *Olivella* beads, indicating a trade network with coastal groups. Obsidian stone from Oregon sources suggests a southern network of exchange that may have involved contact with lower Cowlitz River, Columbia River, or Portland Basin groups. The distribution of toolstone materials in local archaeological sites indicates that local

bands - groups living within the analysis area - ranged as far east as the crest of the Cascade Range during annual subsistence forays.

(Abandonment: ca. 3,500 to 1,500 years ago)

Initial human use of the Middle Cowlitz area appears to have ended abruptly with the onset of Mount St. Helens' Smith Creek Eruptive Phase 3,900 to 3,500 years ago. Lewarch and Benson (1991) suggest that the intensity of vulcanism, including the largest tephra eruptions in the history of the volcano, may have been the initial cause of human abandonment. Environmental degradation resulting from Smith Creek phase eruptions may have included tree defoliation, burial of herb and shrub layer flora by a meter thick deposit of pumice, and intensive sediment loading in streams and rivers (McClure 1992). Effects to the subsistence resources of the native human population were undoubtedly devastating. The sequence of radiocarbon dates for the upper Cowlitz basin shows a hiatus in occupation that lasted for nearly 2,000 years.

In reevaluating potential casual mechanisms which may underlie the hiatus, Kenneth Reid (1993) suggests that we consider the cooling effects of neoglaciation, documented between 3,700 and 2,000 BP (1950 BC to 50 BC). A temporal correlation between glaciation records and vulcanism was noted by Loren Davis, in his recent assessment of vulcanism and culture change in southern Washington (Davis 1995). Davis acknowledges that direct effects of the Mount St. Helens eruptions were more extensive proximal to the volcano, but hypothesizes that more lasting and widespread *indirect* effects may have resulted from atmospheric loading of sulfuric aerosols during eruptive events.

The Middle Cowlitz analysis area may have been more hard-hit by the eruptions than were other portions of the upper Cowlitz watershed. Tephra studies by Mullineaux (1981) and others demonstrate that this area was within the zone of thickest tephra deposition, directly downwind from the eruption. Archaeological sites near Packwood, to the east, and near Morton, to the west, lack the deposits of the Smith Creek (set Y) pumice so common in soil profiles near Randle. One of the sites near Morton produced a radiocarbon date of 2,240 years BP (300 BC), suggesting these areas were recolonized by people somewhat earlier than the sites within the analysis area.

(Late Prehistoric Period: ca. 1,500 to 150 years ago)

By about AD 450 people were reoccupying the same sites used by Early Period inhabitants, as well as establishing camps and settlements in new locations. Presumably, these people utilized a subsistence strategy quite different than their predecessors. A regional shift toward increased sedentism occurred between 5,000 and 2,500 years ago (Burtchard 1990). Groups that reoccupied the area about 1,500 years ago are thought to have used a strategy incorporating logistically-organized collection, processing, and storage of key resources. These developments

may have given rise to the development of semi-permanent winter villages not unlike those used by native groups in the historic period.

Excavations at the Judd Peak Site (45LE222) provide the most extensive data on late prehistoric occupation within the analysis area. The well-preserved faunal remains from this site provide an inventory (Table 3-23) of some of the animal species present in the general area ca. AD 750 to AD 1690. Faunal remains from the Koapk site (45LE209) at Cowlitz Falls, just outside the analysis area, indicate *Canis* sp. (coyote, wolf, or dog) and *Lynx* cf. *rufa* were also present in the area during this time period (Ellis et al. 1991). Archaeobotanical studies at Koapk suggest that plant communities in the Cowlitz River during this period were reasonably similar to the modern native vegetation, as Douglas-fir, western red cedar, red alder, salal, and Oregon grape are represented in samples of charcoal, seeds and tissue.

Table 3-23:
Identified Faunal Remains from the Judd Peak Archaeological Site

Taxa	Common Name	cultural	non-cultural
Onchorhychus kisutch	Coho Salmon	✓	☐
Dendrasgopus obscurus	Blue Grouse	✓	☐
Aliaeetus or *Aquila*	Eagle	☐	✓
Bubo cf. *virginianus*	Great Horned Owl	☐	✓
Corvus corax	Raven	☐	✓
Ardea herodias	Great Blue Heron	☐	✓
Scapanas cf. *orarius*	Coast Mole	☐	✓
Tamias sp.	Chipmunk	☐	✓
cf. *Tamiasciurus* [*douglasii*]	Douglas' Squirrel	☐	✓
Glaucomys sp. [*sabrinus*]	Northern Flying Squirrel	☐	✓
cf. *Citellus* [*saturatus*]	golden-mantled ground squirrel	☐	✓
Neotoma cinerea	Bushy-tailed Wood Rat	☐	✓
Thomomys talpoides	Northern Pocket Gopher	☐	✓
Microtus sp. [4 possible species]	Vole	☐	✓
Castor canadensis	Beaver	✓	☐
Ondrata zibethicus	Muskrat	✓	☐
Aplodontia rufa	Mountain Beaver	☐	✓
Lepus cf. *americanus*	Snowshoe hare	✓	☐
Ursus cf. *americanus*	Black Bear	☐	✓
Procyon lotor	Raccoon	✓	☐

Martes cf. *caurina*	Western Marten	☐	✓
cf. *Lutra canadensis*	River Otter	☐	✓
Felis concolor	Mountain Lion	☐	✓
Cervus canadensis	Wapiti or Elk	✓	☐
Odocoileus sp. [*hemionus*]	Black-tailed Deer	✓	☐
Ovis cf. *canadensis*	Mountain Sheep	✓	☐

Throughout the Northwest, prehistoric populations peaked during this time period. Burtchard (1990) suggests that the density of human populations was reaching environmental carrying capacity. Possible responses were greater emphasis on the collection of more "marginal" resources - those requiring greater energy expenditure for return. Late Period people appear to have exploited a greater variety of environments than had the earlier culture.

The Taitnapam

During the 19th century the Middle Cowlitz study area lay within the territory of the Taitnapam, or Upper Cowlitz, Indians. These people spoke Northern Sahaptin, a language shared with several groups living east of the Cascade Range. Settlements were scattered along the Cowlitz River and larger tributaries between Mossyrock and Packwood. The total population of Taitnapam circa 1840 was estimated at 350 (Ray 1974) but may have been as high as 1000 before epidemic diseases swept through the area at the onset of the historic period (Ellis et al. 1991).

Individual settlements were the basis of band organization. Village/band populations varied in size from 20 to 75 people. Settlements were comprised of one or more large cedar wood gable-roof houses occupied by multiple family groups. Within the analysis area, settlements were said to have existed at the mouth of Kiona Creek (*ce 'q ĭ*) and along Siler Creek (*taita ĭ*) (Anderson 1939). Using the average estimated populations of settlements prior to the effects of disease, the inferred protohistoric resident population of the Middle Cowlitz analysis area may have been between 50 and 75 individuals. The Cowlitz-Yakima Trail connected these settlements with other Taitnapam communities to the west, a band living near Packwood, and Yakama villages to the east of Cowlitz Pass. The Klickitat Trail, a trans-Cascades route through Cispus Pass, connected the Cowlitz valley with other Yakama settlements.

Deer were the most frequently hunted game. Curtis (1913) reports that they were taken at all seasons. Elk, bear, and mountain goats were also hunted, the latter in late summer, when family groups were camped in the mountains for berry picking. The bow and arrow was the principal hunting weapon for larger game. The use of dogs in fall/winter elk hunting is indicated by Curtis (1913). Deer, elk, and mountain goat meat was dried in the sun on wooden racks, sometimes over smoky fires, as a means of preservation (Yoke 1934). Smaller game obtained by

the Taitnapam include mountain beaver, marmot, and grouse (Kiona 1964; Smith 1964). Grouse were probably obtained during the late summer when they congregate in huckleberry patches.

Within the upper Cowlitz River watershed, coho salmon, chinook salmon, steelhead, arctic grayling, rainbow trout, Dolly Varden char, and suckers were caught for food (Yoke, Costima 1934). A variety of methods were used to obtain the fish. According to Jim Yoke and Lewy Costima, dip nets, spears, traps, and line hooks were used. Dip nets made of soft maple and willow were used specifically for salmon. Spears consisting of a pole and detachable point, sometimes double-tined, were also used for salmon and steelhead. Hooks on long ropes were used for trout. Traps were placed in shallow streambeds and apparently included "dams", in Costima's terminology, and basket traps. In addition to immediate use, some fish were dried on racks and stored for future consumption.

A variety of plant foods were gathered by the Taitnapam from several ecological communities. Most frequently mentioned in the ethnographic and ethnohistoric literature are huckleberries. Three species, *Vaccinium deliciosum*, *V. membranaceum*, and *V. ovalifolium*, which occur most abundantly between 915 m and 1,520 m in elevation, were preferred (Smith 1964). Huckleberry gathering was usually done by the women and children based at mountain camps during the late summer. Berries were dried to a raisin-like form on mats laid atop wooden racks or directly on the ground. Taitnapam from the *ce 'q ƛ* settlement traditionally used berry patches on the ridge connecting Cockscomb Mountain with Purcell Mountain, within the analysis area.

Salal berries, wild strawberries, red elderberries, thimbleberries, salmonberries, blackberries, and the berries of Oregon grape were also eaten (Gunther 1945). Camas was the most important root food. The bulbs of this plant were baked in earth ovens. Bulbs of several other lilies were also collected and prepared in this manner. Greens of wild celery (water parsley), wood sorrel, and rhizomes of several ferns were collected and eaten in the spring. Some Taitnapam travelled over the mountains to the Teiton River valley to collect bitterroot and *Lomatium* (Yoke 1934).

Interaction with non-native people began in the period ca. 1833-1840 as local Indian people took their furs to the Hudson's Bay Company trading post at Cowlitz Farm, near present-day Toledo. By 1882, only two Indian families remained in the area, which had been almost totally depopulated by smallpox, according to Tompkins (1933). The smallpox epidemic occurred in 1853, but the effects of endemic malaria in the 1830s and the appearance of measles at Cowlitz Farm in 1848 may also have contributed to a 85% population loss by 1860 (Boyd 1990). The United States government formally extinguished Indian title to all lands in the upper Cowlitz River basin in 1864, despite the fact that no treaty was ever signed or ratified. A few descendents of the *ceq ƛ* Taitnapam continue to live on a plot of Indian Trust land along Kiona Creek. All are enrolled members of the Yakama Indian Nation.

Historic Conditions - Historic Period Land Use Patterns

A significant shift in human land use occurred between 1880 and 1890. It was during this decade that the cultural composition of the area changed from an essentially Sahaptin-speaking indigenous population to one of English -speaking immigrants. Into the 1880s, the subsistence economy of the small local native population continued to focus on traditional hunting and gathering, although potatoes were cultivated by inhabitants of the Kiona Creek settlement. Non-native settlers began to establish land claims in the area in 1883 and 1884, bringing with them the traditions of agricultural subsistence and property ownership. To reach the Cowlitz "Big Bottom", these immigrants followed an Indian trail (Cowlitz-Yakima Trail) from Mossyrock.

Agricultural subsistence required land suitable for cultivation or the grazing of livestock. For most settlers this initially meant the hard labor of clearing maple and alder thickets along the Cowlitz River. Using slash and burn methods, and "stump-grubbing", pastures and fields were established throughout the valley bottom (Anonymous 1890). Horses were initially scarce, so oxen were used as the first draft animals (Fechtner 1939). Oats, wheat, potatoes, carrots, onions, cabbage and other vegetables were raised for personal use, and timothy raised as feed for livestock (Davis 1902). Horses, dairy and beef cattle, hogs, sheep, chickens and turkeys were raised on the family farms. Beef cattle raised in the valley were driven to market in Chehalis. Turkeys were taken to Elbe and shipped by rail to Tacoma markets (Fenby 1981).

By 1886 as many as 80 people had settled in the Cowlitz River valley bottom (Tompkins 1933). In the same year, a post office established the community of Vance, on the south side of the Cowlitz near Siler Creek. The town of Randle was platted on the north side of the river in 1890, destined to become a commercial center for "Big Bottom" area residents. A general merchandise store was also in operation in 1890. Travel to the isolated community was difficult, even after settlers built a wagon road between Randle and Mossyrock in 1893. A wagon trip to Chehalis, 65 miles west, took six to ten days. As the community grew, a post office, school, sawmill, grist mill, church and community hall were built. A blacksmith and physician were in residence by 1908.

The earliest wave of settlers to the area came from many different places. Although German, Irish, and Canadian immigrants were among the number, most were of American birth, from at least twelve different eastern, midwestern, and southern states (Tompkins 1933). Between 1900 to 1937 the local population nearly doubled as large numbers of Appalachian highlanders migrated to the area from the hills of Kentucky, Tennessee, Virginia, West Virginia, and North Carolina (Clevenger 1938). Most were drawn by prospects of economic improvement that included land, seasonal employment, and the opportunity to supplement small-scale farming with subsistence hunting and fishing. Within a generation, the lifestyle, folklore, philosophy, and religious traditions of the Appalachian region had become the foundation of the local culture.

Public forest lands in the analysis area were set aside as the Pacific Forest Reserve in 1893, and subsequently administered as the Mount Rainier Forest Reserve (1897), Rainier National Forest (1907), Columbia National Forest (1922) and Gifford Pinchot National Forest (1949). The executive order creating the Forest Reserve effectively closed the Cowlitz valley to further land claims. A limited number of homestead claims were allowed within the Forest Reserve subsequent to the enactment of the Forest Homestead Act in 1906. Eight of these claims were developed on lands within the analysis area. Initially, a local settler was hired as the first Forest Ranger to administer Reserve lands in the upper Cowlitz area and impose restrictions on timber cutting and burning. The first U.S. Forest Service administrative site in the area was the Silver Creek Ranger Station, established 1904-1905 at the present location of the Randle Ranger Station work center.

One of the principal early uses of National Forest lands was for grazing of livestock. In 1890 local settlers began using Purcell Mountain as a cattle range, and this use continued through 1955. Between ca. 1910 and 1927 up to 100 head of dairy and beef cattle grazed the upper elevations of the mountain from July to October. When the Forest Service established a permit system for allotment use, numbers were reduced to an average of 32 head per year for the period 1927-1955. The Purcell Mountain allotment incorporated 1,004 acres at elevations between 4,500 and 5,000 feet.

Grazing permit administration was but one aspect of early National Forest management. During the 1920s, personnel based at the Randle Ranger Station were involved in a massive reforestation effort for areas burned by the extensive wildfires of 1902 and 1918. Many miles of trails were constructed during this period to improve access for general forest administration and fire suppression. Fire patrols and lookout stations were established for fire detection. Within the analysis area, fire lookout stations were built on Kiona Peak, Watch Mountain, and Purcell Mountain (Whalehead Ridge). In 1933 the Army established a Civilian Conservation Corps (CCC) camp south of Randle. CCC enrollees were engaged in a variety of "forest improvement projects" in the District from 1933 to 1942. One of their major accomplishments within the analysis area was the construction of a complex of buildings at the Randle Ranger Station.

The agricultural focus of the Randle area was gradually replaced by an economy oriented toward exploitation of forest products, a trend that ultimately changed the role of the Forest Service. By 1940 a majority of area residents were engaged in part-time or full-time work associated with forest resources, including logging, lumber millwork, and the production of cedar shakes and shingles (Clevenger 1942). Prior to World War II most production was from privately-owned timberlands. Up to this time, timber harvest on National Forest lands had been limited to small sales of cedar for shingle bolts. The national post-war economic boom resulted in a demand for timber from National Forest lands to supply local mills. Responding to economic and political pressure, the Forest Service left behind the era of "custodial" resource management to enter a period of intensive commodity production (Hirt 1994).

Current Conditions - Heritage Resources

Evidence of past human use in the study area exists in the form of prehistoric and historic archaeological sites and features, standing historic structures, and historic landscapes. Natural landscape features associated with the oral traditions and religious beliefs of the Taitnapam people also occur within the area. Heritage resources are documented through the process of cultural resource inventory by field surveys for specific land management activities. Since 1974 a total of 99 survey projects have been conducted within the analysis area, most in conjunction with the District timber sale program. These surveys have covered approximately 16,399 acres, or 19.4% of the Middle Cowlitz Watershed Analysis area, and have produced an inventory of 72 cultural resource properties. Although 97% of the surveyed acreage is National Forest land, only 26 of the properties are on Federal lands. The majority of identified cultural resource sites are located on or adjacent to the Cowlitz River valley floor.

The largest number of cultural resource properties are represented by historic period buildings and domestic sites from the period ca. 1890-1942. The Hampton house and barn on Silverbrook Road, Robert McNee house on Kehoe Road, and Siler house are examples in private ownership. Examples from National Forest land include six buildings constructed by the CCC at the Randle Work Center, off Silverbrook Road, that are listed on the National Register of Historic Places. Documented historic period archaeological sites include three former timber claim "homesteads" with no remaining standing structures. Many more undocumented sites and buildings exist on privately-owned lands, among them the historic Kiona family cemetery, on Indian Trust land, and several homes and farms associated with non-native pioneer families, and several buildings in the town of Randle, including the Methodist church.

A number of historic trails have been identified during cultural resource surveys. Abandoned segments of the Klickitat Trail (#7), a trans-Cascade Indian travel route, exist north of Siler Creek and along the north flank of Lone Tree Mountain (Roulette 1997). Parts of the Silver Creek Trail (#279) and other abandoned Forest Service trails still exist in the area. The present Purcell Mountain Trail (#284) largely follows the route of an old Taitnapam trail to the huckleberry patches on Prairie Mountain.

Seventeen prehistoric archaeological sites have been recorded on National Forest and private lands within the analysis area. The sites represent occupation by Native American peoples from ca. 4000 B.C. to A.D. 1850. For the most part, site locations cluster along the edges of the valley floor. Site types include rockshelters and subsurface lithic scatters. Additional, as yet undocumented sites have been reported from private lands on the valley floor east of Randle.

An inventory of ethnographic sites conducted 1992-1995 identified 15 traditional cultural places within the analysis area (Hajda et al 1995). These places are of possible significance to descendants of local Taitnapam families. Three of the places, *ceq ̓k* (*sekk sekk*) on Kiona Creek,

t'at 'ashiya on Hopkins Creek, and *yiLhw (nitlu)* on Silver Creek, are linked to oral traditions regarding *Spilyai*, the transformer, and thus may be considered religious or sacred sites. Other sites represent traditional camps, fishing locations, and places where subsistence resources were gathered. *Waq 'amu-yash*, for example, was a traditional camas ground north of Huffaker Mountain, on private land.

Recreational Use

Data Sources/Data Gaps

Information on recreation uses came from a variety of databases, maps and individual knowledge of the area. Facility information was obtained from maps, the Infrastructure and Geographical Information System (GIS) database. Recreation visitation numbers were compiled from a recreation database (Infrastructure), road counter summaries and from the observations of personnel.

There is not complete information on the number or size of dispersed campsites in the watershed nor to the extent that they may not be meeting the Aquatic Conservation Strategy Objectives. An inventory would be needed to determine this information.

There is limited information about the amount and type of recreation that is occurring on private lands other than at the developed facilities.

Assumptions

Information on the location of dispersed campsites and their associated recreation use is lacking. Because of the mostly steep terrain and inaccessibility of riparian areas, dispersed campsite impacts may be less of a concern in this area.

Reference (Historic) and Current Conditions - Recreation Use

Within the Middle Cowlitz watershed are a variety of developed recreation facilities and dispersed recreation activities. U.S. Highway 12 bisects the area east and west connecting people with Interstate 5 and Interstate 82. Annually more than 1.7 million vehicles pass through the watershed on this highway. Forest Roads (FR) 23 and 25 serve as cross Forest routes that ultimately tie into Highway 14 on the Columbia River. Road 47 provide main access into and across the northern part of the watershed tying into FR 84 at the headwaters of Silver Creek. The following table summarizes major road use in the watershed.

Table 3-24: Public Use of Roads

Road #	Vehicle Count (public use only)	% Change (over four year period)	Comments
2500	137,737 vehicles	- 20%	Reduction associated with new facilities on Westside of Mount St. Helen.
2300	177,538 vehicles	+38%	
4700	2480 vehicles	- 66%	
8400	10,890 vehicles	- 64%	

Data from Gifford Pinchot National Forest Traffic Surveillance Reports (1988-1996)

Within the Middle Cowlitz watershed there are four developed recreation facilities and three trail systems. The newly constructed Cowlitz Falls Campground and boat launch are operated by the Public Utilities District (PUD) within the Lower Cowlitz, subwatershed 2. The campground contains 90 campsites and annually serves 9,047 people. A day use boat launch downriver three miles also serves an additional 2,500 people. It is the only formal river access along the upper section (Riffe lake to the Cowlitz River headwaters). Fishing is popular here from June 1 through February 28. Maple Grove Campground is operated by a private owner year around serving 4,200 campers (subwatershed #2D). Fishing along the bank of the Cowlitz is popular at both campgrounds. The fourth developed recreation site is a Forest Service operated visitor center at the Randle Ranger Station (subwatershed #2D). Annually 13,198 people stop at this site to get information on where to recreate in the area.

Until the late 1960's the Forest Service operated the Silver Creek Campground in subwatershed 2J. Due to vandalism the site was closed and in the mid-1980's turned into the Mary Kiona Picnic area. In 1996 the site was closed to vehicle access after years of complaints by adjacent landowners. This site has been a popular swimming and fishing spot for local youth.

A total of 10.3 miles of trails are maintained for public access within the watershed. The Purcell Trail #284 is within subwatersheds 2J, 2L, 2M . This trail receives very light use due to the difficult road access caused by a washout on Road 6300057 in Davis Creek via the Purcell Lookout Trail #285 and due limited public lands access off Highway 12. The Allen Mtn. Trail #269 in the headwaters of Silver Creek (subwatershed 2K) is 4.0 miles long. It receives light trail use (< 10 users/week) including occasional motorcycle riders. The eastern end of the Kraus Ridge Trail #275 is located within this watershed (subwatershed 2Q). It is open to motorcycle users (4/1 to 12/1) and also receives light use. A small amount of horse use occurs on roads along the lower part of Road 4700 in subwatershed 2L .

A total of 3,600 people are estimated to disperse recreate off FR 23 and 25 in subwatersheds 2P, 2Q, and 2P.Another 1500 are estimated to disperse recreate in the northern part of the watershed in along FR 47 and 84, subwatersheds 2J and 2K. Dispersed recreation activities in the watershed include hunting, fishing, huckleberry picking, firewood gathering, driving for pleasure, and dispersed camping. Overnight camping in dispersed sites is not as common as in other watersheds due to the steepness of the terrain and proximity to residential areas. Some reoccurring dispersed campsite use has been observed at Long (subwatershed 2K), Lone Tree (subwatershed 2Q), and Watch (2E) Lakes. A few small dispersed campsites are scattered along Roads 47 and 63. Vehicle access to Watch and Lone Tree Lakes is now limited due to washouts and road closures.

Fishing is popular in the lower 1/3 of Silver Creek (subwatershed 2J) and along the Cowlitz River from boats and along the bank. The recent creation of Lake Scanewa has created a fishery (June 1 through February 28) above Cowlitz Falls Dam. The lake is also popular for wildlife viewing.

Huckleberry picking has been popular in the upper Silver Creek area, subwatershed 2J and 2K.

Some rafting/boating occurs on the Cowlitz in subwatersheds 2, 2P, and 2D. There are no known commercial guided operations within the watershed.

The scenery of the vegetative landscape is a human resource consideration along Highway 12 and FR 23 and 25. Overall the condition of the watershed is considered "slightly altered". The vegetative conditions are least natural in the northwest portion of the planning area were hundreds of acres under private ownership appears unvegetated from a distance.

Future Projects

Yew Tree Trail (subwatershed 2J): a local organization expressed interest in seeing a trail constructed to the record Pacific Yew Tree (*Taxus brevifolia*). This tree is listed in the American Forestry Association's big tree list.

Allen Mountain RTT (subwatershed 2K): The Gifford Pinchot National Forest Road to Trails Assessment (RTT) proposes a loop trail for mountain bikes that would tie to the existing Allen Mountain Trail #253 by converting 4.2 miles of FR 8400134 and 8418037 to trails. Two miles of trail would be build to connect the converted roads.

Long Lake/Willamie RTT (partially in subwatershed 2K): The RTT assessment proposed the conversion of 3.5 miles of roads (FR 4700110 and 112, and 4740) and 4.5 miles of short trail connections to form a mountain bike and ORV loop trail system.

Pompey Peak Trailhead (subwatershed 2P): A trailhead is needed off the Cline Road on the westside of the Kilborn Creek crossing. A trailhead located in the Cowlitz Valley would eliminate one of the reasons to maintain FR 2304 to public access standards. An adjacent homeowner has expressed some concerns with the proposal.

Lands, Minerals and Special Uses

Data Sources/Data Gaps and Assumptions

The primary data source for mining activities is the current (9/96) USDI, Bureau of Land Management, Geographic Claims Listing for unpatented mining claims recorded with the BLM's mining claims office in Portland, OR. Although BLM's listing can sometimes be up to six months old, the current claims listings for the analysis area is typical for activities in this area during the last several years; i.e. public records of active claims indicate little if any mining activities. While the Forest Service does deal with owners of claims not filed with BLM, few reports of such claims have been received by either the Packwood or Randle Districts.

All private uses of National Forest lands, except for common recreational uses such as camping, hiking fishing, etc., timber harvest, grazing and mining, require prior authorization through a Special Use Permit. The primary data sources for special use authorizations within the analysis area are the Packwood and Randle Districts' special use files.

The primary data source for land use adjustments are the Packwood and Randle Districts' files for proposed land exchanges between the Forest Service and other private land owners. The primary data source for the management of adjacent private lands comes from the Packwood and Randle Districts' lands and special uses files for road right-of-way, road cost/share, cooperative maintenance, land exchange and special use activities during the last several years.

Reference (Historic) and Current Conditions - Mining

The areas encompassed by the Packwood and Randle Districts, which include the analysis area, have been open to mineral exploration for better than a century. Where areas with mineral deposits of commercial potential were found long ago, interest in same on the part of mineral prospectors has continued unabated to the present. Based upon a review of District and BLM records, the analysis area is not an area where there has historically been, nor would there likely be, extensive interest in mineral prospecting and development. The underlying geology simply does not support such activities. Within the Middle Cowlitz watershed we might expect to see an occasional filing of a mining claim for a minor amount of exploration at the pick and shovel, panning and maybe suction dredging levels. Minor amounts of recreational gold panning and suction dredging not associated with formal mining claims might also be expected.

Reference (Historic) and Current Conditions - Special Uses

A review of District files indicates three general categories of special use authorizations of relevance to watershed analysis. The categories include authorizations for water transmission lines, underground utilities and private uses of National Forest roads.

Water Transmission Lines - A Special Use Permit for a water transmission line authorizes placement on National Forest land of a pipeline which will transport water from a diversion point (usually a catch basin or a small cement/rock diversion dam), to the National Forest boundary (as opposed to the right, or authorization, to actually draw water from a stream, which must be obtained from the State of Washington). In the Middle Cowlitz watershed, all such pipelines continue past the National Forest boundary and on to private residences where transported water is used for domestic purposes and/or for powering small generators that produce electricity. Within the analysis area there are currently three permit-authorized water transmission lines. These lines are located within 6th field watersheds 2B, 2D and 2L. There very likely are other existing lines located on the analysis area's National Forest lands, that the Forest Service is not aware of.

The three permit-authorized water transmission lines mentioned above have been in place for long periods of time. The youngest of these lines was first authorized in 1980. The other lines were authorized in 1962 and 1934. One permit holder's family has apparently held such permits in the same vicinity since 1907.

Utility Lines - There exist within 6th field watershed 2Q, several miles of buried utility lines. These lines are located along the edges Forest Roads 23, 2305, 2306, 2504 and 2504-041. They provide phone and electrical services to privately-owned Cispus Valley lands located within the National Forest, as well as to the Cispus Learning Center. The first of these lines were installed between 1962 and 1965, the most recent in 1996. Replacement of older lines took place in 1987 and 1996. The useful life of new underground utility lines is currently about 30 years. It may be expected, therefore, that the above-mentioned existing utility lines will have to be replaced periodically. Given the fairly gentle terrain and deep soils to be found in subwatershed 2Q, new buried line can be installed with a minimum of ground disturbance along road edges. Special equipment can be used to push new line beneath streams and riparian areas, leaving the latter areas undisturbed.

Private Uses of National Forest Roads - (As opposed to recreational use and use by Forest Service contractors). Existing National Forest roads within the analysis area provide owner access to privately-owned lands located within or adjacent to the National Forest. These private lands range from the extensive holdings of large timber companies, to small residential lots. By various Federal laws, the Forest Service must grant access across National Forest lands to an owner of such private lands, when the most reasonable access route to the owner's land is across

the National Forest. Access authorizations are usually granted through a permit, and more rarely by easement. Most such authorizations in the analysis area have involved use of existing and functional Forest Service roads. In rarer instances, the Forest Service has issued permits that also authorized minor reconstruction of existing National Forest roads; i.e. 8500-042, 8500-044 (S's. 15 and 22-13N-7E, Willie Creek area) in 6th field watersheds 2G and 2T, to facilitate access to Murray Pacific Corp. lands for pre-commercial thinning activities. A request was also received for authorization to build a minor amount of road (less than 0.10 miles) as access to a proposed private residence in 6th field watershed 2D.

Forest Roads 23 and 25, in and out of the analysis area, are favored routes for the hauling of logs from non-National Forest lands to the lumber mills of the upper Cowlitz valley. Other types of commercial traffic include tour busses and the transport of heavy equipment. Such authorizations are usually by permit. In recent years, fees generated by such permits issued by the Packwood and Randle Districts have been a major source of additional funding for the maintenance of this Forest's roads.

In years to come, it is reasonable to expect additional requests from Murray Pacific for use of existing National Forest roads in T.13N., R.7E. as listed below. At one time, National Forest and Murray Pacific ownerships in T.13N., R.7E. were arranged in a checkerboard pattern. Prior to completion of land exchanges that blocked up National Forest and Murray Pacific land holdings into the patterns seen today, Murray Pacific had already developed many of the road segments listed below as integral parts of roads systems that served their then and present holdings. Given all of the above, as Murray Pacific conducts management activities on its current holdings, it is logical to expect that Murray Pacific would request the use of these same road segments. Conversely, it is conceivable that reciprocal access over Murray Pacific lands may be needed someday by the Forest Service for management of National Forest lands in the same vicinity.

Within Section 3 and 6th field watersheds 2G and 2H, FR 8500-130, including some reconstruction, most likely for commercial timber haul.

Within Section 22 and 6th field watersheds 2E, 2G, 2J and 2T, FR 4778, including some reconstruction, most likely for pre-commercial thinning (commercial harvests are at least 10 years away).

Within Section 28 and 6th field watershed 2E, a small segment of FR 4778, most likely for pre-commercial thinning activities (commercial harvests are at least 10 years away).

Within Sections 31 and 32 and 6th field watershed 2E, FR 7561, including some reconstruction, most likely for pre-commercial thinning activities (commercial harvests are at least 10 years away).

Reference (Historic) and Current Conditions - Management of Adjacent Private Lands

Large Land Holdings - In the past, large corporate and State land holdings within the analysis area were managed for the maximization of income from timber harvest. Investments were subsequently made in replanting and pre-commercial thinning in anticipation of future commercial harvests. Investments in construction and maintenance of transportation facilities were commensurate with management of these private and State lands primarily for current and future timber production.

In the past ten to fifteen years, as these same lands have been cut over and replanted, as these land holdings have been blocked up via exchanges, and as more restrictions on harvesting have come into effect, timber management activities (from planting through harvesting, and repeat) have been concentrated on lands still reasonably remote from residential interface. At least one local corporate land holder is currently working with State and Federal agencies to implement a 100 year management plan for its large and more remote land holdings along the western edge of the analysis area, as a primarily timber-producing area. Where large corporate land holdings do abutt residential interface, and given the right circumstances, such corporate lands could be (and have been) sold to developers of residential properties, or directly to individual homeowners.

Small Land Holdings - Small land holdings in the analysis area vary from large farms to small lots for private homes. As income from farming and logging diminishes, there will be more pressure on small landowners to log and/or subdivide their lands, and some of these lands do abutt the National Forest boundary. Indeed, there are some investors who purchase small timbered parcels of land, harvest the timber, and resell these parcels to prospective home builders or developers. A number of such harvested and subsequently remarketed properties are located adjacent to National Forest lands within the analysis area.

Chapter 4 - Interpretations/Areas of Concern

This chapter focuses on the interpretation of data presented in Chapter 3 as it pertains to current and proposed management within the watershed. It is through this understanding of the function of the various ecosystem elements that the context for future management is set. As in Chapter 3, the information is presented for the major terrestrial, aquatic, and social elements known from the Middle Cowlitz watershed.

Terrestrial Elements

Forest Vegetation

Interpretation/Areas of Concern - Vegetation

The most pronounced change since the turn of the century is the increase in young plantations as a result of clearcutting. More than half of the watershed is in the grass/pole structure. A certain amount of this is in permanent farmland on private ownership, but most of it is in large blocks of young trees which are growing rapidly. There is an immediate concern that many of these plantations will not be managed with stocking control treatments in time to benefit tree growth. There is an opportunity to accelerate the development of these stands into the desired conditions with thinnings. Some of these blocks are many hundreds of acres in size, and if left unthinned, could seriously delay accomplishment of resource objectives and increase the risk of damage from weather extremes. There is a large concentration of these stands in subwatersheds 2: G, H, J, K, and T in the northern portion, and another concentration in 2Q in the southern portion - all of which are scheduled for thinning within the next ten years.

In the long term, these same large blocks of plantations will grow as one contiguous age class, and in order to more rapidly achieve the desired condition of "widely distributed size classes", there will be a need for regeneration harvests at the earliest possible time. These harvests may begin when the stands reach culmination of mean annual increment which can be as early as age 70 in some cases.

Interpretation/Areas of Concern - Forest Health Assessment

Root rot disease is the most damaging pathogen operating in this watershed. Stands which are weakened by this disease can contribute to larger short term damage events like windthrow or beetle attacks. In those places where this disease is common, future projects have to evaluate the need for treating these stands with silvicultural methods which will minimize the damage. The subwatersheds where this is likely to occur are 2: B, C, D, L, P, and Q. The most effective treatments are regeneration harvests which attempt to start a new stand of more resistant or immune tree species.

The Role of Fire

Interpretations/Areas of Concern

Currently, the watershed is outside the natural condition related to fire "effects". Past harvest activity in the watershed has been extensive, resulting in the loss of certain structural elements, such as snags, large down coarse woody debris, and possibly duff layers. The overall successional status of the watershed has been skewed towards an early seral condition. This has been caused by extensive logging. Significant modification of the spatial arrangement of vegetation and associated fauna that depend on it have occurred in this watershed. Logging has created large areas of uniform grass/pole stands north of the Cowlitz river drainage.

There are currently no specific areas of concern where natural or management created fuels have accumulated to an extent which would pose the risk of a catastrophic fire event.

Botanical Species of Concern

Interpretations/Areas of Concern - TES Plant Species

Population dynamics of known sites of TES plant species have not been monitored. Without information on population trends it is difficult to assess how these species are responding to changes within the watershed. Surveys for TES species within the analysis area have been specific to individual project boundaries and thus do not accurately portray the distribution of these species across the landscape.

Of the thirteen known populations of TES plants within the analysis area, eight are protected by virtue of the land allocation within which they are located. Of the five remaining populations, one is located on private land, two were protected by modifying riparian reserves during the planning phase of the Siler Owens Timber Sale, and two remain vulnerable. Table 4-1 is a summary of the status of known TES plant sites within the analysis area.

Table 4-1
Protection Status of Known Populations of TES Plant Species Within the Analysis Area

Species	Land Allocation	Protection
Githopsis specularioides	Non-Federal Ownership	Unknown
Orobanche pinorum	Deer and elk winter range	Vulnerable

Table 4-1
Protection Status of Known Populations of TES Plant Species Within the Analysis Area

Orobanche pinorum	Deer and elk winter range	Vulnerable
Orobanche pinorum	Visual Emphasis/Riparian Reserve	Protected
Pleuricospora fimbriolata	Late Successional Reserve	Protected
Pleuricospora fimbriolata	Late Successional Reserve	Protected
Pleuricospora fimbriolata	Late Successional Reserve	Protected
Pleuricospora fimbriolata	Late Successional Reserve	Protected
Pleuricospora fimbriolata	Adaptive Management Area/Riparian Reserve	Protected
Pleuricospora fimbriolata	Adaptive Management Area/Riparian Reserve	Protected
Pleuricospora fimbriolata	Adaptive Management Area/Riparian Reserve	Protected
Pleuricospora fimbriolata	Adaptive Management Area/Modified RR	Protected
Pleuricospora fimbriolata	Adaptive Management Area/Modified RR	Protected

It is important to note that several of the populations are protected by virtue of being located within riparian reserves. This protection may be in jeopardy if riparian reserves are modified in any way from the ROD standards.

Nine of the thirteen populations of TES plant species are populations of *Pleuricospora fimbriolata*, a species that tends to be found inhabiting late-seral forested stands. While individual populations are well protected at the site level at this time, a look at the watershed scale reveals the fact that late-seral habitat is highly fragmented within the Middle Cowlitz watershed. This may present a problem for the long-term viability of this species in this area. This is especially true in subwatershed 2Q (Siler Creek) where there is a concentration of known sites within a small area of highly fragmented late-seral habitat.

Interpretations/Areas of Concern - Survey and Manage Botanical Species

Population dynamics of known sites of survey and manage species have not been monitored. Without information on population trends it is difficult to assess how these species are responding to changes within the watershed. No specific surveys for survey and manage species have been conducted within the analysis area. Known sites are not based upon surveys and thus do not accurately portray the distribution of these species across the landscape.

Late-seral habitat is fragmented within the analysis area. While individual populations of late-seral dependent species may be protected in the short-term, this landscape pattern may pose a long-term viability problem for these species. This is especially true for *Allotropa virgata*, a survey and manage species that occupies the same habitats as *Pleuricospora fimbriolata* (see discussion under TES plant species above).

Due, in part, to the large amounts of non-federal lands within the analysis area, the amount of late-successional habitat for survey and manage species has been drastically reduced from historic levels. It is estimated that historically, as much as 75% of the analysis area supported late-successional habitat. Currently, only 19% of the analysis area supports late-successional habitat types.

Interpretations/Areas of Concern - Noxious Weeds

There are currently no control measures in place for these species within the analysis area. Future spread of these species into previously uninfested areas is likely given the variety of dispersal methods and corridors that are available.

Wildlife

Interpretations/Areas of Concern

In general, fragmentation has reduced the quantity of late-successional habitat throughout the Middle Cowlitz watershed, and on private lands, late-successional habitat is nearly eliminated. As a result of forest fragmentation, connectivity for less mobile species is compromised in the east portion of the watershed, and in the west portion, the lack of late-successional habitat nearly eliminates connectivity for all late-successional dependent species. Fragmentation has compromised the connectivity and travel corridor functions of riparian reserves. Riparian habitat along the Cowlitz River and Silver and Lynx Creeks has been fragmented. These three waterbodies should provide the major linkages throughout the watershed and into adjacent watersheds.

Fragmentation has also reduced the quantity of optimal cover for deer and elk within their biological winter range to well below the Amendment 11 goal of 44% (considering both National Forest and private lands). If optimal cover within biological winter range is below the 44% goal on National Forest lands, no regeneration harvest should occur within optimal cover stands. The actual amount of optimal cover needs to be evaluated through field reconnaissance.

Areas of concern for each sixth-field watershed within the Middle Cowlitz Watershed are summarized in Table 4-2 below. Abbreviations in the table are defined as follows:

NSO Northern spotted owl habitat within home range(s) has been reduced below "take" thresholds defined by the US Fish and Wildlife Service.

MM Subwatershed is within marbled murrelet Zone II. Suitable habitat within these subwatersheds will require occupancy surveys and protective buffers established around occupied habitat before any ground disturbing activities are implemented.

TES Known nest, den, or occurrence site of a TES, or other protected species that requires a site-specific protection.

BWR Road densities exceed Amendment 11 goals within deer and elk biological winter range.

Frag Habitat for late-successional interior forest species reduced or eliminated from fragmentation due to fire, conversion to pasture, and timber harvest. If large tree patches are present, they are either isolated or interior is reduced by grass/pole stands.

Conn Connectivity in subwatershed is compromised by fragmentation.

RR Riparian reserves (or zone on private lands) do not provide connectivity for late-successional dependent species.

Table 4-2: Wildlife Habitat and Species Concerns by Sixth-Field Watershed
(column headings defined in text above table)

6th Field	NSO	MM	TES	BWR	Frag	Conn	RR
2	X	X	X	X	X	X	X
2A			X	X	X	X	X
2B	X	X	X	X	X	X	X
2C	X	X	X	X	X		
2D	X	X	X	X	X	X	
2E	X	X	X	X	X	X	
2F		X			X	X	X
2G		X		X	X	X	X
2H		X	X		X	X	X

Table 4-2: Wildlife Habitat and Species Concerns by Sixth-Field Watershed
(column headings defined in text above table)

6th Field	NSO	MM	TES	BWR	Frag	Conn	RR
2J	X	X	X	X		X	X
2K		X	X		X		X
2L	X	X	X	X		X	
2M	X	X	X	X	X		
2P	X		X	X	X		
2Q	X	X	X	X			X
2R	X	X	X	X			X
2T		X	X	X	X	X	X

Surveys for Larch Mountain and Van Dyke's salamanders are required to precede the design of any timber sales or other ground disturbing activities initiated during and following FY97. Surveys for the mollusk species *Cryptomastix devia* and *Monadenia fidelis minor* are required to precede the design of any timber sales or other ground disturbing activities initiated during and following FY99.

Geologic Processes

Interpretations/Areas of Concern - Seismic Conditions and Volcanic Eruption

Earthquakes and volcanic eruptions are natural processes that will take place regardless of human opinions or wishes. The most we can do is be aware of the potential for occurrence, and where possible, try to describe possible consequences. For Middle Cowlitz, we need to note that Mount St. Helens has erupted, on average, once per century over the last 500 years, and that at least two of these eruptions have deposited ash and tephra across the watershed. The deposits have contributed to increased (fine) sediment delivery to streams for a period of years to decades after each eruption. Mt. Rainier has also inundated the floodplain of the Cowlitz River with mudflows since the retreat of the last glaciation, and will do so again, with or without an actual volcanic eruption (Scott and Vallance, 1995). Seismic activity in the area can also be expected to continue.

Interpretations/Areas of Concern - Mass Wasting

Mass wasting in the form of large landslides has been occurring in the Silver/Lynx/Willie Creek drainage for thousands of years. Portions of these features are stable or marginally stable and not overly sensitive to disturbance by management activities, whereas some other areas are. Site specific investigation is required to identify these areas.

A number of shallow, rapid landslides have occurred throughout Kiona Creek drainage since the late 1950's. Most have been linked to roads and/or timber harvest (Murray Pacific Corp., 1994). Increased levels of mass wasting related to roads and timber harvest have also occurred throughout the Silver Creek, Lynx Creek, Willie Creek, and Cunningham/Owens Creek drainages. In particular, roads systems within these drainages are in need of reconstruction and/or decommissioning efforts to reduce sedimentation. See Road Conditions, below, and Chapter 6, Management Recommendations.

Interpretations/Areas of Concern - Hillslope Erosion

Hillslope erosion is generally not a concern in this watershed except in local situations where mass wasting has exposed tracts of soil, and revegetation has not yet successfully occurred.

Interpretations/Areas of Concern - Road Conditions

A number of roads within the watershed have been identified as contributors of elevated sediment levels to streams. In particular, roads in the Lynx Creek, Willie Creek, Silver Creek, and Cunningham/Owens Creek drainages been identified as concerns. Listed below, by subwatershed, are roads on federal lands noted for needing some type of restoration work (* identifies roads needing more extensive work). This listing is not all inclusive, but does identify a majority of road restoration projects. Flood damage sites (1994-96) are identified in the sixth-field recommendation tables of Chapter 6. All roads on lands owned by Murray Pacific with existing failures or identified potential problems, were identified during the Kiona Creek Watershed Analysis (1995). Problem areas were either corrected by the time the report was released, or were expected to be repaired within a year or two. No data was available regarding flood damage sustained during the 11/95 or 2/96 storm events.

02 A Private Land

02 B 7534-040

02 C none known

02 D 75 (in places)

02 E 4778

02 F Private Land

02 G Private Land, 8500-130; -131

02 H 85

02 J 47; 7500-065; 7561*; 7561-018*; 8500-042*; 8500-045

02 K 63; 85; 8518

02 L 47 (maintenance)

02 M 4700-185

02 P 2304

02 Q 55 and associated spurs

02 R none

02 T 4778; -044; -045

Aquatic Elements

Hydrology and Fisheries

Interpretations/Areas of Concern - Water Quality and Channel Conditions

Oliver, Kiona, Silver, and Lynx Creeks and Watch Lake all are in non-attainment of Washington State dissolved oxygen standards. This could be caused by an increase in water temperatures and subsurface flows.

Kiona, Oliver, Peters, Silver, Lake, Lynx, Martin, Arsenic Creeks and Watch Lake all have exceeded Washington State temperature standards for Class AA waters. The increase in water temperature can be directly tied to the amount of openings in riparian corridor canopy that has taken place in these sub-watersheds. There are a total of 15,705 acres in the riparian corridors, and of these, 44 percent are in grass/pole seral stage.

Portions of Kiona, Oliver, Peters, Hampton, Lynx, Owens, and Cunningham Creeks flow sub-surface part of the year. This is an indicator of an over-load of sediment to the stream channel.

Cattle grazing is having an effect on the riparian vegetation, stream banks, and sediment amounts in Peters, Cunningham, Schooley, Hampton, and Siler Creeks.

There is a lack of LWD, and pool habitat in all of the fish bearing streams in all of the sub-watersheds. Pools and wood are needed to provide adequate holding areas for protection from predators and high water temperatures.

Kiona, Oliver, Peters, Miller, Hampton, Silver, Sethe, Hopkins, Siler, and Cunningham Creeks all have reaches that have been ditched, diked, dredged, or channelized in an attempt to protect improvements or claim farmland/pasture. In most cases when the stream is channelized all of the fish habitat complexity is removed: LWD, pools, large boulders, riparian vegetation , and the stream is straightened. This action increases the velocity, thus increasing the cutting action, increasing erosion potential, and causing greater problems down stream on the deposition reaches. In the case of the Miller Creek the channel through Randle is a "concrete ditch". Historically these reaches contained the best spawning gravels for anadromous fish.

Anadromous habitat in Kiona, Oliver, and Peters Creeks is lost due to an increase in bedload material (streams goes sub-surface).

The density of roads in Peters, Hampton, Lake, Martin, Upper/Lower Lynx, and Willie Creeks exceeds the recommended levels.

Interpretations/Areas of Concern - Peakflow and Flooding

Several subwatersheds are rated as having a high concern for peakflows: 02, 2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2K, 2P, 2R and 2T. See table 3-18. Many of these watersheds flow into other watersheds that are also experiencing peakflow problems, compounding the problem. All watersheds north of highway 12 are experiencing high peakflow concerns except portions of 2M and 2J.

Interpretations/Areas of Concern - Riparian Condition and Wetlands

The riparian corridors for Kiona, Oliver, Peters, Lake, Lynx, Willie, and Martin are grass/pole seral. The removal of the shading component has led to the increase in water temperature in these streams.

The riparian zone around Watch, Gibbs, and Lone Tree Lakes is early seral.

There are approximately 84 miles of road inside the riparian corridors. The road system restricts the ability of the stream to interact with the floodplain during periods of high flows and reduces the amount of wood available to the stream.

Interpretations/Areas of Concern - Aquatic Organism Distribution

The Cowlitz River, Kiona, Silver, and Siler Creeks are included in an effort to re-establish runs of spring chinook, coho and steelhead. Kiona and Silver Creeks have limiting components needed for the reintroduction effort to work; high water temperatures, lack of rearing pools, lack of spawning gravels, and lack of hiding cover.

Silver Creek has a healthy population of west slope cutthroat trout that was established in the 1930's. The west slope cutthroat is unique in the state of Washington and adds to the diversity of the fisheries in the Middle Cowlitz watershed. Every effort should be made to maintain this population.

Social Elements

Past Human Uses

Interpretations/Areas of Concern - Human Ecology

Information pertaining to past human use of the watershed was examined from the perspective of ecosystem management. Maintenance of a "properly functioning, self-sustaining ecosystem" is described as a necessity of management, identified previously in this document as Issue 4, Ecosystem Function (see page 2-5). The principal questions addressed by this analysis relate to the retention of native plant and animal species within the watershed including adequate distributions of suitable habitat and populations.

Comparing the reference (historic) and current conditions, the most obvious change in species composition and distribution is that of human populations. As the ethnohistoric data suggest, the properly functioning, self-sustaining ecosystem of 200 years ago included a human population of probably 50 to 75 people. Current numbers are at least 75% higher. The subsistence economy of 200 years ago limited human populations to sustainable levels *within the watershed ecosystem*. As the ethnic composition of the area changed in the late 19th century, the structure of the economy shifted toward greater reliance on a regional market economy. As different resources were exploited by non-native residents, the entire relationship to the local ecosystem changed radically, both in terms of land use patterns and the quantities of resources extracted from the environment. The underlying question, which cannot be fully explored within the scope of this analysis, remains, "Can a properly functioning, self-sustaining ecosystem exist without humans occupying a niche as hunter-gatherers at historic population levels".

Historic shifts in local land use practices and the resource demands of an increasing *regional* population resulted in impacts to the distributions of other plants and animals native to the

analysis area. The following summarizes historic occurrences of and impacts to populations of nine species that were of traditional economic importance to indigenous people within the analysis area.

- **Coho (silver) salmon** (*Onchorhynchus kisutch*) - Jim Yoke and Lewy Costima, Taitnapam men interviewed in 1927 by anthropologist Melville Jacobs (1934), described places where "silverside" salmon could be found in the Cowlitz River above Randle. Identification as coho (silver) salmon is based on Sahaptin fish taxonomy (Hunn 1990) which uses the noun *sinux* for this species, instead of *tk"inat* for Chinook, *shushaynsh* for steelhead, or the generic *núsux* for all salmonids. Within the watershed analysis area, Yoke identifies Siler Creek (*taitái*) and Kiona Creek (*céq ̓k*) as salmon fishing places (*núsuxpama, núsuxas*), but does not indicate which species occurred there. Wallace Morris, an older resident of the area interviewed in 1982, noted that salmon were formerly abundant in Siler Creek near his place in Section 21. Archaeological remains of *O. kisutch*, identified by distinctive cranial elements, were recovered from archaeological site 45LE222, located in the lower Siler Creek sub-basin (Daugherty et al. 1987). Given the proximity of the site to Siler Creek, procurement of salmon from this stream is indicated, as opposed to the more distant Cowlitz River. Over 1,200 identifiable salmonid bones were recovered from occupational surfaces dating from ca. AD 710 to AD 1600. Probable salmonid remains were also found at site 45LE215, located adjacent to Siler Creek, a prehistoric occupation of similar age.

- **Chinook salmon** (*Onchorhynchus tschawytscha*) - Lewy Costima (1934) mentions fishing sites for chinook salmon near Cowlitz Falls, and locations above Randle in the upper Cowlitz watershed.

- **Steelhead** (*Oncorhynchus mykiss*) - Lewy Costima (1934) mentions Silver Creek (*yílh"*) as a place where steelhead could be found. They are also mentioned at locations further upstream in the Cowlitz watershed, east of the analysis area.

- **Dolly Varden trout** (*Salvelinus malmo*) - Lewy Costima (1934) mentions "a great many" Dolly Varden, *ashchinsh* in Sahaptin, at two locations on the Cowlitz River, above and below the analysis area (1934).

- **Grayling** (*Thymallus arcticus*) - Costima (1934) also mentions grayling at two locations above and below the analysis area in the upper Cowlitz watershed.

- **Sucker** (*Catostomus sp.*). Jim Yoke identifies *xewu'nac* , which translates as "place for suckers", on the Cowlitz River west of the analysis area. Costima notes that suckers were caught by the Taitnapam near Cowlitz Falls, but makes no mention of their occurrence in the river above this point.

- **Huckleberries** (*Vaccinium spp.*) - The ridge system that includes Purcell Mountain, Prairie Mountain, Grassy Mountain, and Cockscomb Mountain was a highly productive huckleberry field used by historically by Taitnapam people. One historic source from 1890 indicates that huckleberries had been collected here for "several generations", and provides descriptions of the berries that suggests collection focused on *V. membranaceum*. Plummer's map of 1899 shows the area as a former burn. Timber encroachment within the former burn is documented in the records for an historic cattle grazing allotment, closed in 1955 due to reduced forage. Comparison of historic maps, aerial photographs, and personal inspection (1989) indicate huckleberry production within the historic berry field is greatly reduced.

- **Camas** (*Camassia quamash*). The bulb of the camas plant is one of the most important traditional foods of many Northwest native peoples. *Waq 'amu-yash*, a traditional camas ground north of Huffaker Mountain, is the only place referenced as a local source for this plant food (Hajda et al. 1995). Favored habitat of camas is wet meadows. The probable location of *waq 'amu-yash* was converted to use as cattle pasture prior to 1900, the beds of camas apparently destroyed by the cattle. No other large populations of camas have been reported within the analysis area.

- **Mountain goats** (*Oreamnos americanus*) - Historically, a small population of mountain goats occupied the Purcell Mountain/Prairie Mountain ridge. An account from 1890 describes the hunting of a band of goats in the area. Wildlife inventory records indicate no population remained by 1933.

Past human use of the Middle Cowlitz watershed analysis area by indigenous people included hunting, fishing, and gathering of a variety of native plants and animals. These species were important components of the naturally functioning ecosystem prior to 1882, when non-native people began settlement of the area. Populations of six species of fish were sufficient to have contributed to the subsistence base of the indigenous culture. Historic data suggest the salmonids (*Onchorhynchus sp.*) were the must abundant. Construction of hydroelectric dams on the Cowlitz River has eliminated the native runs of all three species. Hatchery coho and steelhead have been reintroduced, but numbers and distribution do not approximate historic conditions. Dolly Varden trout (char) and arctic grayling populations in the upper Cowlitz watershed are now extinct. The status of sucker populations is unknown. This situation suggests a significant imbalance within the structure of the aquatic ecosystem.

Former populations of camas, and the wet meadow habitat in which they thrive, have been eliminated as a result of agricultural practices. Distribution and density of huckleberry species, particularly *Vaccinium membranaceum*, has been reduced in historic patches associated with former burns, but overall productivity may approximate historic levels given the abundance of huckleberries in clearcuts at upper elevations in the Silver Creek drainage.

Recreational Use

Interpretations/Areas of Concern - Recreation Use

Although there are no known areas where recreation facilities or recreation use is causing the significant degradation of riparian habitat or water quality, some improvements may be beneficial on a small scale. Information about dispersed recreation use is lacking. It is suspected that most is occurring in subwatershed 2K. This may be an area to focus a dispersed campsite inventory if riparian habitat or water quality concerns are suspected.

Garbage dumping off roads adjacent to the town of Randle has been a problem in subwatersheds 2C, 2D, 2J, 2L, 2M, 2Q and 2R. Several known sites have been cleaned up. There may be new or known sites where garbage is degrading water quality. Road closures have been effective at reducing the dumping in specific areas.

Washouts on Road 2304 continue to limit public access to the Pompey Peak Trail #128. The trail receives light use. Public access could be provided off the Cline Road at the Kilborn Creek crossing. This would eliminate one of the reasons to keep Road 2304 open for public access in subwatershed 2P.

Road washouts and private land ownership have limited the access to the Purcell Mountain #284. Improvements to Road 6300057, just east of subwatershed 2J, are needed or an alternative trailhead should be formalized. The southern portion of the trail terminates on private land at Highway 12. A trailhead is needed just east of this location on the Davis Creek road.

Mary Kiowa Day Use site was closed with a rock barricade to limit vehicle access after years of neglect, vandalism and liability concerns from adjacent land owners. Although closed to street legal vehicles, the riparian vegetation is not abundant, there is often litter, and informal trails are eroded. The site needs to be revegetated and monitored for continued use.

Lands, Minerals, and Special Uses

Interpretations/Areas of Concern - Mining

While the apparent level of mining activities in the analysis area is minimal, mining is a legitimate activity on National Forest lands, as recognized by a century and-a-quarter of Federal mining laws. Proposed mining activities are <u>not</u> discretionary; i.e. the Forest Service cannot choose to defer consideration of a mining proposal, as it could an application for a Special Use Permit. As they arise, mining proposals are matters that the Forest Service must deal with. The Forest Service's function is to evaluate a mining proposal pursuant to all pertinent Federal laws

and regulations, to help shape actual resulting on-the-ground operations pursuant to same.

Interpretations/Areas of Concern - Special Uses

Water Transmission Lines - It should be recognized that the current authorized uses are long-standing ones. These facilities will continue to be authorized so long as the permit holders comply with the terms of their permits, and actual use continues. It is currently Regional Forest Service policy to discourage the issuing of permits for newly constructed water transmission lines, given that such authorizations may unacceptably limit Forest Service management options and other public uses upstream of such facilities.

Utility Lines - It should be recognized that these underground utility lines may need to be replaced periodically. Such replacement can probably be accomplished with only minor amounts of ground disturbance.

Private Use of National Forest Roads - The Forest Service, by law, must allow access across National Forest lands for the benefit of adjacent private lands, when such access across the National Forest is reasonable.

Interpretations/Areas of Concern - Land Use Adjustments

Within the analysis area are nine National Forest sections of land, and part of another, that are candidates for exchange from the United States Government to Plumb Creek Timber Company, as part of a larger proposed exchange involving National Forest and Plumb Creek lands in the vicinities of the Wenatchee, Mt. Baker-Snoqualmie and Gifford Pinchot National Forests.

The nine sections that are currently candidates for exchange to Plumb Creek are as follows:

1. T.12N, R.7E., Sections 4, 5, and 6

2. T.13N., R.7E., Sections 28,31,32 and 33

3. T.14N.,R.7E., Sections 32, 33 and part of 31

It is reasonable to expect that in the future, the Forest Service would be involved in other land use adjustment activities within the analysis area, including various types of boundary adjustment actions, land disposals, transfers, exchanges, purchases, and donations.

Chapter 5 - Sixth Field Watershed Evaluations

The primary purpose of watershed analysis is to provide a scientifically-based understanding of ecological processes that can be used to guide future management activities within a watershed. Management on the North Skills Center defined the boundaries of our analysis to be at the fifth field watershed scale. Project planning (especially for timber sales) however, is usually conducted at the sixth-field watershed scale, thus it is useful to stratify our analysis by sixth fields. The Middle Cowlitz, is further stratified into the following sixth field subwatersheds:

Table 5-1: Sixth-Field Watersheds

6th Field #	Name	Acres	% of 5th Field
2	Cowlitz River	12,277	14.54%
2A	Kiona Creek	8,073	9.56%
2B	Peters Creek	4,463	5.29%
2C	Miller Creek	1,545	1.83%
2D	Hampton Creek	3,142	3.72%
2E	Lake Creek	3,861	4.57%
2F	Martin Creek	2,487	2.95%
2G	Lower Lynx Creek	4,541	5.38%
2H	Upper Lynx Creek	3,667	4.34%
2J	Lower Silver Creek	7,081	8.39%
2K	Upper Silver Creek	7,414	8.78%
2L	Surrey/Hopkins	8,002	9.48%
2M	East Fork Silver Creek	2,135	2.53%
2P	Cunningham/Owens	3,955	4.68%
2Q	Siler Creek	8,584	10.17%
2R	Schooley Creek	1,377	1.63%
2T	Willie Creek	1,828	2.17%
	TOTAL	84,432	100.00%

Fifth-Field Watershed Perspective

Even though most project planning on the North Skill Center is put within the context of sixth-field watersheds, some resource conditions are best understood when they are evaluated at more than one scale. A brief description of the condition of selected resources at the fifth-field scale is provided here in order to put them into the necessary context for the ensuing sixth-field evaluations.

Terrestrial Resources

Connectivity of late-successional habitat along Silver and Lynx Creeks and the Cowlitz River has been compromised by large blocks of grass/pole sized stands. Connectivity along these watercourses is important to provide habitat and travel corridors throughout the watershed and between LSR's. These corridors would also provide connectivity to the adjacent watersheds.

Optimal cover is currently below the desired level of 44% in the watershed, although data is limited on which stands actually qualify as optimal cover. A field survey needs to occur to verify optimal cover stands, and accurately assess the level of optimal cover in the watershed. Opportunities to accelerate the development of optimal cover should also be assessed and implemented if available.

Aquatic Resources

The channelization of the lower reaches on many of the tributaries to the Cowlitz River has removed channel complexities necessary for good fish habitat. Records indicate these areas had the greatest use for spawning and rearing. Timber harvesting of the riparian reserves has removed the ability of the stream to recruit large woody debris (LWD), has increased the water temperature and possibility decreased the dissolved oxygen in many of these streams. Poor water quality conditions have not been experienced in other 5th field watersheds to the same extent as they are here. Also, this watershed contains a high number of road/stream crossings. Each crossing is a high risk in terms of potential for adding sediment to an already overloaded system. All of the subwatershed, with the exception of one, have road densities that exceed the Forest's recommended level of 2.0 mi/sq.mi. Again, each road is a high risk in terms of adding large sediment loads to the streams. Peakflow conditions are evident within streams throughout the 5th field watershed. Many 6th field watersheds experiencing peakflow problems flow into other 6th field watersheds also experiencing peakflow problems. Cumulatively, these elements (physical condition, sediment regime, peakflow conditions, water quality, riparian condition) added together would indicate that the Middle Cowlitz watershed is in poor aquatic condition.

Sixth-Field Watershed Evaluations

In the ensuing tables, each sixth-field watershed is evaluated in terms of meeting the nine Aquatic Conservation Strategy (ACS) objectives and one additional management objective of maintaining late-successional habitat across the landscape. Take special note of the amount of non-federal land in each subwatershed as this has an influence on the ratings. A brief description of each of these ten objectives follows with an explanation of the evaluation criteria that were used to assign the various ratings. ACS objectives are presented as they appear in the ROD.

1. "Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine aquatic features such as perennial streams, intermittent streams, wetlands, lakes and ponds. Note: We interpret this ACS objective to refer to the continued physical existence of the variety of aquatic features from historic or reference times to the present. It does not address the quality of aquatic conditions, as these are addressed in the other ACS objectives.

   Assumptions - The overall drainage networks have increased due to roading - roads intercept groundwater which increases the network of channels carrying water. New intermittent and ephemeral streams exist as road cross drains that cause water to flow where channels previously did not exist.

2. "Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine spatial and temporal connectivity of aquatic and riparian systems. Note: The basis of this evaluation was on *Hydrologic* connectivity; *Riparian* connectivity is addressed in ACS # 8.

   Assumptions: Human and natural features which influence hydrologic connections include hydroelectric facilities (or other stream flow diversions), road crossings of streams (primarily used to address barriers to fish migration, and does not account for possible barriers for other aquatic species because of data gaps), roads built along floodplains and wetlands, sediment deposits instream (gravel bars) or flow routed subsurface.

3. "Maintain and restore the physical integrity of the aquatic system, including shorelines,

banks, and bottom configurations." (ROD, page B-11)

Evaluation Criteria - Compare historic/reference and current conditions, examine the physical integrity of the following aquatic systems: a) shorelines (lakes and ponds); b) stream banks - includes observations regarding channel widening, channel migration, and occurrence of Large Woody Debris (LWD) as it relates to pool formation and stream bank cutting; c) stream bottom configurations; d) condition of upper banks and inner stream gorges of deeply incised streams.

4. "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine water quality of aquatic, riparian, and wetland ecosystems:

   a. biological - macroinvertebrate and fish (limited surveys occur in selected streams).
   b. physical - stream temperature information occurs on selected streams; turbidity is approximated in ACS #5
   c. chemical - pH
   Note: Unless specific statements are made in this section, no data is available with which to evaluate ACS Objective #4.

5. "Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine elements of the sediment regime (input, storage, and transport) including: timing, volume, rate, and character of sediment.

   Assumptions - Erosion from roads delivers fine sediment to streams. Sediment delivered to streams from mass wasting is both fine and coarse.

6. "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected." (ROD, page B-11)

Evaluation Criteria - Compare reference and current conditions, examine the ability of in-stream flows to create and sustain riparian, aquatic, and wetland habitats by looking at timing, magnitude, duration, and spatial distribution.

Assumptions - Aggregate Recovery Percentage (ARP) and Water Available for Run-off (WAR) models were used to evaluate whether a subbasin was meeting this objective. Note: If a subbasin had an ARP of 75% or lower, or a WAR of 9% or higher, then subbasin was not meeting this objective.

7. "Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine floodplain inundation and the elevation of water tables in meadows and wetlands:

   Assumptions - A majority of inventoried wetlands are associated with either high ridges and talus slopes or floodplains adjacent to streams. A majority of wetlands under the forest canopy are not inventoried.

8. "Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability." (ROD, page B-11)

   Evaluation Criteria - Compare historic/reference and current conditions, examine the species composition and structural diversity of plant communities in riparian areas looking specifically for functions regarding the following:

   a. thermal regulation (summer and winter)
   b. nutrient filtering
   c. rate of surface and bank erosion and channel migration
   d. amount and distribution of coarse woody debris
   e. connectivity and structural characteristics of forest in riparian zone

   Assumptions - Late seral habitat provides required components and complexity (horizontal and vertical diversity within plant communities) to achieve the objective. Mid-seral habitat achieves the objectives to a lesser degree; early-seral habitat least achieves the objectives.

9. "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species." (ROD, page B-11)

Evaluation Criteria - Compare historic/reference and current conditions, examine the ability of the area to support well-distributed populations of native plants, invertebrates, and vertebrate riparian-dependent species.

Note: Data on species occurrence and populations in riparian areas are very limited, as is site-specific habitat data.

LS. Evaluate late-successional and oldgrowth species habitat within the watershed.

Evaluation Criteria - Compare historic (reference) and current conditions, examine the condition of late-successional habitats *outside* of riparian reserves with respect to:

a. fragmentation of late-successional habitat patches (i.e. reduction in "interior habitat")
b. connectivity of late-successional habitat patches
c. condition of late-successional habitats with respect to insects, disease, windthrow, etc..

Rating Definitions and Confidence

The evaluation criteria listed above for each objective are rated in the following tables according to the following scale:

Good (G) Criteria elements have not changed; they are essentially the same as historic/ reference conditions. The subwatershed meets the management objective with only minor exceptions.

Fair (F) Criteria elements have changed somewhat from historic/reference conditions. The subwatershed is near the margin for meeting the management objective.

Poor (P) Criteria elements have definitely changed from historic/reference conditions. The subwatershed does not meet the management objective.

Data Gap (D) No information, or not enough information available to assign a rating.

The evaluation ratings are assigned a level of confidence for accuracy according to the following scale:

High (H) High confidence that assigned rating is accurate.

Moderate (M) Moderate confidence that assigned rating is accurate.

Low (L) Low confidence that assigned rating is accurate.

Table 5-2: 6th Field #2 - Cowlitz River *(12,277 acres, 14.5% of 5th field, 99% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	M	**Perennial Streams** - No change. **Intermittent Streams** - No change. **Wetlands** - Decreased due to conversion to pasture. **Lakes & Ponds** - Scanewa lake, Cowlitz Falls Dam
2) Connectivity between watersheds	G	L	No stream flow diversions present. No road crossing problems.
3) Integrity of aquatic systems	D	-	Lack of data
4) Water quality for healthy ecosystems	D	-	No physical or biological data available. There has been reintroduction of anadromous fish species.
5) Appropriate sediment regime	D	-	Lack of data Numerous debris flows have been observed on the north side of Huffaker Mountain over the last decade.
6) In stream flow	P	H	High WAR (45%) Low ARP (70%)
7) Floodplain Function	P	H	Conversion to pasture land, home developments, new dam has wiped out floodplain function along Cowlitz River.
8) Structural diversity of plant communities	P	H	Due to non-federal ownership, riparian vegetation is primarily grass/pole and some small tree. There is no late-successional habitat within riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	No data
LS) Late successional habitat	P	H	99% of this subwatershed is in non-federal ownership and is currently a combination of grass/pole and small tree. Small area of LS habitat on eastern edge (LSR). Total LS habitat outside of RR is 265 acres (2% of subwatershed).

Comments: Not much available data to rate ACS objectives for this subwatershed. Large percentage of the subwatershed is in non-federal ownership. We don't have management responsibility on this land, however, this area is extremely important to anadromous fish. Land use is primarily human oriented resulting in a large change from previous condition.

Table 5-3: 6th Field #2A - Kiona Creek *(8,073 acres, 9.6% of 5th field, 100% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Kiona Creek flows subsurface. **Intermittent Streams** - Minor increase due to road drainage. **Wetlands** - Minor decrease. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	P	H	No stream flow diversions present. Subsurface flow in lower sections of Kiona Creek. Road in floodplain.
3) Integrity of aquatic systems	P	H	Lack of large woody debris, poor pool quality/quantity. Channel widening, debris flows. Braiding is taking place in Kiona Creek due to large sediment loads. Channelization/diking taking place on Kiona Creek.
4) Water quality for healthy ecosystems	P	H	Anadromous species to reach #2 - Resident fish to reach #2. Water temperature exceed Washington State standards on Kiona, West Fk. Kiona, and Dry Creeks. Reaches K1 & K2 have low D.O.
5) Appropriate sediment regime	P	H	Several deep-seated landslides in WS, most are inactive. Coarse and fine sediment from Mass wasting has increased to a High level above reference conditions. 114 road/stream crossings, road density of 2.85 mi/sq. mi. Channel braiding confirms sediment loading.
6) In stream flow	P	H	High WAR (17%) Low ARP (60%) Channel widening occurring in Kiona Cr.
7) Floodplain Function	P	M	Some housing developing and roads influencing floodplain function along Kiona Cr.
8) Structural diversity of plant communities	P	H	Due to non-federal ownership, riparian vegetation is primarily grass/pole and some small tree. There is no late-successional habitat within riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	No data. May be data in Kiona Creek Watershed Analysis.
LS) Late successional habitat	P	H	This subwatershed is 100% in non-federal ownership and is dominated by grass/pole and small tree categories.

Comments: We have no management responsibility in this subwatershed. Watershed analysis of Kiona Creek was conducted by Murray Pacific and data in this table is mostly from that report. Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management.

Table 5-4: 6th Field #2B - Peters Creek *(4,463 acres, 5.3% of 5th field, 76% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Oliver and Peters Creek flow subsurface. **Intermittent Streams** - Increase due to roading. **Wetlands** - Minor decrease due to pasture conversion. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	P	H	No stream flow diversions present. Subsurface flows in Oliver and Peters Creeks. No road crossing problems.
3) Integrity of aquatic systems	P	H	Lack of large woody debris. Poor pool quality/quantity. Lack of spawning gravel. Channel widening. Peters Creek has become channelized and diked.
4) Water quality for healthy ecosystems	P	H	Anadromous fish in reach #1 of Peters and Oliver Creeks. Resident fish to reach Km 13 - Peters Creek. Water temperature exceed Washington State standards on Oliver and Peters Crs. D.O. standards exceeded on Oliver Cr. Peters Creek is a domestic water source.
5) Appropriate sediment regime	P	H	Several deep-seated landslides in WS; most appear inactive; slide above Hwy 12 is an exception. Coarse and fine sediment delivery from mass wasting is High above reference conditions. 128 road/stream crossings, road density of 4.3 mi/sq. mi. Subsurface flow of stream confirms high sediment loading.
6) In stream flow	P	H	High WAR (25%) Low ARP (50%) Channel widening in Oliver Cr.
7) Floodplain Function	P	M	Conversion to pasture land, wetland drained for pastures along Peters Cr., roading influencing floodplains
8) Structural diversity of plant communities	P	H	Of the federally owned land, 33% is large tree within riparian reserves. Only 4% of the entire subwatershed is large tree within riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	Known locations for tailed frog and Pacific giant salamander in Peters Creek.
LS) Late successional habitat	P	H	Approximately 5% of the subwatershed is currently in large tree outside of riparian reserves. This habitat is concentrated in a large block near the middle of the subwatershed, with a small connection to other areas of large tree to the east.

Comments: This area also included in Kiona Creek Watershed Analysis, so a lot of data came from that document. Peters Creek is a domestic watersource. Channelization has removed all instream complexity in portions of Peters Creek. Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management

Table 5-5: 6th Field #2C - Miller Creek *(1,545 acres, 1.8% of 5th field, 43% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Miller Creek is channelized. **Intermittent Streams** - No change. **Wetlands** - No change. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	F	L	No stream flow diversions present. Possible road crossing problems.
3) Integrity of aquatic systems	P	H	Lower section of Miller Creek has been channelized. Lack of large woody debris. Poor pool quality/quantity. Lack of spawning gravel. High width to depth ratio. Garbage dumping in lower reach.
4) Water quality for healthy ecosystems	D	-	Anadromous and resident fish to reach #1 in Miller Creek. First half mile of Miller Cr. has garbage problems.
5) Appropriate sediment regime	F	H	One large, deep-seated landslide in WS; appears to be inactive except for margins. Sediment delivery from mass wasting is Slight above reference conditions. 20 road/stream crossing, road density of 2.9 mi/sq. mi.
6) In stream flow	P	H	High WAR (21%) Moderate ARP (78%)
7) Floodplain Function	P	H	Channelized portion of Miller Cr. - no floodplain function
8) Structural diversity of plant communities	F	H	National Forest portion is mostly large tree in riparian reserve. Rating reduced to fair due to large amount of non-federal land in grass/pole stage.
9) Habitat to support well distributed populations of riparian species	D	-	Tailed frog, Pacific giant salamander, and Cascade frog sites in Miller Creek below FR 7534.
LS) Late successional habitat	F	H	Approximately 21% of the subwatershed is in large tree with connections to the east and west. The large tree is in a fairly large block surrounded by small tree which alleviates edge effects.

Comments: Channelization of portions of Miller Creek have removed all instream complexity in those areas. Approximately ½ mile of anadromous fish habitat has been lost in Miller Creek due to channelization.

Table 5-6: 6th Field #2D - Hampton Creek *(3,142 acres, 3.7% of 5th field, 73% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Hampton Creek flows subsurface. **Intermittent Streams** - No change. **Wetlands** - Decrease due to pasture conversion. **Lakes & Ponds** - No change.
2) Connectivity between watersheds	P	H	No stream flow diversion present. Undersized culvert on Silverbrook Road. Road in floodplain/wetland. Hampton Creek flows subsurface.
3) Integrity of aquatic systems	P	L	Lower Hampton Creek has been channelized. No data for large woody debris, pools, width to depth ratio, or substrate. Rating is based on channelization and subsurface flows.
4) Water quality for healthy ecosystems	D	-	Resident fish in reach #1. Data Gap Domestic water source.
5) Appropriate sediment regime	F	H	One deep-seated landslide in WS, currently active and disrupting 75 Rd, possible concern for Pvt. landowners at base of hill. Sediment delivery from mass wasting is Slight above reference conditions. 35 road/stream crossing, road density of 4.5 mi/sq. mi.
6) In stream flow	P	H	High WAR (32%) Moderate (81%)
7) Floodplain Function	P	H	Conversion to pasture land, housing development, ditching of stream, and highway 12 dissects the floodplain.
8) Structural diversity of plant communities	F	H	National Forest portion is mostly large tree in riparian reserve. Rating reduced to fair due to large amount of non-federal land.
9) Habitat to support well distributed populations of riparian species	D	-	Red legged frog and Pacific giant salamander sites known from Hampton Creek.
LS) Late successional habitat	F	H	Approximately 10% of the subwatershed is large tree outside riparian reserves. This is concentrated in the north. Southern portion is in non-federal ownership. Large tree is in one large block with good connections except to the south.

Comments: Hampton Creek is a domestic watersource. Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management. The National Forest portion of Hampton Creek is currently in large tree, however root rot may be a problem here.

Table 5-7: 6th Field #2E - Lake Creek *(3,861 acres, 4.6% of 5th field, 76% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - Increase due to road drainage. **Wetlands** - Minor decrease. **Lakes & Ponds** - No change.
2) Connectivity between watersheds	F	M	No stream flow diversions present. No known road crossing problems. Roading in floodplain.
3) Integrity of aquatic systems	P	H	Lake Creek reaches 2, 3, &4 lack large woody debris. Width to depth ratio is poor for reaches 2 & 3. No data for pools. Lack of spawning gravel.
4) Water quality for healthy ecosystems	P	H	Anadromous fish at confluence of Lake and Silver Creeks. Resident fish to (and within) Watch lake. Water temperature exceeds Washington State standards in Lake Cr. and Watch Lake. Dissolved Oxygen is below state standards in Watch Lake.
5) Appropriate sediment regime	P	H	One large , deep-seated landslide at confluence of Lake & Silver Creeks may be effecting channel. Sediment delivery by mass wasting is Moderate above reference conditions. 85 road/stream crossing, road density of 4.3 mi/sq. mi. , bank cutting of channel observed.
6) In stream flow	P	H	Moderate WAR (12%) Low ARP (38%) Bankcutting occurring on Lake Cr.
7) Floodplain Function	D	-	Roads may be influencing floodplain function.
8) Structural diversity of plant communities	P	H	Mostly grass/pole and some small tree within the riparian reserves. Only 3% of the entire subwatershed is large tree within riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	No data.
LS) Late successional habitat	P	H	Approximately 5% large tree (outside riparian reserves) in small fragmented blocks. 76 % of the subwatershed is in non-federal ownership.

Comments: Water quality is a problem in this subwatershed. High temperature is limiting salmonid distribution in Lake Creek and Watch Lake. Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management.

Table 5-8: 6th Field #2F - Martin Creek *(2,487 acres, 2.9% of 5th field, 100% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - Increase due to roading. **Wetlands** - None known. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	F	L	No stream flow diversions present. No known road crossing problems. Roading in the floodplain.
3) Integrity of aquatic systems	D	-	No data available
4) Water quality for healthy ecosystems	P	M	No data available for fish Water temperatures exceed Washington State standards for North Fork Martin Cr. Dissolved oxygen exceeds state standards on Martin Cr.
5) Appropriate sediment regime	P	M	Sediment delivery by mass wasting is High above reference conditions. 80 road/stream crossing, road density of 6.4 ml/sq. mi.
6) In stream flow	P	H	High WAR (32%) Low ARP (21%)
7) Floodplain Function	D	-	Roads may be influencing floodplain function.
8) Structural diversity of plant communities	P	H	Riparian reserves dominated by grass/pole stage. There is no late-successional habitat within riparian reserves in this subwatershed.
9) Habitat to support well distributed populations of riparian species	D	-	No data available
LS) Late successional habitat	P	H	This subwatershed is 100% in non-federal ownership. Approximately 83% in grass/pole stage. No large tree.

Comments: Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management.

Table 5-9: 6th Field #2G - Lower Lynx Creek *(4,541 acres, 5.4% of 5th field, 83% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - Increase due to road drainage. **Wetlands** - None Known. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	F	H	No stream flow diversions present. Roading in the floodplain. No known problems with road crossings.
3) Integrity of aquatic systems	P	M	Lack of large woody debris. Poor pool quality/quantity. Lack of spawning gravel. No data on channel widening or width to depth ratio.
4) Water quality for healthy ecosystems	P	H	Anadromous/resident fish from confluence with Silver Creek to L 10. Lynx Cr. exceeds Washington State water temperature standards. Arsenic and Lynx Cr. exceed state D.O. levels.
5) Appropriate sediment regime	P	H	Sediment delivery from mass wasting is Severe above reference conditions. 113 road/stream crossing, road density of 5.4 mi/sq. mi., Bankcutting and channel braiding confirm sediment loading.
6) In stream flow	P	H	High WAR (11%) Low ARP (32%) Bankcutting and braiding occurring on Lynx Cr.
7) Floodplain Function	D	-	Roading may be influencing floodplain function.
8) Structural diversity of plant communities	P	H	Some large tree in headwater streams (NE corner), the rest mostly grass/pole stage in riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	No data available
LS) Late successional habitat	P	H	Approximately 7% large tree (outside RR), mostly in one block in the NE corner of the subwatershed surrounded by grass/pole. This is one of the largest blocks of large tree in the analysis area - approximately 600 acres, but influenced by edge.

Comments: Lynx Creek has a large population of resident fish, despite poor ratings. Sediment delivery from mass wasting is severe in this subwatershed and this is likely to continue given the density of roads and their condition. Overall, this subwatershed is in an early seral stage. The future of the watershed condition is largely dependent upon the direction of private management.

Table 5-10: 6th Field #2H - Upper Lynx Creek *(3,667 acres, 4.3% of 5th field, 21% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Lynx Creek flows subsurface. **Intermittent Streams** - Increase due to road drainage. **Wetlands** - None known. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	P	H	No stream flow diversions present. Lynx Creek flows subsurface in reach L 14. Roading in the floodplain. No known problems with road crossings.
3) Integrity of aquatic systems	P	H	Fair to good amount of large woody debris. Data gaps on substrate, width to depth ratio, channel widening, and sediment deposition. Would get a fair rating except for the fact that subsurface flow completely removes the integrity of an aquatic system.
4) Water quality for healthy ecosystems	P	H	Anadromous/resident fish from reach L 10 to L 14. Lynx Cr. exceeds Washington State standards for water temperature and dissolved oxygen.
5) Appropriate sediment regime	P	H	Sediment delivery from mass wasting is Moderate above reference conditions. 107 road/stream crossing, road density of 5.1 mi/sq. mi., Subsurface flows in watershed.
6) In stream flow	P	H	Moderate WAR (11%) Low ARP (34%)
7) Floodplain Function	D	-	Roading may be influencing floodplain function.
8) Structural diversity of plant communities	P	H	Scattered sections of large tree in riparian reserves. Vast majority is grass/pole.
9) Habitat to support well distributed populations of riparian species	D	-	No data available
LS) Late successional habitat	P	H	Approximately 10% large tree (outside riparian reserves) in fragmented blocks surrounded by grass/pole.

Comments: Reach 14 of Lynx Creek has gone subsurface. Water quality problems are similar to other subwatersheds. There is more instream wood within the streams of this subwatershed as compared to others (this is good!).

Table 5-11: 6th Field #2J - Lower Silver Creek *(7,081 acres, 8.4% of 5th field, 3% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - Silver Creek has been channelized. **Intermittent Streams** - Increase due to roading. **Wetlands** - Minor loss. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	F	H	No stream flow diversions present. No known road crossing problems. Roading in the floodplain.
3) Integrity of aquatic systems	P	H	Lack of large woody debris. Poor width to depth ratio. Poor pool quality/quantity. No data on channel widening or debris flows. Lower reach of Silver Creek has been channelized. Bank scour is evident.
4) Water quality for healthy ecosystems	P	H	Anadromous fish from confluence to S 4. Resident fish from confluence to S 6. Silver Cr. exceeds Washington State standards for water temperature and dissolved oxygen.
5) Appropriate sediment regime	P	H	Several deep-seated landslides occur in WS; several of which are active. Sediment delivery from mass wasting is High compared to reference conditions (noting that ref. conditions are also high). 113 road/stream crossing, road density of 3.9 mi/sq. mi., Channel aggradation and braiding support sediment loading.
6) In stream flow	P	H	Low WAR (9%) Low ARP (71%)
7) Floodplain Function	P	H	Highway 12 dissects floodplain, there is housing development, industrial development, channelization, and pasture land influencing floodplain.
8) Structural diversity of plant communities	F-	H	Large amounts of late-seral in mainstem Silver Creek (southern portion), otherwise late-seral is scattered. Remainder mostly grass/pole with some small tree.
9) Habitat to support well distributed populations of riparian species	D	-	No data available.
LS) Late successional habitat	P	H	Approximately 19% large tree (outside of riparian reserves), distributed on periphery of subwatershed. The largest block in the southern portion with connections to the east and west. Problem with interior habitat leads to poor rating.

Comments: Loss of instream complexity has occurred in lower reach of Silver Creek where it has been channelized. This has importance to anadromous fish as well as other aquatic species. Historic anadromous barrier at river mile 2.7 is no longer there (20' waterfall became a 7' waterfall during the 1996 flood. This area filled in with sediment.). Lots of braiding in response reaches throughout Silver Creek.

Table 5-12: 6th Field #2K - Upper Silver Creek *(7,414 acres, 8.8% of 5th field, 0% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	F	H	**Perennial Streams** - Silver Creek flows subsurface. **Intermittent Streams** - Increase due to roading. **Wetlands** - Minor decrease. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	P	H	No stream flow diversions present. Silver Creek flows subsurface. No known problems with road crossings. Roading in floodplain/wetland.
3) Integrity of aquatic systems	P	H	Channel braiding and bank scour is occurring. Lack of large woody debris. Poor pool quality and poor spawning gravels. Subsurface flow in reach 7.
4) Water quality for healthy ecosystems	G	H	Resident fish from reach S 6 to S 7.
5) Appropriate sediment regime	P	H	Sediment delivery from mass wasting is Slight above reference conditions, however, several flood damage sites were noted on roads from the '96 event.. 137 road/stream crossing, road density of 3.6 mi/sq.mi., Pools filling with sediment and subsurface flows indicate sediment loading.
6) In stream flow	P	H	Low WAR (9%) Low ARP (59%) Bank scouring occurring on Silver Cr.
7) Floodplain Function	D	-	Roads may be influencing floodplain function.
8) Structural diversity of plant communities	F+	H	Mainstem of upper Silver Creek mostly large tree with one large gap in the middle. Headwaters in northwest corner in grass/pole stage, the rest a combination of large tree and grass/pole.
9) Habitat to support well distributed populations of riparian species	D	-	Tailed frog, Cascade frog, and Pacific giant salamander sites in mainstem and tributaries of Silver Creek.
LS) Late successional habitat	F	H	Approximately 32% large tree (outside of riparian reserves), well distributed but fragmented. Connectivity is fair, but interior size of blocks is poor.

Comments: Upper Silver Creek has one of the few isolated stocks of Westslope Cutthroat. A portion of reach #6 is subsurface. Channel braiding and bank scour are a problem in Silver Creek. 65% of this subwatershed is in LSR which should lead to improvement over time in meeting aquatic and late-successional objectives.

Table 5-13: 6th Field #2L - Surrey/Hopkins *(8,002 acres, 9.5% of 5th field, 44% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	F	H	**Perennial Streams** - Hopkins Creek flows subsurface. **Intermittent Streams** - No change. **Wetlands** - decrease due to pasture conversion. **Lakes & Ponds** - No change.
2) Connectivity between watersheds	F	H	No stream flow diversions present. No known problems with road crossings. Road in floodplain/wetland.
3) Integrity of aquatic systems	D	-	Channelization of Surrey Creek. No instream data available.
4) Water quality for healthy ecosystems	D	-	Possible use of area at confluence with Cowlitz by fish.
5) Appropriate sediment regime	F	H	Several deep-seated landslides in WS; two have active portions that are effecting roads. Sediment delivery is Slight above reference conditions. 45 road/stream crossing, road density of 2.1 mi/sq.mi.
6) In stream flow	F	H	High WAR (22%), mainly due to valley bottom. High ARP (89%)
7) Floodplain Function	P	H	Highway 12 dissects the floodplain, housing development, channelization, and drained wetlands.
8) Structural diversity of plant communities	F	H	National Forest portion mostly large and small tree within riparian reserves, however large amount of non-federal land in grass/pole reduces rating to fair.
9) Habitat to support well distributed populations of riparian species	D	-	No data available.
LS) Late successional habitat	F-	H	Approximately 12% large tree (outside RR), concentrated in the northern portion. Southern portion is in non-federal ownership. Small tree surrounding large tree blocks alleviates edge effects. Connectivity to north and west.

Comments: Large portion in valley bottom is in non-federal ownership. Future of these areas is dependent upon private management. Forest Service land is generally in good condition relative to the management objectives rated in the table. Domestic water source present.

Table 5-14: 6th Field #2M - East Fork Silver Creek *(2,135 acres, 2.5% of 5th field, 0% nf)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - No change. **Wetlands** - None known. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	G	H	No stream flow diversions present. No known problems with road crossings.
3) Integrity of aquatic systems	D	-	No instream data available.
4) Water quality for healthy ecosystems	D	-	Quarter mile length used by anadromous and resident fish.
5) Appropriate sediment regime	F	H	Several large, deep-seated landslides in WS; portions of two are active and disrupting the 47 Rd. Sediment delivery is Slight compared to reference conditions. 14 road/stream crossings, road density of 1.2 mi/sq. mi., road failure, debris flows
6) In stream flow	G	H	Low WAR (8%) High ARP (90%)
7) Floodplain Function	D	-	Data Gap
8) Structural diversity of plant communities	G	H	High percentage of large tree with some small tree in riparian reserves.
9) Habitat to support well distributed populations of riparian species	D	-	No data available
LS) Late successional habitat	G	H	Approximately 41% large tree (outside riparian reserves) concentrated in the east and middle of the subwatershed. Limited connectivity to the north and west, good connectivity south.

Comments: This subwatershed is in better condition (relative to the rated objectives) than all the others in the fifth field.

Table 5-15: 6th Field #2P - Cunningham/Owens *(3,955 acres, 4.7% of 5th field, 35% non-f)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	F	H	**Perennial Streams** - Cunningham/Owens are subsurface and channelized. **Intermittent Streams** - No change. **Wetlands** - Decrease due to pasture conversion. **Lakes & Ponds** - No change.
2) Connectivity between watersheds	P	H	No stream flow diversions present. Undersized culvert on Owens Creek. Subsurface flows on both Cunningham and Owens Creeks.
3) Integrity of aquatic systems	D	-	Cunningham Creek has been channelized. No instream data available.
4) Water quality for healthy ecosystems	D	-	The first mile is used by resident fish.
5) Appropriate sediment regime	P	H	Background rate of mass wasting/erosion is high along Cunningham & Owens Creeks. Sediment delivery from mass wasting is Moderate above references conditions. 39 road/stream crossings, road density of 2.4 mi/sq. mi., chronic road failures along Forest Road 2304.
6) In stream flow	P	H	High WAR (21%) Moderate ARP (84%)
7) Floodplain Function	P	H	Conversion to pasture land, housing development, and roading influencing floodplain functions.
8) Structural diversity of plant communities	F	H	On National Forest lands, riparian reserves dominated by small tree and large tree with small gaps of grass/pole. Non-federal mostly grass/pole.
9) Habitat to support well distributed populations of riparian species	D	-	No data available
LS) Late successional habitat	F-	H	Approximately 14% large tree (outside riparian reserves) scattered and fragmented but surrounded by small tree.

Comments: All instream complexity has been removed in channelized reaches of Cunningham Creek. Lack of data makes this one difficult to rate.

Table 5-16: 6th Field #2Q - Siler Creek *(8,584 acres, 10.2% of 5th field, 27% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - Increase due to roading. **Wetlands** - Decrease due to roading. **Lakes & Ponds** - No change.
2) Connectivity between watersheds	F	H	No stream flow diversions present. Road in floodplain/wetland. Culvert on Road 2304 is a fish passage barrier.
3) Integrity of aquatic systems	F	M	Questionable data on large woody debris (salvage harvest has occurred in stream). Pool quality and quantity is fair. Poor spawning gravels.
4) Water quality for healthy ecosystems	G	M	Anadromous/resident fish from confluence to S 3. Resident from S 3 to S 9 in Siler Creek. Resident fish in Squire Creek to Road 2305. Possible residents in Lone Tree Lake. Resident fish in Gibbs Lake. Water temperature data on Siler Cr. is good.
5) Appropriate sediment regime	F	H	Sediment delivery from mass wasting is Slight above reference conditions. 95 road/stream crossing, road density of 3.9 mi/sq. mi., Bankcutting and silty substrate observed.
6) In stream flow	F	H	High WAR (18%) Moderate ARP (84%)
7) Floodplain Function	P	H	Conversion to pasture land, industrial development, cattle grazing, drainage of wetlands, and roads influencing floodplains function
8) Structural diversity of plant communities	F	H	Northern portion non-federal dominated by grass/pole. Southern portion is mix of small tree (north of Siler Creek) and large tree (south of Siler creek) with several grass/pole gaps. Cattle grazing on private lands.
9) Habitat to support well distributed populations of riparian species	D	-	No data available.
LS) Late successional habitat	F-	H	Approximately 22% large tree (outside riparian reserves), concentrated in the southern half of the subwatershed. Large tree habitat has been heavily fragmented by timber harvest. Siler Owens timber sale will remove more large tree in this area. East/west connectivity is fair if you include small tree areas.

Comments: Overall, this watershed is evaluated as fair in meeting the rated objectives. 45% of the subwatershed is in LSR, which will lead to improvements in meeting ACS objectives as young stands mature.

Table 5-17: 6th Field #2R - Schooley Creek *(1,377 acres, 1.6% of 5th field, 43% non-fed)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - No change. **Wetlands** - Decrease due to pasture conversion. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	F	M	No stream flow diversions present. Culvert on Skinner Road and Road 2502016 is a barrier.
3) Integrity of aquatic systems	D	-	No instream data available.
4) Water quality for healthy ecosystems	G	L	Resident fish in first mile of Schooley Creek. Not much water quality data.
5) Appropriate sediment regime	G	M	Sediment delivery from mass wasting is Slight above reference conditions. 13 road/stream crossings, road density of 3.7 mi/sq. mi.
6) In stream flow	P	M	High WAR (28%) Moderate ARP (82%) *Verification needed with a stream survey on Schooley Cr.
7) Floodplain Function	P	M	Conversion to pasture lands and housing development
8) Structural diversity of plant communities	F	H	Lower portion of Schooley Creek in large tree, upper portion includes large gaps of grass/pole.
9) Habitat to support well distributed populations of riparian species	D	-	No data available.
LS) Late successional habitat	F	H	Approximately 33% large tree (outside riparian reserves) concentrated in the middle of the subwatershed with connectivity to the south and east.

Comments: All of the Forest Service land in this subwatershed is in LSR. Most of the LSR portion is already in a large tree stage.

Table 5-18: 6th Field #2T - Willie Creek *(1,828 acres, 2.2% of 5th field, 0.1% non-federal)*

Management Objectives	Rating	Confidence	Rationale
1) Existence of aquatic features at landscape scale.	G	H	**Perennial Streams** - No change. **Intermittent Streams** - Increase due to roading. **Wetlands** - None known. **Lakes & Ponds** - None known.
2) Connectivity between watersheds	G	M	No stream flow diversions present. No known problems with road crossings. Roading in the floodplain.
3) Integrity of aquatic systems	P	L	Bank cutting and poor pool habitat for first four reaches. Poor spawning gravel. Channel braiding. Electroshocking yielded no fish in Willie Creek.
4) Water quality for healthy ecosystems	F	L	Water temperature data is only spot checks from stream survey.
5) Appropriate sediment regime	P	M	One large, deep-seated landslide in the WS; portions of which are active. Sediment delivery from mass wasting is Moderate above reference conditions. 49 road/stream crossing, road density of 4.9 mi/sq. mi. Bankcutting and channel braiding observed in watershed.
6) In stream flow	P	M	Moderate WAR (11%) Low ARP (60%) Bank cutting occurring on Willie Cr.
7) Floodplain Function	D	-	Roads may be influencing floodplain function.
8) Structural diversity of plant communities	P	H	Large tree in riparian reserves mostly on southernmost edge and in a few headwaters. Mainstem of Willie Creek mostly grass/pole.
9) Habitat to support well distributed populations of riparian species	D	-	No data available.
LS) Late successional habitat	P	H	Approximately 19% large tree (outside riparian reserves) in four patches isolated by grass/pole on all sides. No connectivity.

Comments: Lots of bank cutting and deposition indicate peak flow problems. Existing large tree component is within LSR.

Chapter 6 - Management Recommendations

Introduction

The purpose of this chapter is to identify those management activities which are considered to be appropriate for closing the gap between the present condition and the desired future condition of this watershed. All proposed activities will be consistent with the guidelines of the Gifford Pinchot Land and Resource Management Plan, as amended.

Historic and current conditions of the watershed were described in chapter 3. In order to best describe the appropriate management activities that will close the gap between the present condition and the desired future condition of this watershed, we first need a picture of that desired future condition. It is important to note that current management direction plays a large role in defining future conditions. While we may desire to restore certain portions or elements of the watershed to conditions similar to those in historic times, the entire watershed will not reflect historic conditions. The following is a description of the desired future condition for this watershed.

Desired Future Condition

Vegetation:

The desired condition in the **Late Successional Reserves** (LSR) and the **Unroaded Recreation** (UL) allocations will resemble the condition at the historic reference time, because there is no expectation of regeneration harvests for these allocations. The only management activity in these allocations will be thinnings in stands which are young enough to benefit from it. The long term objective of these allocations is to produce late successional habitat for all species that depend on it. Stands in these allocations are expected to produce large trees, snags, multiple layered canopies, and large course woody debris on the forest floor. Average stand diameters will exceed 21 inches, and Douglas-fir will be the dominant tree in the overstory. In other words, the large tree component in these allocations is expected to approach a relatively high percent of the area within the allocation - approximately 75%, or higher.
Associated tree species will include western hemlock, western redcedar, and big leaf maple at lower elevations, and noble fir, pacific silver fir, mountain hemlock, subalpine fir, Engleman spruce, and western white pine at higher elevations.

The desired condition for **Matrix** and **Adaptive Management Area (AMA)** allocations - General Forest (TS), Deer and Elk Winter Range (EM,ES), and Visual Emphasis (VM) will include stands of various ages across the landscape that is in these allocations. Each of these allocations has a predetermined level of scheduled timber harvest associated with it. The harvests will include both thinnings and regeneration harvests. As a result, the landscape within these

allocations will show a mosaic of stands in many different sizes or ages at any one point in time. These stand sizes will range from grass/pole to large tree, and they will be widely distributed across the landscape to the extent that they are consistent with other coincident resource objectives and limitations.

The percent distribution between grass/pole, small tree, and large tree will vary over time, but each will be represented at any one point in time. The percent of large tree stands will be at least 28% at any time, because, even in the general forest allocation (with an average rotation of 110 years), there will be at least 18% in large trees under a fully managed condition. In the deer and elk allocations, at least 47% will be in large trees at any time. And in the visual allocations, at least 25% will be in large trees at any time. Weighting these percentages by the appropriate acres in each allocation yields an average of 28% in large trees. (This will be in addition to the large tree component associated with riparian reserves which occupy as much as 30% to 40% of the watershed.)

The remaining 72% of land, outside of riparian reserves, can be assumed to be split fairly evenly between small trees and grass/poles after the land is in a fully managed condition. The tree species mix will be similar to that described for the reserved allocations above.

Wildlife and Botanical Resources

The desired future condition of the watershed relative to wildlife and botanical resources would have riparian corridors providing connectivity and travelways for late-successional dependent species so that individuals, groups, and populations are not isolated. Water quality is such that it meets ACS objectives and can sustain an appropriate riparian flora and fauna including lesser known species of fungi, bryophytes, lichens, amphibians, mollusks, and fish.

Fragmentation in the LSRs is reduced so that an approximate minimum of 10% of the watershed contains late-successional interior forest habitat. Optimal cover and forage for deer and elk is distributed as described in Amendment 11.

Surveys are complete and protective buffers for TES species are established where necessary. Species monitoring will identify declining populations or other problems and management actions will be designed to improve conditions where appropriate. Special habitats are located and protected where appropriate.

Aquatic Resources

The aquatic component of this analysis is based on data available from the turn of the century and later, the current condition, and the ability to meet the Desired Future Condition (DFC) as defined in the Columbia River Basin Anadromous Fish Habitat Management Policy and

Implementation Guide (PIG), the Land and Resource Management Plan, Amendment 11, state and federal laws and interpretation of ACS objectives.

More specifically, the desired future condition of the physical component of a stream is evaluated largely using PIG Guidelines. Standards such as 80 pieces of LWD per mile or more and width to depth ratios of 10 or less are all generally considered in good condition depending on channel type (See appendix A). The desired future condition for water quality is to achieve the state standards. Water temperatures of below 16 degrees Celsius and dissolved oxygen standards above 9.5 mg/l for class AA waters are some of the common state standards used. The desired future condition for peakflow is to meet ARP and WAR thresholds as defined in the Gifford Pinchot Cumulative Assessment Report and the Washington State Peakflow Module. Other desired future conditions for the aquatic component are to meet the ACS objectives. (See page 5-3 of this document for interpretation of ACS objectives.)

Recommendations at the Fifth-Field Watershed Scale

Recommendations provided here span the sixth-field subwatersheds and are provided to eliminate the need for duplication within the sixth-field management recommendation tables.

Boundary Changes of Riparian Reserves

This watershed analysis does not identify site specific, or general changes in riparian reserve boundaries. Interim riparian reserves, as they are prescribed in the ROD, are recommended based on the evaluation of each subbasin relative to ACS objectives 1 through 9. Deviation from this course should only occur after thorough review by an interdisciplinary team comprised of a hydrologist, soil scientist, botanist, wildlife and fisheries biologist, and silviculturist. The most likely streams to have changes are those that fall into the category of Class IV. It is likely that project-specific surveys will identify many such streams. Any changes to riparian reserves should be based upon "on-the-ground" reviews, and determining that such a change would not affect the maintenance of the Aquatic Conservation Strategy objectives. Any changes to riparian reserve boundaries are to be evaluated and documented as part of the NEPA process.

Regeneration Harvest Within Riparian Reserves

Pages C-31 and C-32 of the ROD describe conditions of acceptable regeneration harvest and salvage activities within riparian reserves. Recommendations other than those identified in the Northwest Forest Plan should be developed through interdisciplinary, site-specific analysis.

Commercial Thinning Within Riparian Reserves

Commercial thinning may be appropriate within the riparian reserves when the harvest activities are *specifically designed to improve the aquatic conditions and/or develop late structural corridors.* In the event of such activity, original reserve buffers should be maintained on the ground, and activities within the buffer should be implemented more conservatively than outside the buffer. Site-specific review by an interdisciplinary team should be the mechanism by which such prescriptions are recommended. Measures to minimize disturbance to soil, vegetation, and aquatic features should be identified prior to implementation.

Other Silvicultural Activities (Inside and Outside of Riparian Reserves)

Other silvicultural activities (including pre-commercial thinning, pruning, fertilization, and conifer release) should be reviewed by an interdisciplinary team to develop joint proposals for such activities both inside and outside of riparian reserves. Within riparian reserves, proposals should be designed to improve aquatic conditions and promote the Aquatic Conservation Strategy objectives.

Connectivity of Riparian Reserves

Restoration activities in the Middle Cowlitz watershed should initially focus on restoring connectivity in riparian reserves associated with Silver and Lynx Creeks and the Cowlitz River. Because most of the Cowlitz River and Lynx Creek are on private lands, partnerships and possibly funding of restoration projects will be required to restore riparian areas. Restoring connectivity along these watercourses will provide habitat and travel corridors which lead throughout the watershed. Connectivity would be provided between the LSR's located in the south and northeast portions of the watershed. These corridors would also provide connectivity to the adjacent watersheds. Restoration could include planting riparian species, fencing of the riparian area in pastures, and pre-commercial and commercial thinnings designed to promote late-successional habitat conditions, snag and coarse woody debris placement and/or creation.

Roads

Given the substantial cumulative hydrologic effects observed in this watershed which in large part are attributable to erosion and mass wasting associated with roads, it is apparent that a need exists to reduce the impacts of these roads on the aquatic conditions. Since most of the Federally administered land in the Middle Cowlitz watershed is in timber producing allocations (Matrix and Adaptive Management Area), the challenge is how best to effectively administer the timber production duties while simultaneously reducing the hydrologic effects that an extensive road network on steep slopes produces.

In making these determinations, it is important to note that harvest opportunities (particularly regeneration harvest) under the current management guidelines appear to be very limited in this fifth-field watershed over at least the next 10 years, and in some parts of the watershed for as long as 20-25 years. However, the current analysis indicates a need for precommercial thinning on the order of 4,500 acres in this fifth-field watershed to promote the goals of long-term timber production on Matrix and AMA allocations. In addition, there is a concern that the existing condition of the road system is susceptible to severe storm events that occur several times per decade. Storm events in years 1994-96 have combined to create damage to the road network that will require greater than $347,000 to repair to the same or slightly improved condition Continued storm damage costs of this magnitude in the future may occur at a rate that we are not able to repair on a sustainable basis, and cumulative effects to the watershed will continue at an undesirable rate.

Taking all these factors together, a cost effective alternative worth considering is the concept of placing portions of the road network into "storage". By this, we mean determining which roads will not be needed for a given time (e.g., 10-25 years), evaluating those roads to determine which portion are at risk of some type of damage from storm events, and weatherizing those portions of road to withstand a span of time with no maintenance such that storm damage during that time is minimized. It is anticipated that main trunk roads and other roads actually needed over the next 10-25 years will remain open and be maintained; the emphasis here is to reduce the risk of monetary and ecological costs from leaving roads open that won't be used for management activities during the 10-25 year window.

The sequence of steps required to implement this idea of road system storage might look something like:

1. Conduct ATM Phase II Road Condition Surveys on roads in this watershed as soon as possible. These surveys will identify "at risk" segments of roads, and will help prioritize roads needing stabilization or decommissioning. During the same time, evaluate and locate precommercial and commercial thinning needs in the watershed; determine roads needed to accomplish this work.

2. Review and revise the existing Access and Travel Management plan (ATM) to reflect new information from road condition surveys and timber management assessment. When planning for these stabilization needs, be sure to consult with adjacent private and commercial landowners regarding their needs for access and cost-share agreements.

3. Repair roads needed for TSI work and begin precommercial and commercial thinning. On roads determined to not be needed for TSI work, evaluate, design, and begin stabilization work (e.g., remove culverts, pullback unstable shoulder, install waterbars, etc), for only those roads or segments determined to pose some risk. Roads not posing

any risk will be dealt with as suggested in the ATM Plan.

4. As TSI work is completed along given roads, design and implement necessary work on those road systems as well. The idea is to deal with stability concerns as we proceed with TSI work.

5. Maintain records of construction needs for each "weatherized"road (e.g., size and number of culverts needed per road, estimated quantities of material needed, etc). The idea is to have a rough design on the shelf for when a given road is reopened in the future, but recognize that future construction will need specific survey and design..

Developed Recreation and Trails

Clarify access to trails by formalizing trailheads near the Cowlitz Valley. Limit new developments to trail opportunities near existing facilities. Focus recreation access on main arterials that provide routes to known dispersed sites, huckleberry patches, and trailheads (fishing sites along Silver Creek). Close roads near the Cowlitz Valley where garbage dumping has been a problem. Implement roads-to-trails proposals where feasible as roads are closed.

Dispersed Recreation

Inventory dispersed recreation camps at lakes (see sixth-field tables for specifics). Focus of recreation within the watershed should be for dispersed recreation including huckleberry picking, firewood gathering, and dispersed use at lakes. Management and administration of public use will be minimal.

Recommendations at the Sixth-Field Watershed Scale

The ensuing tables contain specific recommendations and concerns related to specific management activities for each sixth-field watershed. It is important to note that the recommendations are put within the temporal context of the next ten years. Thus, while a specific sixth-field watershed may not have identified opportunities for certain management activities now, it does not preclude future opportunities.

Table 6-1: 6th Field #2 - Cowlitz River *(ROD Allocations: LSR 1%)*

Activity	Recommendations	Concerns
Regeneration Harvest	None. The only federal land is LSR.	
Commercial Thinning	No apparent opportunities	Within the home range of one known spotted owl pair. This is also within the marbled murrelet zone 2.
Roads	No recommendations, mostly private land.	
Other Restoration	Nothing planned. There may be partnership opportunities for enhancement of fish habitat and riparian restoration.	
Recreation and Trails	Nothing planned	
Other Issues	None known	

Table 6-2: 6th Field #2A - Kiona Creek *(ROD Allocations: none, 100% non-federal)*

Activity	Recommendations	Concerns
Regeneration Harvest	None, this is all private land.	
Commercial Thinning	None, this is all non-federal land.	
Roads	None, this is all non-federal land.	
Other Restoration	This is all non-federal land, however there may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	None, this is all non-federal land.	
Other Issues	None, this is all non-federal land.	

Table 6-3: 6th Field #2B - Peters Creek *(ROD Allocations: Matrix 24%)*

Activity	Recommendations	Concerns
Regeneration Harvest	There are some large tree stands however based on their location and what we know about hydrological concerns in the subwatershed, no opportunities are identified beyond those already included in the planned Silver Watch Timber Sale.	High WAR (25%), low ARP (50%). Presence of permit authorized water transmission lines. Within the home range of one known spotted owl pair, within marbled murrelet zone 2 and biological winter range for deer and elk.
Commercial Thinning	Appears to be limited opportunities, needs closer scrutiny.	See above
Roads	Restoration opportunities exist on FR 7534-040	
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	Nothing planned.	
Other Issues	Look for opportunities to improve viewshed by blending existing unit edges.	Existing condition of viewshed does not meet Visual Quality Objectives due to past harvest units. Parts of T12NR07ES05,06 and T13NR07E S31,32 may be exchanged with Plumb Creek Timber Co.

Table 6-4: 6th Field #2C - Miller Creek *(ROD Allocations: Matrix 57%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Forest Plan MAC is visual emphasis so any regeneration would need to comply with this allocation. Estimate is that only a small opportunity exists beyond that which is already included in the planned Silver Watch Timber Sale.	High WAR (21%), Moderate ARP (78%). Within the home ranges of two known spotted owl pairs. Within zone 2 for marbled murrelets. Within biological winter range for deer and elk.
Commercial Thinning	Some small tree stands, though their status is unknown. Needs a more detailed look.	See above.
Roads	Close affected roads per ATM plan guidance.	Known areas of garbage dumping
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	Nothing planned.	
Other Issues	None known.	Parts of T12NR07ES04,05 and T13NR07E S32,33 may be exhanged with Plumb Creek Timber Co.

Table 6-5: 6th Field #2D - Hampton Creek *(ROD Allocations: Matrix 23%, Adm. Wthd. 4%)*

Activity	Recommendations	Concerns
Regeneration Harvest	May be salvage opportunities due to root rot, however concerns (see right) may limit other regeneration beyond that which is already included in the planned Silver Watch Timber Sale.	High WAR (32%), Moderate ARP (81%). TES plant location. Within the home ranges of two known owl pairs, within zone 2 for marbled murrelets, and within biological winter range. Presence of permit authorized and other water transmission lines.
Commercial Thinning	Small tree stands exist, but need a closer look to determine status.	See above
Roads	Close affected roads per ATM plan guidance. ERFO projects on FR 75 MP 0.6, 1.2, 1.4	Known sites of garbage dumping. Have received application for private road easement T12NR07ES10. Be aware of deep seated landslide displacing FR 75, due north of WP Highschool.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Rehabilitation of pond and spring on Randle compound. Service road on compound should be converted to a trail.	
Recreation and Trails	Rehabilitate and revegetate the Mary Kiona day use site. Increase closure methods to fully restrict access.	Riparian area is being adversely affected.
Other Issues	None known.	T12NR07ES04 may be exchanged with Plumb Creek Timber Co.

Table 6-6: 6th Field #2E - Lake Creek *(ROD Allocations: Matrix 24%)*

Activity	Recommendations	Concerns
Regeneration Harvest	No apparent opportunities.	Moderate WAR (12%), Low ARP (38%). Within the home range of one known owl pair, within zone 2 for marbled murrelets, and within biological winter range.
Commercial Thinning	No apparent opportunities.	See above
Roads	Restoration opportunities exist on FR 4778.	Expect application for use of FR 4778 as access to private land. Would require reconstruction.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Riparian restoration at Watch Lake. Should monitor water chemistry at Watch Lake. Restoration (culvert removal) at outlet.	Known water quality concerns at Watch Lake (T and DO).
Recreation and Trails	Inventory use at Watch Lake.	Watch Lake reported to have garbage and campsite management concerns.
Other Issues	None known.	Part of Sections 28, 31, and 32 of T13N R07E could be exchanged with Plumb Creek Timber Co.

Table 6-7: 6th Field #2F - Martin Creek *(ROD Allocations: none, 100% non-federal)*

Activity	Recommendations	Concerns
Regeneration Harvest	None, this is all non-federal land.	
Commercial Thinning	None, this is all non-federal land.	
Roads	None, this is all non-federal land.	
Other Restoration	This is all non-federal land, however there may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	None, this is all non-federal land.	
Other Issues	None, this is all non-federal land.	

Table 6-8: 6th Field #2G - Lower Lynx Creek *(ROD Allocations: LSR 9%, Matrix 8%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Matrix is all grass/pole. No regeneration opportunities in the near future.	High WAR (11%), Low ARP (32%). Within zone 2 for marbled murrelets and within biological winter range. 4.4 miles of anadromous habitat.
Commercial Thinning	No opportunities.	See above.
Roads	Restoration opportunities may exist on FR 8500130 and 8500131 (costshare with private landowners??)	FR's 8500-042 and -044 have provided access to private lands with one log bridge. Expect application for use and reconstruction of FR's 4778 and 8500-130 for access to private lands.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. New stream survey is needed. Possible instream restoration projects in reaches 8, 9, 10.	
Recreation and Trails	None proposed	
Other Issues	Recommend dropping the Forest Plan pine martin allocation within this subwatershed.	

Table 6-9: 6th Field #2H - Upper Lynx Creek *(ROD Allocations: Matrix 79%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Four isolated large tree stands, surrounded by grass/pole. Probably not much opportunity for regeneration harvest.	Moderate WAR (11%), Low ARP (34%). Within the home range of one known owl pair. Within marbled murrelet zone 2. Forest Plan pine martin allocation retained here.
Commercial Thinning	One small tree stand, but probably not at commercial age at this time.	See above
Roads	Restoration opportunities exist in several places on FR 85; flood damage sites on FR 85 at MP 13.5 and FR 85-130 MP 0.8.	Expect application for use of FR 8500-130 with reconstruction for access to private lands.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Restoration of reach 14 and continuation of stream survey.	
Recreation and Trails	Nothing planned	
Other Issues	Recommend retaining Forest Plan Pine Marten allocation.	Sections 32, and 33 and parts of Section 31 of T14N R07E could be exchanged with Plumb Creek Timber Co.

Table 6-10: 6th Field #2J - Lower Silver Creek ***(ROD Allocations: Matrix 79%, LSR 14% Adm. Wthd. 4%)***

Activity	Recommendations	Concerns
Regeneration Harvest	Very limited opportunities. Most already taken with Silver Watch Timber sale.	Low WAR (9%), Low ARP (71%). One TES plant location. Within the home ranges of five known owl pairs. Within zone 2 for marbled murrelets and within biological winter range. 5.5 miles of anadromous habitat.
Commercial Thinning	Very limited opportunities. Most already taken with Silver Watch Timber sale.	See above.
Roads	Close affected roads per ATM plan guidance. Restoration opportunities exist on the following roads: 47, 75, 7500-018, -065, 7561, 7561-018, 8500-042, -045. Flood damage sites on FR 47 at MP 15.0. FR 63 MP 13.9, FR 75 MP 4.9, FR 85 MP 0.5, FR 74-185 MP 8.0, FR 4778 MP 2.3, 2.4, 2.9, FR 75-064 MP .25, 1.25, FR 4778.	Known sites of garbage dumping. Expect application for reconstruction and use of FR 4778 for access to private lands.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	Either fix washout or define alternate trailhead. Construct trail to record yew tree.	No access to Purcell Mtn Trail (285,284) due to washout on Rd 6300057.
Other Issues	None known	Parts of Sections 4 of T12N R07E and Sections 28 and 33 of T13N R07E could be exchanged with Plumb Creek Timber Co.

Table 6-11: 6th Field #2K - Upper Silver Creek *(ROD Allocations: LSR 65%, Matrix 35%)*

Activity	Recommendations	Concerns
Regeneration Harvest	No apparent opportunities	Low WAR (9%), Low ARP (59%). Within the home ranges of three known owl pairs. Within zone 2 for marbled murrelets.
Commercial Thinning	No apparent opportunities	See above
Roads	Restoration opportunities exist on roads 63, 85, 8518. Flood damage sites on roads 47 MP 11.9; 4773 MP 0.5, 1.4, 1.5; 6300-130 MP 0.1; 8522; 8522-028; 8522-029; 4772 MP 0.1; 8400-134; 4773 at junction with FR 47.	
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Stream restoration at Silver Creek reach 6.	Interior habitat in LSR is fragmented.
Recreation and Trails	Allen Mtn roads to trails project (convert 4.2 mi of FR 8400134 and 8418037) for proposed mtn bike loop to tie in with existing Allen Mtn Trail 253. Long Lake/Willame roads to trails project (convert 3.5 mi of FR 4700110, 4700112 and 4740) for mtn bike and ORV trail. Inventory use at Long Lake	Lack of inventory of dispersed sites in upper Silver Creek. Long Lake reported to have garbage and campsite management concerns.
Other Issues	None known	

Table 6-12: 6th Field #2L - Surrey/Hopkins *(ROD Allocations: Matrix 38%, AMA 11% Adm. Wthd. 7%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Mostly visual emphasis Forest Plan MAC. Limited opportunity for regeneration. There is a problem with root rot, so there may be salvage opportunities.	High WAR (22%). Within the home ranges of six known owl pairs. Within zone 2 for marbled murrelets and within biological winter range. Presence of permit authorized water lines.
Commercial Thinning	Lots of small tree stands. Probably some opportunities, but need further scrutiny to determine availability.	See above
Roads	Close affected roads per ATM plan guidance. Recognize the need for maintenance on FR 47 where deep seated slides are disrupting road.	Known sites of garbage dumping.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	Locate new trailhead on Forest Service land just to the east of current location.	No access off of Highway 12 to Purcell Mtn Trail (284) due to private land.
Other Issues	Recommend dropping the Forest Plan pine martin allocation within this subwatershed.	

Table 6-13: 6th Field #2M - East Fork Silver Creek *(ROD Allocations: Matrix 65%, Adm. Wthd. 35%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Small opportunity in western two thirds of the subwatershed. Not much beyond that which is already included in the planned Silver Watch Timber Sale.	Within the home ranges of four known owl pairs. Within zone 2 for marbled murrelets and within biological winter range. One quarter of a mile of anadromous habitat.
Commercial Thinning	Very little apparent opportunity.	See above
Roads	Close affected roads per ATM plan guidance. Flood damage sites on FR 4700-185 at MP 1.3 and beyond. Also on FR 47 MP 17.7 and 18.4. Recognize the need for maintenance on FR 47 where deep seated slides are disrupting road.	Known sites of garbage dumping.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Need a stream survey on East Fork Silver Creek.	
Recreation and Trails	Nothing proposed	
Other Issues	Look for opportunities to improve viewshed by blending unit edges.	Existing condition of viewshed does not meet Visual Quality Objectives due to past harvest units.

Table 6-14: 6th Field #2P - Cunningham/Owens *(ROD Allocations: AMA 65%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Forest Plan MAC is visual emphasis. Moderate opportunities for regeneration if carefully designed.	High WAR (21%), Moderate ARP (84%). Within the home ranges of four known owl pairs. Within biological winter range. Pileated woodpecker allocation from Forest Plan is retained.
Commercial Thinning	Moderate opportunity, though needs closer scrutiny.	See above.
Roads	Create trailhead at Cline Road, just west of Kilborn Creek (adjacent landowner concerns). Further restoration opportunities exist on FR 2304. Flood damage on FR 2304 at Owens Creek, Cougar Creek, Cunningham Creek. Culvert at Owens Creek and Cline Road needs to be enlarged.	Public access on 2304 to Pompey Peak Trail (128) is limited (seasonal washouts, distance to trailhead)
Other Restoration	Habitat restoration at Cunningham Creek below the Cline Road. There may be partnership opportunities for enhancement of fish habitat and riparain restoration.	
Recreation and Trails	Nothing planned	
Other Issues	Look for opportunities to improve viewshed by blending unit edges. Recommend keeping Forest Plan pileated woodpecker allocation.	Existing condition of viewshed does not meet Visual Quality Objectives due to past harvest units.

Table 6-15: 6th Field #2Q - Siler Creek *(ROD Allocations: LSR 45%, AMA 29%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Small opportunity for regeneration harvest in this area.	High WAR (18%), Moderate ARP (84%). Within the home ranges of five known owl pairs. Within marbled murrelet zone 2 and within biological winter range. Fragmentation of late seral habitat. This subwatershed has 7 known sites of a TES plant and one known site of a survey and manage plant that are dependent on late seral habitat. 2.7 miles of anadromous habitat.
Commercial Thinning	Moderate opportunity for thinning.	Same as above
Roads	Close affected roads per ATM plan guidance. Restoration opportunities exist along road 55 (near Lone Tree Lake). Flood damage site on FR 55 at MP 0.8.	Known sites of garbage dumping. Presence of buried telephone and electrical lines along FR's 23, 2305, 2306, 2504, and 2504-041 will probably require periodic maintenance and replacement. Some FR's provide access to private land.
Other Restoration	There may be partnership opportunities for enhancement of fish habitat and riparain restoration. Restoration opportunities in Squire and Siler Creeks. Riparian planting may be needed along reach 10 of Siler Creek. Culvert replacement needed at crossing of FR 55. Lone Tree Lake needs to be surveyed (fish) and needs riparian rehabilitation. Culvert replacement needed on Squire Creek at FR's 23, 2304, and 2305.	Interior habitat in LSR is fragmented.
Recreation and Trails	Inventory use at Lone Tree Lake.	Lone Tree Lake reported to have garbage and campsite management concerns.
Other Issues	Look for opportunities to improve viewshed by blending unit edges. Recommend dropping the Forest Plan pine martin allocation within this subwatershed.	Existing condition of viewshed does not meet Visual Quality Objectives due to past harvest units.

Table 6-16: 6th Field #2R - Schooley Creek *(ROD Allocations: LSR 57%)*

Activity	Recommendations	Concerns
Regeneration Harvest	None. All the federal ownership is in LSR.	
Commercial Thinning	Small opportunity within LSR.	High WAR (28%), Moderate ARP (82%). Within the home range of one known owl pair. Within zone 2 for marbled murrelets and within biological winter range.
Roads	Close affected roads per ATM plan guidance.	Known sites of garbage dumping.
Other Restoration	Culvert replacement needed on Skinner Road and FR 2502-016. There may be partnership opportunities for enhancement of fish habitat and riparian restoration.	
Recreation and Trails	Nothing planned	
Other Issues	None known.	

Table 6-17: 6th Field #2T - Willie Creek *(ROD Allocations: Matrix 70%, LSR 29%)*

Activity	Recommendations	Concerns
Regeneration Harvest	Small block of large tree habitat (approx. 160 acres) within matrix allocation may be an opportunity.	Moderate WAR (11%), Low ARP (60%). Within the home range of one known owl pair. Within zone 2 for marbled murrelets and within biological winter range.
Commercial Thinning	No opportunity for thinning. Mostly grass/pole.	See above.
Roads	Restoration opportunities exist on FR's 4778, 4778-044, 4778-045. Flood damage sites at FR's 85 at MP 2.0, 3.0, 17.7, 18.4, 19.7; 4778 MP 1.9, 2.1.	Expect application for the use and reconstruction of FR 4778 for access to private lands.
Other Restoration	New stream survey needed. May be partnership opportunities for enhancement of fish habitat and riparian restoration.	
Recreation and Trails	Nothing planned	
Other Issues	None known.	

References

Anderson, Rolfe. 1938. History of the Randle and Cispus Valley. Memo: Historical Information Files, Columbia National Forest. Original on file, Gifford Pinchot National Forest, Washington.

Anonymous. 1890. The Big Bottom -- A Great Undeveloped Valley in Eastern Lewis County. Bee-Nugget, August 5, 1890, Chehalis.

Barnosky, Cathy W. 1981. A Record of Late Quaternary Vegetation from Davis Lake, Southern Puget Lowland, Washington. Quaternary Research 16:221-239.

Beak Consultants Incorporated. 1995. Water quality and water temperature monitoring for surface waters on the Mineral tree farm. Murray Pacific Corporation.

Birtchet, R.E. 1963. Physical Description of Cowlitz River Tributaries Surveyed for Silver Salmon in 1962. Washington Department of Fisheries.

Boyd, Robert T. 1990. Demographic History, 1774-1874. Handbook of North American Indians, Volume 7, Northwest Coast. Edited by Wayne Suttles. Smithsonian Institution, Washington, D.C.

Bryant, F. G. 1949. A Survey of the Columbia River and its Tributaries with Special Reference to its Fishery Resources. U.S. Department of the Interior. Special Scientific Report No. 62.

Burtchard, Gregory C. 1990. The Posy Archaeological Project. Report submitted to the Mt. Hood National Forest. Laboratory of Archaeology and Anthropology, Portland State University, Resource Investigation Series No. 3. Portland, Oregon.

Clevinger, Woodrow. 1938. The Appalachian Mountaineers in the Upper Cowlitz Basin. Pacific Northwest Quarterly.

Costima, Lewy. 1934. Upper Cowlitz Myth and Geographic Text. Northwest Sahaptin Texts, Part I. Columbia University Contributions to Anthropology, Vol. 19, by M. Jacobs, pp. 238-246. New York.

Crandell, D.R. and Mullineaux, D.R. 1978. Potential Hazards from Future Eruptions of Mount St. Helens volcano, Washington., U.S. Geological Survey Bulletin 1383-C, p. 26.

Curtis, Edward S. 1913. The North American Indians, Volume 9. The Plimpton Press, Norwood, Massachusetts.

Davis, Mary Frances. 1902. Diary of Mary Frances [Gilleland] Davis.

Easterbrooks, J.A. 1980. Salomon Production Potential Evaluation for the Cowlitz River System Upstream of the Cowlitz Falls Dam Site. Washington Department of Fisheries.

Ellis, David V., Jeffrey Scott King, David Putnam, David Francis, and Gail Thompson. 1991. Archaeological Excavations at Cowlitz Falls, Lewis County, Washington, Volume II. Report prepared for Bechtel Corporation. Historical Research Associates, Inc., Seattle.

Environmental Protection Agency. 1986. Water quality criteria for 1986. U.S. Environmental Protection Agency, Washington D.C.

Fechtner, Don. 1939. A Brief History of the Big Bottom Country. Memorandum dated February 17, 1939, I - Studies, Historical, Columbia [National Forest].

Fenby, E. J. 1981. E.J. Fenby Memoirs 1883-1966. Timberlines, August 1981.

Gifford Pinchot National Forest. 1986. Plant Association and Management Guide for the Western Hemlock Zone. Pacific Northwest Region, R6-ECOL-230A- 1986.

Gifford Pinchot National Forest. 1988-1996. Traffic Surveillance Summary,

Gifford Pinchot National Forest. March 1995. Roads To Trails Assessment.

Gunther, Erna. 1945. Ethnobotany of Western Washington; the Knowledge and Use of Indigenous Plants by Native Americans. University of Washington Publications in Anthropology, University of Washington, Seattle.

Harris, S.L. 1988. Fire Mountains of the West: The Cascade and Mono Lake Volcanoes., Mountain Press Publishing Co., Missoula, MT., 379 p.

Hirt, Paul W. 1994. Historical Roots of the Current National Forest Management Crisis: A Case Study From the Gifford Pinchot National Forest. Paper presented at the Northwest History Conference, March, 1994, Bellingham, Washington.

Interagency Committee for Outdoor Recreation. 1991. Washington Outdoors: Assessment and Policy Plan, 1990-1995.

Jacobs, Melville M. 1934. Northwest Sahaptin Texts, Part I. Columbia University Contributions to Anthropology, 19(1). New York.

Kiona, Mary. 1964. Taped interview by Martha Hardy, Packwood, Washington. Copy in the

author's possession.

Landres, P., Morgan, P., and F. Swanson. 1997. Evaluating the Usefulness of Natural Variability in managing Ecological Systems. Abstract submitted to the annual meeting of the Ecological Society of America, August 1997.

Lewarch, Dennis E., and James R. Benson. 1991. Long-term Land Use Patterns in the Southern Washington Cascade Range. Archaeology in Washington 3;27-40.

McClure, Richard H., Jr. 1992. An Archaeological Assessment of the Beech Creek Site (45LE415), Gifford Pinchot National Forest. USDA Forest Service, Gifford Pinchot National Forest, Vancouver.

Meekin, T. 1962. Physical Description of Cowlitz River Tributaries Surveyed for Silver Salmon in 1961. Washington Department of Fisheries.

Mullineaux, Donal R. 1981. The Eruptive History of Mount St. Helens. In The 1980 Eruptions of Mount St. Helens, Washington, edited by P.W. Lipman and D.R. Mullineaux. USGS Professional Paper 1250. Denver.

Murray Pacific Corporation. 1995. Kiona Creek Watershed Analysis. Murray Pacific Corporation.

Porter, Dave. 1993. Recreation Demand and Trend Analysis for the Gifford Pinchot National Forest.

Pringle, P.T. 1993. Roadside Geology of Mount St. Helens National Volcanic Monument and Vicinity., Washington Department of Natural Resources, Division of Geology and Earth Resources Circular 88, Olympia, WA, 120 p.

Randle Ranger District. 1983. Schooley Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1987. Electroshocking Data. Gifford Pinchot National ForestRandle

Randle Ranger District. 1987. Lynx Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1987. Squire Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1991-1996. Silver Creek Temperature Monitoring Reports. Gifford

Pinchot National Forest.

Ranger District. 1994. Access and Travel Management Plan.

Randle Ranger District. 1995. Kiona Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1995. Miller Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1995. Oliver Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1995. Siler Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 1996. Infrastructure Reports. Database.

Randle Ranger District. 1996. Siler Creek Temperature Monitoring Report. Gifford Pinchot National Forest.

Randle Ranger District. 1996. Silver Creek Stream Survey Report. Gifford Pinchot National Forest.

Randle Ranger District. 199x to present. Snorkel Surveys.

Ray, Verne. 1974. Handbook of the Cowlitz Indians. In Coast Salish and Western Washington Indians III, edited by D.A. Horr, pp. 245-315. Garland American Indian Ethnohistory Series. New York.

Reid, Kenneth. 1993. Paleoenvironmental Context. In The Archaeology of Chester Morse Lake: Long-Term Human Utilization of the Foothills in the Washington Cascade Range. Center For Northwest Anthropology, Department of Anthropology, Washington State University, Project Report No. 21. Pullman.

Scott, K.M., and Vallance, J.W. 1995. Debris Flow, Debris Avalanche, and Flood Hazards at and Downstream from Mount Rainier, Washington. U.S. Geological Survey Hydrologic Investigations Atlas HA-729, 9 p. and 2 sheets.

Scott, K.M., Vallance, J.W., and Pringle, P.T. 1995. Sedimentology, Behavior, and Hazards of Debris Flows at Mount Rainier, Washington. U.S. Geological Survey Professional Paper 1547, 56 p.

Smith, Allan. 1964. Ethnographic Guide to the Archaeology of Mount Rainier National Park. Mimeographed report submitted to National Park Service. Department of Anthropology, Washington State University, Pullman.

Swanson, D.A., et al. 1989. Cenezoic Volcanism in the Cascade Range and Columbia Plateau, Southern Washington and Northernmost Oregon., Fieldtrip Guidebook T106, American Geophysical Union, Washington D.C., 60 p.

Tompkins, Walker. 1933. The Big Bottom (Lewis County) 1833-1933. Washington Historical Quarterly 24:250-257.

USDA Forest Service. 1936. "G - Fish & Game", Lake & Stream Investigations, Columbia. Physical Description of Streams, Randle District. Fish and Game Records Columbia National Forest. Atlas #27 - H-14. On file, Gifford Pinchot National Forest.

USDA Forest Service. 1940. "W - Management - Fish" Inventory for Lakes and Streams, Randle Ranger District. Fish and Game Records Columbia National Forest. Atlas #27 - H-14. Gifford Pinchot National Forest Headquarters, Vancouver, WA.

USDA Forest Service. "G - Fish & Game, Lake Management Plan, Fish Stocking Record, Columbia National Forest" and "G - Fish & Game, Lake Management Plan, Fish Stocking Record, Gifford Pinchot National Forest". Gifford Pinchot National Forest.

USDA Forest Service. 1996. Disturbance and Forest Health in Oregon and Washington. Pacific Northwest Research Station, General Technical Report PNW-GTR-381.

USDA Forest Service and USDI Bureau of Land Management. 1994. Appendix J-2 of the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

USDA Forest Service and USDI Bureau of Land Management. 1994. Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.

Waitte, R.B., Jr. and Dzurisin, D. 1981. Proximal Air-Fall Deposits from the May 18 Eruption - Stratigraphy and Field Sedimentology., in: The 1980 Eruptions of Mount St. Helens, Washington., US Geological Survey Professional Paper 1250, p. 601-616

Washington Department of Transportation. 1997. Traffic Counts: over phone with the

Wolcott, E.E. 1973. Lakes of Washington, Volume 1, Western Washington, Third Edition.

Yamaguchi, D.K. 1983. New Tree-ring dates for recent eruptions of Mount St. Helens. Quaternary Research, vol 20, no.2, p. 246-250.

Yoke, Jim. 1934. Upper Cowlitz Geographic Notes. In Northwest Sahaptin Texts, Part I. Columbia University Contributions to Anthropology, Vol. 19, by M. Jacobs, pp. 228-237. New York.

Appendix A

Hydrologic Data (ARP, WAR, Channel Condition)

ARP Peakflow Analysis

Combined for Forest Service and Private Ownership's

Sixth Field	Watershed ARP	Total Acres	FS Land ARP	FS land Acres	Pvt land ARP	Pvt land Acres
Cowlitz-2	70.4	12279	100	170	70	12109
Kiona-2A	60.0	8076	0	0	60	8076
Peters-2B	49.6	4460	71	1056	43	3404
Miller-2C	78.0	1544	93	882	58	662
Hampton-2D	81.3	3141	92	907	77	2234
Lake-2E	37.8	3860	68	942	28	2918
Martin-2F	21.0	2484	0	0	21	2484
Lower Lynx-2G	32.3	4540	57	805	27	3735
Upper Lynx-2H	33.5	3665	35	2890	28	775
Lower Silver-2J	71.0	7080	71	7080	0	0
Upper Silver-2K	59.0	7417	59	7417	0	0
Surrey/Hopk-2L	89.2	8002	94	4483	83	3519
E. Fk Silver-2M	90.0	2135	90	2135	0	0
Cunning/Ow-2P	84.2	3955	90	2596	73	1359
Siler-2Q	83.8	8583	83	6230	86	2353
Schooley-2R	82.0	1375	82	789	82	586
Willie-2T	66.0	1830	66	1830	0	0

Under 70%

Summary of Middle Cowlitz Sixth Field Watersheds

WAR Peakflow Analysis

	Percent Increase Normal Event Current Conditions Over All Mature	Percent Increase Unusual Event Current Conditions Over All Mature	Percent Increase Normal Event All Immature Conditions Over All Mature	Percent Increase Unusual Event All Immature Conditions Over All Mature	Percent Increase Normal Event All Immature Conditions Over Current	Percent Increase Unusual Event All Immature Conditions Over Current
WAU	84433 acres					
2 Year	12.18%	21.28%	17.61%	32.93%	4.94%	9.94%
5 Year	9.95%	17.04%	14.12%	26.36%	3.84%	8.17%
10 Year	8.79%	14.81%	12.31%	22.88%	3.27%	7.19%
25 Year	7.68%	12.52%	10.54%	19.27%	2.68%	6.11%
50 Year	7.00%	11.07%	9.47%	17.06%	2.34%	5.47%
100 Year	6.73%	10.51%	9.01%	16.09%	2.16%	5.12%
Cowlitz-2	12278.9 acres					
2 Year	27.85%	45.24%	30.94%	50.55%	2.42%	3.66%
5 Year	22.51%	34.62%	24.80%	38.68%	1.87%	3.02%
10 Year	21.52%	32.61%	23.66%	36.44%	1.76%	2.89%
25 Year	18.82%	26.88%	20.55%	30.04%	1.46%	2.49%
50 Year	17.30%	23.63%	18.81%	26.40%	1.29%	2.25%
100 Year	17.08%	23.13%	18.56%	25.85%	1.26%	2.21%
Kiona-2A	8076.7 acres					
2 Year	10.10%	17.91%	11.04%	20.20%	0.85%	1.94%
5 Year	8.60%	15.22%	9.37%	17.17%	0.71%	1.69%
10 Year	7.14%	12.50%	7.75%	14.10%	0.57%	1.42%
25 Year	6.25%	10.73%	6.76%	12.11%	0.48%	1.24%
50 Year	5.69%	9.54%	6.14%	10.77%	0.43%	1.11%
100 Year	5.40%	8.94%	5.82%	10.08%	0.40%	1.05%
Peters-2B	4460.4 acres					
2 Year	13.97%	25.33%	16.08%	29.49%	1.85%	3.31%
5 Year	11.64%	20.90%	13.33%	24.33%	1.51%	2.83%
10 Year	9.50%	16.69%	10.81%	19.43%	1.20%	2.34%
25 Year	8.49%	14.55%	9.61%	16.93%	1.04%	2.08%
50 Year	7.88%	13.23%	8.89%	15.39%	0.94%	1.91%
100 Year	7.53%	12.47%	8.48%	14.51%	0.88%	1.82%

Miller-2C	1544.1 acres					
2 Year	13.24%	21.32%	20.54%	36.03%	6.44%	12.12%
5 Year	11.46%	18.22%	17.57%	30.79%	5.48%	10.63%
10 Year	9.34%	14.14%	13.91%	23.89%	4.18%	8.54%
25 Year	8.39%	12.28%	12.29%	20.74%	3.60%	7.54%
50 Year	7.87%	11.22%	11.40%	18.96%	3.27%	6.96%
100 Year	7.59%	10.69%	10.95%	18.06%	3.12%	6.66%
Hampton-2D	3141.1 acres					
2 Year	20.36%	32.09%	24.77%	42.17%	3.67%	7.64%
5 Year	18.03%	27.32%	21.70%	35.91%	3.11%	6.74%
10 Year	15.25%	22.15%	18.07%	29.11%	2.44%	5.70%
25 Year	13.91%	19.36%	16.31%	25.44%	2.11%	5.10%
50 Year	12.91%	17.12%	14.99%	22.51%	1.84%	4.60%
100 Year	12.74%	16.77%	14.77%	22.04%	1.80%	4.52%
Lake Cr-2E	3860.6 acres					
2 Year	5.32%	12.54%	7.06%	15.96%	1.65%	3.04%
5 Year	3.87%	9.68%	5.13%	12.32%	1.21%	2.40%
10 Year	3.17%	8.17%	4.20%	10.39%	1.00%	2.06%
25 Year	2.76%	7.26%	3.67%	9.24%	0.88%	1.84%
50 Year	2.38%	6.36%	3.16%	8.09%	0.76%	1.63%
100 Year	2.20%	5.92%	2.91%	7.54%	0.70%	1.52%
Martin-2F	2484.4 acres					
2 Year	18.41%	34.72%	19.72%	37.18%	1.10%	1.82%
5 Year	13.79%	27.06%	14.77%	28.97%	0.86%	1.50%
10 Year	11.27%	22.60%	12.07%	24.20%	0.72%	1.30%
25 Year	9.39%	19.15%	10.05%	20.51%	0.61%	1.14%
50 Year	8.20%	16.92%	8.78%	18.11%	0.54%	1.02%
100 Year	7.53%	15.63%	8.07%	16.74%	0.50%	0.96%
L. Lynx-2G	4540.4 acres					
2 Year	5.21%	11.18%	6.18%	13.16%	0.93%	1.78%
5 Year	3.85%	8.73%	4.57%	10.27%	0.69%	1.42%
10 Year	3.23%	7.51%	3.83%	8.83%	0.59%	1.24%
25 Year	2.66%	6.34%	3.16%	7.46%	0.48%	1.05%
50 Year	2.32%	5.61%	2.75%	6.60%	0.42%	0.94%
100 Year	2.15%	5.24%	2.56%	6.17%	0.39%	0.88%
U. Lynx-2H	3665.3 acres					
2 Year	4.68%	11.26%	8.36%	19.58%	3.51%	7.48%
5 Year	3.45%	8.66%	6.16%	15.06%	2.62%	5.89%
10 Year	2.84%	7.30%	5.07%	12.69%	2.17%	5.02%
25 Year	2.21%	5.82%	3.96%	10.13%	1.71%	4.07%
50 Year	1.99%	5.27%	3.56%	9.18%	1.54%	3.71%
100 Year	1.83%	4.88%	3.27%	8.50%	1.42%	3.45%

L. Silver Cr-2J	7080.8 acres					
2 Year	4.39%	8.96%	15.16%	31.53%	10.31%	20.71%
5 Year	3.33%	7.04%	11.44%	24.79%	7.85%	16.58%
10 Year	2.86%	6.17%	9.79%	21.70%	6.74%	14.63%
25 Year	2.27%	5.00%	7.74%	17.60%	5.35%	12.00%
50 Year	2.00%	4.45%	6.79%	15.67%	4.70%	10.74%
100 Year	1.83%	4.12%	6.21%	14.48%	4.30%	9.95%
U. Silver Cr-2	7417.1 acres					
2 Year	4.00%	9.12%	12.15%	26.48%	7.83%	15.91%
5 Year	2.80%	6.65%	8.50%	19.31%	5.55%	11.88%
10 Year	2.51%	6.02%	7.61%	17.48%	4.98%	10.80%
25 Year	1.98%	4.83%	6.00%	14.02%	3.94%	8.77%
50 Year	1.70%	4.20%	5.17%	12.20%	3.41%	7.68%
100 Year	1.52%	3.78%	4.62%	10.99%	3.05%	6.94%
Surrey/Hopk-2	8002 acres					
2 Year	13.81%	22.11%	19.87%	34.86%	5.33%	10.44%
5 Year	12.19%	19.18%	17.32%	30.24%	4.58%	9.28%
10 Year	9.98%	15.00%	13.88%	23.64%	3.54%	7.52%
25 Year	9.41%	13.77%	12.95%	21.71%	3.24%	6.98%
50 Year	8.52%	11.98%	11.56%	18.90%	2.81%	6.17%
100 Year	8.10%	11.16%	10.92%	17.60%	2.61%	5.79%
E. Fk Silver-2	2135.7 acres					
2 Year	3.86%	7.96%	12.29%	25.74%	8.12%	16.47%
5 Year	3.12%	6.62%	9.94%	21.41%	6.61%	13.87%
10 Year	2.47%	5.37%	7.81%	17.35%	5.22%	11.37%
25 Year	2.09%	4.61%	6.60%	14.90%	4.42%	9.83%
50 Year	1.78%	3.97%	5.59%	12.85%	3.75%	8.53%
100 Year	1.64%	3.68%	5.15%	11.90%	3.46%	7.93%
Cun/Owens-2P	3955.5 acres					
2 Year	12.63%	21.25%	22.50%	40.27%	8.76%	15.69%
5 Year	9.74%	16.04%	16.84%	30.40%	6.47%	12.38%
10 Year	9.26%	15.17%	15.94%	28.76%	6.11%	11.80%
25 Year	7.84%	12.34%	13.12%	23.39%	4.90%	9.84%
50 Year	7.29%	11.22%	12.04%	21.27%	4.43%	9.04%
100 Year	6.84%	10.31%	11.17%	19.55%	4.05%	8.37%
Siler-2Q	8583.8 acres					
2 Year	10.51%	18.08%	20.14%	42.29%	8.72%	20.50%
5 Year	8.87%	15.08%	16.44%	35.26%	6.95%	17.54%
10 Year	7.93%	13.29%	14.27%	31.07%	5.88%	15.70%
25 Year	6.70%	10.96%	11.55%	25.63%	4.54%	13.22%
50 Year	6.16%	9.86%	10.32%	23.06%	3.93%	12.02%
100 Year	5.80%	9.19%	9.55%	21.49%	3.54%	11.27%

Schooley-2R	1375.7 acres					
2 Year	15.58%	27.70%	23.26%	45.13%	6.65%	13.65%
5 Year	13.35%	23.56%	19.65%	38.39%	5.56%	12.00%
10 Year	11.83%	20.76%	17.22%	33.82%	4.83%	10.82%
25 Year	10.62%	18.15%	15.21%	29.57%	4.15%	9.67%
50 Year	9.09%	15.02%	12.71%	24.48%	3.32%	8.22%
100 Year	9.03%	14.78%	12.59%	24.08%	3.26%	8.10%

Willie-2T	1830.5 acres					
2 Year	5.26%	11.15%	13.90%	29.00%	8.21%	16.05%
5 Year	3.82%	8.39%	10.08%	21.84%	6.03%	12.40%
10 Year	3.05%	6.85%	8.06%	17.82%	4.86%	10.26%
25 Year	2.63%	5.96%	6.94%	15.51%	4.20%	9.01%
50 Year	2.24%	5.15%	5.92%	13.39%	3.60%	7.84%
100 Year	2.04%	4.71%	5.39%	12.25%	3.28%	7.20%
	Over 9.5%					

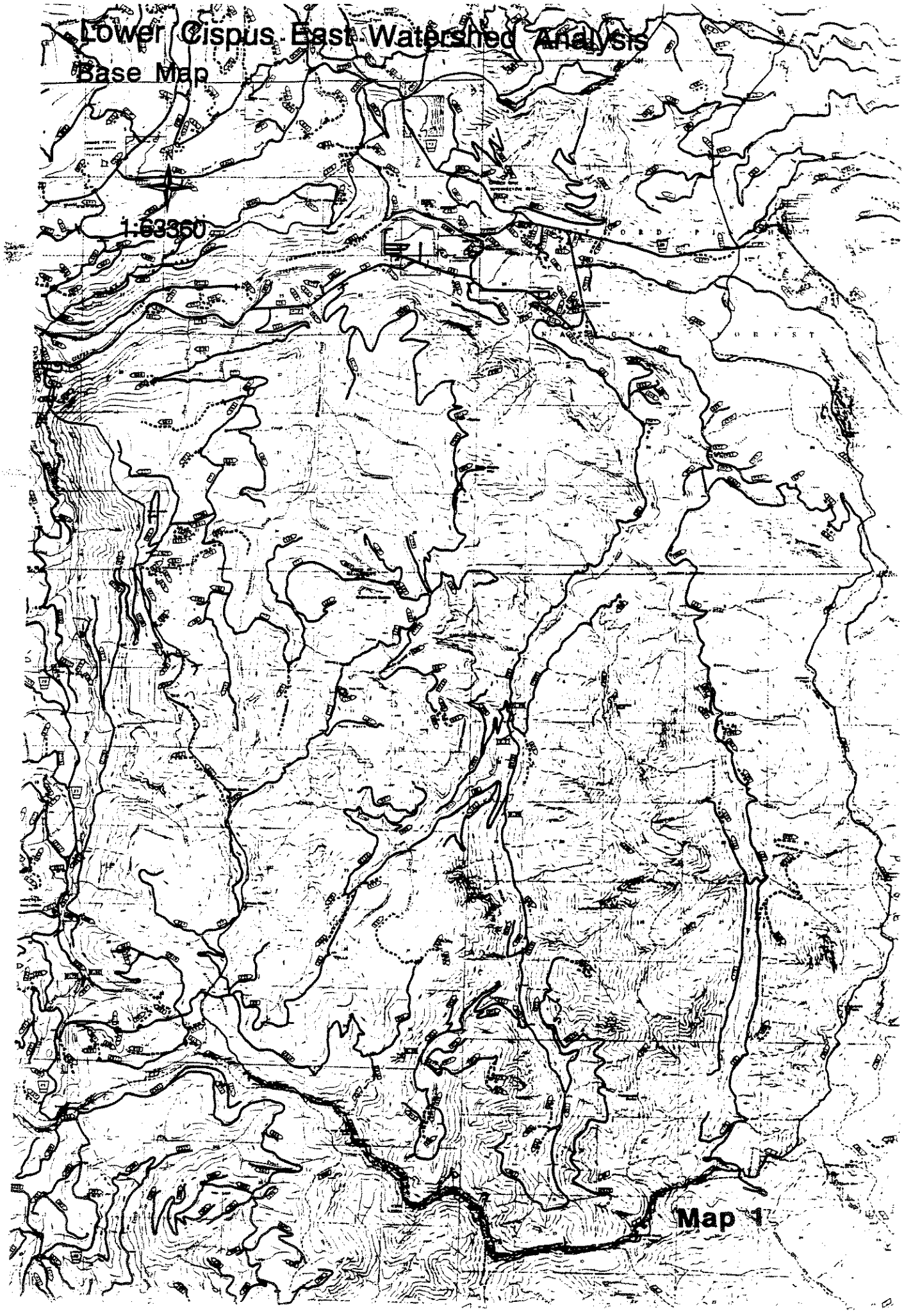
Stream	Reach No.	6th Field	Reach Lgth	LWD	LWD/ Mile	LWD Rate	W:D	W:D Rate	Pools	Pools Rate	WAR	ARP	Peak Rate	Chan Widen	WQ Temp	WQ DO	Grav Cond	Grav Quant	Fish	Dom Sub	SubDom Sub	Grad	Riparian	VST	Rating	Rating Reasons
Cowlitz		2	NA	NA	NA	NA	NA	NA	NA	NA	45.2	70	P	NA	NA	NA	NA	NA	A	NA	NA	NA	NA	1	H	Peakflow is poor, floodplain dissected, loss of wetlands
Kiona Cr	K1	2A	36432	0	0.3	P	35	P	0	P	17.9	60	P	Y	P	P	P	F	A	SA	SA	2	EARLY	1	H	Subsurface, diked, timber harvest, peakflow
Kiona Cr	K2	2A	NA	NA	NA	P	NA	NA	NA	NA	17.9	60	P	Y	P	P	P	F	R	GR	CO	4	EARLY	2	H	Braided, peakflow
Kiona Cr	K3	2A	NA	NA	NA	P	NA	NA	NA	NA	17.9	60	P	NA	P	G	NA	NA	NO	NA	NA	6	EARLY	3	H	Landslides, debris flows, peakflow
Kiona Cr	K4	2A	NA	NA	NA	P	NA	NA	NA	NA	17.9	60	P	NA	P	G	NA	NA	NO	BO	NA	8	EARLY	3	H	Landslide, peakflow
Kiona Cr	K5	2A	NA	NA	NA	P	NA	NA	NA	NA	17.9	60	P	NA	P	G	NA	NA	NO	CO	BO	15	EARLY	4	H	Landslides, debris flows, peakflow
W. Fk Kiona	WK1	2A	NA	NA	NA	P	NA	NA	NA	NA	17.9	60	P	NA	P	G	NA	NA	NO	CO	BO	12	EARLY	4	H	Landslides, peakflow
Dry Cr	D1	2A	NA	NA	NA	NA	NA	NA	NA	NA	17.9	60	P	NA	NA	NA	NA	NA	NA	BO	CO	8	EARLY	3	H	Subsurface flow, landslides, debris flows, peakflow
Dry Cr	D2	2A	NA	NA	NA	NA	NA	NA	NA	NA	17.9	60	P	NA	NA	NA	NA	NA	NA	NA	NA	20	EARLY	4	M	Potentially unstable, no data, peakflow
Oliver Cr	O1	2B	8976	0	0	P	19	P	12.6	P	25.3	50	P	Y	P	P	F	P	A	CO	GR	2	EARLY	1	H	subsurface, diked, timber harvest, peakflow
Oliver Cr	O2	2B	NA	0	0	P	NA	NA	NA	NA	25.3	50	P	NA	P	P	NA	NA	NO	BO	CO	4	EARLY	2	H	Debris flows, aggradation, peakflow
Oliver Cr	O3	2B	NA	0	0	P	NA	NA	NA	NA	25.3	50	P	NA	P	P	NA	NA	NO	BO	CO	20	EARLY	4	H	Timber harvest, heavy roading, peakflow
Peters Cr	P1	2B	5280	0	0	P	NA	NA	NA	NA	25.3	50	P	Y	P	NA	P	P	A	SI	SA	1	EARLY	1	H	channelization, diked, subsurface, water source, peakflow
Peters Cr	Km13	2B	NA	0	0	P	NA	NA	NA	NA	25.3	50	P	Y	P	NA	NA	NA	NO	SA		1	EARLY	1	H	Wetlands, diked, dredged, peakflow
Peters Cr	Km14	2B	NA	0	0	P	NA	NA	NA	NA	25.3	50	P	NA	P	NA	NA	NA	NO	BO	CO	8	EARLY	2	H	Debris flows, aggradation, peakflow
Peters Cr	Km15	2B	NA	0	0	P	NA	NA	NA	NA	25.3	50	P	NA	P	NA	NA	NA	NO	BO	CO	20	EARLY	4	H	peakflow
Miller Cr	M1	2C	2798	2	NA	P	19	P	24	P	21.3	78	P	NA	NA	NA	P	P	R	Co	Gr	5	EARLY	2	H	channelization, sewage and garbage peakflow
Hampton Cr		2D	NA	NA	NA	NA	NA	NA	NA	NA	32.1	81	P	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	H	Flow goes subsurface, peakflow
Cowlitz R		2D	NA	NA	NA	NA	NA	NA	NA	NA	32.1	81	P	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1	H	Peakflow is poor, floodplain dissecte, loss of wetlands
Lake Cr.	L1	2E	NA	NA	NA	F	7	G	NA	NA	12.5	38	P	NA	P	NA	P	P	A	BR	BO	2	EARLY	3	H	Temperature, slope failure, riparian veg., mass wasting, peakflow
Lake Cr.	L2	2E	NA	NA	NA	P	20	P	NA	NA	12.5	38	P	NA	P	NA	P	P	R	BO	RU	4	EARLY	5	H	Temperature, lack of LWD, pools, gravel, peakflow
Lake Cr.	L3	2E	NA	NA	NA	P	20	P	NA	NA	12.5	38	P	NA	P	NA	P	P	R	RU	BO	3	EARLY	5	H	Temperature, lack LWD, pools, gravel, bank cutting, peakflow
Lake Cr.	L4	2E	NA	NA	NA	P	12	F	70	P	12.5	38	P	NA	P	NA	P	P	R	RU	BO	7	EARLY	5	H	Temperature, lack LWD, pools, gravel, peakflow
Watch Lake		2E	NA	NA	NA	NA	NA	NA	NA	NA	12.5	38	P	NA	P	P	NA	NA	R	NA	NA	NA	EARLY	NA	H	Temperature, DO, riparian vegetation
Martin Cr		2F	NA	NA	NA	NA	NA	NA	NA	NA	34.7	21	P	NA	G	P	NA	NA	NA	NA	NA	NA	EARLY	4	H	DO, Peakflows, riparian veg.
N Fk Martin		2F	NA	NA	NA	NA	NA	NA	NA	NA	34.7	21	P	NA	P	G	NA	NA	NA	NA	NA	NA	EARLY	4	H	Temperature, Peakflow, riparian veg.
Lynx	L1	02G	1254	NA	NA	P	NA	NA	NA	NA	11.2	32	P	NA	P	P	NA	NA	A	BR	BO	7	LATE	3	H	Lack LWD, pools, temp, DO, peakflow
Lynx	L2	02G	1320	NA	NA	P	NA	NA	NA	NA	11.2	32	P	NA	P	P	NA	NA	A	BO	BR	3	EARLY	5/10	H	Lack of LWD, mass wasting, temp, DO, peakflow
Lynx	L3	02G	1188	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	P	P	P	P	A	BO	RU	5	EARLY	5	H	Lack of LWD, temp, DO, mass wasting, peakflow
Lynx	L4	02G	4026	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	P	P	F	P	A	RU	BO	3	EARLY	5	H	Mass wasting, lack of LWD, bank scour, braiding, temp, DO, peakflow
Lynx	L5	02G	530	NA	NA	P	NA	NA	NA	F	11.2	32	P	NA	P	P	NA	NA	A	BO	RU	6	EARLY	5	H	Mass wasting, lack of LWD, bank scour, temp, DO, peakflow
Lynx	L6	02G	792	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	P	P	F	P	A	RU	BO	3	EARLY	5	H	Lack of LWD, pools, temperature, DO, peakflow
Lynx	L7	02G	528	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	P	P	NA	NA	A	BR	BO	10	EARLY	5	H	Lack of LWD, pools, no gravels, temperature, DO, peakflow
Lynx	L8	02G	2112	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	P	P	NA	NA	A	BO	RU	3	EARLY	5	H	Lack of LWD, pools, temperature, DO, peakflow
Lynx	L9	02G	792	NA	NA	P	NA	NA	NA	F	11.2	32	P	NA	P	P	NA	NA	A	BO	RU	5	EARLY	5	H	Lack of LWD, mass wasting, bank scour, temperature, DO, peakflow
Lynx	L10	02G	4488	NA	NA	P	NA	NA	NA	P	11.2	32	P	NA	G	P	G	F	A	RU	BO	3	EARLY	5	H	Lack of LWD, mass wasting, bank scour, DO, peakflow
Lynx	L11	02H	1584	NA	NA	P	NA	NA	NA	P	11.3	34	P	NA	G	P	NA	NA	A	RU	CO	2	EARLY	5/10	H	Lack of LWD, mass wasting, bank scour, DO, peakflow
Lynx	L12	02H	4356	NA	NA	P	NA	NA	NA	P	11.3	34	P	NA	P	P	F	P	A	RU	BO	4	EARLY	5	H	Lack of pools, mass wasting, debris flow, DO, peakflow
Lynx	L13	02H	2112	NA	NA	F	NA	NA	NA	P	11.3	34	P	NA	P	P	G	G	A	RU	CO	2	EARLY	10	H	Temperature, DO, debris flow, peakflow
Lynx	L14	02H	1848	NA	NA	G	NA	NA	NA	F	11.3	34	P	NA	P	P	G	G	A	NA	NA	2	EARLY	10	H	Sub-surface flows, peakflow
Lynx	L15	02H	792	NA	NA	F	NA	NA	NA	P	11.3	34	P	NA	G	NA	NA	NA	NO	NA	NA	3	EARLY	10	M	Very little data, peakflow
Lynx	L16	02H	1980	NA	NA	G	NA	NA	NA	F	11.3	34	P	NA	G	NA	NA	NA	NO	NA	NA	6	EARLY	5	M	Mass wasting, debris flow, peakflow
Arsenic Cr		2G	NA	NA	NA	NA	NA	NA	NA	NA	11.2	32	P	NA	G	P	NA	NA	NA	NA	NA	NA	EARLY	4	H	Temperature, DO, peakflow
Silver	S1	02J	7938	1	4.66	P	41	P	3	P	9	71	F	NA	P	P	P	P	A	RU	CO	1	EARLY	2	H	Channelized, no vegetation, temp, DO, lack pools & LWD, peakflow
Silver	S2	02J	5237	13	38.31	P	55	P	12	P	9	71	F	NA	P	P	F	F	A	RU	BO	2	LATE	3	H	Sediment deposition, temp, DO, lack of pools, LWD, W:D, peakflow
Silver	S3	02J	7001	16	42.99	P	38	P	29	G	9	71	F	NA	P	P	P	P	A	RU	BO	3	LATE	3	H	mw, deposition, temp, lack of LWD, bank scour, debris flows, pf
Silver	S4	02J	9155	10	30.57	P	30	P	24	F	9	71	F	NA	P	G	F	F	A	RU	BR	3	MID	3	H	MW, deposition, braiding, temp, lack pools, LWD, peakflow
Silver	S5	02J	13396	26	73.71	F	19	P	26	F	9	71	F	NA	F	G	P	P	R	BO	RU	5	MID	5	H	MW, deposition, pools filling w/ sediment, braiding, peakflow
Silver	S6	02K	20231	17	77.77	P	25	P	31	F	9.1	59	P	NA	G	G	F	F	R	RU	GR	2	EARLY	7	H	Subsurface flow, mw, pools filling w/ sed , lack of LWD, braids, pf

	Reach	6th	Reach		LWD/	LWD		W:D		Pools			Peak	Chan	WQ	WQ	Grav	Grav		Dom	SubDom					Rating
Stream	No.	Field	Lgth	LWD	Mile	Rate	W:D	Rate	Pools	Rate	WAR	ARP	Rate	Widen	Temp	DO	Cond	Quant	Fish	Sub	Sub	Grad	Riparian	VST	Rating	Reasons
Silver	S7	02K	3358	17	62.89	P	19	P	28	P	9.1	59	P	NA	G	G	G	G	R	BR	RU	6	MID	4	H	MW, deposition, lack pools, LWD, debris flow, bank scouring, pf
Silver	S8	02K	1637	24	77.41	F	15	F	45	P	9.1	59	P	NA	G	G	NA	NA	NO	BR	RU	7	LATE	8	M	Peakflow
Hopkins		2L	NA	NA	NA	NA	NA	NA	NA	NA	22.1	90	F	NA	NA	NA	NA	NA	NA	NA	NA	NA	LATE	8	C	Cowlitz valley reach has been channelized, grazing
Surrey		2L	NA	NA	NA	NA	NA	NA	NA	NA	22.1	90	F	NA	NA	NA	NA	NA	NA	NA	NA	NA	LATE	8	C	Cowlitz valley reach has been channelized, grazing
Cowlitz R		2L	NA	NA	NA	NA	NA	NA	NA	NA	22.1	90	F	NA	NA	NA	NA	NA	R	NA	NA	NA	EARLY	1	H	Peakflow is poor, floodplain dissecte, loss of wetlands
East Fork		2M	NA	NA	NA	NA	NA	NA	NA	NA	8	90	G	NA	NA	NA	NA	NA	A	NA	NA	NA	LATE	3	M	Debris flow, road failure, mass wasting
Cunningham		2P	NA	NA	NA	NA	NA	NA	NA	NA	21.3	84	P	NA	NA	NA	NA	NA	R	NA	NA	NA	MID	4	H	Subsurface flows, mass wasting, road failure, peakflow
Owens		2P	NA	NA	NA	NA	NA	NA	NA	NA	21.3	84	P	NA	NA	NA	NA	NA	R	NA	NA	NA	LATE	4	H	Subsurface flows, mass wasting, road failure, peakflow
Mullins		2P	NA	NA	NA	NA	NA	NA	NA	NA	21.3	84	P	NA	NA	NA	NA	NA	NA	NA	NA	NA	LATE	4	H	Mass wasting, road failure, peakflow
Cougar		2P	NA	NA	NA	NA	NA	NA	NA	NA	21.3	84	P	NA	NA	NA	NA	NA	NA	NA	NA	NA	LATE	4	H	Debris flow, peakflow
Cowlitz R		2P	NA	NA	NA	NA	NA	NA	NA	NA	21.3	84	P	NA	NA	NA	NA	NA	R	NA	NA	NA	EARLY	1	H	Peakflow is poor, floodplain dissecte, loss of wetlands, peakflow
Siler	S1	02Q	4752	NA	NA	NA	18	F	NA	NA	18.1	84	F	NA	NA	NA	P	P	A	SA	SA	1	EARLY	1	H	Private Lands, used for cattle grazing and hay.
Siler	S2	02Q	14009	0	0	P	17	F	54	G	18.1	84	F	NA	G	NA	P	P	A	SI	SA	1	EARLY	1	C	Lack of LWD, cattle grazing, lack of gravel
Siler	S3	02Q	1980	35	36	F	20	F	5	P	18.1	84	F	NA	G	NA	P	P	A	RU	CO	7	MID	6	M	Fish Structures added to the stream in the 80's.
Siler	S4	02Q	330	30	480	G	12	G	2	P	18.1	84	F	NA	G	NA	F	F	R	RU	CO	2	LATE	10	C	Poor pool habitat, Buffer strip blown in
Siler	S5	02Q	1320	59	236	P	12	G	10	F	18.1	84	F	NA	G	NA	F	F	R	BR	BO	2	LATE	8	C	Bank cutting, past timber salvage from channel
Siler	S6	02Q	1320	18	72	P	12	G	40	G	18.1	84	F	NA	G	NA	P	P	R	RU	CO	6	EARLY	3	C	Possible lack of spawning gravel
Siler	S7	02Q	1650	31	99	F	12	G	30	G	18.1	84	F	NA	G	NA	F	F	R	GR	CO	1	MID	7	C	Past timber salvage, lack of pools
Siler	S8	02Q	1320	59	236	F	12	G	7	P	18.1	84	F	NA	G	NA	F	F	R	RU	CO	3	EARLY	7	C	Past timber harvest, beaver pond, silt substrate
Siler	S9	02Q	1980	32	85	F	12	G	15	F	18.1	84	F	NA	G	NA	F	F	R	BR	RU	9	EARLY	4	M	Rd. 55 culvert is a migration barrier, resident fish, mw, braids
Siler	S10	02Q	660	21	168	F	12	G	30	G	18.1	84	F	NA	G	NA	NA	NA	NO	BR	BO	10	MID	4	M	Lost of buffer strip, clearcutting, mass wasting
Siler	S11	02Q	2640	38	76	P	12	G	10	P	18.1	84	F	NA	G	NA	NA	NA	NO	BR	BO	8	MID	3	M	Mass wasting, bank failures,
Siler	S12	02Q	2640	59	118	F	12	G	0	P	18.1	84	F	NA	G	NA	NA	NA	NO	BR	BO	45	EARLY	8	M	Mass wasting (road failures)
Siler	S13	02Q	1320	14	56	P	12	G	0	P	18.1	84	F	NA	G	NA	NA	NA	NO	BR	BO	50	MID	8	M	Mass wasting
Squire Cr	SQ1	2Q	NA	NA	NA	F	NA	NA	NA	P	18.1	84	P	NA	F	NA	P	P	R	SI	SN	1	LATE	7	H	Culvert barriers Rd. #23,2304,2305, lack of pools
Schooley Cr	SC1	2R	NA	NA	NA	P	NA	NA	NA	F	27.7	82	P	NA	G	NA	P	P	A	SI	SN	2	EARLY	2	H	Culvert barrier Skinner Rd. cattle grazing, peakflow
Schooley Cr	SC2	2R	NA	NA	NA	P	NA	NA	NA	F	27.7	82	P	NA	G	NA	P	P	NO	SN	GR	15	EARLY	4	H	Culvert barrier Rd. #2502016, peakflow
Willie	W1	02T	430	NA	NA	G	20	P	2	P	11.2	66	P	NA	NA	NA	P	P	NA	RU	CO	2	LATE	6	H	Mass wasting, flow deflection, peakflow
Willie	W2	02T	3233	NA	NA	G	12	G	10	P	11.2	66	P	NA	NA	NA	NA	NA	NO	RU	BO	5	LATE	5	H	Bank cutting, braiding, deposition, peakflow
Willie	W3	02T	1185	NA	NA	F	20	P	5	P	11.2	66	P	NA	P	NA	NA	NA	NO	RU	CO	3	EARLY	5	H	Bank cutting, deposition, braiding, no main channel, temp, peakflow
Willie	W4	02T	4741	NA	NA	F	7	G	20	P	11.2	66	P	NA	NA	NA	NA	NA	NO	RU	BO	7	EARLY	5	H	Bank cutting, deposition, mass wasting, peakflow
Willie	W5	02T	1015	NA	NA	G	20	P	50	G	11.2	66	P	NA	G	NA	NA	NA	NO	SI	SA	2	EARLY	10	H	Bank cutting, deposition, peakflow
Willie	W6	02T	1020	NA	NA	G	20	P	50	G	11.2	66	P	NA	G	NA	NA	NA	NO	GR	CO	3	EARLY	10	M	Bank cutting, deposition, peakflow
Willie	W7	02T	2335	NA	NA	P	12	G	55	G	11.2	66	P	NA	G	NA	NA	NA	NO	RU	BO	5	EARLY	5	M	Bank cutting, deposition, peakflow

	Reach	6th	Reach		LWD/	LWD		W:D		Pools			Peak	Chan	WQ	WQ	Grav	Grav		Dom	SubDom					Rating
Stream	No.	Field	Lgth	LWD	Mile	Rate	W:D	Rate	Pools	Rate	WAR	ARP	Rate	Widen	Temp	DO	Cond	Quant	Fish	Sub	Sub	Grad	Riparian	VST	Rating	Reasons

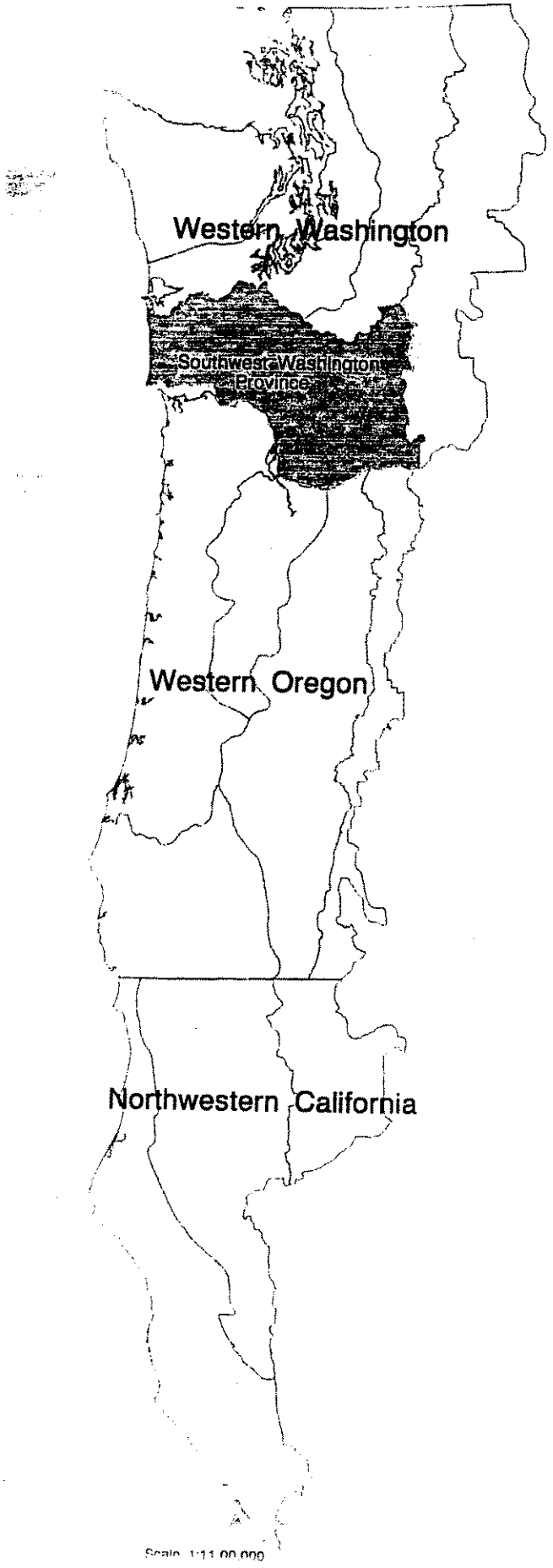
Key

NA	Not available or Data Gap
Reach No.	Reach Number
6th	6th Field watershed number
Reach Lgth	Reach Length, feet
LWD	Large Woody Debris
LWD/Mile	Large Woody Debris, number of pieces per mile
LWD Rate	Rating of LWD per mile (Good - G, Fair - F, Poor - P)
W:D	Width to Depth Ratio
W:D Rate	Width to Depth Ratio rating (Good - G, Fair - F, Poor - P)
Pools	Number of Pools per mile
Pools Rate	Pool Rating (Good - G, Fair - F, Poor - P)
WAR	Water Available for Runoff
ARP	Aggregate Recovery Percentage, %
Peak Rate	Rating for Peak Flow analysis (Good - G, Fair - F, Poor - P)
Chan Widen	Channel Widening Rating (Good - G, Fair - F, Poor - P)
WQ Temp	Water quantity Temperature Rating (Good -G, Fair - F, Poor - P)
WQ DO	Water quantity Dissolve Oxygen Rating (Good -G, Fair - F, Poor - P)
Grav Cond	Gravel Condition Rating, used only on reaches with fish (Good - G, Fair - F, Poor - P)
Grav Quant	Gravel Quantity Rating, used only on reaches with fish (Good - G, Fair - F, Poor -P)
Fish	Are fish present? (Anadromous - A, Resident - R, NO - None Present)
Dom Sub	Dominant Substrate (SI - Silt, SA - Sand, GR - Gravel, RU - Rubble, CO - Cobble, BO - Boulder, BR - Bedrock)
Subdom Sub	Subdominant Substrate (SI - Silt, SA - Sand, GR - Gravel, RU - Rubble, CO - Cobble, BO - Boulder, BR - Bedrock)
Grad	Gradient
Riparian	Riparian Vegetation (Early - Early Seral, Mid - Mid Seral, Late - Late Seral)
VST	Valley Segement Type (1 - Alluviated mtn valley, 2 - Alluvial fan, 3 - Steeply incised valley/mod. gradient, 4 - Steeply incised /steep gradient, 5 - Incised glacial till, 7 - U-shaped glacial trough, 8 - Valley wall, 10 - Alluvial valley)
Rating	Overall rating of reach (H - High Concern, M - Moderate Concern, C - Low Concern)
Rating Reason	Reason for giving overall rating (bc - bank cutting, mw - mass wasting, LWD - large woody debris, temp - temperature, sed - sediment, cw - channel widening, pf - peak flow, do - dissolved oxygen)

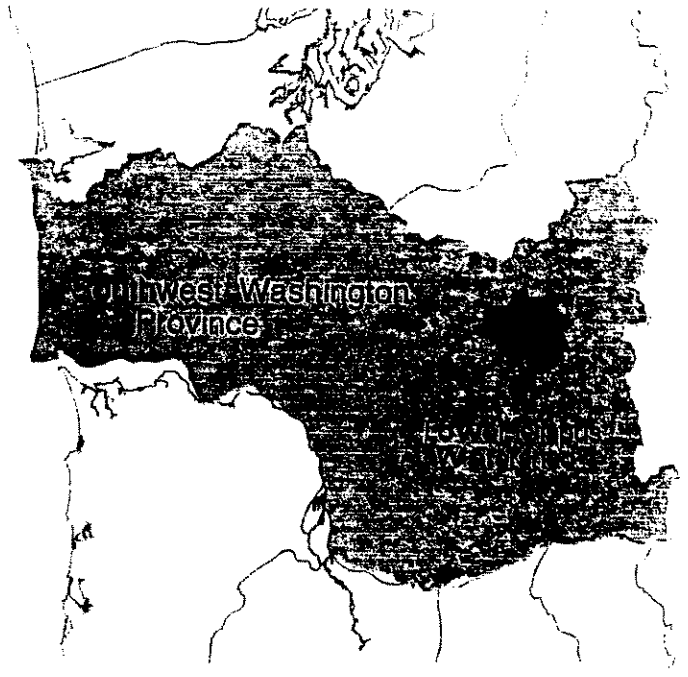

Lower Cispus East Watershed Analysis
Base Map
1:63360
Map 1

Lower Cispus East Watershed Analysis

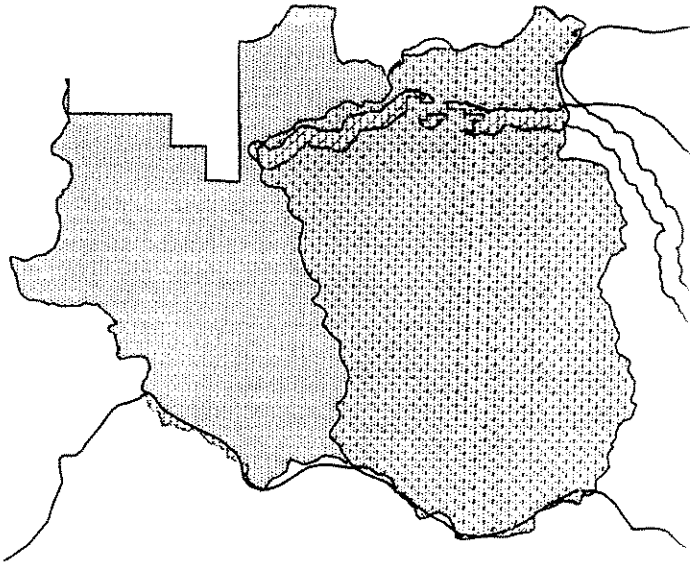
Vicinity Map - Regional



Scale 1:11,00,000



Scale 1:6,555,000



Scale 1:442,500

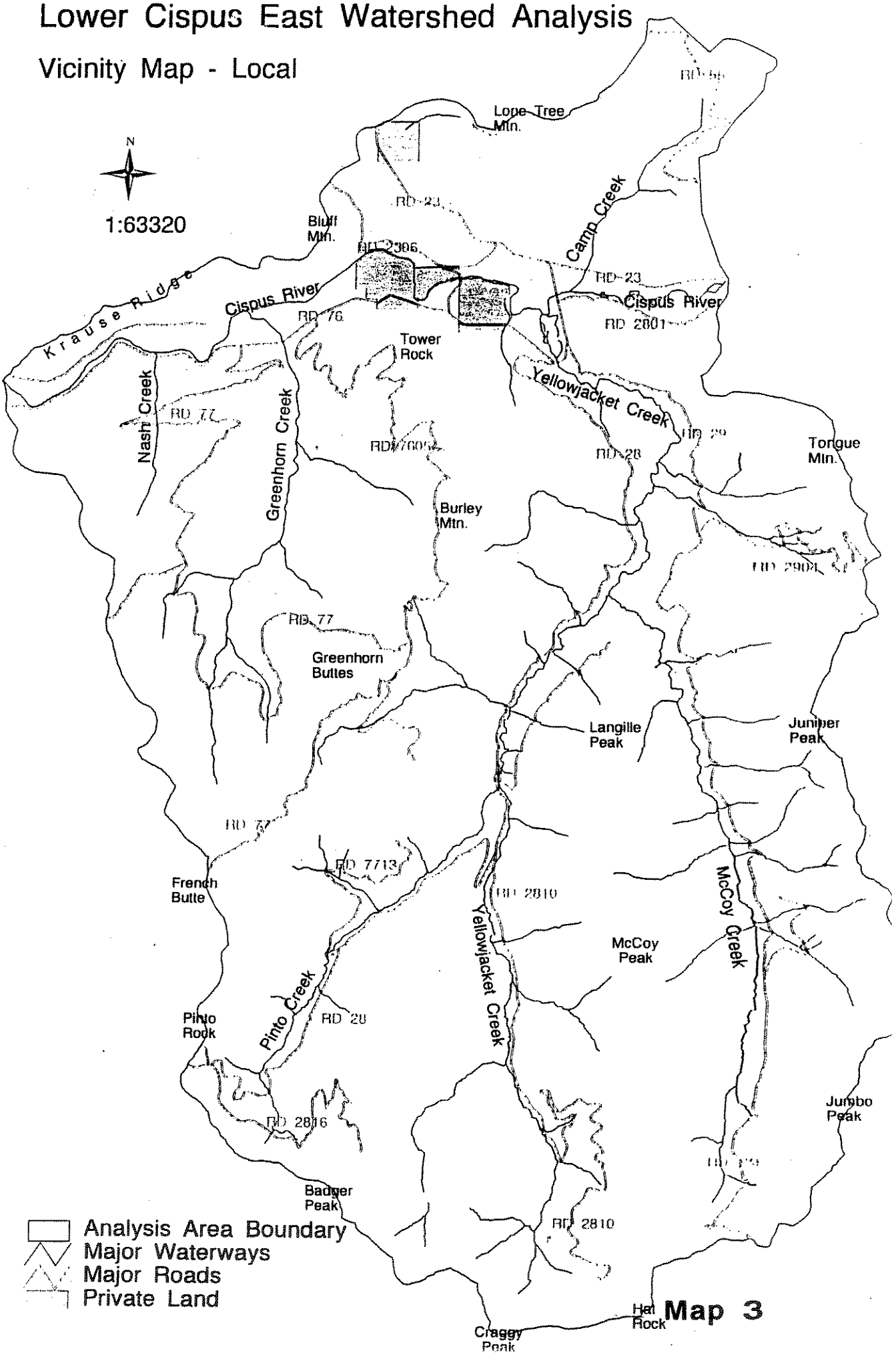
Lower Cispus East Analysis Area
Key Watersheds
Lower Cispus Watershed

N

Map 2

Lower Cispus East Watershed Analysis

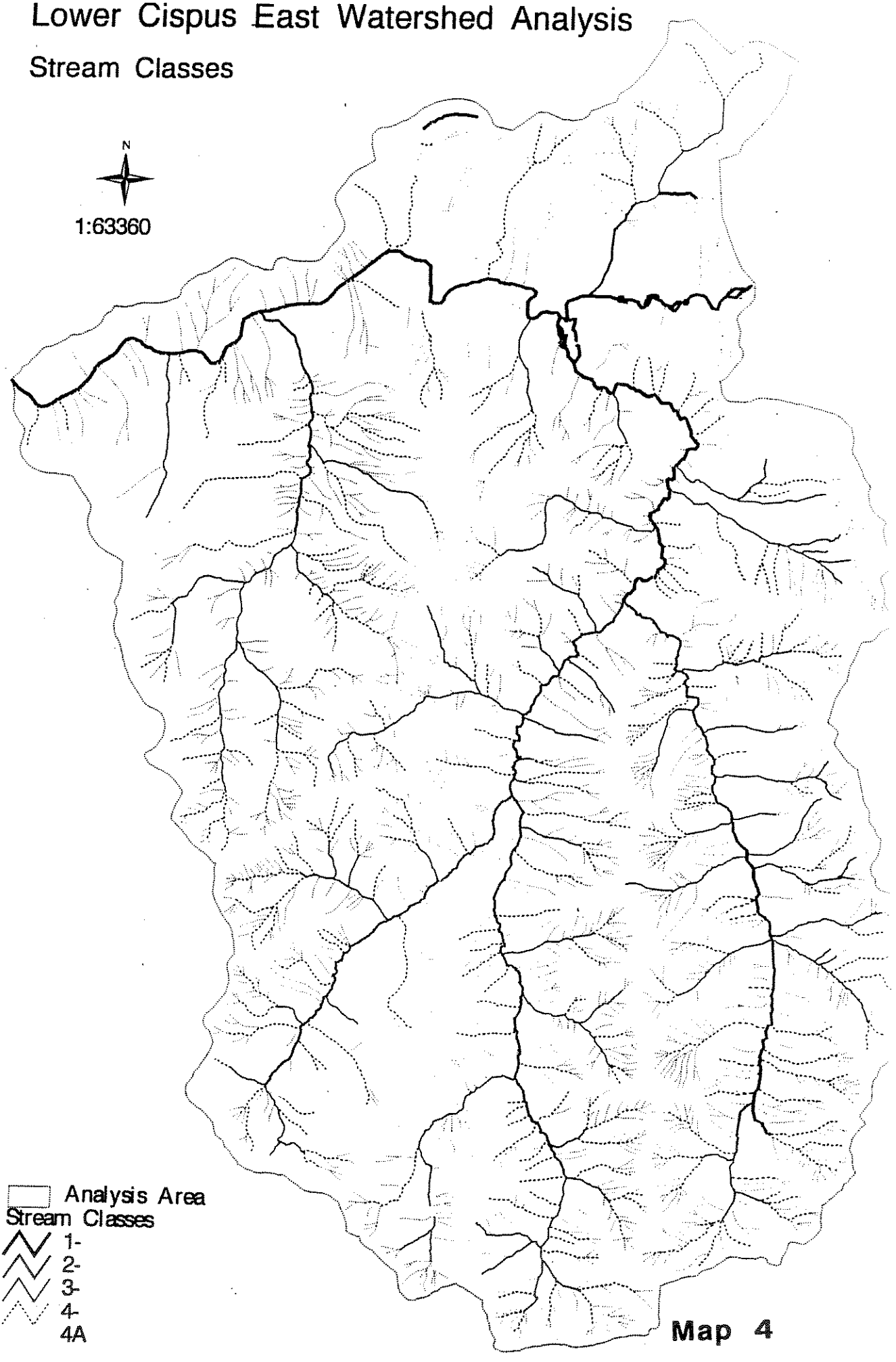
Vicinity Map - Local



Map 3

Lower Cispus East Watershed Analysis

Stream Classes



Lower Cispus East Watershed Analysis

Erosion Potential

1:63360

Boundary

Erosion Potential

Moderate

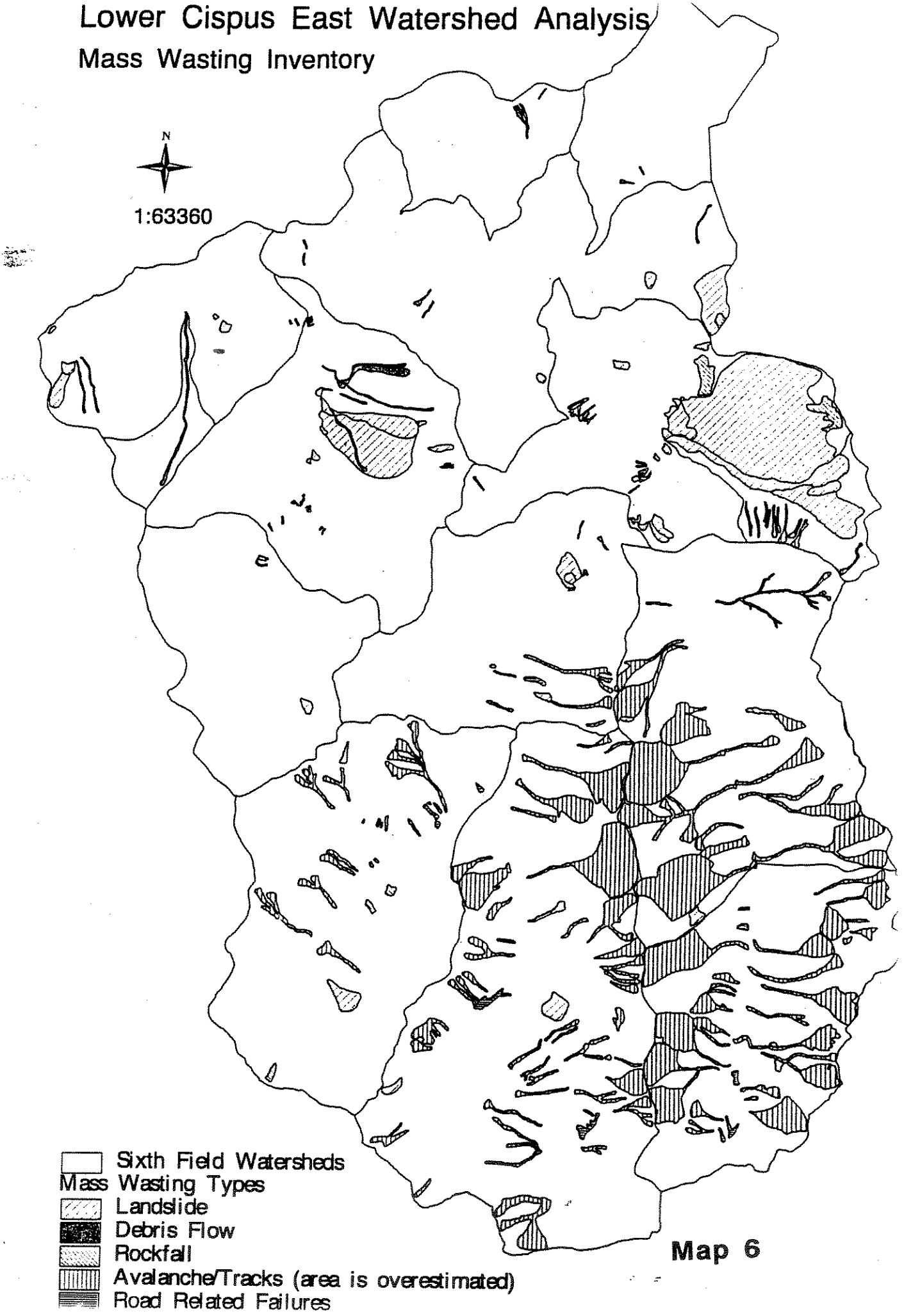
Severe

Slight

Map 5

Lower Cispus East Watershed Analysis

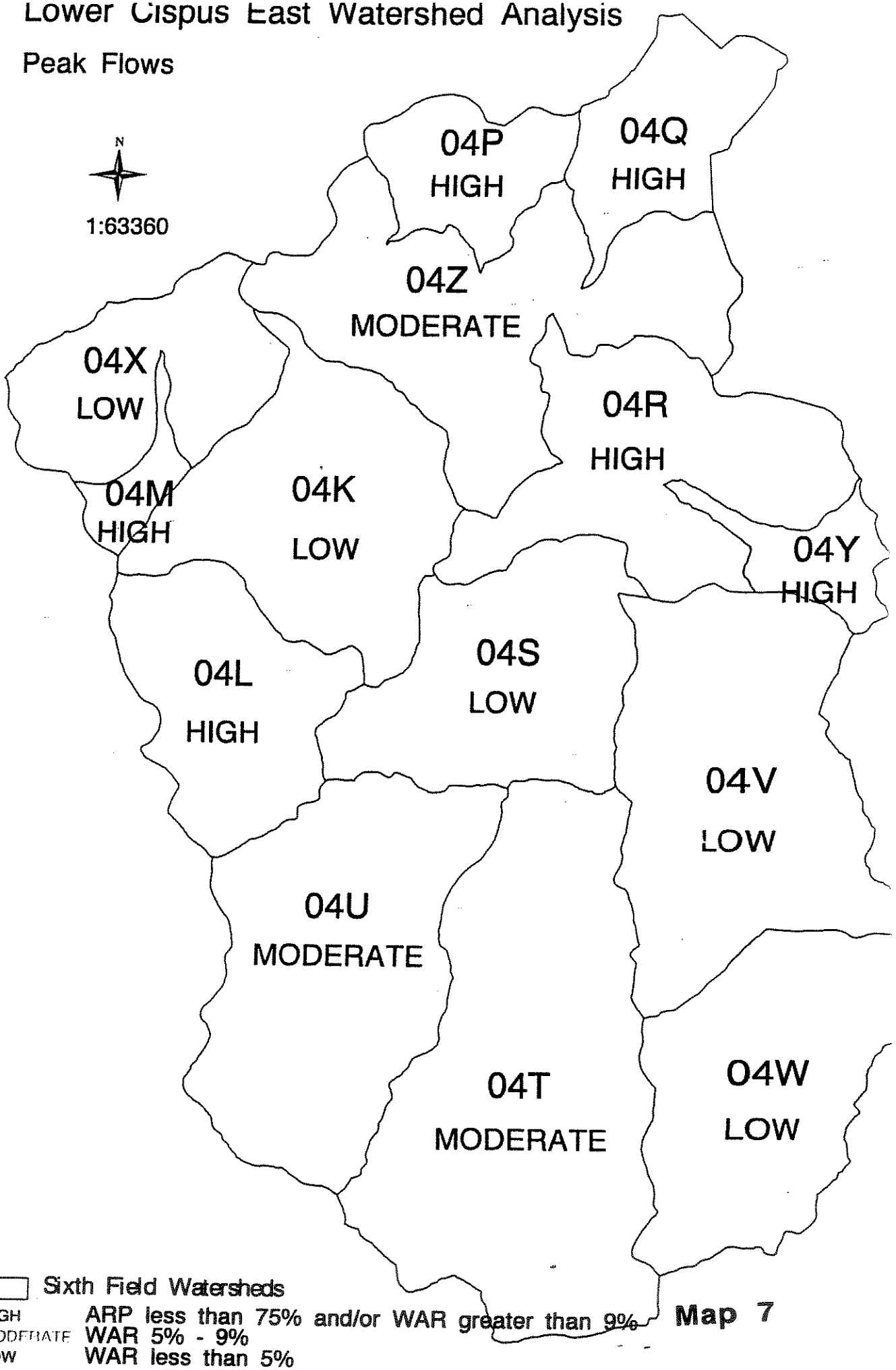
Mass Wasting Inventory



Map 6

Lower Cispus East Watershed Analysis

Peak Flows



Sixth Field Watersheds

HIGH ARP less than 75% and/or WAR greater than 9%

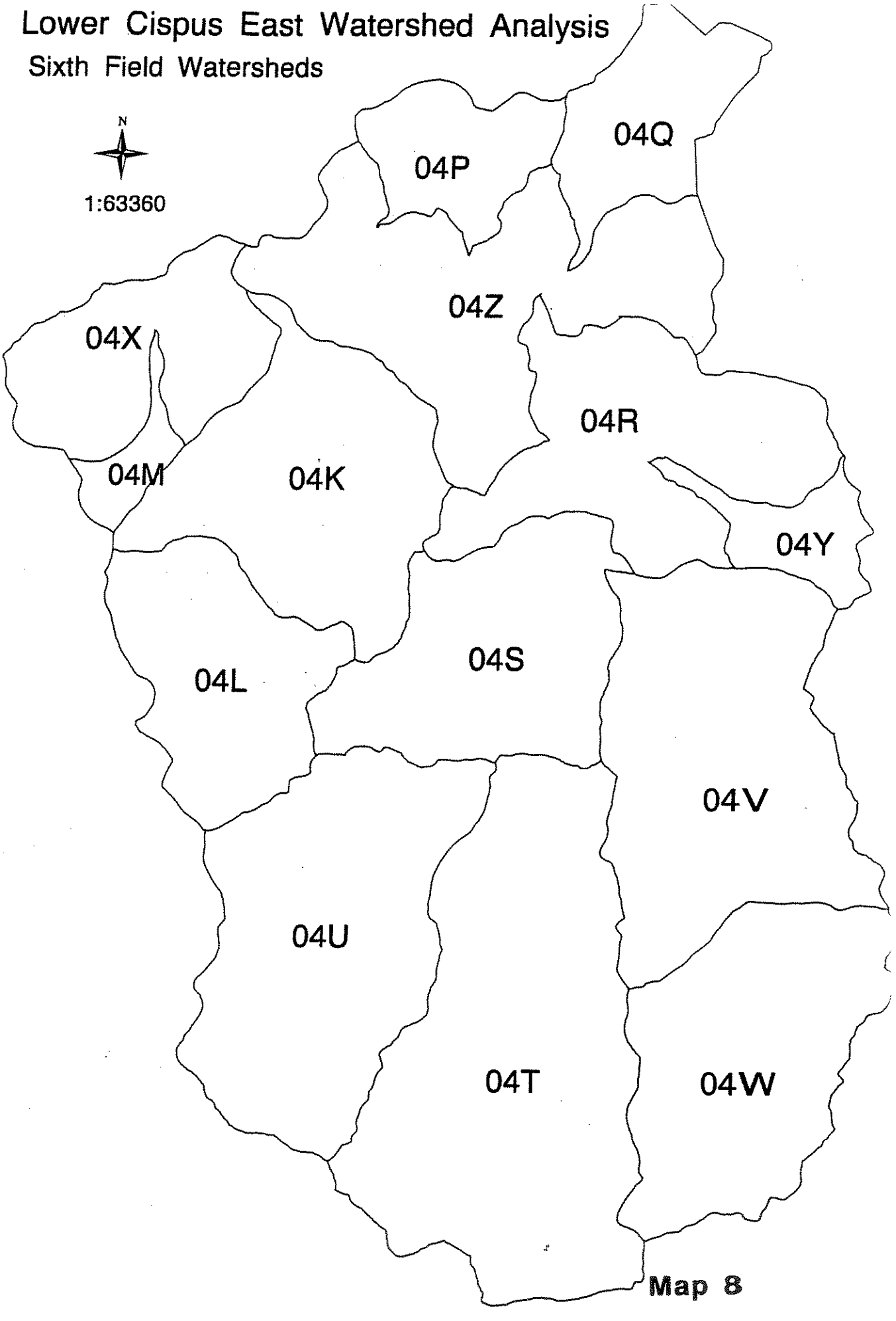
MODERATE WAR 5% - 9%

LOW WAR less than 5%

Map 7

Lower Cispus East Watershed Analysis

Sixth Field Watersheds



Map 8

Lower Cispus East Watershed Analysis

Forest Stand Structure

Lower Clispus East Watershed Analysis

Historic Vegetation 1880

1:63360

Stand Age

Blank

Early

Late

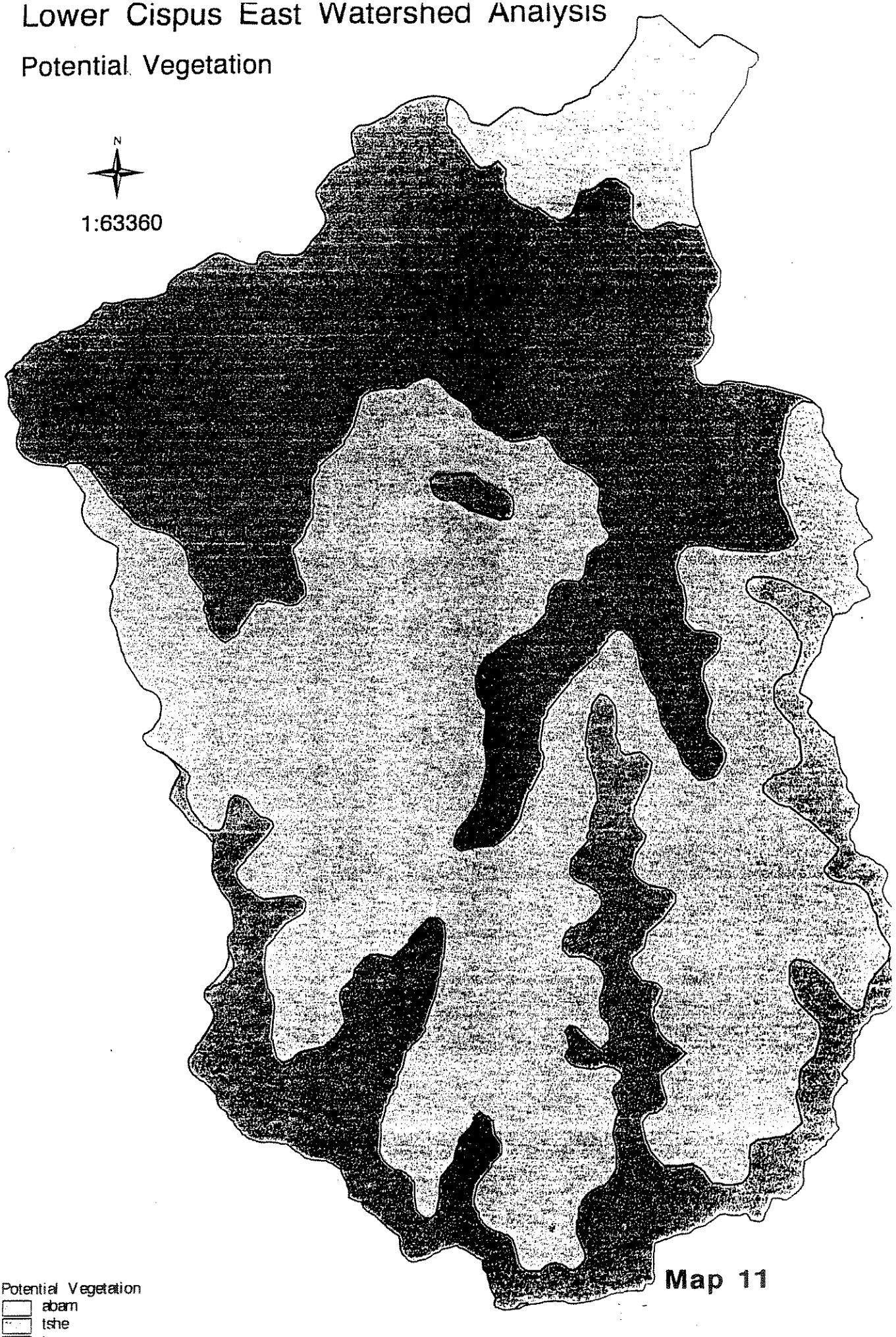
Mid

Non-Forest

Map 10

Lower Cispus East Watershed Analysis

Potential Vegetation

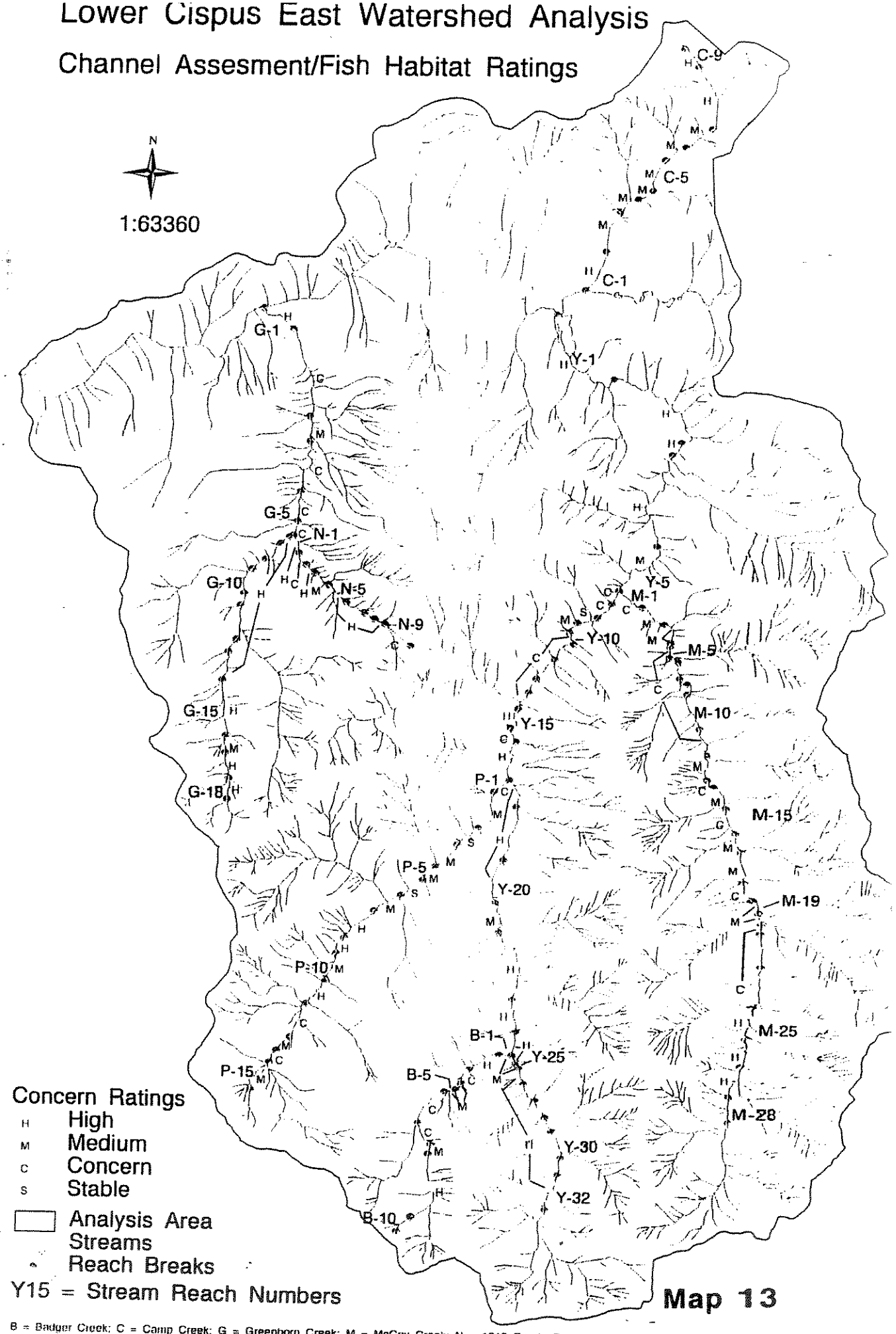


Lower Cispus East Watershed Analysis

Nutrient Deficient Soils

Lower Cispus East Watershed Analysis

Channel Assesment/Fish Habitat Ratings

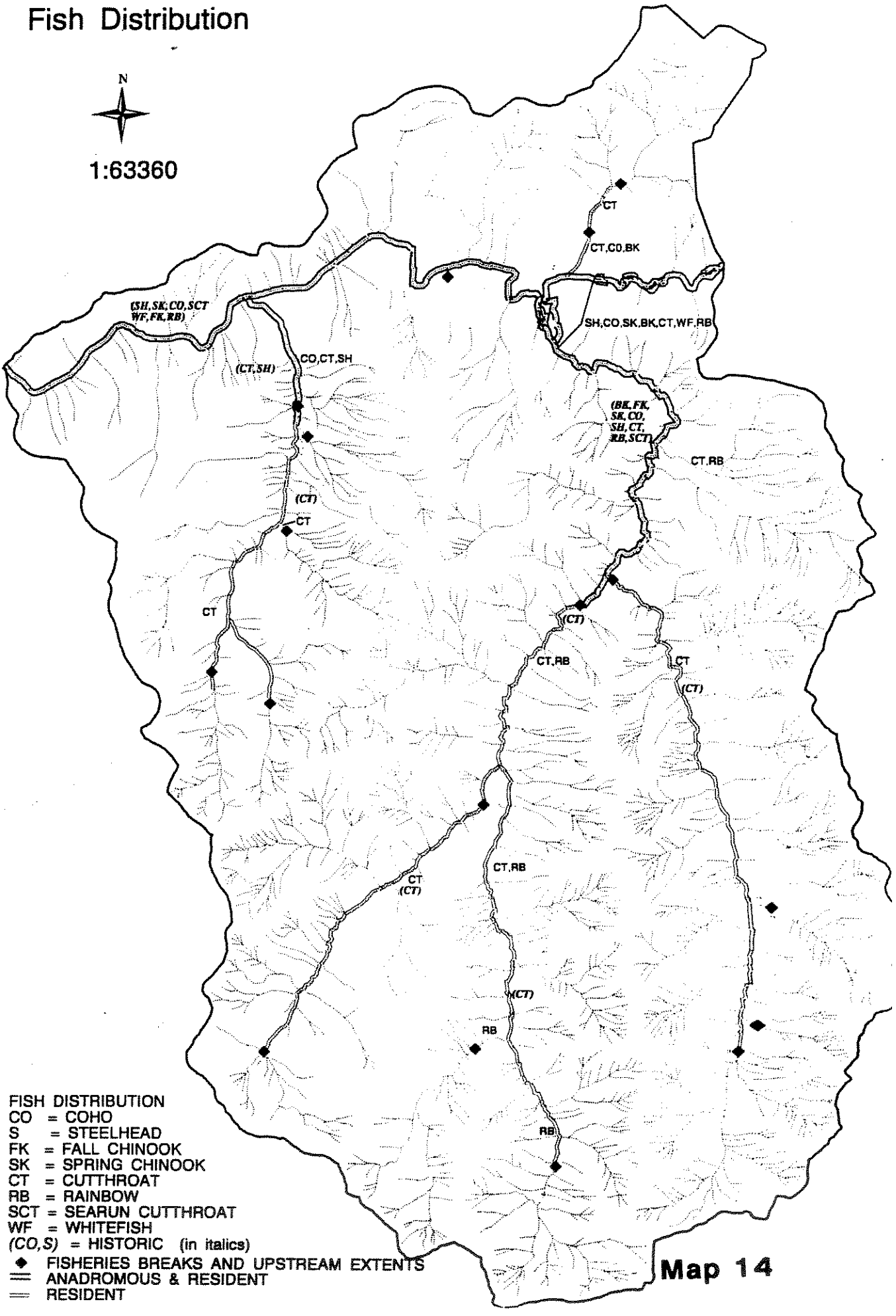


Map 13

B = Badger Creek; C = Camp Creek; G = Greenhorn Creek; M = McCoy Creek; N = 1918 Creek; P = Pinto Creek; Y = Yellowjacket Creek

Lower Cispus East Watershed Analysis

Fish Distribution



FISH DISTRIBUTION
CO = COHO
S = STEELHEAD
FK = FALL CHINOOK
SK = SPRING CHINOOK
CT = CUTTHROAT
RB = RAINBOW
SCT = SEARUN CUTTHROAT
WF = WHITEFISH
(CO,S) = HISTORIC (in italics)
◆ FISHERIES BREAKS AND UPSTREAM EXTENTS
═ ANADROMOUS & RESIDENT
═ RESIDENT

Map 14

Lower Clispus East Watershed Analysis

Riparian Connectivity

Lower Cispus East Watershed Analysis

Wildlife Corridors

1:63360

Sixth Field Watersheds

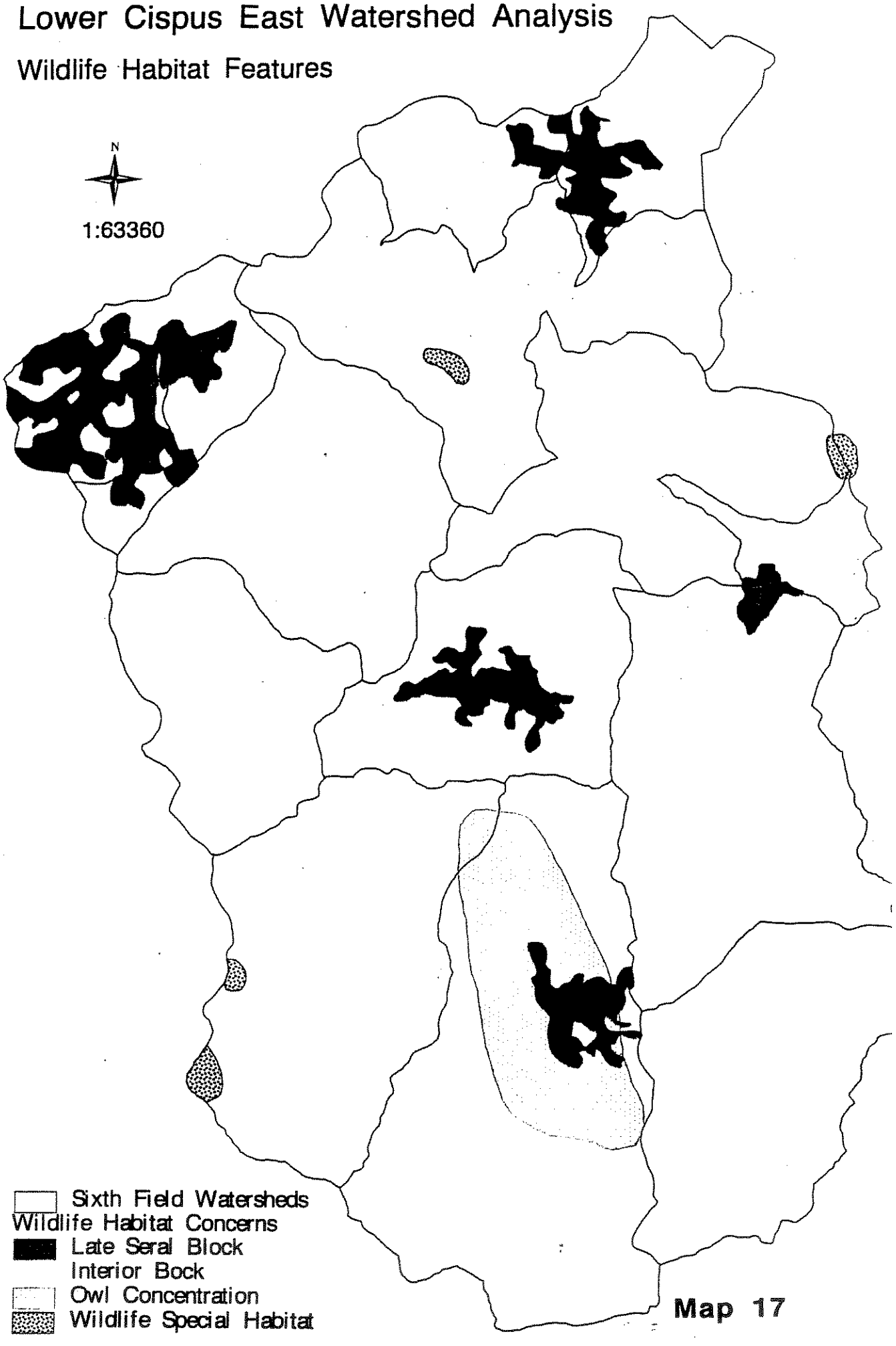
Wildlife Corridors

- Fragmented Riparian Corridors
- Ridgetop Corridors
- Riparian Corridors

Map 16

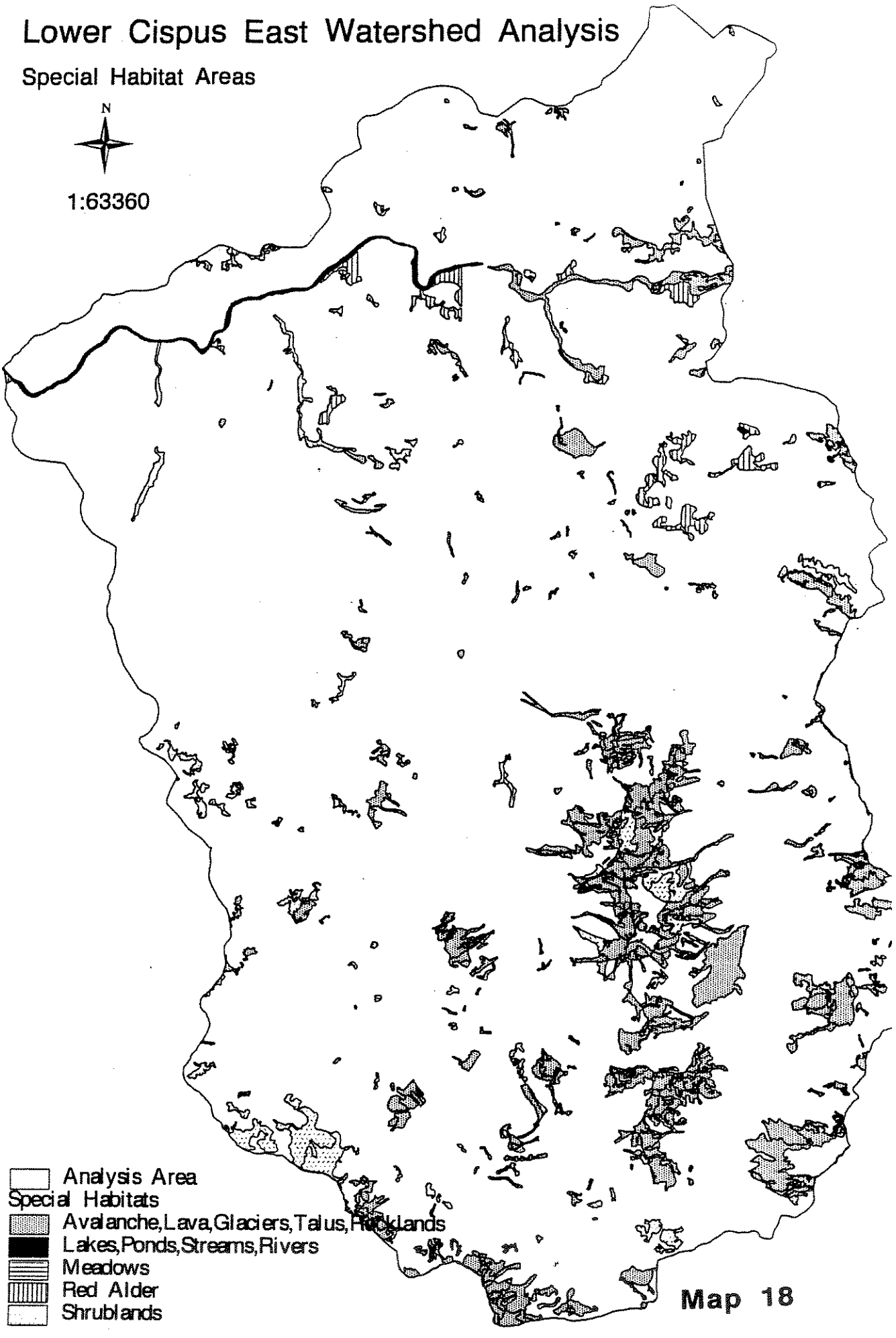
Lower Cispus East Watershed Analysis

Wildlife Habitat Features



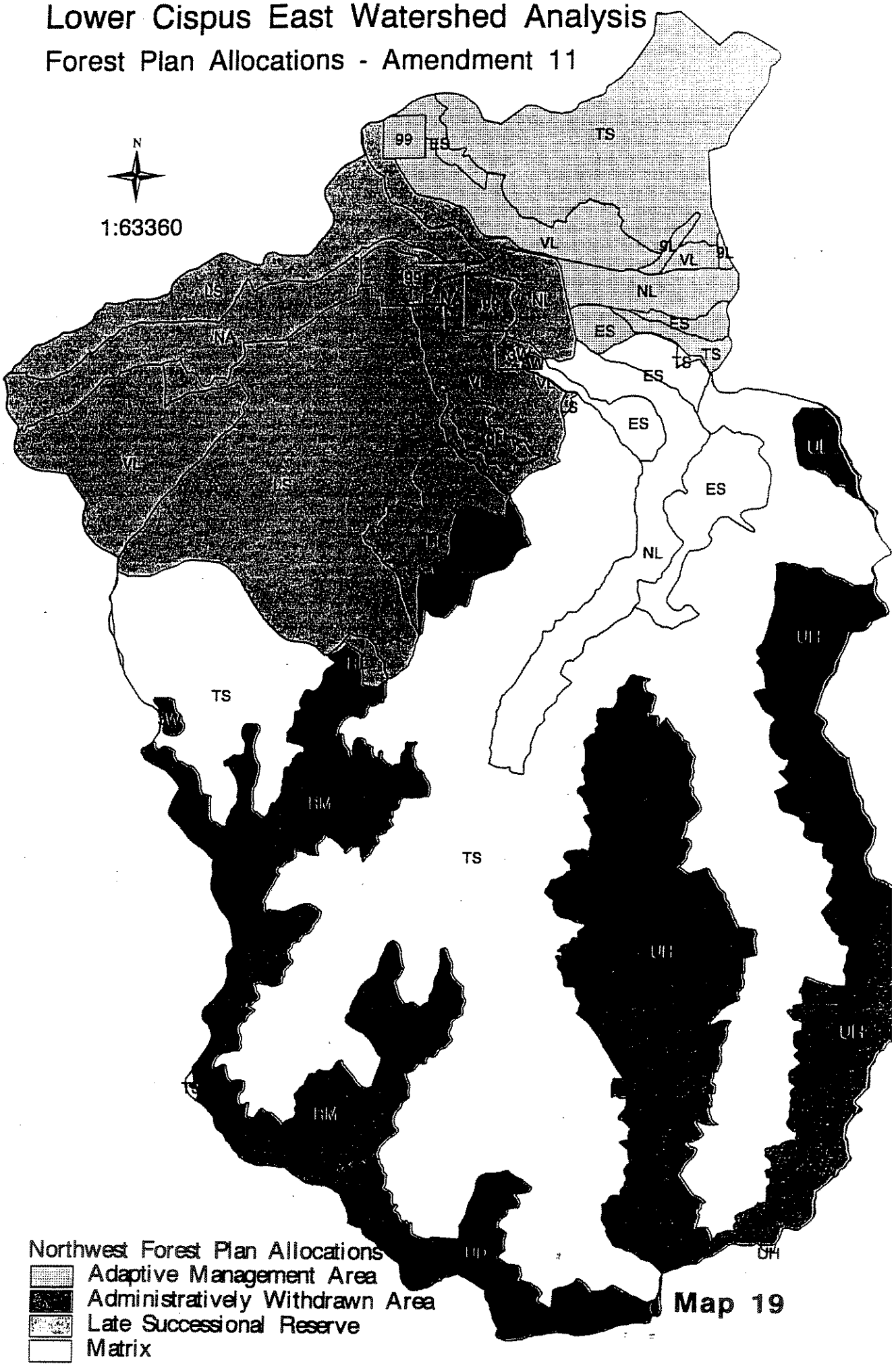
Lower Cispus East Watershed Analysis

Special Habitat Areas



Lower Cispus East Watershed Analysis

Forest Plan Allocations - Amendment 11



Northwest Forest Plan Allocations

- Adaptive Management Area
- Administratively Withdrawn Area
- Late Successional Reserve
- Matrix

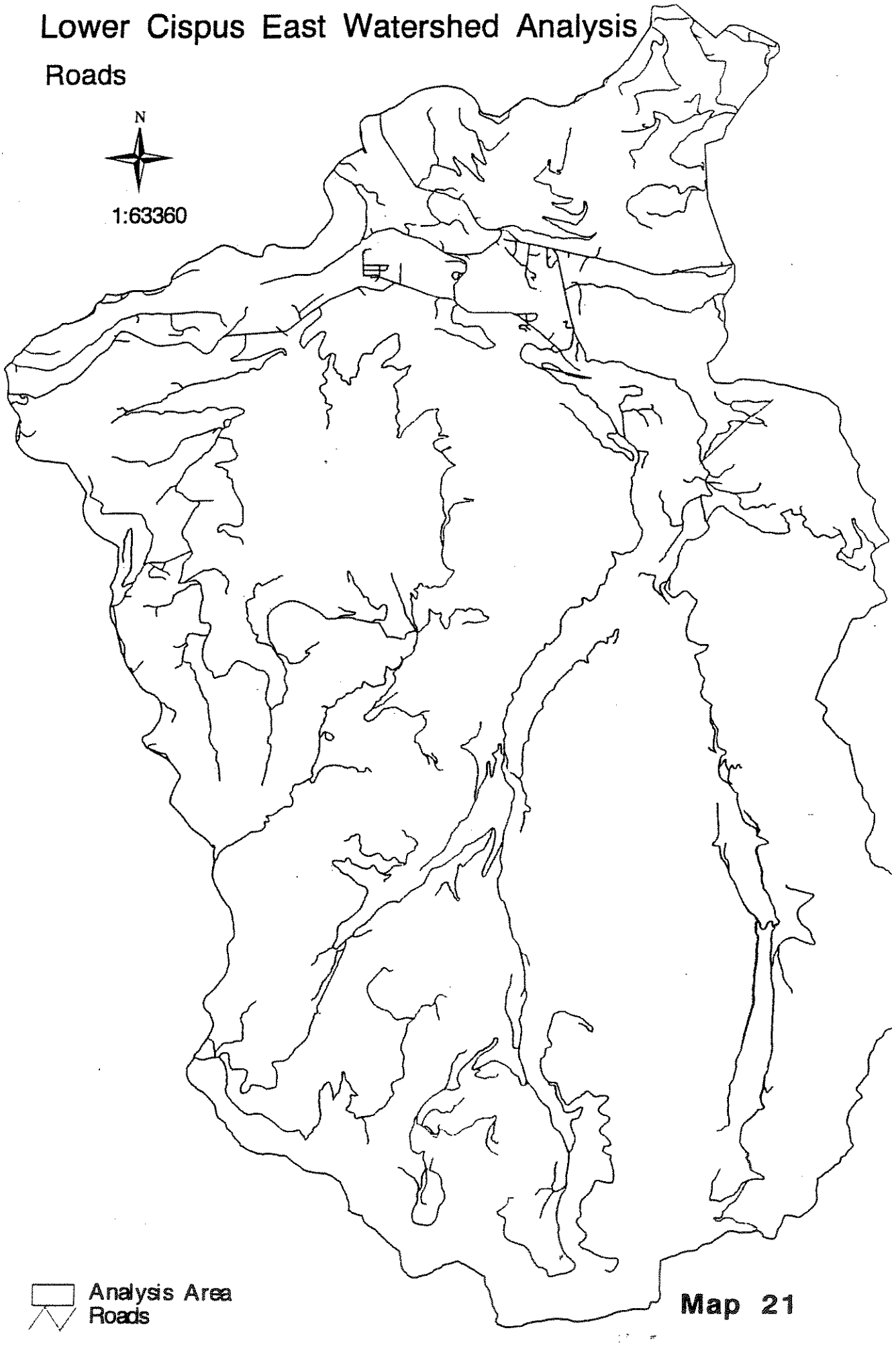
Map 19

Lower Cispus East Watershed Analysis

Riparian Reserves

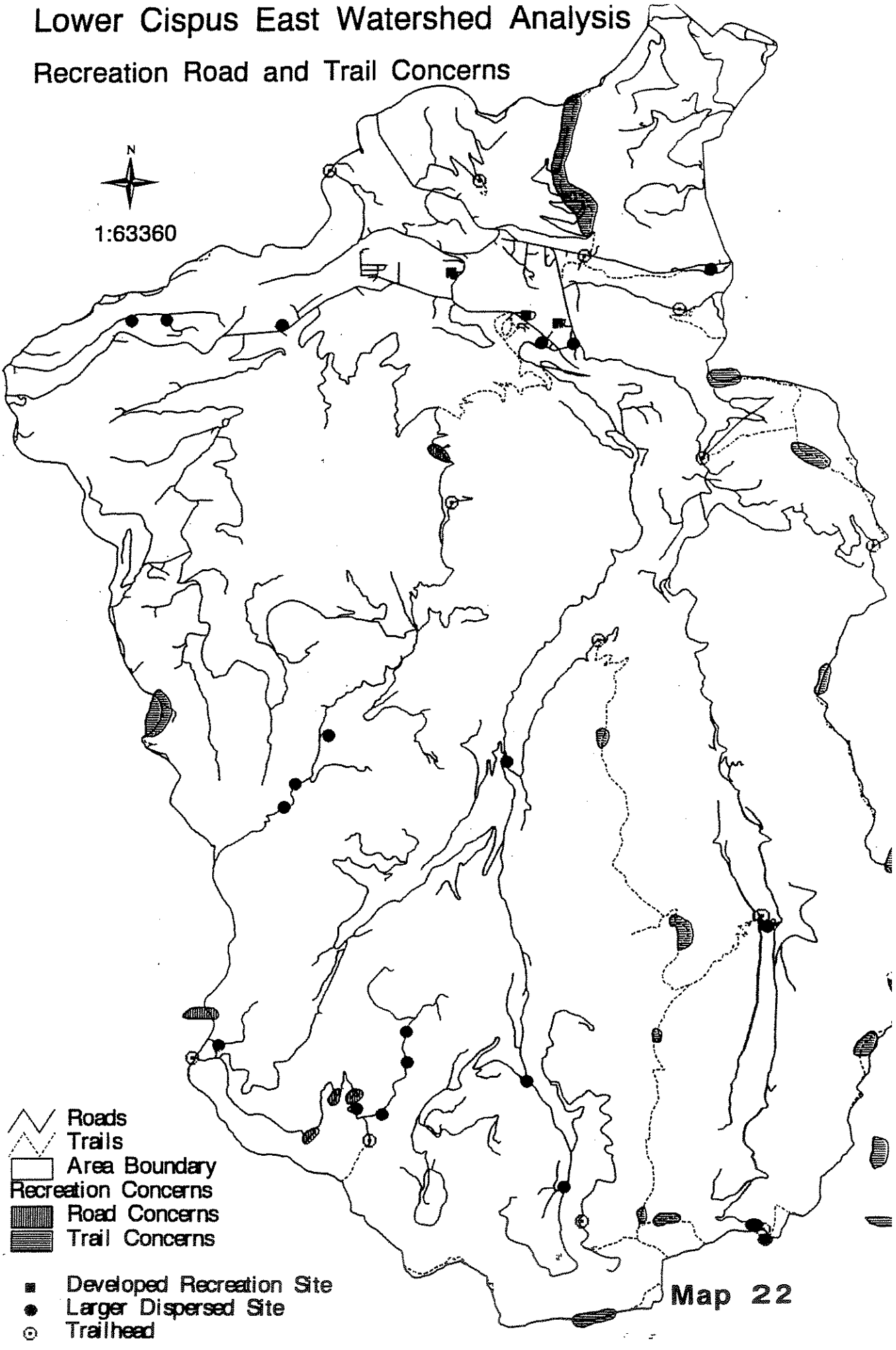
Lower Cispus East Watershed Analysis

Roads



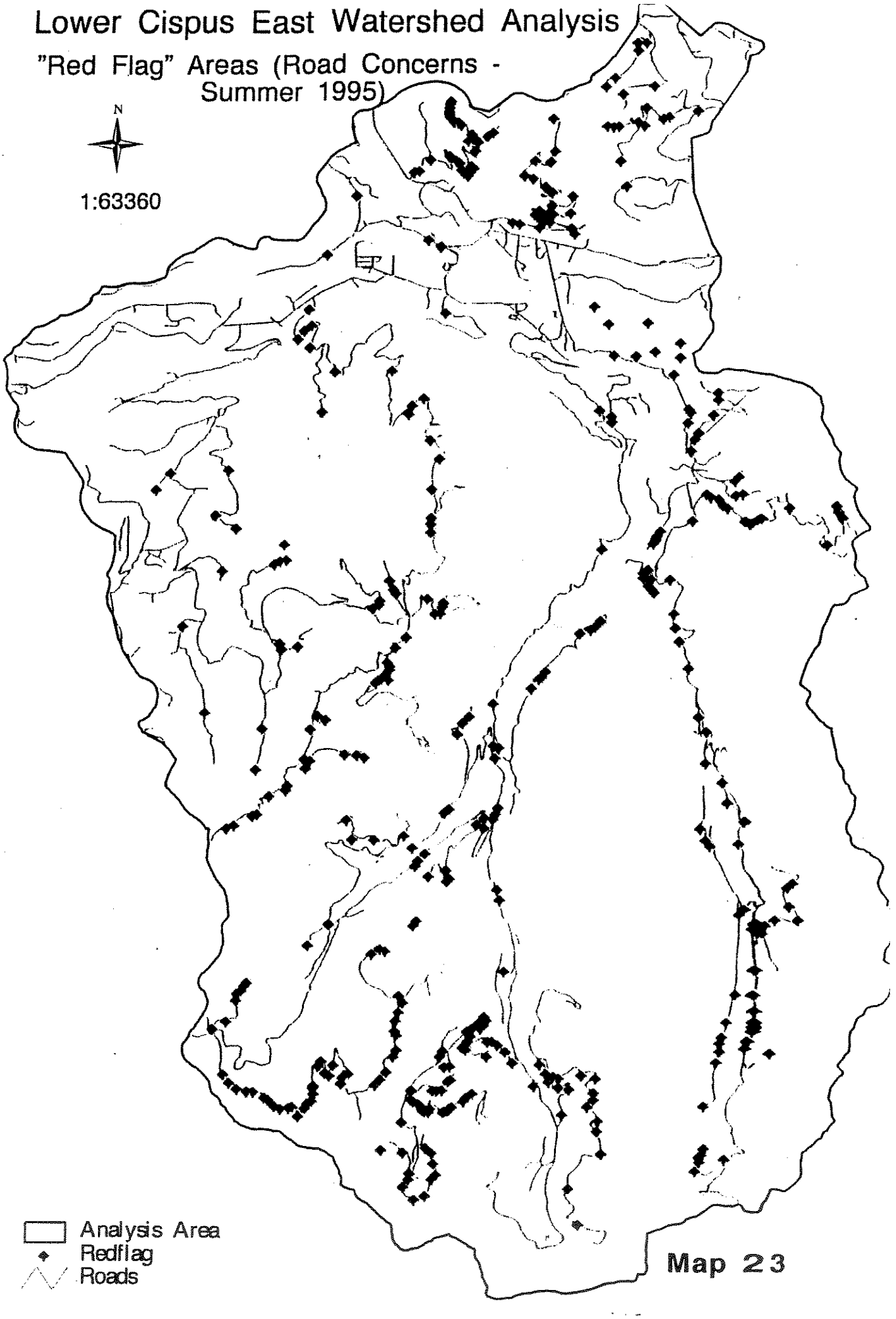
Lower Cispus East Watershed Analysis

Recreation Road and Trail Concerns



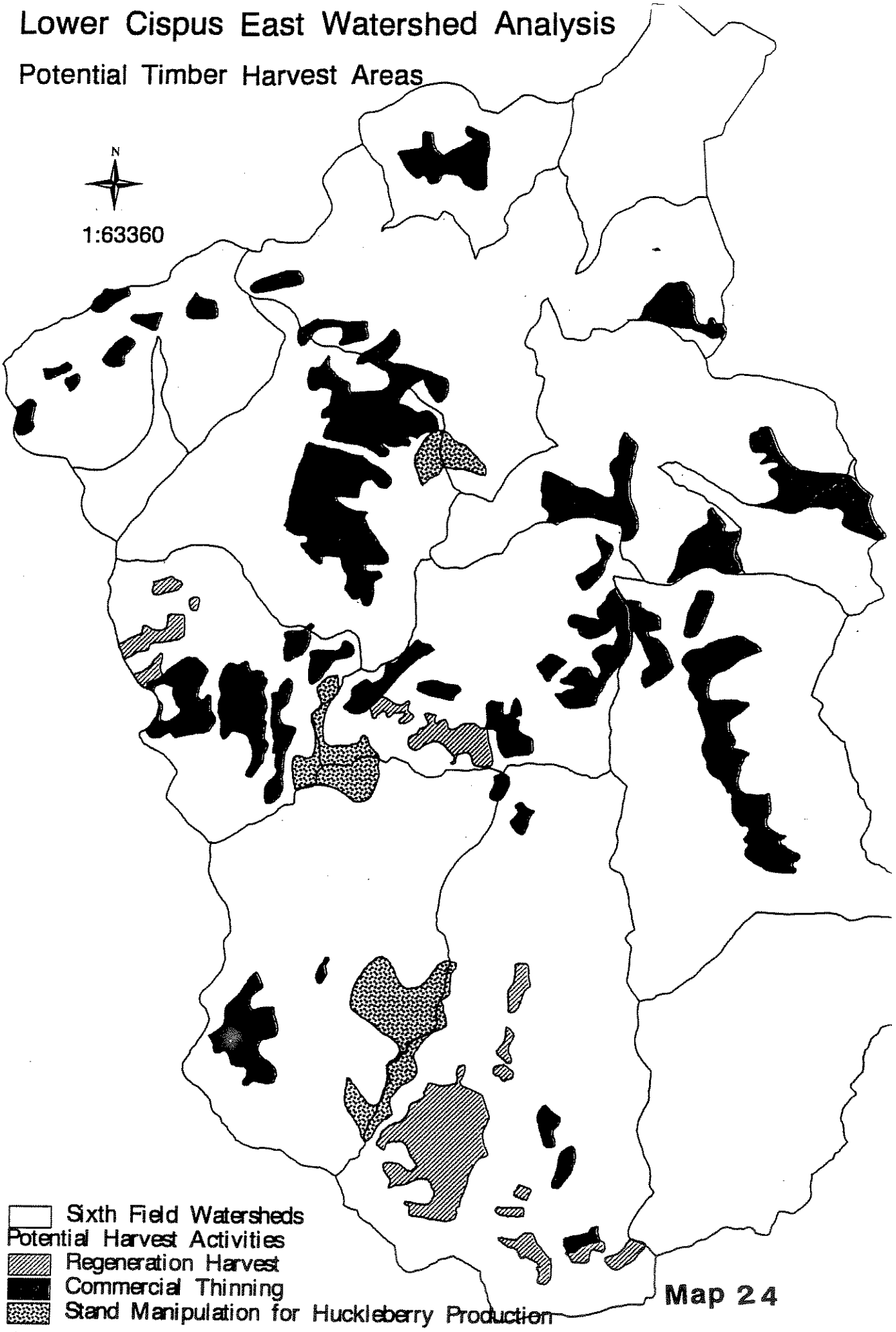
Lower Cispus East Watershed Analysis

"Red Flag" Areas (Road Concerns - Summer 1995)



Lower Cispus East Watershed Analysis

Potential Timber Harvest Areas

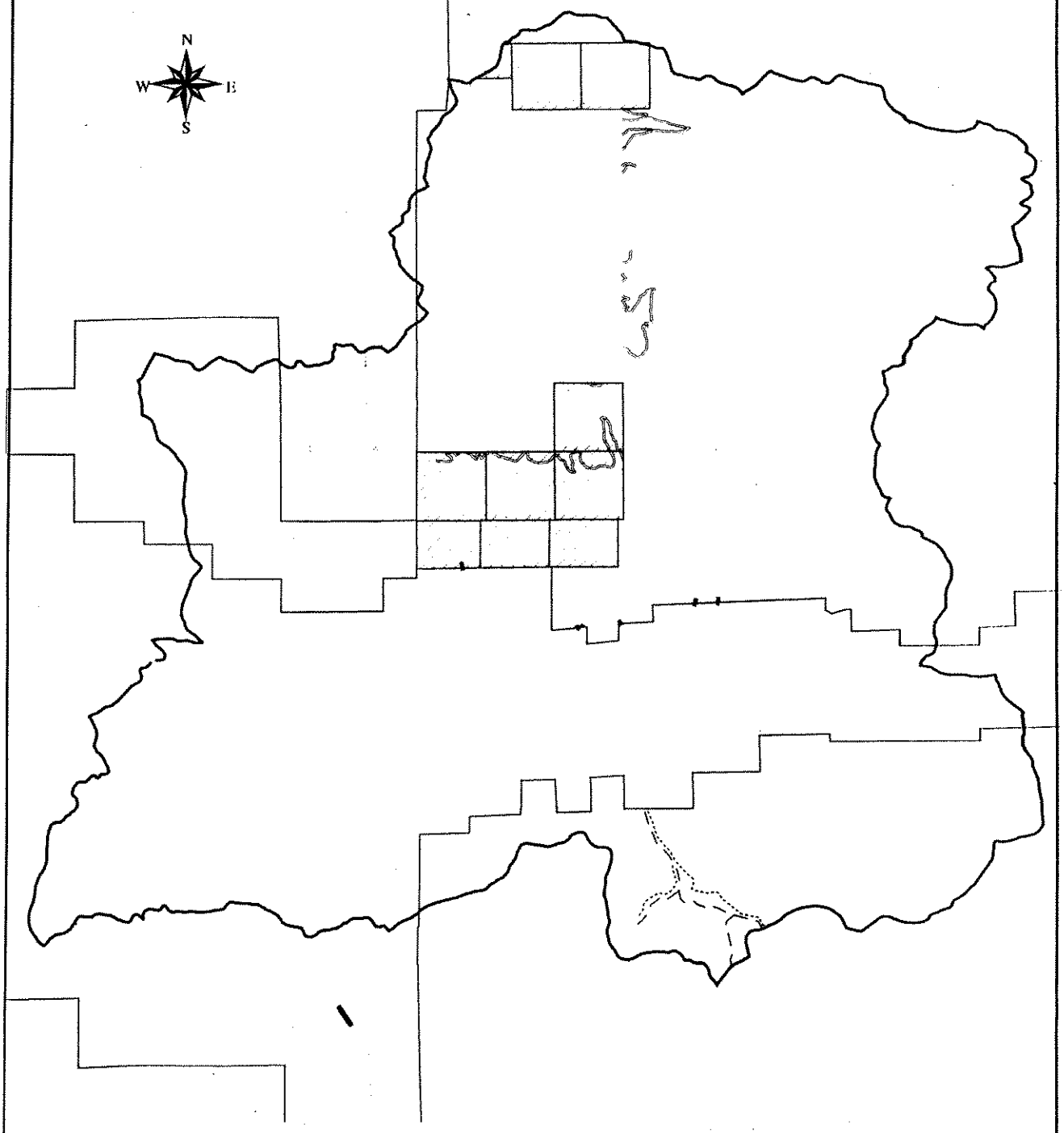


Map 24

FOOTNOTE TO HARVEST MAP: This map portrays some suggested areas where timber harvest may be possible, based on the recommendations in Chapter 7. These potential harvest areas have not been field verified, nor does the map portray every possible harvest area. It is intended to be used as a general starting point for further analysis.

Middle Cowlitz Watershed Analysis

#16 Special Uses

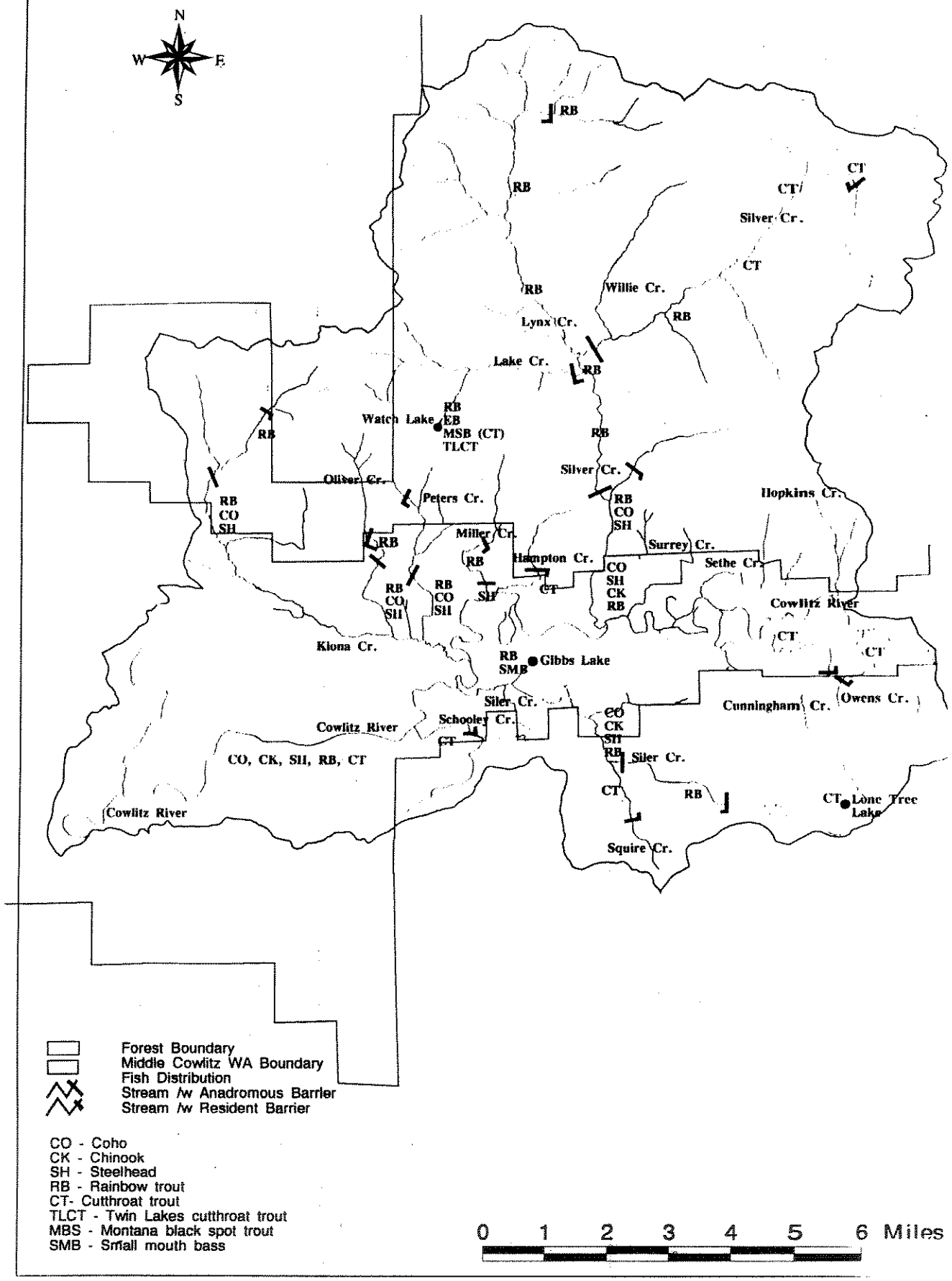


Special Uses
- NF Roads which R/W may be requested
- Underground Power Line
- Underground Telephone Line
- Water Transmission Line
- Middle Cowlitz WA Boundary
- Forest Boundary
- Possible Land Exchange

0 1 2 3 4 5 6 Miles

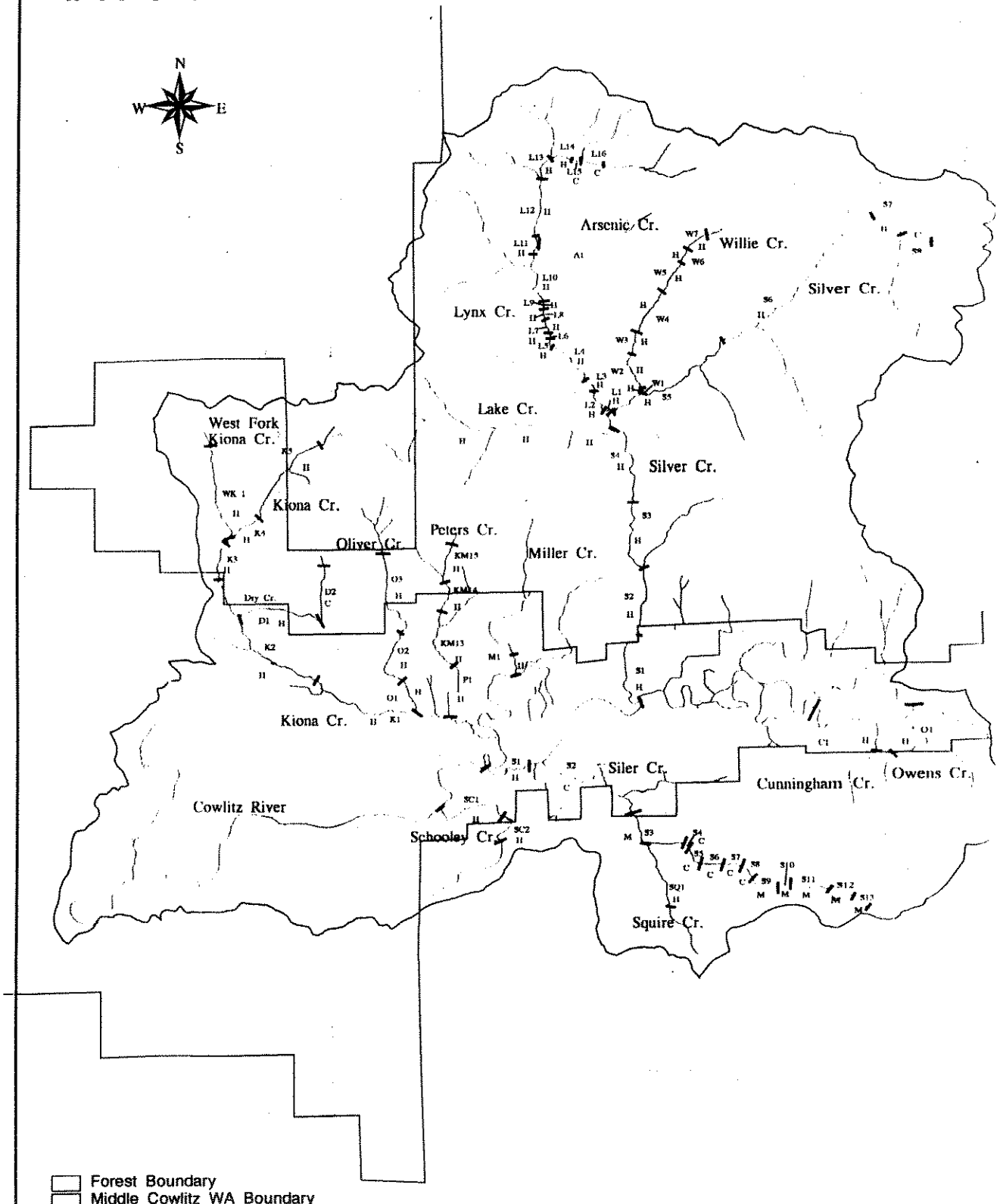
Middle Cowlitz Watershed Analysis

#15 Fish Distribution



Middle Cowlitz Watershed Analysis

#14 Channel Condition



Forest Boundary
Middle Cowlitz WA Boundary
Streams

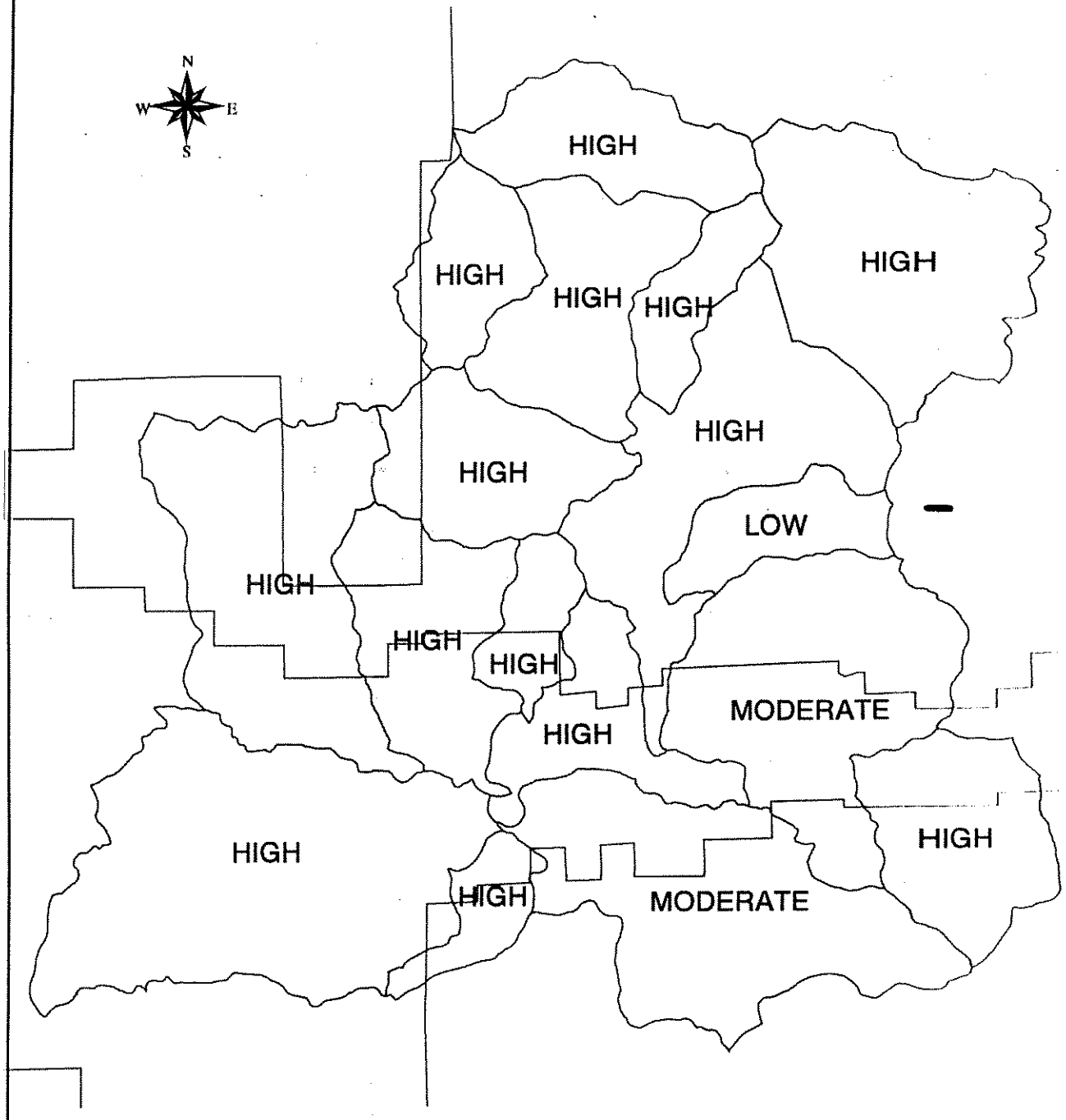
Channel Condition Rating

H High
M Moderate
C Concern
S3 Reach Number
— Reach Break

0 1 2 3 4 5 6 Miles

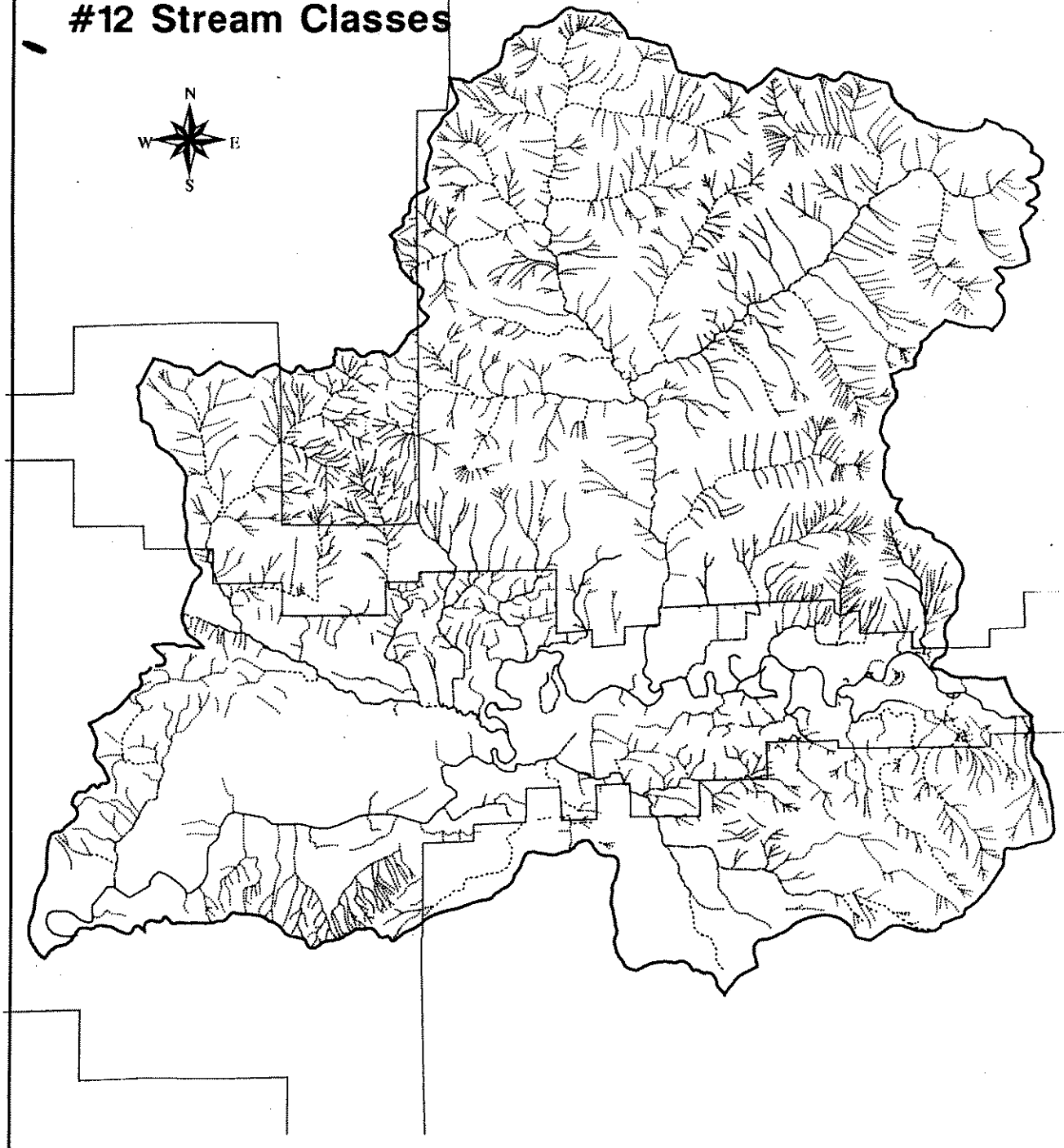
Middle Cowlitz Watershed Analysis

#13 Peak Flow



Middle Cowlitz Watershed Analysis

#12 Stream Classes

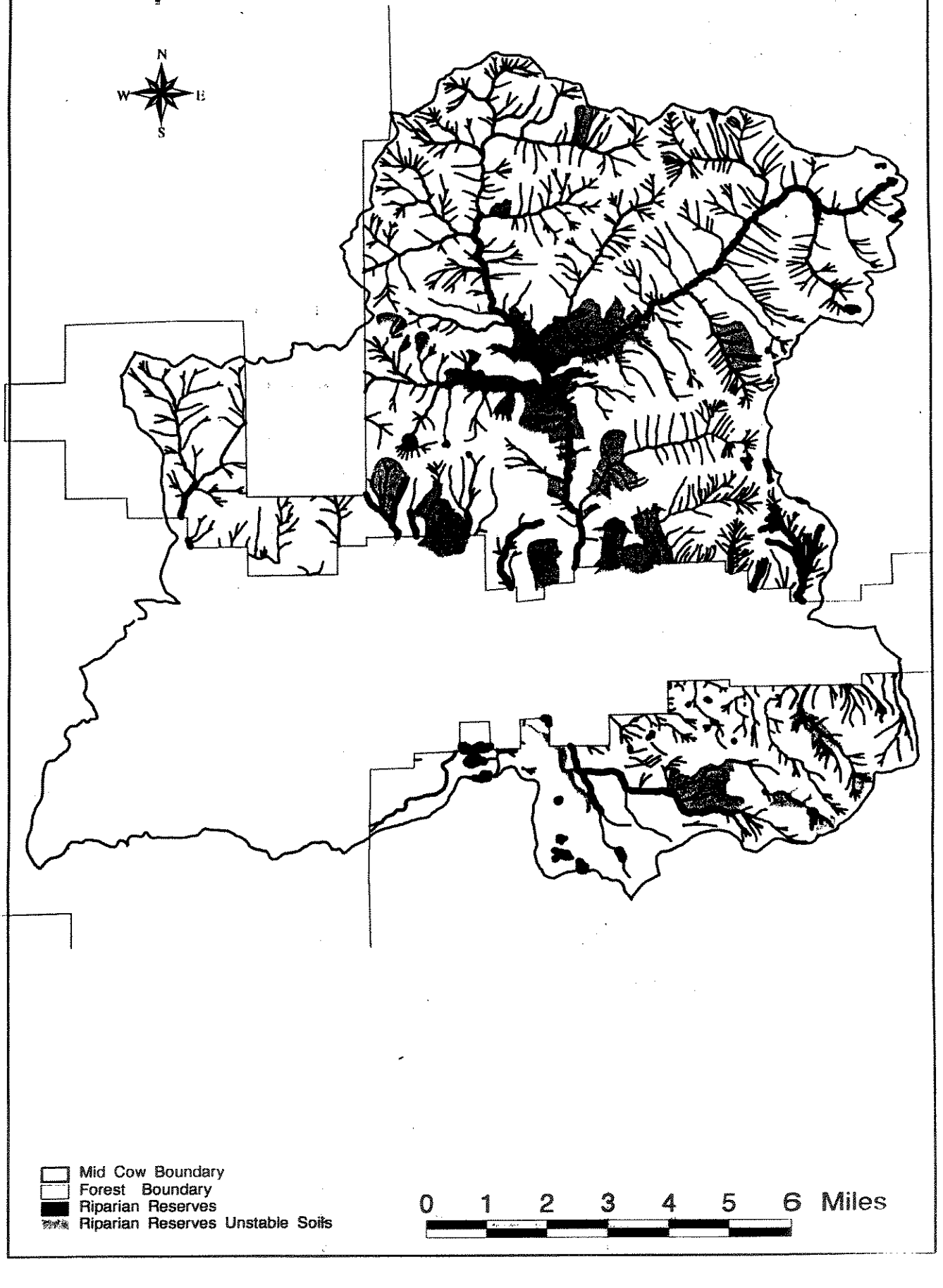


Streams
1
2
3
4
Middle Cowlitz WA Boundary
Forest Boundary

0 1 2 3 4 5 6 Miles

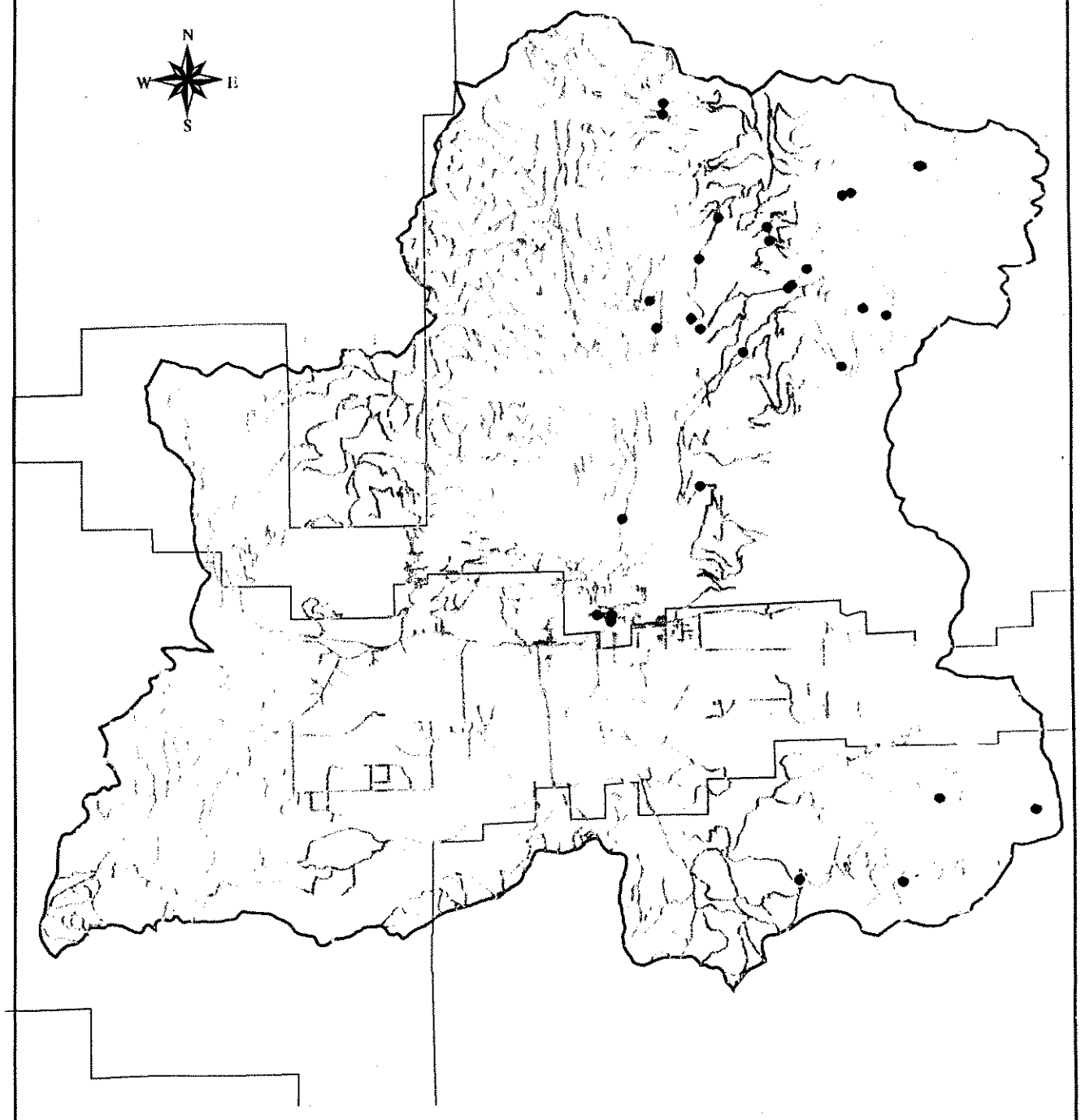
Middle Cowlitz Watershed Analysis

#11 Riparian Reserves



Middle Cowlitz Watershed Analysis

#10 Flood Damage Sites

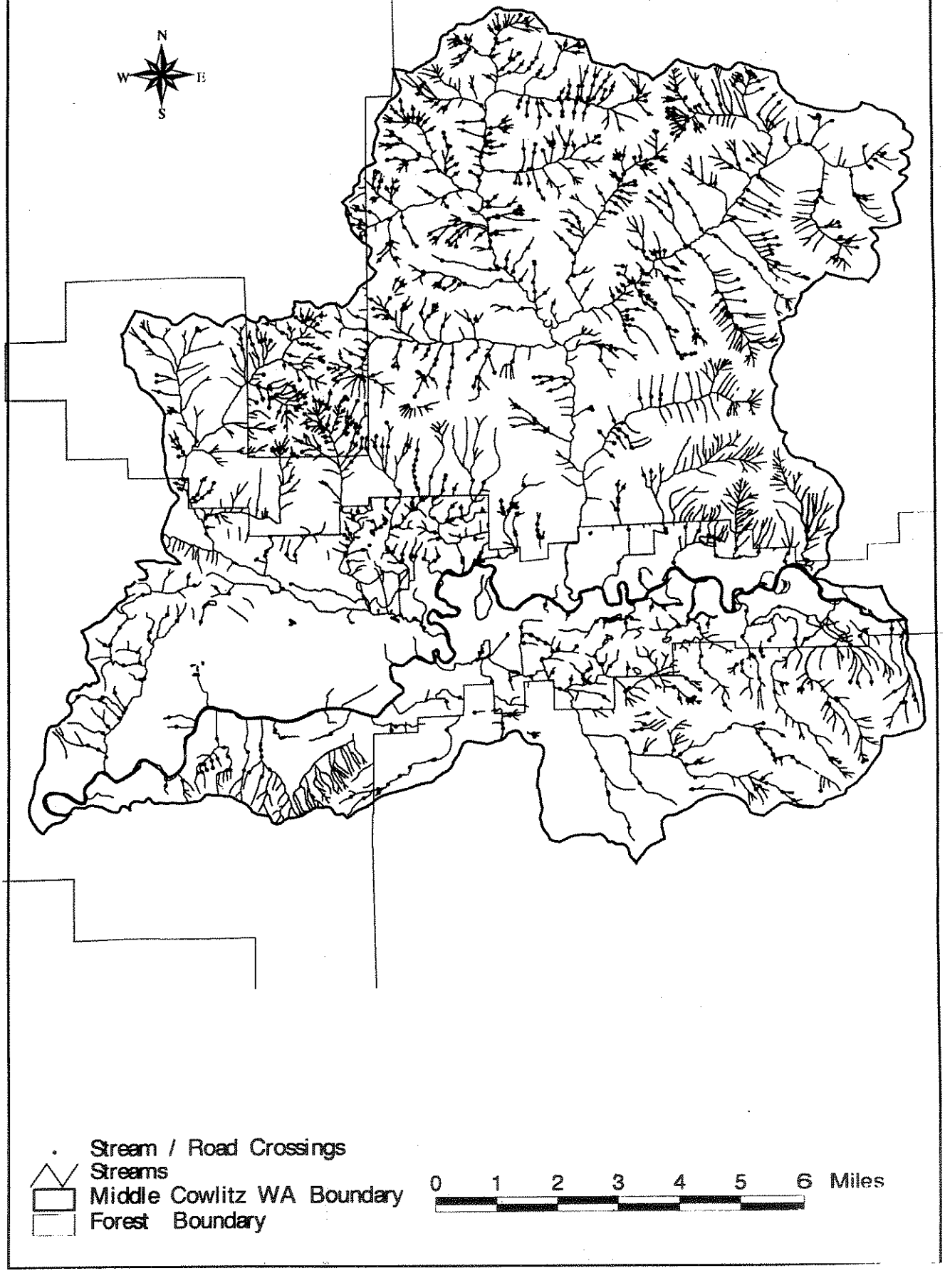


Known Flood Damage on Federal Land
Roads
Mid Cow Boundary
Forest Boundary

0 1 2 3 4 5 6 Miles

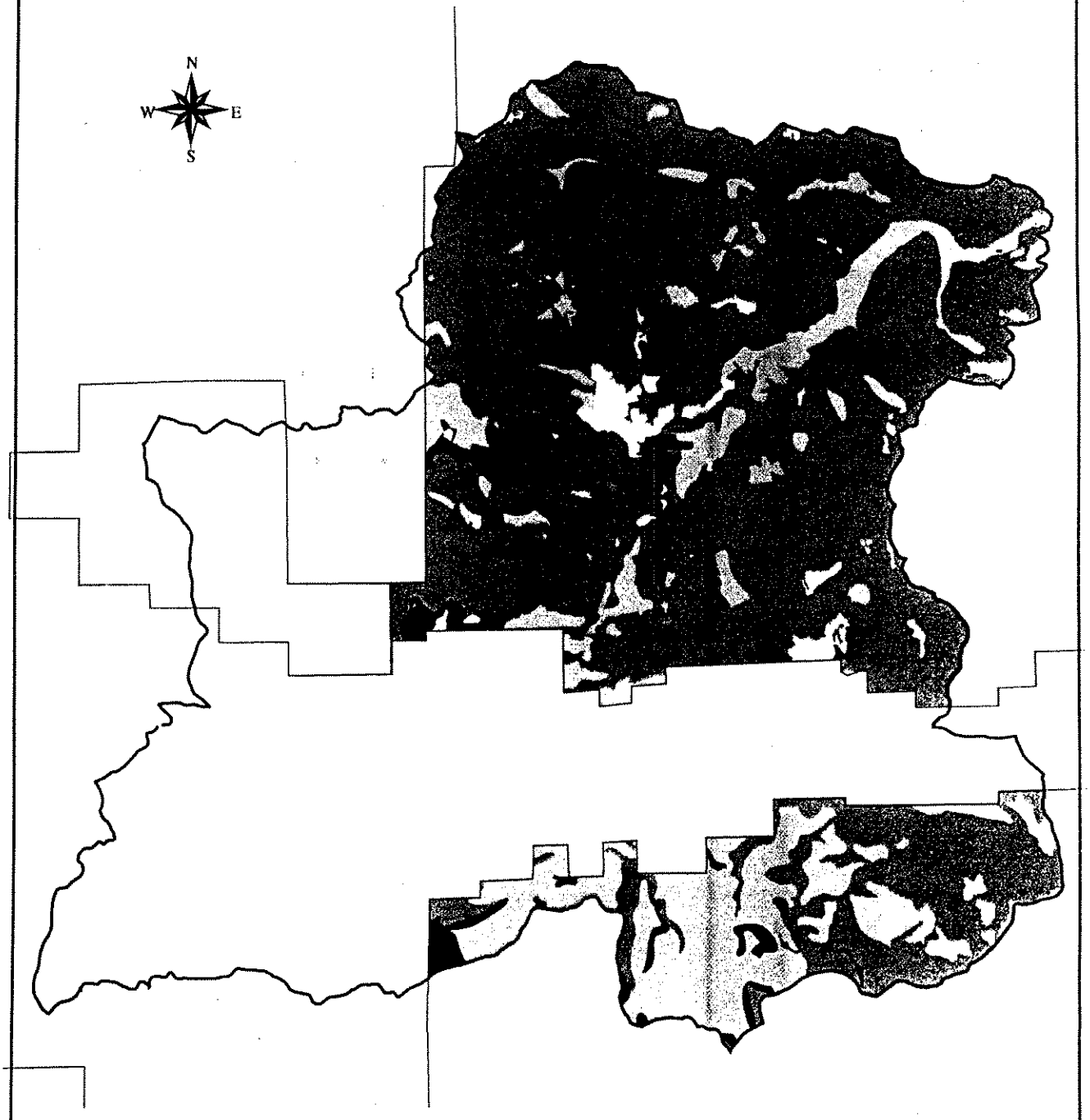
Middle Cowlitz Watershed Analysis

#9 Road and Stream Crossings



Middle Cowlitz Watershed Analysis

#8 Erosion Potential

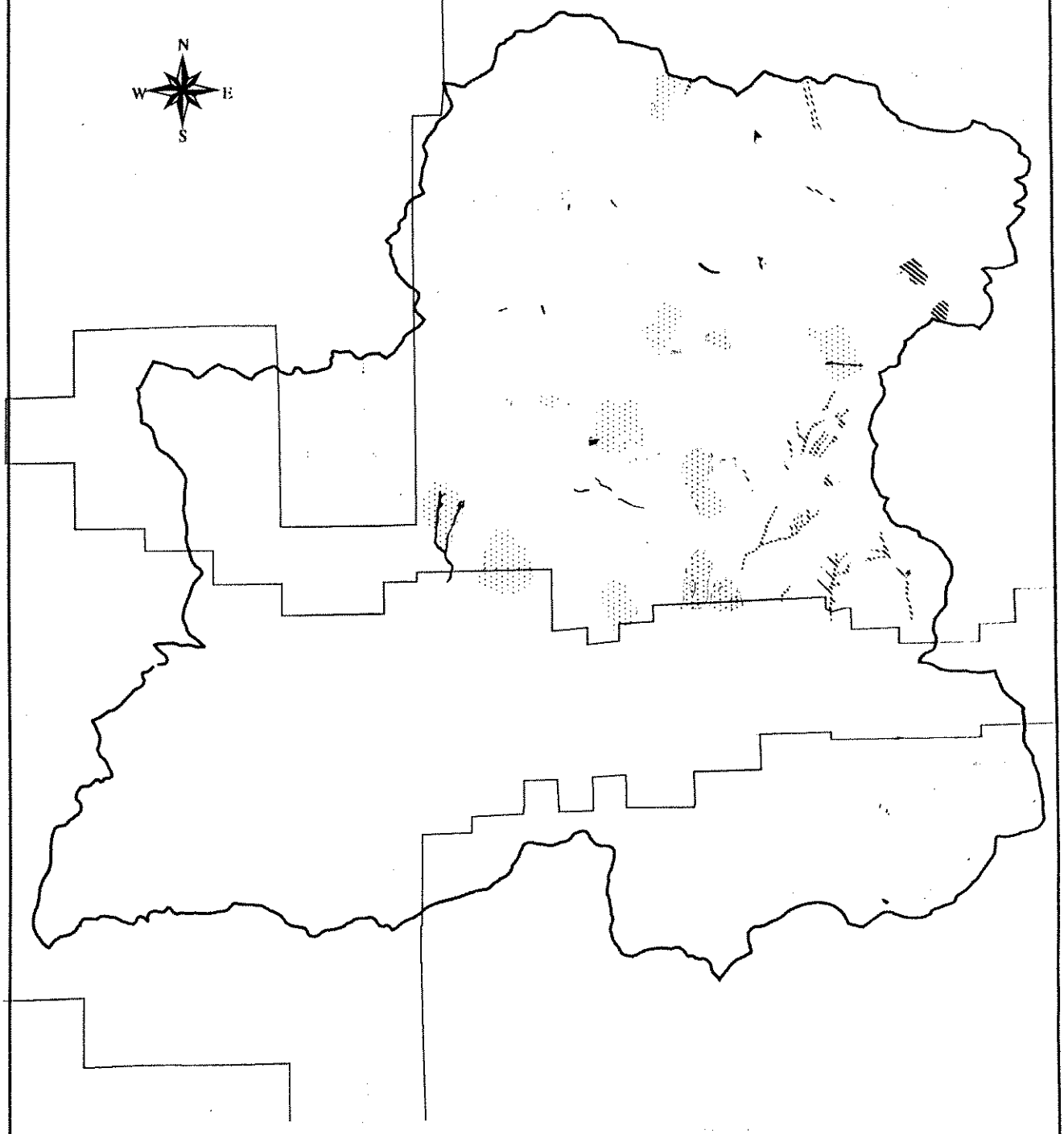


Middle Cowlitz WA Boundary
Forest Boundary
Erosion Potential
Moderate
Severe
Slight

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#7 Mass Wasting

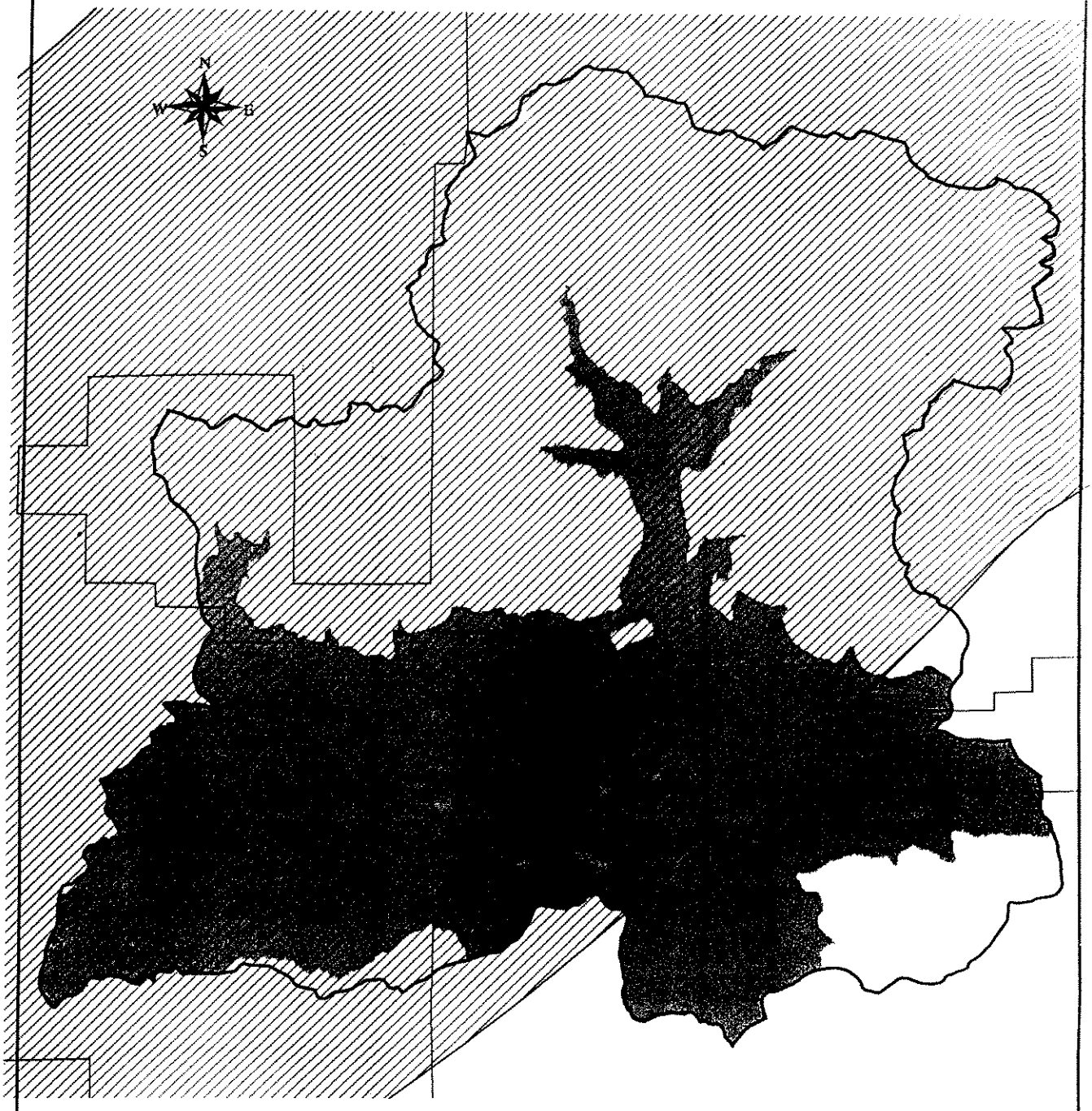


Middle Cowlitz WA Boundary
Forest Boundary
Mass Failures
1 Landslides (Most Naturally Occurring)
2 Earthflows (Most Naturally Occurring)
3 - 4 Avalanche Chutes / Rock Fall (Natural)
5 - 7 Road Related Mass Wasting

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#6 Murrelet and Big Game Areas

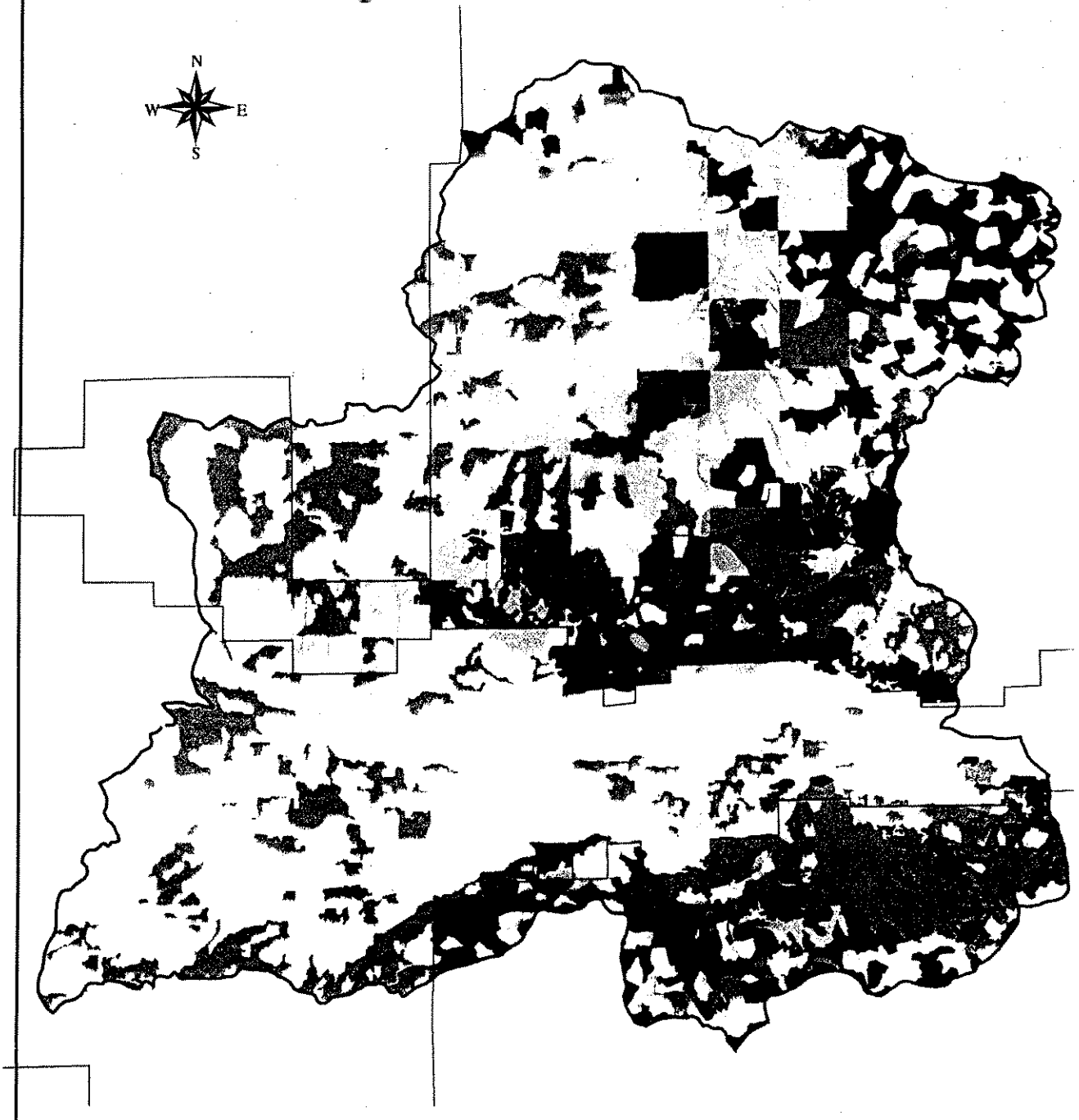


Middle Cowlitz WA Boundary
Forest Boundary
Marble Murrelet Zone II
Deer Elk Winter Range

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#5 Habitat Fragmentation

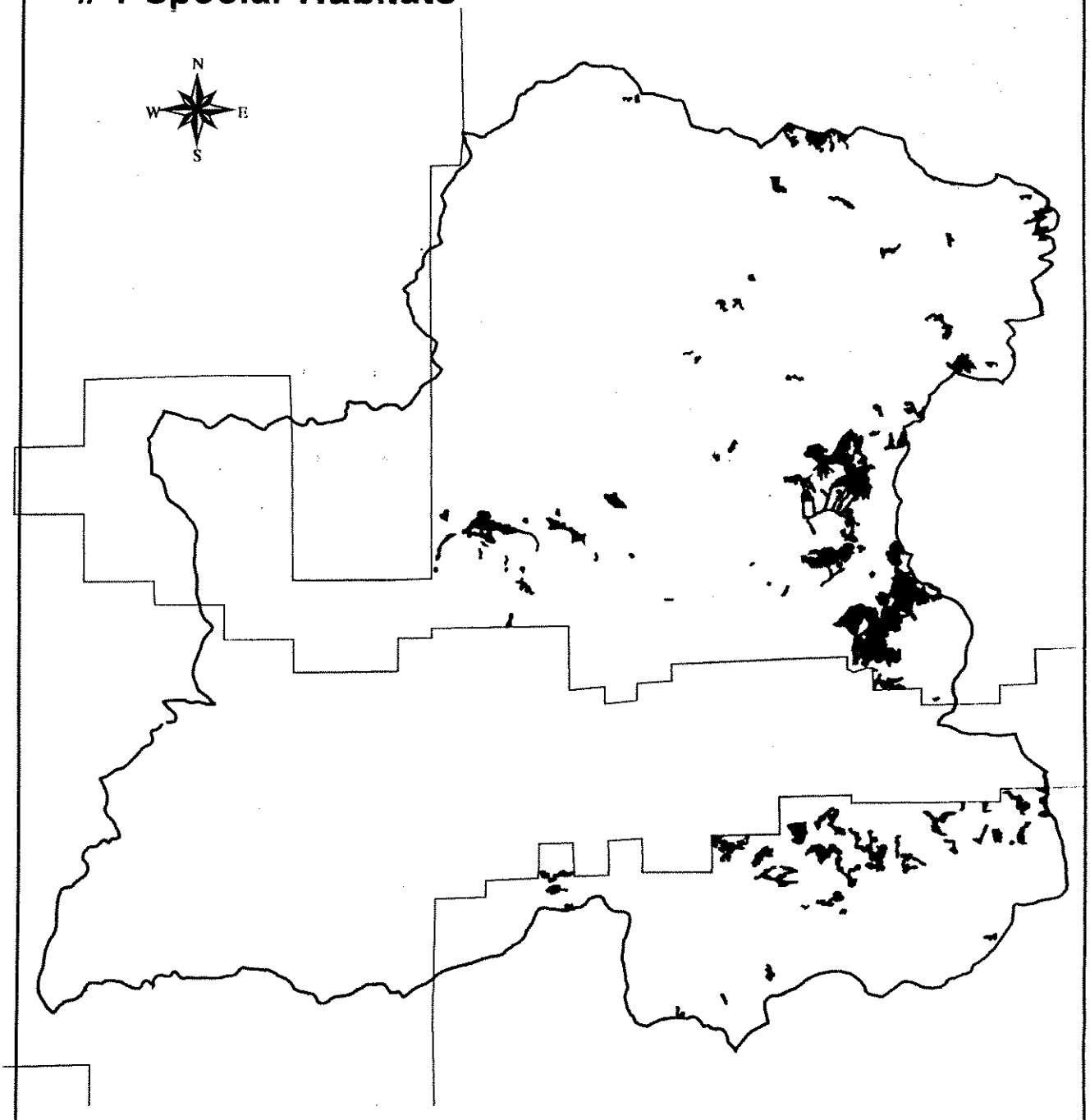


Middle Cowlitz WA Boundary
Forest Boundary
Wildlife Corridors
LARGE TREE
SMALL TREE
Riparian Reserves Unstable Soils

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#4 Special Habitats

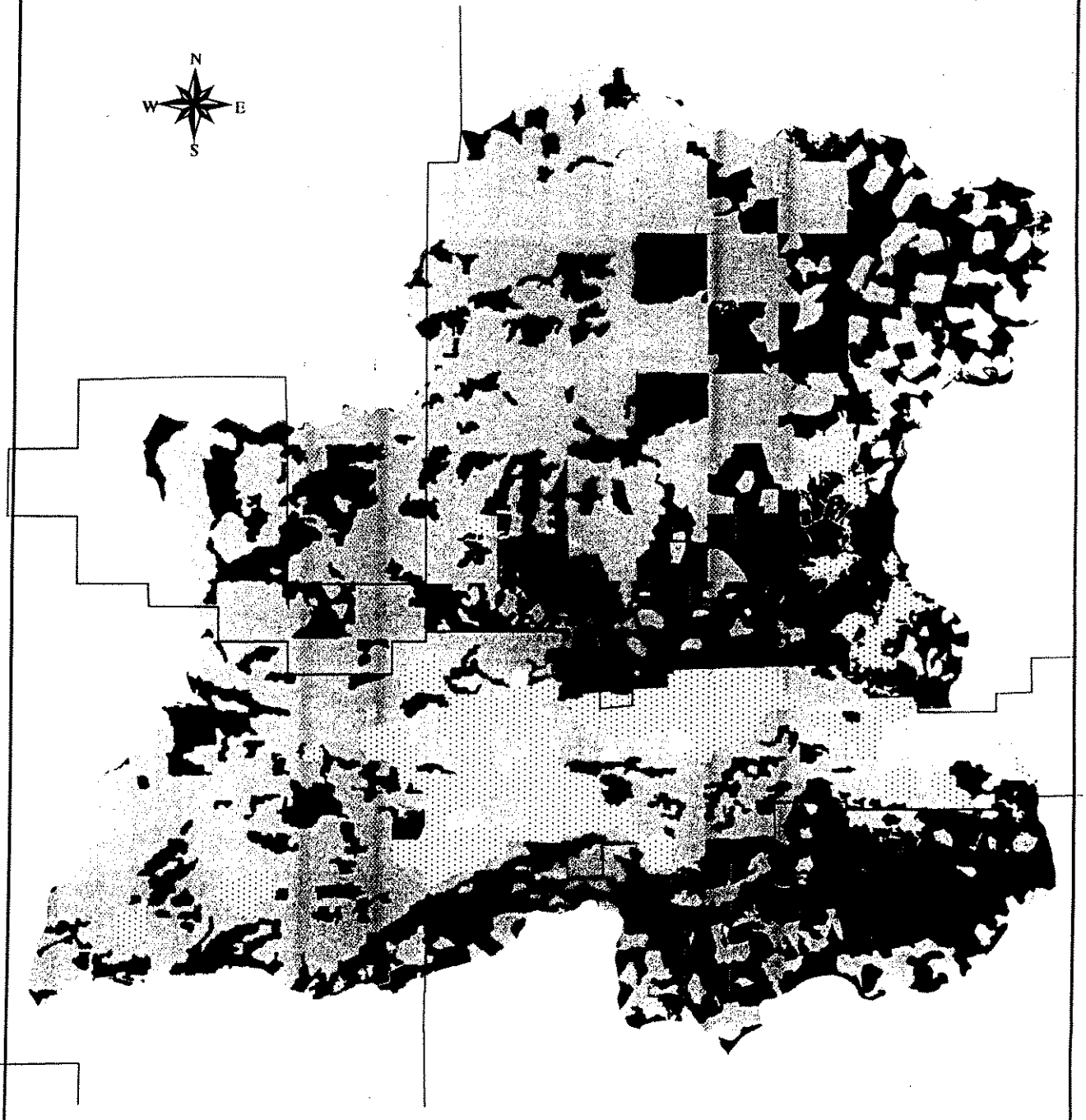


Special Habitats
Middle Cowlitz WA Boundary
Forest Boundary

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#3 Forest Stand Structure

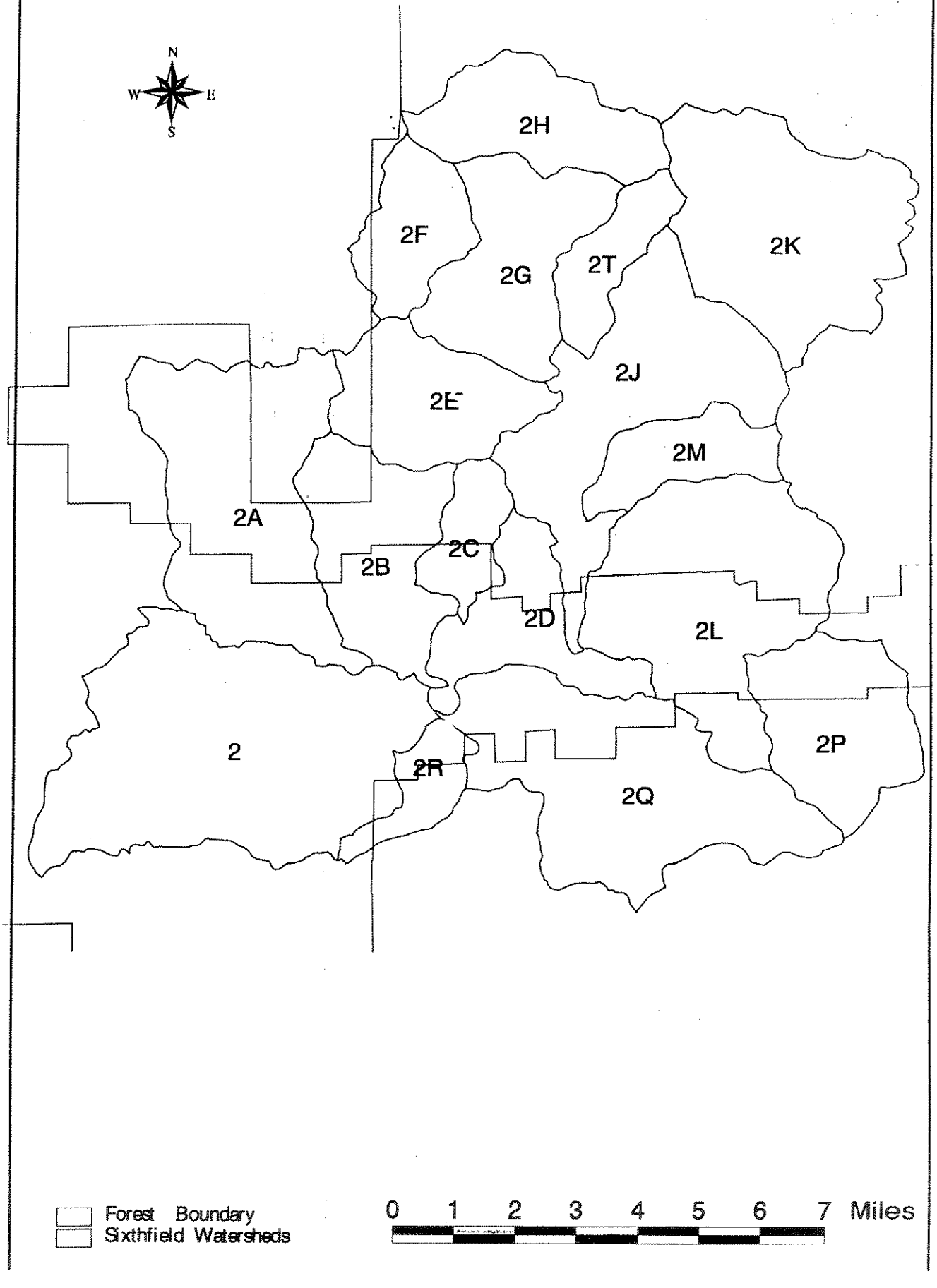


Forest Boundary
Forest Stand Structure
NON-FOREST
GRASS/POLE
SMALL TREE
LARGE TREE

0 1 2 3 4 5 6 Miles

Middle Cowlitz Watershed Analysis

#2 Sixth Field Watersheds



Middle Cowlitz Watershed Analysis

#1 Vicinity Map