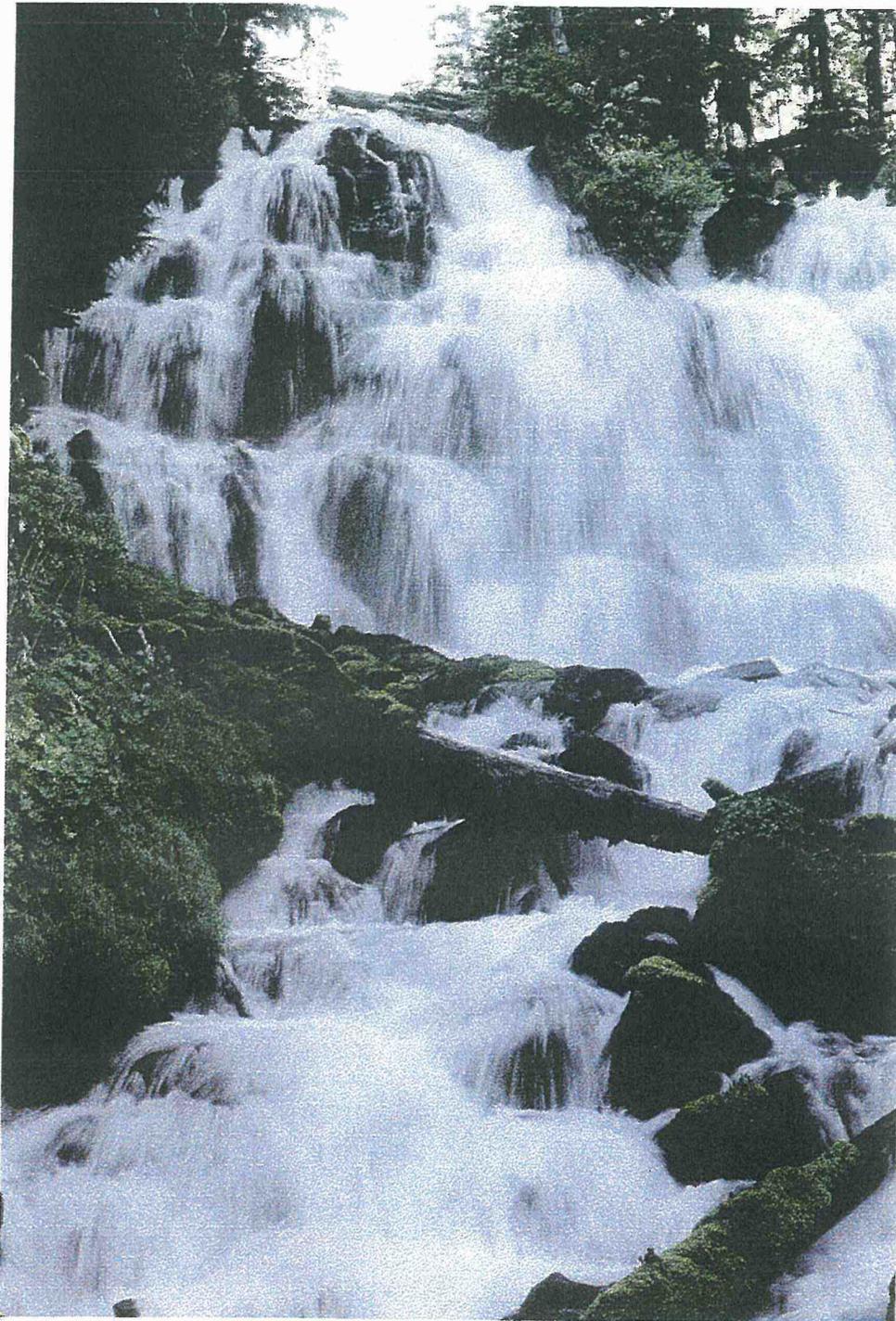


Horse Creek Watershed Analysis

Willamette National Forest

September 1997



United States
Department of
Agriculture



Forest Service
Pacific Northwest
Region

HORSE CREEK WATERSHED ANALYSIS

September 1997

**McKenzie Ranger District
Willamette National Forest**

For further information contact:

Administrative Contact:

John Allen, District Ranger

**McKenzie Ranger District
McKenzie Bridge, OR 97413**

Technical Contact:

Cheryl Friesen, Team Leader

**McKenzie Ranger District
McKenzie Bridge, OR 97413**

TEAM MEMBERS

Cheryl Friesen
Al Brown
Michelle McSwain
John Phillips
Pat Ford
Dawn Pozzani
Rich Pyzik
Phil Raab
John Orbeton
Eric Bergland

Team Leader, Wildlife Biologist
Forester
Hydrologist
Soil Scientist
Botanist
GIS Specialist
Fisheries Biologist
Recreation Specialist
Fire Behavior Specialist
Archaeologist

with important assistance by:

Shane Kamrath
Lisa Lyon
Gene Skrine
Dave Bickford
Jane Kertis

Wildlife Biologist
Wildlife Biologist
Silviculturist
Fisheries Biologist
Ecologist

HORSE CREEK WATERSHED ANALYSIS

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HORSE CREEK WATERSHED ANALYSIS

CHAPTER 1

INTRODUCTION

INTENT OF WATERSHED ANALYSIS

The intent of this Watershed Analysis is to develop and document a scientifically based understanding of the processes and interactions occurring within the Horse Creek watershed. This understanding, which is focused by the watershed's key issues, is essential for making sound management decisions. Gaining an understanding of the interactions between land-use activities and the physical and biological environments in this area will be invaluable to the success of managing this ecosystem for all its values.

Direction for conducting this report lies within the FEMAT Report (USDA/USDI 1993) and the FEIS ROD on Management for Late Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl (USDA USDI 1994, hereafter referred to as the ROD). A Federal Agency Guide for Watershed Analysis (versions 1.1 and 1.2)(USDA 1994) was followed to guide this analysis.

This watershed analysis will produce a "living" document. Appendices and other additions will continue to be produced over time as new data is obtained or new issues are recognized.

Products of the analysis will include:

- A description of the watershed, including its biotic and abiotic resources
- A description of the watershed key issues
- Past and current conditions and processes on this landscape
- Trends and potential effects of future land management actions
- Recommendations for future management actions
- Guidance to be considered in future site-specific analysis and project-level planning

The findings within this analysis represent a foundation on which to develop site specific project proposals and to base specific future decisions.

RELATED DOCUMENTS

Documents with direction or information related to this project at the forest level includes the Willamette National Forest Resource Plan (1990) as amended by the ROD (1994). At the subbasin scale, the McKenzie Watershed Council is compiling some analytical information through the Lane Council of Governments (LCOG). Information from these documents was incorporated into this analysis.

CHARACTERIZATION OF WATERSHED

LOCATION AND LAND USE

The Horse Creek is an approximately 101,000 acre Watershed that lies within the McKenzie sub-basin on the western flank of the Cascade Crest (Maps 1-1 and 1-2). Relief ranges from about 1200 feet at the confluence of Horse Creek and the mainstem of the McKenzie River at McKenzie Bridge, to 10,358 feet at the summit of South Sister.

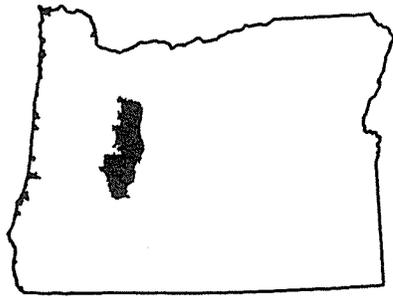
Table 1-1 and Maps 1-3 and 1-3a display the land allocations within this watershed. The bulk of the area is Late Successional Reserve and wilderness. There is a small amount of private land within the watershed, primarily residences along King Road.

Table 1-1: Land Allocations within the Horse Creek Watershed.

Willamette National Forest Land Management Plan (1990) Allocations:

Land Allocation	Acres
Wilderness (Three Sisters)	76,031
Research Natural Area (Olallie)	533
Special Interest Area	417
Special Wildlife Habitat Area	60
Dispersed Recreation: Semi-primitive, Nonmotorized use	912
Scenic - Modification: Middleground	155
Scenic - Partial Retention Middleground	1,406
Scenic - Partial Retention Foreground	1,085
Scenic - Retention Middleground	3,080
Scenic - Retention Foreground	824
General Forest	15,200
Private	1,725
TOTAL	101,428

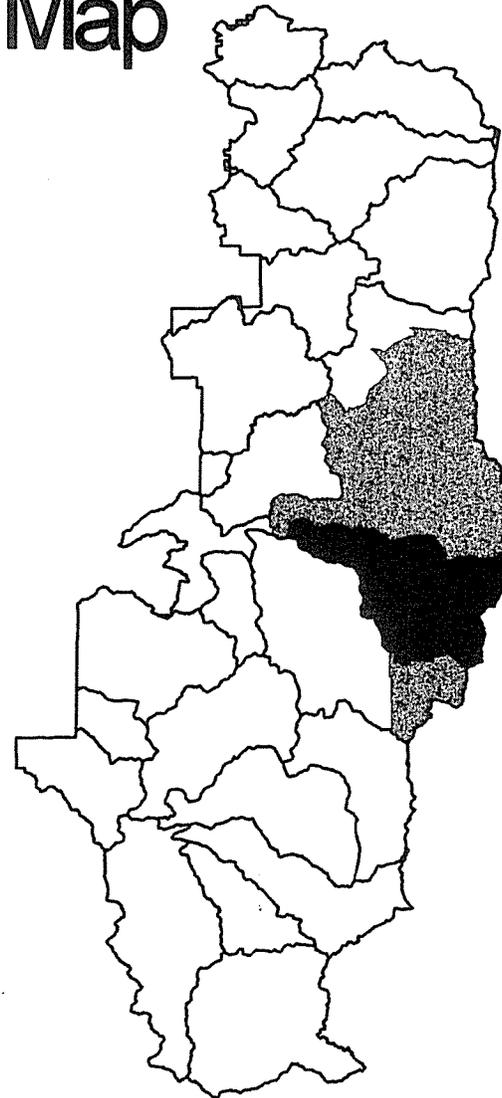
Map 1: Horse Creek Watershed Locator Map



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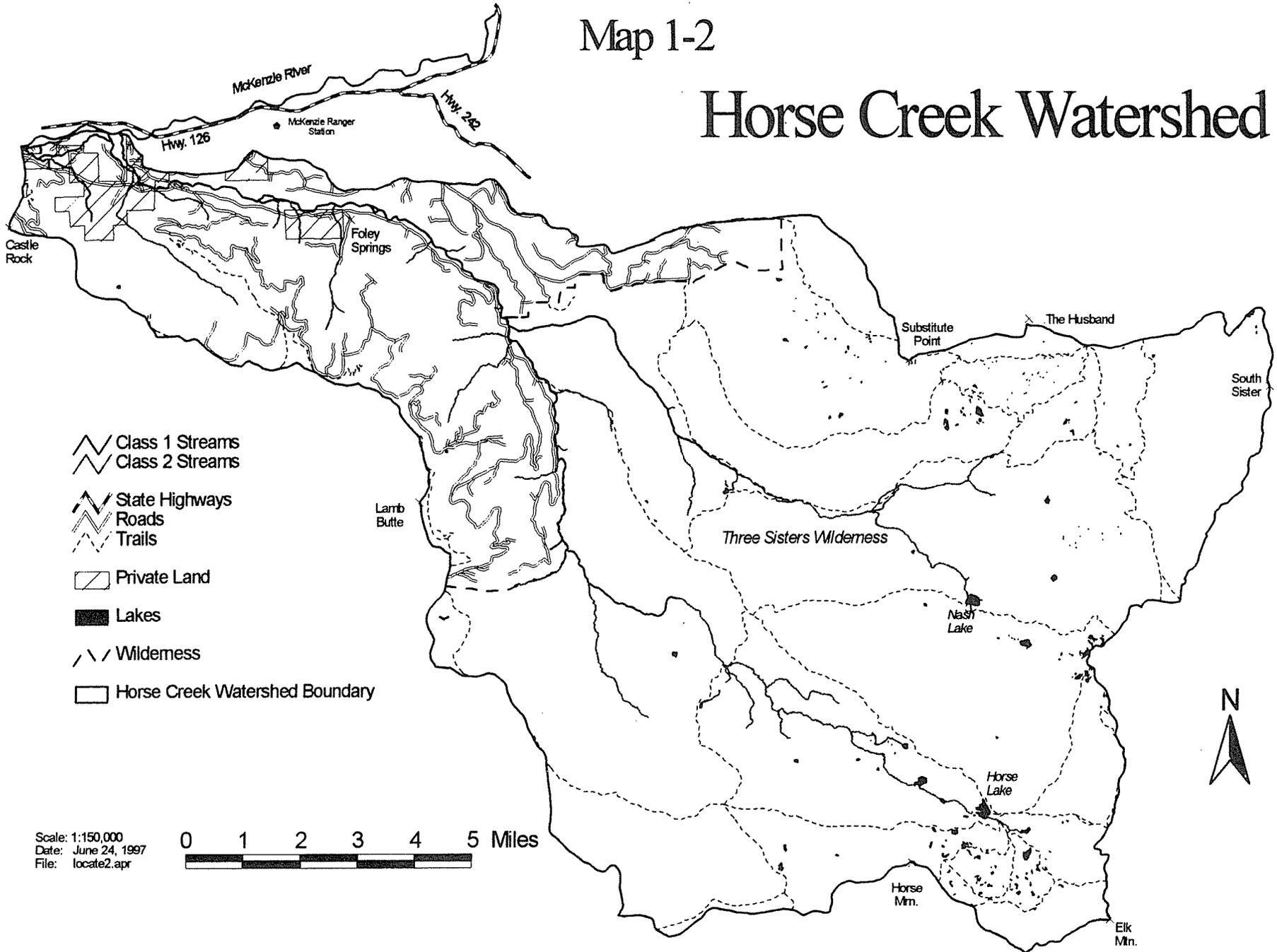
Willamette National Forest



-  Horse Creek Watershed
-  McKenzie Ranger District
-  Watersheds intersecting Willamette NF

Map 1-2

Horse Creek Watershed

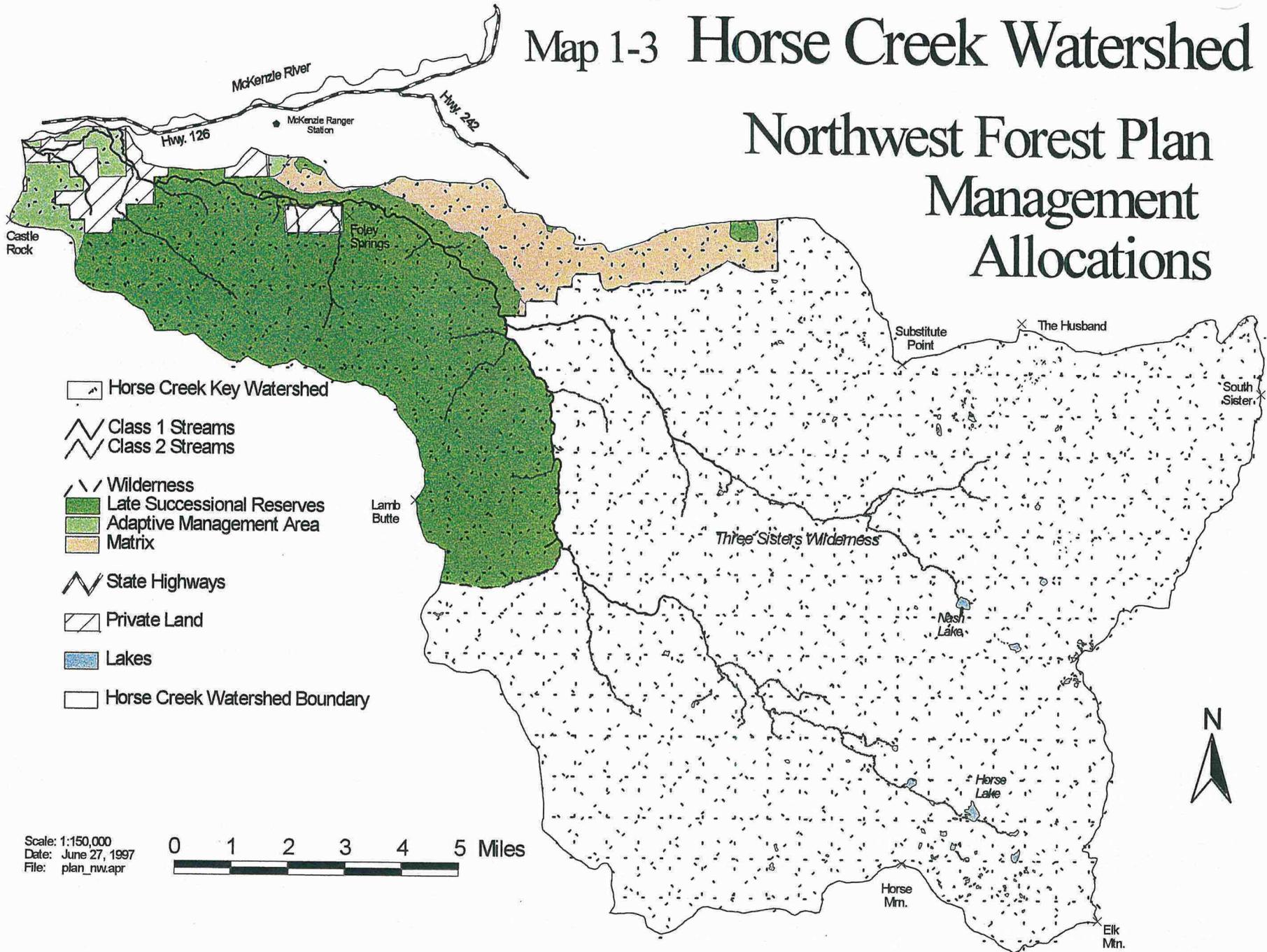


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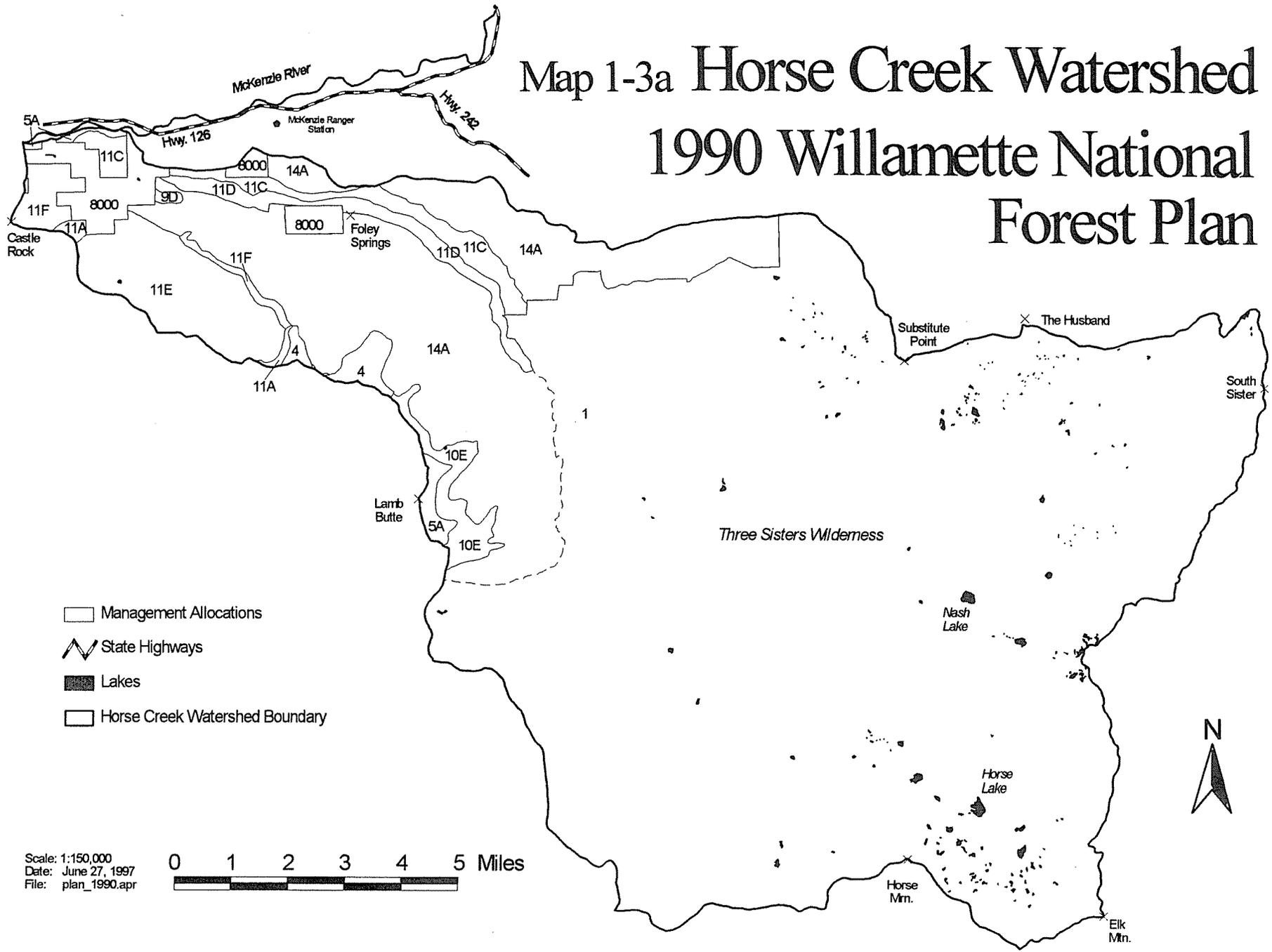


Map 1-3 Horse Creek Watershed

Northwest Forest Plan Management Allocations



Map 1-3a Horse Creek Watershed 1990 Willamette National Forest Plan



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Northwest Forest Plan Allocations*

Land Allocation	Acres
Late Successional Reserves	18,320
Late Successional Reserves (100ac)	168
Adaptive Management Area	1207
Riparian Reserve (outside of LSR, AMA, and Wilderness allocations, but overlaps with Matrix)	357
Matrix	3,620
Wilderness (Three Sisters)	76,031

**These allocations overlap with the Willamette National Forest Plan Allocations*

GEOLOGY

Horse Creek Watershed a volcanic terrain modified by glacial and fluvial processes. The watershed can be subdivided into two geographical areas: The Western Cascades and the High Cascades.

Western Cascades

The western 1/3 of the watershed lies in the Lower Horse Creek subwatershed between 1,000 and 4,000 feet elevation. This subwatershed is comprised of older Western Cascade basaltic lava flows that are interbedded with pyroclastic tuffs and breccias 10 to 17 million years old. Ridge-capping basalts of the Early High Cascades (9 - 4 million years old) overlie the Western Cascade rocks. These ridge-capping basalts, the peaks of Olallie Ridge, define the watershed boundary to the south and separate it from the tributaries of the South Fork of the McKenzie. The intracanyon basalt flows of Foley Ridge (2-4 million years old) dominate the northwestern portion of the watershed, and form the boundary with the McKenzie River mainstem. Lower Horse Creek subwatershed is very steep, with approximately 5200 acres on slopes greater than 70%. Steep slopes form the canyon walls along Separation Creek and lie south and west of Horse Creek. The valley bottoms contain glacial outwash and terrace deposits as well as two large ancient landslides.

High Cascades

The eastern 2/3 of the watershed is located in the Three Sisters Wilderness. The majority of this area lies on the High Cascade volcanic plateau (4,000 to 6,000 feet elevation) with relatively low relief except for the valley side slopes of Separation and upper Horse Creeks and the side slopes of small cinder cones. The source area for the Late High Cascade basalts (1 - 4 million years old) is the South Sister composite volcano and other smaller High Cascade volcanic cones. The most recent lava flows from South Sister are less than 2,600 years old (Taylor et al., 1987). Five alpine glaciers (Frazier, Eugene, Lost Creek, Skinner, and Clark) are still active on the west slope of South Sister.

EROSION PROCESSES

The areas with most active erosion are on the west flank of South Sister and other cinder cones, where snow melt on slopes greater than 100% produces high gradient streams in loose unconsolidated volcanic ash and cinders. Much of the material is then deposited in the high elevation meadows between 4,000 and 6,000 feet elevation. Thin glacial soils on the valley sideslopes of Separation Creek and upper Horse Creek (in the wilderness) are prone to mass wasting in the form of translational landslides, especially in zones of rain-on-snow potential and in areas where high intensity wildfire has occurred. Rockfall and debris avalanches are common in valley headwall areas.

The lower Horse Creek area is more prone to mass wasting due to the steeply incised valleys. Higher strength ridge-capping basalts and intracanyon flows that sit on top of older, less resistant Western Cascade rocks result in differential erosion. This is especially the case in the uplands of Olallie and Foley Ridges. The accumulation of surface deposits in the form of glacial outwash and terrace gravels on the lower slopes provide a large sediment source for debris slides that initiate higher up on the hillslope. High intensity storm and fire events may trigger these debris slides, which become debris flows as they gather wood, water, and sediment along the way downslope.

VEGETATION / DISTURBANCE

The vegetation of the Horse Creek Watershed is characteristic of plant communities west of the Cascade crest. Figure 1-1 and Map 1-4 display the condition of the forests in this area by series. Plant series classification is a convenient and often used way of defining and stratifying these plant communities. The forested plant series typically found in the Western Cascades include:

- 1) Douglas-fir series - (Pseudotsuga menziesii),
- 2) Grand fir series - (Abies grandis),
- 3) Western hemlock - (Tsuga heterophylla),
- 4) Pacific silver fir series - (Abies amabilis),
- 5) Mountain hemlock series - (Tsuga mertensiana)
- 6) Subalpine Communities

Map 1-4 Horse Creek Watershed Forest Series

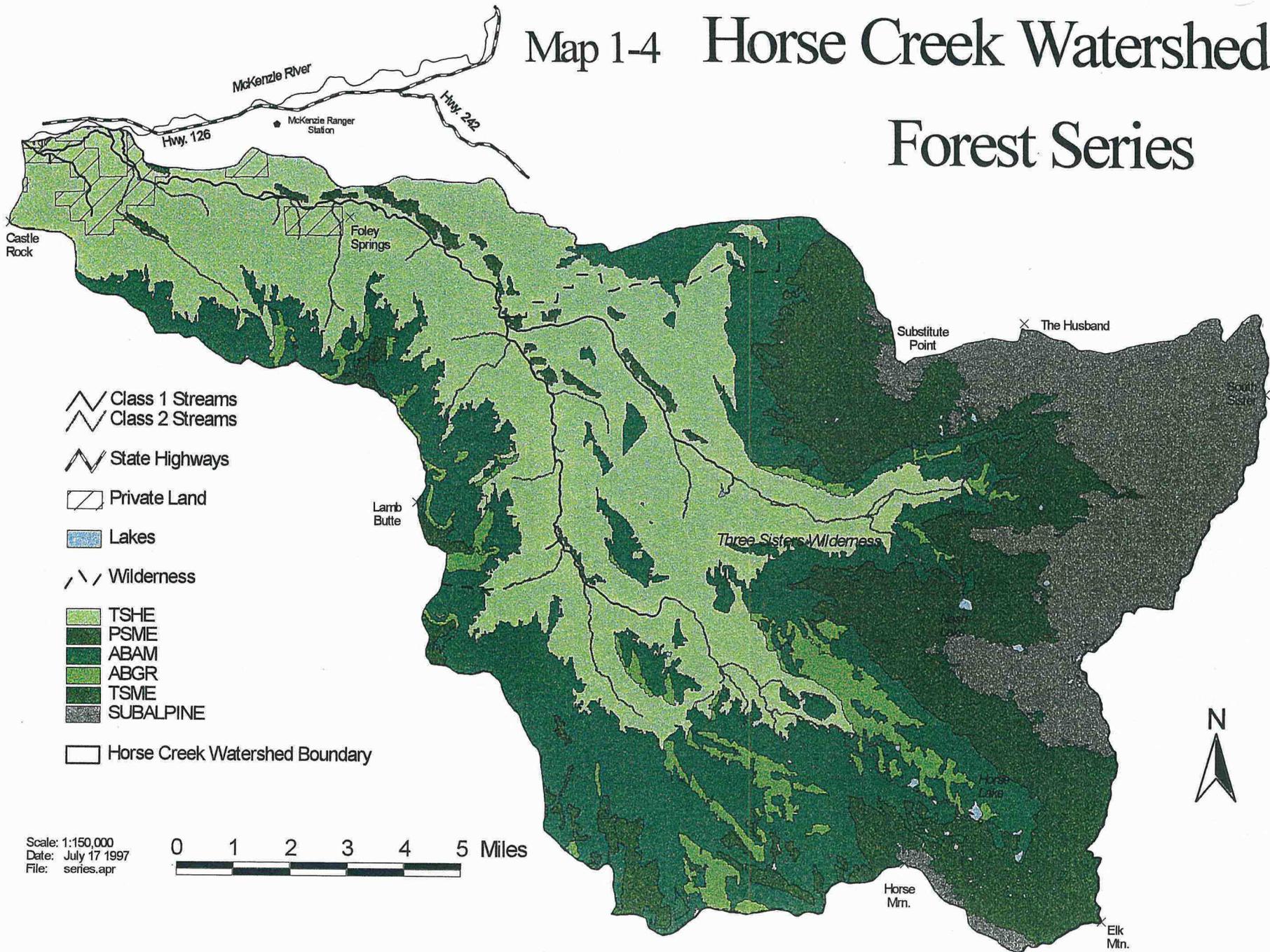
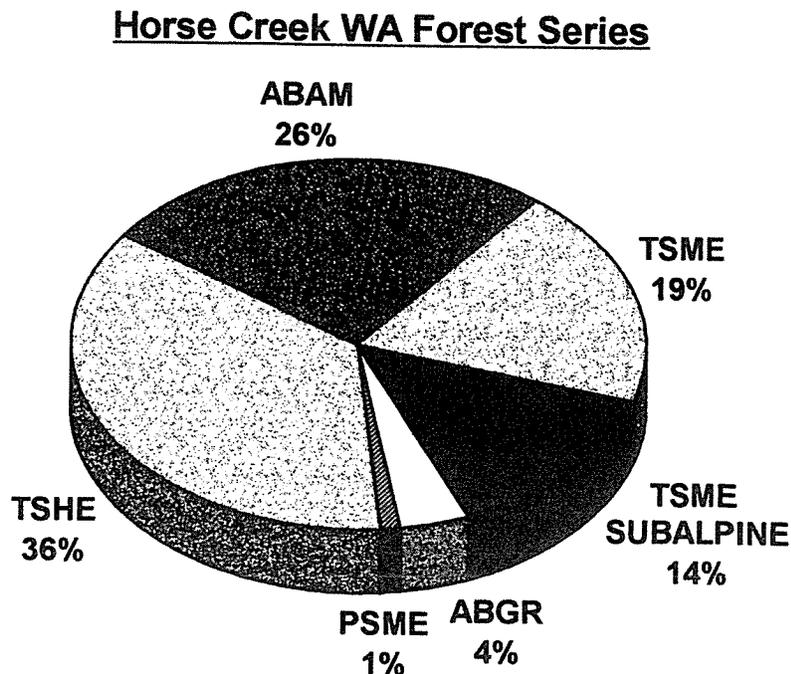


Figure 1-1: Percentage of each plant series in the Horse Creek watershed.



For a more complete description of the environmental conditions, classification system, listings of plant species, and plant association groups for each series, refer to the Willamette National Forest Plant Association and Management Guide (Hemstrom et. al 1987).

RIPARIAN AND AQUATIC RESOURCES

Precipitation within the Horse Creek Watershed is dominated by snow accumulation, with rain and rain-on-snow events occurring at lower elevations in approximately 1/4-1/3 of the watershed. The majority of the wilderness area is located within the permanent snow zone, thereby making it a low probability for a rain-on-snow event to take place. Beneficial uses within the Horse Creek watershed include aquatic life, domestic water supply (lower Horse Creek residents, City of Eugene), and recreation. Aquatic life uses include spawning and rearing habitat for spring chinook and rearing habitat for bull trout in the mainstem of Horse Creek. Separation Creek, a tributary to Horse Creek, provides suspected spawning habitat and rearing habitat for bull trout. Water quality parameters important to spawning and rearing success are low stream temperature, low sediment, and relatively constant flow.

Table 1-2 displays the miles of stream within the Horse Creek Watershed by management allocation and stream class. Map 1-5 shows the distribution of streams by class within the watershed.

Table 1-2: Miles of stream by stream class and acres of wet areas by Management Allocation.

Management Allocation	Class I (miles)	Class II (miles)	Class III (miles)	Class IV (miles)	Lakes and Ponds (acres)
Matrix	0	0	4	5	0
Wilderness	10	31	61	356	231
Late Successional Reserve	9	12	30	104	0
Adaptive Management Area	2	0	0	1	0
Private	4	2	1	1	0
Total	25	45	96	467	231

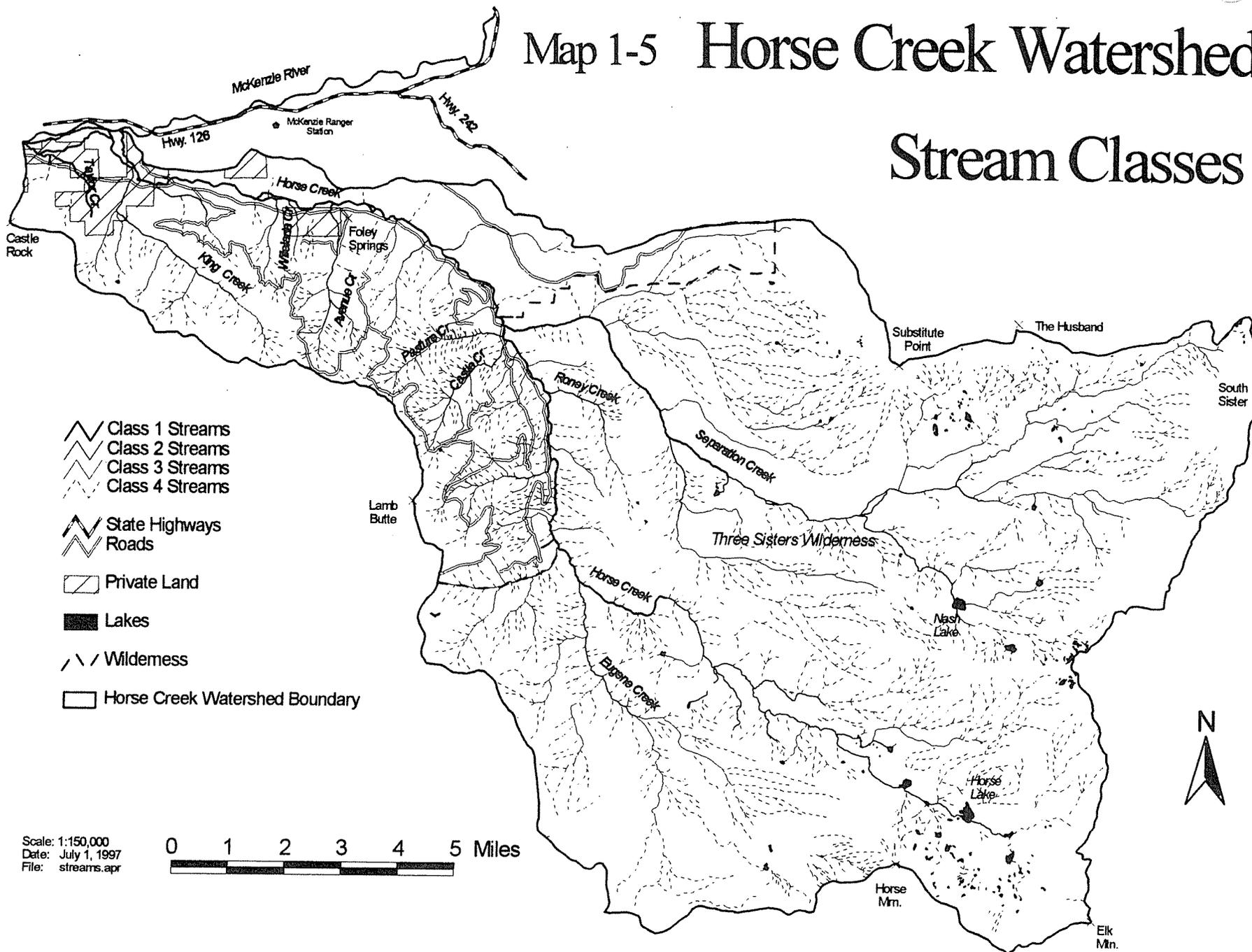
Horse Creek is a major tributary of the McKenzie River. It originates in Sunset and Horse Lake, and flows 28 miles through a glacially carved valley into the south side of the McKenzie River (near McKenzie Bridge). Downstream from Separation Creek, Horse Creek flows within a well-defined channel, dominated by swift riffle and white water stretches. Within the Lower Horse Creek Subwatershed, the channel is relatively unconstrained, allowing the main channel to shift location during large flow events. This is particularly true where Horse Creek flows within the McKenzie River Valley. Following large storm events, multiple channels that flow over a large alluvial fan change locations. Upstream of Separation Creek, Horse Creek flows through a number of broad, active flood plain deposits, often in multiple channels. Large, deep pools are not common in Horse Creek, but smaller pools formed by scour near wood, large rocks, and the stream bank are more common.

Examination of aerial photos from 1955 and 1967 show a decrease in the amount of large wood within the active channel following the 1964 flood. Prior to the 1964 flood, there were large accumulations of wood on point bars and at heads of islands, as well as within the channel which formed jams. Following the flood, salvage operations were extensive as depicted in interdepartmental memos recommending that rootwads and logs be removed to prevent further damage to roads and bridges. Salvage of logs was also recommended to facilitate fish passage as documented in the 1960's and 1970's. Recent events such as the flood in 1996 and stream restoration activities in the early 1990's have restored some of the lost large wood component to the mainstem Horse Creek.

With a few exceptions, the riparian area of Horse Creek is relatively undisturbed by human activities. Large conifers and 30-year old alder dominate the riparian area,

Map 1-5 Horse Creek Watershed

Stream Classes



- Class 1 Streams
- Class 2 Streams
- Class 3 Streams
- Class 4 Streams
- State Highways
- Roads
- Private Land
- Lakes
- Wilderness
- Horse Creek Watershed Boundary

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providing a great potential source for future large wood input to the channel. Large cobble and small boulders dominate the substrate composition in the upper sections of the stream. Fine sediment is generally not a concern in Horse Creek due to the nature of the geology. Late High Cascade lava flows and glacial deposits are the dominant sediment source within the watershed. This geology type results in stream channels low in sediment, and dominated by gravels and cobbles lower in the watershed; excellent substrate for chinook spawning.

Fine sediments entering the Horse Creek system are the result of debris slides and debris flows located in the Lower Horse Creek subwatershed. Initiation of debris slides and debris flows in Lower Horse Creek may be caused by fire, large storm events, and from roads and harvest units. Fine sediment resulting from slides may be more of a localized problem in and near the mouths of tributaries, where timber harvest and road building has affected riparian vegetation, potential in-stream wood, and embeddedness in places. Fine sediment has deposited in side channels of Horse Creek.

Upper Horse Creek, Eugene Creek, Upper Mosquito Creek, Separation Creek, and Roney Creek flow through the Three Sisters Wilderness. Separation Creek is unique among the Horse Creek tributaries. It originates from glaciers on the South Sister and flows west through the wilderness into Horse Creek. The stream's relatively constant flow maintains bank stability, low embeddedness, and a large amount of in-stream wood.

Horse Creek originates from a series of lakes in Three Sisters Wilderness. The major lakes that form Horse Creek include Sunset, Upper Horse, Middle Horse, and Lower Horse Lakes. Of these lakes, Horse Lake is most substantial at 56 acres and 24 feet maximum depth. Although the other lakes are shallower and smaller, all of these lakes have or provide access to spawning gravels for resident and introduced trout species.

Aquatic Species

The fish populations in Horse Creek, its tributaries, and the lakes within the watershed are diverse. In Horse Creek itself, spring chinook salmon, summer steelhead, rainbow, cutthroat, brook and bull trout, mountain whitefish, and several sculpin species occur. In Horse Creek tributaries, cutthroat trout and sculpin are the dominant species. In some of the larger tributaries, rainbow trout occur with the cutthroat trout in low gradient downstream reaches. Bull trout adults and sub-adults and chinook salmon juveniles probably utilize the lower reaches of most of these creeks, particularly during the winter, for foraging and rearing respectively. Bull trout are suspected to spawn and rear in the relatively constant flow and cold water of lower Separation Creek. Introduced to Horse Creek in 1970 but no longer stocked, a remnant population of steelhead still returns to spawn.

The past introduction of non-native trout in the headwater lakes of Horse Creek has and may continue to impact native fish populations in the watershed. The population

of wild cutthroat trout which once inhabited Horse Lake has been displaced by introduced brook trout. Brook trout may also be affecting the populations of wild cutthroat trout which inhabit Middle and Lower Horse Lakes. There is a potential these introduced brook trout may be moving down Horse Creek and may impact bull trout populations. During a night snorkel in a side channel of lower Horse Creek in 1993, suspected bull trout/brook trout hybrid was observed. It is uncertain whether this fish was produced in Horse Creek or somewhere in the upper McKenzie River, but brook trout/bull trout hybrids are a concern in Horse Creek. These fish have developmental problems, their offspring have been shown to be sterile, and the reproductive union depletes genes from the already small bull trout gene pool.

The diversity of fish species that inhabit Horse Creek reflect the diversity of habitat available within the watershed. Although some creeks and lakes within the watershed have been impacted by management, on the whole, Horse Creek is in good condition. Holding and rearing pools, formed by scour associated with wood, rocks, and stream banks, are found throughout the length of Horse Creek. Side channels, important habitat for rearing chinook salmon and refuge from high winter flows, are common. Although tributaries to Horse Creek are generally steep, they also provide spawning and rearing habitat, particularly for cutthroat and rainbow trout and bull trout. Numerous lakes occur in the headwaters, some deep enough to sustain fish populations throughout the winter and some with available spawning habitat.

RECREATION RESOURCES

Recreation takes many forms within the wilderness area of the Horse Creek Watershed. Hiking, horse-back riding, climbing, camping and viewing scenery are the more common pursuits in the Three Sisters Wilderness area.

Horse Creek is a popular fishing destination, particularly from the confluence with Castle Creek, downstream and in its headwater lakes. As ease of access to the creek decreases further upstream, fish resource use also decreases. The anglers are diverse and range from locals to individuals from out of state, and from spinning reel users to expert fly-fishers. The creek is not stocked with hatchery fish.

This area is also popular for deer and elk hunting. Though no records are available for exact numbers of hunters that enter the area, during the fall months traffic is definitely on the rise from hunting parties moving to and from favorite spots. A large portion of the watershed is wilderness, providing the potential for high quality hunting opportunities.

BOTANICAL AND WILDLIFE RESOURCES

Horse Creek Watershed contains potential habitat for over 300 species of wildlife and over 1000 species of plants. Threatened species in the watershed include the northern spotted owl and bald eagle. Endangered species include the peregrine falcon. Sensitive species include the sandhill crane, red-legged frog, wolverine, Townsend's big-eared bat, harlequin duck, and the plant Adder's tongue.

This watershed has a rich diversity of habitats including forests, lakes, wetlands, lava flows, meadows, and alpine areas. The majority of the watershed has not been actively managed for timber resources. Habitats have generally not been degraded. All species that historically occurred in this area are thought to still be present.