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 Upper McKenzie 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). An Integrated Resource Analysis (IRA) and a Watershed Analysis were conducted for the Santiam Pass portion of the watershed in 1993 and 1994, respectively. Information from these documents was incorporated into this analysis.

CHARACTERIZATION OF WATERSHED

LOCATION AND LAND USE

The Upper McKenzie Watershed Analysis Area (UPMKWA) extends north from the town of McKenzie Bridge into the Mt. Jefferson Wilderness. To the east, it abuts the western edge of the Cascade Crest (Figure 1-1). Management objectives on 99% of this landscape are outlined in the Willamette National Forest Land Management Plan (LMP), as amended by the ROD for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA, USDI 1994). Approximately 1% of the watershed is private land. A mix of private timber production and residential uses occur in these areas. Land allocations are listed in Tables 1 and 2 and shown in Figures 2 and 3.

Table 1: Land Allocations within the ROD for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl (USDA, USDI 1994) and the Critical Habitat Unit designated by the USFWS (1991). Several of these allocations overlap.

ROD Allocation	Acres
Late Successional Reserve (large)	111
Late Successional Reserves (100 acre)	4,933
Adaptive Management Area	25,290
Matrix	66,746
Riparian Buffers (w/default widths)	40,416
Critical Habitat Unit	38,074
Key Watershed	134,937

Table 2: Willamette National Forest Land Management Plan land allocations within the Upper McKenzie Watershed.

Management Area Number and Name	Acres
1 Wilderness	79,482
10B Dispersed Recreation-Semiprimitive Motorized	17,651
10C Dispersed Recreation-Semiprimitive Motorized	2,864
10E Dispersed Recreation-Semiprimitive Nonmotorized	14,394
10F Dispersed Recreation-Lakeside Setting	527
11A Scenic-Modification Middleground	6,195
11C Scenic-Partial Retention Middleground	11,579
11E Scenic-Retention Middleground	5,207
11F Scenic-Retention Foreground	7,438
12B Developed Recreation-Special Use Permits	662
13A Special Use Permit Areas	62
13B F.S. Administrative Use Area	53
14A General Forest--Intensive Timber Management	60,078
3A H.J. Andrews Experimental Forest	3
4 Research Natural Areas	1,880
5A Special Interest Areas	5,625
6D Wild and Scenic River - McKenzie River	4,290
7 Old Growth Groves	222
9D Wildlife Habitat-Special Areas	6,313
8000 Private lands	6,389

Figure 1-1. Upper McKenzie Watershed

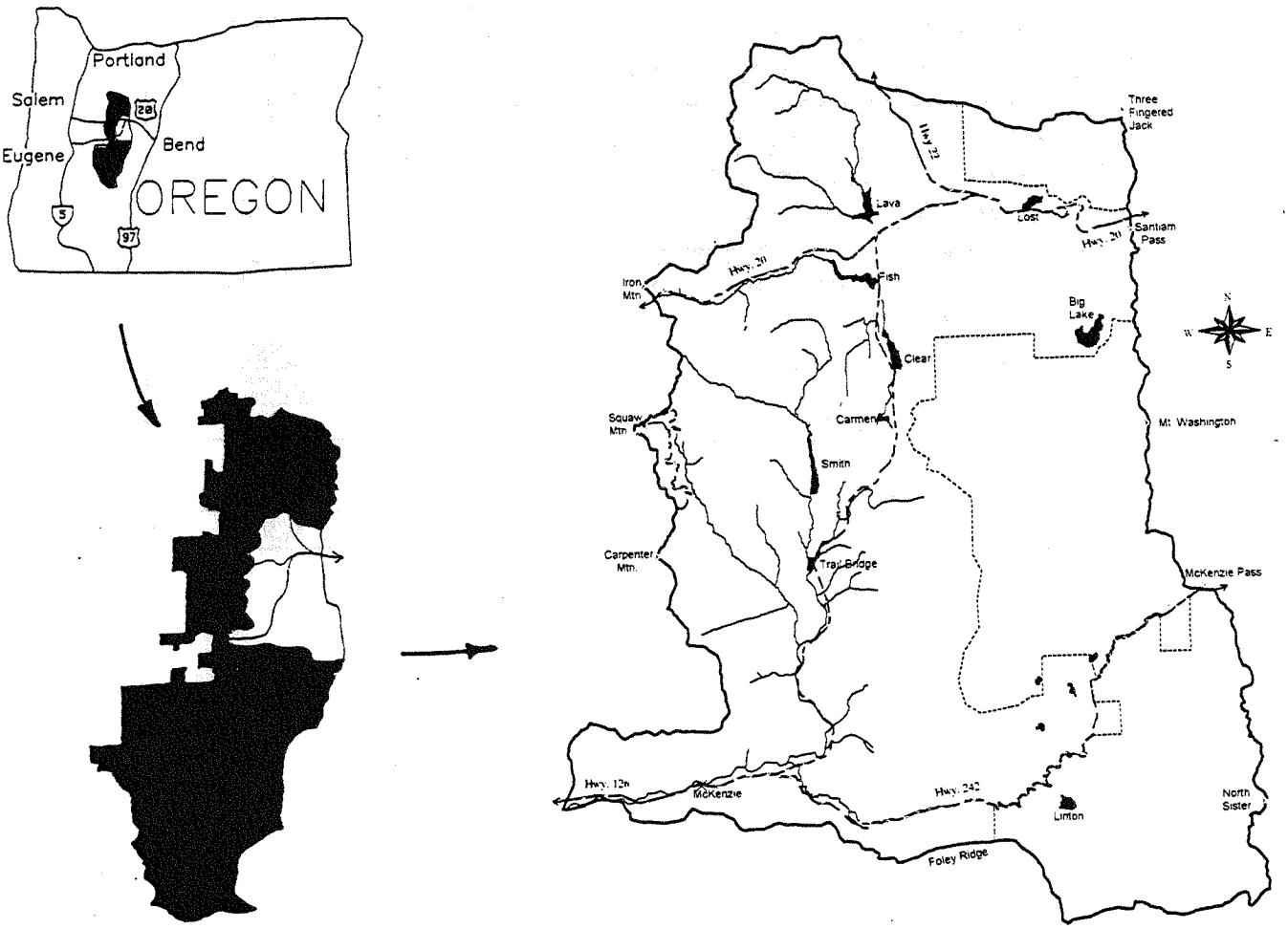


Figure 1-2. 1990 Forest Plan Management Areas

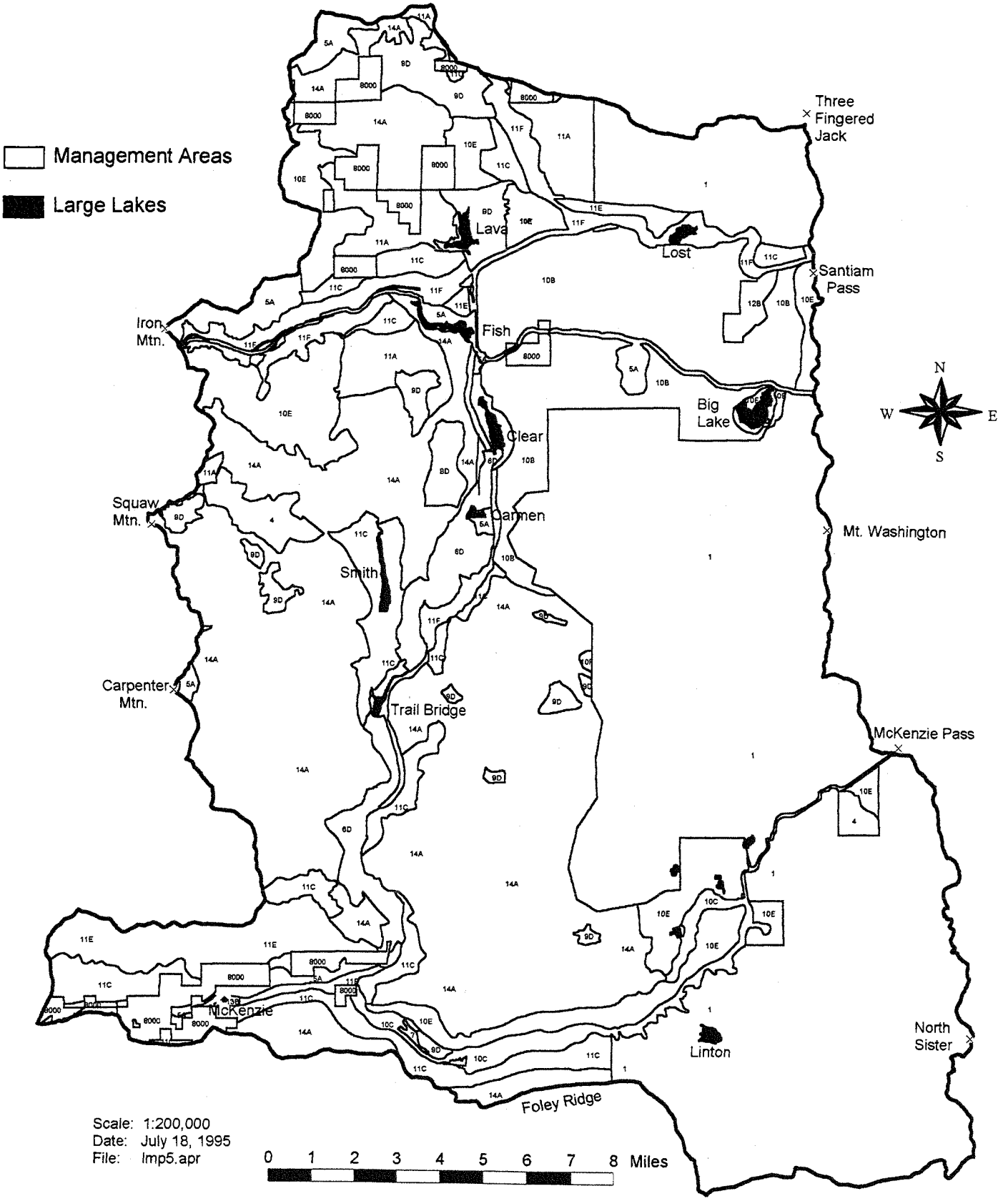


Figure 1-3. ROD Allocations - AMA & Reserves

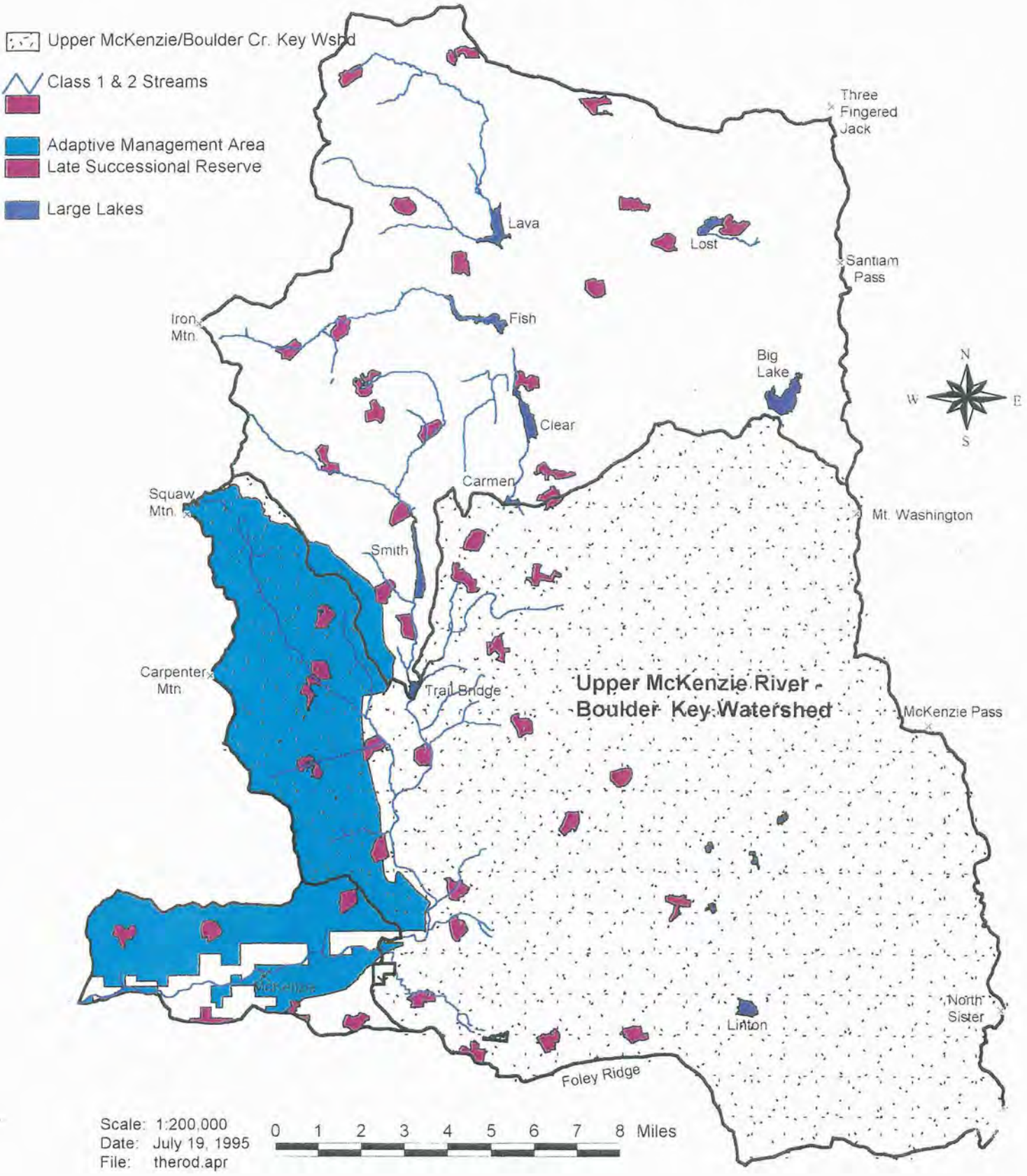
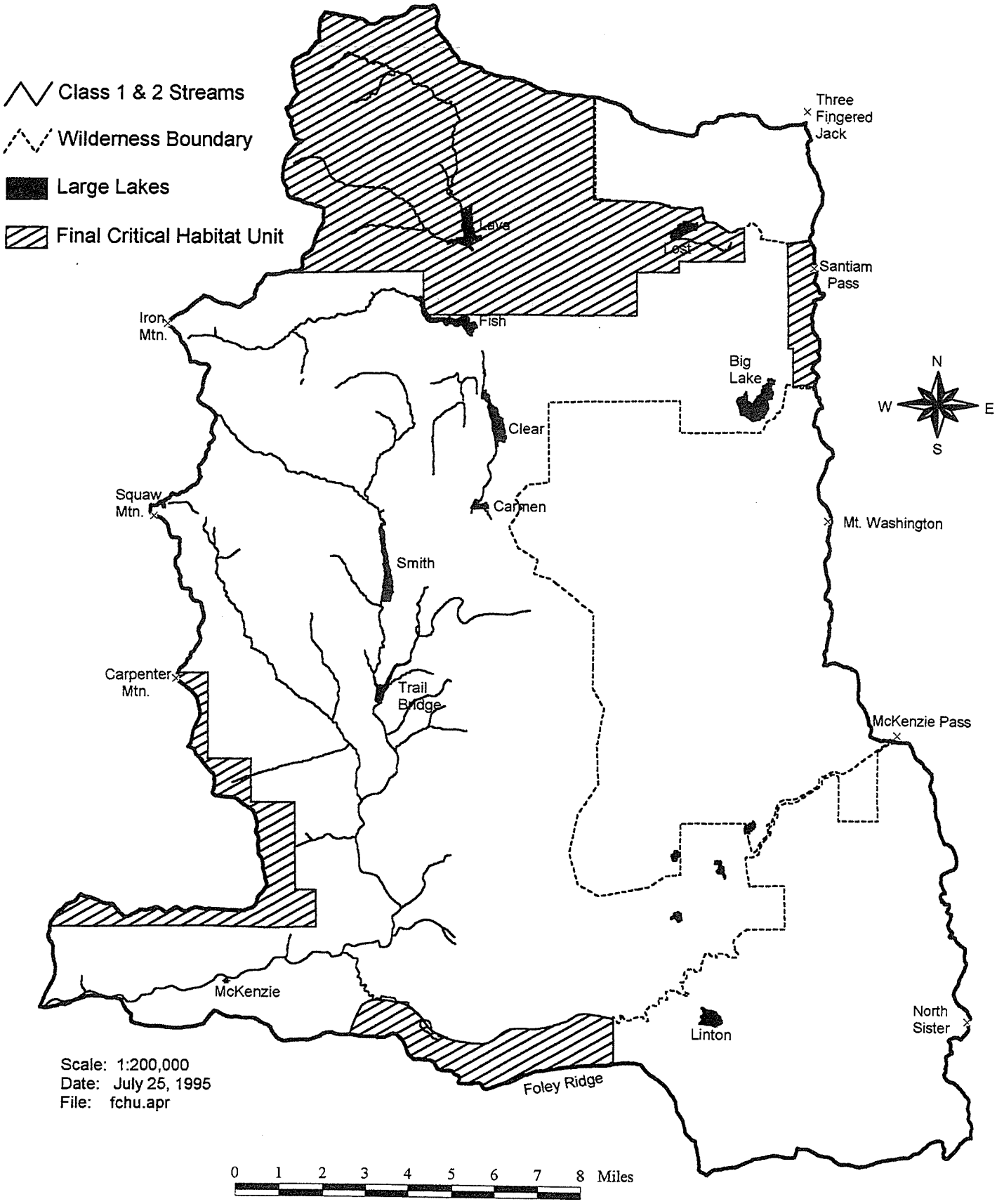


Figure 1-4. FCHU - Final Critical Habitat Units



GEOLOGY AND WATER

The Upper McKenzie Watershed is truly a landscape formed by fire and ice. It is located in a area of volcanic terrain on the west side of the Cascade Range. Two physiographic provinces meet here: the Western Cascades and the High Cascades. The High Cascades are divided into three areas: older, Early High Cascade volcanic flows (9 - 4 million years old); younger, Late High Cascade volcanic flows (4 million - 12,000 years old); and recent volcanic flows (12,000 - 1,500 years old). The Early High Cascade flows are ridge-capping basalts in the highest elevations of the Western Cascades.

Two periods of major faulting took place in the area 8 - 10 million and 4 - 5 million years ago as a result of extension of the Earth's crust. These major northwest-trending fault systems developed near the present boundary of the Western and High Cascades. These fault systems control the north-south flow of many of the upper reaches of Cascade rivers, including the McKenzie, South Fork of the McKenzie, Smith, and North Santiam (Priest et. al. 1983).

Approximately 3 - 5 million years ago, regional uplift began taking place at a rate of approximately 20 centimeters per 1,000 years, which produced an increase in elevation of approximately 1,300 feet. This increase in elevation was associated with an increase in stream gradients, some of which were more than twice their norm (Sherrod 1986). The increased stream gradients produced deeply dissected valleys; increased relief; and created drainage patterns now present in the Western and Early High Cascades.

The early High Cascades and Western Cascades were subsequently eroded by at least three periods of alpine glacial advance down-valley as far as Blue River (Long & Leverton 1984, Scott 1977, Van Dusen 1962). Glacial floods and lower mean sea levels produced further valley scouring. However, subsequent outwash, still water, and landslide deposits (to depths of over 100 feet) refilled the valleys to a base stream level that matches the existing sea level. Valley fills have been drilled to 146 feet in the Blue River area and up to 175 feet in the McKenzie Bridge area (Williamson 1961).

Remnants of these ancient glaciers are found on the side slopes of the Three Sisters, which now contain approximately 5.6 billion cubic feet of ice in five major glaciers The glaciers cover 3.2 square miles (Allen 1985). The younger volcanic flows, which erupted after the ice ages, buried most of the glacial deposits in their path. The extent and volume of these recent lava flows (as recent as 1,500 years ago) combined with their associated cinder cones (over 50 in all) make this watershed geologically unique. These recent lava flows filled ancient valleys and produced water falls, lakes, and underground springs in an abundance not found in other watersheds.

The filtering characteristics of the younger High Cascades lava and glacial deposits produce a subsurface aquifer very low in fine sediments. Unlike streams that flow overland within stream channels, the water that flows subsurface within the upper McKenzie does not have potential to pick up channel sediment, nor is it exposed to air temperatures and direct sunlight that could heat the water. This results in springs with extremely clear and cold water, such as at Clear Lake and Koosah Falls, and the sources of Sweetwater, Anderson, Ollallie, and Lost Creeks. Because these creeks were filled by

younger High Cascade lava flows, they flow within channels that have broad valley bottoms that are not incised or entrenched.

In contrast, streams such as Kink, Twisty, Boulder, and Scott Creeks that flow over the lava of the older High Cascades and glacial deposits have more incised channels than those flowing over the New High Cascades. The channels are more incised because they have downcut through the glacial deposits, returning to their original channels within the older High Cascades lava that have been subjected to fluvial processes for a longer period of time. The upstream portions of these channels are intermittent where streams flow over the top of the glacial deposits and have not cut down into the underlying lava of the older High Cascades.

Streams within the Western Cascades, such as Frissel, Deer and its tributaries, and Hackleman (in the upper reaches) have been greatly modified by fluvial processes including downcutting and mass wasting of unstable hillslopes. These processes, which began when the uplift of the block produced steep gradients, continue to this day. Water that flows from the Western Cascades generally contains more sediment and is warmer than water from the High Cascades.

FISH RESOURCES

The geological processes of this landscape have played an essential role in determining the Upper McKenzie Watershed aquatic community. Following the most recent glacial periods, this portion of the McKenzie River began to be inhabited by the aquatic animals currently present. This diverse aquatic community has adapted to many landscape processes including erosion, groundwater storage and delivery, and large woody debris transport. Our understanding of the aquatic organisms and their interactions among themselves and their landscape is limited. Animals of cultural or economic value are better known and will be described in this analysis.

To understand the aquatic community of this portion of the McKenzie basin, it is best to first review two general types of geology described above that shape habitat elements of the aquatic community. The processes of storage and delivery of large quantities of groundwater in the High Cascades, and erosion, sediment, and debris transport in the Western Cascades have created numerous habitat types that provide for sixteen suspected or documented fish species. The New High Cascades, with their constant, cold, clear water flow, host an aquatic community adapted to a narrow range of environmental conditions. Bull trout spend a portion of their life in the New High Cascades by utilizing the spring-fed portions of the subbasin as spawning and rearing habitat. Willamette spring Chinook, returning to the McKenzie River as adults, also seek out cool water temperatures in the upper subbasin and utilize gravel and cobble-rich portions of rivers and streams as spawning habitat. Much of the necessary sized gravel and cobble sought by spring Chinook originated from the Western Cascades, and these substrates now compose a significant portion of the McKenzie riverbed. Here in the Upper McKenzie Watershed, the landscape to which these two species have adapted is due to the contact between the Western and High Cascades.

VEGETATION

Upper McKenzie vegetation is generally characteristic of vegetation west of the Cascade crest. Forested 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 (*Pseudosuga 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*)

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).

Douglas-fir

The Douglas-fir series occurs on warm, relatively dry sites at lower elevations on southerly exposures. Major tree species include Douglas-fir, incense cedar, and grand fir. Douglas-fir generally dominates both the canopy and regeneration layers. Common dry site indicator species associated with the Douglas-fir series are chinkapin, madrone, oceanspray, poison oak, salal, dwarf Oregon grape, whipple vine, and grasses.

Grand fir

The grand fir plant series represents cool and relatively dry conditions, often found in the transition areas between the western hemlock and the Pacific silver fir series. Within the watershed, it is found on relatively dry, south-facing slopes and excessively well-drained soils of relatively recent volcanic origin. Important species include Douglas fir, grand fir, lodgepole pine, western white pine, subalpine fir, Prince's pine, dwarf Oregon grape, vanilla leaf, and beargrass.

The grand fir series is common in the 3500 to 4500 feet elevation band on the relatively droughty volcanic soils between Clear Lake and Santiam Pass within the UPMKWA. It is also found in isolated pockets in the Lava Lake and Parks Creek area.

Western hemlock

The western hemlock series occurs on warm, moist sites over a wide variety of slope and topography. Common species within the series include: Douglas-fir, western hemlock, western red cedar, bigleaf maple, red alder, vine maple, dwarf Oregon grape, salal, rhododendron, swordfern, vanilla leaf, Oregon oxalis, twinflower, and redwoods violet.

The western hemlock series is common along the McKenzie River valley and lower elevations throughout the Upper McKenzie.

Pacific silver fir

The Pacific silver fir series represents cool, moist conditions on upper slopes. Important species include: Douglas-fir, noble fir, Pacific silver fir, mountain hemlock, western hemlock, vine maple, dwarf Oregon grape, big huckleberry, rhododendron, grouse huckleberry, coolwort foamflower, false solomonseal, queencup beadlily, dogwood bunchberry, sidebells pyrola, and beargrass.

The Pacific silver fir series dominates moist upper-slopes, from approximately 3500 to 5000 feet elevation within the UPMKWA.

Mountain Hemlock

The mountain hemlock series occurs in cold, moist conditions at upper elevations. Most of the annual precipitation in this series falls as snow and results in a deep long-lasting snowpack. Important species include: mountain hemlock, subalpine fir, lodgepole pine, western white pine, whitebark pine, Engelmann spruce, big huckleberry, grouse huckleberry, Prince's pine, and beargrass.

The mountain hemlock zone (Franklin & Dryness 1973) can be divided into two major subzones, a lower subzone of closed forest and an upper parklike subzone. In the lower subzone, there is an essentially continuous forest cover of mountain hemlock and its associates. The upper zone (subalpine parkland) is a mosaic of forest patches and tree groups interspersed with shrubby or herbaceous subalpine communities.

The mountain hemlock series dominates the high elevation, greater than 4400 ft. elevation. It occurs all along the Cascade crest within the Upper McKenzie. The subalpine parkland subzone is typically found at elevations greater than 5600 ft.

Fire

The fire history of the watershed is similar to other westside Cascade watersheds. Return intervals and fire intensities are related to the plant association for an area and the age and health of the stand. The historic fire return intervals vary from low-intensity ground fires at approximately 25 to 110 year intervals to high-intensity stand-replacing fires at intervals of 100-200 years and greater.

Unique Botanical Resources

The Upper McKenzie watershed consists of many interesting and unique non-forest plant communities. Extreme ranges in temperature, wind, elevation, and soils contribute to making this a unique botanical area. A spring hike to Iron Mountain is filled with colors from the variety of wildflowers in bloom. Later in the summer as the snow melts in the wilderness areas, hikers are surrounded by meadows of lush vegetation and the majestic beauty of the Oregon Cascades. Wild huckleberry picking is an annual event for many in the late summer. A drive along Highway 20, 242, and 126 in the fall rewards the viewer to the brilliant red colors of vine maple against the stark gray background of the lava fields.

The watershed is home to many rare plants. Two sensitive plants, Newberry's gentian (*Gentiana newberyi*) and Mountain grapefern (*Botrychium montanum*) are the only known populations on the Willamette National Forest. Several botanical Special Interest Areas and Old-Growth Groves are also located within the watershed. These areas have been recognized for their outstanding biological and ecological contributions to forest ecosystems. Two Research Natural Areas in the watershed are biotic preserves of ecological and genetic diversity. There are hundreds of non-forested plant communities that range from low elevation meadows to subalpine rock gardens. The Upper McKenzie watershed is a botanical delight to be enjoyed by all.

WILDLIFE

The geological processes that shaped this landscape have heavily influenced the variety of wildlife habitat that exists here. These influences, combined with the ecotonal effects of the Cascade Crest, have created habitat that is unique on the Willamette National Forest. In the higher elevations, xeric sand blow outs provide habitat for the rare short-horned lizards and lava tubes provide homes to Townsend's Big-eared bats. In the lower elevations, mesic old-growth forests on deep soils provide habitat for high densities of spotted owls and red-backed tree voles. Volcanic eruptions dammed rivers to create lakes that are important winter stopovers for migrating water fowl; and golden eagles utilize updrafts created by the cinder cones. Harlequin ducks flourish in the amazingly clean water of the McKenzie River. Spotted frogs and sandhill cranes breed in the high elevation marshes. Other unique species, including the goshawk, great gray owl, wolverine, western pond turtle, and black-backed woodpecker help to make the Upper McKenzie the most species' rich watershed on the Forest.

HUMAN USE

The McKenzie River corridor had its scenic beauty and recreation potential noted by the earliest explorers and settlers of the area. In fact, some settlers used the recreation resources as their economic base as much as farming or ranching. A distinctive note about the town of McKenzie Bridge, when compared to most Oregon Cascade mountain settlements, is that the area did not develop around a lumber mill. Although logging eventually became a major economic feature, tourism and visitor services provided by lodges, inns, hot springs, and outfitters were the original features of the area.

This area has many major destinations that would individually be seen as the crown jewels of other regions: all within an hour drive of each other. Places such as Sahalie, Koosah, and Proxy Falls are often featured on calendars and advertising photos. Dee Wright Observatory, the historic stretch of Highway 242, and the lava fields are unique features in Oregon. Fish Lake Guard Station has been in continuous use as a commercial station and later as a Forest Service working station since the 1870's. Clear Lake, with its outstanding water clarity, allows views of the submerged forest flooded during the lake's formation 3,000 years ago. The McKenzie River itself is an outstanding feature with white water rafting, fishing, and recreation facilities that have been the focus of visitors since the earliest travel routes allowed access.

Prehistoric heritage resources are not well-understood at this time. This portion of the Cascades was occupied primarily by people indigenous to the Cascades, probably ancestral to the Molalla people.

CONTEXT OF THE WATERSHED

It is important to understand how a particular watershed functions within a larger landscape. Watersheds are not closed systems. The condition of the surrounding area will influence patterns and processes within the watershed. The following is a brief overview of the context of the Upper McKenzie Watershed as it lies in the McKenzie Subbasin and Willamette Basin.

LANDUSE–McKenzie Subbasin

The Upper McKenzie Watershed contains the headwaters of the McKenzie River Subbasin, which is part of the Willamette River Basin. A Watershed Council for the McKenzie Subbasin has been in existence since June of 1993. The purpose of this group is to provide a consensus-based forum to address issues affecting the watershed. Council partners include representatives from local, state, and federal agencies, special interest groups, and residents.

In 1990, 22,648 people lived in the McKenzie Subbasin; 9,512 in rural areas and 13,136 in urban areas (McKenzie Watershed Council 1994. Approximately 61% of the subbasin is managed by the USFS and 6% by the Bureau of Land Management. Other government agencies manage 1%; industrial forest land comprises 22%; and other private uses including residential areas and agricultural lands fall on 10% of the subbasin.

Harvestable forest lands account for 49% of the McKenzie Subbasin. Industrial forest companies manage approximately 45% of the harvestable base. These figures are approximate due to portions of industrial forest land subject to restrictions on harvest, such as riparian buffer zones, and some acres small woodland owners may log. One third of USFS lands within the subbasin are in harvest allocations.

Development and demands for recreation along the river is widespread and growing. People use the McKenzie river and its adjacent lands for fishing, hunting, hiking, biking, photography, picnicking, boating, and swimming. Fishing and boating are the are the most popular uses.

WATER MANAGEMENT–McKenzie Subbasin and Willamette Basin

The Upper McKenzie Watershed represents 25% of the McKenzie River Subbasin. The water of the McKenzie River is one of the most cherished resources of the subbasin. In addition to providing habitat for fish and other aquatic species the McKenzie River provides drinking water for over 200,000 people in the Willamette Valley.

Five dams lie within the Subbasin: three on the mainstem and two on tributaries. There are eight additional dams in the Willamette Basin. The dams were constructed for flood control within the Willamette Valley. During flood season, the dams provide maximum flood control storage space. In February, the space reserved for flood control storage is gradually filled. Flood control regulation is based primarily on downstream channel capacities and reservoir storage space available (US Army Corps of Engineers 1989). Augmented flows released from the reservoirs during the months of low precipitation and streamflow helps to meet DEQ water quality standards (dissolved oxygen, temperature, dissolved solids) in the Willamette River downstream from Corvallis to Portland. The dams also supply hydroelectric power to the Eugene Water and Electric Board, which sells some to the Bonneville Power Administration.

FISH AND WILDLIFE RESOURCES–McKenzie Subbasin

Twenty-three fish species are native to the McKenzie subbasin. The bull trout has been identified as eligible but precluded for listing under the ESA. The Willamette spring chinook has been identified as a stock-at-risk.

Three hundred and twenty nine wildlife species live within the subbasin. Habitat for these species has been influenced during the past 100 years by timber harvest and residential development. In the future under the President's Plan, the eastern portion of the watershed will provide the majority of the late successional habitat. The majority of the high quality blocks are in high elevation wilderness areas. Small patches of BLM land in the western portion of the subbasin may provide some connectivity between the Coast Range and the Cascades. Intervening private timber lands will be maintained in early and mid seral stages.