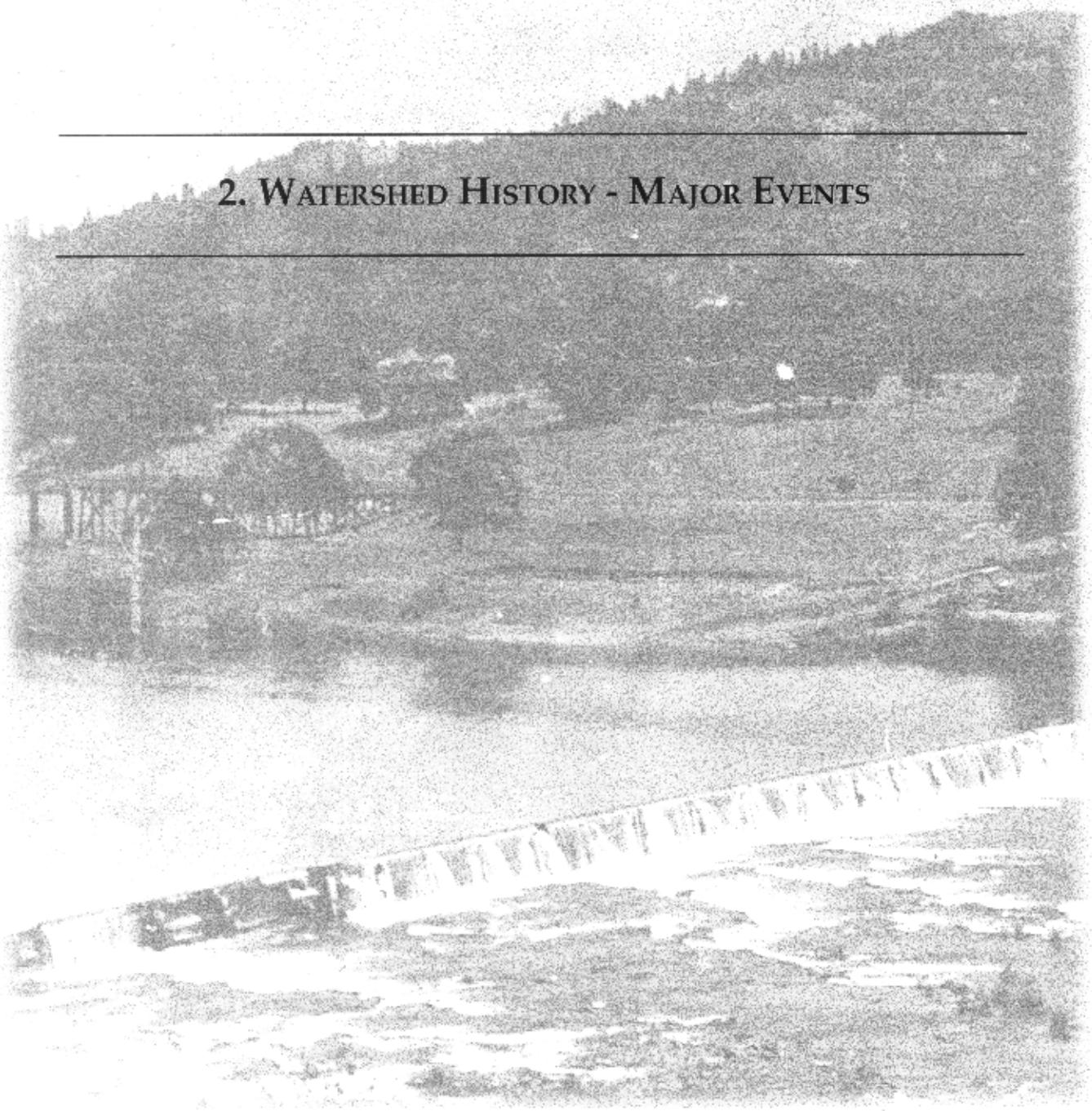
2. Watershed History - Major Events



2. WATERSHED HISTORY – MAJOR EVENTS

This section, organized into four parts, describes the major events, both natural and human, that have shaped the North Umpqua watershed. Introductory material describing the relevance of these events to the watershed analysis is presented in Section 2.1. The methods used to identify important events and evaluate their significance are described in Section 2.2. The geomorphic events and processes that have shaped watershed landforms are described in Section 2.3. The human history of the area is discussed in Section 2.4, which includes information on human occupation, river alterations, road construction, agriculture, timber harvest, mining, fisheries, and hydroelectric power development.

2.1 INTRODUCTION

An understanding of the historical events that have influenced the North Umpqua watershed is important for two reasons. First, it facilitates the description of watershed reference conditions prior to significant human disturbance. Second, it identifies the events that may still be influencing current watershed or channel conditions. The information presented in this section, in combination with Section 1 (Characterization of the Watershed), provides the appropriate context for understanding the current features and processes of the watershed.

2.2 METHODS

Geomorphic processes and landscape evolution in the basin were reconstructed by combining information derived from a review of geologic literature describing the Oregon Cascades with field observations in the North Umpqua River basin. Information describing human occupation and activities that have affected the watershed was collected from historical accounts of western Oregon and Douglas County. This information was supplemented by historical photographs from the collections of the Douglas County Museum and from U. S. Geological Survey publications. Interviews with private citizens and local, state and federal resource agency representatives provided additional information on local events influencing the watershed, particularly timber harvest and hydroelectric development.

2.3 GEOMORPHIC HISTORY

2.3.1 Overview

The geology and present landscape of the North Umpqua basin reflect an underlying structure established by tectonic and volcanic activity over the last 40 million years and by more recent Pleistocene Epoch glacial and Holocene Epoch interglacial activity. The landscape of the North Umpqua basin bears the imprint of the High and Western Cascade basaltic flows; the glacial and fluvial valley carving and glacial outwash deposition associated with Pleistocene alpine glaciations; the incision of valley fills caused by the shift to a drier, warmer Holocene climate; and

the effects of the eruption of Mt. Mazama 7,500 years ago, which blanketed the area with thick pumice and ash (USDA Forest Service 1997). Changing conditions within the fluvial, glacial, and mass wasting systems in the late Holocene have also caused adjustments in the valley features and channel morphology of streams in the watershed analysis study area.

2.3.2 Pleistocene Glaciations and Early Holocene

Region-wide glaciations during the late Pleistocene Epoch that are responsible for forming much of the current landscape include at least three alpine glacial and interglacial periods from 132,000 to 10,000 years ago. The Pleistocene continental ice sheet capped the entire High Cascade geologic province as late as 11,000 years ago (Sherrod 1986), deeply weathering and eroding the underlying High Cascade basaltic and andesitic deposits in the North Umpqua basin at elevations generally above 4,400 feet (1,350 meters). Valley glaciers extended for dozens of miles from the summit ice fields of Mt. Mazama down major valleys of otherwise unglaciated areas on the western and eastern slopes of the Cascades during the late Pleistocene. In the North Umpqua River basin, glaciers likely reached at least as far as Rock Creek (Crandell 1965) between 32,000 and 25,000 years ago. The most recent glacial episode (25,000 to 12,000 years ago) did not extend farther than Stump Lake.

Beginning about 12,000 years ago, the climate gradually shifted from the cool (about 5°C [9°F] colder than modern temperatures), wet conditions of the Pleistocene to the warmer, drier climate of the Holocene. Recession of glaciers left behind a low-relief cap of thick glacial drift in elevations above 1,350 m (4,400 ft) and massive deposits of unconsolidated, unvegetated glacial till. During the paraglacial period (12,000 to 9,000 years ago), these deposits were carried by water from the hillslopes to the channels during storm events. This process caused rapid sedimentation of entire valleys and stream channels in parts of the North Umpqua River basin with reworked glacial till. Field observations indicate that glacial outwash filled the channel of the North Umpqua River up to as much as 18 m (59 ft) in elevation above its present active bed during this time.

Temperatures have oscillated by a few degrees Centigrade since the shift to a warmer climate about 12,000 years ago, which affected the geomorphic regimes in the watershed. As temperatures increased between 10,000 and 9,000 years ago to levels 2°C (3.6^{o} F) warmer than today, a transition from the aggradational regime in valleys during the paraglacial period to a degradational (downcutting) regime likely occurred in the North Umpqua basin. Cessation of paraglacial sedimentation, increased vegetation densities and colluvial (hillslope sediment) buildup, and later development of conifer forests likely reduced sediment yields to stream channels between 9,000 and 6,000 years ago (Schumm 1965, Reneau et al. 1989). This resulted in incision of valley fills that had built up during the paraglacial period and formation of present-day alluvial and glaciofluvial stream-cut terraces in the lower reaches of Steamboat and Canton creeks and the North Umpqua River. Although warmer, drier conditions in the Cascades during this period may have caused increased summer fires and subsequent debris flow activity during intense storms, the overall pattern of valley degradation dominated. Streams in the Oregon Cascade Range likely approximated their present-day morphology after about 6,000 years ago (Benda 1994).

2.3.3 Eruption of Mt. Mazama

The Cascade Range was among the most volcanically active regions in the world during the late Quaternary. In the largest volcanic event in the Holocene in the area of the North Umpqua River basin, Mt. Mazama cataclysmically erupted approximately 7,500 years ago, and, losing its top, formed Crater Lake (Peck et al. 1964). Enormous volumes of volcanic ash and dust were expelled and swept down the slopes as ashflows and avalanches, and tephra-fall and pyroclastic-flow deposits from the eruption buried the till left by Pleistocene glaciations. This event primarily affected the upper watershed above Toketee Falls by choking streams with pumice and causing acid fallout and extreme increases in water turbidity, which likely led to an immediate extirpation of many organisms in much of the upper North Umpqua watershed.

2.3.4 Recent Holocene Climate Variations and Associated Debris Flow Activity

Since the eruption of Mt. Mazama, late Holocene climate fluctuations have influenced geomorphic processes in the North Umpqua region. In the Little Ice Age (1300 to 1860), 2°C (3.6^{o}F) cooler temperatures and higher precipitation levels caused the world-wide advance of glaciers to pre-Holocene positions. During the early part of this period, increased frequency of large storms and floods led to increased mass wasting and floodplain aggradation (Knox 1984), with especially pronounced debris flow activity in the Cascades between 1565 and 1670 (Osterkamp and Hupp 1987). In the North Umpqua River basin, certain geomorphic features appear to reflect a period of summer fires and subsequent high debris flow activity around 1560 (USDA Forest Service 1996a). Debris torrents, which are triggered when wildfires and storms lead to hillslope debris avalanches, are the geomorphic process that causes the most significant disturbances in high- and low-order channel morphology.

The transition out of the Little Ice Age has occurred since about 1860, during which time increased greenhouse gas emissions have been accompanied by rising temperatures. Large losses of glacier ice in most mountain ranges of the world and increased runoff levels have perturbed alpine geomorphic systems and created conditions conducive to mass wasting (Evans and Clague 1994). High precipitation between 1947 and 1981, one of the wettest half-century intervals of the past 1,000 years, may have triggered an increase in the background levels of natural landsliding.

Given the inherent link between hillslope and channel processes, episodic mass wasting events on hillslopes and associated bed material waves in channels probably dominated channel morphology in the North Umpqua River basin prior to human disturbance. Such events have a natural recurrence interval of 100 to 200 years in the Western Cascades (Muhs et al. 1987) and are tied to fire and flood frequency. Floods in 1861 and 1890 were likely accompanied by debris torrents in the mainstems of the North Umpqua River and Steamboat Creek. The 1964 flood, and associated streamside landsliding and debris flows, significantly reworked valley floors in the Cascade region and changed channel morphologies, effectively obscuring channel changes which had occurred in the previous 100 to 1,000 years.

In the North Umpqua basin, the hydrologic response of stream to storms is linked to the nature of underlying bedrock. In the area east of Toketee Falls, which is in the High Cascade geologic province, the geomorphic effects of the 1964 storm were attenuated by the high infiltration capacity of the fractured and permeable basalt and pumice in this area. In the Western Cascade geologic province, the response was severe due to the low water storage capacity of the weathered andesite and basalt. Tributary basins experienced extensive debris slides and debris flows as evidenced by the debris deposits at the confluences of the large streams, and major streams experienced debris torrents, possible channel widening, and associated loss of riparian zones. Major geomorphic changes do not appear to have occurred following the 1964 storm in the mainstem North Umpqua River downstream of the hydroelectric project area, where the river is naturally highly confined in a bedrock gorge.

Climatic variations are typically accompanied by variations in the frequency and apparent severity of fires, which can be an important source of surface erosion and debris flow activity. While major natural crown fires have a return period of about 300 years in the Cascades, fire frequency in various subbasins of the North Umpqua watershed have been estimated at 20 to 100 years (Little River), 140 to 200 years (Fairy Creek), 20 to 120 years (Canton Creek), 44 years (moderate-severity fires, Clearwater Creek) and less than 150 years (Cedar Creek) (USDA Forest Service 1995, USDA Forest Service 1994, USBLM 1995, USDA Forest Service 1996). The last large fires in the North Umpqua River watershed occurred in 1889 and 1910. Fire suppression this century has altered natural fire dynamics in the Cascades, reducing the frequency of small fires and associated surface erosion but exacerbating the risk of high-intensity fires and larger mass wasting events (USDA Forest Service 1997a).

2.4 HUMAN HISTORY

Human activities have influenced the Umpqua watershed and its biological processes in many ways, ranging from limited impacts associated with subsistence-based occupation to the more recent effects associated with the cultural and social transition in the West from an agricultural, grazing economy into a modern, industrial economy. The following text provides an overview of human actions that have influenced both the Umpqua River basin and those that more directly affect the watershed analysis study area.

2.4.1 Human Occupation

Prior to European settlement, the Umpqua River basin was occupied by five distinct tribes of American Indians, including the Southern Molalla, Cow Creek Band of Umpqua, Umpqua, Yoncalla (or Calapooia), and the Lower Umpqua. In the North Umpqua River basin, results of radiocarbon testing of several archaeological sites in the Dry Creek and Medicine Creek drainage and other areas have shown that the area was inhabited prior to the eruption of Mt. Mazama, which occurred about 7,500 years ago. The existence of these peoples depended on harvesting natural resources throughout the basin. For example, American Indians in the basin used weirs and spears to harvest salmon and other fish, gathered seeds, berries, roots and bulbs, and participated in game drives to capture deer (Beckham and Minor 1992). Elevational movements

occurred in order to take advantage of seasonally available food resources (Beckham and Minor 1992).

By the 1850s, a population of only about 125 of the Umpqua Tribe lived on the North Umpqua River (Beckham and Minor 1992). However, this was following significant population declines resulting from disease epidemics which decimated American Indian populations in western Oregon in the early 1830s (Beckham and Minor 1992). In addition, a hemisphere-wide smallpox epidemic occurred from 1520 to 1524 that was estimated to have caused mortality rates of around 75 percent (Dobyns 1983); therefore, American Indian populations in the Umpqua basin prior to this period may have been considerably larger. The American Indians in the Umpqua River basin are known to have used fire to facilitate harvest of tarweed seeds and remove the forest understory to encourage production of berry and browse for deer (Beckham 1986, Beckham and Shaffer 1991). Long-term effects of American Indians on the habitats and native species of the basin are unknown, but are presumed to be minor in comparison to the impacts resulting from settlement of the area by European-Americans.

It appears that British and American ships first began exploring the estuary and river mouth in the 1790s (Beckham and Minor 1992). Inland expeditions in the 1820s resulted in the establishment of a local fur trade, primarily focusing on beaver, that was active in the lower Umpqua basin during the period of about 1820 to 1850. The first permanent European-American settlement is thought to have been Fort Umpqua, the Hudson's Bay Company post built in 1836 near the confluence of Elk Creek and the Umpqua River. More substantial European-American immigration and settlement into the region began in 1848. Within three generations, most of the communities now present in the Umpqua River basin were established (Beckham 1986).

The rough terrain of the North Umpqua watershed study area prevented European-American exploration of the area until the mid-1800s. Steamboat Creek basin was first explored by miners in about 1860 in the vicinity of City Creek, a tributary to Steamboat Creek (Bakken 1970, USDA Forest Service 1997b). Cattle grazing occurred in the area around Rock Creek by 1885 and, shortly thereafter, the community of Hoaglin was established. Hoaglin consisted of about 15 families located on Rock Creek two miles upstream from the North Umpqua River. This town included a post office, a sawmill, and fish hatchery (USDI Bureau of Land Management 1996).

Between the 1920s and the 1970s, the area surrounding the confluence of Steamboat Creek and the North Umpqua River was occupied by fishing camps, lodges, and a Forest Service ranger station. In 1880, Bill Bradley entered the area of Dry Creek, a tributary of the North Umpqua River between Steamboat Creek and Copeland Creek, and built a cabin there. In 1907, Perry Wright applied for a homestead and in 1909, several more applications for homesteads were filed. During this period, the Forest Service established small field stations throughout the upper North Umpqua River basin (Wright and Catley 1982).

The area around Toketee Falls was first occupied by European-Americans between 1907 and 1910 when a cabin was built and vegetation was cleared for the initial stages of a proposed hydroelectric development (Wright and Catley 1982). However, no settlements or developments

were completed at this time. Development began at Toketee Falls in 1946 when surveys commenced for the hydroelectric project currently operated by PacifiCorp (Boyle 1977), that . The construction of the hydroelectric project and the desire to extract timber contributed to the development of the road network in the basin, linking the area to the rest of Oregon. This resulted in increased occupation and establishment of new enterprises (Wright and Catley 1982). The Diamond Lake resort area was established in the 1920s.

Human waste from previous and existing settlements has been introduced to the North Umpqua River watershed analysis area in various stages of treatment, introducing nutrients that affect primary production and water quality. In the past, waste treatment has ranged from none (open pipes discharging into streams) to well-designed drain fields. In 1971 and 1972, PacifiCorp and the U.S. Forest Service conducted a study on nutrient sources of Toketee Lake. Samples collected adjacent to Clearwater Village and Toketee Ranger Station had high nitrate concentrations, indicating septic tank influence. Septic systems adjacent to Toketee Lake were subsequently improved, but no samples have been collected recently (PacifiCorp 1995, Vol. 21).

During the hydroelectric plant construction period (1947-56) at Toketee, waste was treated in septic systems and drain fields or pumped and transported to landfills (C. Meracle, pers. com., 1997). At Diamond Lake, waste from the resort (including fish entrails) is routed into a lagoon that drains into pumice within the Lake Creek basin; the subsequent fate of these nutrients is unknown. Waste from private houses along the lakeshore undergoes various treatments from none (outhouses) to sand filters; some nutrients certainly enter the lake in this area (G. Farrell, pers. com. 1997). Waste from small resorts (Lemolo Lake) and various campgrounds is dispersed in drain fields or pumped from vault toilets, and that from the Steamboat Inn is pumped to a soil bench and drain field. At the ODOT housing area near Steamboat Creek, treated waste is directly discharged into the North Umpqua river, but this system may be replaced with a sand filter (S. Wert, pers. com. 1997). The Glide area of the North Umpqua River has a sewer system and treatment plant. Currently, most treatment systems in the watershed analysis area are adequate to reduce nutrient discharges into the river to non-measurable levels (S. Wert, pers. com., 1997).

2.4.2 River Alterations

Some of the most important effects of human activities on the Umpqua River have been direct modifications to the channel and estuary. These actions have included blasting rocks, dredging, harbor and breakwall construction, and the addition of large rock and log structures. These activities may also have affected fish habitat and/or migration patterns during time of work. Some of these activities are described below.

The Umpqua River estuary is the fourth largest estuary in Oregon (ODFW 1979). Although surveys in 1854 and 1879 indicated that the Umpqua River estuary at the Pacific Ocean was relatively navigable, modifications began in 1916 that produced substantial changes in the estuary. These included construction of the 1,980-meter (6,500 foot) long north jetty during 1916 to 1927, the south jetty during 1930 to 1938, and associated channel dredging (Beckham 1986). Between 1945 and 1967, Winchester Bay, located at the mouth of the Umpqua River, was rapidly

developed which included dredging of channels, construction of breakwaters, filling of tidelands and construction of campgrounds, parking areas, and docks (CH2M 1956, Hinsdale 1970). Tidal marshes in the estuary were diked in order to create farmland and to develop Reedsport and Winchester Bay. Due in part to extensive diking, filling and sedimentation of marshes and tidelands, the estuary is now primarily subtidal and riverine in nature (C. Burns, pers. com. 1997).

On the mainstem Umpqua River, rocks and shoals were blasted and excavated between 1871 and 1897 in an attempt to facilitate steamboat navigation between Gardiner and Roseburg (Beckham 1986). In 1871, engineers removed 1,888 yards of rock from rapids downstream of Roseburg. Rock and shoals near Scottsburg were blasted and dredged in 1886 to create a channel 15-meter (50 feet) wide and 0.6-meter (two-feet) deep at low water. Between 1891 and 1893, 780 cubic yards (1,200 tons) of rock were blasted and hauled out of the main channel and an additional 633 cubic yards (990 tons) of rock were blasted and removed in 1897.

In the North Umpqua River, rock was blasted at the aboriginal fishing site at the Narrows in 1904 to facilitate log passage (Bakken 1970). Other undocumented in-channel blasting is believed to have also occurred in the North and South Umpqua rivers during this period (Bakken 1970).

2.4.3 Road Construction

Road construction can affect watersheds by causing siltation, altering stream channels, destabilizing steep slopes, inhibiting fish movement through culverts, and creating access for human settlement and extraction. By 1900, the mainstem Umpqua River valley was laced with roads, often following rivers and streams, connecting the many established towns. In contrast, the watershed analysis study area was accessible only by foot and pack trail until the 1890s.

The first roads in the watershed analysis study area included one constructed in 1899 that followed Rock Creek for two miles upstream from its mouth, and one built in 1898 from Klamath County to Diamond Lake (Bakken 1970). In 1925, a dirt road was completed between Diamond Lake and Big Camas Ranger Station on Fish Creek (Bakken 1970). In 1926, a primitive dirt road was built from Rock Creek to the confluence of Steamboat Creek, and by 1939, dirt roads connected the Steamboat Creek area with Diamond Lake (Bakken 1970).

Between 1947 and 1964, the precursor to what is now the North Umpqua Highway State Route 138 was constructed, then widened and paved. At some points along this route, it was necessary to cut and fill tributary channels at their mouths, to route tributary flow through culverts, and to straighten and stabilize portions of riverbank (Bakken 1970). During the December 1964 flood, several portions of the highway and some bridges washed out. For example, a sizable section of the highway washed into the Clearwater River downstream from the hydroelectric project's Clearwater No. 2 diversion dam (B. Keesee, pers. com. 1993). Ongoing maintenance work occurs on this highway during the summer and periodically when rockfalls, mudslides, and river erosion warrant such activities.

Most roads arterial to State Route 138 were built after 1946 in conjunction with either hydroelectric project construction and/or timber harvest. These roads typically parallel streams and generally incorporate culverts and bridges at stream crossings. Road density in areas of timber harvest are two to four miles of road per square mile (USDA Forest Service 1996a, 1997a, 1997b; USDI Bureau of Land Management 1995, 1996). Spills of gasoline and diesel fuel occasionally occur from the tank trucks servicing construction and logging equipment on roads directly adjacent to the river and its tributaries (USDA Forest Service 1993). Highway maintenance has included brush clearing and herbicide spraying.

2.4.4 Agriculture and Livestock

Agriculture and livestock grazing were established in the 1830s by early settlers in the low hills and floodplains of the Umpqua River. During the 1890s, sheep grazing was widespread and unregulated although some restrictions were established when the Umpqua National Forest was created in 1907. Today, cattle and sheep are abundant in the lower North Umpqua and Umpqua river basins, but not in areas upstream of Rock Creek. This is because in the North Umpqua River watershed analysis area, the rugged, forested terrain leaves very little land suitable for agriculture or grazing. Consequently, there are no commercial or otherwise substantial agricultural or livestock operations in this area, although small numbers of cattle were grazed on open range between 1909 and 1930 in the vicinities of Illihe near Dry Creek, Mountain Meadows on the north side of the North Umpqua River near the Lemolo No. 2 forebay, and Fish Creek Desert near the Fish Creek forebay (Wright and Catley 1982). There are currently two grazing allotments within the watershed analysis area, both in the Fish Creek drainage (C. Burns, pers. com, 1997). Because there is no substantial agriculture and only minimal use of water for domestic and hatchery purposes, the watershed analysis area has probably not been affected by water withdrawals from the North Umpqua River.

2.4.5 Timber Harvest

The timber industry has been an important element of the Umpqua River basin economy for over one hundred years. Small-scale logging began in the 1860s (Brauner and Honey 1977, as cited in USDA Forest Service 1993b). Initially, logging was mostly limited to the estuary region where logs could be easily floated and shipped. Timber harvest escalated after 1885 due to increased use of steam donkeys and small railroads and in the 1930s with the expansion of roads. Annual log production in Douglas County ranged from 100 to 900 million board-feet between 1935 and 1947, and exceeded one billion board-feet from 1948 to 1966 (DCPD 1968).

Through the 1970s, harvest practices in the basin included removal of riparian trees, removal of logs and woody debris from stream channels, and construction of roads along valley bottoms. Logs were transported by whatever routes were available. Splash dams were sometimes built on tributary streams and breached to transport logs to the mainstem Umpqua River, especially in Coast Range streams as documented in historical photographs of Smith River, Schofield Creek, and Camp Creek (FCO and OSGC 1946, LUHS 1976, Douglas County Museum photo archives).

Splash dams created for logging were implicated in the destruction of salmon habitat in Camp Creek (FCO and OSGC 1946).

Limited timber operations in the watershed analysis study area began as early as 1876 with the establishment of a small sawmill operated near Tioga located at the confluence of Rock Creek and the North Umpqua River. By 1904, larger-scale harvesting was underway locally in the Rock Creek basin (Bakken 1970). During this period, timbermen attempted several log drives down the North Umpqua River although these drives proved infeasible. Stream channels sometimes served as skid roads for log transport (Clare and Marston 1968, as interpreted by Dambacher 1991). In the upper Steamboat Creek basin, virtually all of the streams adjacent to roads were cleared of large wood (USDA Forest Service 1997b).

The rugged terrain of the watershed analysis study area inhibited access to much of the forest until the post-World War II era when road construction and timber extraction escalated through the 1970s. In the Umpqua National Forest Diamond Lake Ranger District, for example, commercial harvesting per acre by decade was: 445 in the 1940s, 3,280 in the 1950s, 10,434 in the 1960s, 15,310 in the 1970s, and 11,401 in the 1980s (USDA Forest Service database, Diamond Lake RD). In the 1930s, Bureau of Land Management lands in the Rock Creek watershed consisted of late seral (greater than 80 years of age) forest and 97 percent of the vegetation within 180 feet of streams was late-seral (USDI Bureau of Land Management, 1996). The first timber sale in the Rock Creek watershed was in 1941 (USDI Bureau of Land Management, 1996). By 1990, 34 percent of the Steamboat Creek basin forest had been clear-cut (Holaday 1992) Today, the bulk of the remaining old-growth forest in the Steamboat Creek basin occurs in fragmented stands (USDA Forest Service 1993b).

In addition to timber harvest, there have been other commercial uses of the forest including collection of firewood, beargrass, hardwood shrubs, Christmas trees and boughs, matsutake and other mushrooms, princess pine, and yew wood (USDA Forest Service 1996a). Forests in the watershed have also been affected by introduced insects and pathogens, such as the fungus white pine blister rust which is one of the "...most important disturbance agents in the Upper Clearwater watershed" (USDA Forest Service 1996a), causing mortality or die-back of western white pines and whitebark pine. Forest management practices in the study area have included fertilization of harvest units. Fire suppression has accompanied timber harvest into the North Umpqua basin and has increased fuel loads and locally-increased potential for local, high-intensity fires (USDA Forest Service 1997a).

2.4.6 Mining

Mining can affect riverine systems when the actions include removal or manipulation of rock and gravels in streambeds, especially gravel mining or placer mining when unconsolidated gravel or sand deposits are worked by washing, dredging, or other hydraulic methods.

In the North Umpqua River watershed analysis area, mining for gold has occurred in a few small areas, mostly in the upper Steamboat Creek basin where gold was discovered in 1863 (USDA

Forest Service 1997). Following a surge of mining claims, the Bohemia mining district and city of Bohemia was established in 1867 in the headwaters of City Creek (USDA Forest Service 1997b). In 1868 Bohemia City had cabins, a hotel, a saloon, a gold mill and over 100 men (USDA Forest Service 1997b). The area had peaks of mining activity during 1889 to 1906, 1934 to 1945, and the mid-1950s in City Creek, Horse Heaven Creek, and Little Rock Creek (tributaries to Steamboat Creek) basins (USDA Forest Service 1997b). Early mining used picks, shovels, and dynamite to find gold but some placer mining may have also occurred (Walling 1884; Brauner and Honey 1977, as cited in USDA Forest Service 1993b). Activities associated with mining included large amounts of local timber cutting for use in buildings, mine timbers, and for heat (USDA Forest Service 1997). On the North Umpqua River, a 40-foot-long tunnel mine (Laugh's Mine) with several smaller shafts is located several hundred meters downstream of Calf Creek although no mineral production was reported from it. Limited coal mining occurred on the North Umpqua River and in the Little River area.

2.4.7 Fisheries

Humans can alter fish populations by over-harvesting certain species, sizes, and/or runs of fish, altering habitat, introducing competition or predation by non-native fish, or reducing genetic integrity and fitness via artificial propagation. Human activities that have affected fish populations and habitat in the Umpqua basin and in the watershed analysis study area are described below.

Commercial fisheries

Commercial salmon fishing was an important element of Douglas County's economy from 1870 until 1940 (FCO and OSGC 1946; Beckham 1986). Most commercial fishing occurred on the lower portions of the Umpqua River near the towns of Gardiner and Reedsport, both located within the tidally-influenced zone of the river, where several canneries were in operation by the early 1900s (LUHS 1976, Beckham 1986). Salmon and trout were commercially harvested in the late 1800s near Roseburg, Winchester Dam, and Tioga. Most commercially harvested fish were taken using set or drift gillnets in the estuary or along river margins (Beckham 1986). Pilchard and crabs were also harvested in the estuary (FCO and OSGC 1946).

Indications of declining salmon runs in the Umpqua River were described as early as 1901, when the State of Oregon's master fish warden reported that:

> "the Umpqua is one of our rivers that derive its waters from the Western slope of the Cascade mountains; in consequence of this, it always has been frequented by an early variety of the Chinook salmon but of late years this species is almost extinct, but with a well established hatchery plant some place on its upper waters, there is no reason why this should not be overcome and the stream built up and made as it once was, one of the best streams that the state has." (ODF 1903).

Heavy commercial harvesting of spring and fall chinook salmon in the 1920s and coho salmon in the 1930s may have caused declining run sizes (FCO and OSGC 1946). Although there was no

deliberate commercial fishery for steelhead, high incidental catches in shad and coho salmon nets during the mid 1920s were implicated in reducing the run size of summer steelhead during subsequent years (FCO and OSGC 1946). Generally, commercial harvest gradually increased from 1916 to 1923, but in 1924 sixteen additional gillnet boats arrived from the Columbia River, producing an all-time high commercial effort in the Umpqua River in the mid-1920s. As run sizes diminished during the late 1920s, commercial effort dropped for most species until fish prices increased after the Depression when another boost in fishing effort occurred, primarily for fall chinook and coho salmon. Commercial salmon fishing was heavily reduced by regulation in the early 1940s in the hope that populations would rebound, but only coho salmon showed evidence of increasing run size as of 1946 (FCO and OSGC 1946).

Recreational fisheries

Sport fishing has been popular throughout the Umpqua River basin for salmon, steelhead, trout, and other fish (shad, smallmouth bass, striped bass, sturgeon). In the lower Umpqua River, recreational fishing was limited by a lack of rental boats until 1946, when two resorts were developed between Reedsport and Gardiner (FCO and OSGC 1946). The development of Winchester Bay and its harbor facilities, as well as other boat facilities, from the 1940s through 1960s, led to increased sport effort and harvest of salmon (CH2M 1956).

On the North Umpqua River, substantial sports fisheries exist for steelhead, spring chinook salmon, coho salmon, and trout. Upstream from Rock Creek, regulations have prohibited harvest of salmon since the mid-1940s. The reach between Rock Creek and the Soda Springs powerhouse is world-renowned as a high-quality flyfishing stream for summer steelhead (Baughman 1995) and fishing gear has been restricted to artificial flies since 1953.

In September 1996, the Umpqua River population of coastal cutthroat trout was listed under the ESA as an endangered species due to “extremely low and declining numbers of adult cutthroat trout counted at Winchester Dam...” since the mid-1950s (NMFS 1996a). Beginning in 1997, fishing for all trout except steelhead was prohibited in the mainstem and North Umpqua rivers and all tributaries downstream of Soda Springs dam, and all wild steelhead caught in the artificial fly water of the North Umpqua River must now be released (ODFW 1997c).

Lakes and reservoirs in the North Umpqua River watershed analysis area also support recreational harvest of trout. The Diamond Lake area became popular for trout fishing in the 1920s after rainbow trout were stocked into this previously fishless lake (Bauer 1976), and has since been operated as a productive fishery for planted rainbow trout. Lemolo and Toketee lakes, Soda Springs reservoir, and the forebays created by the North Umpqua Hydroelectric project provide recreational fishing (PacifiCorp 1995, Vol. 26). Although these waters were originally planted with trout by the Oregon Department of Fish and Wildlife, they have not been stocked since the mid-1970s and now provide high-quality fishing of wild trout.

Illegal harvest

Illegal methods such as blasting, snagging, spearing, gillnetting, dipnetting and shooting have commonly been used to harvest adult summer steelhead, spring chinook salmon, and other fish throughout the Umpqua River basin, and have locally caused substantial mortality of some fish runs (D. Loomis, pers. com. 1997). For example, Steamboat Creek has been closed to angling and harvest of all fish since 1932 to protect summer steelhead, which spend the summer and fall in holding pools where they are particularly vulnerable, but illegal harvest has nevertheless been documented in Steamboat Creek during recent years (Baughman 1995, Dambacher 1991) and undoubtedly occurred during the early mining and logging years. Because the potential for illegal harvest to impact fish runs is high, the Oregon Department of Fish and Wildlife and Oregon State Police cooperate in annual enforcement plans specifically to deter illegal fish harvest in the Umpqua River basin (D. Loomis, pers. com. 1997).

Harvest for egg production

Besides harvest for sport, subsistence, and commercial purposes, steelhead and salmon in the Umpqua watershed have also been harvested for egg production. Fish racks were installed in the North Umpqua River as early as 1900 to collect eggs of spring chinook salmon for artificial propagation. Between 1902 and 1925, temporary racks were installed downstream of Rock Creek. These were replaced by permanent racks from 1926 to 1942 (FCO and OSGC 1946). Juveniles produced from most eggs taken this way were released within the Umpqua River drainage, but 34 million eggs were shipped out of the basin, including 24 million between 1914 and 1919 (FCO and OSGC 1946). Steelhead eggs were also collected, with three million taken between 1939 and 1946 and the juveniles released mostly within the Umpqua River basin (FCO and OSGC 1946). There have been no hatchery programs for winter steelhead, fall chinook salmon, or Pacific lamprey on the North Umpqua River.

Fish habitat modifications

In an effort to partially offset past LWD removal from stream channels, logs and boulder structures have been placed in some tributaries to the North Umpqua River; this continues to be an occasional activity of the USDA Forest Service in the watershed analysis study area. During the 1980s, over 500 structures were placed in Steamboat Creek to improve fish rearing habitat (Dambacher 1991). In 1996, several hundred large logs were placed in Cedar Creek (a tributary to Steamboat Creek). A fish ladder was installed in 1959 at Steamboat Falls—a seasonal obstacle to upstream migration of fish—to facilitate fish passage during low flows (Dambacher 1991). In the North Umpqua River, log weirs and boulders were placed in the Soda Springs bypass reach (between the dam and the powerhouse) in 1992 to hold gravel. Gravel is periodically placed in this reach to create spawning habitat for spring chinook salmon.

Introduction of non-native fish

Several species of introduced fish have become established in the Umpqua River basin. In the mainstem Umpqua River, striped bass, smallmouth bass, and American shad are common, and are potential predators on and/or competitors with native fish species. American shad and striped bass were first recorded in the Umpqua River basin in 1888 and 1941, respectively (FCO and OSGC 1946). Although rainbow trout and cutthroat trout are native to the North Umpqua river downstream of Soda Springs dam, hatchery-bred strains of these species have been stocked in the past. Cutthroat trout were stocked between 1961 and 1973, and catchable-sized rainbow trout were stocked until 1997, when this planting program was ended to protect native cutthroat trout.

In the watershed analysis area, brown trout, brook trout, and rainbow trout were introduced several times during 1900s through 1970s and have succeeded in establishing themselves as self-sustaining populations in various river systems. Stocking hatchery-produced trout into streams and lakes throughout the watershed was a fairly common practice between 1930 and 1975. Diamond Lake and Lemolo Lake contain substantial numbers of tui chubs, which are believed to have been introduced in the 1930s, and Lemolo Lake contains a population of kokanee (landlocked sockeye salmon) that were stocked in the mid-1900s. Diamond Lake was historically fishless, but is currently stocked with about 400,000 rainbow trout (primarily fry) annually; other waters upstream of Soda Springs dam have not been stocked with hatchery fish since the mid-1970s.

2.4.8 Wildlife and Recreation

Hunting and trapping of beaver, deer, elk, bear, mountain lion, bobcat, wolf, coyote, and other furbearers were common activities of early mountain men and settlers in the North Umpqua River basin (Bakken 1970, Catley 1982). Today, the North Umpqua River basin remains a popular area for hunting deer, elk, black bear, mountain lion, coyotes, mountain quail, grouse, and other animals. Wildlife populations that may have been extirpated or reduced by human activities include wolf, wolverine, and fisher. Beaver may have been reduced by trapping during the fur trade era of the mid-1800s. Recreational activities affecting the basin include camping, hiking, boating, whitewater rafting and kayaking, skiing, and snowmobiling.

2.4.9 Hydroelectric Power Development

Winchester Dam was the first hydroelectric facility built on the North Umpqua River. The dam, which was constructed in 1890, was seven feet high (FCO and OSGC 1946). The dam was raised sometime between 1904 and 1922 (Bakken 1970, Boyle 1977) to its present height of 14 feet. It may have inhibited or blocked upstream movement of fish during low-flow conditions (FCO and OSGC 1946) although a fish ladder was constructed in 1946 to facilitate upstream passage of adult salmonids. This dam is no longer used for hydroelectric generation, but is retained for irrigation and to maintain the existing river scenery for local residents as well as for the fish counting station associated with the fish ladder.

The hydroelectric potential of the upper portion of the North Umpqua River was first documented in 1907 by a team of surveyors working for the Southern Pacific Railroad Company. In the late 1920s, John C. Boyle, an engineer for the California Oregon Power Company (Copco), developed the initial plan for the North Umpqua Hydroelectric Project.

During the 1940s, the southern Oregon population and economy boomed, causing increased demand for electricity. The area was subject to service interruptions and power outages, restricting the growth of local industry. In response to this growing need, Copco filed applications to the state and federal regulatory agencies for the North Umpqua project. Approval of the plan by the Hydroelectric Commission of Oregon hinged on Copco agreeing to work with the government in developing and improving local roads, and to limit the project geographically to the rugged areas in the upper watershed, so as not to damage the growing tourist and recreation industry along the Rock Creek and Steamboat Creek areas of the North Umpqua River. In 1947, licenses to construct the first of the North Umpqua facilities were issued and work was initiated (Boyle 1977). The first of the eight developments at Toketee was completed in 1949, and the other seven developments were all completed by 1956 (Boyle 1977).

The hydroelectric project was designed to use native materials and involved constructing about 70 miles of road, 40 miles of canals and flumes, eight dams and powerhouses, and several smaller diversion dams. It involved harvesting 43 million board feet of timber, of which 21 million board feet were used in construction of the project (Boyle 1977).

The project diverts flow from about 40 miles of stream channel in the North Umpqua River, Clearwater River, Fish Creek and Deer Creek drainages. Three reservoirs, several smaller impoundments, and four forebay ponds were created. Construction of the hydroelectric project, roads, and the highway in the early 1950s periodically caused fluctuations in the water level and high turbidity in the North Umpqua River; turbidity made the river unfishable at times, as anglers couldn't see fish (Baughman 1995). The project reservoirs, ranging in size from 32 to 400 acres, inundated forested river bottoms which had already been logged.

The Lemolo No. 1 development is the most upstream on the North Umpqua River and includes a 270-meter (885-foot) long, 37 meter (120-foot) high rock-filled dam that contains 180-hectare (450-acre) Lemolo Lake. Except for the instream flow release and occasional higher flood flows, water exiting Lemolo Lake is conveyed about five miles via a system of waterways (mostly open canals), then discharged through the Lemolo No.1 powerhouse into the North Umpqua River. Discharged water is immediately re-diverted by the low-head Lemolo No. 2 dam into a second waterway for a 21-kilometer (13-mile) journey to the Lemolo No. 2 forebay and powerhouse. Water thus discharged enters Toketee Lake, where it joins water discharged from the Clearwater River and its developments.

The Clearwater No. 1 development is the uppermost facility on the Clearwater River, a tributary to the North Umpqua River. The dam is predominantly an earthfill structure, five meters (17 feet) high and 425 (1,400) feet long, which creates 6-hectare (15-acre) Stump Lake. Except for the instream flow release of five cfs and higher flood flows, water is conveyed about three miles in

waterways to the Clearwater No. 1 forebay and powerhouse. From there, water is immediately diverted by the Clearwater No. 2 dam into a second waterway and conveyed 10 kilometers (6 miles) to the Clearwater No. 2 forebay and powerhouse, which discharges into Toketee Lake.

The Toketee development is located at the confluence of the Clearwater and North Umpqua rivers. The largest unit of the North Umpqua Project, Toketee consists of an earthfill dam about 18 meters (58 feet) high and 420 meters (1,381) feet long (which creates the 40-hectare [100-acre] Toketee Lake), a 3.2-kilometer (2 mile) tunnel, and a 3-generator powerhouse. Toketee is unique in the project because the water is carried through an underground tunnel to the powerhouse, rather than through canals; also, because the Toketee plant contains three indoor turbines, whereas the other plants are single outdoor turbines. Water discharged from the Toketee powerhouse into the North Umpqua River joins that discharged from Fish Creek powerhouse.

The Fish Creek development diverts water via a low-head dam on Fish Creek, a tributary to the North Umpqua River, and conveys it about five miles to the Fish Creek forebay and powerhouse. Downstream from Toketee on the North Umpqua River, the Slide Creek development uses an 5-meter (18-foot) high concrete dam to divert water about 3.2 kilometers (2 miles) through an open canal to the Slide Creek powerhouse, which discharges into Soda Springs reservoir.

The Soda Springs development is the farthest downstream, and consists of a thin-arch concrete dam that creates a 13-hectare (32-acre) reservoir. About 610 meters (2,000 feet) of penstock deliver water from the dam to the Soda Springs powerhouse. From the Soda Springs powerhouse, water is discharged into the free-flowing, Wild and Scenic portion of the North Umpqua River. Water from Lemolo Lake travels about 37 kilometers (23 miles) and is used by five different powerhouses before it reaches the Wild and Scenic reach.