LOWER ROGUE WATERSHED ASSESSMENT

Lower Rogue Watershed Council

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Prepared by

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ABSTRACT

Thank you for your interest in The *Lower Rogue Watershed Assessment*. The Lower Rogue Watershed Council's mission is: To help foster, develop and coordinate a basin-wide approach to resource planning and management so as to protect, enhance and restore the natural resources of the entire Rogue Basin through a framework of assessing the Lower Rogue Watershed's conditions and trends, implementing and monitoring proven management practices, and testing new management practices that are designed to support environmental integrity and economic stability for the communities of the Lower Rogue Watershed. The "Lower Rogue Watershed" consists of all lands and waters that drain into the Rogue and Illinois Rivers within Curry County.

ACKNOWLEDGEMENTS

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OUTLINE

The Lower Rogue Watershed Council Assessment is organized into thirteen chapters:

REVIEWERS

Chapter(s)	Reviewers	Group/Agency
Watershed Characterization	John Wilson	Lower Rogue Watershed Council
Watershed Issues	Pete Aspinwall	Lower Rogue Watershed Council
Ecoregions	Scott Thiemann	Lower Rogue Watershed Council
Channel Habitat Types	Steve Mazur	Oregon Department of Fish and Wildlife
Fish and Habitat	Mark Lottis	Curry Sportfishing Association
	Todd Confer	Oregon Department of Fish and Wildlife
	James Simino	United States Forest Service
Water Quality	Cindy Myers	Lower Rogue and South Coast Watershed Councils
	Clare Bowen	Lower Rogue Watershed Council
Sediment	James Simino	United States Forest Service
Riparian	Steve Mazur	Oregon Department of Fish and Wildlife
	Ron Ray	Lower Rogue Watershed Council
	Ray Adams	Lower Rogue Watershed Council
Hydrology Water Use	Hilaire Peck	United States Forest Service
	Dennis Graves	Lower Rogue Watershed Council

This document is also available online at http://www.currywatersheds.org. We hope that you enjoy the assessment and find it as useful. If you have any comments please contact us at 541-247-2755 or dana.hicks@oacd.org.

I WATERSHED CHARACTERIZATION

A INTRODUCTION

The Lower Rogue watershed is defined herein for the purposes of this assessment as the Rogue River and its tributaries downstream from river mile 55, at the Curry County/Josephine County Line in Southwest Oregon. While the Lower Rogue Watershed Council includes the Illinois River and it's tributaries below river mile 6.6 in its interest, this area is considered by the state of Oregon as part of the Illinois River Watershed and has been assessed by the Illinois Valley Watershed Council. In addition, the Lower Rogue Watershed hydrologic unit extends beyond river mile 55, but the portion beyond river mile 55 is part of the Middle Rogue Watershed Council's territory as defined by the state of Oregon.

The Lower Rogue basin is 226,668 acres and empties into the Pacific Ocean at Gold Beach, Oregon. The basin lies entirely within the Klamath Mountains Physiographic province, an area noted for steep, rugged terrain, narrow valleys, and sharp divides. Due to the geologic substrates present, most of the region is subject to varying degrees of instability. The topography of the basin reflects long-term erosion of a slowly rising upland; the result being a ridge system of roughly uniform elevation. Land use within the basin is primarily forestry related. No major urban areas, industrial centers, or agricultural operations are present in the lower Rogue basin.

B SUBWATERSHEDS

The Rogue River is divided into 13 "subwatersheds" for the purposes of this assessment; including 6 subwatersheds making up the mainstem of the Rogue River, and 7 tributaries. Delineation of subwatershed boundaries was based on several factors, including hydrologic boundaries, preexisting boundaries established by federal agencies, changes in topography, and river designations (e.g. wild & scenic, recreational). Subwatersheds were named after the major tributary (e.g. Quosatana Creek) or position in the watershed (e.g. Lower Rogue Mainstem).

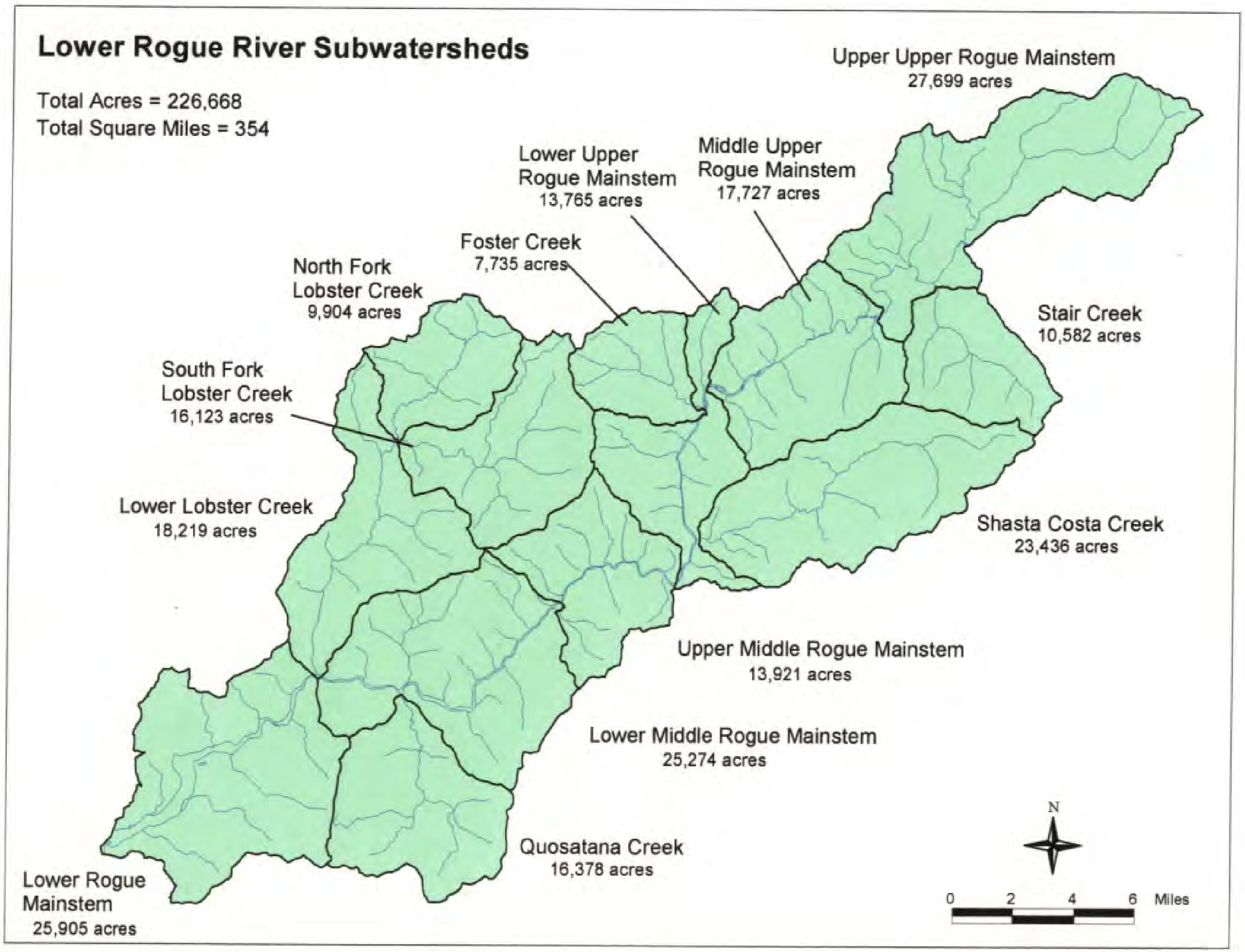
C LAND OWNERSHIP AND USE

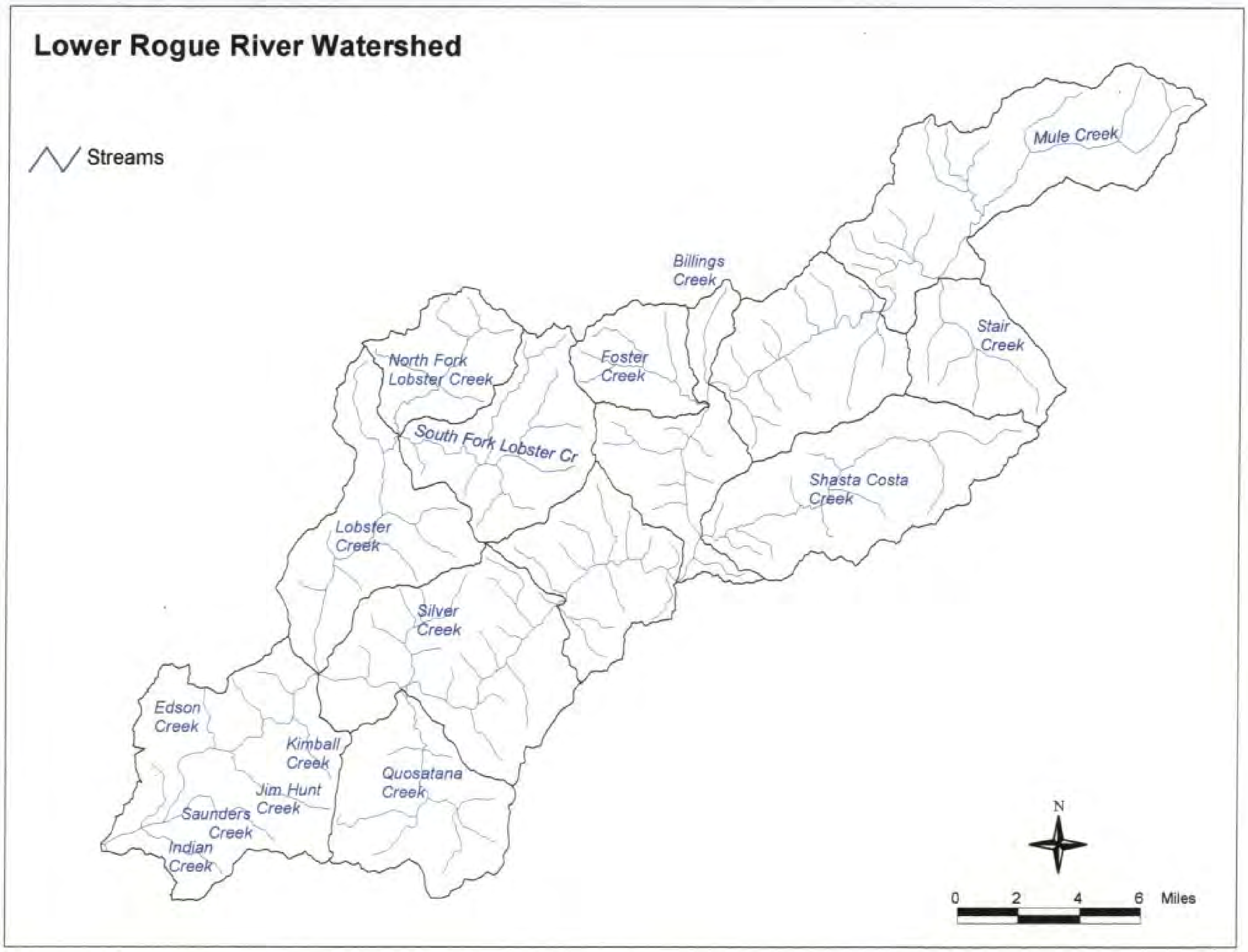
Within the Lower Rogue assessment area, 75 percent of the watershed is in public ownership and includes both federal and state lands. Most of the federal ownership is managed by the US Forest Service, with most of BLM's management being in the Wild and Scenic area in the Upper Upper Rogue Mainstem. Public lands include 87% forest, 13% young nonforest, and <0.5% each in urban/agriculture and water.

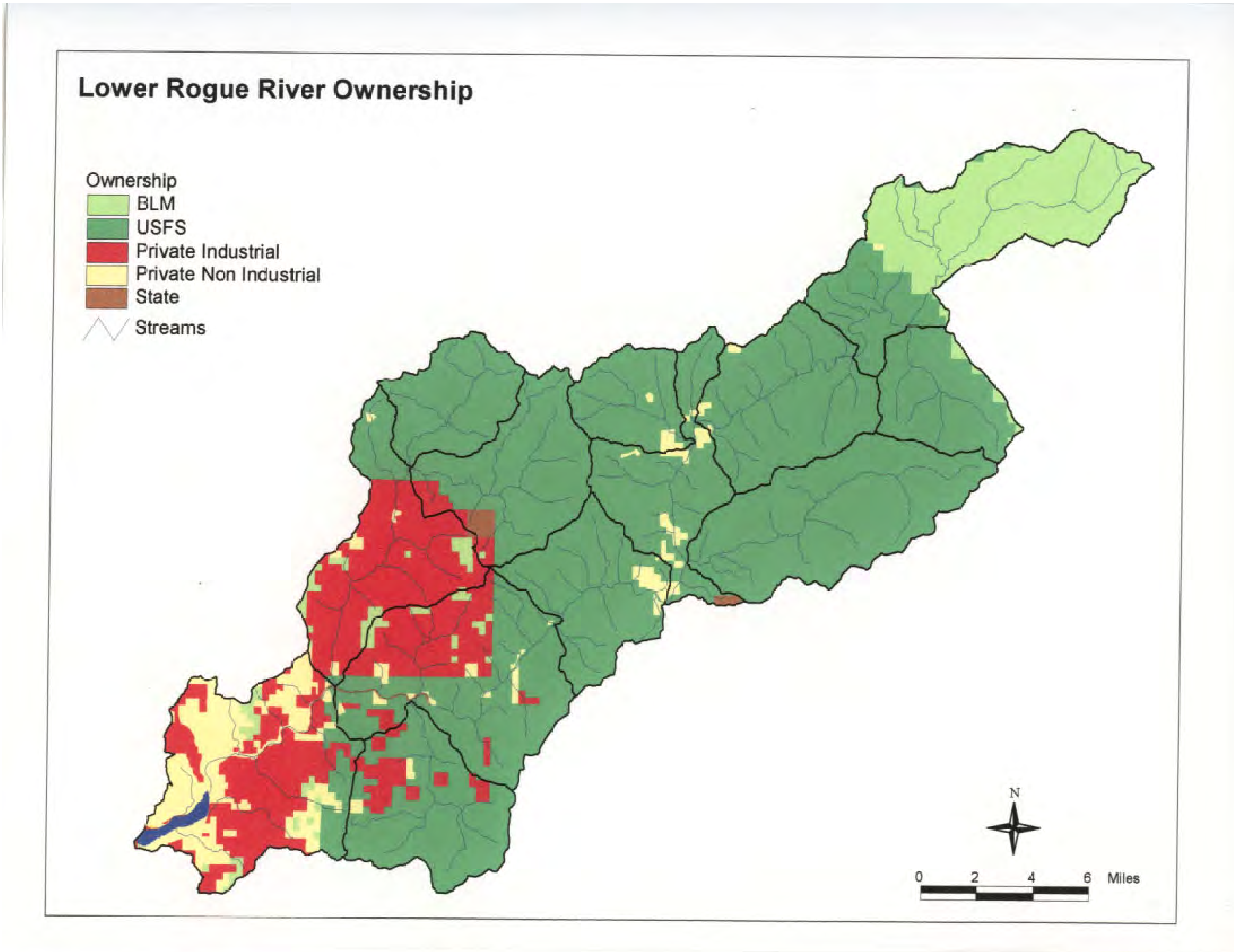
Private lands account for 25% of the watershed and include 74% forest, 22% young nonforest, 3% urban/agriculture, and 2% water. The Gold Beach urban growth boundary (UGB) contains 0.14% of the private lands and includes 12% forest, 45% young nonforest, 40% urban/agriculture, and 3% water.

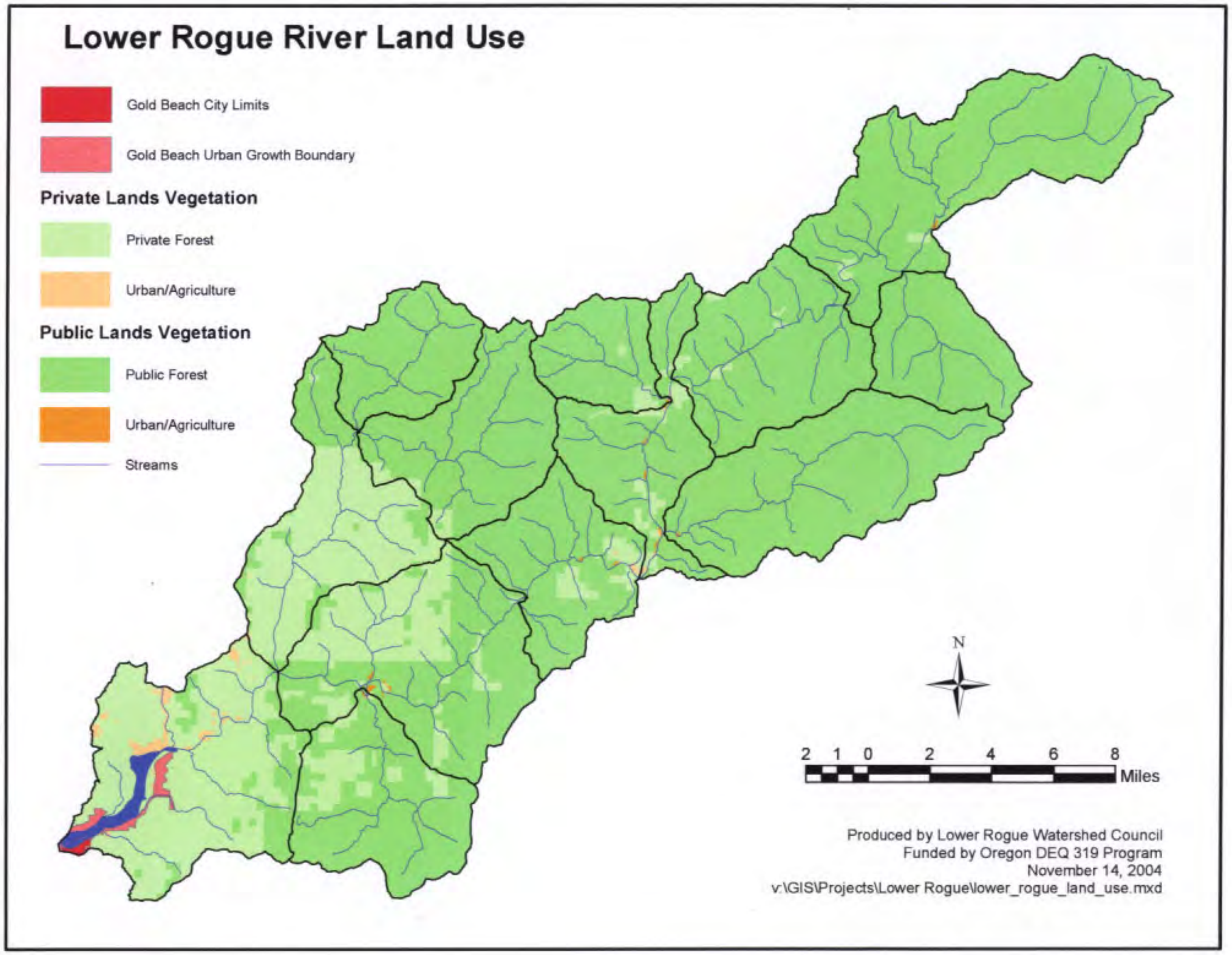
Table 1.1. Lower Rogue Watershed Land Use Summary

Subwatershed	**Public Lands**	**Private Lands**		**UGB**
	All Classes	Forested	Urban/Agriculture	All Classes
Lower Rogue Mainstem	3,640	22,157	1,124	307
Lobster Mainstem	4,315	13,950	10	0
Lobster North Fork	9,904	0	0	0
Lobster South Fork	15,404	719	0	0
Lower Middle Rogue	16,231	9,034	10	0
Quosatana	13,692	2,682	4	0
Upper Middle Rogue	12,467	1,401	53	0
Lower Upper Rogue	12,506	1,225	41	0
Shasta Costa	23,436	0	0	0
Foster	7,352	378	5	0
Middle Upper Rogue	17,312	416	0	0
Upper Upper Rogue	27,345	352	0	0
Stair	10,583	0	0	0
Grand Total	159,966	52,312	1,248	307


Lower Rogue River Subwatersheds
Total Acres = 226,668
Total Square Miles = 354
Upper Upper Rogue Mainstem
27,699 acres
Lower Upper Rogue Mainstem
13,765 acres
Middle Upper Rogue Mainstem
17,727 acres
Foster Creek
7,735 acres
North Fork Lobster Creek
9,904 acres
South Fork Lobster Creek
16,123 acres
Stair Creek
10,582 acres
Lower Lobster Creek
18,219 acres
Shasta Costa Creek
23,436 acres
Upper Middle Rogue Mainstem
13,921 acres
Lower Middle Rogue Mainstem
25,274 acres
Quosatana Creek
16,378 acres
Lower Rogue Mainstem
25,905 acres
N
0 2 4 6 Miles


Lower Rogue River Watershed
Streams
Mule Creek
Billings Creek
Stair Creek
Foster Creek
North Fork Lobster Creek
South Fork Lobster Cr
Shasta Costa Creek
Lobster Creek
Silver Creek
Edson Creek
Kimball Creek
Quosatana Creek
Jim Hunt Creek
Saunders Creek
Indian Creek
N
0 2 4 6 Miles


Lower Rogue River Ownership
Ownership
BLM
USFS
Private Industrial
Private Non Industrial
State
Streams
N
0
2
4
6
Miles


Lower Rogue River Land Use
Gold Beach City Limits
Gold Beach Urban Growth Boundary
Private Lands Vegetation
Private Forest
Urban/Agriculture
Public Lands Vegetation
Public Forest
Urban/Agriculture
Streams
N
2 1 0 2 4 6 8
Miles
Produced by Lower Rogue Watershed Council
Funded by Oregon DEQ 319 Program
November 14, 2004
v:\GIS\Projects\Lower Rogue\lower_rogue_land_use.mxd

II WATERSHED ISSUES

A BACKGROUND (GWEB 1999)

The issues to be addressed in a watershed assessment typically arise from local efforts to address concerns that often begin at federal and state levels. Listing of fish populations under the federal Endangered Species Act, for example, immediately focuses attention on evaluating habitat quality or hatchery production in the watershed. Likewise, water quality limited stream segments, listed under authority of the federal Clean Water Act, require that watershed management plans or Total Maximum Daily Loads (TMDLs) be developed at the state or local level.

B INTRODUCTION

The identification of watershed issues was intentionally conducted early in the process to help direct the watershed assessment. The purpose of identifying watershed issues was primarily to gain an understanding of the Lower Rogue Watershed Council's perspective on those practices that may potentially impact salmonid fish habitat and water quality.

C RESULTS

The Lower Rogue watershed issues are summarized in two tables: Table 2.1, Lower Rogue River Regulatory Issues and Table 2.2, Lower Rogue Watershed Council Issues.

Table 2.1 Lower Rogue River Regulatory Issues

Aquatic Resource Issues (based on federal and state law)	**Endangered Species Act**		
	Species		**Status**
	coho salmon		threatened
	green sturgeon		species of concern
	Clean Water Act- 303 (d) List		
	Tributary/Reach	**River mile**	**Parameter**
	Foster Creek	0 to 5.2	Temperature
	Indian Creek	0 to 1.7	Temperature
	Quosatana Cr.	0 to 8.1	Temperature
	Rogue River	0 to 68.3	Temperature

	Shasta Costa Cr.	0 to 13.4	Temperature

Table 2.2 Lower Rogue Watershed Council Issues

Land Use	Fish Habitat	Water Quality	Other Beneficial Uses
Forestry			
Industrial	Have harvest activities (past or present) affected diversity and quality of riparian areas?	Have harvest activities (past or present) affected water temperatures? Do forest roads generate high levels of sediment?	Are there cumulative effects on hydrology from forestry? Was stream cleaning performed on streams in basin?
Agriculture			
Ranching	Have ranching activities affected riparian areas or wetlands?	Do ranching activities deliver sediment or manure to streams?	How does irrigation use affect stream flow? How much irrigation is/is not permitted?
Fishing			Are current fishing regulations adequate to protect populations?
Commercial			Does commercial fishing impact fish populations?
Sport		Do boat wakes erode banks?	Does catch and release affect fish populations?
	Does boat traffic load affect		Does guided fishing affect populations
Rural Residential and RV Parks	Has RR reduced/impacted riparian vegetation?	Do RR and RV Parks have adequate septic treatment?	

		Does home yard chemical use affect aquatic populations?	
Urban		How does urbanization affect water quality and quantity?	Does construction result in turbidity?
County/Federal Roads	Have roads reduced riparian area size?	Does road runoff contribute contaminants to streams? Does roadside spraying contaminate streams?	Does slide material disposal affect streams?
Port of Gold Beach	Does the Port affect fish habitat? What were estuary habitat values before modification?	Do Port activities affect water quality?	What species may have disappeared from estuary? What could be done to enhance productivity of estuary?
Mining (gravel/rock/gold)	Has mining impacted riparian vegetation or fish habitat?	Has mining affected water quality? Has placer mining on Illinois and Rogue affected water quality?	
Dams	Are changes in flows affecting habitat?		How has change in natural flow regime affected beneficial uses?

REFERENCES

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999

III HISTORICAL CONDITIONS

The land of the Lower Rogue River Watershed was once under a shallow ocean that covered all of Oregon. The Klamath Range was pushed up by plate tectonics, developing a large inland area known as the Klamath Peneplain. The tremendous outpouring of precipitation eroded the Peneplain into carved valleys, including the Rogue River (Schroeder 1999).

Archeological records point to a continued human occupation of Southwest Oregon for at least the last eight to nine thousand years. A site at Marial provides carbon-14 dates beginning at 8560 before present, and a site near the mouth of the Illinois River unearthed materials from a culture using the site at 6000 and 2000 years ago (USDA 2000). The "tunne" people who spoke Athapascan dialects came to the area approximately 1500 years ago and were the final Native American cultural period in southwestern Oregon (USDA 2000). Tunne means 'the people' and there were various villages, for example the Tututunne were 'the people who lived by the river' (Schroeder, 1999). In the Lower Rogue watershed, the tunne settled from the coast to Marial and close to the border between Curry and Josephine Counties along the Illinois River (Schroeder 1999).

The tunne had a life more strongly oriented to riverine resources than previous groups whom may have had a greater reliance on the uplands. The tunne's numerous villages included major sites at the mouth of the Rogue River and at the confluences of the Rogue with Lobster Creek, Shasta Costa, and Quosatana, and on a flat near Ferry Hole (Schroeder 1999, USDA 2000). Population estimates are 8,800, with each village numbering 30 to 150 individuals (Schroeder 1999). The tunne diet consisted primarily of salmon and acorns supplemented by a variety of game and collected food items. Villages near the ocean also collected tidal organisms such as clams, crabs, sea urchins, chitons, limpets, and snails, hunted sea mammals such as seals and sea lions, and occasionally salvaged meat and blubber from a whale washed ashore (Schroeder 1999). Fishing methods for salmon included communal fish weirs and fishing scaffolds, dip nets, basketry fish traps, hook and line, nets and spears (Schroeder 1999, USDA 2000).

Native Americans had intensive management techniques, the most powerful being the use of fire. Fire was used to help maintain wildlife habitat, procure tarweed and grass seeds, manage groves for acorns and hazel, cultivate tobacco, propagate roots and berries, and extract sugar pine sap and seeds. Native Americans burned meadows once every year or two and brush areas once or twice a decade. Fire was also used to assist in warfare and for communication and ceremonial purposes (USDA 2000). For example, it was tradition for bands living near the mouth of a river or stream to burn off the hills nearby to help the salmon find their way (Schroeder 1999).

The earliest recorded contact between the coastal natives and Europeans was recorded in the logs of Captains George Vancouver and Robert Gray in 1792. Fur trappers and traders reached the area in 1827 (Alexander McLeod of the Hudson Bay Company) and in 1828 (Jedediah Smith party) but no known trapping occurred, perhaps because many of the beaver burrow into the river banks due to high flows and do not leave external evidence of a den (Schroeder 1999). While the land inhabited by the tunne people did not seem heavily occupied at the time of white contact, historical accounts from tribal tradition indicated that many years before their numbers had been higher. Wars and disease had destroyed whole tribes (USDA 2000).

There was a vast amount of green timber in the Lower Rogue at the time of exploration. The amount of land in old growth timber ranged from 45 – 75% depending on soils and fire history. The timber near the coast was in stands separated by large meadows, which were regularly burned by Native Americans. Farther inland the meadows were still numerous and supported oak savanna, but did not cover nearly as much of the landscape due to the relative abundance of different soil types. Serpentine soils support thinner forests with different species (P.O. cedar, incense cedar, Jeffrey pine, knobcone pine) that do not grow as large as those on more fertile soils.

Mining

In 1849 gold was discovered at Sutter's Mill in California and as the areas there were claimed, prospectors filtered out into the surrounding areas. Gold was discovered on the Rogue River in Southwest Oregon in 1851 and later in 1853 on the coast on the beaches surrounding the mouth of the Rogue River. Mining occurred on the beach for 12 miles on either side of the Rogue and water was diverted from nearby drainages to provide flow for sluiceboxes. One tunnel dug by Chinese miners during the 1880's diverted water from Indian Creek to the beach behind the present City Hall (Schroeder 1999).

Miners moved inland and over the ensuing years mined every area along the Rogue River with gold in sufficient concentrations (Schroeder 1999, USDA 2000). Sluiceboxes on the river bars, use of water cannons, and blasting the soil using diversion of streams into flumes all muddied the river and made it difficult for the Native Americans to catch salmon. The mining methods also changed the configuration of the river banks (Schroeder 1999). Boulder Creek, Lobster Creek (and tributaries), and Mule Creek were known mining areas, with a couple still active at present time. Hydraulic mining began in the 1870's and was a major activity by the 1880's. Most of the hydraulic mining activity was conducted in the winter because of the higher water availability, and sediment filled in over salmon and steelhead redds, further affecting Rogue fish. Hydraulic mining reached its peak in the 1890's and early 1900's (Schroeder 1999). From 1850 to1930, displaced mining wastes and tailings would turn the Applegate and Illinois Rivers red with sediment. Silt loads in excess of 200 ppm were thought to cause damage to aquatic life. Gravel bars exposed during low flows were found to be sealed with 1/8 to 1/4 inch deep silt (ODFW 1993). Dredging also affected chinook salmon by creating deficiencies of spawning gravel of fine and intermediate sizes in areas where spawning had occurred previously. Other species were less affected because they tend to spawn in smaller streams where dredging could not be done. Many fish were also lost when large quantities of cyanide, used to separate gold from rock, were used next to or in streams.

The discovery of gold, combined with the Donation Act of 1850 led to thousands of transient miners and permanent residents entering southwest Oregon between 1850 and 1855. Shanties, shacks and log cabins were clustered on the south side of the mouth in 1855. The settlement was known by several names including Sebastopol and Ellensburg. There was also a cluster of dwellings on the north side of the mouth by 1856 called Whalesburg (Schroeder 1999). In 1855 a series of skirmishes collectively called the Rogue River Indian War occurred. The war ended in 1856 with a 36-hour siege at the Battle of Big Bend in May, and subsequent tracking and capture or killing of remaining Indians. The tunne that surrendered were transported to the Silez and Grand Ronde reservations by boat, but those that were tracked down later were marched to the reservations by foot (Schroeder 1999, USDA 2000).

Mining began to slow in 1863 as salmon fishing began to replace mining as a source of income (Schroeder 1999). Some mining continued through the 1940's, with an increase in activity during World War I, and in the years proceeding World War II as the federal government offered incentives for mining strategic minerals such as chrome (USDA 2000). Some small-scale mining occurred during the depression of the 1930's as out of work individuals sought a subsistence economy lifestyle (USDA 2000), and some mining sites continue to be active today, primarily for recreation.

Commercial Fishing

Fishing on the Rogue at the time of settlement was for individual use until 1857 when A.F. Myers began catching, salting, and barreling salmon (Schroeder 1999). In 1861, entrepreneurs in the fish canning industry labeled the Rogue River runs as large, or larger, as any in Alaska (USDA 2000). Myers sold his operation ~1870 to Michael Riley and Frank Stewart, and they sold to Robert Deniston Hume in 1876 (Schroeder 1999). The Hume family had salmon canning operations in Sacramento, Californa and R.D. Hume and his brother opened a cannery on the Columbia River in 1867. R.D. operated several canneries on the Columbia when his two children and then his wife died and he sold the canneries and bought a steamer (Schroeder 1999). Riley and Stewart approached Hume while he was in the Rogue picking up a load of lumber. Hume saw an opportunity to be the major canner on the Rogue and called himself a "Pygmy Monopolist". In time he owned and controlled almost the entire fishery, owned thousands of acres, including all the tidelands on both sides of the river, operated a merchandise store and hotel, ran a newspaper, and owned ships carrying goods to and from the area (Schroeder 1999).

Industrial fishing was conducted primarily from the mouth of the Rogue River to Lobster Creek (river mile 11.0) (USDA 2000). Hume used two main methods of fishing. The first was the use of a seine in the estuary to take advantage of fish in the tidewater waiting for the fall rains to move upstream. A seine was anchored on the shore and pulled across the channel as the tide ebbed. Fish were also caught using a gill net put out for about 2 hours at high tide and stretched between a pole on shore and a pole out in the water (Schroeder 1999).

Having seen the effect of industrial fishing on fish populations in other rivers, including the Columbia, Hume tried to tightly manage the salmon fishery on the river. Hume hired fisherman and assigned them to areas of the river where they could fish and only allowed 3-6 boats to fish from the present day location of Patterson Memorial Bridge to the mouth of the river (Schroeder 2000). Hume also believed in hatchery production to supplement the natural runs. This belief was common at the time following an 1875 report on threats and proposed actions by Spencer Baird, the U.S. Fish Commissioner at the time. Baird identified three threats to the salmon industry, centered at that time on the Columbia River: excessive fishing, dams, and altered habitat (OCSRI Conservation Plan 1997). Baird recommended that it was better to spend $15,000-20,000 to use artificial propagation to make salmon so plentiful that protective regulations would be unnecessary (OCSRI Conservation Plan 1997). Even though the first hatchery for Pacific salmon had opened just three years before and there was not enough data to support whether or not artificial propagation would be successful, the region embraced Bairds recommendation with very little critical evaluation (OCSRI Conservation Plan 1997). Hume built his first hatchery in 1878 at "Hatchery Gulch" about one-quarter mile south of Indian Creek, another at the present day Patterson Memorial Bridge on the south side of the river (burned in 1893), one on Squaw Creek, one at Trail in the upper Rogue River built in 1890, and the final hatchery on Indian Creek in 1906, which is still in operation today (Schroeder 1999). In 1907 Hume had about 1,400,000 fry in the hatchery pens (Schroeder 1999). When Hume died in 1908 his estate was sold. His successors allowed between 200 and 300 boats to cover the same area with nets all across the river (Schroeder 1999).

In addition to Hume's cannery and after R.D. Hume's death, The Seaborg Cannery was constructed in 1915 on the north bank of the Rogue River, but was destroyed by fire in 1927. At the peak of fish canning, packs contained up to 82,500 adult Chinook in 1917 and 50,500 adult coho in 1928 (USDA 2000). Cases of salmon produced peaked in 1891 and 1917 with 25,000 cases and fell to 4,400 by 1930. The nets used to fish with caught steelhead, considered a game fish, in addition to salmon and other species. Steelhead fishermen in the upper river were upset that the commercial fisheries were taking steelhead in the lower river. Fish numbers in general were also declining in the Rogue River due to commercial fishing, climatic changes, dams, mining, and water diversions in the upper basin (USDA 2000). The factors combined and led to a state law passed in 1935 that banned commercial fishing on the Rogue River (Schroeder 1999, USDA 2000). The action was virtually unopposed by the canning companies because fish numbers were too low to support the industry. From 1922 to 1935, 6 million pounds of salmon were canned (USDA 2000).

After commercial fishing was banned, sports fishing increased, with associated development of hotels and restaurants for tourists. There was also interest in establishing a port at Gold Beach. Some port facilities were in Gold Beach, but the mouth of the Rogue River was treacherous and many products from the Lower Rogue River area were brought offshore to waiting ships in Brookings (Schroeder 1999). In the 1940's a group of local business men established a port district and funding was sought and awarded by Congress based on figures on the benefits of increased stumpage values as the result of barge traffic (Schroeder 1999). The jetties were constructed in 1960 and changed the estuary and the coarse of the river from where it ran along the North bank where Lex's

Landing sits now and out across Doyle's Point to its present location (Martin 2004). The river channel between the jetties was dredged and it in turn scoured out a bigger channel. Dredging by the Corps of Engineers followed (Schroeder 1999). The area used as a boat basin was suffering problems in the late 1960's due to winter and spring floods, and the Corps of Engineers accepted a proposal to build a training jetty around the boat basin. A high flood washed away the nearly completed project and the Corps stepped away from the project. Members of the port commission organized local people and supplies and completed the training jetty (Schroeder 1999). The boat basin supports recreational and commercial boats (ocean fishing). In 1971 commercial harvest of food fish received at Gold Beach totaled 237, 594 pounds (Schroeder 1999). A fisherman's direct processing facility and store currently operate at the port.

Floods and Dams

The largest flood of historical record was in 1861 with an estimated stage height of 43 feet in Grants Pass. The first recorded flood, and second largest, was in January 1890 when hurricane force warm winds came ashore and rainfall accumulated in the basin. The stage height at Grants Pass was estimated at 36 feet. Flow at the mouth was half a mile wide and carried thousands of giant trees, remains of homes and barns, mills, and bridges with it. Much of the farmland along the river was washed away including farms near Canfield and Coyote Riffles and bottomland at present day Huntley Park (Schroeder 1999). Floods followed every 10 to 12 years with the largest in recent memory occurring in December 1964 at 35 feet at the Grants Pass stage (Schroeder 1999).

The Rogue River had a computed average annual water yield into the Pacific Ocean of 5,661,000 acre feet from 1933 to 1966, varying from under 1,000 cfs in the record drought years of 1931-1940, to over 500,000 cfs in the December 1964 flood (Schroeder 1999, Percy et al. 1974). Mean stream flow from 1933 to 1955 was 7,800 cfs ranging from a high flow rate during January of 16,200 cfs to a low flow rate during September of 1,200 cfs. Annual yield of the Illinois river from 1929 to 1956 averaged 1,986,000 acre feet with a high yearly mean of slightly over 1,000,000 acre feet and a low of about 3,500,000 acre feet.

Dams were built as early as 1869 across the Rogue and its tributaries higher in the watershed for irrigation, power, and mining. Discussions regarding flow management of the Rogue River for flood control began in the 1940's. Fishery resource surveys and the documentation of large in-river mortalities of salmonids in the canyon area also occurred during this period. After discussions in the 1950's, dam sites were selected and Rogue dams were authorized with fisheries enhancement as an authorized use of the storage allocation. Construction of the Lost Creek Dam, Applegate Dam, and Cole Rivers Hatchery occurred in the 1970's with fishery evaluation studies funded by the Corps of Engineers. Large in-river mortalities of fall Chinook occurred in the first three years that Lost Creek Dam operated, but modified releases in the 1980's almost negated fall Chinook mortality. Early emergence of spring Chinook fry was documented, accompanied by later spawning by spring Chinook due to an increase in fall and winter temperatures. Loss of early-run spring Chinook, and an increase in fall Chinook was also documented. The Applegate Dam evaluation ended in late 1980's, but the Lost Creek

Dam evaluation was extended to evaluate modified water temperature releases on spring Chinook. In the 1999's, project findings indicated that changes in mainstem flows due to the dams have lesser effects on steelhead and coho. This, and large in-river mortalities of spring Chinook in 1992 and 1994 made maintenance of wild spring Chinook runs the priority for fishery managers. After the Lost Creek Dam evaluation ended, Coho salmon were listed as threatened under the Endangered Species Act, but Chinook salmon were not listed. In the present decade, the final ODFW recommendations were submitted to the Corps of Engineers for the release schedule for fisheries management. The year of 2001 was predicted to be a drought year though, and fisheries managers and the Corps of Engineers worked together to protect spring Chinook by providing variable releases from the dams based on water temperatures in the canyon area. During this same year there were large in-river mortalities of fall Chinook in the Klamath River. As of 2004, the general fishery management priorities as related to reservoir management are:

1) Maximize production of Coho salmon
2) Maximize production of Spring Chinook
3) Enhance Fall Chinook Production
4) Enhance Steelhead Production
5) Maintain Production Capabilities at Cole Rivers Hatchery
6) Maintain Angling Opportunities

Fire

In March 1907 forested land in Southern Oregon was set aside by President Theodore Roosevelt and named the Siskiyou National Forest (Schroeder 1999). In 1909 the forest was described as little changed from the way the Indians left it. Native Americans often used fire as a management tool, prospectors had burned off the country to make it easier to prospect and ranchers burned off brush and young timber for grazing lands, but timber had not been logged to any extent because there were no roads to access the lands for logging (Schroeder 1999). Evidence supports that historic fire was more commonly multiple, low intensity underburns rather than individual high severity stand resetting fire events (USDA 2000). Studies within the Klamath Province conducted in more recent years found evidence of fire within 63% of the stands examined (USDA 2000).

Fire control and tree planting were two major jobs of the forest service. In 1916, 247 fires were suppressed, of which 173 were incendiary (Schroeder 1999). The majority of fires were simply monitored prior to 1940 as effective fire resources and tactics did not exist (USDA 2000). The average number of acres burned per year on the Siskiyou National forest prior to 1940 was 20,833. After 1940, fire suppression policies mandated that all fires be controlled, and the average acres burned per year reduced to 2,772 (USDA 2000). The Regional Fire Atlas and Record from 1910 to 1959, and individual fire reports after this, indicate a low frequency of natural fire occurrence with 14 lightning fires recorded and approximately 43 human fire caused burns (USDA 2000). The amount of acreage burned from natural fires was also less with none growing to more than 5 acres, and most less than 1 acre. In contrast, 25 of the human caused fires grew to more than 5 acres, burning an estimated 14,500 acres (USDA 2000). Some incendiary fires were set during the 1930's due to lack of other work. Settlers would set fires and then get paid by the forest service to fight the fires or hire out their stock. The Forest Service adopted a policy of not hiring settlers to fight fires (Schroeder 1999)

The worst fire season in decades occurred in 1936 with a strong northeast wind and extremely low humidity. The fire occurred all over the south coast. Over 2,700 acres burned in Squaw Valley and some 70 to 80 thousand acres in Coos and Curry Counties (Schroeder 1999). A 1939-1940-1941 aerial photo series serves as reference for historical vegetation on forest service lands and shows high disturbance from fire. Vegetation is smaller over much of the landscape and miles of ridgetops are bare (USDA 2000).

Roads

During the period of mining and commercial fishing settlement of the area was slow, in part to its remoteness due to the geology of the area and lack of roads. Census data for Curry County in 1870 was 1,200 people. The tunne had a network of trails within the watershed to allow travel to hunting and gathering areas, interaction between villages, and for trade routes, including ridgetop trails that allowed trade with inland Native American tribes (Schroeder 1999, USDA 2000). These trails served as the primary transportation corridors for the early settlers as well.

It was not until 1890 that a wagon road was built to Gold Beach from the north and south. The population around the Rogue River from a census this same year was 317 at Ellensburg (name changed to Gold Beach later this year), 232 at Jerry's Flat (near Saunders (formerly Sanders) Creek), 87 at Quosatin (Quosatana Creek), and 36 at Big Bend with 1,528 of these people being white, two African, 58 Chinese, and 121 Indians (Schroeder 1999). The town continued to grow and in 1898 the population all of Curry County was ~3,000 people (Schroeder 1999). A 1915 census by the State of Oregon noted that Gold Beach had a population of 254, Agness had 60 people, and Illahe had 48 (Schroeder 1999).

The graveled Theodore Roosevelt Highway was built in 1925 and allowed more people to come to the area. The Forest Service built a road on the north bank of the Rogue this same year from Wedderburn to Lobster Creek. Travel across the river was by ferry until the Patterson Memorial Bridge was completed in 1932 (Schroeder 1999). In 1937 the road from Powers was extended to Agness and Illahe (Schroeder 1999). The new Highway 101 was built in the late 1950's and opened in December 1961, for higher speeds and more ocean views. The highway required massive cuts and fills across the deep canyons with large culverts embedded in the canyons to carry high winter flows (Schroeder 1999). In the late 1960's and early 1970's the Forest Service and Bureau of Land Management roads joined to make Bear Camp and Burnt Ridge Roads to provide access to and from the coast to the Rogue River Valley (Schroeder 1999).

Most of the roads in the National Forest portion of the watershed from Agness to the mouth of the Rogue River were constructed in the 1960's. The road to Agness was built in the early 1960's as a forest service road. The road parallels the Rogue River and crosses geologic faults and slump-earthflow features that cause chronic road failures and drainage problems (USDA 2000). From Marial to Agness, roads were limited prior to 1940. Aerial photos of 1969 show road construction heavily concentrated on the lower slopes above the Rogue River and its tributary streams (USDA 1999). By 1986 photos, road activities had moved upslope. Landslides associated with road conditions, timber harvest and mining peaked in number between the 1960's and 1980's (USDA 1999).

In "Rogue River County," H.E. Timeus (1990) surmises the damage caused by roads associated with logging saying, "The writer speaks with first hand knowledge of this activity, having been actively engaged in the lumbering industry for many years . . . denuded hills plus the disturbance of the surface ground caused by yarding and construction of logging roads permit a fast runoff of rain and melting snow. This runoff carries the loosened soil, rock and debris into our rivers covering the spawning beds, thereby smothering the salmon eggs. Also our increased efficiency in earth moving is a major contributing factor, extremely detrimental to fish life. . . we blast and displace millions of yards of soil in our watergrade road construction. Much of the excess material is bulldozed into the adjacent streams, causing more destruction of our salmon spawning areas."

Timber Harvest

Timber harvest was limited prior to 1940, although lumber was an early export as indicated by the note that R.D. Hume originally came to the area in the 1870's to pick up a load of lumber (Schroeder 1999). Hume also had a sawmill built on Lobster Creek to provide lumber for the construction of his buildings in Wedderburn after a suspicious fire burned many of his buildings on the Gold Beach side in 1893 (Schroeder 1999). After Hume died in 1908, the Macleay Estate purchased all of his holdings in 1911. "The 15,000 acres included 4,000 acres heavily timbered, 7,000 open grazing land, and the remainder in brush and second growth timber" (Schroeder 1999).

On National Forest lands in the Gold Beach District, timber harvest began in the 1940's, but timber production expanded rapidly following WWII due to mechanization, with a total of 204,000 acres available for harvest (Schroeder 1999). Private holdings within the National Service boundary were heavily harvested during the 1950's and 1960's.

Various lumber mills were established in the watershed to process the timber coming off of private and Forest Service lands and mills (saw and plywood) were constructed in nearly every valley along the coast. In 1964 Sause Brothers Ocean Towing barged 100 million board feet of lumber from Gold Beach and Brookings to southern California and Hawaiian markets. Their largest warehouse was located east of the Coast Guard summer station at the mouth of the Rogue River (Schroeder 1999).

Tractor logging was common and skid roads were closely spaced. All vegetation was removed and streams and riparian areas were not buffered. Many stream channels were used as skid roads. Numerous debris torrents, streamside failures, and debris slides associated with roads and logging activities were noted (USDA 1999). Logging practices included placing and leaving log stream crossings, ground skidding over compactable soils and low standard roads (USDA 1999). While the rivers were used for log transport, splash damming was not conducted due to inadequate flows. Timber harvest has been concentrated on the productive lower elevation sites over the years (USDA 2000). Photos from 1969 show road construction and commercial logging concentrated on the lower slopes above the Rogue River and its tributary streams. By 1986 logging activities had moved upslope, especially into the step upper reaches of Shasta Costa and Billings Creeks. Streamside failures and debris torrents were associated with harvest within and along steep inner channels of streams (USDA 2000).

Over 9,000 acres on the Rogue River below Agness have been harvested since the 1950's, with the most heavily harvested areas in the west side of the Quosatana Creek watershed along the 090 and 100 road systems, along the eastern side of Quosatana Creek watershed in the upper stretches along Wildhorse Ridge, and from the north side of the Wakeup Rilea Creek drainage northeast into the Nail Keg Creek area. Additional scattered harvest has been on the north side of the Rogue River in the upper reaches of Tom East, Bridge, Stonehouse, and Sundown drainages (USDA 2000). Historic levels of late-successional forest have fluctuated due to climatic changes and human influence, but the Regional Ecosystem Assessment Report estimated historic levels of late-successional habitat between 45 and 75% of the Lower Rogue Basin. Historic vegetation mapping shows 67% of the analysis area below Agness provided late –successional habitat in the 1940's prior to any timber harvest, reduced to 29% in the analysis area and to 26% on the Siskiyou National Forest (USDA 2000).

On National Forest Lands from Marial to Agness (USDA 1999) streams are steep and timber harvest has occurred on ~10% of the watershed, mostly occurring within the Twomile, Foster, Billings, Stair and Shasta Costa Creek drainages (USDA 1999). Streams between Mule Creek and Billings Creek have had little timber harvest or road construction. A lack of conifers in the riparian area of Slide Creek is noted as possibly being the result of early logging on private ground. Historic late-successional habitat within the Marial to Agness analysis area was on the low end of the 45-75% range given in the Regional Ecosystem Assessment Report. Historic vegetation mapping shows 69% of the Rogue River (Marial to Agness) watershed provided late-successional habitat in the 1940's prior to timber harvest (USDA 1999).

The largest private timber holding in the watershed originated from the R.D. Hume holdings. U.S. Bank took over the holdings from Macleay Estate in the 1930's after commercial fishing closed and the depression combined to cause financial hardship. The property was sold to the Lloyd Corporation and retained for 17 years until Associated Plywood purchased the major portion in 1952. A few years later, United States Plywood bought 26,000 acres of timberland from Associated Plywood and a mill site from the Lloyd Corporation. The mill was built beginning in 1955. Several years later the operation and land were purchased by Champion International Timber Products. When the land they owned was logged and Federal Timber harvest was less due to environmental regulations, Champion sold the land to John Hancock Insurance Company (managed by Lincoln Timber, LLC) and the mill to Agnew Timber Products. The mill was closed after a year and destroyed in a fire in January 1991 (Schroeder 1999). In 2002, the timber lands were purchased by Menasha Company, LLC, and in 2004 some of the holdings along the Rogue River, including Libby Pond, Kimble Hill, Graveyard Prairie, and lands around Saunders Creek, God Wants You Creek, and Jerry's Flat were sold to Golden Gate Trust.

Miscellaneous

Wildlife

The Lower Rogue Watershed has varied wildlife, some of which have been affected by settlement:

- Large herds of Roosevelt elk were almost eliminated from Curry County from overhunting. Transplants were brought in and there are several herds in the area (Schroeder 1999).
- Sea lions were once hunted extensively for oil and furs. In 1900 the Oregon Legislature authorized a $2.50 bounty on sea lions scalps to protect salmon. The bounty was later raised to $5 and then to $10. In 1926 it was reduced to $0.50. Hunting on the Rogue River Reef in the early 1900's resulted in 300 to 400 sea lions killed per month using both rifles and dynamite. Most of the sea lions on the reef in the early 1900's were Stellar sea lions that feed in the ocean (Schroeder 1999). California sea lions feed extensively in the Rogue River. The Federal Marine Mammal and Protection Act now protect seals and sea lions.
- Sea otter were once plentiful, but the high prices for their pelts created a market for fur trappers who completely eliminated them in this area. In the late 1960's and early 1970's twenty-seven sea otter were captured at Kamchatka Island and released south of Port Orford. They survived for a short while and then disappeared (Schroeder 1999).
- The murre is a small sea bird that lays an egg almost as large as a goose egg. Eggs are laid directly on the bare rocks and early settlers supplied a booming San Francisco market by 1909 (Schroeder 1999).
- A local recalls thousands of mallard ducks that once flew up and down the river, but their numbers decreased over the years (Martin 2004).
- A common waterfowl found in or around the estuary includes the American merganser. "Medium" common are American widgeon, pintail, red-breasted merganser, surf scoter, and white-winged scoters. Shore birds most common are great blue heron, least sandpiper, western sandpiper, western gull, herring gull, California gull, belted kingfisher, common crow, and double crested cormorant (Percy et al. 1974).
- Common mammals are California sea lions, Stellars sea lions, and black tailed deer. "Medium" common are harbor seal, river otters, and beavers. Uncommon are mink and muskrats (Percy et al. 1974).
- Game fish found in the estuary are summer steelhead, winter steelhead, fall Chinook, spring Chinook, sea-run cutthroat, shad, coho, green and white sturgeon, and chum salmon. Non-game fish are anchovy, surf smelt, herring, red-tail surf perch, silver surf perch, spot-fin perch, striped perch, starry flounder, tom cod and ling cod (Percy et al. 1974).
- Bald eagles, Northern Spotted Owl and Marbled murrelet are listed as threatened on the Endangered Species Act. Peregrine falcons were

removed from the list in 1999 and were listed as a sensitive species by the Siskiyou National Forest.
- Other sensitive species on the Siskiyou Forest Service include Del Norte salamanders, red-legged frogs, Townsend's big-eared bats, Northwestern pond turtles, and California mountain kingsnakes. Neotropical migratory birds include the willow flycatcher, pacific-slope flycatcher and hermit warbler, and Vaux's swift. Sensitive plants include Howell's manzanita, Siskiyou sedge, Siskiyou daisy, California globemallow, Siskyou monardella, Del Norte Willow, Leach's Brodiaea and Kurybayash's Trillium, Dwarf Downingia, and Waldo rockcress.

Other interesting information

- The Rogue River estuary has the largest drainage area per acres of estuary. The drainage basin is 5,100 square miles and the estuary has 575 acres of surface area at high water (Percy et al. 1974). Tidal influence only extends approximately 4 miles upriver.
- The drainage of the Rogue River includes Jackson, Josephine, Curry, Klamath, Douglas, and Coos Counties in Oregon and Siskiyou and Del Norte Counties in California (Percy et al. 1974).
- The estuary is moderately exposed to waves at the throat; mean tide range is 4.9 feet with a diurnal range of 6.7 feet (Percy et al. 1974).
- The coastal zone of the Rogue River extends to Agness.
- Around 1952 an exotic root disease fungus or water mold Phytophthora lateralis, was introduced into the Pacific Northwest from an unknown source, perhaps from nursery stock in Portland. It has been spreading throughout the range of Port-Orford Cedar. Of the 44,674 acres of the National Forest land within the Rogue River area below Agness, 15,000 acres contain some Port-Orford cedar and ~19% of this area is infected. Quosatana Creek Watershed is a noted infection area. Most riparian area between Marial and Agness are infected, although some exceptions are Waters, Flora Dell, Clayhill, Stair, Scott, Walker, and Shasta Costa Creek watersheds (USDA 1999, USDA 2000).
- The mailboats began in 1895 to deliver mail to upstream homesteaders, and carried some passengers. By the mid 1920's a larger boat was used and businesses up river offered lunch and overnight accommodations. Business boomed after World War II with 15-20 passengers a day and 3,000 a year due to publicity. In 1960 jet propulsion replaced the propeller and allowed travel during lower water conditions. Jerry's Jet Boats, started in 1958, and the Mail Boats are thriving businesses in Gold Beach, serving between 60 and 70 thousand passengers annually (Schroeder 1999).
- The Rogue was one of the 8 original Wild and Scenic Rivers designated in 1968 (USDA 2000). Access to the wild section of the Rogue is by permit only from May 15 to October 15 (Schroeder 1999). From Agness to Blue Jay Creek (1.5 miles) the river is classified as "Recreational", to Slide Creek (7.5 miles) as "Scenic" and to Lobster Creek (7 miles) as "Recreational" (USDA 2000).
- From Lobster Creek to the mouth the Rogue River is designated as an Oregon Scenic Waterway.

- The first agriculture in the Lower Rogue was classed as subsistence farming and was concentrated in homesteads along the river. Most homesteads had an orchard and a subsistence garden. In the late 1800's and early 1900's there were farms on the terraces along the lower Rogue. In 1898 there were 8,000 acres in production, but this declined to 5,600 acres by 1936. The Curry SWCD was formed in 1953. Currently, agriculture is restricted to ranching.
- Historic summer grazing of livestock was mentioned on the prairies on Wildhorse, Big Meadow, Bald Mountain, Fishhook, Indigo, and Burnt Ridge. At one time, 5,000 to 7,000 head of cattle roamed the hills up to Grizzly Mountain until the winter when the ranchers would go round them up and drive them to market (Martin 2004). The Taylor Grazing Act in 1934 made grazing on National Forest fee based and cattle are now removed from all the hill prairies in the National Forest. The only grazing leases are on Oak Flat on the Illinois River and Big Bend on the Rogue (Schroeder 1999). All of the Gold Beach area east and west of Ellensburg Avenue toward the south part of town was grazing land for cattle at one time (Martin 2004). Grazing currently occurs around Agness, and near Gold Beach around Indian Creek, Edson Creek, and Ranch Creek (in Wedderburn).
- The early grazing of mountain meadows was responsible for the continued burning of meadows after the Native Americans were removed. By 1880, there were 22,000 sheep and 4,000 cattle in the County. By the early 1900's, grazing had shifted to beef cattle. The dairy industry developed along the rivers to the point where 400 small dairies were active in the County in 1938 with a total of 4200 cows. Dairies may have been responsible for the clearing of riparian vegetation from most river terraces for conversion to pasture.

Lower Rogue River Time Line

9000-8000 Before Present. Earliest humans colonize region
1500 Before Present. Tunne colonize region
1792 Vancouver maps Curry coast and names Port Orford
1826 Trappers from Hudson Bay Company visit Curry County
1828 J. Smith trapper party visits area and camps on Rogue
1850 – 1863 Black sand mining on beaches of Curry, ditching to carry water to sluices on beach
1851 Placer mining starts on Rogue
1855 Curry County formed and voting districts established
1855-56 Indian wars reach coast of Curry County
1857 Commercial catch of salmon begins in Curry w/ fish salted in barrels
1857 Ferry service begins on Rogue at Ferry Hole
1861 Big flood; destroys farms on terraces along lower Rogue
1876 Hume builds cannery at mouth of Rogue
1878 Hume builds hatchery at mouth of Rogue
1880 Dredging for gold starts, heavy in Illinois Valley, destroys much chinook spawning
1880 Peak of sheep ranching with 22,500 sheep in Curry County (1897-21k,1935-17k)
1890-1910 Heaviest hydraulic mining leaves Rogue heavily silt-laden
1890 Big Flood; destroys most of farming along lower Rogue terraces
1890 Wagon road built to Gold Beach from north and south
1890 Carp introduced to Rogue
1895 Mail boats start service
1900-26 Bounty on sea lions to reduce predation on salmon
1902 Mule Ck. large flume built past Marial for placer mining in vicinity on Rogue
1904-05 Gold Ray Dam constructed, replaced 1940
1905 Ament Dam built above Grants Pass; dynamited 1927 because blocked fish
1913 Fishing w/ traps/weirs/fish dams/fish wheels outlawed on river
1917 Steelhead decline blamed on unscreened diversions
1921-22 Savage Rapids dam built; no fish passage first 4 yrs.; 1923 N ladder; 1934 S ladder
1927 Big Flood
1927 Game Commission introductions (white &black crappie, bluegill, warm- and largemouth bass, suckers, carp, bullhead catfish)
1930's Commercial fishermen become guides leading to large sport fishery
1930's Gold mining accelerated by depression
1930-31 Lowest water years on record; existing diversions have large effect on fish in tributaries; leads to much irrigation development and water rights
1931-32 Construction of Hwy 101 bridge over Rogue
1935 Powers to Agness road built by Civilian Conservation Corps
1935 Rogue River closed to commercial fishing
1936 Heavy fire year with no rain until early December; approximately 75k acres in Coos and Curry burned
1936-37 Draining wetlands and pastures for sheep liver fluke control (1261 acres)
1938-40 Steelhead hatchery operating on Foster Creek

1940 Curry lumber production 200 mbf; jumps to 1350 mbf in 1955
1955 Big Flood
1959 Highest USFS timber cut of 51 mbf (1951-2.6, 1958 – 11.6, 1960 – 38.3, present – 5.0)
1960 Jetties built - river put through large culverts during construction
1963 Coon Rock Bridge built
1964 Big Flood; Illinois River ad Agness swinging bridges destroyed.
1970 Quail Creek Fire burns 2900 acres, reaches Rogue at Tucker Flat
1977 Lost Creek dam completed
1980 Applegate Dam completed
1987 Silver Fire (Tributary of Lower Illinois River)
2002 Biscuit Fire burns Kalmiopsis Wilderness area in the Illinois River drainage and comes within a few miles of Agness. Silver Fire area reburns.

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IV CHANNEL HABITAT TYPES

A BACKGROUND (GWEB 1999)

Stream classification systems can be organized on different scales within a watershed: from as large as the entire channel network down to individual pools or microhabitats within those pools. The Oregon Watershed Assessment Manual provides a classification system that incorporates landscape features such as valley type and stream reach features such as gradient. The variables selected to describe each channel type remain relatively constant within time scales of concern to land management. The scale of channel features is small enough to predict patterns in physical characteristics, yet large enough to be identified from topographic maps and limited field-work.

The following classification system, titled Channel Habitat Types (CHT), is based on several existing stream classification systems including Rosgen and Montgomery & Buffington (Rosgen 1993; Montgomery and Buffington 1993). The CHTs will enable users to make inferences about how land use impacts can alter physical channel form and process and, therefore, fish habitat.

Bankfull Width, Confinement & Modern Floodplain

Bankfull width is the width of the channel at the point at which over-bank flooding begins (unless the stream is incised), and often occurs as flows reach the 1.5 year recurrence interval level. *Confinement* is defined as the ratio of the bankfull width to the width of the modern floodplain. *Modern floodplain* is the flood-prone area (Rosgen 1996); it may or may not correspond to the 100-year floodplain.

Confinement Class	Floodplain Width
Unconfined	>4x Bankfull Width
Moderately Confined	>2x Bankfull Width but <4xBankfull Width
Confined	<2x Bankfull Width

Management Considerations

It is important to remember that CHTs cannot be managed as isolated segments. Stream reaches in one part of a watershed can be affected by activities taking place in a different part of the watershed, either up-stream, down-stream, or on adjacent land areas.

B INTRODUCTION

The Rogue River and its tributaries represent a diversity of Channel Habitat Types. There are 15 different channel types that potentially occur in a watershed. Each of these stream channels provides unique functions and significant values to both anadromous and resident fish. Eleven of these CHTs (see list below) were identified within the Lower Rogue Watershed Council Boundary. A description of these Channel Habitat Types is presented in Section E of this component.

1. Large Estuary (EL)
2. Low Gradient Medium Floodplain Channel (FP2)
3. Low Gradient Small Floodplain Channel (FP3)
4. Low Gradient Moderately Confined Channel (LM)
5. Low Gradient Confined Channel (LC)
6. Moderate Gradient Moderately Confined Channel (MM)
7. Moderate Gradient Confined Channel (MC)
8. Moderate Gradient Headwater (MH)
9. Moderately Steep Narrow Valley Channel (MV)
10. Steep Narrow Valley Channel (SV)
11. Very Steep Headwater Channel (VH)

C METHODOLOGY

1. US Geologic Survey (USGS) maps at the 7.5-minute or 1:24,000 scale were compiled and utilized as base maps for the Rogue River below river mile 55 and the Illinois River subwatersheds below river mile 6.6. Perennial streams and landscape features such as valley type were analyzed for consideration of stream classification.
2. Stream reaches were delineated on mylar overlays based on channel gradient and channel confinement. Stream reaches were then evaluated based on valley shape, channel pattern, stream size, position in drainage and dominant substrate.
3. Preliminary CHTs were assigned to each reach using a CHT Guide to Identification (Table 6) as well as CHT Descriptions provided in the GWEB Oregon Watershed Assessment Manual.
4. CHT lengths were measured using a map wheel.
5. A labeling system was developed for purposes of subwatershed characterization.

D CHANNEL SENSITIVITY / RESPONSIVENESS

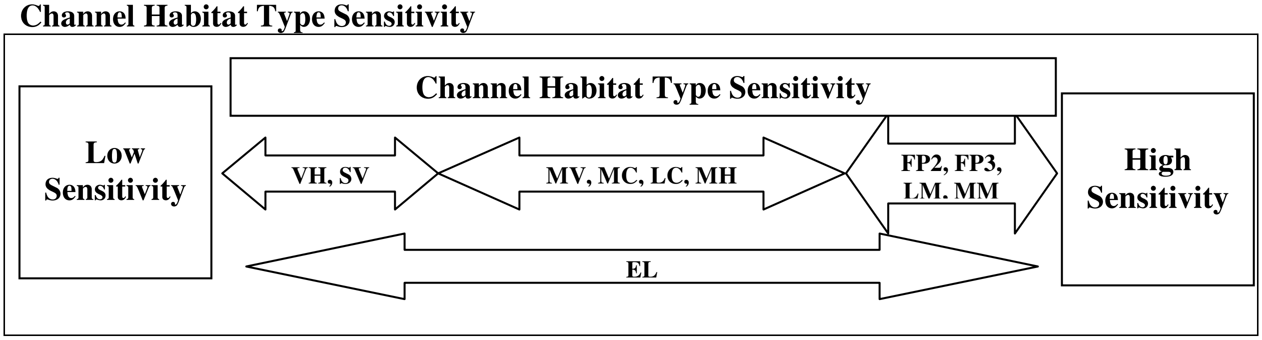
In general, responsive portions of the channel network are those that lack the terrain controls which define confined channels. Unconfined or moderately confined channels display visible changes in channel characteristics when flow, sediment supply, or the supplies of roughness elements such as large woody debris are altered. These areas are commonly referred to as response reaches, and usually possess an active floodplain. At the other end of the responsive spectrum would be those channels whose characteristics and form are not easily altered, such as bedrock canyon.

Differences in gradient, confinement, and bed morphology suggest that different channel types are more or less responsive to adjustment in channel pattern, location, width, depth sediment storage, and bed roughness (Montgomery and Buffington 1993). These changes in channel characteristics will in turn trigger alterations of aquatic habitat conditions. The more responsive or sensitive areas are more likely to exhibit physical changes from land management activities, as well as restoration efforts.

Channel Sensitivity/Response Descriptions

Rating	Large Woody Debris	Fine Sediment	Coarse Sediment	Peak Flows
High	Critical element in maintenance of channel form, pool formation, gravel trapping/sorting, bank protection	Fines are readily stored with increases in available sediment resulting in widespread pool filling and loss of overall complexity of bed form	Bedload deposition dominant active channel process; general decrease in substrate size, channel widening, conversion to planebed morphology if sediment is added	Nearly all bed material is mobilized; significant widening or deepening of channel
Moderate	One of a number of roughness elements present; contributes to pool formation and gravel sorting	Increases in sediment would result in minor pool filling and bed fining	Slight change in overall morphology; localized widening and shallowing	Detectable changes in channel form; minor widening, scour expected
Low	Not a primary roughness element; often found only along channel margins	Temporary storage only; most is transported through with little impact	Temporary storage only; most is transported through with little impact	Minimal change in physical channel characteristics, some scour and fill

Channel Habitat Type Sensitivity



E DESCRIPTION OF CHANNEL HABITAT TYPES (GWEB 1999)

(1) Large Estuary (EL) (<1% of Assessed Channels)

Large Estuarine Channels are most commonly found at the mouths of drainages along outer coastal beaches or bays. They are intertidal streams that occur exclusively within estuary landforms, usually draining a high-relief or moderate-sized watershed. They are often associated with saltwater marshes, meadows, mudflats, and deltas, although the steep topography of the Rogue River limits these types of habitats (See Chapter 10.2).

These streams are predominantly depositional channels associated with low-relief coastal landforms; therefore, sediment retention is a dominant process. Stream energy is low due to nearly flat gradients and substrate material consists mainly of small gravels, sand and silt. Water flow and depth are strongly influenced by tidal stage. Fine-grained stream banks are highly sensitive to erosion. Beach erosion processes often have a dominant influence on deposition and erosion in the outer coastal estuarine streams.

Channel Sensitivity / Responsiveness
These channels are low-energy areas where sediment deposition is a dominant process. While channel sensitivity in estuaries can vary, the unconfined nature of these areas tends to attenuate changes over space and time. Abandonment and reoccupation of relic channels commonly occurs.

Input Factors	**Sensitivity/Responsiveness Rating**
Large Woody Debris	Moderate
Fine Sediment	Moderate to High
Coarse Sediment	Low to Moderate
Peak Flows	Low

Fish Use
Anadromous - Important rearing and migration corridor
Resident - Important spawning and rearing

Riparian Enhancement Opportunities
Many enhancement efforts in estuaries are related to long-term preservation of the area. As these channels harbor unique biologic communities, limiting development is a common strategy. Structural enhancement activities often involve dike breaching or removal to reconnect wetlands or sloughs.

(2) Low Gradient Medium Floodplain Channel (FP2) (<1% of Assessed Channels)

FP2 channels are mainstem streams in broad valley bottoms with well-established floodplains. Alluvial fans, dissected foot slopes, and hill slope and lowland landforms may directly abut FP2 floodplains. These channels are often sinuous, with extensive gravel bars, multiple channels, and terraces. FP2 channels are generally associated with extensive and complex riparian areas that may include such features as sloughs, side-channels, wetlands, beaver pond complexes, and small groundwater-fed tributary channels.

Sediment deposition is prevalent, with fine sediment storage evident in pools and point bars, and on floodplains. Bank erosion and bank-building processes are continuous, resulting in dynamic and diverse channel morphology. Stream banks are composed of fine alluvium and are susceptible to accelerated bank erosion with the removal or disturbance of stream-bank vegetation and root mats. Channel gradient is low, and high stream flows are not commonly contained within the active channel banks, resulting in relatively low stream power.

Channel Sensitivity / Responsiveness

Floodplain channels can be among the most responsive in the basin. The limited influence of confining terrain features and fine substrate allows the stream to move both laterally and vertically. Although often considered low-energy systems, these channels can mobilize large amounts of sediment during high flows. This often results in channel migration and new channel formation.

Input Factors	Sensitivity/Responsiveness Rating
Large Woody Debris	High
Fine Sediment	Moderate
Coarse Sediment	High
Peak Flows	Low to Moderate

Fish Use

Anadromous – Important spawning, rearing, and migration corridor

Resident – Important spawning, rearing, and overwintering

Riparian Enhancement Opportunities

Due to the unstable nature of these channels, the success of many enhancement efforts is questionable. Opportunities for enhancement do occur, however, especially in channels where lateral movement is slow. Lateral channel migration is common, and efforts to restrict this natural pattern will often result in undesirable alteration of channel conditions downstream. Side channels may be candidates for efforts that improve shade and bank stability.

(3) Low Gradient Small Floodplain Channel (FP3) (1% of Assessed Channels)

FP3 streams are located in valley bottoms and flat lowlands. They frequently lie adjacent to the toe of foot slopes or hill slopes within the valley bottom of larger channels, where they are typically fed by high-gradient streams. They may be directly downstream of small alluvial fan and contain wetlands. FP3 channels may dissect the larger floodplain. These channels are often the most likely CHT to support beavers, if they are in the basin. Beavers can dramatically alter channel characteristics such as width, depth, form, and most aquatic habitat features.

These channels can be associated with a large floodplain complex and may be influenced by flooding of adjacent mainstem streams. Sediment routed from upstream high-and-moderate gradient channels is temporarily stored in these channels and on the adjacent floodplain.

Channel Sensitivity / Responsiveness

Floodplain channels can be among the most responsive in the basin. The limited influence of confining terrain features and fine substrate allows the stream to move both laterally and vertically. Although often considered low-energy systems, these channels can mobilize large amounts of sediment during high flows. This often results in channel migration and new channel formation.

Input Factors	Sensitivity/Responsiveness Rating
Large Woody Debris	High
Fine Sediment	Moderate to High
Coarse Sediment	High
Peak Flows	Low

Fish Use

Anadromous – Important spawning, rearing, and migration corridor

Resident – Important spawning, rearing, and overwintering

Riparian Enhancement Opportunities

Floodplain channels are, by their nature, prone to lateral migration, channel shifting, and braiding. While they are often the site of projects aimed at channel containment (diking, filling, etc.), it should be remembered that the floodplain channels can exist in a dynamic equilibrium between stream energy and sediment supply. As such, the active nature of the channel should be respected, with restoration efforts carefully planned. The limited power of these streams offers a better chance for success of channel enhancement activities than the larger floodplain channels. While the lateral movement of the channel will limit the success of many efforts, localized activities to provide bank stability or habitat development can be successful.

(4) Low Gradient Moderately Confined Channel (LM) (4% of Assessed Channels)

These channels consist of low-gradient reaches that display variable confinement by low terraces or hill slopes. A narrow floodplain approximately two to four times the width of the active channel is common, although it may not run continuously along the channel. Often low terraces accessible by flood flows occupy one or both sides of the channel. The channels tend to be of medium to large size, with substrate varying from bedrock to gravel and sand. They tend to be slightly to moderately sinuous, and will occasionally possess islands and side channels.

Channel Sensitivity / Responsiveness

The unique combination of an active floodplain and hill slope or terrace controls acts to produce channels that can be among the most responsive in the basin. Multiple roughness elements are common, with bedrock, large boulders, or wood generating a variety of aquatic habitat within the stream network.

Input Factors	Sensitivity / Responsiveness Rating
Large Woody Debris	Moderate to High
Fine Sediment	Moderate to High
Coarse Sediment	Moderate to High
Peak Flows	Moderate

Fish Use

Anadromous - Potential spawning and rearing for chinook, coho, steelhead and sea-run cutthroat trout

Resident - Potential spawning, rearing and over-wintering for cutthroat trout

Riparian Enhancement Opportunities

Like intact floodplain channels, these channels can be among the most responsive of channel types. Unlike floodplain channels, however, the presence of confining landform features often improves the accuracy of predicting channel response to activities that may affect channel form. Additionally, these controls help limit the destruction of enhancement efforts common to floodplain channels. Because of this, LM channels are often good candidates for enhancement efforts.

In forested basins, habitat diversity can often be enhanced by the addition of wood or boulders. Pool frequency and depth may increase, and side-channel development may result from these efforts. Channels of this type in non-forested basins are often responsive to bank stabilization efforts such as riparian planting and fencing. Beavers are often present in the smaller streams of this channel type. Fish habitat in some channels may benefit from beaver introduction through side-channel and scour pool development. Introduction of beavers, however, may have significant implications for overall channel form and function, and should be thoroughly evaluated by land managers, as well as biologists, as a possible enhancement activity.

(5) Low Gradient Confined Channels (LC) (11% of Assessed Channels)

LC channels are incised or contained within adjacent, gentle landforms or incised in uplifted coastal landforms. Lateral channel migration is controlled by frequent high terraces or hill slopes along stream banks. They may be bound on one bank by hill slopes and lowlands on the other. They may also have a narrow floodplain in places, particularly on the inside of meander bends. Streambank terraces are often present, but they are generally above the current floodplain. Channels confined by hill slope or bedrock are often stable and display less bank erosion and scour compared to incised channels that are often unstable and confined by alluvial terraces.

High flow events are well-contained by the upper banks. High flows in these well-contained channels tend to move all but the most stable wood accumulations downstream or push debris to the channel margins. Stream banks can be susceptible to landslides in areas where steep hill slopes of weathered bedrock parent materials meet the channel.

Caution: Caution should be used in interpreting channels that have downcut into alluvial material set in a wide flat valley. If streambanks are high enough to allow a floodplain width less than two times the bankfull width, then the stream meets the definition of confined. However, some streams meeting this definition may have recently down-cut, effectively reducing floodplain width as the channel deepens. It is beyond the scope of this assessment to address technical issues such as the rate of channel incision. However, for the purpose of interpreting Channel Sensitivity / Responsiveness, it should be noted that these channels may have transitioned from LM to LC channels.

Channel Sensitivity / Responsiveness
The presence of confining terraces or hill slopes and control elements such as bedrock limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is usually localized and of a modest magnitude.

Input Factors	Sensitivity/Responsiveness Rating
Large Woody Debris	Low to Moderate
Fine Sediment	Low
Coarse Sediment	Moderate
Peak Flows	Low to Moderate

Fish Use
Anadromous - Important spawning, rearing and migration corridor for chinook, coho, steelhead and sea-run cutthroat trout
Resident - Important spawning, rearing and overwintering for cutthroat trout

Riparian Enhancement Opportunities
These channels are not highly responsive, and in-channel enhancements may not yield intended results. In basins where water-temperature problems exist, the confined nature of these channels and stable banks lends itself to establishment of riparian vegetation. In non-forested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access control measures.

(6) Moderate Gradient Moderate Confined Channel (MM) (1% of Assessed Channels)

This group includes channels with variable controls on channel confinement. Altering valley terraces and/or adjacent mountain-slope, foot-slope, and hill-slope landforms limit channel migration and floodplain development. Similar to the LM channels, a narrow floodplain is usually present, and may alternate from bank to bank. Bedrock steps with cascades may be present.

Channel Sensitivity / Responsiveness
The unique combination of a narrow floodplain and hill-slope or terrace controls acts to produce channels that are often the most responsive in the basin. The combination of higher gradients and the presence of a floodplain set the stage for a dynamic channel system. Multiple roughness elements such as bedrock, large boulders, or wood may be common, resulting in a variety of aquatic habitats within the stream network.

Input Factors	Sensitivity / Responsiveness Rating
Large Woody Debris	High
Fine Sediment	Moderate
Coarse Sediment	Moderate to High
Peak Flows	Moderate

Fish Use

Anadromous - Potential steelhead and coho spawning and rearing; may have pockets of suitable chinook habitat depending on site-specific factors
Resident - Potential spawning, rearing and overwintering for cutthroat trout

Riparian Enhancement Opportunities

Like floodplain channels, these channels are among the most responsive of channel types. Unlike floodplain channels, however, the presence of confining landform features improves the accuracy of predicting channel response to activities that may affect channel form. Additionally, these controls help limit the destruction of enhancement efforts, a common problem in floodplain channels. Outcome of enhancement efforts are a bit more uncertain than in LM channels. MM channels, however, are often good candidates for enhancement efforts.

In forested basins, habitat diversity can often be enhanced by the addition of roughness elements such as wood or boulders. Pool frequency and depth may increase as well as side-channel development as the result of these efforts. Channels of this type in nonforested basins are often responsive to bank stabilization efforts such as riparian planting and fencing.

Beavers are often present in the smaller streams of this channel type, and fish habitat in some channels may benefit from beaver introduction through side-channel and scour pool development. Introduction of beavers, however, may have significant implications for overall channel form and function, and should be thoroughly evaluated by land managers as well as biologists as a possible enhancement activity.

(7) Moderate Gradient Confined Channel (MC) (3% of Assessed Channels)

MC streams flow through narrow valleys with little river terrace development, or are deeply incised into valley floors. Hill slopes and mountain slopes composing the valley walls may lie directly adjacent to the channel. Bedrock steps, short falls, cascades, and boulder runs may be present; these are usually sediment transport systems. Moderate gradients, well contained flows, and large-particle substrate indicate high stream energy. Landslides along channel side slopes may be a major sediment contributor in unstable basins.

Channel Sensitivity / Responsiveness

The presence of confining terraces or hill slopes and control elements such as bedrock substrates limits the type and magnitude of channel response to changes management. Adjustment of channel features is usually localized and of a modest magnitude.

Input Factors	Sensitivity / Responsiveness Rating
Large Woody Debris	Low
Fine Sediment	Low
Coarse Sediment	Moderate
Peak Flows	Moderate

Fish Use

Anadromous - Potential steelhead and coho spawning and rearing; may have pockets of suitable chinook habitat depending on site-specific factors

Resident - Potential spawning, rearing and overwintering for cutthroat trout

Riparian Enhancement Opportunities

These channels are not highly responsive, and in-channel enhancements may not yield intended results. Although channels are subject to relatively high energy, they are often stable. In basins where water-temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. In nonforested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access control measures.

(8) Moderate Gradient Headwater Channel (MH) (1% of Assessed Channels)

These moderate-gradient headwater channels are common to plateaus in Columbia River basalts, young volcanic surfaces, or broad drainage divides. They may be sites of headwater beaver ponds. These channels are similar to LC channels, but occur exclusively in headwater regions. They are potentially above the anadromous fish zone.

These gentle to moderate headwater streams generally have low streamflow volumes, and therefore, low stream power. The confined channels provide limited sediment storage in low-gradient reaches. Channels have a small upslope drainage area and limited sediment supply. Sediment sources are limited to upland surface erosion.

Channel Sensitivity / Responsiveness

The low stream power and presence of confining terraces or hill slopes and control elements such as bedrock substrates limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is usually localized and of a moderate magnitude.

Input Factors	Sensitivity / Responsiveness Rating
Large Woody Debris	Moderate
Fine Sediment	Moderate
Coarse Sediment	Moderate to High
Peak Flows	Moderate

Fish Use

Anadromous - Potential steelhead and coho spawning and rearing; may have pockets of suitable chinook habitat depending on site-specific factors

Resident - Potential spawning, rearing and overwintering for cutthroat trout

Riparian Enhancement Opportunities

These channels are moderately responsive. In basins where water-temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. In nonforested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access control measures.

(9) Moderately Steep Narrow Valley Channel (MV) (8% of Assessed Channels)

MV channels are moderately steep and confined by adjacent moderate to steep hill slopes. High flows are generally contained within the channel banks. A narrow floodplain, one channel width or narrower, may develop locally.

MV channels efficiently transport both coarse bedload and fine sediment. Bedrock steps, boulder cascades and chutes are common features. The large amount of bedrock and boulders create stable streambanks; however, steep side slopes may be unstable. Large woody debris is commonly found in jams that trap sediment in locally low-gradient steps.

Channel Sensitivity / Responsiveness

The gradient and presence of confining terraces or hill slopes and control elements such as bedrock substrates limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is localized and of a minor magnitude.

Input Factors	Sensitivity / Responsiveness Rating
Large Woody Debris	Moderate
Fine Sediment	Low
Coarse Sediment	Moderate
Peak Flows	Moderate

Fish Use

Anadromous - Potential steelhead, coho and sea-run cutthroat spawning and rearing
Resident - Potential spawning, rearing and overwintering for cutthroat trout

Riparian Enhancement Opportunities

These channels are not highly responsive, and in channel enhancements may not yield intended results. Although channels are subject to relatively high energy, they are often stable. In basins where water-temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. In nonforested land, these channels may be deeply incised and prone to bank erosion from livestock. As such, these channels may benefit from livestock access control measures.

(10 & 11) Steep Narrow Valley Channel (SV) & Very Steep Headwater (VH)
(SV = 16% & VH = 55% of Assessed Channels)

These two channel types are very similar and are thus presented together. However VH channels are steeper. SV channels are situated in a constricted valley bottom bounded by steep mountain or hill slopes. Vertical steps of boulder and wood with scour pools, cascades, and falls are common. VH channels are found in the headwaters of most drainages or side slopes to larger streams, and commonly extend to ridge-tops and summits. These steep channels may be shallowly or deeply incised into the steep mountain or hill slope. Channel gradient may be variable due to falls and cascades.

Channel Responsiveness

The gradient and presence of confining terraces or hill slopes and control elements such as bedrock substrates limit the type and magnitude of channel response to changes in input factors. Adjustment of channel features is localized and of a minor magnitude. These channels are also considered source channels supplying sediment and wood to downstream reaches, sometimes via landslides.

Input Factors	**Sensitivity / Responsiveness Rating**
Large Woody Debris	Moderate
Fine Sediment	Low
Coarse Sediment	Low to Moderate
Peak Flows	Low

Fish Use

Anadromous (SV) - Lower gradient areas provide limited rearing (if accessible)
Resident (SV) - Limited resident spawning and rearing **/ Resident** (VH) - Very limited rearing

Riparian Enhancement Opportunities

These channels are not highly responsive, and in-channel enhancements may not yield intended results. Although channels are subject to relatively high energy, they are often stable. In basins where water temperature problems exist, the stable banks generally found in these channels lend themselves to establishment of riparian vegetation. Trees may also serve as a future source of large woody debris in the basin.

F RESULTS

Table 4.1 Channel Habitat Types by Subwatershed (Miles)

	Channel Habitat Types										
	EL	FP2	FP3	LM	LC	MM	MC	MH	MV	SV	VH
Lower Rogue Mainstem	4.81	0	3.90	14.66	0	4.87	0	0.42	5.27	10.21	16.57
Lobster Mainstem	0	0.19	0	0	9.13	0.49	1.99	1.08	1.78	5.36	31.89
Lobster North Fork	0	0	0	0	4.17	0	0.91	0	3.16	4.83	7.90
Lobster South Fork	0	0	0	0	4.20	0	1.63	0.80	7.48	7.10	19.83
Lower Middle Rogue	0	0	0	1.80	6.44	0	1.86	0.40	1.14	7.42	45.09
Quosatana	0	0.34	0	1.14	2.33	0	0	0.57	3.41	8.31	20.70
Upper Middle Rogue	0	0	0.32	0	4.92	0	0	0.23	0.42	4.81	25.66
Lower Upper Rogue	0	0	0	0.98	6.10	0	0	0	0.91	2.99	8.64
Shasta Costa	0	0	0	0	5.25	0.74	3.09	0	3.52	8.60	31.61
Foster	0	0	0.61	0	1.53	0	0	0	2.37	6.38	7.48
Middle Upper Rogue	0	0	0	0	7.01	0	0	0	0.53	4.15	17.78
Upper Upper Rogue	0	0	0	0	8.37	0	3.81	0	12.12	10.68	47.78
Stair	0	0	0	0	0	0	1.61	0	1.36	3.26	13.64
Grand Total	4.81	0.53	4.83	20.61	59.45	6.10	14.89	3.48	43.47	84.11	294.58
Percent	0.93	0.10	0.90	3.97	11.07	1.18	2.87	0.65	8.10	15.67	54.87

G KEY FINDINGS

- The channel types "Steep Narrow Valley Channel (SV) and Very Steep Headwater (VH)" account for 70% of the channel types existing in the assessment area. These streams are typically the small headwater streams in all of the Lower Rogue River subwatersheds and are considered stable, not highly responsive to either disturbance or restoration, but are good candidates for riparian planting or thinning to encourage the development of large trees.
- Moderate gradient streams (MC, MH and MV) comprise about 12% of the channels, and low gradient confined channels (LC) comprise 11%, for a total of 22%. These streams have moderate sensitivity and responsiveness and are found throughout the watershed, with a few exceptions.
- The Lower Mainstem subwatershed contains most of the privately owned and non-industrial forest land in the assessment area. Within this watershed, 23% of its streams are classified as low gradient (<2% gradient), 5% of its streams are

classified as medium gradient (2-4% gradient), and 32% are high gradient (>8% gradient).

- Channel types typically having high response to disturbance are low gradient medium floodplain (FP2), low gradient small floodplain (FP3), low gradient, moderately confined (LM), and moderate gradient, moderately confined (MM). These channel types are among the most responsive to both disturbance and restoration activities. Within the Lower Rogue Mainstem subwatershed, 23% of the river miles fall under these categories, with 14.7% of these being LM. Within other subwatersheds, only a small number of river miles fall into these categories, with LM channels occurring in Lower Middle Rogue, Quosatana, and Lower Upper Rogue subwatersheds. All of the stream miles in the LM classification are part of the mainstem Rogue River or Quosatana Creek.
- Only 4.8 miles, or 1%, of the watershed is classified as estuarine (EL). This is due to the steep topography of the Rogue River, which is a characteristic shared with other estuaries in Curry County.

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V ECOREGIONS

A BACKGROUND (GWEB 1999; USEPA 1996)

The State of Oregon is divided into ecoregions that have been identified based on climate, geology, physiography, vegetation, soils, land use, wildlife, and hydrology. Each ecoregion has characteristic disturbance regimes that shape the form and function of watersheds in the region (OWEB Watershed Assessment Manual). They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. Ecoregions are directly applicable to the immediate needs of state agencies, including the development of biological criteria and water quality standards, and the establishment of management goals for nonpoint-source pollution (Omernik, 1995). They are also relevant to integrated ecosystem management, an ultimate goal of most federal and state resource management agencies (Omernik, 1995). Table 4.1 illustrates the hierarchy of ecoregions characterized for North America. Level I is the coarsest level, dividing North America into nine ecological regions, whereas at Level II the continent is subdivided into 32 classes. Level III contains 98 subdivisions in the continental United States whereas Level IV is a subdivision of Level III. Level IV Ecoregion descriptions provide the most detail and are therefore, the focus of this assessment.

Table 5.1 Hierarchical Scheme of Ecoregions
(Adapted from United States Environmental Protection Agency [USEPA], 1996)

Level I	9 Ecological Regions of North America
Level II	32 Ecological Regions of North America
Level III	98 Ecological Regions of North America
Level IV	>98 Ecological Regions (Subdivision of Level III)

B INTRODUCTION

The Lower Rogue River watershed is situated within two Level-III Ecoregions that are subdivided into six Level-IV Ecoregions. The Level-III Ecoregions include **(I) Coast Range** and **(II) Klamath Mountains**. Brief descriptions of these two broad ecoregions are provided in the following paragraphs. More detailed descriptions of the six Level-IV Ecoregions are provided in the following pages.

(I) Coast Range

The Coast Range contains highly productive, rain drenched coniferous forests that cover low elevation mountains. Sitka spruce forests originally dominated the fog-shrouded coast, while a mosaic of western red cedar, western hemlock, and seral Douglas-fir blanketed inland areas. Today Douglas-fir plantations are prevalent on the intensively logged and managed landscape. Within the Coast Range exist several Level IV Ecoregions. A portion of the Lower Rogue River watershed is situated within two of these Level

IV Ecoregions. They include the **Mid-Coastal Sedimentary** and the **California Coast Range Extension**. The Mid-Coastal Sedimentary include portions of the Central Coast Range, South Fork Coquille River, north to upper Yamhill River, east to Willamette Valley foothills, west to within 20 miles of the ocean. The **California Coast Range Extension** includes the southern coastal area from Bandon to Brookings and extends inland from 5 to 20 miles.

Table 5.2 Level IV Ecoregions--Acres by Subwatershed

Subwatershed	California Coast Range Extension	Coastal Siskiyous	Coastal Uplands	Mid-Coast Sedimentary	Serpentine Siskiyous	Total Acres
Lower Rogue Mainstem	9,915	6,433	10,852			25,940
Lower Middle Rogue Mainstem	8,729	16,593				25,322
Lower Lobster Creek	18,254					18,254
North Fork Lobster	9,923					9,923
South Fork Lobster	16,145	8				16,153
Quosatana Creek	2,217	14,193				16,410
Lower Upper Rogue Mainstem	609	13,000		182		13,791
Middle Upper Rogue Mainstem		17,762				17,762
Shasta Costa Creek		23,481				23,481
Foster Creek	3,268	4,482.				7,750
Upper Middle Rogue Mainstem	765	13,183				13,947
Upper Upper Rogue Mainstem		21,381		546	5,827	27,754
Stair Creek		10,564			39	10,603
Total Acres	69,825	141,079	10,852	728	5,865	227,089

(II) Klamath Mountains

The Klamath Mountains ecoregion is physically and biologically diverse. Highly dissected, folded mountains, foothills, terraces, and floodplains occur and are underlain by igneous, sedimentary, and some metamorphic rock. The mild, subhumid climate of the Klamath Mountains is characterized by a lengthy summer drought. It supports a vegetal mix of northern California and Pacific Northwest conifers. Within the Klamath Mountains exist several Level IV Ecoregions. A portion of the Lower Rogue River watershed is situated within three of these Level IV Ecoregions. They include the **Coastal Siskiyous**, the **Coastal Uplands,** and the

Serpentine Siskiyous. The Coastal Siskiyous reflect the steep southwest mountains located within 60 miles of the coast. The Coastal Uplands include portions of the coastal area extending up to 30 miles inland, from Astoria to Brookings. Finally, the Serpentine Siskiyous are the southwestern Oregon mountains with soils derived from serpentine.

C LEVEL IV ECOREGION DESCRIPTIONS

(1) California Coast Range Extension (30.8% of Lower Rogue River Watershed)

Overview

Highly productive, rain-drenched coniferous forests cover the low mountains of the Coast Range. Sitka spruce forests originally dominated the fog-shrouded coast, while a mosaic of western red cedar, western hemlock, and seral Douglas-fir blanketed inland areas. Today, Douglas-fir plantations are prevalent on the intensively logged and managed landscape.

The California Coast Range Extension is listed as “Southern Oregon Coastal Mountains” in the Oregon Watershed Assessment Manual (1999). This is a mountainous ecoregion with an ocean-modified climate. It is a transitional area between the Siskiyou Mountains and the Coast Range and is underlain by Jurassic sandstone, metamorphosed sediments, granite, and serpentine. Overall, the geology is complex, like that of the Siskiyou Mountains, but its mountains are lower and not as dissected. The distributions of northern and southern vegetation blend together and species diversity is high. Elevations in this ecoregion range from sea level to 3,400 feet.

Physiography & Topography

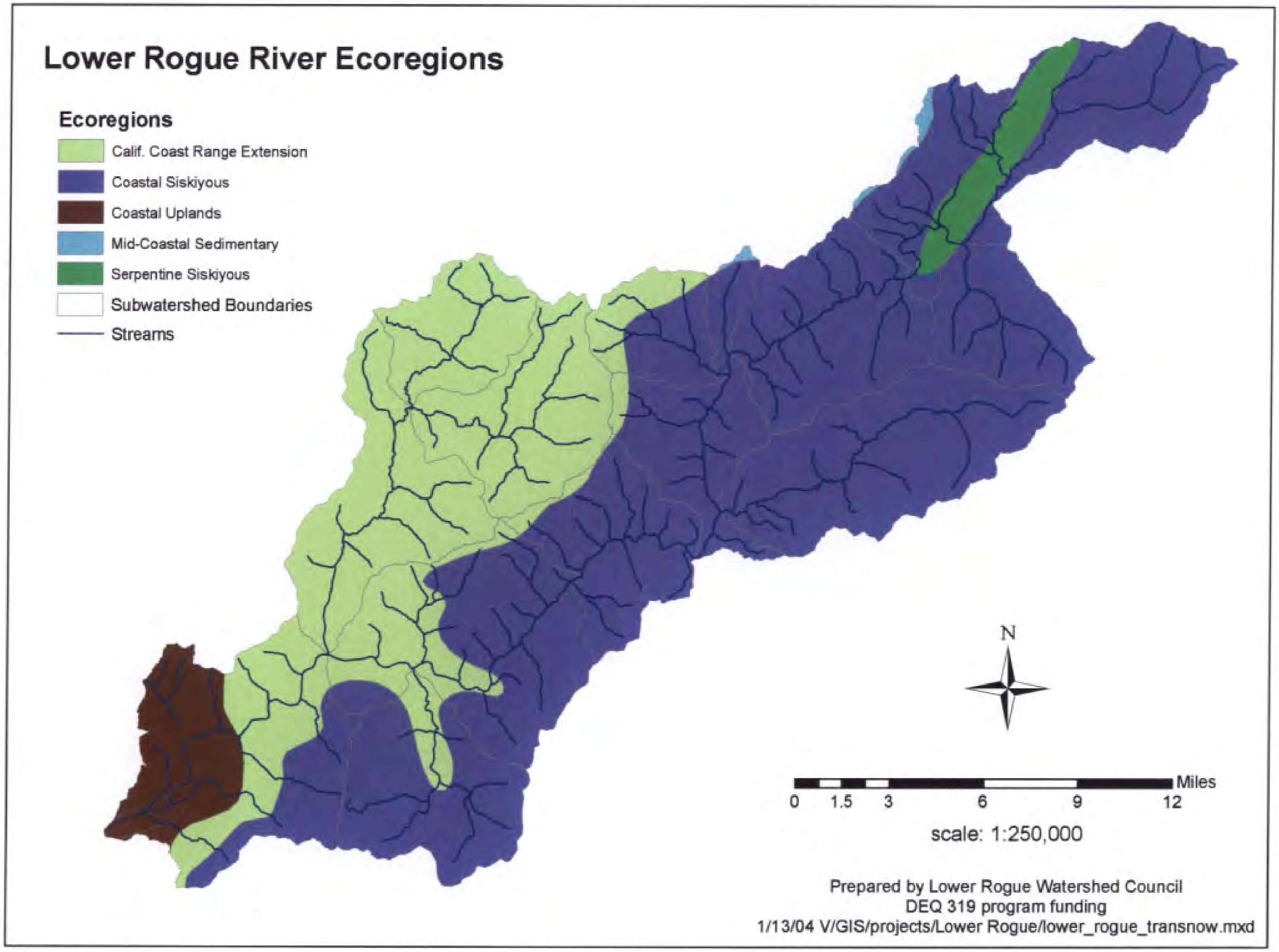
This ecoregion is part of the Siskiyou Mountains. Its mountains are dissected with high gradient streams and steep side-slopes; waterfalls are common. Watersheds in this ecoregion typically have a high stream density due to the high precipitation and fractured geology.

Geology & Soil

Geology is a complex mix of highly-fractured siltstone, shale, sandstone, gray wackle, granite and serpentine. Soils range from very deep to shallow, silt loam to very gravelly loam.

Climate

Precipitation	Frost Free	Mean Temperature	
Mean Annual (Inches)	Mean Annual (Days)	January Min/Max (°F)	July Min/Max (°F)
70 – 140	170 – 220	36/52	52/76


Lower Rogue River Ecoregions
Ecoregions
Calif. Coast Range Extension
Coastal Siskiyous
Coastal Uplands
Mid-Coastal Sedimentary
Serpentine Siskiyous
Subwatershed Boundaries
Streams
N
Miles
0 1.5 3 6 9 12
scale: 1:250,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
1/13/04 V/GIS/projects/Lower Rogue/lower_rogue_transnow.mxd

Runoff

Spring	Partially uniform; rainstorms create periods of higher runoff
Summer	Uniform; runoff gradually declines
Fall	Mostly uniform; runoff gradually increases; higher runoff during late fall rains
Winter	Not uniform; high runoff during rainstorms, especially when snow on ground

Erosion & Peak Flows
Erosion rate is high due to abundant precipitation, high uplift rates, earthquakes, steep slopes, fractured geology, and high landslide occurrence. Landslides are deep-seated earth flows in lower gradient areas or are shallow landslides (often triggering debris slides) in steep headwater channels. Peak flows (50-year recurrence interval, cfs per square mile) are 300 in northern portion to 550 in southern portion of ecoregion.

Stream Channel Characteristics

Characteristic	Gradient	Stream Size		
		Small	**Medium**	**Large**
Substrate	Low	Gravel	Gravel	Gravel / cobbles
	High	Gravel / cobbles	Gravel / cobbles	Cobbles / bedrock
Beaver Dams	Low	Some year-round	Few year-round	None
	High	Few in summer	None	None

Natural Disturbances
Fires are more frequent in Douglas fir / western hemlock forests than in their neighboring Sitka spruce forests, although the interval between fires is quite variable. Large wildfires during late summer and fall once burned large areas within the southern Coast Range. Fires sometimes skipped over streamside areas. Fire suppression has now eliminated most large wildfires.

Extreme windstorms capable of toppling large patches of trees occur about every 35 to 100 years. Smaller earthquakes capable of triggering landslides occur every decade or so and catastrophic earthquakes occur about every 300 years.

Upland & Riparian Vegetation
Douglas fir, western hemlock, tanoak, Port Orford cedar and pasture grasses, characterizes upland vegetation.

Current riparian conifer regeneration is uncommon unless streamside areas are intensively disturbed, followed by control of competing hardwoods and brush. Potential riparian vegetation will vary according to channel confinement. Confined and moderately confined channels may include a narrow band of hardwoods (tanoak, myrtle, red alder) and brush nearest the stream with mainly Douglas fir and hardwoods beyond. Unconfined channels may consist of similar riparian communities although the band of vegetation may be considered moderately wide. Coniferous dominated sites along unconfined channels often occur on infrequently disturbed higher terraces.

Land Use
Land use is mostly commercial forestry with some farm use in the wider valleys and gentle slopes. There is some recreation and rural residential development.

Other
Irrigation withdrawals result in the partial dewatering of a number of streams during the summer.

(2) Coastal Siskiyous (62.1% of Lower Rogue River Watershed)

Overview
The Coastal Siskiyous ecoregion has a wetter and milder maritime climate than elsewhere in the Klamath Mountains. Productive forests composed of tanoak, Douglas-fir, and some Port Orford cedar cover the dissected, mountainous landscape. These steep mountains are located within 60 miles of the coast. Elevations in this ecoregion range from 1,000 to 4,800 feet.

Physiography & Topography
Mountains are highly dissected. High gradient perennial and intermittent streams along with a few small alpine glacial lakes are characteristic of this ecoregion. Waterfalls are common. Stream density within watersheds is high; valleys are narrow.

Geology and Soil
Geology is underlain by conglomerates, sandstone, or siltstone. Soils range from deep, very gravelly silt loam to very gravelly loam.

Climate

Precipitation	**Frost Free**	**Mean Temperature**	
Mean Annual (Inches)	Mean Annual (Days)	January Min/Max (°F)	July Min/Max (°F)
70-130	100-190	38/50	50/76

Runoff

Spring	Partially uniform; rainstorms create periods of higher runoff
Summer	Uniform; runoff gradually declines, higher runoff during thunderstorms
Fall	Mostly uniform; runoff gradually increases; higher runoff during late fall rains
Winter	Not uniform; high runoff during rain storms and snow melt

Erosion and Peak Flows
Natural erosion rate is high due to steep terrain, high winter precipitation, high uplift rates, and weak rock. Peak flows (50-year recurrence interval, cfs per square mile) are 400 to 600.

Stream Channel Characteristics

Characteristic	Gradient	Stream Size		
		Small	**Medium**	**Large**
Substrate	Low	Gravel	cobbles/gravel	cobbles
	High	gravel / cobbles	Cobbles	cobbles / bedrock
Beaver Dams	Low	some year-round	some year-round	none
	High	few in summer	few in summer	none

Natural Disturbances
Both lightning-caused and human-caused fires were common in this region in the past. Streamside areas sometimes escaped the fires. Past fires varied in severity, depending on specific site conditions. Fire suppression has reduced the frequency of wildfires.

Upland and Riparian Vegetation
Tanoak and Douglas-fir forests characterize upland vegetation. Potential natural vegetation includes Jeffrey Pine and some Port Orford cedar.

Current riparian conifer regeneration is common except where tanoak becomes established. Potential riparian vegetation will vary according to channel confinement. Confined and moderately confined channels (see Chapter 4—Channel Habitat Types) may include a narrow band of hardwoods with Douglas-fir, tanoak, Port Orford cedar, and Jeffrey pine beyond. Unconfined channels differ primarily in their width of hardwoods, which may be considered moderately wide rather then narrow.

Land Use
Forestry, recreation, rural residential development and some mining dominate the land use. Much of this area is managed by the Siskiyou National Forest so commercial forestry activities have been greatly reduced in recent years.

(3) Coastal Uplands (4.8% of Lower Rogue River Watershed)

Overview
The Coastal Uplands ecoregion extends to an elevation of about 500 feet. The climate is marine-influenced with an extended winter rainy season, enough fog during the summer dry season to reduce vegetal moisture stress, and a lack of seasonal temperature extremes. The ecoregion roughly corresponds with the historic distribution of Sitka spruce. The extent of the original forest has been greatly reduced by logging.

Physiography &Topography
Coastal headlands and upland terraces with medium to high gradient, black-water streams are common. Medium and large streams and some small streams are low gradient; few waterfalls exist. Headwater small streams are often steep gradient and usually bordered by steep slopes. Other streams are bordered by a variety of flat to steep slopes. Watersheds in this ecoregion have a high stream density.

Geology & Soil
Geology is weak sandstone. Soil is mostly deep silt loam.

Climate

Precipitation	Frost Free	Mean Temperature	
Mean Annual (Inches)	Mean Annual (Days)	January Min/Max (°F)	July Min/Max (°F)
70-125	190-240	36/48	52/68

Precipitation and Runoff Patterns
Wet winters, relatively dry summers and mild temperatures are typical characteristics of the climate in this ecoregion. The highest monthly precipitation occurs in November, December, and January. Heavy precipitation results from moist air masses moving off the Pacific Ocean onto land. Peak streamflows occur in the winter months. The peak flow generating process in this ecoregion is rainfall. Snowpack development is minimal except during unusual storms, which bring very cold, moist air to the region. The 2-year 24 hour precipitation ranges from 3.5 to 5.5 inches. The peak flow magnitude (2 year recurrence interval) is 50 cfs/square mile to 150 cfs/square mile.

Erosion & Peak Flows
Erosion rate is high due to abundant precipitation, high uplift rates, steep slopes, weak rock, and high landslide occurrence. Landslides are deep-seated earth flows in lower gradient areas or are shallow landslides (often triggering debris slides) in steep headwater channels.

Stream Channel Characteristics

Characteristic	Gradient	Stream Size		
		Small	**Medium**	**Large**
Substrate	Low	gravel / fines	Fines	fines
	High	gravel / bedrock	fines / bedrock	bedrock
Beaver Dams	Low	many year round	many year round	some in summer
	High	some in summer	few in summer	none

Natural Disturbances
Fires tend to be infrequent in Sitka spruce forests, although they are usually stand-replacing fires since the typical species are not tolerant of fire. Fires are more frequent in Douglas-fir/western hemlock forests, although the interval between fires is quite variable. Large wildfires during late summer and fall once burned large areas of central Coast Range, killing most trees in its path. The Coastal Uplands ecoregion was sometimes skipped over by wildfire because of coastal fog influence. Fire suppression has now eliminated most large wildfires.

Extreme windstorms capable of toppling large patches of trees occur about every 35 to 100 years. Young hemlock trees are particularly susceptible to wind damage if located along cutting lines or within streamside buffers.

Catastrophic earthquakes capable of triggering numerous landslides occur about every 300 years.

Upland & Riparian Vegetation
Douglas-fir, western hemlock, Sitka spruce and western red-cedar are common forest types. Current riparian conifer regeneration is common, especially if an organic substrate exists for hemlock and spruce seed regeneration. Competition from non-conifers can be intense, especially where salmonberry, huckleberry, and alder become established.

Potential riparian vegetation will vary according to channel confinement. Confined channels include a narrow band of hardwoods (red alder or others) and brush. Situated behind the hardwoods are conifers (western hemlock, Sitka spruce, western redcedar, Douglas-fir) and some alder. Few conifers are present where slopes are unstable or perpetually wet.

Moderately confined channels differ primarily in their width of streamside vegetation, which is considered moderately wide rather than narrow. Well-drained streamside areas are mostly dominated by conifers. Few conifers are present where slopes are unstable or perpetually wet. Also, there are usually no conifers on low terraces. Beaver browsing sometimes modifies vegetation.

Unconfined channels differ again in their width of streamside vegetation, which is considered wide rather than narrow or moderately wide. Well-drained streamside areas are mostly dominated by conifers. Few conifers are present where slopes are perpetually wet. Also, there are usually no conifers on low terraces. Beaver browsing sometimes modifies vegetation.

Land Use
Land use is mostly forestry, rural residential development or recreation.

(4) Serpentine Siskiyous (2.6% of Lower Rogue Watershed)

Overview
The mountainous Serpentine Siskiyous ecoregion is highly dissected and is underlain by Jurassic serpentine. Rare understory species and sparse woodlands grow on its unique soils. Mining and associated water quality problems occur. Elevations in this ecoregion range from 1,500 to 4,200 feet.

Physiography & Topography
Mountains are highly dissected. High gradient perennial and intermittent streams are characteristic of this ecoregion. Waterfalls are common. Stream density within watersheds is high; valleys are narrow.

Geology and Soil
Geology is underlain by serpentine rock. Soils are derived from serpentine rock that results in sparse vegetation and a limited number of species. Soils range from stony clay loam to gravelly loam.

Climate

Precipitation	Frost Free	Mean Temperature	
Mean Annual (Inches)	Mean Annual (Days)	January Min/Max (°F)	July Min/Max (°F)
45-140	70-140	32/44	49/82

Runoff

Spring	Partially uniform; rainstorms create periods of higher runoff
Summer	Uniform; runoff gradually declines; higher runoff during thunderstorms
Fall	Mostly uniform; runoff gradually increases; higher runoff during late fall rains
Winter	Not uniform; high runoff during rainstorms and snow melt

Erosion & Peak Flows

Natural erosion rate is high due to steep terrain and high winter precipitation. Peak flows (50-year recurrence interval, cfs per square mile) are 100 to 600.

Stream Channel Characteristics

Characteristic	Gradient	Stream Size		
		Small	Medium	Large
Substrate	Low	Gravel	cobbles / gravel	cobbles
	High	gravel / cobbles	cobbles	cobble / bedrock
Beaver Dams	Low	few year-round	few year-round	none
	High	None	none	none

Natural Disturbances

Both lightning-caused and human-caused fires were common in this region in the past. Streamside areas sometimes escaped the fires. Past fires varied in severity, depending on specific site conditions. Fire suppression has eliminated many wildfires.

Upland and Riparian Vegetation

Sparse woodlands with unique understory vegetation characterize upland vegetation. Potential natural vegetation includes Jeffrey pine, tanoak, Douglas-fir, and unique understory plants due to soils derived from underlying serpentine rock.

Current riparian conifer regeneration is common except where tanoak becomes established. Potential riparian vegetation will vary according to channel confinement. Confined and moderately confined channels are characterized by a narrow band of sparse brush with Jeffrey pine, tanoak, and Douglas-fir beyond. Unconfined channels differ primarily in their width of riparian vegetation, which is considered moderately wide rather then narrow.

Land Use

Land use includes recreation, forestry, and mining.

Other

This ecoregion is a regional water source.

(5) Mid-Coastal Sedimentary (0.3% of Lower Rogue River Watershed)

Overview

The Mid-Coastal Sedimentary ecoregion is characterized by steep mountainous terrain with a high stream density. Elevations range from 300 to 4000 feet.

Physiography & Topography

Medium and large streams and some small streams are low gradient; few waterfalls exist. Headwater small streams are often steep and bordered by steep slopes. Watersheds have a high stream density.

Geology & Soil

Geology consists of alternating beds of thin siltstone and thick sandstone. Soils on gentle slopes are deep clay loam; steeper slopes are shallow gravelly loam.

Runoff

Spring	Partially uniform; rainstorms create periods of higher runoff
Summer	Uniform; runoff gradually declines
Fall	Mostly uniform; runoff gradually increases; higher runoff during late fall rains
Winter	Not uniform; high runoff during rainstorms, especially when snow on ground

Erosion & Peak Flows

Erosion rate is high due to abundant precipitation, high uplift rates, steep slopes, soft rock and high landslide occurrence. Landslides are deep-seated earth flows in lower gradient areas or shallow landslides (often triggering debris flows) in steep headwater areas. Peak flows (50-year recurrence interval, cfs per square mile) are 200 to 250.

Stream Channel Characteristics

Characteristic	Gradient	Stream Size		
		Small	Medium	Large
Substrate	Low	Gravel/fines	Fines/gravel	Fines/bedrock
	High	Gravel/bedrock	Gravel/bedrock	bedrock
Beaver Dams	Low	Many year-round	Many year-round	Some in summer
	High	Some in summer	Few in summer	None

Natural Disturbances

Fires are more frequent in Douglas fir/western hemlock forests than in neighboring Sitka spruce forest, although the interval between fires is quite variable. Large wildfires during late summer and fall once burned large areas of the central Coast Range, killing most trees in their paths. Fire suppression has now eliminated most large wildfires. Extreme wind storms capable of toppling large patches of trees occur every 35 to 100 years. Catastrophic earthquakes capable of triggering numerous landslides occur about every 300 years.

Upland & Riparian Vegetation

Forests of Douglas fir, western hemlock, red alder, and western red cedar are common. Meadows of pasture grasses often occur.

Current riparian conifer regeneration is uncommon unless streamside areas are intensively disturbed, followed by control of competing hardwoods and brush

Potential riparian vegetation consists of: on constrained/semi-constrained reaches a narrow/moderately-wide band of alder or other hardwoods/brush with Douglas-fir and alder beyond; and on unconstrained channels a wide band of alder with mainly an alder and Douglas-fir mix beyond. For all streams the vegetation may be altered by beaver browsing and dam building.

Land Use

Forestry, pastureland in valleys, and some rural residential development.

REFERENCES

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999

U.S. Environmental Protection Agency 1996. Level III ecoregions of the continental United States (revision of Omernik, 1987): Corvallis, Oregon, U.S. Environmental Protection Agency—National Health and Environmental Effects Research Laboratory Map M-1, various scales.

VI FISH & FISH HABITAT

A BACKGROUND

<u>Salmonid Life Cycles</u> (OSU 1998, Provost et al. 1997)
Salmonid is the group name for salmon, trout, and char. These fish share a common life history pattern. Many are anadromous, i.e., they spawn in fresh water, migrate to sea as juveniles, grow to maturity, and return to their freshwater stream to reproduce.

Adult salmonids spawn by burying their eggs in nests called redds. Spawning site selection depends on the species, gravel size, and flow pattern of the stream. A common spawning location is the "tail-out" of a pool – the area where a pool becomes shallow before entering a downstream riffle. The eggs remain in the gravel for 45 – 70 days depending on water temperatures. Hatching alevins (fry with yolk sacs for nutrients) remain in the gravel until the yolk sac is absorbed. They then work their way through the gravel and emerge into the stream channel as feeding fry. This is a critical stage for all salmonid species. During this part of their life, fry need adequate food and sediment-free water that contains a lot of oxygen.

Natural mortality of juveniles is high during the first month. Many fry are eaten by birds, amphibians, reptiles, and other fish. Depending on the species, juvenile anadromous salmonids grow 1-3 years before migrating to sea as smolts. Smolts need to adapt from freshwater to saltwater by spending transition time in the estuary. After maturing in the ocean, they return to the stream to spawn.

Life cycles vary greatly from river to river and among species (e.g., winter vs. summer steelhead, spring vs. fall chinook, sea run vs. resident cutthroat trout). Where several salmonid species coexist in a river system, each species has its own schedule for rearing, spawning, and migration, although it is not uncommon for juveniles and adults to occupy the same stream areas throughout the year. Adult anadromous salmonids find their way back from the ocean to the streams where they were born. This life cycle feature is called homing and is one of the least understood yet most wonderful aspects of salmon ecology.

<u>Chinook salmon (*Oncorhynchus tshawytscha*)</u>
Chinook (king) salmon are the largest and longest lived of the Pacific salmon. They average 20-25 pounds as adults, although individuals as large as 100 pounds have been reported. Since chinook are large, they can dig redds deep in the gravel, thus protecting the eggs from channel scouring during winter storms. If an unusually heavy storm does scour the eggs and a year is lost, successive

generations can replace the stock because adult chinook spawn from 3-6 years of age. All chinook can spawn once but they then die. There are two basic life-history patterns of chinook in Oregon – fall and spring.

Fall chinook return from the ocean from July through December and peak from mid-August through mid-September. The Oregon Department of Fish and Wildlife divides the fall chinook run into two distinct populations that are based on run timing and life history differences. The early entry adults spawn most heavily between Grave Creek (RM 68) and Gold Ray Dam (RM 127) and in the lower 25 miles of the Applegate River. Only a small portion of the run (about 10%) spawns above the fish counting station at Gold Ray Dam. This early entry population is considered healthy. The late entry adults typically spawn from mid- to late November below Watson Creek (RM 35) and in the Illinois basin. This population is considered severely depressed from historic levels. Historically, there was spawning in the mainstem Rogue within the Lower Rogue Watershed. From approximately 1970-1990 spawning in the lower Rogue mainstem was not observed, possibly due to overall decreased numbers of fish and in part to the flow regime in the river. In the last two years though, some of the largest spawning count numbers have been counted between Canfield Bar (RM 6) to Two Mile Creek near Illahe (RM 33) (Confer 2005).

Alevins stay in the gravel until the egg sac is absorbed, which takes from 1 week in colder water to 1 month in warmer water. The juveniles then emerge from the gravel and immediately move downstream around mid-June in Lower Rogue tributaries. Juveniles can be found in the estuary beginning in May, with peak abundance in July. They generally spend the next 3-4 months in the estuary and then migrate to the ocean, with most gone from the estuary by the end of August.

Spring chinook adults return to the Rogue River between March and June and spend the summer in deep pools. They spawn from September to mid-November. Juveniles rear in the mainstem a short period, migrate downstream, and enter the ocean in August and September to rear off the coast of California. Spring Chinook use the Lower Rogue river as a corridor from the ocean to their spawning habitat in the upper river. Most wild spring Chinook spawn in the main stem or major tributaries above Gold Ray Dam, and hatchery fish return to Cole Rivers Hatchery at Lost Creek Dam. This species of salmonid in the Rogue is considered to have healthy populations.

It is difficult to tell juvenile fall chinook and spring chinook apart. As outlined in the history section of this assessment, flow management for spring chinook is the second fishery management priority as related to reservoir management. As a result of the change in hydrology from the dams on the Rogue and its tributaries, spring chinook are spawning later in the year and fall chinook are spawning earlier. Historically, fall chinook did not spawn above Gold Ray Dam, but now a large number do so. Therefore, there is an increased temporal and spatial interaction among the two runs (Confer 2005)

Coho salmon (*Oncorhynchus kisutch*)

Coho (silver) salmon adults average 6-12 pounds and have a 3-year life cycle. Because coho spawn mostly at age 3 with no year class overlap, their survival is susceptible to catastrophic events. If a year is lost, a population is likely to remain depressed for an extended time. Coho can recolonize tributaries from highly populated source areas. However, this species can be eliminated from a basin quickly if these source areas deteriorate.

Coho using the Rogue River and South Coast basins are part of the Klamath Mountains Province Evolutionarily Significant Unit (ESU). Coho begin entering the Rogue River as early as August through October for runs that will spawn upriver of the Lower Rogue and between October and January for runs that will spawn in the Lower Rogue tributaries. Coho may hold in the main river until the rains allow them to move into secondary streams and tributaries to spawn. Spawning and rearing take place in small low gradient (generally <3%) tributary streams. Spawning occurs between November and January in the Lower Rogue, with the bulk of spawning occurring in December. Coho are not as large as chinook, they spawn in smaller gravel, and their redds are not as deep as those of chinook. Thus, their redds are likely to be scoured out during winter storms.

Fry emerge between February and April and stay close to their natal streams during the first year. During the summer, coho prefer pools in small streams. During the winter, young coho are in large pools, beaver ponds and backwaters which provide cover during high water months. The fish rapidly migrate downstream as one year olds during the spring and spend less than 2 weeks in the estuary. Approximately 10% of coho males return as 2-year-old jacks if habitat conditions are favorable to allow the fish to become sexually mature by its second year, but most males and all females return as 3-year-old adults (Confer 2005).

Coho use of the Lower Rogue watershed is slight, other than as a corridor to and from the Ocean. Other than sea-run cutthroat, coho are the least abundant native anadromous salmoninds in the basin. Historical spawning occurred primarily in the tributaries and upper third of the main Applegate, Illinois, and Rogue Rivers. Known distribution of coho salmon in Lower Rogue tributaries includes South Fork Lobster (6.8 miles), Quosatana (3.9 miles), Silver (4.1 miles), Shasta Costa (5.5 miles), and some in Foster, Mule, and Billings Creeks. Edson Creek has potential to be coho habitat, but there have been no coho reported here and there are only anecdotal reports of coho use in the past.

Steelhead (*Oncorhynchus mykiss*)

Steelhead are seagoing rainbow trout. The Klamath Mountains Province steelhead population is one of 15 steelhead Evolutionarily Significant Units within the Pacific Northwest states. Steelhead utilize habitats that are often not used by other salmonids and utilize multiple stream environments in addition to spawning and rearing in the uppermost reaches of tributaries. They can create multiple small scattered redds in large streams, or may spawn below logs or boulders in faster flowing stream riffles and lateral scour pools, or even in the upper shallow reaches of tributaries that larger fish cannot reach. Steelhead can spawn in stream gradients from flat to 5º slopes and survive water temperatures up to 5 ºC warmer than coho (18-23°C). Steelhead are powerful swimmers and can leap barriers that are insurmountable to other fish. They have also been known to ascend rivulets of only few inches depth to spawn in shallow upland pools. Like salmon, steelhead deposit their eggs in gravel. However, not all steelhead die after spawning. About 30 percent survive to spawn again in the stream of their birth, and some adults live as long as 7 years.

Winter steelhead return from the ocean between November and May with a peak in late January, allowing them to move into headwaters of streams during winter flows. Spawning occurs from December to June, primarily in tributary streams throughout the Rogue Basin, but spawning may also occur in the mainstem if winter flows are depressed or a barrier to migration is present. Fry emerge from early April in the warmer river sections to August in the cooler headwater streams. About 50% of winter steelhead rear for two years in mainstem waters and larger tributaries before migrating to the ocean to rear for two years, with the other 50% split fairly evenly between migrating as one or three years old. Outmigration occurs between March and June, with a peak in early to mid-May. Within the Lower Rogue, relatively small populations occur in many tributaries, including Saunders, Edson, Kimble, Jim Hunt, Lobster, Quosatana, Shasta Costa, Two Mile, Foster, Billings and Mule Creeks. Populations are considered healthy.

Summer steelhead have an early run (May, June and July) and a late run (August, September and October). They enter the Rogue River when flows are lowest and water temperatures are highest and move upstream about 4.5 miles/day. Unlike winter fish, but like spring chinook, summer steelhead need deep, cool pools to reside in for 5-7 months until they migrate upstream when fall stream freshets make the stream accessible. They spawn from December through March.

The majority of summer steelhead adults spawn between the mouth of the Applegate (RM 95) and Gold Ray Dam (RM 126), with the Lower Rogue watershed serving only as a travel corridor. Summer steelhead are prone to spawn in small tributaries. Juveniles emerge from the gravel as late as July and often move into larger tributaries and the mainstem river to rear because the streams in which the spawn go dry by early summer. Juveniles spend from one to three years in freshwater before migrating to the ocean. This long freshwater residence time makes them more vulnerable to habitat degradation than other species. During the first year they live in riffles and along the edges of stream channels. Therefore, low water conditions can severely affect steelhead. In the winter, rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Current runs of summer steelhead are declining, likely due to human water use withdrawals within their preferred small spawning and rearing streams.

Half-pounders are unique to the Rogue River among steelhead populations Pacific coast wide. Half pounders reenter fresh water 3-5 months after first entering the ocean, but do not spawn. Instead, they reenter the ocean and return to spawn a year later. Half pounders typically over-winter within the lower 50 miles of the Rogue mainstem before returning to the ocean the following spring. Over 95% of the summer steelhead, and about one-third of winter steelhead have a half-pounder life cycle. The half-pounder life history is a trait of upper river fish (Confer 2005).

Cutthroat trout (*Oncorhynchus clarki clarki*)

Cutthroat trout have variable life history patterns. Some migrate to the ocean while others remain in the same area of a stream all of their lives. Anadromous and fluvial forms use estuarine, mainstem, and lower portions of the system for adult holding and juvenile rearing, and use small headwater streams for spawning. The resident form of cutthroat are also typically found in headwater areas, but can be found in low gradient backwater areas lower in the system.

Cutthroat spawn in the spring or fall, usually in very small tributaries, although spawning in the mainstem is also seen. Steelhead and both runs of cutthroat are able to spawn together. Juveniles emerge by June or July. Cutthroat are probably present in the estuary nearly year-round. Sea-run cutthroat migration to the ocean is similar to steelhead, with a slug of cutthroat seen in the estuary within about 1 week of the peak migration of steelhead (Confer 2005).

Salmonid Habitat

Successful spawning and development from eggs to fry stages require the following:

- No barriers to upstream migration for adults
- Spawning areas (usually in a riffle or at the tail-out of a pool) with stable gravel, free of fine sediment
- A combination of pools and riffles that provides both spawning areas and places to hide nearby
- A constant flow of clean, well oxygenated water through the spawning gravel

During rearing, fry are vulnerable to predators and must endure high stream flows and food shortages. They need pools for rearing, temperature regulation, and cover. Good juvenile-rearing habitat exhibits the following characteristics:

- Low to moderate stream gradient (slope) and velocity
- A good mix of pool and riffle habitats
- Clean, oxygenated water and cool stream temperatures
- A variety of bottom types to provide habitat for juvenile fish and food organisms

- Overhanging vegetation, large woody material, and stream cutbanks, which provide protection for juvenile fish and leaf litter for aquatic insect food
- Sufficient nutrients to promote algal growth and decomposition of organic material

As young fish grow, they seek increased summer flow, moving from the edge of a stream to midstream to take advantage of insect drift. In winter, all species seek areas of lower water velocity where they can conserve energy while food and growing conditions are limited.

Salmonid Habitat Use

Although their basic requirements are the same, salmonid species differ in the types of habitat they use. For example, juvenile coho prefer pool areas of moderate velocity in the summer, especially those with slack water current near undercut stream banks, root wads, or logs. In winter, they seek slow, deep pools or side channels, utilizing cover under rocks, logs and debris.

Conversely, juvenile steelhead spend their first summer in relatively shallow, cobble-bottomed areas at the tail-out of a pool or shallow riffle. During winter, they hide under large boulders in riffle areas. In summer, older steelhead juveniles prefer the lead water of pools and riffles where there are large boulders and woody cover. The turbulence created by boulders also serves as cover. During winter, these steelhead juveniles are found in pools, near streamside cover, and under debris, logs or boulders.

Cutthroat trout habitat requirements are similar to those of steelhead with the exception that they spend the summer in pools. Chinook juveniles tend to rear in large tributaries, and their habitat requirements are different than those of coho. For example, estuarine residence and growth are key elements in a chinook life-history pattern. Coho salmon require backwaters, beaver ponds, or side-channel rearing habitats to survive high winter flows and low summer flows.

Salmonid Limiting Factors

The quantity and quality of spawning and rearing habitat limit the success of spawning and production of smolts. These limiting factors establish the carrying capacity of a stream. Carrying capacity is the number of animals a habitat can support throughout the year without harm to either the organisms or the habitat. Depending upon the limits of available habitat, ocean factors, escapement, etc., salmonid populations fluctuate annually as a result of varying environmental factors (e.g. extreme high and low stream flows, high stream temperatures in the summer, or ice). A stream does not necessarily reach its carrying capacity each year because of these factors.

Fish Passage

Stream channel crossings by roads have been the cause of serious losses of fish habitat. Assessment of migration barriers is important, because anadromous salmonids migrate upstream and downstream during their life cycles. In addition, many resident salmonids and other fish move extensively upstream and downstream to seek food, shelter, better water quality, and spawning areas. Where these barriers occur, fish can no longer reach suitable habitats. Because of reduced accessible habitat, fish populations may be limited.

Culvert road crossings can create barriers to fish migration in the following ways:

- The culvert is too high for the fish to jump into.
- The water velocity in the culvert is too fast for the fish to swim against.
- The water in the culvert is not deep enough for the fish to swim, or has a disorienting turbulent flow pattern, making it difficult for fish to find their way through.
- There is no pool below the culvert for the fish to use for jumping and resting, so they cannot access the culvert, or there are no resting pools above the culvert, so the fish are washed back downstream.

A combination of these conditions may also impede fish passage. It is not always clear when a culvert blocks fish passage. Some culverts may be velocity barriers during high flows but pass fish successfully during low flows. Other culverts may not be deep enough during summer low flows to pass fish, but fish can pass successfully during higher flows. Large, adult anadromous fish may be able to pass through culverts that are total barriers to smaller juvenile or resident fish. For these reasons it is important to understand what fish species occur in the watershed and when they will be migrating.

Culverts can be round, square, elliptical, or other shapes. Culverts can be made of various materials, including concrete, but metal pipe is the most common material. Because of the variability in culvert type and design, it is often difficult to definitively determine if a culvert blocks fish passage.

Other fish passage concerns can include impoundments, dams, unscreened and screened irrigation pipes and water withdrawals that result in dewatered reaches and/or low flows that restrict migration. Natural barriers, in contrast, are characteristic of a stream's channel morphology and where present, play a vital role in the co evolution of various fish species.

Other species of interest

While salmonids are the focus of this chapter due to their importance, both as an indicator species and to Pacific Northwest communities, the Rogue River does support other fish species. One of interest is the sturgeon. Green sturgeon (*Acipenser* *medirostris)*, and white sturgeon (*Acipenser transmontanus*) both use the Rogue River, but not much is known about their historic levels, life cycle characteristics or habitat requirements.

In the Rogue River, green sturgeon far outnumber white sturgeon. Green sturgeon are listed as a "species of concern" and the Rogue River is one of only three known spawning rivers in the world for these fish (Wildlife Conservation Society, 2004). In 1999 the Oregon Dept. of Fish and Wildlife initiated a multi-year project to increase the understanding of green sturgeon. (NOAA Fisheries and the Wildlife Conservation Society, and others joined the effort in 2000). The objectives were to summarize and analyze existing information, describe adult populations in the Columbia, Umpqua, and Rogue Rivers, and describe spawning and recruitment in the Umpqua and Rogue Rivers. Fisheries biologists believe that juvenile green sturgeon captured in beach seines over the last several decades are strong evidence that spawning occurs fairly regularly in the Rogue River. From October 2000 to September 2001 sampling was conducted in the lower 40 km of the Rouge River from Gold Beach to Copper Canyon. Gill netting and beach seining was conducted and sturgeon were tagged. Egg frame substrates were also set out between RM 17.9 and 40.9 immediately downstream of high velocity riffles and at locations occupied by previously radio-tagged sturgeon, and plankton nets were used to capture sturgeon eggs and larvae.

Results have shown that the marked adult sturgeon moved into the Rogue River prior to June 1 to spawn. Once distributed in the system, adults tended to move into deep pools and hold in the same areas from summer through fall. When the water temperature falls to about 10ºC and flows started to increase (November/December), fish began to move downstream. All radio-tagged green sturgeon had left the Rogue River by the end of December. Similar behavior was demonstrated in studies in 2000. After leaving the Rogue River, tagged sturgeon moved north and stayed in water less than 100 meters deep. While some green sturgeon stay offshore, more than 30% of the green sturgeon tagged in the Rogue in 2002 and 2003 were found in Winchester Bay during the summer of 2004. Research into green sturgeon, including life histories and habitat characteristics of juveniles, and population estimates, are continuing and are led by the Wildlife Conservation Society. A recent study looked at any effects of jet boat traffic on green sturgeon movement. The study did not find any effects.

Chum salmon (Oncorhynchus keta) and pink salmon (O. gorbuscha) are occasionally found in tributaries of the Lower Rogue (between the mouth and Agness), probably as strays. The Rogue River is near the southernmost boundary of these species' range (ODFW 1993).

Gamefish that inhabit the Rogue River include largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieui*), black crappie (*Pomoxis migraomaculatus*), bluegill (*Lepomis machrochirus*), American shad (*Alosa sapidissima*) and the brown bullhead

(*Ictalurus nebulosus*). Nongame fish abundant in the basin include the redside shiner (*Richardsonius balteatus*), Klamath smallscale sucker (*Catostomus rimiculus*), common carp (*Cyprinus carpio*), prickly sculpin (*Cottus asper*), threespine stickleback (Gasterosteus aculeatus), riffle sculpin (Cottus gulosis), and Pacific lamprey (*Lampetra tridentate*). The distribution of northern squawfish (*Ptychocheilus oregonensis*) was noted to be rapidly expanding after an illegal introduction in 1979 (ODFW 1993).

B INTRODUCTION

Chinook, coho, steelhead, and cutthroat are all native to the Lower Rogue watershed. Historical numbers of coho are thought to have been relatively small in most south coast basins including Lower Rogue tributaries. This is likely due to the relatively steep topography that leads to a high gradient, confined and high-energy system (ODFW 2001).

<u>Changes from historical abundance</u>

Estimates of historic runs for Oregon coastal salmon south of the Columbia River and north of California range up to 1.6 million adults in the early 1900s, but may have declined to below 100,000 adults in the last decade. The Rogue and South Coast systems together may have represented between five and ten percent of the west coast total salmon production (Prevost et al., 1997). In 1890 the Rogue Basin supported an estimated 60,000 native coho, based upon estimates projected from cannery shipments. At the peak of fish canning, packs contained up to 82,500 adult Chinook in 1917 and 50,500 adult coho in 1928 (USDA 2000). Cases of salmon produced peaked in 1891 and 1917 with 25,000 cases and fell to 4,400 by 1930. The fishing nets used also caught steelhead, considered a game fish, in addition to salmon and other species, and may have affected these populations. Guesses to presettlement populations of steelhead for the Rogue and South Coast basins range from a low of 250,000-300,000 to an upper range of 600,000-800,000 fish (Siskiyou National Forest, 1996).

Fish numbers in general were also declining in the Rogue River due to climatic changes, dams, mining, and unscreened water diversions in the upper basin (Provost et. al. 1997). The factors combined and led to a state law passed in 1935 that banned commercial fishing on the Rogue River (Schroeder 1999, USDA 2000). The action was virtually unopposed by the canning companies because fish numbers were too low to support the industry. From 1922 to 1935, 6 million pounds of salmon were canned (USDA 2000).

ODFW contends that the majority of winter steelhead streams in Southwest Oregon are fully seeded for existing habitat conditions, though this is definitely below historic levels due to loss of habitat quality. Wild production fluctuates widely and this pattern appears to reflect the normal production cycle through time. This fluctuation is a product of the interaction between 1) the interactive, combined, and cumulative effect of reduced stream habitat quality and ocean productivity, 2) the dilution of vitality of native stocks from mixing and replacement by hatchery stocks, and 3) decades of excessive harvest (especially of half-pounders), which depleted native replacement stocks.

According to information collected for the Southwest Oregon Salmon Restoration Initiative (1997), within the Rogue and South Coast basins, 91% of the historic steelhead habitat area, and 90% of the historic coho habitat area, remains available. Loss is mostly related to dams. Access to Lower Rogue spawning habitat was determined to be unchanged from historic levels at 107.0 miles, which may be underestimated. Note that this does not mean that quality of the habitat has not changed—indeed it has. In the draft Rogue Basin Plan, ODFW determined that in the Lower Rogue River and its tributaries logging on unstable slopes, removal of large woody debris, road construction, and mining, in that order, were habitat concerns affecting coho, fall chinook, winter steelhead, and rainbow trout.

Before the construction of Lost Creek Dam, the lower Illinois River served as a refuge area for steelhead because temperatures here were 2-3 degrees cooler than the Rogue River. All adult summer steelhead entering the Illinois River in the summer would then move back to the Rogue River in late fall and continue their upstream migration. After Lost Creek Dam was constructed in the early 1970s, the temperature difference was eliminated and consequently there has been no significant movement of steelhead into the Illinois River observed. The Illinois River at present is generally considered to have only winter steelhead.

<u>Threatened and Endangered Species</u>

Table 6.1 lists the threatened and endangered species according to the National Marine Fisheries Service (NMFS) and ODFW. The Northwest Region of NMFS is responsible for marine and anadromous fishes under the Endangered Species Act (ESA).

Table 6.1 Threatened and Endangered Species

Species	Evolutionary Significant Unit	Date of Decision	ESA Status
Chinook	Southern Oregon and Northern California	September 16, 1999	Not Warranted
Coho	Southern Oregon and Northern California	May 6, 1997	Threatened
Cutthroat		April 5, 1999	Not Warranted
Steelhead	Klamath Mountains Province	April 4, 2001	Not Warranted

(1) NMFS – NW Region website //www.nwr.noaa.gov/1salmon/salmesa/specprof.htm

Estimates of Run Sizes in the Rogue River Basin

The Oregon Fish and Wildlife Department, Gold Beach District conducts yearly seining at Huntley Park, located at river mile 8. Only actual count numbers are given for coho and chinook due to low confidence in estimated population numbers for these species.

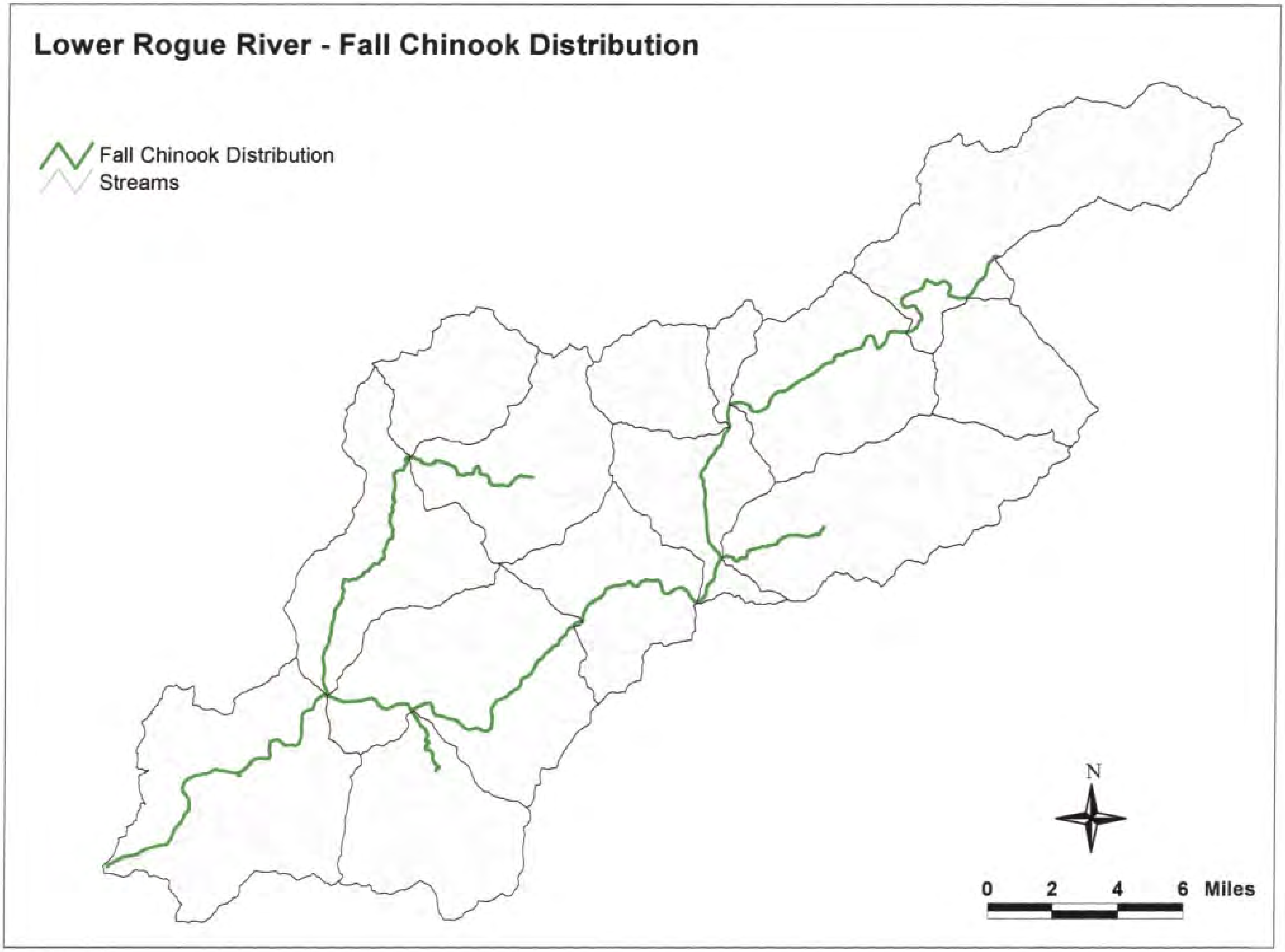
Table 6.2. Huntley Park figures by year and species.
(Data is from Oregon Department of Fish and Wildlife, Gold Beach District Office).

Year	Steelhead	Half-pounders	Coho		Chinook	
	Estimated Total	Estimated Total	Adults	Jacks	Adults	Jacks
1976	10,556	33,005				
1977	26,225	142,089				
1978	30,996	93,591				
1979	29,286	43,256				
1980	19,997	171,324				
1981	39,129	233,401				
1982	39,941	117,166				
1983	12,221	98,736				
1984	18,102	68,990				
1985	35,713	178,078				
1986	41,378	171,336				
1987	37,668	165,095	96	68	1,020	357
1988	26,624	41,900	423	116	790	152
1989	17,500	53,141	84	20	719	154
1990	4,313	34,402	58	18	201	49
1991	4,567	46,844	106	13	157	39
1992	4,045	78,719	94	16	485	345
1993	8,010	39,728	34	31	298	98
1994	13,847	101,877	174	65	781	153
1995	21,533	219,865	212	56	483	140

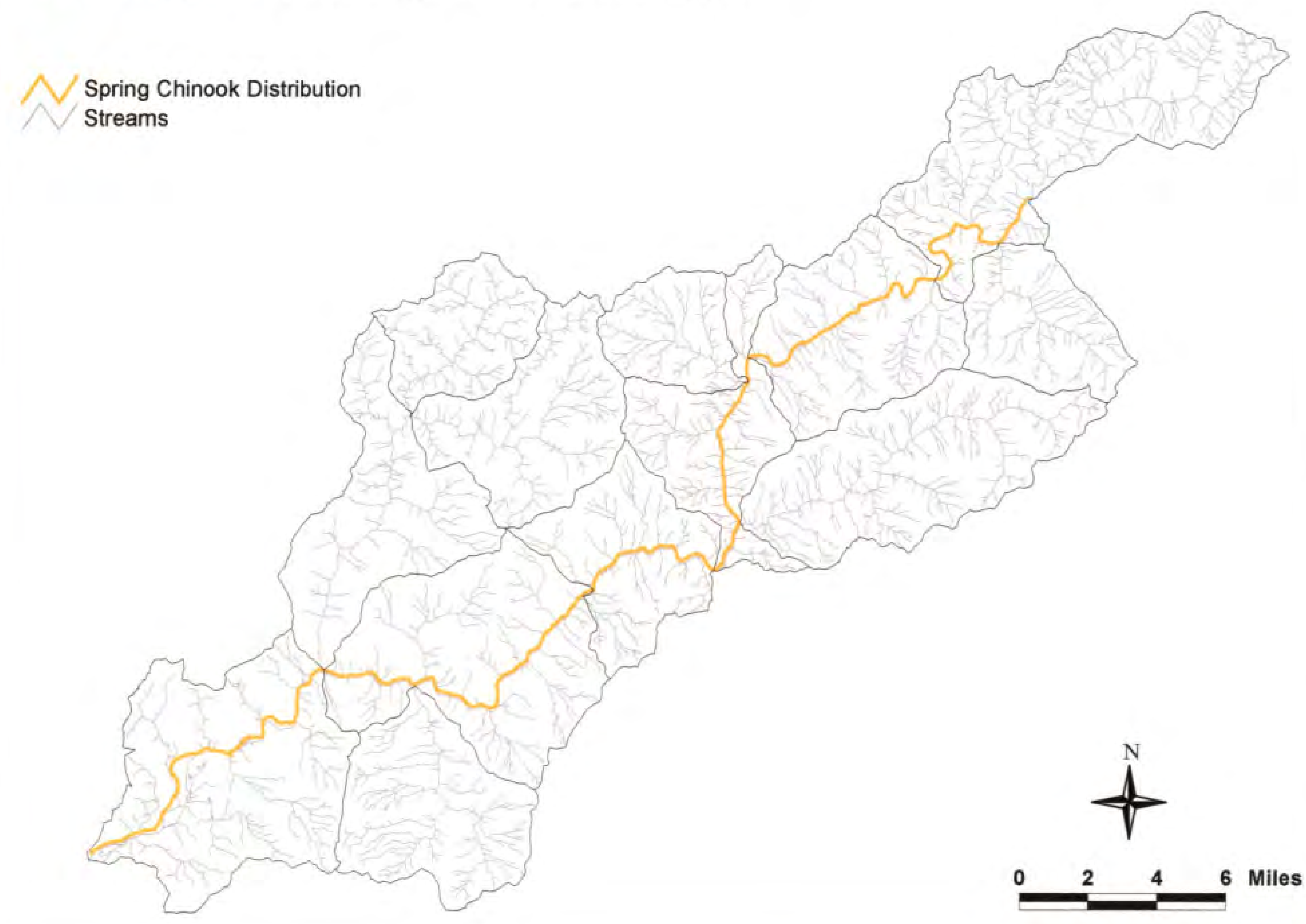
1996	11,413	96,035	375	85	414	135
1997	15,325	152,288	501	81	294	132
1998	9,222	82,410	165	48	335	72
1999	15,882	84,226	163	84	265	129
2000	20,981	224,372	505	285	860	137
2001	17,397	123,357	1041	101	942	327
2002	35,813	109,731	752	160	1561	460

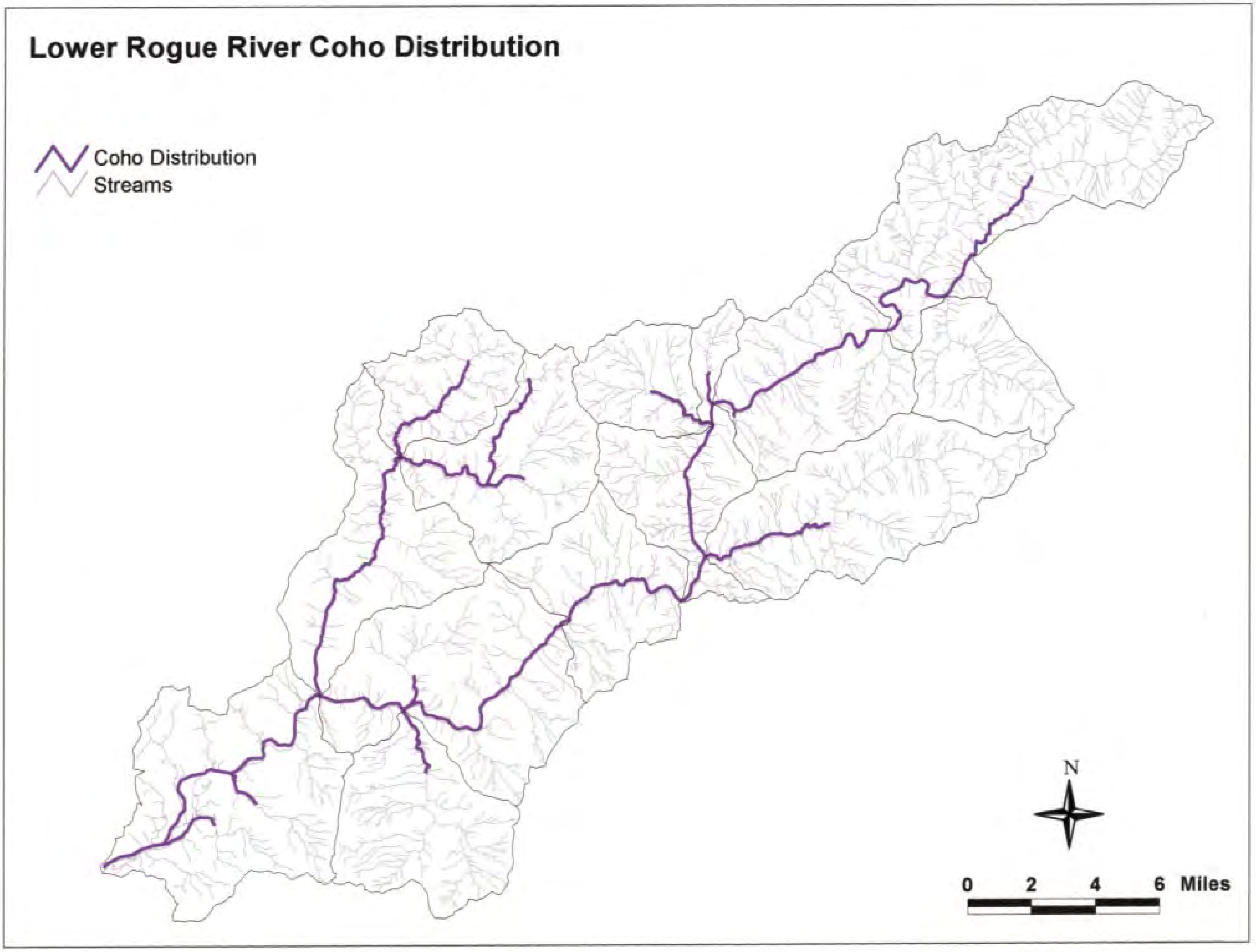
<u>Fish Distribution</u>

Fish distribution maps were obtained from the Southwest Oregon Province GIS data. Metadata came from the Environmental Protection Agency, and originally from Matt Fried at the Pacific States Marine Fisheries Commission and was a subset of the 100k stream coverage obtained from ODFW. Due to the resolution of the scale (1:100,000) distribution of all species was not available for small streams. All maps reflect

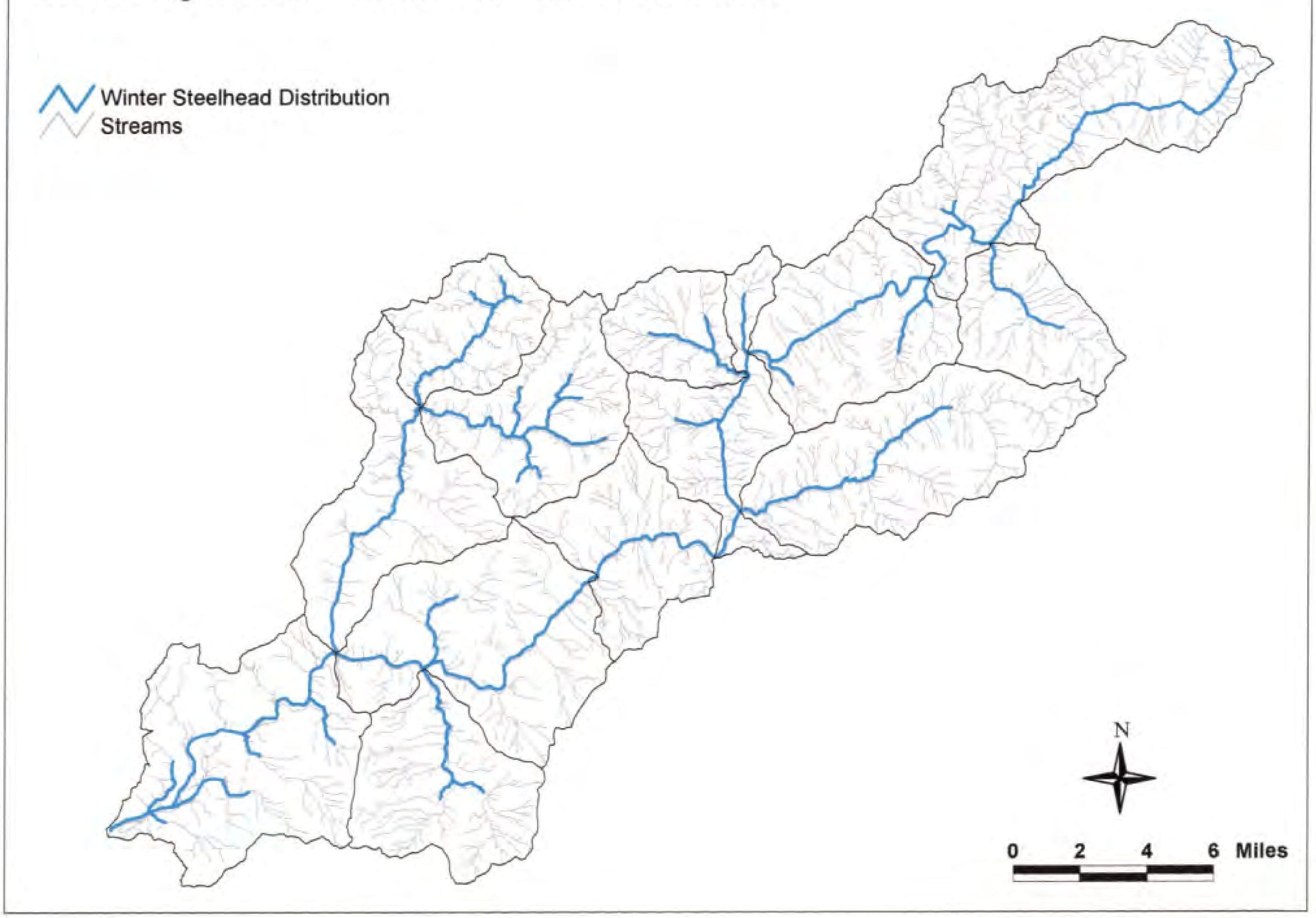

Lower Rogue River - Fall Chinook Distribution
Fall Chinook Distribution
Streams
N
0 2 4 6 Miles

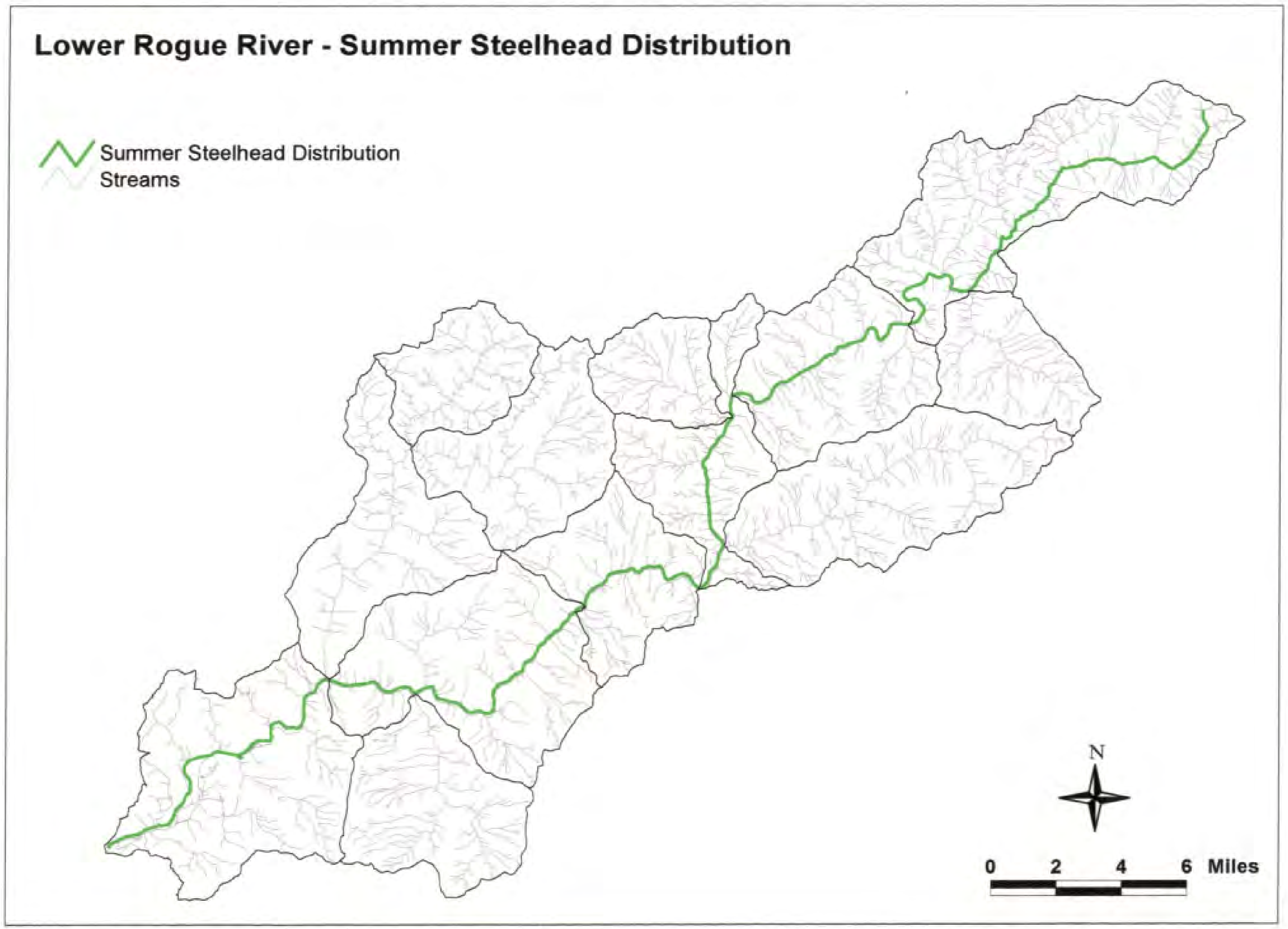
Lower Rogue River Spring Chinook Distribution




Lower Rogue River Coho Distribution
Coho Distribution
Streams
N
0
2
4
6
Miles

Lower Rogue River - Winter Steelhead Distribution




Lower Rogue River - Summer Steelhead Distribution
Summer Steelhead Distribution
Streams
N
0 2 4 6 Miles

distribution only; they do not provide any indication of the relative abundance of each species. Furthermore, all maps are in draft form. The following paragraph was adapted from the fish distribution metadata files (ODFW web site) that correspond to the maps.
The following paragraph was adapted from the fish distribution metadata files (ODFW web site) that correspond to the maps.

> "Fish distribution maps illustrate areas of suitable habitat (spawning, rearing and migration) currently believed to be utilized by wild, natural, and/or hatchery fish populations. The term "currently" is defined as within the past five reproductive cycles. This information is based on survey data, supporting documentation and best professional judgment of ODFW staff biologists and in some cases, that of staff from other natural resource agencies within Oregon. Areas displayed may not be utilized by a species of fish on an annual basis due to natural variations in run size, water conditions, and other environmental factors. Due to the dynamic nature of this information, it may be updated at any time. This distribution information makes no statement as to the validity of absence in any particular area; no attempt has been made to verify where fish are not present. Historic genetic origin and current production origin have yet to be defined and are not found as attributes of the distribution data at this time."

Distribution of salmonids occurs throughout significant areas of the Lower Rogue watershed. While considerable information exists regarding the contemporary distribution of spawning and rearing of chinook, coho and steelhead, little is known about contemporary cutthroat distributions. Typically, however, cutthroat are thought to utilize all portions of the basin.

Juvenile Fall Chinook Trapping

The Oregon Department of Fish and Wildlife conducted trapping on Lobster Creek from 1993 to 1999, although only trapping conducted from 1995 to 1999 was complete enough to estimate fall chinook production. Chinook sampled were sampled for only a short time during the spring in 1993 and 1994 and consisted primarily of fry under 50 mm in length that were flushed out of the system during high water events. Trapping in 1995 to1999 were primarily juvenile chinook that were actively migrating down Lobster Creek throughout the summer. A five foot screw trap was placed at river mile 2.5 and allowed 100% of the spawning habitat in Lobster Creek to be monitored. Trapping began in early spring and operated 5 days per week except during high water events. Trapping ended in late August when low numbers of chinook were being trapped and results of snorkel surveys indicated that few chinook remained in the system.

Table 6.3 Juvenile fall chinook trapping in the Lobster Creek Basin

Brood Year	Dates Trapped	# Days Trapped	#ChF Sampled	#ChF Marked	#ChF Recaptured	Efficiency Estimate	Population Estimate	95% Confidence Interval
1992	5/1-5/15/93	15	3,029	101	15	14.9%	20,329	9,374-31,284
1993	4/1/-5/20/94	57	1,255	286	13	4.5%	29,668	9,025-50,311
1994	5/4-8/25/95	84	1,196	479	107	22.3%	7,283	6,115-8,451
1995	4/7-8/17/96	65	4,187	1,236	242	19.6%	32,877	29,327-36,437
1996	5/1-8/8/97	72	41,150	3,947	1,521	38.5%	150,540	144,815-156,265
1997	5/1-8/7/98	63	19,430	1,968	797	40.5%	75,394	71,251-79,537
1998	6/8-8/27/99	60	8,873	2,134	382	17.9%	76,210	69,367-83,053

<u>Spawning Surveys – Peak Counts</u>

Peak counts from spawning surveys provide one measure of fish populations and long term trends in streams and rivers. Spawning surveys on selected rivers range from ½ mile to 2 miles of stream. A trained biologist walks the stream during the peak spawning season (December to January), counting live and dead salmon. Surveys are conducted every 7-10 days. Adverse conditions such as turbidity indefinitely affect the observer's ability to see fish. The numbers listed in Table 6.4 reflect the peak counts for each spawning season. Numbers include both live and dead adult fish.

Table 6.4 Fall Chinook Peak Counts and Estimated Run Size Per Mile

Survey Name/Spawning Season	**Reach Code/Location**	**Survey Type**	**Peak Counts**		**Estimated Run Size**		**Estimated Spawning Population**	
			Adults	**Jacks**	**Adults**	**Jacks**	**Adult**	**Jacks**
Rogue River	Mile 0.0 to 216.7	Carcass Count						
1977-1999 Avg.			6220	765				
Quosatana								

1999	Mile 0.0 to 1.5	Incidental, Random	2	1			0	0
Saunders	Mile 0.7 to 5.0							
1998		Random/Incidental	14	27			0	0
Jim Hunt	20195.00							
1972			24	25				
1973			23	6				
1975			43	3				
1976			0	0				
1977			62	36				
1978			104	4				
1979			98	2				
1983			2	0				
1984			4	1				
1985			2	0				
1986			15	2				
1987			30	3				
1988			72	2				
1989			13	0				
1990			4	1				
1991			2	0				
1992			33	2				
1993			0	0				
1994			2*	1*				
1995			1*	1*				
1996			1	0				
1997			0	0				
1998			5	1				
1999		Random	10	55				
2000			27	4				
2001		Standard	230	50	470	45		
2002		Standard	356	66	521	66		
2003		Standard	334	21				
Lobster Creek	0.0 to 9.7, except noted							
1972								

1973									
1975									
1976									
1977									
1978									
1979									
1983									
1984									
1985									
1986									
1987			211	26					
1988			96	6					
1989			20	2					
1990			6	0					
1991			8	2					
1992			53	5					
1993			4	1					
1994			21	28*					
1995			57	6*					
1996			60	3					
1997			36	14					
1998			48	8					
1999			49	17			0	0	
2000			213	28					
2001		Standard	298	77	458	84			
2002		Standard	621	179	558	102			
2003		Standard	863	32					

*May be influenced by fed hatchery fish.

Table 6.5 Coho Peak Counts and Estimated Run Size Per Mile

Survey Name/Spawning Season	Reach Code	Survey Type	Peak Counts		Estimated Run Size			
			Adults	Jacks	Adults	Jacks	Adults	Jacks
Lobster Creek								
1998	Mile 0.0 to 0.9	Live Count	0	0				
2000	Mile 0.0 to 0.9	Live Count	0	0				
2001	20199.00	Random, Live and Dead	19	0	17	0		
2002	20199.00	Random, Live and Dead	6	1	4	1		
2003								
Lobster Creek South Fork	20210.70							
2001		Random	46	0	53	0		
2003		Random	10	0	N/A	N/A		
Lobster Creek (Youth Camp)	20203.00							
2002		Random	7	0	0	0		
Lobster Creek—Boulder Creek	20209.00							
2002		Random	2	1	2	1		
Silver Creek								
2001	20215.00	Random	18	2	26	2		
Quosatana Creek	20213.00	Random						
1998	Mile 0.0 to 1.5	Live Count	0	0				
1999	Mile 0.0 to 1.5	Live Count	0	0				
			5	0	7	0		
Saunders	Mile 0.0 to 5.0	Live Count	0	0				

Table 6.6 Steelhead (Winter run unless noted)

Survey Name/Spawning Season	Reach	Survey Type	Live Counts			Redds per mile	Estimated Spawning Population	
			Marked	**Un-marked**	**Unknown**		Adult	Jack
Quosatana Cr/2003*	Mouth to Headwaters		0	7	68	72.0		
Lobster Creek/2003*	Mouth to Deadline Cr.		0	0	0	2.9		
Rogue River	Mile 0.0 to 216.7 unless noted	Live Fish--sportsfishery						
1980-1985, Natural Production							3211	
1980-1985, Hatchery Production							4144	
Summer Steelhead, 1976-2000, Natural	Mile 7.8						15,300	52,143
Summer Steelhead, 1976-2000, Hatchery	Mile 7.8						5272	58,732
1980			5307	3688				
1981			3394	1672				
1982			4525	2773				
1983			589	138				
1984			6903	7785				

*Preliminary Data

Stocking Summary

A stocking summary is provided to help identify potential interactions between native and stocked species. Table 6.7 illustrates the coded-wire tag inventory of releases of hatchery fish for each species and brood year between 1975 and 2001. Stocking (hatchery release) data was compiled from the Regional Mark Information System, coded-wire tag database. Release hatcheries are the Cole Rivers Hatchery and the Indian Creek STEP Program, with a couple of years (1980 and 1981) of releases of fall chinook from the Bandon Hatchery into Lobster Creek. Release locations include sites upstream of the Lower Rogue Watershed Boundary, although the Indian Creek Hatchery releases are within the watershed only. Releases of fall chinook smolts from the Indian Creek Hatchery for the last 4 years were: 70,779 in 2000, 77,250 in 2001, 80,232 in 2002, and 83,442 in 2003 (ODFW, 2004).

Table 6.7 Numbers of hatchery fish released into the Rogue River: Coded-wire tagged only.

Brood Year	Spring Chinook	Fall Chinook	Unknown Chinook	Coho	Summer Steelhead	Winter Steelhead
1975	332114					
1976	760852					
1977	593180	35552		197472		
1978	777006	27902		54458		
1979	787740	24945		13058		
1980	180774	21437		249195		
1981	409605	113857		405463	234788	206334
1982	974104	28072		65685	131397	138182
1983	1890557	29667		182578	142713	225779
1984	1264960	36805		186216	199287	157666
1985	2527247	228111		206333	177503	285876
1986	2412302	214507		192766	170408	330886
1987	2092114			193191	159610	344457
1988	1623008	165458		177310	111296	308938
1989	1591900	70274		195481	97657	281305
1990	1726011			208340	162980	334635
1991	158451	30240		212504	263481	301115
1992	1815003	14236		390038	293139	189896
1993	1737019		28855	184768	214441	133871
1994	617729	23765		204363		
1995	621082	39546		193506		
1996	1925300	71144		214121		
1997	1637251	73551		207154		
1998	1721173	68065		174186		
1999	544904	80805		209736		
2000	1899790	72250		208103		
2001		2023724				
2002*		54452				
Total	32621176	3493913	28855	4726025	2358700	3238940

* 2002 figures are only from Indian Creek PD

Migration Barriers

In 1995, a group of displaced fishermen were hired by the South Coast Watershed Council to conduct surveys of culverts in an effort to address fish passage concerns. The compilation of data from these surveys became known as the "Hire the Fishermen" survey. Culverts from this survey, within the Lower Rogue watershed, were evaluated to determine adult and juvenile fish passage based on guidance (Robinson 1997) from the Oregon Department of Forestry and Oregon Department of Fish and Wildlife.

Initially, culverts were classified as "Adult Barrier," "Juvenile Barrier," or "Passable" categories. However, according to more recent standards (Robison, et. al., Spring 1999, Oregon Road/Stream Crossing Restoration Guide) outlet drops exceeding one foot in height are expected to restrict adults of some species. As a result, another category was created to represent "Adult Restricted". Additionally, some culvert slope measurements were estimated at 1% with a clinometer. Due to the resolution of these measurements, a degree of uncertainty exists in determining whether these slopes actually met the 0.5% slope criteria. As a result, when slope was the only criteria in doubt, these sites were classified as "Uncertain if Juvenile Barrier". Similarly, in consideration of adult passage, some culverts were estimated at 4% slope. Thus, when slope was the only criteria in doubt, these sites were classified as "Uncertain if Adult Barrier". Finally, the Outlet Drop was determined by estimating pool depth at bankfull flow. The assumption was made that bankfull flow is a better estimate of adult migration conditions than the measured summer flow pool depths.

Culvert conditions were evaluated for juvenile and adult salmonid fish passage. The listed criteria apply only to bare culverts. Few culverts surveyed were embedded or baffled. In both cases these criteria are not minimum values; they describe the conditions in which passage of most fish is blocked. Other conditions may still prevent some fish from passing through a specific culvert.

Juvenile Fish Passage Criteria

Slope	<0.5%
Outlet Drop	<6 inches, with residual pool 1.5 times deeper than the jump
Inlet Condition	Diameter > ½ bankfull channel width; no inlet drop
Length	<100 feet long

Adult Fish Passage Criteria

Slope	<4%
Outlet Drop	<4 feet, with residual pool 1.5 times deeper than the jump or 2 feet deep
Length	<200 feet long

Culverts, bridges and fords were assessed by the "Hire the Fishermen" survey. Some culverts and bridges have been more recently assessed and are included as well. Stream crossings are labeled by a "Site ID" and an estimated length of potential fish habitat. Potential fish habitat upstream of each culvert was measured, for all "Hire the Fishermen" culverts, to an estimated channel gradient of 16%. Stream channels having >16% gradient are considered "Very Steep Headwaters" as described in the Channel Habitat Component of this watershed assessment. Salmonid fish habitat in these very steep headwater channels provides only very limited rearing.

Fish Habitat

Stream Surveys

The ODFW has developed a standard stream habitat survey methodology (Moore et al. 1997) that they and other agencies and some industrial landowners have used to collect extensive amounts of fish habitat data. An assessment of existing stream habitat survey data was conducted in the Lower Rogue basin to help determine how habitat conditions vary throughout the watershed and/or to identify specific portions of the watershed where problems may exist. Existing stream survey summary data was compiled in GIS format from the US Forest Service (Randy Frick) and the Southwest Oregon Province GIS Data CD (shapefile titled "Stream Survey Data"). Sampled conditions were compared to "benchmark" conditions established by the ODFW. In some cases, the protocol between the US Forest Service and ODFW differs and information was interpreted. Wood volume was calculated by using the minimum length criteria for each size category and using the midpoint of the volume class.

Conditions were rated as Undesirable (U), Desirable (D), or in-between range (B). The overall condition rating was assigned using the following criteria:

- **Desirable (D):** All parameters rated desirable or in-between
- **Between (B):** Parameter ratings were mixed
- **Undesirable (U):** Most of the parameters rated undesirable
- **ND:** No data

Habitat benchmarks evaluated in this assessment and their criteria for rating are shown in Table 6.8.

ODFW HABITAT BENCHMARKS

(GWEB 1999)

The ODFW habitat benchmark values are designed to provide an initial context for evaluating measures of habitat quality. While the natural regime of a stream depends on climate, geology, vegetation, and disturbance history, it is useful to know whether a value of a habitat feature in a reach of stream is high or low. For example, knowing whether a reach has a lot of large woody debris (LWD) or fine sediments is useful for understanding the condition of aquatic habitat and its influence on the life history of fishes. The determination of whether the “value” of a habitat feature is “good” or “bad” depends on the natural regime of the stream and the fish species of interest. The habitat benchmark values for desirable and undesirable conditions are derived from a variety of sources. Values for specific parameters were derived for appropriate stream gradient, and regional and geologic groupings of reach data (see Moore et al. 1997). This assessment is designed to look at combinations of features rather than to single out individual values. This approach should help identify patterns within these features that can then be interpreted in a broader watershed context.

The benchmark values of habitat features are listed as desirable or undesirable, but emphasis should be applied to view the values on a sliding scale, and that watershed context be considered. For example, eight pieces of LWD per 100 meters may be very low for a stream in the Cascade Mountains, but extremely high for a stream in the high desert of southeast Oregon. The stream must be viewed within its natural environment. Similarly, a reach in the Cascade Mountains may have eight pieces of LWD per 100 meters, but neighboring reaches may have 25 pieces of LWD per 100 meters. Variability within a watershed may reflect normal disturbance and hydrologic cycles in addition to management history. The assessment of habitat conditions should look to other components of the watershed assessment to find if there are historic or current activities influencing these measures. This provides the basis for linking the findings from the broader assessments of upslope and upstream activities and impacts to actual in-channel conditions.

Caution: Stream survey data is like a single photograph of a dynamic system. Stream channel conditions may change drastically between years, especially if there has been a high flow (flood) event. Also, some surveyed reaches have been inconsistently sampled, and the summary data do not necessarily reflect actual conditions.

Table 6.8 Habitat criteria used for the Lower Rogue Assessment.

POOLS	**Importance**	**Desirable**	**Between**	**Undesirable**
% Area	Pools are important rearing areas for juveniles.	>0.35	0.1 to 0.35	<0.1
Pool Frequency		>20	8 to 20	<8
Residual Depth	An indication of the amount of erosion and filling of pools that may be occurring in the watershed.			
Complex Pools	Pools with wood for habitat complexity are important for juveniles.	>2.5	1 to 2.5	<1
RIFFLES				
Width/Depth Ratio	Clean gravel with interstitial space clear of fines for good oxygenation of the eggs is important for spawning and egg development.	<15	15 to 30	>30
% Fines*		<10	10 to 20	>20
% Gravel		>35	15 to 35	<15
WOOD				
Pieces of Wood	Wood is important for fish refuge, nutrients, and habitat complexity. Large "key" pieces are important for pool and riffle development.	>20	10 to 20	<10
Wood Volume		>30	20 to 30	<20
Key Pieces		>3	1 to 3	<1

*In stream reaches where the stream gradient is less than 1%, the criteria are: <12% for "Desirable" and >25% for "Undesirable".

Table 6.9 Comparison of stream survey data against ODFW benchmarks for pool, riffle, and woody debris habitat condition.

National Forest Stream Habitat		Pools				Riffles			Wood		
Stream/ Survey Year	Reach #	% Area	Pool Freq	Residual Depth	Complex Pools	Width/ Depth	% fines	% gravel	Pieces of wood	Wood Volume	Key Pieces
North Fork Lobster Creek 2002	1	D	D	D	B	D	B	B	U	B	U
North Fork Lobster Creek 2002	2	D	B	D	D	*	B	B	U	D	U
North Fork Lobster Creek 2002	3	D	D	B	U	B	B	B	U	B	U
North Fork Lobster Creek 2002	4	B	D	B	D	D	B	D	U	D	U
North Fork Lobster Creek 2002	5	D	D	B	D	D	B	D	U	B	U
Shasta Costa Creek 2000	1	D	D	B	B	B	B	B	U	B	U
Shasta Costa Creek 2000	2	D	D	B	D	B	B	B	U	B	U
Shasta Costa Creek 2000	3	D	B	B	U	B	B	B	U	U	U
Shasta Costa Creek 2000	4	D	D	B	D	B	U	D	U	D	B
Shasta Costa Creek 2000	5	D	D	B	B	D	U	B	U	B	U
Shasta Costa Creek 2000	6	B	D	B	B	*	*	*	U	U	U
Quosatana Creek 98	1	D	B	D	B	B	B	B	U	U	U
South Fork Lobster Creek 96	1	D	D	U	B	B	B	B	U	U	U
South Fork Lobster Creek 96	2	D	D	B	B	D	B	B	U	D	U
South Fork Lobster Creek 96	3	D	B	D	B	B	B	B	U	B	U
South Fork Lobster Creek 96	4	D	B	B	D	*	B	B	U	D	B
Lobster Creek 95	1	D	D	B	B	U	**	**	U	B	U
Lobster Creek 95	2	D	D	B	D	*	**	**	U	D	B
Lobster Creek 95	3	D	D	B	D	*	**	**	U	D	B
Lobster Creek 95	4	D	D	B	D	*	**	**	U	D	B
Lobster Creek 95	5	D	D	B	D	*	**	**	U	D	B

National Forest Stream Habitat		Pools				Riffles			Wood		
Stream/ Survey Year	Reach #	% Area	Pool Freq	Residual Depth	Complex Pools	Width/ Depth	% fines	% gravel	Pieces of wood	Wood Volume	Key Pieces
Lobster Creek 95	6	D	D	B	D	*	**	**	U	D	U
Lobster Creek 95	7	D	D	B	B	U	**	**	U	D	U
Lobster Creek 95	8	D	D	B	D	*	**	**	U	D	U
Lobster Creek 95	9	D	D	B	B	U	**	**	U	U	U
Lobster Creek 95	10	D	D	B	B	U	**	**	U	B	U
Quosatana Creek 94	1	D	B	D	D	B	B	B	U	B	U
Quosatana Creek 94	2	D	B	D	D	D	B	B	U	B	U
Quosatana Creek 94	3	B	U	D	D	*	B	D	U	D	U
Quosatana Creek East 94	1	D	D	B	B	B	U	D	U	U	U
Bradford Creek 92	11	D	B	B	U	*	*	*	U	D	U
Foster Creek 91	1	B	D	B	B	B	U	B	U	D	U
Nail Keg Creek 91	1	D	D	B	D	*	U	B	U	B	U

* no measurements in riffles

** dominant/sub-dom substrate only

High Value Habitat

The Southwest Oregon Salmon Restoration Initiative identified high value streams (HVS) in the Rogue Basin for coho and winter steelhead. HVS were defined based on the present use of the stream by coho and winter steelhead and the productivity and potential high value habitat of the stream as determined using a habitat inventory matrix (Prevost et al. 1997).

In the Lower Rogue watershed, Lobster (South Fork for coho), Quosatana, Shasta Costa and Silver Creeks are considered high value. Lobster Creek was noted as a typical high value stream for habitat assessments for winter steelhead. Within Lobster Creek, limiting conditions are 1) lack of large woody debris due to flushing winter flows leading to simplified winter habitat; 2) lack of riparian diversity and density leading to high summer water temperatures, lack of future large wood, and low summer flows; 3) high road density and culverts leading to increased sedimentation in the stream and potential barriers to fish passage.

Appendix A and B list habitat conditions, limiting factors, and restoration needs as outlined in the Southwest Oregon Salmon Restoration Initiative documents (Provost 1997).

In 1997, the Lobster Creek Partnership (consisting of representatives from the USFS, private timber, the Oregon Department of Fish and Wildlife (ODFW), and the Lower Rogue Watershed Council) sponsored snorkel surveys in Lobster Creek to determine source areas for salmonids. A source area is a stream reach that has intact, high quality spawning and rearing habitat for sustaining wild salmonid populations. The source areas serve as population anchors and can be counted on to remain productive even when adult returns are low or when other factors create less than favorable conditions (The Campbell Group 1997). Surveys were conducted by ODFW in May to identify the early rearing areas of coho and Chinook, and in September to identify the fall rearing areas for the coho salmon and winter steelhead within the basin (Dewberry 1997).

Surveys found three source habitats (see figure). The largest key area found in the Spring 1997 survey was in the South Fork Lobster watershed and the mainstem South Fork section of this area included most of the coho in the basin. The source area on the mainstem Lobster centers around the mouth of Fall Creek and had the highest densities of Chinook salmon. During the fall dive count, winter steelhead made up the largest proportion of salmonids (94% of salmonids estimated) in Lobster Creek. Winter steelhead were distributed throughout the basin with 91% in the Lobster mainstem, North Fork and South Fork. Winter steelhead juveniles were not equally distributed in the mainstem. Below Deadline Creek, the number was proportional to the habitat. From Deadline Creek upstream to Fall Creek, even though the reach makes up only 12% of the habitat, it contained 33% of the juveniles in the mainstem. Numbers fell rapidly above Coffee Butte (above Fall Creek) with one large pool near the youth camp having no fish. There was no apparent explanation given in the summary document (Dewberry 1997).

Macroinvertebrate Sampling
Benthic macroinvertebrates are aquatic animals that lack an internal skeleton, are large enough to be seen by the unaided eye, and live on or among the substrate. The occurrence of macroinvertebrates in a stream is a response to natural and anthropogenic influences. Rivers naturally change as they flow downstream in riparian condition, light, temperature, hydraulics, and substrate composition. Thus, each location in a river has a unique set of conditions that dictate what macroinvertebrate species will live there. Macroinvertebrates are especially useful for stream monitoring because they are common in most streams, readily collected, relatively easily identified, not highly mobile, sensitive to pollution and human disturbance, and have life cycles from several days to more than 120 years (Adams, 2003). Macroinvertebrate monitoring has been conducted by the Oregon Department of Environmental Quality (Oregon DEQ), the US Forest Service (USFS), and the Lower Rogue Watershed Council.

The Oregon DEQ has three reference sites within the Lower Rogue Watershed that are part of the South Coast Reference Group. These are: Lobster Creek at river mile 6.2, Shasta Costa Creek South of USFS Road #23, and Quosatana Creek upstream of USFS Road #33. Together with other sites in the South Coast, the macroinvertebrate assemblages found in these streams serve as a benchmark for comparing other samples in other streams in the area. A site is scored based on the ratio of the macroinvertebrate taxa found at a site to taxa found at the reference sites. Table 6.8 gives scores for four streams in the Lower Rogue.

Table 6.8 Macroinvertebrate Scores for Lower Rogue Streams (Canale Technical Report BIO99-005)

Location	Score	Category	Sample Date
Two Mile Creek @ River mile 0.2	0.72	Moderately Impaired	06-22-1994
Lobster Cr. @ River mile 6.2	0.96	No Impairment Detected	07-12-1995; 08-22-1995
Shasta Costa Cr. South of USFS Rd #23	1.01	No Impairment Detected	07-29-1993
Quosatana Cr. Upstream of USFS Rd #33	0.80	No Impairment Detected	07-29-1993

The USFS sampled macroinvertebrates on stream sites in the Siskiyou National Forest in the late 1980s through the mid-1990s (Appendix C). While different sampling years were interpreted using different methodology, the species and diversity found provide some insight into the functionality of these streams. It should be cautioned that samples taken in 1993-1995 were evaluated using the Aquatic Biotic Assessment method, which was designed for montane watersheds with the objective of monitoring cumulative impacts from land management activities. Therefore, sites are ranked against a pristine, montane reference stream.

Stair Creek (Mangum, F.A. 1990)
Stair Creek mainstem, East and West forks were sampled in October 1989. Indices fell near or within the "excellent" category, except for the standing crop (g/m2), which was "fair" for all sites. Cleanwater macroinvertebrate species indicated there was good water quality and some good instream substrate in the reach sampled. There were warning numbers of those taxa tolerant to sedimentation. The observed number of shredders in the community indicated riparian habitat that was in at least fair condition. The macroinvertebrate community indicated that there was fairly good stability in this ecosystem. The BCI value of 92 indicated this ecosystem was fairly close to its potential. The author noted that maintaining existing conditions could be an option, but that there appeared to be some opportunity for management to improve instream habitat quality.

Foster Creek (Aquatic Biology Associates 1993, EcoAnalysts, Inc. 1994)
Foster Creek was sampled in October 1993 and 1994 beginning at the Illahe bridge and going upstream to a dirt road. All habitats showed low biotic integrity, except a moderate score for margin habitat in 1993. Limiting factors noted were a wide and shallow channel cross-section, very low channel roughness with areas of exposed bedrock, little channel stepping, absence of large woody debris (except enhancement structures added in 1985), high velocities during winter flows, fine sediments filling in crevice spaces, and sand accumulation in pools and riffle areas. The riparian canopy provided some shade with 50% canopy closure. The source of fine sediments at this site is primarily natural slides in headwater areas, possibly exacerbated by timber management. Slides from the Agness Road are also noted as a source. As a result of unstable geology, this site was noted as not having a high habitat potential.

Lobster Creek (Aquatic Biology Associates 1993; EcoAnalysts, Inc. 1994)
Lobster Creek was sampled in October 1993 and 1994. The reach began at first riffle above the wooden bridge near the mouth and ended halfway though the next upstream pool. The site was noted as experiencing significant impacts based on bioassessment scores and habitat assessment sheets. Macroinvertebrate scores showed low biotic integrity for all habitats, with a severe/water quality limited score for erosional habitat in the 1994 sample. Limiting factors identified were: water temperature that is lethal to cool/cold water taxa, a wide and shallow channel cross section, very low channel roughness and stepping, riffle armor layer rocks with 35% embeddness, high levels of gravel in riffle habitat plus sand accumulation in pools, excessive scour, substrate instability, and low shading from riparian vegetation. Human impacts noted were timber harvest and associated roads in the watershed, and pedestrian and vehicular traffic on the reach.

Quosatana Creek (Aquatic Biology Associates 1993; EcoAnalysts, Inc. 1994)
Quosatana Creek was sampled in 1993, 1994 and 1995 upstream of road 3310. Macroinvertebrate scores showed low biotic integrity in downstream reaches and generally improving biotic integrity moving upstream. Limiting factors noted were: water temperatures high enough to be lethal to cool/cold-water taxa; a wide and shallow channel cross section with very low channel roughness and stepping that allows high energy flows to move and resort bedload and fine materials, riffle armor layers with 15%, embeddedness, very low shading from riparian vegetation, high siltation in pools and on the margin, and scour and substrate instability. The field person noted vehicular traffic in creek and gravel bars, and lots of algae.

Shasta Costa Creek (Aquatic Biology Associates 1993; EcoAnalysts, Inc. 1994)
Shasta Costa Creek was sampled in October 1993 and 1994 approximately 0.5 miles above the “rat hole” at the end of road 3#23. Macroinvertebrate scores showed low biotic integrity for all habitats. Limiting factors were possibly water temperature, a wide and shallow channel cross section, low to moderate channel roughness and stepping, riffle armor layers with 80% embeddedness, and low shading from riparian vegetation. Excessive fines in the drainage are due to natural sliding. The notable lack of cold-water taxa and the few warm-water indicators present may be due to the east/west flow of the drainage, which probably allows greater isolation and consequently higher water temperatures. Field person notes vehicular traffic going across creek and up the stream.

The Lower Rogue Watershed Council sampled macroinvertebrates in 2004 as part of a larger sampling effort in the basin. The project, sponsored by the Rogue Basin Coordinating Council sought to sample macroinvertebrates at sites randomly generated by the US Environmental Protection Agency. The Lower Rogue Watershed Council sampled sites in Lobster Creek (mainstem, North Fork Lobster Cr., and Boulder Cr.), Bradford Creek, and Shasta Costa Creek. Samples have been sent to a taxonomist for evaluation and results are not available as of this document. The Rogue Basin Coordinating Council plans to conduct the project again in future years to monitor changes in the health of the Rogue Basin.

C KEY FINDINGS

<u>Threatened and Endangered Species</u>

- Coho have been listed as threatened, according to the Endangered Species Act, since May 1997. No other salmonids are currently listed.
- Green sturgeon are currently listed as a “Species of Concern.”

Fish Distribution

- Winter steelhead populations are considered healthy, but consist of relatively small populations in many tributaries of the Lower Rogue.
- Fall Chinook have a more limited distribution than winter steelhead, but their populations are also considered healthy. Main tributaries with fall chinook distribution are Lobster Creek, Shasta Costa, and Quosatana Creeks.
- Coho, Spring Chinook and Summer Steelhead use the Lower Rogue mainstem primarily as a migratory corridor. There is some coho usage in a few Lower Rogue River tributaries.
- A 1997 spring and fall snorkel survey conducted in Lobster Creek identified three source areas for Chinook, coho, and winter steelhead. Winter steelhead distribution on mainstem Lobster was limited above Fall Creek with no apparent reason.

Stocking Summary

- Chinook releases from the Indian Creek Hatchery have averaged ~78,000 smolts per year between 2000-2003.
- Over time, there has been a modification of hatchery programs in order to reduce risk to naturally produced fish. Large-scale releases of hatchery fish and transfers between basins have discontinued. Stocks of fish from other watersheds that were released in south coast basins were not particularly well adapted and do not appear to have survived well. Limited genetic analysis indicates that non-indigenous stocks have not persisted in south coast basins since releases were discontinued. (ODFW 2001)

Migration Barriers

- Relatively few adult fish passage barriers are thought to exist throughout the watershed, and those identified have been replaced.
- There are potentially several juvenile barriers throughout the basin. Consultation with ODFW fish biologists and site visits as locations are discovered are recommended to verify fish passage and fish presence.

Stream Habitat Condition Summary

Pool Habitat Condition Summary

- The frequency of pools is potentially limiting in Quosatana and Bradford Creeks.
- Residual pool depths are potentially limiting in the Lobster Creek watershed, the east fork of Quosatana Creek, and Bradford, Foster, and Nail Keg Creeks.
- Complex pools are lacking in Bradford Creek and need improvement in Shasta Costa, Quosatana, and South Fork Lobster Creeks.

Riffle and Woody Debris Habitat Condition Summary

- Width to depth ratios are limiting in all reaches where it was measured in mainstem Lobster Creek. Shasta Costa, Quosatana, and Foster Creeks need improvement.
- Riffles are limited by too much fine sediment with not enough spawning gravel in all streams and reaches measured, except two reaches in Quosatana Creek where percent gravel was at a desirable level.
- Pieces of wood is limiting for all streams surveyed. Key pieces of wood are also less than desirable for all reaches. Volume of wood is limiting in Quosatana Creek (1998 survey), east fork of Quosatana Creek and some reaches on Shasta Costa Creek, Lobster Creek mainstem and South Fork Lobster Creek.

<u>High Value Habitat</u>

- Lobster Creek has high value habitat for coho and winter steelhead. The Lobster Creek Partnership identified salmonid source areas in Lobster Creek (see map). While large wood has been placed in the system, the high flows in Lobster Creek make this wood mobile and the Lobster Creek Partnership has determined that the adding more large wood to the mainstem is not a good restoration option. Large wood in tributaries, and the promotion of future large wood from riparian areas are better options. Passive restoration through existing forest practices regulations have been the strategy thus far. Current projects involving shade enhancement trials involve the planting of conifers in hardwood-dominated riparian areas to help determine the success of this type of project.
- Quosatana Creek, Shasta Costa Creek and Silver Creek were identified as having high value habitat for winter steelhead.

<u>Macroinvertebrates</u>

- Macroinvertebrates have been sampled for relatively few streams in the basin. Sampling that did occur was limited to the early to mid 1990's.
- Macroinvertebrate scores showed generally low biotic integrity.
- Limiting factors common to Foster, Lobster, Quosatana, and Shasta Costa Creeks are a wide and shallow cross section, low channel roughness, sediment problems, low riparian shading, and high water temperatures.

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Appendix A

Lower Rogue Watershed: Watershed Habitat Limiting Factors and Restoration Actions (Provost et al. 1997)

Limiting Factor	Stream	Actions Needed
Water Temperature	Shasta Costa Silver, Quosatana, South Fork Lobster	Increase canopy cover. Manage riparian zone for multilayered canopy. Monitor return flows and determine problem area. Monitor and address water temperatures through interagency and community-wide cooperation
Low Stream Flow	Lobster	See Riparian Quality and Canopy Cover actions.
Riparian quality	Lobster	Increase riparian zone as appropriate. Increase the vegetation density and diversity of plant species. Manage riparian vegetation for a multi-layered canopy.
Canopy cover	Lobster	Plant sufficient conifers to provide an 85-15 % conifer-deciduous mixture. Plant trees along the stream to increase canopy cover.
Fish Passage	Silver, South Fork Lobster, Quosatana	Modify culverts restricting fish passage.
Habitat Loss	Shasta Costa, Silver, South Fork Lobster	Monitor riparian management areas under Forest Practices Act. Develop and test approaches to timber practices which restore and maintain the quality of riparian habitat.
Wintering Habitat	Shasta Costa, Silver, South Fork Lobster, Quosatana	Large wood and boulder structures will be placed or secured in streams to provide shelter. Open existing backwater channels that have filled with sediment. Create side channels with equipment such as backhoes.

Appendix B

Current Habitat Indicators
From: Provost, M., R. Horton, J. MacLeod, R.M. Davis. 1997. Southwest Oregon Salmon Restoration Initiative. Phase 1: A Plan to Stabilize the Native Steelhead Population in Southwest Oregon. Rogue Valley Council of Governments.

Lobster Creek is considered a typical high-value stream for winter steelhead in the Lower Rogue Watershed. The watershed habitat conditions developed in the table below were determined from stream surveys, watershed analyses, and anecdotal information provided by area stakeholders and residents.

Habitat Indicator (Ideal standard)	**Historic Condition**	**Current Condition (Consensus based)**	**Trend**	**Status**	**Near Term Vision (1-10 Years)**
Riparian Zone					
Canopy/shade ≥75%	Probably good, large conifers	Heavily harvested, narrow riparian zone, thin density	Improving slowly	Limiting	Improve species diversity, and canopy to ≥75%
LWD Wood sources	Good, abundant source material	Marginal source supply	Stable	Limiting	Needs conifers and species diversity
Bank Stability ≥90% Stable	Good, vegetated	Fair, impacted extensively by logging and road construction	Improving	Limiting	Stabilized exposed banks, enhance riparian areas
Macroinvertebrate Health ≥80% High ≤ 40% severe low	Presumed good	Unknown at this time	Unknown	Unknown	Abundant population greater than 80%
Physical Habitat					
Spawning gravel	Presumed good	Fairly good, not a limiting factor	Stable	Acceptable	Maintain and enhance supply
Substrate condition. ≤20% over natural delivery	Presumed good	Stable, some embeddedness	Stable	Acceptable	Reduce sedimentation
Sediment ≤5%	Presumed low	Variable, moderate to high in some areas	Deteriorating	Limiting	Reduce sediment load, control bank erosion

In stream LWD ≥20 pieces/100 meters	High	Moderate to low. Averages 23 pieces per mile.	Stable	Limiting	Needs large conifers, structures
Side Channels ≥5 mile	Probably good, good sinuosity	Few and of limited quantity	Stable	Limiting	Promote natural meandering of stream channel
Rearing areas	Presumed good	Fairly good summer habitat. Winter habitat may be limiting	Stable	Acceptable	Increase summer flows. Improve winter habitat
Pool/Riffle Ratio ≥35:65%	Good	Good pool-riffle ratio 44/56	Stable	Acceptable	Protect from sedimentation, add LWD
Sinuosity	Good	Poor in mainstem and some tributaries are channelized in areas	Stable, confined	Limiting	Promote natural meandering of channels
Alcoves	Good	Fair, some impacted by logging	Improving	Acceptable	Enhance with LWD, boulders
Beaver Ponds	Good, key feature of area	None	Stable	Limiting	Develop some use on tributaries and educate landowners
Mining	None	Some limited gold mining	Stable	Acceptable	Limit through permit enforcement
Wetland connection	Good	Very few wetlands exist	Stable	Limiting	Protect and enhance wetland areas
<u>Fish Passage</u>					
Dams	None	None	Stable	Acceptable	No action
Diversion Structures	None	None	Stable	Acceptable	No action
Push-up dams	None	None	Stable	Acceptable	No action
Culverts	None	Several problem sites exist. Need inventory	Improving	Limiting	Continue reconstruction
<u>Water Quality</u>					
Flow-low period ≥8CFS	Flows probably adequate to good	Low summer flows	Stable	Limiting	Improve watershed protection
Water withdrawals	None	None	Stable	Acceptable	No action
Release regime	N.A.	Unknown	Unknown	Unknown	Revegetate uplands, enhance ground water storage

Predator condition					
Bird/fish/animal	Normal/moderate	Normal/birds	Stable	Acceptable	No change
Fishery Condition					
Timing of run	Normal	Normal	Stable	Acceptable	No action
Species competition	Normal	Normal	Stable	Acceptable	No action
Upland conditions					
Erosion	Minimal	Timber harvest induced erosion	Improving	Limiting	Improve land use and forest practices
Forest seral stage	Normal/mature	Harvested	Improving	Acceptable	Thin/plant to encourage natural diversity
Disturbance history	Frequent-fire	Extensive timber harvest	Improving	Limiting	Improve forest practices
Road density	None	Severe problem	Improving	Limiting	Close roads
Agriculture	None	None	Stable	Acceptable	No action
Return flows	None	None	Stable	Acceptable	No action
Chemical use on lands	None	Some use for timber management	Unknown	Unknown	Monitor, and evaluate use

Appendix C

Mangum, F.A. Aquatic Ecosystem Inventory Macroinvertebrate Analysis, Annual Progress Report. 1990. Siskiyou National Forest, Galice Ranger District.

Station	Stream Name	Dates	Diversity Index	Standing Crop	Biotic Condition Index
			DAT mean	g/m^2 mean	BCI 50
1	Stair Creek	10-17-89	17.3	1.0	92
2	West Fork Stair Creek	10-12-89	23.0	0.7	92
1	East Fork Stair Creek	10-12-89	20.6	0.6	92

Scale	**DAT**	**Standing crop**	**BCI**
Excellent	18 - 26	4.0 - 12.0	Above 90
Good	11 - 17	1.6 - 4.0	80 - 90
Fair	6 - 10	0.6 – 1.5	72 - 79
Poor	0 - 5	0.0 – 0.5	Below 72

USFS Community tolerant quotient/biotic condition index - This index has been widely used by the USFS and BLM throughout the western United States. Taxa are assigned a tolerant quotient (TQ) from 2-taxa found only in high quality unpolluted water, to 108 - taxa found in severely polluted waters. TQ values were developed by Winget and Mangum (1979). The community tolerance quotient (CTQa) was calculated as:

$$CTQa = \sum (TQ / S) \quad (6)$$

where TQ is the tolerance quotient of that taxon and S is the number of taxa in the sample. The dominance weighted community tolerance quotient (CTQd) was calculated as:

$$CTQd = \sum (n_i \; TQ / N) \quad (7)$$

where TQ is the tolerance quotient of that taxon, n_i is the number of individuals of a taxon, and N is the total number of organisms in the sample. If data on total alkalinity, sulfate, substrate size, and stream gradient was collected, the predicted community tolerance quotient (CTQp) was calculated. This is a prediction of the unimpacted benthic aquatic macroinvertebrate community structure based on these physical and chemical variables. If the CTQp was calculated, the biotic condition index (BCI) was calculated as:

$$BCI = \frac{CTQp}{CTQd} \times 100 \quad (8)$$

Invertebrate samples with BCIs >90 are considered to come from streams in excellent condition, 80-90 good condition, 72-79 fair condition, and <72 poor condition.

(Vinson 2000)

Aquatic Biology Associates. 1992-1993. Benthic Invertebrate Biomonitoring in the Siskiyou National Forest, Oregon.

Scores in Percent

Site	Date	EROSIONAL HABITAT				MARGIN HABITAT				DETRITUS (CPOM)			
		Total	PRI	POS	NEG	Total	PRI	POS	NEG	Total	PRI	POS	NEG
Foster Creek	10-6-1993	51.6	44.4	36.8	71.4	70.4	80.0	66.7	68.8	58.3	60.0	21.4	79.2
Lobster Creek	10-18-93	35.5	33.3	8.8	67.3	56.1	55.0	46.7	62.5	62.5	75.0	50.0	64.6
Quosatana Creek, Reach 1	10-4-93	33.1	33.3	14.0	55.1	55.1	70.0	43.3	56.3	39.6	60.0	14.3	45.8
Quosatana Creek, Reach 1	10-31-95	38.7	22.2	15.8	71.4	48.0	50.0	13.3	68.8	51.0	55.0	3.6	77.1
Quosatana Creek 2	10-30-95	66.9	55.6	56.1	83.7	67.3	50.0	56.7	81.3	82.3	75.0	75.0	89.6
Quosatana 4	10-31-95	81.5	77.8	71.9	93.9	40.8	0	0	83.3	70.8	30.0	67.9	89.6
Quosatana 5	10-31-95	87.9	83.3	78.9	100	77.6	50.0	60.0	100	83.3	55.0	75.0	100
Shasta Costa Creek	10-5-93	51.6	50.0	38.6	67.3	61.2	50.0	50.0	72.9	58.3	80.0	25.0	68.8

EcoAnalysts, Inc. 1994 Stream Bioassessment, Gold Beach Ranger District, Siskiyou National Forest.

Scores are defined as follows:

Scores expressed as a %	Rating	EROSIONAL HABITAT				MARGIN HABITAT				DETRITUS (CPOM)			
		Total	PRI	POS	NEG	TOTAL	PRI	POS	NEG	TOTAL	PRI	POS	NEG
High biotic integrity		80 – 100	75 – 100	75 – 100	85 – 100	80 – 100	75 – 100	75 – 100	85 – 100	80 – 100	75 – 100	75 – 100	85 – 100
Moderate biotic integrity		60 - 79	50 – 74	50 – 74	70 - 84	60 - 79	50 – 74	50 – 74	70 - 84	60 - 79	50 – 74	50 – 74	70 - 84
Low biotic integrity		<60	<50	<50	<70	<60	<50	<50	<70	<60	<50	<50	<70

TOTAL = Total score includes metrics from all 3 categories: Primary, Positive Indicators, Negative Indicators.
PRIMARY METRICS= Sum of 5 general community abundance, richness, dominance, and tolerance metrics.
POSITIVE INDICATORS= Sum of 10-21 metrics that rate positive habitat/water quality indicator taxa.
NEGATIVE INDICATORS= Sum of 17 metrics that rate negative habitat/water quality indicator taxa.
RELATIVE BIOTIC INTEGRITY CATEGORIES:
High biotic integrity; Moderate biotic integrity; Low biotic integrity

Site	Date	EROSIONAL HABITAT				MARGIN HABITAT				DETRITUS (CPOM)			
		Total	PRI	POS	NEG	Total	PRI	POS	NEG	Total	PRI	POS	NEG
Foster Creek	10-13-1994	49.3	27.8	21.1	77.1	56.1	35.0	46.7	70.8	46.9	15.0	10.7	81.3
Lobster Creek	10/11/94	33.3	27.8	5.3	68.8	42.9	20.0	16.7	68.8	57.3	70.0	21.4	72.9
Quosatana Creek	10-14-94	37.4	38.9	8.8	70.8	50.0	45.0	0.0	83.3	42.7	45.0	7.1	62.5
Shasta Costa Creek	10-13-94	50.4	50.0	24.6	81.3	56.1	20.0	36.7	83.3	41.7	25.0	7.1	68.8

High biotic integrity   Moderate biotic integrity   Low biotic integrity   Severe habitat/WQ limited

VII WATER QUALITY ASSESSMENT

A BACKGROUND (McGuire 2001, GWEB 1999 and OSU 1998)

A combination of natural watershed processes and the effect of human activities determine water quality at a particular site on a stream or river. All water contains some dissolved chemical elements, particulate matter, and organic matter. The amounts of these substances vary with different watershed conditions. Water quality is described in terms of the beneficial uses of water and the level of quality needed to support those uses. Measures of water quality – the criteria or indicators – provide the connection between the beneficial uses of water and the natural and human sources of watershed inputs.

An assessment of water quality is based on a process that first identifies the beneficial uses that occur within the watershed (See Table 7.1). The requirements for in-stream water quality are identified to protect these uses, with the most sensitive beneficial use resulting in a water quality standard. Water bodies are assessed by comparison of data to these criteria. This conceptual framework is consistent with the guidelines established by the U.S. Environmental Protection Agency (EPA) under the authority of the federal Clean Water Act and the water quality programs of the Oregon Department of Environmental Quality (ODEQ). The goal of the federal Clean Water Act, *"to protect and maintain the chemical, physical and biological integrity of the nation's waters,"* establishes the importance of assessing both water quality and the habitat required for maintaining fish and other aquatic organisms.

Aquatic species, particularly salmonid fish, are often considered the most sensitive beneficial uses in a watershed. Salmonid species are adapted to cold water habitats where temperatures are cool and dissolved oxygen is high. Salmonids have highly variable life histories but display similarity in laying eggs in gravels and having fry and juveniles that rear close to where they hatch from the egg. Early life stages are particularly sensitive to changes in water quality. Chapter 6, Fish and Fish Habitat describes the life histories and habitat requirements of salmonids in the Lower Rogue Basin. Water quantity affects water quality parameters and subsequently fish, especially during summer low flow conditions. Extracting too much water from a system is just as harmful to fish as are certain water-quality parameters. Chapters 11 and 12, Hydrology and Water Use, respectively, provide water flow information.

Beneficial Uses of Water

The streams and rivers in the diverse landscapes of Oregon support different uses of water. To focus the water quality assessment, it is necessary to identify the beneficial uses of water that are important in a watershed as well as those that are specifically identified in the Oregon water quality standards. Beneficial uses determine which water quality criteria apply. For example, assessment for drinking water primarily focuses on the presence of pathogens that can cause disease or chemicals that can contribute to long-term health effects such as cancer risk. Assessment for water that supports fish populations focuses on elements of the stream system such as temperature, dissolved oxygen, metals, nutrients, and chemical contaminants. The State of Oregon has determined beneficial uses by basin and those for the Rogue Basin are outlined in Table 7.1.

Table 7.1 Beneficial Uses of Water within the Lower Rogue Watershed

Beneficial Uses	Estuaries & Adjacent Marine Waters	Rogue River Mainstem from Estuary to Lost Creek Dam
Public Domestic Water Supply (1)		X
Private Domestic Water Supply (1)		X
Industrial Water Supply	X	X
Irrigation		X
Livestock Watering		X
Anadromous Fish Passage	X	X
Salmonid Fish Rearing	X	X
Salmonid Fish Spawning		X
Resident Fish & Aquatic Life	X	X
Wildlife & Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X
Hydro Power		
Commercial Navigation & Transportation	X	X

(1) With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards. SA\Table\WH5291.5 (ODEQ web site).

Criteria and Indicators

Water quality criteria provide a warning system when activities in a watershed are limiting beneficial uses. Water quality criteria are specifically established in the State Water Quality Standards by major river basin. Water quality indicators are used when the state standards do not specify numerical criteria. Water quality concerns can be grouped into several major parameters for analysis: temperature, dissolved oxygen, pH, nutrients, bacteria, turbidity, toxic contaminants and biological criteria. Water quality status can also be evaluated indirectly by examining the health of the aquatic community using aquatic invertebrates and fish populations, both of which are considered in Chapter 6--Fish and Fish Habitat.

Stream Temperature

Cool water temperatures are necessary features of streams that support salmonid fish and the associated aquatic community. Suitable temperature ranges have been evaluated for all life history stages of salmonids – adult migration, spawning, egg incubation, embryo development, juvenile rearing, and juvenile migration. Growth and reproduction are adversely affected when water temperature is outside of the range to which these organisms were adapted.

The biological rationale for temperature criteria is based on laboratory and field studies. Laboratory studies evaluate egg development rate and juvenile survival under constant temperatures. Field studies evaluate the effect of water temperature on adult and juvenile migration behavior and adult spawning behavior. Oregon water quality standards are established to protect fish populations based on sublethal effects on fish, such as susceptibility to disease, inability to spawn, reduced survival rate of eggs, reduced growth and survival rate of juveniles, increased competition for limited habitat and food, and reduced ability to compete with other species. A general numerical standard of 64° Fahrenheit (7-day moving average of maximum temperatures) was established in Oregon on the basis of preventing these sublethal effects. Several documents (Boyd and Sturdevant 1997, Oregon Department of Environmental Quality 1995) have been published by state agencies that describe the technical basis for the standard, and describe what managers and landowners can do to meet the standard.

The evaluation criteria for stream temperature is a daily maximum 64° F standard that is applied to the average of the maximum temperatures for the warmest 7 consecutive days (known as the "7-day max"). The daily maximum temperature is determined from readings at hourly or half-hour intervals for each day during the monitoring period, usually mid-June through mid-September. The difference between the coolest and warmest temperature during the warmest 7 consecutive days is known as ΔT. High ΔT values result from solar exposure, and may be used to indicate reaches where additional shade can limit the sun's ability to warm the stream. Quite strictly, shade does not lower temperature it simply blocks the sun from warming the stream.

Some basins, especially larger tributaries low in the system, may have never met the standard summer temperature. There are instances where water flowing out of wilderness areas or off of US Forest Service lands is above the temperature standard. Temperature TMDL documents try to research this and account for the potential of the system in question. See the discussion on Lobster Creek in Chapter 9 for an example.

Dissolved Oxygen

High dissolved oxygen is a basic physiological requirement of cold-water fishes such as native salmon and trout. Critical dissolved oxygen levels for various life stages have been evaluated in laboratory and field studies. The early larval stages of fish are wholly dependent on the transfer of oxygen within the salmonid gravel nest, called a redd. When oxygen is below saturation, salmonid embryos are smaller than usual and hatching is either delayed or is premature. Salmonid juveniles survive in dissolved oxygen less than saturation, but growth, food conversion efficiency, and swimming performance are adversely affected.

The concentration of dissolved oxygen is a function of many factors: water temperature, surface and intragravel water interchange, water velocity, substrate permeability, and the oxygen demand of organic material. Organic matter in the water is broken down and utilized by bacteria and other aquatic life resulting in a use of oxygen. Therefore, in water with excess organic matter, especially that in response to eutrophication from excess nutrients, biochemical oxygen demand increases and less dissolved oxygen is available in the water for aquatic life. Water bodies with excess algal growth can also have variation in dissolved oxygen concentrations through the day. Oxygen levels may be low in the morning hours as a result of algal respiration through the night, and may reach supersaturation (over 100%) in the late afternoon as the result of photosynthesis.

Water quality criteria are established to provide for the natural fluctuations below saturation while assuring sufficient dissolved oxygen to protect aquatic life. The Oregon Water Quality Standards contain a number of dissolved oxygen criteria. More restrictive criteria are specified for dissolved oxygen during the period that salmonid fish are spawning and rearing. In the Lower Rogue standards are set at a minimum of 11 mg/l, or 95% saturation during the spring, fall and winter months, and a minimum of 8 mg/l, or 90% saturation during the summer. The content of oxygen in water is directly related to water temperature and barometric pressure, and therefore, temperature and pressure (estimated through elevation) must be measured at the same time.

pH

The pH is a measure of the hydrogen ion concentration of water. pH is measured in a logarithmic scale, with pH below 7 indicating acidic conditions and pH above 7 indicating alkaline conditions. The pH of water is important in determining the chemical form and availability of nutrients and toxic chemicals. Measurement of pH is especially important in mining areas because there is potential for both generation of heavy metals and a decrease in pH. Metal ions shift to a more toxic form at lower pH value. The pH of waters varies naturally across Oregon due to the chemical composition of the rock type in the watershed and the amount of rainfall. Eastside basins generally will have more alkaline water than westside or coastal basins.

The Oregon Water Quality Standards specify the expected pH range for all basins in Oregon. For the purposes of this assessment, the evaluation criterion is set at 6.5 to 8.5 for all westside basins. It should be recognized that, like dissolved oxygen, pH also varies in streams naturally throughout the day due to the photosynthesis and respiration cycles of attached algae.

Nutrients

Nutrients refer to chemicals that stimulate growth of algae and aquatic plants in water. In fast-moving streams, algae grow attached to the substrate and are called "periphyton." Algae and aquatic plants are a necessary part of the stream ecosystem and act as the primary producers in a stream – processing the sun's energy into food for stream fish. Excess algae and aquatic plant growth, however, becomes a problem in slow moving streams and rivers, and in still waters such as ponds and lakes. The excessive growth can result in low or no dissolved oxygen as discussed above, interfere with recreation, and certain algae can produce chemicals that are toxic to livestock and wildlife. Phosphorous and nitrogen are the major growth-limiting nutrients in water, and are therefore the focus of a water quality evaluation.

Total phosphorous measures primarily phosphates in the water column and phosphorous in suspended organic material. Total nitrate (commonly measured as nitrite plus nitrate) provides a measure of the majority of nitrogen present in surface waters. Evaluation criteria are based on literature values that have been identified as causing excessive plant growth.

Samples were evaluated against the 25^{th} percentile values, which represents a "poor" water quality index score. This standard is 0.08 mg/L total phosphorus, and 0.49 mg/l total nitrates.

Bacteria

Bacteria in the coliform group are used as indicators to test the sanitary quality of water for drinking, swimming, and shellfish culture. Bacteria in the coliform group are found in wastes associated with warm-blooded animals, including humans, domestic animals, and other mammals and birds, and are used as indicators of contamination of surface waters by sewage, feedlots, grazing, and urban runoff. The State of Oregon specifies the use of Escherichia coli (E.coli) as the bacterial indicator for water contact recreation, such as swimming, and fecal coliform bacteria as the indicator in marine and estuarine waters for shellfish growing. E.coli is a more specific test for organisms that occur in warm-blooded animals. The fecal coliform procedure tests positive for some bacteria that occur naturally in the environment, but has generally been accepted as a good screening tool.

Fecal coliform bacteria enter streams from many sources associated with human and animal wastes in urban and agricultural watersheds. In rangelands, bacterial contamination occurs primarily from direct deposition of fecal material in streams. Good vegetative cover on the upslope areas and dense riparian vegetation impedes contaminated runoff from reaching streams. Once coliform bacteria enter streams, the majority settle to the bottom and are attached to sediment particles. The stream sediments can act as a reservoir for fecal coliform bacteria; bacteria are resuspended when bottom sediments are disturbed through increased turbulence or animal movement.

For the purposes of this assessment, the evaluation criteria used for E. coli is a single exceedance of >406 E. coli/100ml or samples containing >126 E. coli colonies/100ml. Fecal coliform are evaluated for exceeding the standard if >43 fecal coliform/100ml occur in more than 10% of the samples, or the sample contains >255 colonies/100ml.

Total Solids

A total solids value is a measure of the suspended and dissolved solids in water. Low concentrations of total solids can result in limited growth of aquatic organisms due to nutrient deficiencies. Elevated levels of total solids, however, can lead to eutrophication of the stream or increased turbidity. Both eutrophication and increased turbidity result in a decrease in stream water quality.

Suspended solids are those that can be retained on a water filter and are capable of settling out of the water column onto the stream bottom when stream velocities are low. Suspended solids include silt, clay, plankton, organic wastes, and inorganic precipitates such as those from acid mine drainage. Suspended sediment can directly affect fish by damaging their gills and reducing the feeding ability of sight-feeding fish such as salmonids. Suspended sediment is a carrier for other pollutants (nutrients, pesticides, and bacteria) and is therefore a concern for water quality in general. In addition, suspended sediment interferes with recreational uses and the aesthetic quality of water. Turbidity is often used as a surrogate of suspended solids because it is more easily measured in the field. A turbidity meter compares the amount of interference encountered by a beam of light shone through a water sample versus that of distilled water.

Dissolved solids are those that pass through a water filter. They include some organic materials, as well as salts, inorganic nutrients, and toxins. The concentration of dissolved solids in stream water is important because it determines the flow of water in and out of the cells of aquatic organisms. Also, some dissolved inorganic elements such as nitrogen, phosphorus, and sulfur are nutrients essential for life.

Total solids vary naturally with the soil type in a landscape. Soils that break down into sand size fractions will settle to the bottom and result in comparatively low turbidity values. Soils that break down into less dense fractions will result in higher turbidity. Turbidity in a stream will increase naturally during storm and runoff events, but additional turbidity may be the result of land use practices.

Toxic Contaminants: Organic Compounds, Pesticides, and Metals

The term "contaminants" refers to chemicals that may cause toxicity in aquatic organisms. Because of the large number of organic compounds that are used, it is not feasible to establish standards for each one in a screening level assessment such as this. Values above detection levels are considered a red flag and should be investigated.

The standards for metals are based on either acute or chronic effects. Toxicity levels are based on the hardness of the water using a formula. Two hardness levels are evaluated for fresh water, 25 and 100 mg/l.

B INTRODUCTION

<u>Water Quality Criteria Applicable to the Sensitive Beneficial Uses</u>

Evaluation criteria are based on an interpretation of narrative and numeric standards in the Oregon Water Quality Standards. Where numerical criteria are not provided in the state standards, evaluation indicators have been identified based on the Oregon Department of Environmental Quality Water Quality Index (WQI). The WQI exists for 8 selected measurements of water quality: temperature, dissolved oxygen, biochemical oxygen demand, pH, ammonia + nitrate nitrogen, total phosphates, total solids, and fecal coliform. The WQI uses raw data for each measurement and converts it into a unitless subindex score ranging from 10 (worst case) to 100 (ideal). The "poor" ranking in Table 7.4 corresponds to the value that results in a WQI score of less than 80%. The Oregon Department of Environmental Quality uses the water quality index to describe water quality at its ambient sampling sites. To accomplish this, the subindices are combined using an unweighted formula into a single index value that ranges from 10 (worst case) to 100 (ideal).

Table 7.4 Summary of Water Quality Criteria and DEQ Parameter Levels for "Poor" Water Quality

Water Quality Attribute	Poor	Basis for Break Point
Biochemical Oxygen Demand	>1.2 mg/l	<80% WQI score
Water Temperature	>18ºC	Cold water habitat. Numeric standard.
Dissolved Oxygen	Summer: <8.0 mg/l OR <90% saturation Fall/Winter/Spring: <11 mg/l OR <95% saturation	Numeric standard
pH	<6.5 or >8.5 units	Numeric standard
Total Phosphorus	>0.08 mg/l	<80% WQI Score
Total Phosphorus (EPA)	>0.01 mg/l	Numeric standard
Nitrate + Nitrite plus NH3+NH4	>0.49 mg/l	<80% WQI Score
Nitrate + Nitrite plus NH3+NH4 (EPA standard)	Summer: >0.06 mg/l Fall/Winter/Spring: >0.09 mg/l	
E. coli	Single exceedance: >406 E. coli/100ml; >185 MPN/100mL	Numeric standard; <80% WQI Score
Fecal coliform	43 fecal coliform/ 100ml (not more than 10% of samples)	Numeric standard
Total Solids	>96 mg/l	<80% WQI Score

Water Quality Limited Streams 303(d) List

The ODEQ is required by the federal Clean Water Act to maintain a list of steam segments that do not meet water quality standards. This list is called the 303(d) List because of the section of the Clean Water Act that makes the requirement. The U.S. Environmental Protection Agency has approved ODEQ's 2002 list (ODEQ web site), but the 2004 list was not available for this assessment. ODEQ develops a Total Maximum Daily Load (TMDL) for each listed pollutant, which describes the amount of each pollutant a waterway can receive without violating water quality standards. A stream is removed from the list once the ODEQ has develop for the listed parameter and a Water Management Plan to outline best management practices to meet the maximum load. ODEQ is moving toward developing TMDLs on a basin wide scale and developing TMDLs for all of the pollutants entering the water body (ODEQ 2004). The TMDL for the Lower Rogue River, and most of the Rogue Basin, is scheduled for completion in 2005 (ODEQ 2004). Within the Lower Rogue, Lobster Creek has an approved TMDL for temperature.

Table 7.2 illustrates the Water Quality Limited Streams that pertain to the Lower Rogue River watershed. Table 7.3 includes streams for which DEQ has reviewed data, but a listing did not occur.

Table 7.2 DEQ 303(d) Listed Streams within the Lower Rogue Watershed

Stream	Stream Segment by River Mile (RM)	Parameter	Supporting Data
Foster	RM 0 to 5.2	Temperature/ Summer	7 day moving average of daily maximums from 1990 to 1996 exceed temperature standard (64) (67.8, 67.6, 68.1, 65.0, 67.7, 67.0, 68.7 °F).
Indian	RM 0 to 1.7	Temperature/ Summer	In 2000, 18 days with 7 Daily Max. Avg. > 64°F
Quosatana	RM 0 to 8.1	Temperature	7 day moving average of daily maximums 1991, 66.4; 1992, 69.3; 1994, 67.2 and 1995, 69.0°F. Three up stream sites RM 2.5, 1993,63.2°F; RM 2.6, 1995, 65.0°F; East Fork, 1995, 64.0 and West Fork, 1995, 63.0°F.

Rogue River	RM 0 to 27.2, RM 27.2 to 68.3	Temperature	
Shasta Costa	RM 0 to 13.4	Temperature	1990 to 1996, 75.2, 71.1, 72.5, 67.9, 70.5, 69.0 and 70.7. Four other sites had temperatures of 68.7 and 69.8 in 1991 and 68.7 and 66.8 in 1996

Table 7.3 Streams within the Lower Rogue Watershed Reviewed by DEQ

Stream	Stream Segment	Parameter	Listing Status	Supporting Data
Billings Creek	RM 0 to 3.5	Sedimentation	Insufficient/No Data	
Boulder Creek (tributary of Lobster Creek)	RM 0 to 5.9	Temperature	Attaining Criteria/Uses	No temp. exceedances; 7 day avg. max 63.4°F
Bradford Creek	RM 0 to 2.1	Temperature/ Summer	Attaining Criteria/Uses	7 day moving avg. of daily max. at 59.3 and 59.9°F in 1993 and 1994
Indian	RM 1.7 to 3.4	Temperature/ Summer	Attaining Criteria/Uses	In 2000, 0 days with Daily Max Avg.>64°F
Lobster	RM 0 to 9.7	Biological Criteria	Attaining Criteria/Uses	Discriminate score of 99 (healthy)
Lobster	RM 0 to 9.7	Sedimentation	Insufficient/ No Data	
Lobster	RM 0 to 9.7	Temperature/ Summer	TMDL Approved	
Mule	Mouth to Headwaters	Temperature	Potential Concern	Data used for listing collected in drought year (1994)
North Fork Lobster	RM 3.3 to 6.8	Temperature	Attaining Criteria/Uses	7 Day avg. max. 62.7°F (1996)
North Fork	RM 0 to 3.3	Temperature/	TMDL	

Lobster		Summer	Approved	
Quosatana	RM 0 to 8.1	Sedimentation	Insufficient/ No Data	
South Fork Lobster	RM 3.7 to 7.2	Temperature/ Summer	Attaining Criteria/Uses	Readings from 1990 to 1996 were between 60.0 and 62.4°F
South Fork Lobster	RM 0 to 3.7	Temperature/ Summer	TMDL Approved	
Squaw Creek	RM 0 to 2.3	Temperature/ Summer	Attaining Criteria/Uses	In 2000, 0 days >64.0°F
Stair Creek	RM 0 to 6.5	Sedimentation	Insufficient/ No Data	
Twomile Creek	RM 0 to 2.8	Temperature/ Summer	Attaining Criteria/Uses	7 day moving avg of max. of 61.7°F in 1993
Twomile Creek	RM 0 to 2.8	Biological Criteria	Potential Concern	Discriminate Score of 66

Rogue Basin Contributions

The water quality in the Lower Rogue Mainstem is largely dependent on upstream land uses. The Oregon Department of Environmental Quality has described Rogue Basin water quality characteristics in a few reports.

Oregon Water Quality Index Report for the Rogue Basin (Cude 2002)

Cude (2002) evaluated data from the ODEQ ambient water quality sites in the Rogue Basin. Water quality data from water years 1986 through 1995 were evaluated using the Oregon water quality index described earlier (Table 7.4).

Table 7.4. Seasonal Average Oregon Water Quality Index (OWQI) Results for Rogue Basin (Cude 2002)

			WY 1986 -1995		
Site	STORET Number	River Mile	Summer Average	FWS Average	Minimum Seasonal Average
Rogue R. @ Dodge Park	402093	138.4	89	91	89
Little Butte Ck. @ Agate Rd. (White City)	402279	1.4	61	72	61
Bear Ck. @ Mountain Ave. (Ashland)	402105	24.0	70	64	64
Bear Ck. @ Valley View Rd. (Talent)	402104	19.9	25	26	25
Bear Ck. @ Kirtland Rd.	402728	0.9	38	38	38
Rogue R. @ Rocky Point Br. (Gold Hill)	402091	117.3	85	80	80
Applegate R. @ HWY 199	402098	2.7	85	87	85
Rogue R. @ Robertson Br. (Merlin)	402088	86.6	83	82	82
Illinois R. d/s Kerby	404161	48.4	86	93	86
Rogue R. @ Lobster Bridge	402084	11.0	87	88	87

Summer: June - September; FWS (Fall, Winter, & Spring): October - May
Scores - Very Poor: 0-59, Poor: 60-79, Fair: 80-84, Good: 85-89, Excellent: 90-100

The upper Rogue River receives drainage from the Cascades with excellent general water quality. The monitoring point at Dodge Park is the most upstream site and is upstream of all major point sources. Relatively high concentrations of total phosphates and biochemical oxygen demand occasionally limit water quality during precipitation events when organic matter is deposited with runoff, and during low flows when less dilution of organic matter occurs. Water flowing in from Little Butte Creek is consistently poor due to non-point source pollution in the lower reaches. High fecal coliform, total phosphates, total solids, and biochemical oxygen demand are attributed to the introduction of untreated animal or human waste and runoff. Irrigated agriculture and range, and urban runoff from Eagle Point contribute are contributors.

The middle Rogue River is the most impacted in the basin with point and non-point source contributions of pollution from Bear Creek Valley, the most densely populated and intensively cultivated area in the Rogue Basin. Water quality at the Mountain Avenue site is mainly impacted by non-point sources that contribute to high levels of total phosphates, fecal coliform, total solids, and biochemical oxygen demand are present. Filling of Emigrant Lake reservoir in the fall results in negligible flows in the creek, and irrigation demands in the summer result in poor dilution of pollutants.

The Valley View Road monitoring site is downstream of the confluence of Bear Creek with Ashland Creek and scored poorly throughout the year. The Ashland sewage treatment plant discharges into Ashland Creek above this point. Extremely high concentrations of fecal coliforms, total phosphates, total solids, nitrate and ammonia nitrogen, and biochemical oxygen demand occur. Low dissolved oxygen occurs, with the conversion of high concentrations of ammonia to nitrate being one cause.

At Kirtland Road, Bear Creek still has high concentrations of the parameters listed for Valley View Road, but re-aeration and mixing of the water has helped. Impacts from the Ashland Sewage Treatment Plant may still be present, but irrigation returns contribute a significant amount of non-point pollution.

Monitoring of the Rogue River at Rocky Point in Gold Hill in the middle Rogue sub-basin indicates that water quality has deteriorated from the Dodge Park site upstream. This monitoring site is a mile downstream of the Gold Hill sewage treatment plant. Water quality is deteriorated by high concentrations of fecal coliforms, biochemical oxygen demand, total phosphates and total solids. These impacts are usually in association with higher flows when loadings from the treatment plant, streams, and erosion are more likely to occur.

The Applegate Subbasin and Applegate River are monitored at US Highway 1999. High levels of fecal coliforms and biochemical oxygen demand impact water quality during high flow periods. In the summer, high temperature and concentrated total solids and biochemical demand contribute to low dissolved oxygen concentrations.

The Illinois Subbasin has better water quality than the Rogue River in the fall, winter, and spring. High temperatures and lower flows impact summer values, with high total solids and biochemical oxygen demand. Eutrophication is apparent through high pH values and high dissolved oxygen supersaturation.

In the Lower Rogue Subbasin, the Rogue River is monitored at the Robertson Bridge, which lies eight miles downstream of the confluence of the Rogue and Applegate Rivers, and fourteen miles downstream of the Grants Pass sewage treatment plant. Therefore, non-point sources dominate as impacts. Water quality is impacted occasionally by high levels of fecal coliforms, biochemical oxygen demand, and total solids throughout the year. High temperatures in the summer and eutrophication results in high pH and high percentage of dissolved oxygen supersaturation.

The Rogue River at Lobster Creek Bridge was added as an ambient water quality site beginning in 1992. The bridge lies sixteen miles downstream of the confluence of the Rogue and Illinois Rivers. Non-point sources contribute to high concentrations of total phosphates, total solids, and biochemical demand. The report outlines high pH values in the summer, but this is attributed to samples mistakenly attributed to this site (Blake 2005). High summer temperatures also impact the site.

305b Reports (ODEQ 2004)

In the 2004 305b report published by the Oregon Department of Environmental Quality, the biology, chemistry, and habitat of streams for different regions of the state was evaluated (DEQ 2004). Data for the Rogue Basin was gathered from three different ODEQ monitoring programs: 1994 to 2001 data from the 1994-1996 Coast Range Regional Monitoring and Assessment Program (REMAP), the 1998-2001 Oregon Plan for Salmon and Watersheds, and the 1994-2003 ambient water quality monitoring network. Streams (1^{st}-3^{rd} order) within a region were evaluated against reference sites representing the least amount of disturbance for a given region. The 25^{th} percentile value of the reference site distribution demarcated good and fair condition sites, while the 10^{th} percentile demarcated fair and poor condition sites.

Water quality is the most significant stressor for the Rogue Basin with 36% in poor or fair conditions. Fine sediment is also a stressor with 27% in fair or poor condition. Biotic conditions were relatively unimpaired with 23% of the macroinvertebrate community and

10% of the vertebrate community in poor condition (DEQ 2004). These values are the same as the 303b report published in 2002, so there are no improving or deteriorating trends.

C METHODOLOGY

- Water quality conditions were evaluated using available data from the Lower Rogue Watershed Council Water Quality Program, ODEQ's ambient water quality monitoring site on the Rogue River at Lobster Creek, and the USGS water quality data from the Rogue River near Agness, Oregon (#14372300). Data that met ODEQ quality assurance standards for grade "A" and "B" data was used in the evaluation. A series of pH values from samples taken on the Rogue Mainstem at Lobster Bridge (date) were eliminated from the data after conversations with Pam Blake at ODEQ revealed that the values were mistakenly attributed to the site. These values originally caused a 303(d) listing for pH on the Lower Rogue, and while the listing had been removed, the data still existed in the database (Blake 2004).
- Water quality data were compared to evaluation criteria or indicators and the percent exceedance of criteria was calculated for water quality parameters when a numeric standard did not exist (Table 7.5).
- An impairment category from the table below was assigned for each parameter as outlined in the Oregon Watershed Assessment Manual (1999). Note that the state has different listing criteria.
- Water quality information from the USGS station near Agness exists for a variety of compounds. This information was evaluated against criteria or guidance values not to be exceeded in waters of Oregon. Standards or guidance values for any given compound may include concentrations for the protection of aquatic life (chronic and/or acute), and concentrations for protection of human health, including drinking water standards. Only the standard exceeded was included in Table 7.8.

Criteria for Evaluating Water Quality Impairment

Percent Exceedance of Criteria	Impairment Category	Code in Table 7.6
(<15%)	**No Impairment** No or few exceedances of criteria	NI
(15-50%)	**Moderately Impaired** Criteria exceedance occurs on a regular basis	MI
(>50%)	**Impaired** Exceedance occurs a majority of the time	I
Date lacking/insufficient	Unknown	Blank

D RESULTS and KEY FINDINGS

- The Lower Rogue Watershed includes one current ODEQ ambient water quality monitoring site located at the Lobster Creek Bridge (10414) at river mile 11.0. The Oregon Water Quality Index Summary Report indicates that non-point sources, some coming from upstream land uses, contribute to high concentrations of total phosphates, total solids, and biochemical oxygen demand. High temperatures impact water quality during summer low flow periods (Cude, 2002). The Oregon Water Quality Index Summary Report for Water Years 1992-2001 indicate that water quality is "good" throughout the year with a summer mean value of 89, a fall/winter/spring value of 88, and a minimum season average of 88 (Cude 2002). The report for water years 1994-2003 lists an overall water quality index mean of 88 for summer, a mean of 89 for fall/winter/spring, and a minimum seasonal average of 88 (Myrazik 2004). Summer WQI scores are likely influenced by pH values that were mistakenly assigned to the Rogue River at Lobster Creek as discussed earlier in this chapter.
- Dissolved oxygen levels, fecal coliform, and pH levels are good in the basin with all sampling locations and streams having "no impairment" (Table 7.7).
- Ranch Creek is impaired and Edson Creek is moderately impaired for E. coli based on samples taken in 2004. Further testing is required. Ranch Creek has been fenced except for headwater areas and cattle crossings. Edson Creek is fenced to restrict cattle access.
- The Rogue River mainstem led to most of the moderate impairment for temperature, dissolved oxygen, biochemical oxygen demand, total solids, and nutrients when all samples on the Lower Rogue and its tributaries were combined (Table 7.6). Tributaries with samples exceeding standards were:
    - Temperature: Lobster, Saunders, and Indian Creeks
    - Dissolved Oxygen: Jim Hunt Creek and Hicks Creek.
    - Biochemical Oxygen Demand: Lobster, Twomile, Hicks, and Foster, Quosatana, Shasta Costa, Tom Fry Creeks.
    - Total Solids: Tom Fry, Quosatana, Foster and Hicks Creeks.
    - Nitrate + Nitrite: No impairments occurred using 0.49 mg/L as the standard. Lobster, Quosatana, Indian, and Saunders Creeks exceeded the EPA standard.
    - Total Phosphorus: No impairments occurred using 0.08 mg/L as the standard. All samples exceeded the EPA standard.
- The Rogue River (at Agness and at Lobster Creek Bridge) accounted for all pH exceedences with four samples below 6.5 and four samples above 8.5 units. Six samples were thrown out based on discussions with DEQ. These six samples were apparently mistakenly attributed to the Rogue River at Lobster Creek site and were taken in the 1986-1995 water year. Because these samples were all above 8.5, the DEQ 303d list database lists the Rogue River from mile 0 to 27.2 for pH.

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OSU 1998. Watershed Stewardship- A Learning Guide, Oregon State University Extension Service, July 1998.

Table 7.6 Evaluation of Water Quality Conditions in the Lower Rogue Watershed

Statistic	Temperature (ºC)	Dissolved Oxygen (mg/l)	Biochemical Oxygen Demand (mg/l)	pH	Total Solids (mg/L)	Nitrate + Nitrite (mg/L)	Total Phosphorus (mg/L) (<80% WQI)	Fecal Coliform (per 100 ml)	E. coli (per 100 ml)
Standard	>18°C	Summer: <8 mg/l OR <90% saturation FWS* <11 mg/l OR <95% saturation	>1.2 mg/l	<6.5 or > 8.5 units	>96 mg/l	>0.49 mg/l	>0.08 mg/l	43 colonies/ 100 ml in > 10% of samples or >255 colonies/ 100 ml	>406 colonies/ 100 ml in a single sample or >125 colonies/ 100 ml
Samples	355	321	302	407	279	185	171	183	99
Minimum	4.0	5.2	<0.1	6.0	37.5	<0.005	0	1	<1
Maximum	25	13.4	6.3	8.8	1354	0.4	0.4	7000	1733
Median	14	10.3	0.8	7.9	85	0.1	0.1	36	9.9
# Exceedance	99	28	83	8	66	54	47	9	10
% Exceedance	27.9	8.7	27.5	2.0	23.7	30.0	27.5	4.9	10.1
Impairment	Moderately Impaired	Not Impaired	Moderately Impaired	Not Impaired	Moder-ately Impaired	Moderately Impaired	Moderately Impaired	Not Impaired	Not Impaired

Table 7.7 Lower Rogue Water Quality: Exceedence of Standards by Sampling Location and Total Number of Samples

Location	Years Samples Acquired	TEMP. (C)	Dissolved Oxygen	BOD-5 (mg/l)	pH (SU)	Total Solids (mg/L)	Nitrate + Nitrite EPA Std.	NOx	Tot. PO4 (mg/l)	Tot. PO4 (mg/l) EPA Std.	Fec. Coli (/100 ml)	E. coli (/100 ml)
	Standard	*>18℃*	*Summer: <8 mg/l OR <90% saturation FWS* <11 mg/l OR <95% saturation*	*>1.2 mg/l*	*<6.5 or > 8.5 units*	*>70 mg/l*	*Summer :>0.06 FWS* >0.09*	*>0.49 mg/l*	*>0.08 mg/l*	*>0.01 mg/l*	*43 colonies/ 100 ml in > 10% of samples or >255 colonies/ 100 ml*	*>406 colonies/ 100 ml in a single sample or >125 colonies/ 100 ml*
Rogue @ Lobster Bridge	1966-2004	MI	NI	MI	NI	MI	NI	NI	MI	**I**	NI	NI
		49/152	4/128	32/25	10/ 206	26/129	8/39	0/39	9/31	31/31	5/83	1/30
USGS Agness	1966-1994	MI										
		46/215										
Rogue @Huntley Park	1966-1970	MI	NI	MI	NI	MI	NI	NI	**I**	**I**	NI	
		4/11	1/11	5/11	0/11	4/10	1/10	0/10	7/10	10/10	0/4	
Rogue @ Agness	1980-2002	MI	NI	MI	NI	MI	MI	NI	MI	**I**	NI	
		19/67	2/65	20/67	2/67	14/67	21/66	0/66	13/64	64/64	3/73	
Rogue @ Hwy 101	1967-1968	NI	NI	NI	NI	**I**			MI	**I**	NI	
		0/3	0/3	0/3	0/3	2/2			1/2	2/2	0/3	
Rogue @ Jot's Resort	1969-1976	NI	NI	MI	NI	**I**			NI	NI	**I**	
		0/10	1/10	4/10	0/10	1/1			0/1	1/1	3/3	

Location	Years Samples Acquired	TEMP. (C)	Dissolved Oxygen	BOD-5 (mg/l)	pH (SU)	Total Solids (mg/L)	Nitrate + Nitrite EPA Std.	NOx	Tot. PO4 (mg/l)	Tot. PO4 (mg/l) EPA Std.	Fec. Coli (/100 ml)	E. coli (/100 ml)
Rogue downstream of Illinois R.	1966-1968	MI	NI	MI	NI	MI			**I**	**I**	NI	
		2/7	0/7	3/6	0/7	3/7			5/7	7/7	0/2	
Rogue 500' above Illinois R.	1966-1968	**I**	NI	MI	NI	MI	NI	NI	**I**	**I**		
		3/5	0/5	2/5	0/5	3/5	0/5	0/5	4/5	5/5		
Rogue @ bridge U/S Illinois R.	1969-1977	NI	NI	MI	NI	MI	MI	NI	**I**	**I**	NI	NI
		6/15	1/15	3/13	0/16	4/15	2/5	0/5	1/1	1/1	10%	
Shasta Costa, RM 1.1	1999	NI	NI	NI	NI	N/I	NI					
		0/1	0/1	0/1	0/1	0/1						
Shasta Costa, S. of USFS road 23	1993	NI	NI		NI	NI						
		0/1	0/1		0/1	0/1						
Twomile Creek @ RM 0.2	1994-1996	NI	NI	MI	NI	NI						
		0/2	0/2	1/2	0/2	0/2						
Jim Hunt	2001	NI	NI	NI	NI	NI						
		0/1	0/1	0/1	0/1	0/1						
Quosatana	1993	NI	NI		NI	NI						
		0/1	0/1		0/1	0/1						

Location	Years Samples Acquired	TEMP. (C)	Dissolved Oxygen	BOD-5 (mg/l)	pH (SU)	Total Solids (mg/L)	Nitrate + Nitrite EPA Std.	NOx	Tot. PO4 (mg/l)	Tot. PO4 (mg/l) EPA Std.	Fec. Coli (/100 ml)	E. coli (/100 ml)
Lobster @ RM 6.2	1995-1996	MI	NI	MI	NI	NI						
		1/3	0/3	1/2	0/3	0/2						
SF Lobster near road 3104	1998	NI	NI	NI	NI	NI						
		0/1	0/1	0/1	0/1	0/1						
Tributary to SF Lobster	1998	NI	NI	NI	NI	NI						
		0/1	0/1	0/1	0/1	0/1						
Hicks Creek off 1160 trail 20	1998-1999	NI	NI	**I**	NI	**I**						
		0/3	0/3	2/3	0/3	3/3						
LOWER ROGUE WATERSHED COUNCIL DATA (WARNING: NOT ALL DATA IS GRADED)												
Lobster Creek at mouth, ODFW trap	2002-2004	MI	NI	NI	NI	NI	MI	NI	NI	MI		NI
		2/9	0/11	1/7	0/9	0/5	3/8	0/8	1/8	4/8		0/7
Indian Creek, var. locations	2003-2004	MI		NI	NI		MI	NI	NI	**I**		NI
		1/2	0/6	0/1	0/1		1/4	0/4	0/3	3/3		0/4
Pedro Gulch at N. Bank Rogue	2004											NI
												0/1

Location	Years Samples Acquired	TEMP. (C)	Dissolved Oxygen	BOD-5 (mg/l)	pH (SU)	Total Solids (mg/L)	Nitrate + Nitrite EPA Std.	NOx	Tot. PO4 (mg/l)	Tot. PO4 (mg/l) EPA Std.	Fec. Coli (/100 ml)	E. coli (/100 ml)
Rogue mainstem slough joining Edson Creek	2004											NI
												0/1
Edson Creek, var. locations	2004	NI	NI	NI	NI		NI	NI	NI	**I**		MI
		0/1	0/16	0/1	0/1		0/7	0/7	0/2	2/2		3/16
Ranch Creek, var. locations	2004											**I**
												6/10
Saunders Creek, var. locations	2004	MI	NI	NI	NI		MI	NI	NI	MI		NI
		1/2	0/6				2/5	0/5	0/3	1/3		0/6
Squaw Creek, var. locations	2003-2004	NI	NI	NI	NI		NI	NI	NI	MI		NI
		0/2	0/4	0/1	0/1		0/3	0/3	0/2	1/2		0/3
Bradford Creek, at road abv. Culvert	2002	NI	NI	NI								NI
		0/2	0/2	0/1								0/2
Foster Creek, mouth	2002	NI	NI	MI	NI	MI	NI	NI	NI	**I**		NI
		0/5	0/5	2/4	0/5	1/3	0/3	0/3	0/3	2/3		0/2

Location	Years Samples acquired	TEMP. (C)	Dissolved Oxygen	BOD-5 (mg/l)	pH (SU)	Total Solids (mg/L)	Nitrate + Nitrite EPA Std.	NOx	Tot. PO4 (mg/l)	Tot. PO4 (mg/l) EPA Std.	Fec. Coli (/100 ml)	E. coli (/100 ml)
Rogue River @Coon Rock Bridge	2002,2004	NI	NI	**I**	NI	MI	**I**	NI	MI	**I**		
		0/3	0/4	2/2	0/3	1/2	4/4	0/4	2/4	4/4		
Quosatana Creek, near mouth	2002,2004	NI	NI	MI	NI	MI	MI	NI	NI	MI		
		0/7	0/8	1/5	0/7	1/4	1/4	0/4	0/4	2/4		
Shasta Costa Creek, var. locations	2002,2004	NI	NI	MI	NI	NI	NI	NI	NI	**I**		
		0/6	0/7	1/4	0/6	0/3	0/3	0/3	0/3	3/3		
Silver Creek, mouth	2003-2004	NI	NI	NI	NI		NI	NI	NI	**I**		NI
		0/1	0/3	0/1	0/1		0/2	0/2	0/2	2/2		0/2
Tom Fry Creek	2002	NI	NI	MI	NI	MI	NI	NI	NI	**I**		
		0/2	0/2	1/2	0/2	1/2	0/2	0/2	0/2	2/2		

***Samples not taken for all parameters each visit. Blank entries either had no data available, or the calculation could not be completed with the data available.**

Table 7.8 Water Quality Criteria and Exceedances in the Lower Rogue Watershed for Various Compounds

Compound	Priority Pollutant	Carcinogen	Standard Exceeded	Average Value	Maximum Value
Chlordane, Total (µg/L)	Y	Y	0.0043 µg/L, chronic criteria	0.005	0.100
Copper, Total (µg/L)	Y	N	18 µg/L, acute criteria	90	2300
Dieldrin (µg/L)	Y	Y	0.0019 µg/L, chronic criteria	0.001	0.010
Iron, Total (µg/L)	N	N	1,000 µg/L	613	5,900.0
Lead, Total (µg/L)	Y	N	3.2 µg/L, chronic criteria 82 µg/L, acute criteria, 50 µg/L, water and fish ingestion	81.9	200.0
Manganese, Total (µg/L)	N	N	50 µg/L, water and fish ingestion	26.5	140.0
Mercury, Total (µg/L)	Y	N	0.12 µg/L, chronic criteria 2.4 µg/L, acute criteria, 144 ng, water and fish ingestion	0.4	4.0
Mirex, Total (µg/L)	N	N	0.001 µg/L, chronic criteria	0.01	0.01
Silver, Total (µg/L)	Y	N	0.12 µg/L, chronic criteria	0.64	4.0
Toxaphene, Total (µg/L)	Y	Y	0.0002 µg/L, chronic criteria 0.73 µg/L, acute criteria	0.053	19.0

VIII SEDIMENT ASSESSMENT

A BACKGROUND (GWEB 1999)

Erosion that occurs near streams and on surrounding slopes is a natural part of any watershed. Fish and other aquatic organisms in a region are adapted to deal with a range of sediment amounts that enter streams. The amount of erosion in a watershed and the sediment load in the streams vary considerably during the year, with most sediment moving during the few days that have the highest flows. The most significant land-forming events occur during precipitation or snowmelt events that happen only once every decade or more.

Sediment is delivered and transported to stream channels by a variety of processes. Landslide types vary from rapid, shallow debris slides and flows on steep terrain to slow-moving episodic earthflows covering hundreds of acres. Erosion processes include overland flow, concentrating into rills and gullies as well as streambank erosion.

Effects of sediment on stream channels and aquatic habitat are related to the volume, texture, and rate of delivery (Figure 1), as well as the characteristics of receiving stream channels. Fine particles (sand, organics, and silt) deposited on the streambed may blanket spawning gravels and reduce survival of fish eggs incubating in the gravel. Fine sediment may cover the exposed rock surfaces preferred by aquatic insects, reducing the food supply to fish. Suspended sediments cause turbidity (clouding of water), which prevents fish from feeding. Large deposits of coarse sediments can overwhelm the channel capacity, resulting in pool-filling, burial of spawning gravels, and, in some cases, complete burial of the channel, resulting in subsurface streamflows.

The hardness of the underlying rock and its fracturing as the land is uplifted over long periods of time determine the rate of erosion. These geological processes also influence the pattern and density of streams in a watershed.

Figure 8.1. Channel Response to Bedload Supply (Lisle USFS)

Bedload Supply →		
Incision Bank erosion	← Armoring Embeddedness → Fines in pools →	Braiding Aggradation Bank erosion Pool filling by unsorted bedload Bar construction
Morphologic Response	Textural Response	Morphologic Response

In addition to natural levels of erosion, human-induced erosion can occur from roads, landings, rock sources, and other land disturbances. Separating human-induced erosion from natural erosion can be difficult because of the highly variable nature of natural erosion patterns. Furthermore, human-caused erosion may also be highly variable in timing and spatial pattern. While it is nearly impossible to specify when a human-induced change in sediment is too much for a local population of fish and other aquatic organisms to handle, in general, the greater a stream deviates from its natural sediment levels the greater the chance that the fish and other aquatic organisms are going to be affected. Sediment in streams can have a human dimension, too. High sediment levels can increase the cost of treating drinking water, can be aesthetically displeasing, and can decrease fish angling access.

It is important to recognize that much eroding soil will deposit on a hill slope before it reaches the stream. This is good news, since there are a number of things that can be done to fix a site that is eroding before the sediment enters the streams. For example, water draining from a rutted road surface can be delivered onto a well-drained slope where the sediment will be filtered out, and the clean water can flow beneath the ground's surface to the stream.

Road-Related Erosion

The road network is potentially a significant erosion feature. Improperly placed roads can divert sediment-laden water to streams. Poor drainage of roads can lead to gullying and channeling of the road surface. Improper maintenance of inboard ditches can cause saturation of the roadbed, leading to mass wasting.

Road washouts also can occur when a road adjacent to the stream is undercut and a portion of the road drops into the stream or at stream crossings during a high flow where there was either an undersized or plugged culvert or bridge. In steeper terrain, road washouts can create shallow landslides on unstable fill or cut-slopes failures. Appropriate sizing of culverts and bridges at stream crossings, locating roads away from streams, designing roads properly, and correctly disposing of soil during road construction on steeper slopes can prevent most road washouts.

B INTRODUCTION

The assessment of sediment within the Lower Rogue River watershed was focused on the results of three analyses that serve as indicators of sediment related concerns. These indicators include an analysis of road density on steep slopes (>50%), an analysis of roads within 200 feet of a stream, and an analysis of road crossing density. Individually, each indicator can help direct land managers toward areas within the watershed that may warrant further investigation. Collectively, however, these indicators identify the relative risks of sediment impacts for each subwatershed throughout private lands in the basin.

The three indicators considered in this assessment (See Tables 8.1, 8.2 and 8.3) focus on roads. They are designed to characterize sediment delivery potential. These indicators represent processes that cause sediment delivery to stream channels, and should be interpreted with stream channel data, such as substrate and pool depth benchmarks used by ODFW.

Table 8.1 Roads on Slopes >50% (Indicator I)

Process: Failure of road fills, steep road surfaces and ditches concentrating runoff onto hillslopes.
Comments: Road failures result when road fill becomes saturated and/or incorporated woody debris decays. Prior to changes in the forest practice rules, roads were constructed by excavating and "sidecasting" road fill on slopes greater than 60%. Current practices call for excavating a "full bench" road and end-hauling the material to a stable landing. Although this indicator does not account for the age of the road, most roads were constructed before the change. Roads with well-maintained drainage systems may minimize the erosion, but large storms may move enough sediment to overwhelm the drainages.

Table 8.2 Roads Within 200 feet of Stream Channels (Indicator II)

Process: Ditch erosion delivered directly to streams at crossings and at ditch relief culverts (less opportunity for fines to deposit on slopes), fill failures more frequent in wet toe-slope position and more likely to deliver to channels. Removal of large wood from channels.
Comments: The amount of fines generated from the road surface and ditch is related to the traffic and season (e.g. wet weather haul), frequency of disturbance including grading, and quality of the surfacing on the road. These factors however are not taken into account by this indicator.

Table 8.3 Road Crossings (Indicator III)

Process: Plugging of culverts, leading to wash-outs or diversions down the road and onto unprotected hillslopes.
Comments: Old forest practice rules required culverts to be sized for storms recurring every 25 years or less. Many of these older culverts cause water to pond during storms, and allow woody debris to rotate sideways and plug the culvert. Culverts that are substantially narrower than the stream channel are also more likely to plug. Crossings located on steeper stream channels are subject to higher stream power, which can mobilize sediment and wood both in the channel and on hillslopes when flows are diverted. Debris flows are also more likely to be generated on steeper channels. **Note:** *Currently, this indicator has not been refined by considering the stream gradient or the stream junction angle that would factor in the likelihood of continued debris flow run-out. Also, not all culverts that are included in this indicator are likely to plug or fail.*

Ideally, the sediment indicators could characterize the probability of delivering an estimated volume of sediment with a known range of particle sizes. In reality, we can only infer the processes likely to deliver sediment, and identify locations where the processes are most likely to occur. This assessment does not factor in road conditions (except roads inventoried), frequency of use, or construction date.

C METHODOLOGY

- USGS 7.5 Minute topographic maps and digital orthophoto quads were interpreted to generate a comprehensive watershed road map in GIS. Old roads were included on the map.
- Road Crossings: USGS 7.5 Minute topographic maps and digital orthophoto quads were interpreted to generate a comprehensive watershed road crossing map in GIS. Crossings were identified at sites where contours or road configuration indicated the presence of distinct channels. (Larger drainage areas are required to create channels on more gentle slopes).
- Roads on Slopes >50%: Slopes >50% were generated from a slope class map (originally from 10 meter digital elevation models) prepared by the Rogue Valley Council of Governments' GIS department. The length of all roads with slopes >50% were calculated for each subwatershed.
- Roads within 200 ft of a Stream: We used GIS to create 200 ft buffer on either side of streams. This buffer zone was evaluated with the comprehensive watershed road map to determine the miles of road within 200 ft of a stream. These are the road segments that are more likely to have ditches that flow directly into the stream.
- Roads on steep slopes within 200 ft of a stream: The miles of road that fall into both categories was calculated. Roads with steep side slopes usually have more soil accumulating in the road ditches than roads with less steep side slopes, and plugged road ditches are a common cause of road surfaces breaking down.
- Each subwatershed in the Lower Rogue received a rating of sediment impacts for each indicator. A percentile rating of 0-100 was established to represent the relative risk of each indicator for each subwatershed relative where 0 = lowest possible risk and 100 = highest possible risk.

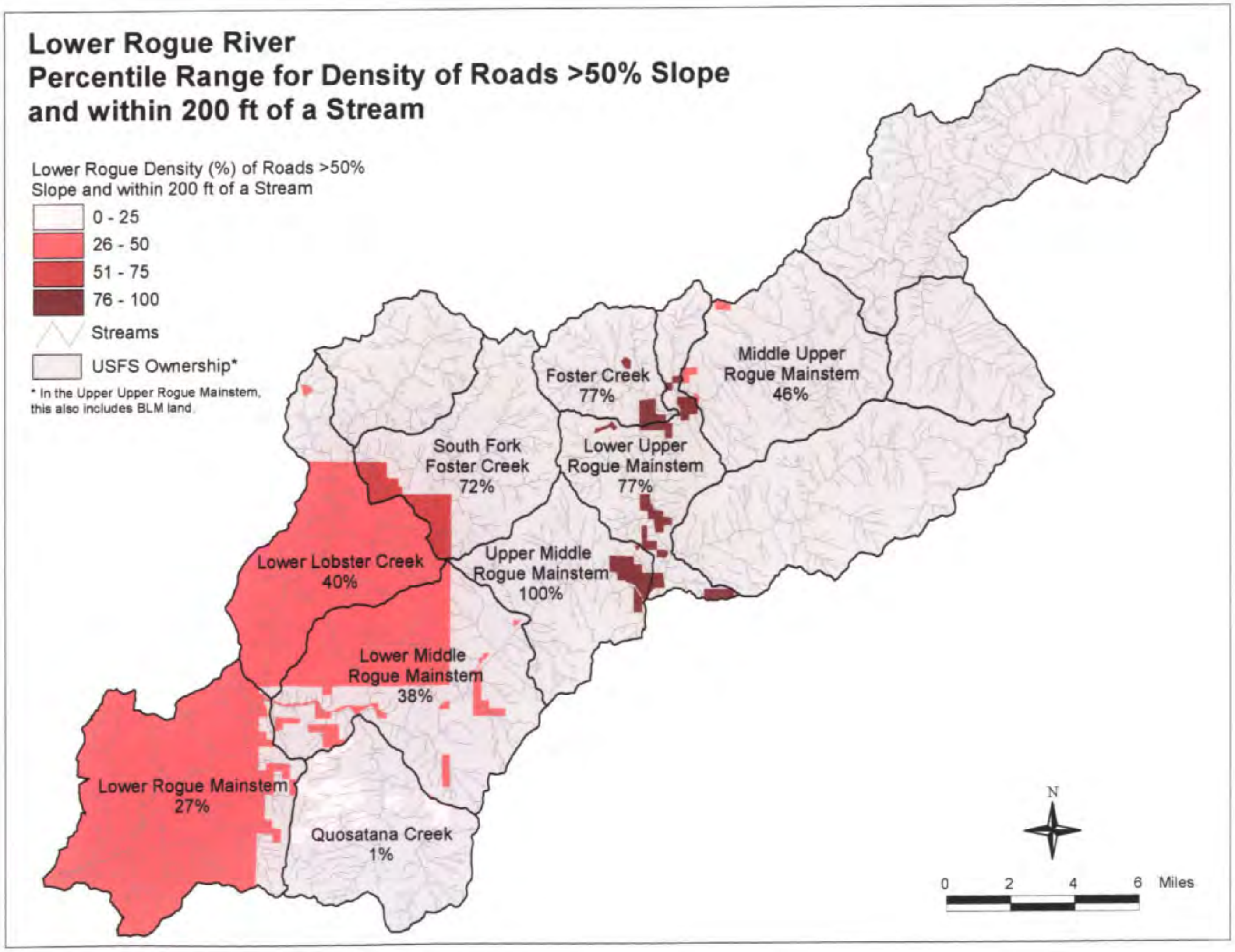
D RESULTS

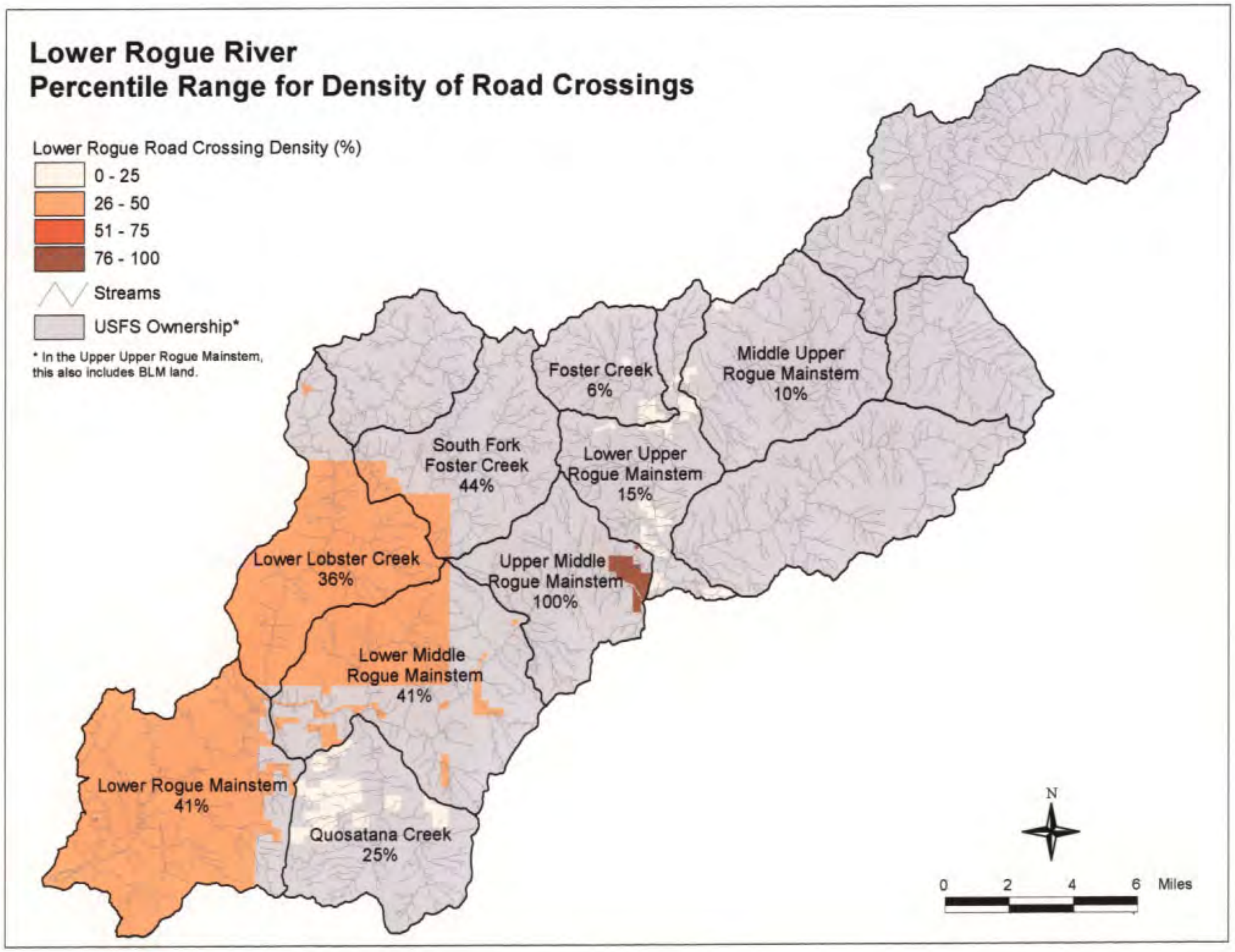
Table 8.4 Summary of Sediment Impacts for Subwatersheds with Private Lands

Subwatershed	Non USFS Acres	Roads on Slopes>50%			Road Within 200 ft of Streams		
		Total Road Miles	Density/ Sq Mi	Perce-ntile	Total Road Miles	Density/ Sq Mi	Percentile
Lower Rogue Mainstem	23,167	13.61	0.34	81	31.38	0.87	49
Lobster Mainstem	15,403	11.93	0.42	100	16.38	0.68	38
Lobster South Fork	1,854	2.82	0.11	26	2.16	0.75	42
Lower Middle Rogue	9,524	5.56	0.14	33	9.44	0.63	36
Quosatana	2,592	0.10	<0.01	0	3.09	0.76	43
Upper Middle Rogue	701	0.94	0.04	10	1.95	1.78	100
Lower Upper Rogue	1,327	1.36	0.06	14	2.84	1.37	77
Foster	355	0.26	0.02	5	0.42	0.76	43
Middle Upper Rogue	225	0.14	0.01	2	0.08	0.24	13
Upper Upper Rogue	352	0	0	0	0	0	0

Table 8.5 Summary of Sediment Impacts for Subwatersheds with Private Lands

Subwatershed	Non USFS Acres	Roads on Slopes>50% and within 200 ft of Streams			Road Crossings		
		Total Road Miles	Density/ Sq Mi	Perce-ntile	Total # of Crossings	Density/ Sq Mi	Percentile
Lower Rogue Mainstem	23,167	4.96	0.14	27	438	12.10	41
Lobster Mainstem	15,403	4.95	0.21	40	256	10.64	36
Lobster South Fork	1,854		0.37	72	37	12.77	44
Lower Middle Rogue	9,524	2.90	0.19	38	180	12.10	41
Quosatana	2,592	0.01	<0.01	1	29	7.16	25
Upper Middle Rogue	701	0.56	0.51	100	32	29.22	100
Lower Upper Rogue	1,327	0.81	0.39	77	9	4.34	15
Foster	355	0.22	0.40	77	1	1.80	6
Middle Upper Rogue	225	0.08	0.24	46	1	2.84	10
Upper Upper Rogue	352	0	0	0	0	0	0


Lower Rogue River
Percentile Range for Density of Roads >50% Slope and within 200 ft of a Stream
Lower Rogue Density (%) of Roads >50% Slope and within 200 ft of a Stream
0 - 25
26 - 50
51 - 75
76 - 100
Streams
USFS Ownership*
* In the Upper Upper Rogue Mainstem, this also includes BLM land.
Foster Creek 77%
Middle Upper Rogue Mainstem 46%
South Fork Foster Creek 72%
Lower Upper Rogue Mainstem 77%
Upper Middle Rogue Mainstem 100%
Lower Lobster Creek 40%
Lower Middle Rogue Mainstem 38%
Lower Rogue Mainstem 27%
Quosatana Creek 1%
N
0 2 4 6 Miles


Lower Rogue River
Percentile Range for Density of Road Crossings
Lower Rogue Road Crossing Density (%)
0 - 25
26 - 50
51 - 75
76 - 100
Streams
USFS Ownership*
* In the Upper Upper Rogue Mainstem, this also includes BLM land.
Foster Creek 6%
Middle Upper Rogue Mainstem 10%
South Fork Foster Creek 44%
Lower Upper Rogue Mainstem 15%
Lower Lobster Creek 36%
Upper Middle Rogue Mainstem 100%
Lower Middle Rogue Mainstem 41%
Lower Rogue Mainstem 41%
Quosatana Creek 25%
N
0 2 4 6 Miles

E OTHER

Road Surveys

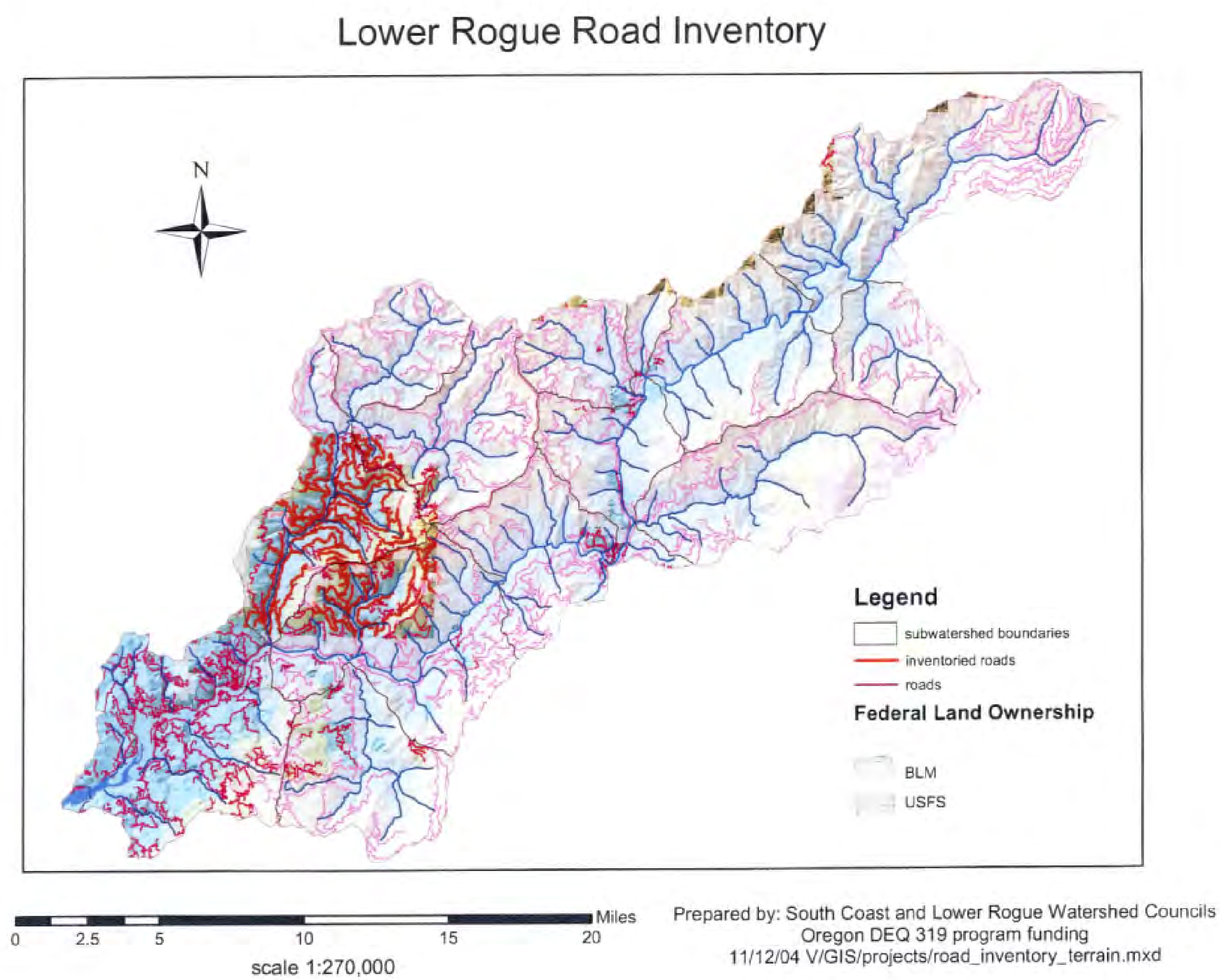
The Lower Rogue Watershed has conducted road surveys on private lands to help manage road related sediment. To date, surveys have been completed in Lobster Creek, Silver Creek, Ranch Creek, Indian Creek and Edson Creek. Detailed information on the locations of crossings and road fill failure risk is maintained in a database. We are currently digitizing surved and completed road project information.

A strategy of the whole basin restoration in the Lobster Creek watershed was to determine upland risk to salmonid source areas (see Chapter VI). The Lobster Creek Partnership developed a road survey and prioritization methodology and in 1998 surveyed roads on private lands that drained to these source areas. On public lands, 128 stream crossings were surveyed and 44 of these were identified for maintenance or replacement. The information for public and private land was aggregated and watershed analysis areas were ranked for sediment risks from roads regardless of ownership.

To date, nearly 87 miles of road have been surveyed in Lobster Creek, which is 74% of the private roads in the watershed. Projects include 58 stream crossing culvert upgrades, the installation of 26 additional cross drains, 7 road fill pull-backs, and 15 crossings that have been excavated. The US Forest Service has also upgraded many of their culverts that were surveyed. The Lobster Creek Partnership is currently updating the watershed analysis area prioritization.

The Silver Creek drainage lies within the Lower Middle Rogue Mainstem subwatershed. Surveys have been completed for 15.74 miles in the west part of the watershed and 8.76 miles in the east part of the watershed. The Lower Rogue Watershed Council and the property owner are currently evaluating the priority sites for possible projects.

Ranch Creek, which lies within the Lower Rogue Mainstem, was surveyed in 2002. A total of 4.5 miles of road was surveyed with several sediment issues noted. One project has been developed that will address a sediment problem and fish passage barrier and funding has been applied for. Additional projects need to be developed with the landowners.


Lower Rogue Road Inventory
N
Legend
subwatershed boundaries
inventoried roads
roads
Federal Land Ownership
BLM
USFS
Miles
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5
10
15
20
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Prepared by: South Coast and Lower Rogue Watershed Councils
Oregon DEQ 319 program funding
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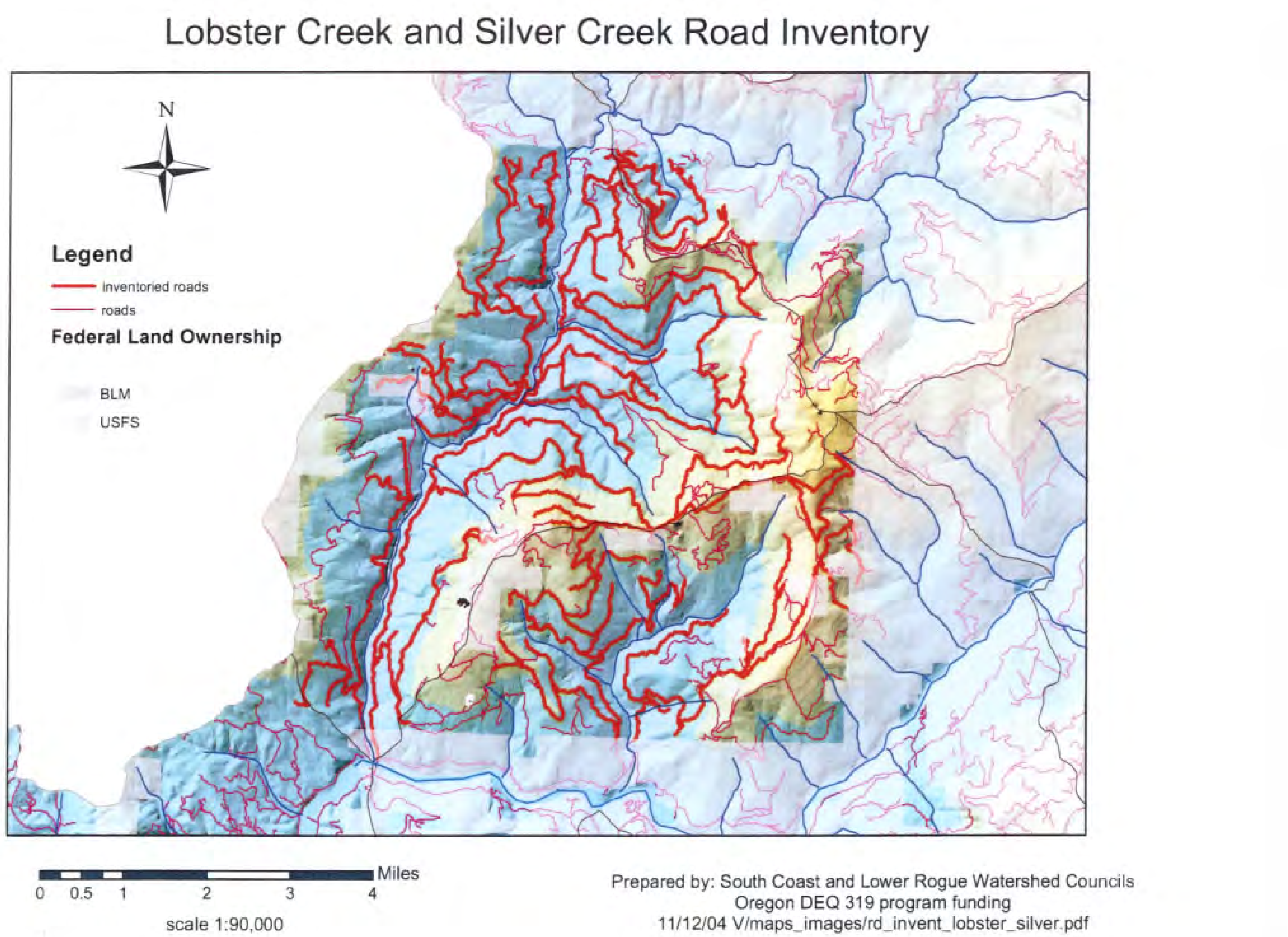
Lobster Creek and Silver Creek Road Inventory
N
Legend
inventoried roads
roads
Federal Land Ownership
BLM
USFS
Miles
0 0.5 1 2 3 4
scale 1:90,000
Prepared by: South Coast and Lower Rogue Watershed Councils
Oregon DEQ 319 program funding
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Landslides on Public Lands

Watershed Analyses on USFS ownerships include discussions on dominant erosion processes in the watershed:

Lobster Creek (USFS 1999)

Aerial photographs from 1940, 1969, and 1986 were used to estimate surface area of landslides (Table 8.6). The number and acreage of landslides is likely underestimated because of canopy cover.

1940 photos are evidence of many active and inactive landslides prior to any roads or commercial timber harvest. In 1969 photos nearly 75% of the slides apparent were determined to be from natural causes. High values are thought to be a result of the 1955 and 1964 flood events. Timber harvest by 1955 was only 30 acres, all within the Lobster Mainstem. By the 1964 flood, 28% of the Lobster Mainstem had been harvested, including nearly 50% of some smaller tributary watersheds. By the 1969 and 1986 photos, the amount of landslide area related to timber harvest and road construction is greater than the area of naturally occurring landslides. Road-related sediment increases may be attributable to road construction practices that altered natural hydrologic function. As of 1999, the existing road system had the potential to deliver sediment, primarily through drainage alterations that may trigger landslides, and through fill failures at stream crossings.

Table 8.6 Acres of Landslides per Thousand Acres of Subwatershed

Year	Subwatershed	Acres in Subwatershed	Natural Landslide Acres per Thousand	Harvest Related Landslide Ac/Thous	Road Related Landslide Ac/Thous	Total Landslide Acres per Thousand
1940	Lobster Mainstem	18,219	0.57			0.57
	Lobster South Fork	16,130	2.13			2.13
	Lobster North Fork	9,904	4.90			4.90
	Total 1940		7.6			7.6
1969	Lobster Mainstem	18,219	2.0*	0.87*	2.10*	4.93*

	Lobster South Fork	16,130	4.49	0.97	0.04	5.50
	Lobster North Fork	9,904	5.96	0.28	0.03	6.28
	Total 1969		12.4*	2.1*	2.2*	16.7*
1986	Lobster Mainstem	18,219	0.04	1.47*	0.17*	1.69*
	Lobster South Fork	16,130	0.84	0.27	0.03	1.14
	Lobster North Fork	9,904	2.50	1.14	0.36	4.00
	Total 1986		3.4*	2.9*	0.6*	6.8*

*Values are estimated due to incomplete aerial photograph coverage and possibly have a large error. Values should be used as a comparison between years in the mainstem.

Shasta Costa Creek (USFS 1996)
Natural landslides in Shasta Costa and its tributaries are common and typically deliver small amounts of sediment and wood to streams. A debris flow was visible in the Elk Wallow/Brandy Peak area. Historic and current active slump-earth flows and flow deposits are visible in the watershed and are noticeable in the cracks and slumps along the Bear Camp Road. In 1986 a large block of rock below Green Knob moved in a rotational failure that caused a 15-acre slide. Sediment was delivered to Shasta Costa Creek and two miles downstream to the Rogue River. The plume extended down the Rogue River past its confluence with the Illinois River.

Human activities including road construction, timber harvest, and fuels treatment are the principal management activities in the watershed. Timber management began in 1962, and units were clearcut with little or no riparian protection, and then burned hot, removing residual vegetation and causing surface erosion. These harvest units in the upper end of the watershed, and where roads are located in the watershed, continue to deliver small amounts of sediment to streams. Bear Camp road is an area containing soils derived from Tertiary sediments that are highly susceptible to erosion and gullying. In a 1990 field survey by the USFS, gullies were found below nearly all of the culvert outlets on Bear Camp road.

F KEY FINDINGS

Watersheds ranking in the top quarter percentile for each category of rural road sediment impacts are:

- Density of Roads on Steep Slopes: Lower Rogue Mainstem and Lower Lobster Creek
- Density of Roads within 200 ft of a Stream: Upper Middle Rogue Mainstem
- Density of Roads on Steep Slopes within 200 ft of a Stream: Upper Middle Rogue Mainstem, Lower Upper Rogue Mainstem, Foster Creek.
- Density of Road Crossings: Upper Middle Rogue Mainstem

REFERENCES

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999

Lisle USFS. Tom Lisle, USFS, Redwood Sciences Laboratory, Arcata, California

USFS 1996. Shasta Costa Creek Watershed Analysis, Iteration 1.0. United States Department of Agriculture, Forest Service, Pacific Northwest Region.

USFS 1999. Lobster Creek Watershed Analysis, Iteration 2.0. United States Department of Agriculture, Forest Service, Pacific Northwest Region.

IX RIPARIAN ASSESSMENT

A BACKGROUND (GWEB 1999, USFS 2000)

A riparian area or zone is a term that is often difficult to define. At its simplest, it is a green area along a body of water such as a stream or river. Riparian areas generally have higher levels of soil moisture than adjacent upland areas, and usually are well-vegetated.
A wide variety of hydrologic, geomorphic, and biotic processes determine the character of a riparian zone.

<u>Stream Types</u>
Different stream types provide unique functions in the watershed. Intermittent channels that do not flow permanently include both ephemeral channels and intermittent channels. Ephemeral channels flow only in response to storm events and may not support riparian vegetation. They supply sediment, water, and organic materials to downstream channels.

Intermittent channels are supplied by groundwater during part of the year and supply seasonal sources of water, sediment, nutrients, and large wood. Because intermittent channels can form a high proportion of the channels in a watershed, it is important that they maintain their functions. They are easily influenced by forest management activities and manipulations of the canopy or streambank vegetation can influence the stream's energy supply. Intermittent channels can be important for amphibian species that do not need open water throughout the year, especially as nursery areas because fewer aquatic predators are present than in perennial channels.

Perennial streams have surface flow throughout the year and generally support a riparian area distinct from the surrounding upland. These riparian areas are important for riparian-dependant species when the surrounding uplands are hot and dry, and intermittent channels are not flowing.

<u>Vegetation types</u>
Riparian zones in the Lower Rogue Watershed can be stratified into four distinct categories, each with their own processes for sediment delivery, channel formation, hydrologic regime, susceptibility and response to change, microclimate qualities, flora, fauna, and migration habitat qualities (USFS 2000). A brief summary of each vegetation type follows:

Conifer Forest Riparian
Conifer riparian forests consist most often of a Douglas-fir overstory with Port-Orford-cedar often present, and an understory of hardwood trees. Stands are generally stable because of the longevity of conifers, and because fire does not start or carry well through most of these stands due to topography, cool and moist microclimates, and a higher percentage of perennial streams than other vegetation types. Wildlife depends on these areas for thermal cover and as migration corridors. Because of their abundance and high

value wood production, more land use activities have occurred in conifer riparian stands than in the other riparian types. Red alder stands are common as an early to mid-seral stage after stand replacement events such as timber harvest, debris flows and inner gorge landslides.

Hardwood Forest Riparian

Hardwood forested riparian areas are present where water limits conifer riparian forests or where frequent low intensity or high intensity fires has disturbed the riparian area. Tanoak is the dominant species, with madrone, myrtle, chinquapin, knobcone and sugar pines present. The microclimate in these stands is less humid and temperatures fluctuate more than in multi-layered conifer canopies. Fire will start and carry well in these stands, but the trees are quick to regenerate. Hardwood forested riparian stands are most frequently found on seasonal streams and provide a high stem density that creates stable banks. Wildlife use these areas riparian areas as watering sites and for foraging for acorns.

Meadow Riparian

Meadow riparian areas are open canopy areas found along the margins of meadows on seasonal creeks or perennial seeps or boggy areas. These areas receive high amounts of solar radiation, have high diurnal temperature fluctuations, little microclimate differences, and a narrow range of influence beyond the active channel. Fire will start and carry rapidly, and this riparian type is dependent upon frequent fire to maintain their open canopy. Meadows are important horizontal migration routes for wildlife, and riparian areas provide important watering sites.

Ultramafic Riparian

Ultramafic soils have developed in serpentinite and peridotite and have high levels of magnesium relative to calcium, high levels of nickel and chromium, and low levels of available soil water. In areas with heavy precipitation, the rocks weather to produce landforms that are prone to mass wasting and erosion. The highly sheared structure and low water permeability of the surface result in frequent springs and bogs, flashy flows, and highly erodible stream channels which are sensitive to ground disturbance. There is a high diversity of specialized plants found on these soils, many of which are endemic or sensitive.

Port-Orford-cedar is often the primary overstory component in riparian areas. This species grows slowly, generally reaching 30 inches in diameter in 400 years on seasonal streams and 30 inches in 200 to 300 years in perennial wet sites. Port-Orford-cedar decomposes slowly, and functions longer as in-stream large wood than other tree species. The introduced pathogen *Phytophthora lateralis* has killed Port-Orford-cedar, reducing shade and concentrating the delivery of large wood.

Most ultramafic riparian stands have an open to moderately closed canopy (20 to 70%) with an understory vegetation layer that varies from open to dense. Because of the low fuel load in these areas, fire is low in intensity when it occurs. Ultramafic riparian areas have more seasonal and diurnal temperature fluctuations compared to other riparian stands, but they still provide a cooler microclimate to the harsh upland ultramafic areas and serve as water sources and travel corridors for wildlife.

Riparian Area General Functions

Riparian vegetation influences fish habitat and water quality in a number of ways.

Riparian vegetation may act as a filter in some areas, keeping sediment and pollutants out of streams. The roots of riparian vegetation stabilize streambanks by reducing erosion and preventing stream channels from downcutting. Streamside vegetation provides habitat for insects, some of which fall in the water and provide a food source for fish. In addition, vegetative litter is an important source of nutrients to the stream. During high stream flows, riparian vegetation may slow and dissipate the energy of floodwaters, preventing erosion. Although all of these are important functions of riparian vegetation, they are difficult to quantify and are beyond the scope of this assessment. This assessment focuses only on the functions of riparian areas in providing a source of large wood to the stream, and in providing shade for temperature control. Riparian zones that are functioning to provide these two key inputs typically provide many other valuable functions and processes attributed to these dynamic areas.

Large Wood Recruitment

Riparian areas are an important source of large woody debris (LWD) that enters, or is recruited to, the stream channel. LWD, including tree boles, root wads, and large branches, is recruited to the stream by bank erosion, mortality (e.g. disease or fire), or wind throw. Also, trees from both riparian and upland areas may also be carried into the stream by landslides.

In the stream channel, LWD diverts and obstructs flow, thereby increasing channel complexity (i.e., the large wood creates pools and riffles that provide areas of different velocity and depth). This complexity provides cover from predators, creates rearing areas, and develops refuge areas for fish during high stream flows. LWD also creates storage sites for sediment in all sizes of streams. In small headwater streams, wood controls sediment movement downstream. In larger streams, accumulation of sediment behind LWD often provides spawning gravels. LWD plays an important role in stream nutrient dynamics by retaining leaf litter and needles, making these energy supplies available for consumption by aquatic insects that ultimately serve as food for fish.

Riparian Shade

Although other processes besides shading affect heating and cooling of water (such as groundwater inflows), shade can have the largest affect because it counteracts the most important source of stream heating during the summer – solar radiation. Riparian enhancement efforts that provide shade have a high potential to contribute to temperature moderation as well as provide direct benefits to fish and wildlife habitat.

Shade provided by riparian vegetation affects stream temperature by reducing the inputs of solar radiation to the water surface. Although the vegetation itself will radiate heat to the stream, the increase in water temperature due to radiation from this source is very small compared with heating from direct solar radiation. Radiation from vegetation is important, however, because it decreases fluctuation of water temperatures on a daily (or diurnal) basis in forested streams compared with streams that have no canopy cover. The slope and aspect of a site also affect the amount of radiation received. In some areas (e.g. deep canyons) the topography of the land can also provide significant shade.

Role of Ambient Air Temperature

In most streams, evaporation of moisture is a primary mechanism of stream cooling; the heat is used to turn water into vapor. Turbulent streams will cool faster than slow streams with smooth surface conditions, due to the higher evaporation rate. Inputs of cool groundwater are also a significant source of stream cooling in some areas.

Stream temperatures are cooler than the ambient air temperature because of the higher specific heat of the water, and the cooling processes associated with evaporation and the inflow of groundwater. The daily patterns in stream temperature follow the daily change in air temperature. Typically, the maximum daily temperature occurs in the late afternoon and the minimum occurs late at night or early morning.

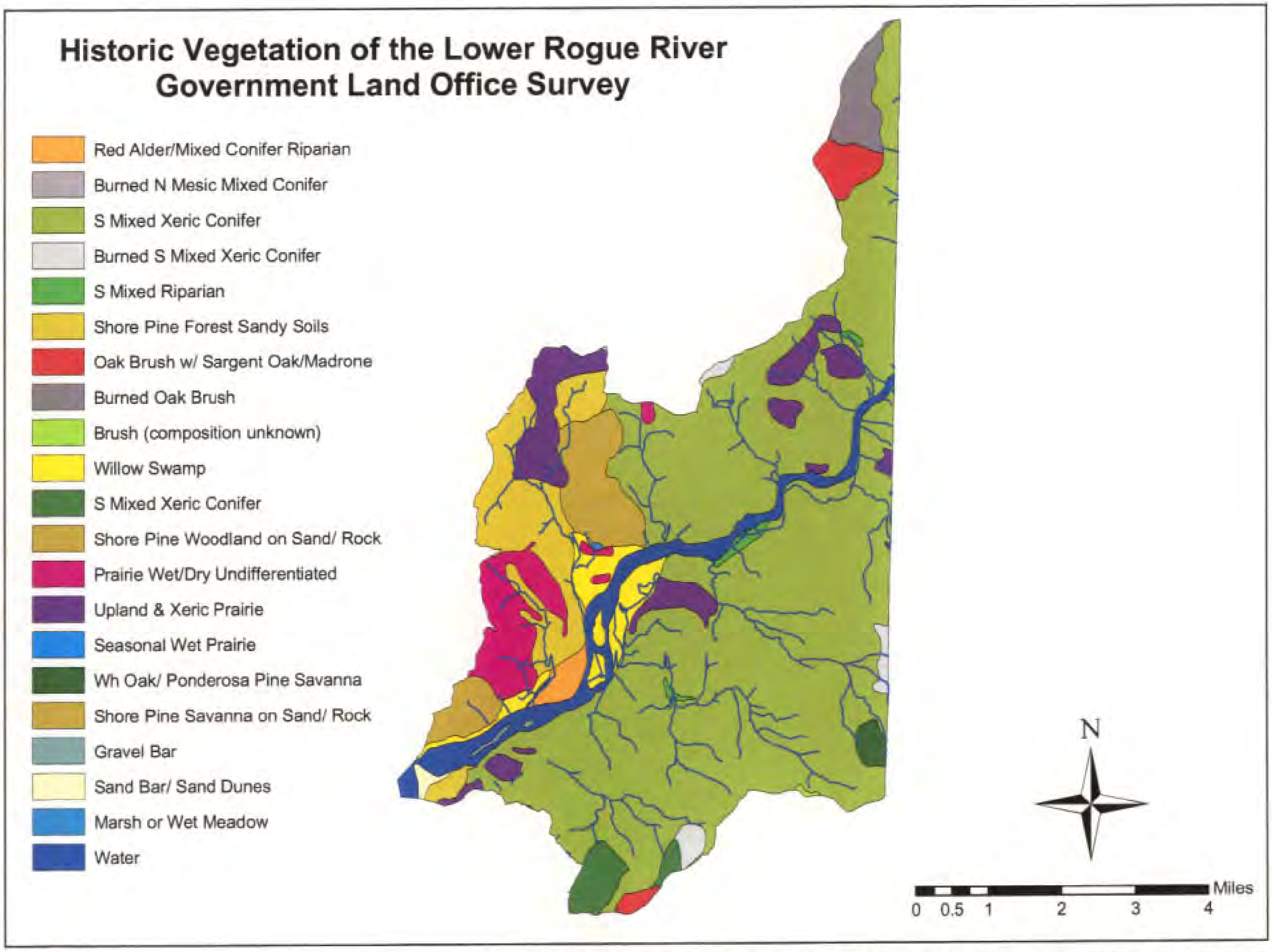
In many streams in Oregon, late-summer streamflows are lowest when the net heat gain is the greatest, resulting in the warmest water temperatures of the year. This phenomenon reflects the fact that the maximum water temperature is a result of both the net heat received and the amount of water that is heated. Consequently, the maximum annual stream temperatures may be higher in low-flow or drought years even though the stream receives the same level of heating each year.

B INTRODUCTION

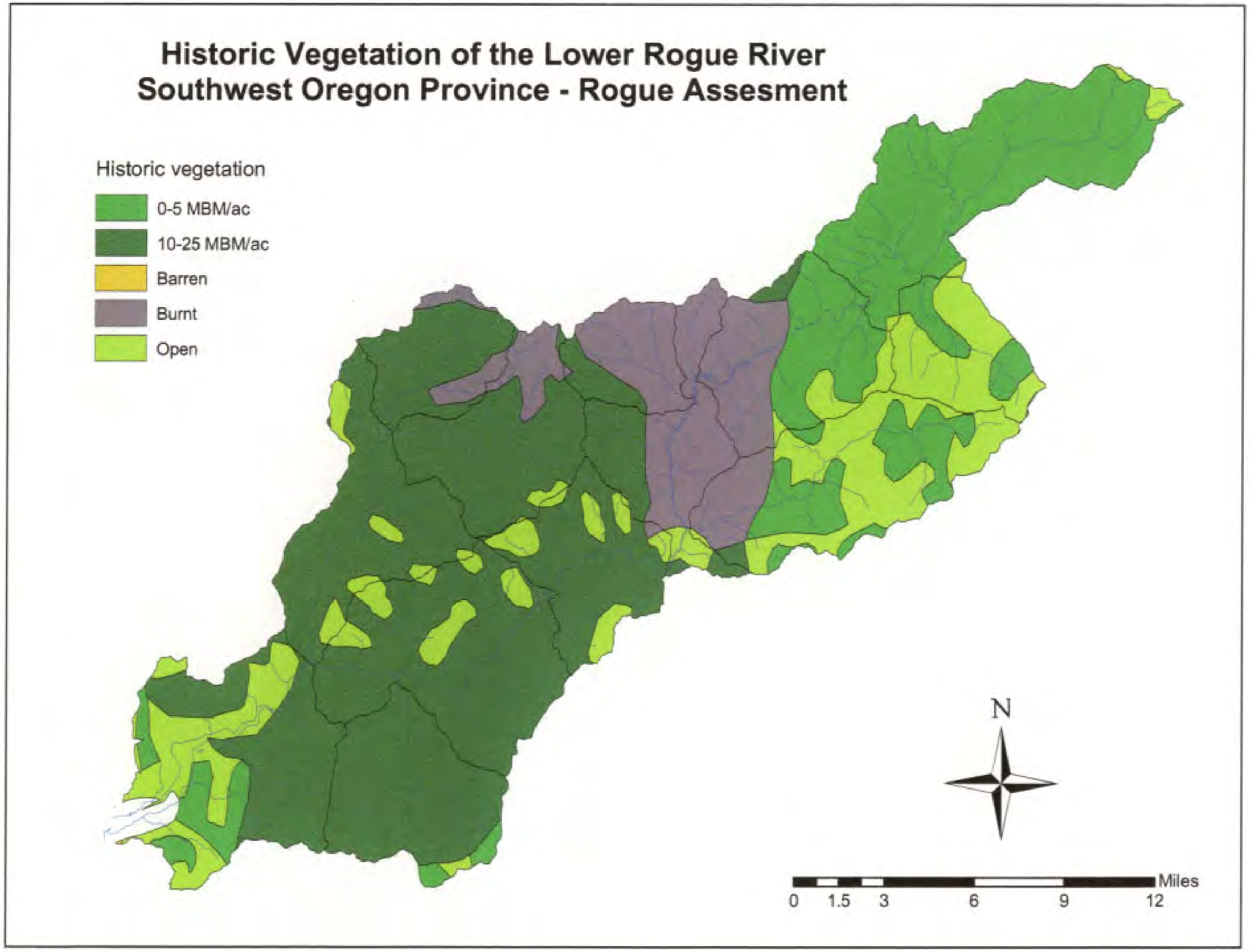
Riparian vegetation has been removed along streams throughout the Lower Rogue watershed for a variety of management practices and also naturally, through streambank erosion. Historically, many riparian zones within the Lower Rogue basin contained large conifers that were later harvested. US Forest Services Watershed Analysis for the watershed (USFS 1999), and other documents dealing with coastal streams as a whole, recognize that past harvest of conifers in riparian areas prior to current regulations have resulted in the subsequent dominant regrowth of hardwood stands with alder (*Alnus rubra*) dominant riparian communities common. While hardwood stands provide shade, nutrients, and other riparian functions, and alder in particular contributes nitrogen to the soil, the conversion from conifers has reduced the supply of future large woody debris and changed the shade levels and miroclimates around the stream. In a study by Nierenberg and Hibbs (2000), riparian areas in the Coast Range that had not been logged or burned for 145 years were dominated by shrubs rather than trees in 52% of the areas evaluated. Without disturbances, tree recruitment in riparian areas is limited so that stands of trees seldom become dominant or self-sustaining in the riparian zone.

The removal of riparian vegetation has reduced shade and subsequently increased the amount of sunlight reaching the stream. As noted previously, shade is one of the factors that controls summer stream water temperatures. In-stream flow and groundwater, as well as channel width/depth, and bedrock/substrate heating are other factors to be considered, but are not included in this assessment.

An assessment of the riparian condition on selected streams on private lands was performed in 2003 according to the protocol outlined in the Oregon Watershed Assessment Manual (1999). Lobster Creek was not included in this analysis because a riparian shade assessment was completed in this watershed as part of the Total Maximum Daily Load and Water Quality Management Plant (DEQ 2002). That analysis included an estimate the existing and potential shade on perennial streams. Private lands in the watershed were assessed by the Lower Rogue Watershed Council in 1998, while lands managed by the USDA Forest Service were assessed in 2000. Existing shade is defined as shade that is currently present as evidenced by aerial photograph interpretation and selected field measurements. Potential shade is defined as the amount of shade that can be produced over time based on the site's potential to grow trees. The results of these two analyses were compared to estimate the potential increase in shade throughout the watershed.



May 10, 2004 C/GIS/Projects/Lower Rogue/Historical Veg. Lower_rouge_hist_veg.shp derived from Hawes, S.M., J.A. Hiebler, E.M. Neilsen, C.W. Alton & J.A Christy. 2002. Historic vegetation of the Pacific Coast, Oregon, 1851-1910. ArcView coverage, Version 1.0. Oregon Natural Heritage Information Center, Oregon State University.


Historic Vegetation of the Lower Rogue River
Southwest Oregon Province - Rogue Assesment
Historic vegetation
0-5 MBM/ac
10-25 MBM/ac
Barren
Burnt
Open
N
Miles
0 1.5 3 6 9 12

C METHODOLOGY

Riparian Assessment

- Aerial photos from (2002) were interpreted for riparian characteristics on selected privately owned tributaries including Indian, Ranch, Edson, Saunders, Jim Hunt, Libby, Squaw, Kimball, Quosatana, Silver, Fox, Rilea, Billings and Bradford Creeks.
- Riparian Condition Units (RCU) were designated by breaking the riparian zone into segments based on changes in characteristics.
- Information on each RCU was collected and included the ecoregion and channel habitat type the RCU occurred in; and the length, vegetation type, tree size, stand density, and stream shading within the RCU. Classifications were made according to the categories given in the Oregon Watershed Assessment Manual (1999):

Vegetation Type	
C	Mostly conifer trees (>70% of area)
H	Mostly hardwood trees (>70% of area)
M	Mixed conifer/hardwoods
B	Brush species
G	Grass/meadow
N	No riparian vegetation
Tree Size Classes	
R	Regeneration (<4-inch average diameter at breast height (DBH)
S	Small (4- to 12-inch average DBH)
M	Medium (>12-to 24-inch average DBH)
L	Large (>24-inch average DBH)
N	Nonforest (applies to vegetation types B, G, and N)
Stand Density	
D	Dense (<1/3 ground exposed)
S	Sparse (>1/3 ground exposed)
N	Nonforest (applies to vegetation types B, G, and N)

Codes to describe estimated shade

Code	**Shade**	**Indicator**
H	>70%	Stream surface not visible, slightly visible or visible in patches
M	40-70%	Stream surface visible but banks are not visible

L	<40%	Stream surface visible; banks visible or visible at times

- RCUs were evaluated to determine whether current riparian conditions provide adequate or inadequate recruitment potential. RCUs were adequate if the current conditions in the riparian zones (RA1 and RA2) were as good as or better than potential conditions described in the ecosystem descriptions (GWEB 1999). If conditions in the RA1 were inadequate, the reason why was noted (canned situations).

Lobster Creek Shade Assessment

- Topographic maps (USGS 7.5 minute quads) and aerial photos (1997 BLM) were compiled to divide streams into 470 reaches (segments) based on differences in riparian vegetation, orientation (aspect), size and gradient.
- Riparian vegetation was characterized into eight different classes by the Lower Rogue Watershed Council. These classes and their attributes include the following: Mature = coniferous trees >121 feet; High (reproduction) = coniferous trees 91 – 120 feet; Low (reproduction) = coniferous trees 31 to 90 feet; Hardwood = deciduous and evergreen hardwood trees >31 feet; Brush = shrubs < 30 feet; and Pioneer = bare or nearly bare ground. The USDA Forest Service classified vegetation into seven categories: Large conifer >100' tall, medium conifer 40-99' tall, hardwoods, short conifer 20-39' tall, pioneer conifer, brush <20' tall, and sparse conifer <50% shade density, of any height.
- Field visits were conducted at 20 sites by the Lower Rogue Watershed Council and 15 sites by the USDA Forest Service. Measurements included the following: summer low flow width, bankfull channel width, streambank slope, various tree heights, percentage of overhanging vegetation, and shade density. The existing percentage of shade was also measured at each site in the middle of the bankfull channel with an instrument known as the Solar Pathfinder. This device allows the user to estimate the percent of solar radiation shaded by riparian vegetation for any given day of the year.
- Existing shade was estimated using a computer spreadsheet program known as SHADOW. SHADOW considered the angle of the sun on August 1st in determining how far a tree projects a shadow across a stream during each hour of the day. For each stream reach, information was obtained from maps, photos, and field measurements to estimate a low flow channel width (wetted width) and existing tree height. SHADOW estimated shade for each stream reach based on its aspect, characterized as diagonal, north-south, or east-west. Unlike the Lower Rogue Watershed Council assessment on private lands, the USDA Forest Service assessment was able to complete all fields of the SHADOW model, allowing the calculation of existing stream temperatures as well as shade.
- Average channel widths and tree heights were used to create the Existing Shade map overlay. Local conditions differ from assumed conditions and will determine the actual shade along any particular stream reach. Landowners can obtain more specific estimates of Potential Shade for any set of field conditions. SHADOW can also be used to calculate widths of riparian vegetation that are shading in the primary (11:00AM-1:00 PM) and secondary (before 11:00 AM and after 1:00 PM) zones.

- The process for estimating potential shade was identical to that of estimating existing shade, with the added assumption that a tree can grow to a certain height over time. It was assumed that trees could grow to a height of 160 feet based on measurements of Douglas-firs in the watershed.
- The percentage of existing shade was mapped, in 20% increments, to illustrate the current condition on all perennial streams within the watershed. Similarly, the percentage of increased shade was mapped, in 20% increments, to illustrate the potential condition on all perennial streams within the watershed. Increased shade was determined by subtracting the existing shade from the potential shade.

D RESULTS

Riparian Assessment

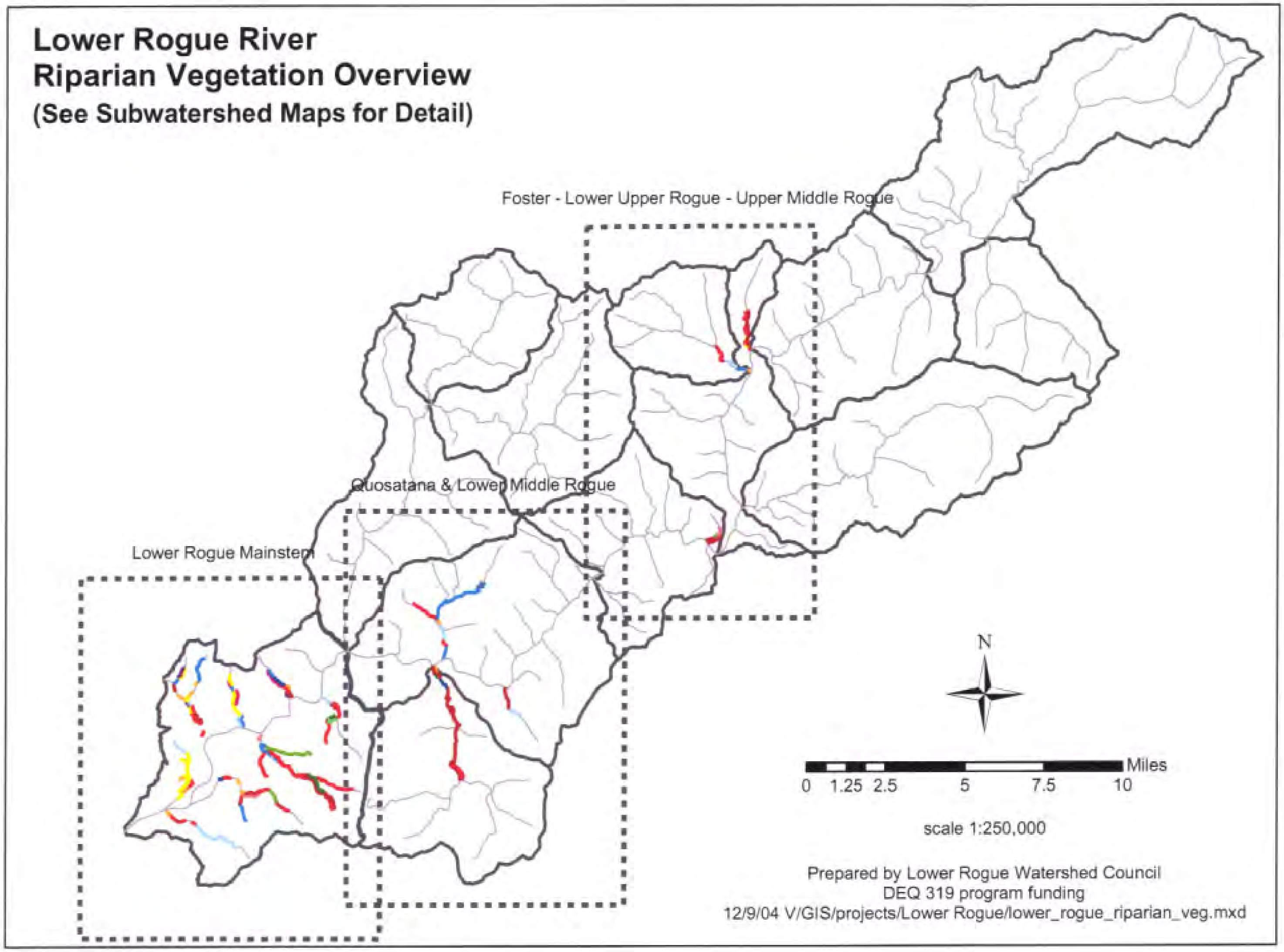
Table 9.1 Miles of assessed streams on private lands in shade rating levels high, medium, and low.

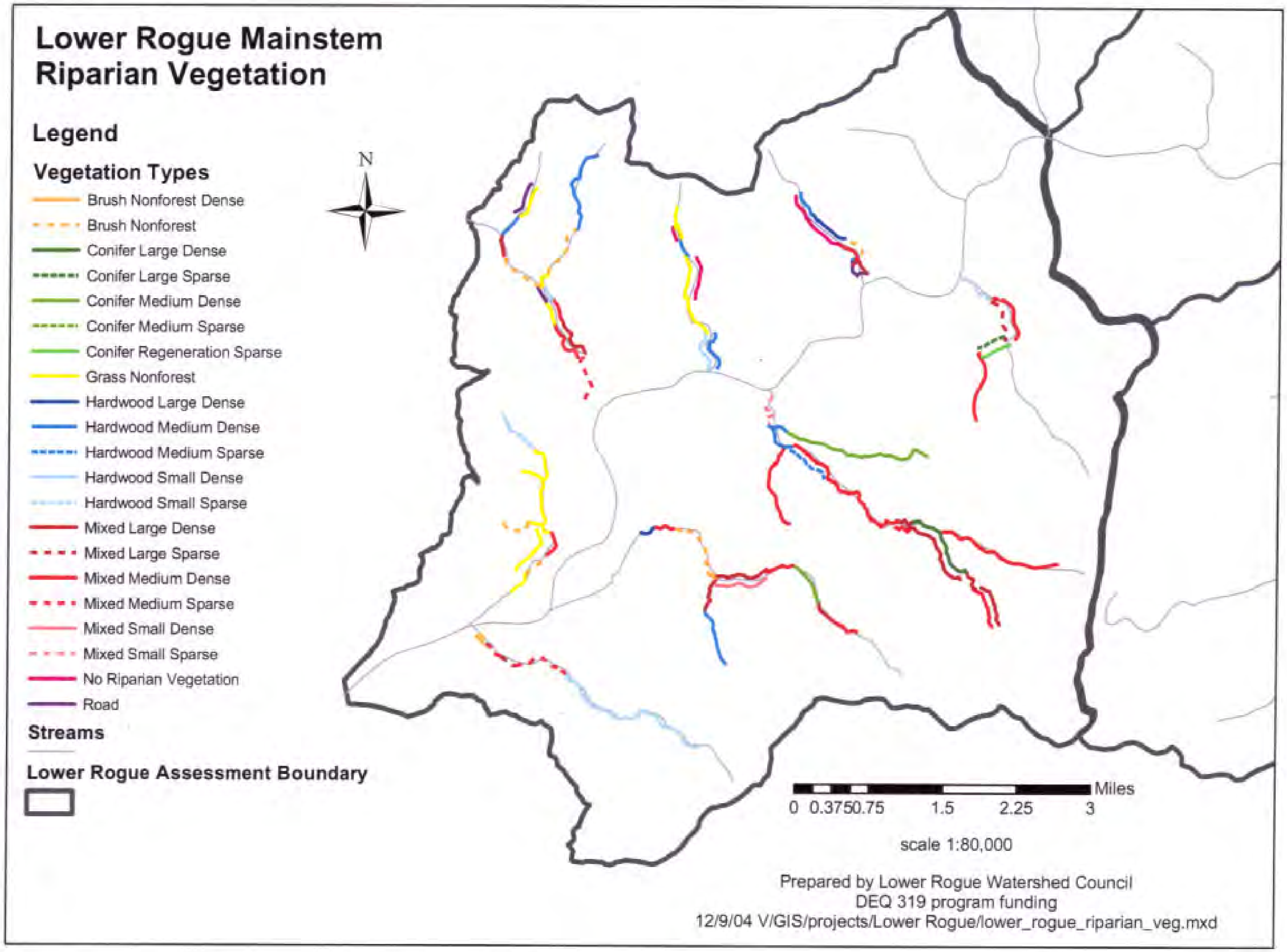
Shade Categories							
Subwatershed	**High**	**%**	**Medium**	**%**	**Low**	**%**	**Stream Miles evaluated**
Lower Rogue Mainstem	11.44	40.3	9.98	35.2	6.97	24.6	28.39
Lower Middle Rogue Mainstem	5.35	92.4	0.44	7.6			5.79
Quosatana Creek			4.44	100			4.44
Upper Middle Rogue Mainstem	0.48	72.7	0.18	27.3			0.66
Lower Upper Rogue Mainstem			1.21	91.0	0.12	9.0	1.33
Foster Creek			1.61	90.4	0.17	9.6	1.78
Middle Upper Rogue Mainstem					<0.01	100	<0.01

Lobster Creek Shade Assessment

Table 9.2 Lobster Creek Shade Conditions for mainstem Lobster and its major tributaries.

	Existing Shade Percent		**Potential Shade Percent**	
Location	**National Forest**	**Private Timber**	**National Forest**	**Private Timber**
South Fork Lobster abv. Boulder Cr.	73		96	
South Fork Lobster below Boulder Cr.	93	90	94	94
North Fork Lobster	94		96	
Boulder Cr.	87		92	
Lost Valley	93		96	
Fall Creek		88		93
Deadline Creek		90		93
Mainstem Lobster		80		88


Lower Rogue River
Riparian Vegetation Overview
(See Subwatershed Maps for Detail)
Foster - Lower Upper Rogue - Upper Middle Rogue
Quosatana & Lower Middle Rogue
Lower Rogue Mainstem
N
Miles
0 1.25 2.5 5 7.5 10
scale 1:250,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/9/04 V/GIS/projects/Lower Rogue/lower_rogue_riparian_veg.mxd


Lower Rogue Mainstem
Riparian Vegetation
Legend
Vegetation Types
Brush Nonforest Dense
Brush Nonforest
Conifer Large Dense
Conifer Large Sparse
Conifer Medium Dense
Conifer Medium Sparse
Conifer Regeneration Sparse
Grass Nonforest
Hardwood Large Dense
Hardwood Medium Dense
Hardwood Medium Sparse
Hardwood Small Dense
Hardwood Small Sparse
Mixed Large Dense
Mixed Large Sparse
Mixed Medium Dense
Mixed Medium Sparse
Mixed Small Dense
Mixed Small Sparse
No Riparian Vegetation
Road
Streams
Lower Rogue Assessment Boundary
N
Miles
0 0.3750.75 1.5 2.25 3
scale 1:80,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
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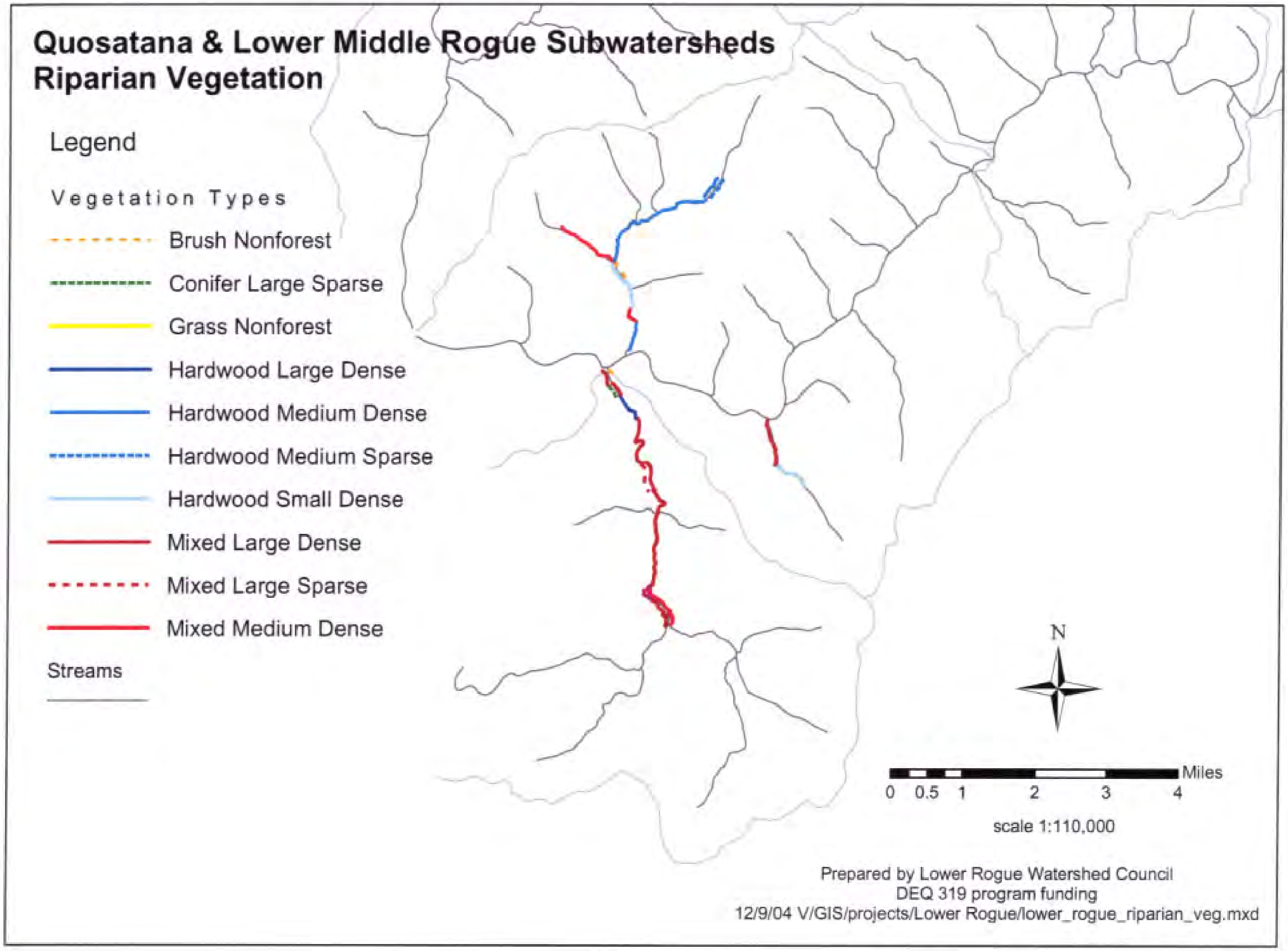

Quosatana & Lower Middle Rogue Subwatersheds
Riparian Vegetation
Legend
Vegetation Types
Brush Nonforest
Conifer Large Sparse
Grass Nonforest
Hardwood Large Dense
Hardwood Medium Dense
Hardwood Medium Sparse
Hardwood Small Dense
Mixed Large Dense
Mixed Large Sparse
Mixed Medium Dense
Streams
N
Miles
0 0.5 1 2 3 4
scale 1:110,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
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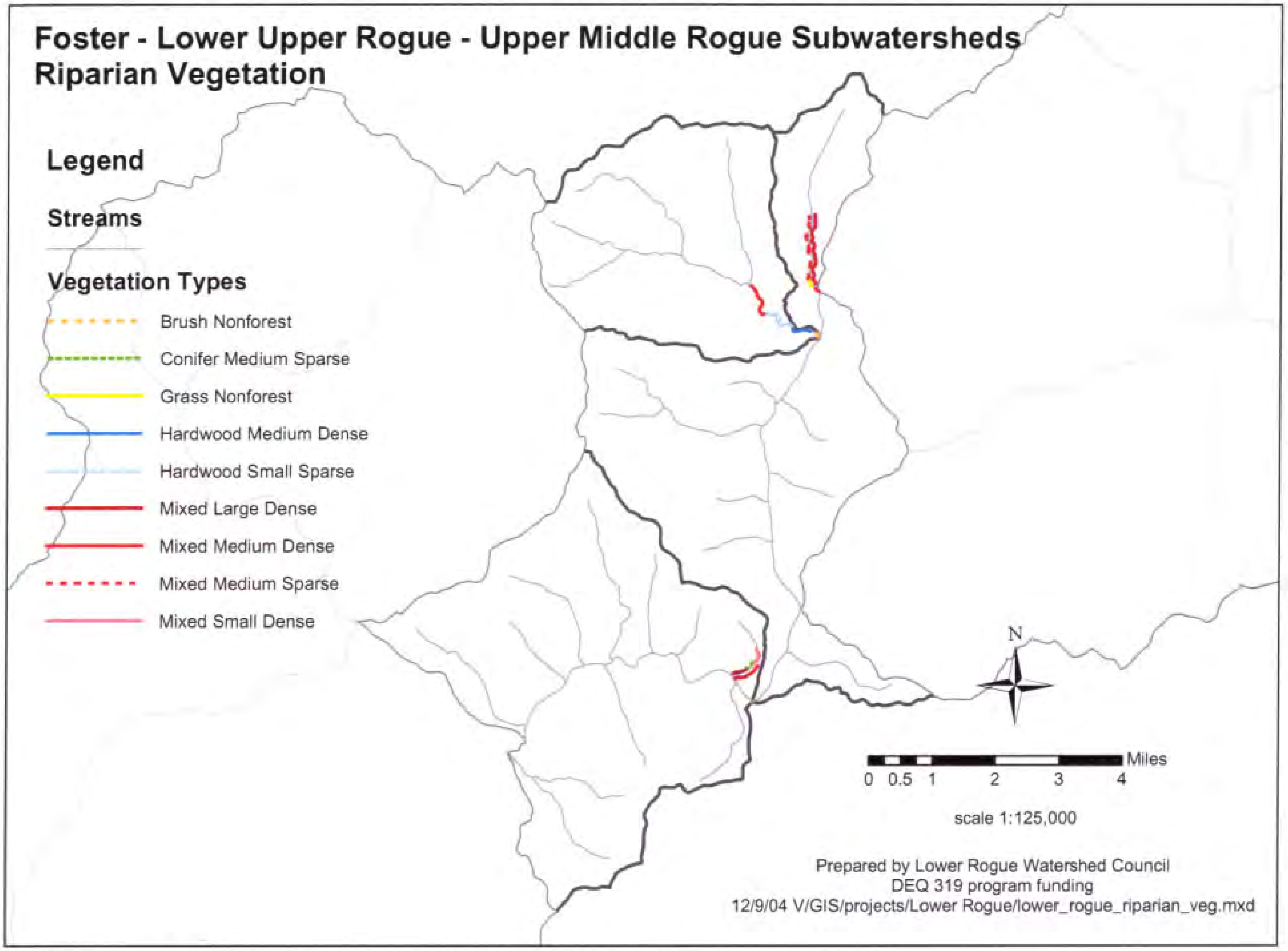
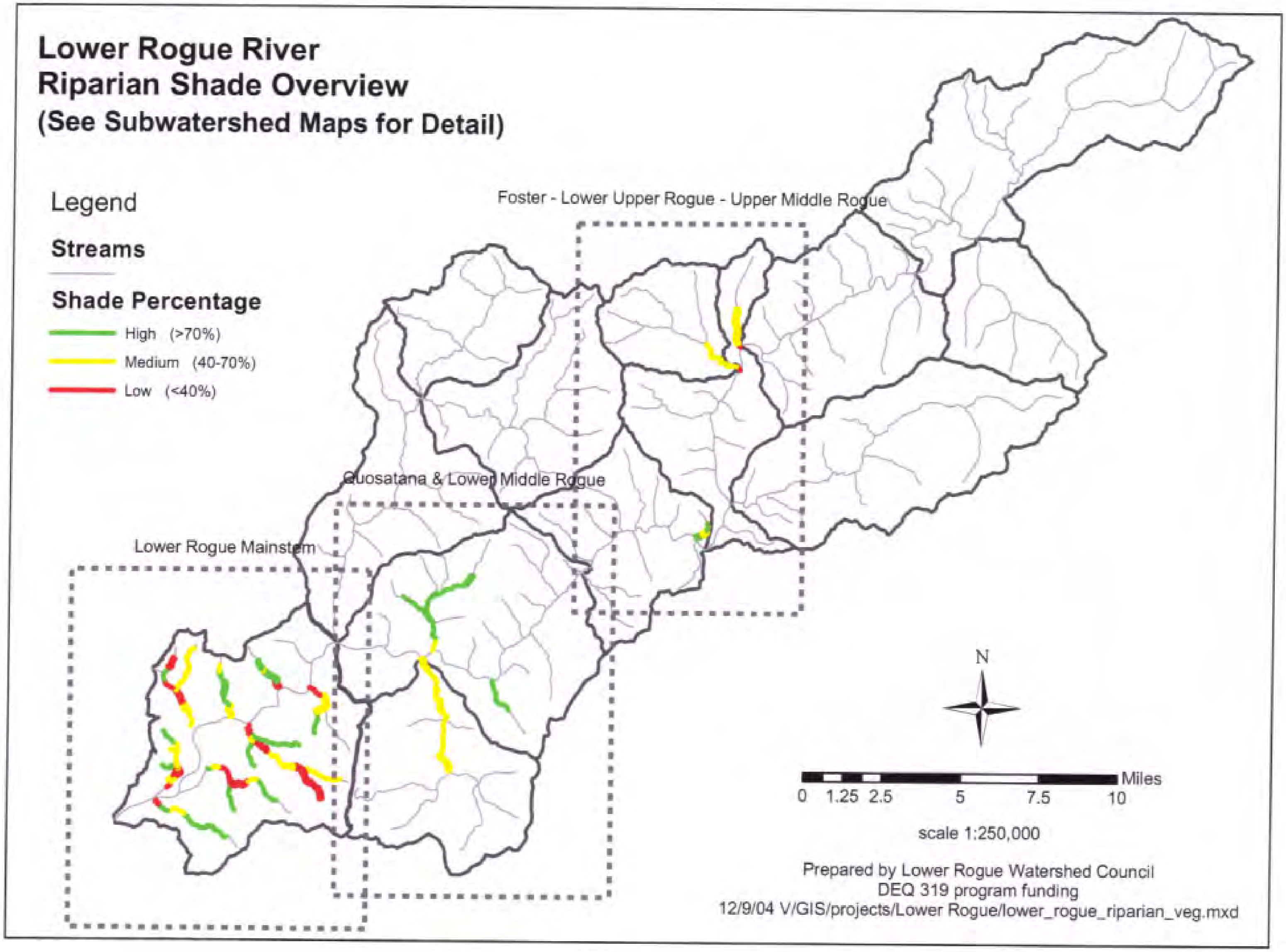
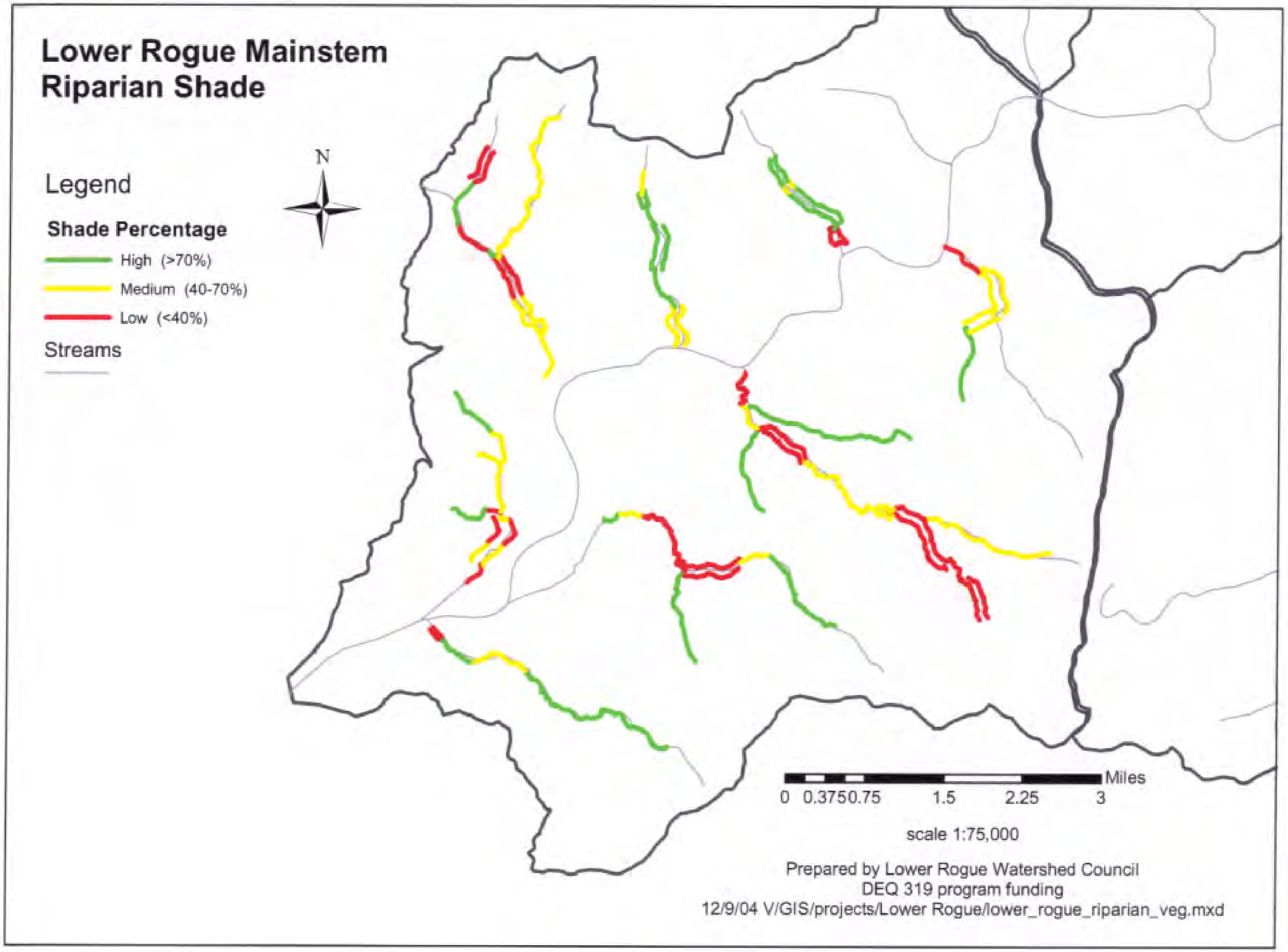
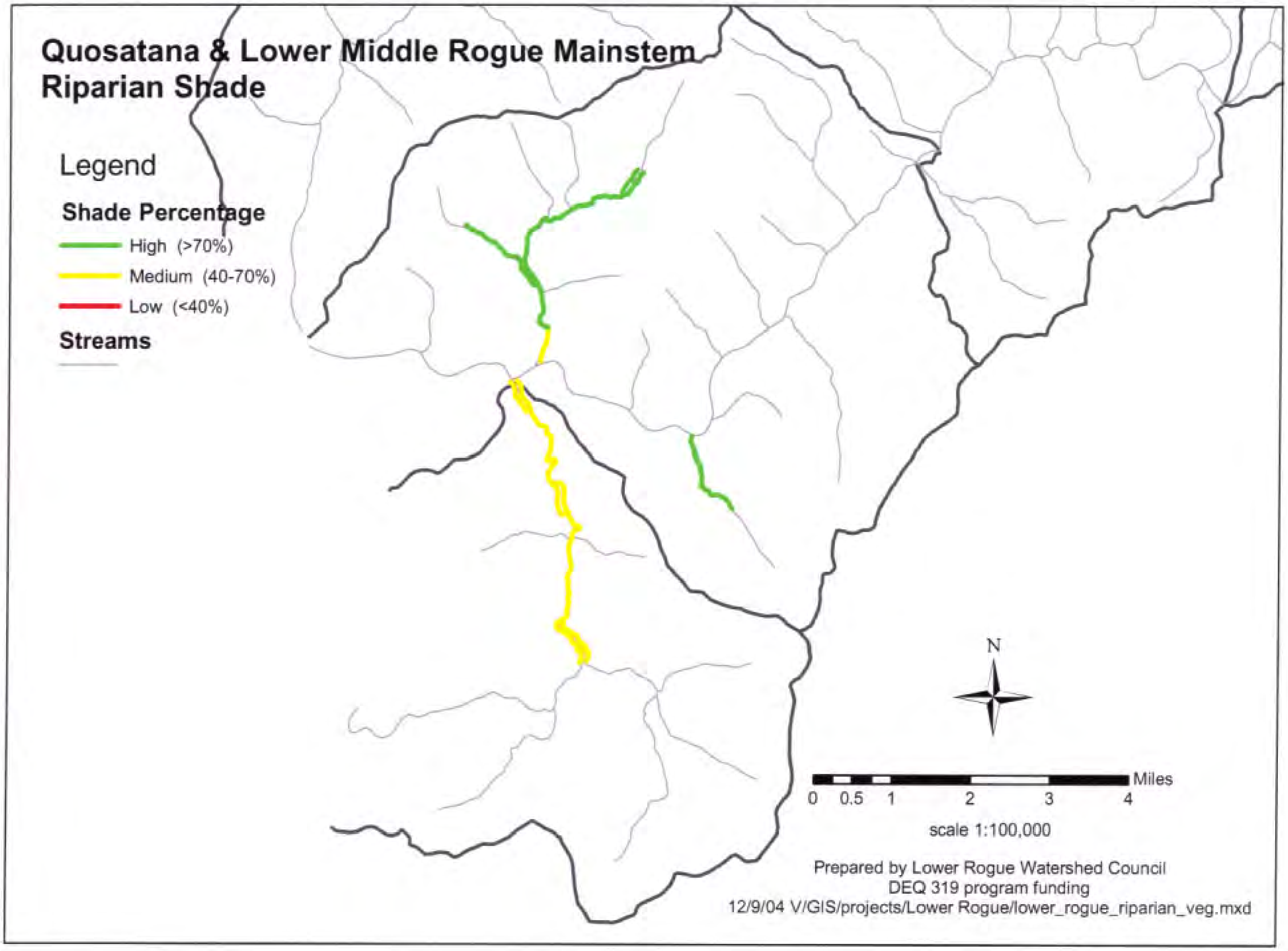

Foster - Lower Upper Rogue - Upper Middle Rogue Subwatersheds
Riparian Vegetation
Legend
Streams
Vegetation Types
Brush Nonforest
Conifer Medium Sparse
Grass Nonforest
Hardwood Medium Dense
Hardwood Small Sparse
Mixed Large Dense
Mixed Medium Dense
Mixed Medium Sparse
Mixed Small Dense
N
Miles
0 0.5 1 2 3 4
scale 1:125,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/9/04 V/GIS/projects/Lower Rogue/lower_rogue_riparian_veg.mxd

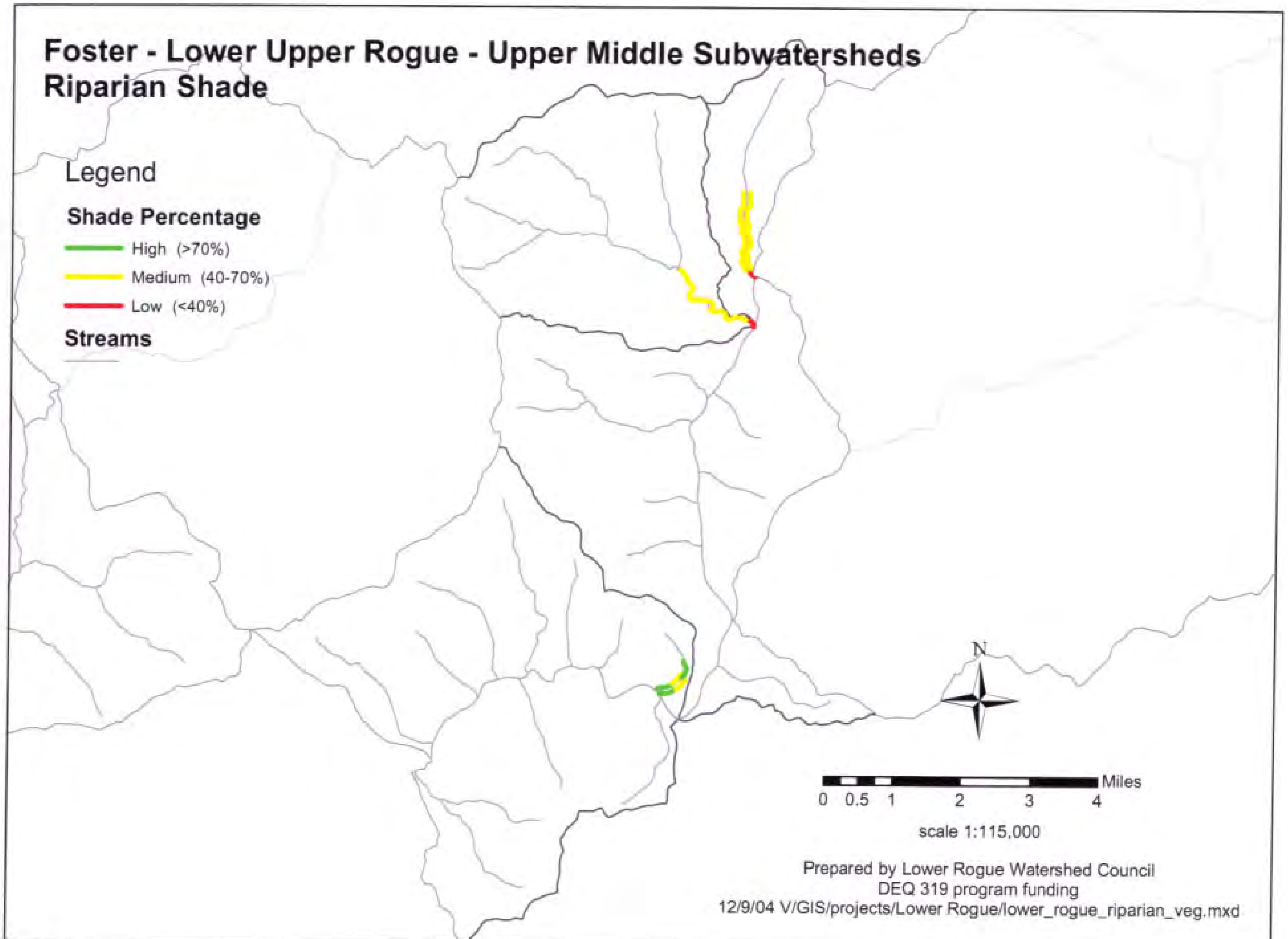
Lower Rogue River
Riparian Shade Overview
(See Subwatershed Maps for Detail)




Lower Rogue Mainstem
Riparian Shade
Legend
Shade Percentage
High (>70%)
Medium (40-70%)
Low (<40%)
Streams
N
Miles
0 0.375 0.75 1.5 2.25 3
scale 1:75,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/9/04 V/GIS/projects/Lower Rogue/lower_rogue_riparian_veg.mxd



Quosatana & Lower Middle Rogue Mainstem
Riparian Shade
Legend
Shade Percentage
High (>70%)
Medium (40-70%)
Low (<40%)
Streams
N
0 0.5 1 2 3 4
Miles
scale 1:100,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/9/04 V/GIS/projects/Lower Rogue/lower_rogue_riparian_veg.mxd


Foster - Lower Upper Rogue - Upper Middle Subwatersheds
Riparian Shade
Legend
Shade Percentage
High (>70%)
Medium (40-70%)
Low (<40%)
Streams
N
Miles
0 0.5 1 2 3 4
scale 1:115,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/9/04 V/GIS/projects/Lower Rogue/lower_rogue_riparian_veg.mxd

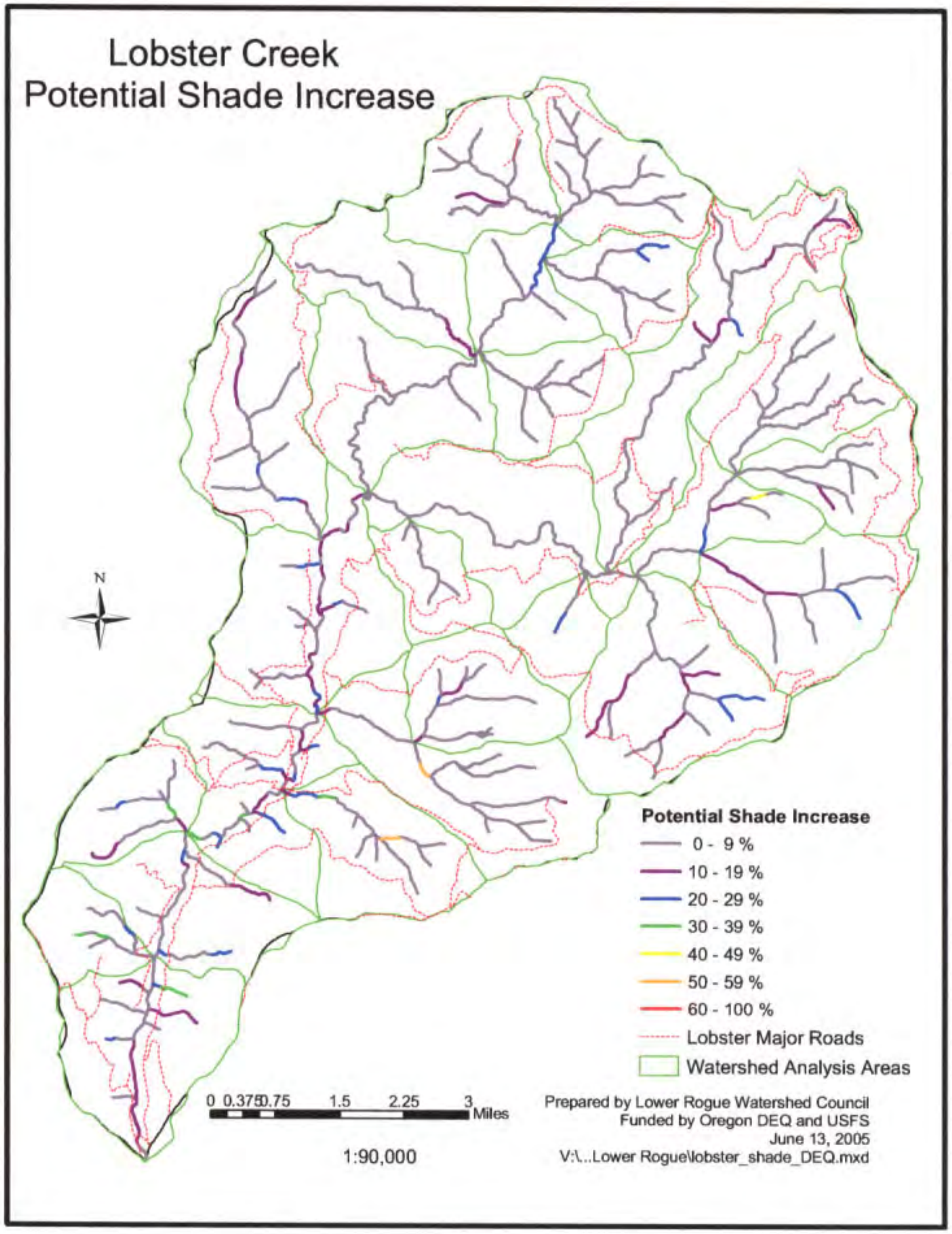

Lobster Creek
Potential Shade Increase
N
Potential Shade Increase
0 - 9 %
10 - 19 %
20 - 29 %
30 - 39 %
40 - 49 %
50 - 59 %
60 - 100 %
Lobster Major Roads
Watershed Analysis Areas
0 0.375 0.75 1.5 2.25 3 Miles
1:90,000
Prepared by Lower Rogue Watershed Council
Funded by Oregon DEQ and USFS
June 13, 2005
V:\...Lower Rogue\lobster_shade_DEQ.mxd

Table 9.3. Existing and Target Shade and Solar Loading in the Lobster Creek Watershed.

Management Entity	**Target Shade Values**	**Existing Shade Values**	**Increase Predicted**
USFS	93%	91%	2%
Private Timber Company	90%	83%	7%
All lands (watershed)	92%	88%	4%
	Target Solar Loading or TMDL (BTU/sqft/day)	**Existing Solar Loading** (BTU/sqft/day)	**Reduction Predicted** (BTU/sqft/day)
USFS	171	220	49
Private Timber Company	244	407	165
All lands (watershed)	195	292	98

E KEY FINDINGS

<u>Riparian Assessment</u>

Over 75% of the stream miles evaluated in the Lower Rogue Mainstem had over 40% shade using the OWEB protocol. Low shade areas (<40%) were concentrated in Saunders Creek, Jim Hunt Creek, Ranch Creek and Edson Creek.

Indian Creek, Ranch Creek, Edson Creek, Saunders Creek, Squaw Creek, and Lower Kimball Creek all have significant lengths of their riparian areas in brush, grass, or small hardwoods and may be good candidates for planting if they have not been planted already. Areas of the assessed river miles have been planted over the last ten years by the Lower Rogue Watershed Council, but trees are not able to be seen in aerial photos. Segments include the majority of Ranch Creek and the East Fork of Edson coded as "Brush Nonforest" on the Lower Rogue Mainstem Riparian Vegetation map. The south fork of Jim Hunt Creek has low shade on the aerial photos and is in a timber harvest area on the aerial photos used. Vegetation was noted as a dense mixed or conifer riparian area. Notes mention that the area evaluated was the riparian buffer and leave trees.

Riparian areas with hardwoods may be good candidates for thinning and underplanting with conifers to introduce some riparian complexity. Indian Creek, a fork of Saunders Creek, Squaw Creek, and Libby Creek in the Lower Rogue Mainstem subwatershed are possibilities.
Foster Creek also has a riparian area near the mouth classified as small hardwood, but the stream from the mouth to the County Road 375 bridge is highly confined in a narrow gorge (USFS 1999).

Lobster Creek Shade Assessment

Mainstem Lobster has the greatest predicted shade increase at 9% over the lower 9.5 miles. Historical vegetation in this area prior to timber harvest activities was primarily old growth Douglas-fir, at 10-25 MBM/acre, with a hardwood dominated area upstream of the mouth (USFS 2000, SWOP CD). Current conditions are early seral Douglas-fir stands.

REFERENCES

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999

Nierenberg, T.R. and D.E. Hibbs. 2000. A characterization of unmanaged riparian overstories in the central Oregon Coast Range. Forest Ecology and Management. 129:195-206.

USFS 1999. Rogue River Below Agness Watershed Analysis, Iteration 1.0. United States Department of Agriculture, Forest Service, Pacific Northwest Region.

X.A WETLANDS—BASIN WIDE ASSESSMENT

A BACKGROUND (Adamus 2001, GWEB 1999, OSU 1998)

Wetlands are often considered ecological "hot spots." They play a role disproportionate to their size in supporting endangered species and maintaining biodiversity. When considering wetland assessments and associated restoration projects it seems prudent to first understand a regulatory definition of a wetland as used by the U.S. Army Corps of Engineers and the Oregon Division of State Lands: **Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions.**

Wetlands provide a variety of important functions, including water storage and delay, water quality improvement, thermoregulation, primary production, fish and wildlife habitat, and support of native vegetation. These functions are described below.

<u>Hydrologic Functions—Water storage and Delay</u>

Wetlands can help alleviate downstream flooding by storing, intercepting, or delaying surface runoff. Wetlands within the floodplain of a river can hold water that has overtopped river-banks. Floodwater desynchronization occurs when wetlands higher in the watershed temporarily store water, reducing peak flows. The most effective wetlands at providing desynchronization are generally located in the middle elevations of the watershed; these wetland locations are far enough away from the receiving water to create delay, but are low enough in the watershed to collect significant amounts of water.

Additional values are that long delays in runoff timing, as potentially caused by storage and slow release of accumulated runoff from wetland/riparian sediments, can sustain aquatic habitats and fish, help maintain water temperature and help augment base flows. Detriments of storage and delay of water may include 1) large floods are essential to some ecosystem processes and lessening of their frequency or magnitude can impair landscape function; 2)attenuation of runoff can limit economic use of otherwise dry land located downslope; 3) storage in shallow, unvegetated basins can sometimes raise water temperatures, and 4) rapid evaporation or transpiration of stored water can potentially reduce water tables, flows, and water quality downstream (Adamus 2001).

<u>Water Quality Improvement</u>

Wetlands have the capacity to alter the physical and chemical characteristics of surface and ground water. Wetlands which are in good condition will retain (temporarily or permanently) sediment that is suspended in the water, but does so at a rate that does not cause permanent or severe damage to other wetland functions. This function is related to the size, location, and presence of plants within the wetland that all serve to reduce or displace the velocity of the water and allow gravity settling to occur.

Phosphorus retention is often correlated with sediment retention because phosphorus adsorbs onto some types of sediment particles, particularly clays. Phosphorus can then be converted into different forms, although retention in the wetland depends on factors such as dissolved oxygen levels and pH in the water and sediment, the phosphorus loading rate, and the distribution and type of plants present in the wetland. Wetland sites in good condition temporarily or permanently remove phosphorus from the water, but do so without causing eutrophication of the wetland. Eutrophication is a process whereby water bodies receive excess nutrients that stimulate excessive plant growth (algae, periphyton attached algae, and nuisance plants weeds). This enhanced plant growth, often called an algal bloom, reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die.

Eutrophication can also be caused by excess nitrogen availability. Wetlands in good condition can also temporarily or permanently retain or remove the dissolved nitrogen from incoming water. Nitrogen is removed when microbes in the sediment, water column, or attached organic material convert dissolved nitrogen (nitrate or ammonium) to a gas. This process is called denitrification and can occur when the water-holding capacity of a soil exceeds ~60%. Wetland plants can also assimilate nitrogen into their tissue, although some of this nitrogen may be re-released into the water column when fall die-back (senescence) occurs.

Toxic organic substances that are readily volatilized and exported as a gas, or oxidized by sunlight, may be removed from the shallow, microbe-rich areas of wetlands. Other toxins may be assimilated into plant tissue or bound in sediments. Other toxic organic substances may be mobilized by the high concentration of dissolved organic matter and low oxygen levels that often prevail in wetlands. The detoxification ability of a wetland thus depends on the contaminant, the concentration of microbe-supporting organic matter, sediment chemistry, oxygen, pH, and salinity.

The value of a wetland in nutrient and sediment processing will depend on its opportunity for receiving large loads of nutrients and suspended sediments and the significance of resources located downslope of the site.

Thermoregulation

Thermoregulation is the capacity of a site to maintain the range (physical as well as temporal) of water temperatures that would naturally be present in its basin and in connected downstream waters. This is accomplished in wetlands by providing shade and serving as a conduit and holding area for cooler groundwater. If wetland plants are not shading the water surface and groundwater inflow is not occurring or is blocked, heating can also occur. Thermoregulation is of most value when incoming runoff or channel flow is warm due to lack of shade. Significance of this function is greatest when the wetland itself, or downslope waters, are known to contain sensitive species or to have harmful summer water temperatures.

Primary Production

Long-term productivity in systems depends upon a balance of three processes: production, decomposition, and dispersion. Plants are able to produce carbon through photosynthesis. Decomposition is the conversion of this carbon to dissolved carbon, primarily through invertebrate and microbial communities. Some of the carbon can be dispersed into a secondary environment, such as from riparian to aquatic in the form of litter or tree fall.

Many wetlands in good condition can process, oxidize and/or disperse much of the organic matter that is produced, and thus minimize severe and uninterrupted oxygen deficits. In systems where organic matter accumulates, further productivity and use by aquatic animals can be limited (bogs are an exception). Other wetland functions such as water quality processes and animal community support depend on primary production.

Fish Habitat

Wetlands provide feeding, breeding, nursery, overwintering, and/or refuge areas for fish. Anadromous fish make extensive use of wetland areas such as side channels, sloughs, undercut banks and pools (connected to the river) in riparian areas depending on the accessibility, water quality, water quantity, food, and shelter from predators and environmental conditions that are provided. In addition to directly providing habitat, wetlands can directly support fish through some of the functions, discussed previously that protect water quality and channel stability. Estuarine wetlands provide important feeding and holding areas for out-migrating salmon smolts, as well as many other fish species. The value of a wetland for fish habitat will depend on the site's habitat capacity as well as how unique the site is in a watershed and regional context, and the degree to which fish depend on the resources provided.

Wildlife Habitat

Wetlands can provide habitat for amphibians (including frogs, salamanders, and toads), and water birds. The value of a wetland will depend on water quality, water quantity, food, and shelter provided. These values are different by species, and may differ by life stage. Many species spend only a short time in wetland/riparian sites and spend the rest of their lives in upland areas.

One of the most important factors predicting amphibian use of a particular site in the Pacific Northwest is the type and density of vegetation in uplands adjoining the site. The age, extent, and proximity of natural cover types are important. For example, in a study in the Oregon Coast Range, riparian buffers 40 m wide had twice the amphibian richness as 20 m buffers. A diversity of habitats within a wetland, such as open water areas interspersed with vegetated spawning and rearing areas and a supply of woody debris for foraging and cover (both in and out of the water) is also important.

Wetland sites with open water areas interspersed with stands of emergent vegetation also often provide the best habitat for waterbirds, mainly at sites larger than 1 acre and wider than 100 feet. Sites that are mostly 2-24 inches deep provide habitat to the largest variety of waterbird species.

Support of Native Vegetation

Vegetation that is adapted to live in wetland conditions can be important to the local or regional biodiversity of plants, and can support the function of wildlife habitat. At least 63 of the 1406 vascular plant species associated with Oregon's wetlands are considered rare, threatened, or endangered by the Oregon Natural Heritage Program.

B INTRODUCTION (Adamus 2001, GWEB 1999, OSU 1998)

Wetlands are protected by federal, state, and local regulations. In order to plan for growth and development in a watershed, it is necessary to know where these resources are located. In addition, wetlands can contribute to critical functions in the health of a watershed as mentioned above.

Purpose

The purpose of the wetland characterization is to gain specific information on the location and potential values of wetlands in the watershed. In addition, this inventory will help watershed councils determine whether it is appropriate or necessary to collect additional data on wetland function.

Hydrogeomorphic Method of Wetland Classification and Function Assessment

The hydrogeomorphic method (HGM) is a wetland classification system that is based on their dominant source of water and their position in the landscape. The HGM approach compares the characteristics of a specific wetland to the characteristics of reference wetlands in the region to determine how well the individual wetland is performing selected functions. There are 7 major HGM classes that were developed (Table 10.1),

Table 10.1 National hydrogeomorphic classes for wetlands

Hydrogeomorphic Class	Dominant Water Sources	Water Flow Direction
Riverine	Channel flow & overbank flow from channel	Unidirectional (channels) & Bidirectional (floodplain)
Depressional	Interflow, groundwater discharge	Vertical (seepage)
Mineral Soil Flats	Direct precipitation	Vertical (seepage)
Organic Soil Flats	Direct precipitation	Vertical (seepage)
Slope	Groundwater discharge	Unidirectional, horizontal
Lacustrine Fringe	Interflow & surges from lake	Bidirectional, horizontal
Estuarine Fringe	Interflow & tidal surges	Bidirectional, horizontal

Oregon's HGM classification system of subclasses was completed in 2001. These are:
Riverine—Subclasses: Riverine Flow-Through and Riverine Impounding
Depressional—Subclasses: Closed Permanently Flooded, Closed Nonpermanently Flooded, Outflow, Alkaline, and Bog
Slope—Subclasses: Headwater and Valley
Flats
Lacustrine Fringe—Subclasses: Headwater and Valley
Estuarine Fringe—Subclasses: River-sourced and Embayment

An abbreviated description of each subclass that was used in the assessment follows. Complete descriptions can be found in Adamus, 2001.

Class Riverine—Sites where water flows visibly during most of the wet season. The site may be a channel, an island in a channel, or border a channel or ditch. It should include any channel to the 2 meter depth.
Subclass Riverine Flow-Through (RFT)—Includes riverine sites that have most of their surface water visible during the wet season and are not substantially ponded by natural or artificial constrictions.

Class Depressional—Sites located in topographic depressions that are fed primarily by overland flow and interflow from surrounding uplands. Sites are isolated from both channels and from frequent overbank river flooding. Sites are smaller than 8 hectares and shallower than 2 meters.
Subclass Depressional Closed, Permanently Flooded (DCP)—Sites have at least 0.25 acres of standing water during the driest season of most years, no outlet channel or connection to a permanent river or lake during a majority of years in any 10-year period, a mean water column pH of less than 8 during most growing seasons, and vegetation cover that is never more than 10% *Sphagnum* moss. Vegetation may consist largely of plants whose wetland indicator status is "obligate," and especially species that characteristically are submersed or floating-leaved.
Subclass Depressional Closed, Nonpermanently Flooded (DCNP)—Sites are distinguished by being completely without surface water for at least one day of most years, and have no outlet channel or other water connection to a permanent river or lake more than once every 3 years, and have a pH of less than 8 during most growing seasons, and vegetation cover that is never more than 10% *Sphagnum* moss. Vegetation often contains a high proportion of annual species, and a relatively small proportion of "obligate" wetland plants.
Subclass Depressional Outflow (DOF)—Sites have one or more outlet channels or other surface water connection to a permanent river, lake, or estuary more than once every 3 years, a water column pH of less than 8 during most growing seasons, and vegetation cover that is never more than 10% *Sphagnum* moss.

Class Slope—Sites whose hydrology is dominated by groundwater inputs. Sites commonly occur as seepage at the toe of steep slopes. During some seasons groundwater inputs may be less than inputs from surface runoff and direct precipitation. Sites are isolated from navigable waters. Sites are difficult to recognize and may be classified as slope if no other category class fits.
Subclass Headwater Slope (SH)—Sites typically have an outlet channel but no inlet channel, are visibly sloping and are located in topographically high or intermediate positions. Sites may include or a part of montane wet meadows. Sites can originate from 1) Contacts, where a geologically permeable, water-bearing unit overlies a less permeable unit that intersects the ground surface; 2) Fractures where cracks in bedrock emerge at the ground surface on slopes; and 3) Seeps where numerous small openings in permeable soil discharge groundwater very slowly.
Subclass Valley Slope (SV)—Sites may or may not have any apparent gradient. They may or may not have an outlet channel, but inlet channels are usually absent. They may be permanently or nonpermanently flooded, but they always have little or no surface water in pools or channels within the site, except when their outlets have been partly impounded. They are located in a topographically low position, often where there is a noticeable slope. They may also occur on seemingly flat ground such as adjoining the upper edge (<2-year flood return frequency) of lowland Riverine sites. Water is sometimes much cooler in summer than surrounding waters and this can be diagnostic.

Class Lacustrine Fringe—Sites are on the edge of lakes. The water table is maintained primarily by the water elevation in the adjoining lake, which must be larger than 8 hectares, nonalkaline, and not flooded more than once every 2-years by overflow from an adjoining river. Lake water itself to a depth (maximum annual) of 2 meters may be classified as lacustrine fringe.
Subclass Lacustrine Fringe, Headwater (LFH)—Sites located in lakes that are in headwater positions and usually higher than the mean elevation of their region.

Class Estuarine Fringe—Sites whose hydrodynamics are influenced mainly by the daily bidirectional movement of tides. Their deepwater edge is defined by the 2 meter depth contour, estimated at mean daily low tide. Sites do not always contain surface water and vegetation. They can include mud and gravel tidal flats. They may receive runoff from adjoining uplands and some may seem dry at the surface, but their water tables are influenced primarily by tidal fluctuations.
Subclass Estuarine Fringe, River-sourced (EFR)—Sites receive most of their water inputs from rivers rather than the ocean. During rising tide the normally unidirectional, outflowing river currents collide with incoming tidal currents, causing a noticeable velocity reduction or even reversal of river current at the site. Many EFR sites are mapped by NWI as "Riverine Tidal".
Subclass Estuarine Fringe, Embayment (EFB)—Sites usually receive more of their water inputs from the ocean than from rivers. EFB sites may be fed by input channels and contain internal channels. Water level in most sites does not rise noticeably during seasonal runoff events or in response to individual storms. Probably all EFB sites are mapped by NWI as "Estuarine."

C METHODOLOGY

1. NWI Maps: Digital NWI maps (scale 1:24,000) were obtained from http://www.nwi.fws.gov for the majority of the Lower Rogue River watershed.
2. Type: Wetlands on the NWI maps are based on the Cowardin Classification System, which was published as the *Classification for Wetland and Deepwater Habitats of the United States* (see Appendix A for a description). The guidelines outlined in Appendix B were used to reclassify the wetlands according to the hydrogeomorphic classification so that a functional assessment of the wetlands could be constructed.
3. Size: The acreage of each wetland type was calculated for each subwatershed in the assessment area with private lands.
4. Watershed Position: Using the USGS topographic maps, the watershed was divided into thirds to determine the general location of each wetland within the basin. The position of a wetland was characterized as highest, middle or lowest in position based on elevation.

5. Wetland Values: The degree to which the different wetland subclasses provide the functions described in the "Background" section (Section A of this chapter) was assigned based on suggestions in Adamus (2001), which is included in Appendix B. The values of a particular wetland must be determined through subsequent on-site visits.

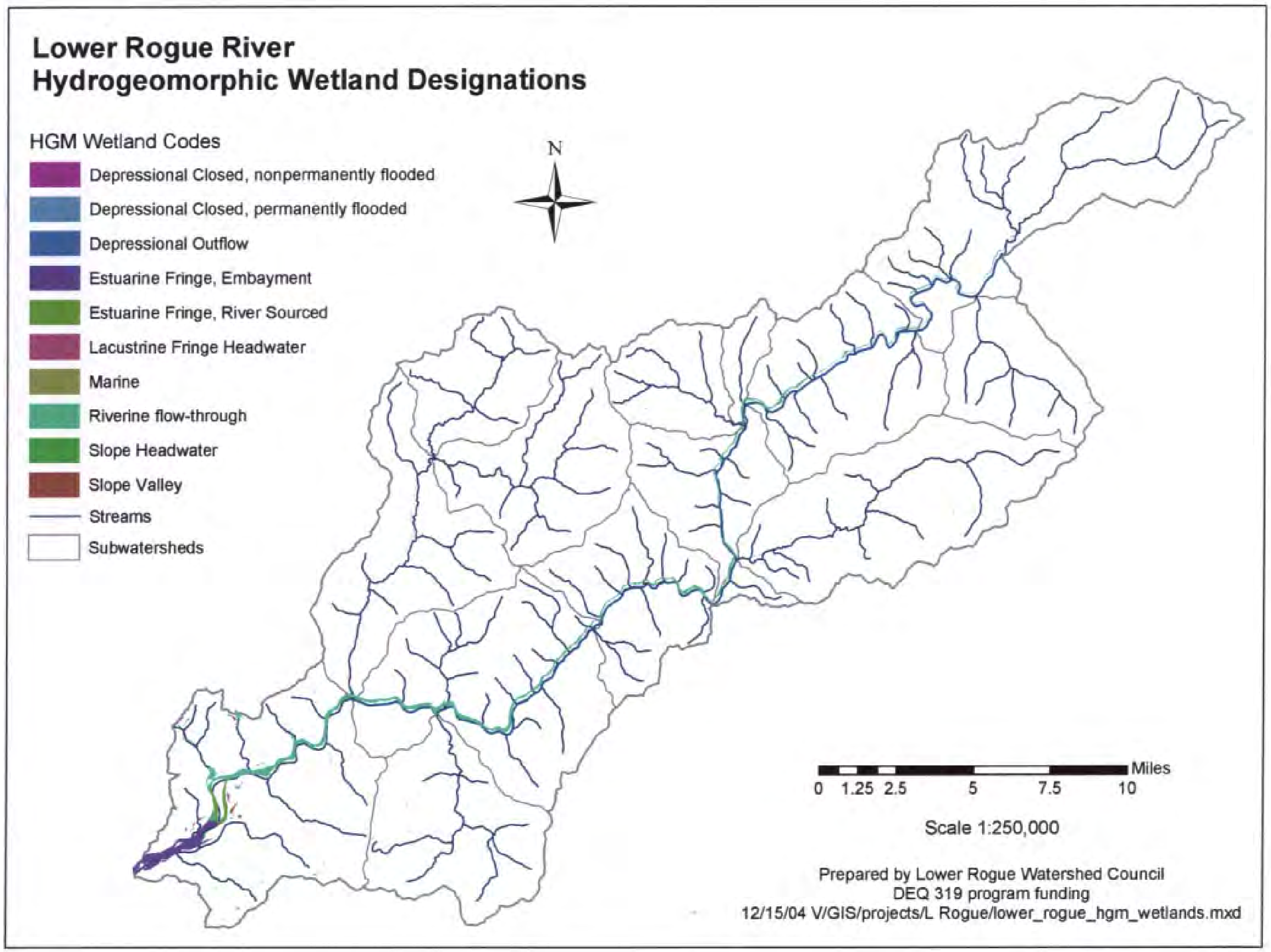
D RESULTS

Table 10A.1 Acres of each HGM class by Subwatershed

	DCNP	DCP	DOF	EFB	EFR	LFH	RFT	SH	SV
Lower Rogue Mainstem	12.3	13.8		616.5	178.3		765.7	20.7	0.6
Lower Middle Rogue Mainstem		0.1	0.5				612.6	3.0	
Upper Middle Rogue Mainstem		0.2				2.8	194.4	1.5	
Lower Upper Rogue Mainstem		0.6					235.7	1.9	
Middle Upper Rogue Mainstem			0.1				213.4	0.4	0.6
Upper Upper Rogue Mainstem							101.1	3.6	
Lower Lobster Creek							44.5	1.7	0.6

Table 10A. continued

	DCNP	DCP	DOF	EFB	EFR	LFH	RFT	SH	SV
South Fork Lobster Creek							5.4	3.1	
North Fork Lobster Creek							1.0	0.5	
Quosatana Creek							18.8	15.2	0.1
Foster Creek							1.9	6.6	
Shasta Costa Creek							5.3	5.5	
Total	12.3	14.8	0.6	616.5	178.3	2.8	2199.8	63.7	62.3


Lower Rogue River
Hydrogeomorphic Wetland Designations
HGM Wetland Codes
Depressional Closed, nonpermanently flooded
Depressional Closed, permanently flooded
Depressional Outflow
Estuarine Fringe, Embayment
Estuarine Fringe, River Sourced
Lacustrine Fringe Headwater
Marine
Riverine flow-through
Slope Headwater
Slope Valley
Streams
Subwatersheds
N
Miles
0 1.25 2.5 5 7.5 10
Scale 1:250,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/15/04 V/GIS/projects/L Rogue/lower_rogue_hgm_wetlands.mxd

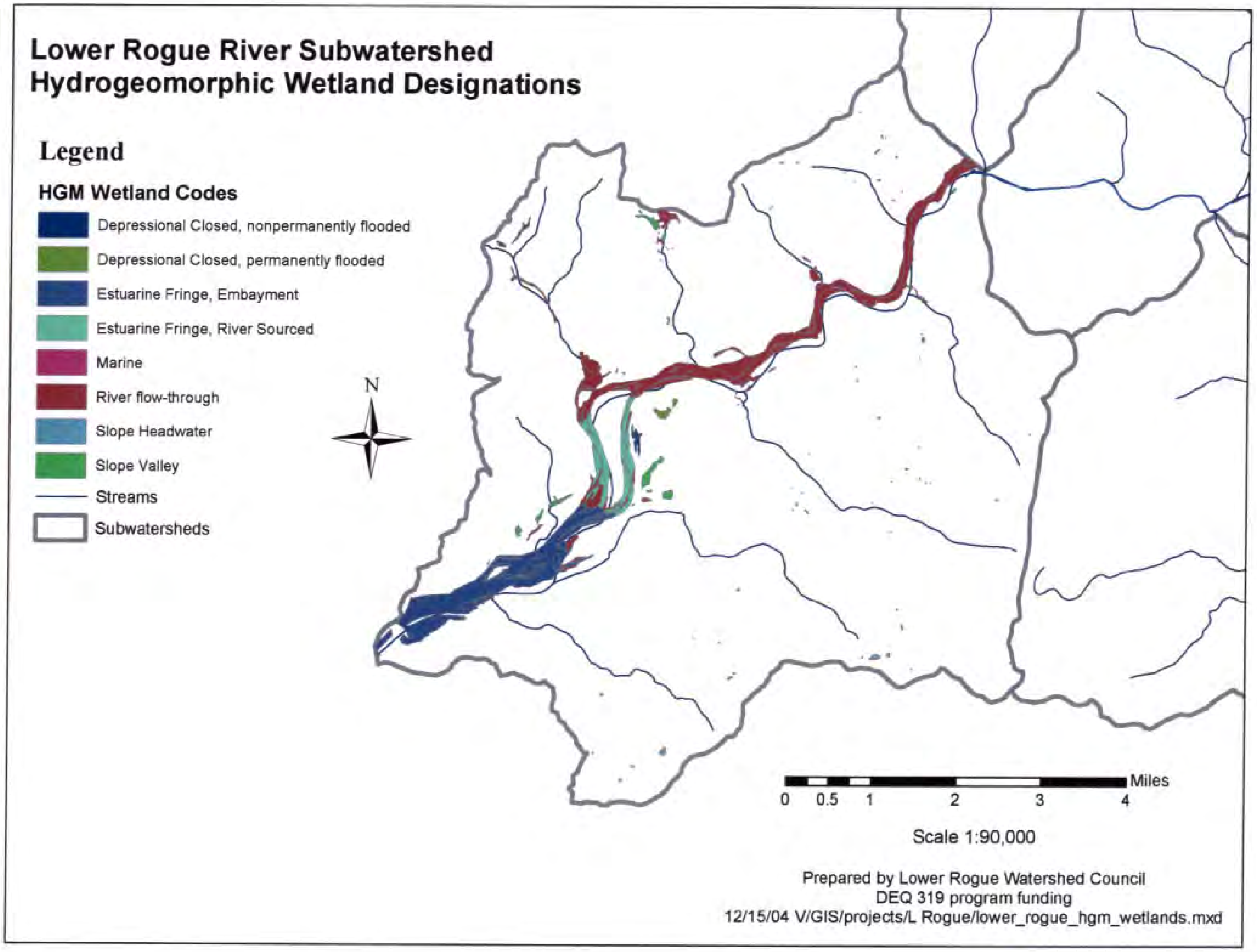

Lower Rogue River Subwatershed
Hydrogeomorphic Wetland Designations
Legend
HGM Wetland Codes
Depressional Closed, nonpermanently flooded
Depressional Closed, permanently flooded
Estuarine Fringe, Embayment
Estuarine Fringe, River Sourced
Marine
River flow-through
Slope Headwater
Slope Valley
Streams
Subwatersheds
N
0 0.5 1 2 3 4
Miles
Scale 1:90,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
12/15/04 V/GIS/projects/L Rogue/lower_rogue_hgm_wetlands.mxd

Table 10A.2 Percent of wetland acres by land use.

Agriculture Farm Zone	1
Forest and Grazing Zones	18
Gold Beach UGB	2
Pacific Ocean	2
Public Facilities Zone	1
Rec. Com. Res. Zone (RCR)	1
Rural Industrial Zone	1
Rural Residential Zone	8
Timber Zone	67

E KEY FINDINGS

- There are 3,150 acres of wetlands included in the National Wetland Inventory for the Lower Rogue assessment area.
- Nearly 70% of the wetland acreage in the assessment area is Riverine Flow-Through. 25% of the wetland acres are Estuarine Fringe class with the majority (19.5%) in the Estuarine Fringe, Embayment subclass.
- Over 76% of the wetlands lie on timber lands that fall within the "Timber" and "Forest and Grazing" zones in Table 10.2.
- Only four individual wetlands are over 5 acres that are not in the Estuarine or Riverine classes. All lie within the Lower Rogue Mainstem with three wetlands being in the Slope class (5.0, 8.1, and 12.0 acres, respectively) and one wetland in the Depressional Closed, Permanently Flooded (DCP) subclass (9.5 acres). The DCP wetland lies on private grazing land and has been excavated.

REFERENCES

Adamus. P.R. 2001. Guidebook for Hydrogeomorphic (HGM)-based Assessment of Oregon Wetland and Riparian Sites: Statewide Classification and Profiles. Oregon Division of State Lands, Salem, OR.

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999

OSU 1998. Watershed Stewardship - A Learning Guide, Oregon State University Extension Service, July 1998

Appendix A

National Wetlands Inventory and the Cowardin Classification System

The most widely available and comprehensive wetlands information in the United States is the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI). The NWI has located and classified wetlands as well as mapped the entire aquatic ecosystem network. NWI maps contain information on location in the watershed, water regime, vegetation class or subclass, morphology, and sheet versus channel flow. The NWI is based on the Cowardin Classification System, which was published as the *Classification for Wetland and Deepwater Habitats of the United States*. It has four objectives:

1. To describe ecological units whose natural attributes are fairly homogenous
2. To arrange these units in a system that will help people make decisions about resource management
3. To provide information for inventory and mapping
4. To create standard concepts and terminology for use in classifying aquatic ecosystems

A major weakness of the Cowardin system and the NWI is that the descriptions of mapped units often don't relate consistently to ecosystem functions. Because of the system's reliance on plant types as identifying criteria, wetlands that function very differently often are grouped into the same Cowardin class simply because they have the same vegetation.

Cowardin Classification's five major systems:

1. Marine (ocean): Consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides.
2. Estuarine (estuaries): Deepwater tidal habitats and adjacent tidal wetlands that are semi-enclosed by lands but have open, partially obstructed, or sporadic access to the open ocean, and in which open water is at least occasionally diluted by freshwater runoff from the land.
3. Riverine (rivers): Includes all wetlands and deepwater habitats contained within a channel, except: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) areas with water containing ocean-derived salts in excess of 0.5 parts per thousand.
4. Lacustrine (lakes): Includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 hectares (20 acres).

5. Palustrine (marshes): Includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand.

These systems are divided into subsystems, which reflect water flow regimes (subtidal, intertidal, etc.). The subsystems are then divided into many different classes, which reflect structural vegetative characteristics (e.g. RB Rock Bottom, UB Unconsolidated Bottom, etc.). The classification of a mapped wetland is coded by a series of letters and numbers. The first letter of the code represents the system, the subsequent number represents the subsystem and the next two letters indicate the class. All Cowardin codes have more than three letters and/or numbers. These additional characters represent more specific information about each wetland. Generally, however, the first three letters and numbers of each code are the most important for the purpose of this assessment. A summary of the Cowardin Classification Codes is provided below. These codes will be helpful in identifying restoration opportunities within the Chetco River watershed.

Due to the common occurrence of Palustrine wetlands, specific descriptions of five common classes are provided as follows:
1. EM Emergent: Dominated by rooted herbaceous plants, such as cattails and grass.
2. FO Forested: Dominated by trees taller than 20 feet.
3. OW Open Water: No vegetation evident at the water surface.
4. SS Scrub-Shrub: Dominated by shrubs and saplings less than 20 feet tall.
5. UB Unconsolidated Bottom: Mud or exposed soils.

Summary of Cowardin Classification Codes

System	Subsystem	Class	
M= Marine	1 = Subtidal	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed	RF Reef OW Open Water/Unknown Bottom
	2 = Intertidal	AB Aquatic Bed RF Reef	RS Rocky Shore US Unconsolidated Shore
E= Estuarine	1 = Subtidal	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed	RF Reef OW Open Water/Unknown Bottom

	2 = Intertidal	AB Aquatic Bed RF Reef SB Streambed RS Rocky Shore	US Unconsolidated Shore EM Emergent Wetland SS Scrub/Shrub Wetland FO Forested Wetland
R= Riverine	1 = Tidal	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed SB Streambed	RS Rocky Shore US Unconsolidated Shore EM Emergent Wetland OW Open Water/Unknown Bottom
	2 = Lower Perennial	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed RS Rocky Shore	US Unconsolidated Shore EM Emergent Wetland OW Open Water/Unknown Bottom
	3= Upper Perennial	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed	RS Rocky Shore US Unconsolidated Shore OW Open Water/Unknown Bottom
	4 = Intermittent	SB Streambed	
L= Lacustrine	1 = Limnetic	RB Rock Bottom UB Unconsolidated Bottom	AB Aquatic Bed OW Open Water/Unknown Bottom
	2 = Littoral	RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed RS Rocky Shore	US Unconsolidated Shore EM Emergent Wetland OW Open Water/Unknown Bottom
P= Palustrine		RB Rock Bottom UB Unconsolidated Bottom AB Aquatic Bed US Unconsolidated Shore ML Moss-Lichen Wetland	EM Emergent Wetland SS Scrub/Shrub Wetland FO Forested Wetland OW Open Water/Unknown Bottom

Source: Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. US Fish and Wildlife Service, FWS/OBS-79-31, Washington DC.

Appendix B

Guidelines used for reclassifying NWI wetland types to the Hydrogeomorphic types—Based on Adamus, P.R. 2001. Guidebook for Hydrogeomorphic (HGM)-based Assessment of Oregon Wetland and Riparian Sites: Statewide Classification and Profiles. Oregon Division of State Lands, Salem, Oregon.

Cowardin Class	Cowardin Subsystem	HGM Class	HGM Code
Estuarine	Subtidal	Estuarine	EFB
	Intertidal		EFR
Lacustrine	Limnetic	Lacustrine Fringe	LFH
	Littoral		LFV
Palustrine		Depressional	DO
		Flat	
		Slope	SH, SV
Riverine	Tidal	Riverine	RFT, RI
	Lower Perennial		
	Upper Perennial		
	Intermittent		

*Note: table does not indicate a direct exchange of classes. Use the information below:

<u>**Estuarine Fringe**</u>

Hydrodynamics influenced mainly by the daily bi-directional movement of tides.
Estuarine Fringe, Embayment (EFB)—water levels not visibly affected by 24 hour storm runoff events; usually fringes a bay; salinity always brackish or saline. Probably all EFB sites are mapped by the Cowardin system as "Estuarine".
Otherwise **Estuarine Fringe, River Sourced (EFR)**—Receive most of their water inputs from rivers rather than the ocean. Many EFR sites are classified as riverine tidal in the Cowardin system.

Riverine
Sites occurring in topographic valleys, always in association with channels of streams and rivers. Upland boundary is to the upland edge of the 2-year floodplain. Lower edge in the channel is to a low-flow depth of 2 meters.
Some NWI palustrine wetlands, including sites labeled PUB, PEM, PSS, or PFO with A, C, F, or H water regime codes may be classified as Riverine if it is associated with a channel or floodplain.
Riverine Impounding (RI) includes sloughs connected (seasonally or permanently) to main channels, channels dammed by beavers or humans, wetlands sustained primarily by water diverted or pumped from offsite channels, river alcoves with seasonally stagnant conditions, and depressions or temporarily ponded areas within active biennial floodplains.
Riverine flow-through (RFT) includes sites with no seasonal ponding of floodwater and includes wetlands that comprise entire islands within channels.

Lacustrine Fringe
Located on margin of or within a lake, i.e. a body of permanent standing water that is deeper than 2 m over an area of >8 hectares (20 acres). On NWI maps, most sites labeled L and others with A, C, F, or H water regime codes that border an L site.
Lacustrine Fringe Headwater (LFH)—located in a headwater position and usually higher than the mean elevation of the region.
Lacustrine Fringe Valley (LFV)—located in valley position and usually lower than the mean elevation of the region.

Depressional
Located on topographic depressions and are fed primarily by overland flow and interflow from surrounding uplands. They are isolated from both channels and from frequent overbank river flooding. Not located on a noticeable slope. If a wetland is flooded primarily by river water at least one every other year, it should be classified as Riverine regardless of whether it is in a depression or lacks inlets and outlets. If part of the basin in which the wetland resides is deeper than 2 m and the basin is larger than 8 hectares, the site should be classified as Lacustrine Fringe.
To **Depresional Outflow (DOF)**: Has (a) one or more outlet channels or other surface water connection to a permanent river, lake, or estuary more than once every 3 years, (b) a water column pH of less than 8 during most growing seasons, and (c) vegetation that is never more than 10% *Sphagnum* moss. Water level fluctuations are mainly in response to runoff and direct precipitation.
Depressional Closed, permanently flooded (DCP): have (a) at least 0.25 acre of standing water during the driest season of most years, (b) no outlet channel or connection to a permanent river or lake during a majority of years in any 10-yr period, (c) a mean water column pH of less than 8 during most growing seasons, and (d) vegetation cover that is never more than 10% *Sphagnum* moss. May have species that characteristically are submersed or floating-leaved (Aquatic Bed in Cowardin system).

Depressional Outflow (DOF): have (a) one or more outlet channels or other connection to a permanent river or lake during a majority of years in any 10-yr period, (b) a water column pH of less than 8 during most growing seasons, and (d) vegetation cover that is never more than 10% *Sphagnum* moss. May be permanently or nonpermanently flooded. Many are the result of partly successful attempts to drain DCP or DCNP sites by constructing outlet ditches.
Depressional Alkaline (DA): have a mean water column pH of 8 or greater during most growing seasons. Cowardin will often classify these as mineral flat or lacustrine fringe.
Depressional Bog (DB): Have greater than 10% cover of *Sphagnum* moss over an area of at least 0.25 acre, and, a mean annual water pH of less than 5.5.

To **Flats**: Fed mainly by direct precipitation, secondarily by lateral subsurface flow or surface runoff. Precipitation may be "ponded" at the site due to surrounding natural levees, ridge-swale topography, hummocks or constructed dikes; and/or due to soils with subsurface layers that strongly impede infiltration; and/or due to high water table due to subsurface seepage from nearby river, lake, or irrigated fields. Usually in a shallow (<2 ft) basin situated on a broad flat terrace. Includes wet prairie, wet wooded flats, some fens and some ash swales. On NWI maps may include many sites labeled PUS, PEM, PFO, or PSS with A, B, or C water regime codes.

To **Slope Class:** Located on, or near base of, a slope. Inlet channel absent or very short. Outlet channel frequently present. Downhill-flowing sheet flow may be visible at land surface, especially during wet months. Downhill side of site sometimes partly blocked by berm or dam (natural or manmade). Fed by runoff and precipitation, but with a proportionally large component of lateral subsurface flow or discharging groundwater. Soil moisture tends to persist more into the summer than other wetlands of similar size, depth, and soil type. Ratio of wetland surface area to the area of the apparently contributing watershed is relatively large. Includes springs, seeps, sites sustained in summer mainly by seepage from upslope irrigated fields. Harder to identify—may resemble depressional outflow sites.

Headwater Slope (SH): Outlet channel is present, but may be dammed in some form. Slope may be slight, but is always noticeable. No inlet channel. Located in topographically high or intermediate positions. Usually closer to a region's major drainage divides than to lowlands in the region, and usually higher than the average elevation of the region.

Otherwise— **Valley Slope (SV)**

Possible functions of HGM subclasses in Oregon (Adamus 2001)
Legend
3= one of the more important subclasses for this function
2=function present in many sites of this subclass; capacity usually greater than in several other subclasses
1=function present in some sites of this subclass; capacity usually less than in several other subclasses
0=function is minimal or absent in typical sites of this subclass

Class:	Riverine		Depressional*			Slope		Flats	Lacustrine		Estuarine	
	RFT	RI	DCP	DCNP	DOF	SV	SH		LFV	LFH	EFR	EFB
Water & Storage delay	1	2	2	3	2	1	1	1	0	0	0	0
Sediment Stabilization	1	2	3	3	2	1	1	1	2	1	1	1
Phosphorus Retention	1	2	2	3	2	2	2	2	2	2	2	2
Nitrogen Removal	1	2	2	3	2	2	2	2	2	2	2	1
Thermoregulation	3	2	0	0	0	3?	3	0	0	0	2	1
Primary Production	3	2	1	1	2	2	2	1	2	2	2	2
Anadromous Fish	3	3	0	0	1	1?	0	0	2?	1?	3	3
Resident Fish	3	3	1	0	2	2?	1?	0	3	3	3	3
Amphibian Habitat	1	2	3	2	3	3	3	2	3	3	0	0
Waterbird Habitat	2	3	3	2	2	2	1	3	3	2	2	3
Biodiversity Support	2	2	2	2	2	2	2	2	2	2	2	2

*Two depressional types not included are alkaline and bog.

Order for converting Cowardin system to HGM

- Cowardin code begins with L—use Lacustrine Fringe values
- Cowardin code begins with E—use Estuarine Fringe Embayment values.
- Cowardin code begins with R—use Riverine values, unless Cowardin code is R1, then use Estuarine Fringe Riverine (EFR) values. For Cowardin R sites with a modifier of b or h, classify as Riverine Impounded (RI), otherwise Riverine Flow through (RFT)
- Cowardin code begins with P:
    - If the wetland is closely associated with a channel or floodplain classify as Riverine
    - Otherwise classify as Slope, Depressional, or Flat

  Hints: If the Cowardin code is PEM, PSS or PFO with a –B water regime code, may be a slope class. If the Cowardin code is PUB or PAB, it may be a depressional. If the Cowardin class is aquatic bed (PAB), you likely have a Depressional closed permanently flooded classification under HGM. If an outlet channel is noted on an NWI map and it is not riverine, it is a depressional outflow (DOF)

X.B WETLANDS—ROGUE RIVER ESTUARY

The Rogue River has a drainage area of 5,100 square miles, yet the estuary of the Rogue River is one of the smallest in Oregon, measuring approximately 1,880 acres during winter flows, and less during summer flows.

History

One of the first major modifications of the estuary was to manage the estuary for the commercial harvest of fish to support a cannery. The cannery was originally constructed at river mile 1.0 on the south side of the Rogue River, and later moved across the river and upstream. The old pilings can still be seen under the Highway 101 bridge. Habitat modifications of the river likely included the removal of large woody debris in later years from some areas of the estuary and after winter flows to allow for boat traffic and the use of harvesting nets (Frick 2005).

The Rogue River historically formed a shoal or sill at the mouth during low flows in the summer months at the mouth and was considered virtually unnavigable with the depth varying between 2 feet in late summer and 9 feet in the winter. In 1960, the Army Corps of Engineers (ACOE) constructed jetties 1,000 feet apart to stabilize the position of the entrance, and a 13-foot channel was dredged in 1961 with a turning basin on the north side of the river. Shoaling continued to be a problem for navigation after the project was complete and a breakwater dike from the highway 101 bridge tangent to the south jetty was initiated by ACOE in 1964, but was abandoned due to record floods. Severe shoaling halted lumber barge traffic and the dredge boat could not enter the estuary for maintenance. In 1971, locals resumed work on the dike and it was completed in 1973.

As of a report in 1975 by ACOE, shoaling continues to be a problem and an average of 112,000 yd^3/yr is dredged to maintain the waterway. The report estimated that winter floods up to 400,000 cfs could transport a million cubic yards of sand and gravel. The constructed dike also created a breakwater for the large shallow area to the south, part of which the Port developed into the marina. The entrance channel into the basin is also subject to annual sedimentation from waves moving material along the south jetty and into the entrance.

As a result of the dike and jetties, currents in the main channel are probably stronger throughout the year. These structures have also stabilized the location of the channel and spits, which historically fluctuated to the north and the south of its current location. The dike also restricts circulation in the protected basins to a single small opening.
Historically, the basin was a shallow subtidal and intertidal area with unrestricted circulation. The northern shore has been extensively riprapped and there are several boat moorages. The Mail Boats and Rogue River Jet Boats make regular trips up the river from the

estuary, with the latter being located inside the boat basin. Other developments in the estuary waterway include the U.S. Highway 101 bridge abutments, two gravel removal operations and some boat docks, which are removed during winter flows.

Hydrology and Water Quality

The estuary is river flow dominated. The mean high tide on the Rogue River is at 4.9 ft, and these tides extend approximately 4 miles from the mouth to a riffle below Edson Creek. The mean higher high water is 6.7 ft and many summer tides extend to river mile 4.5, above Edson Creek near the old Champion sawmill. The tidal prism, which describes the volume of water between the mean low water and mean high water, is estimated to be 1.6 x 10^8 ft^3. During high river flows, the volume of incoming water during a tidal cycle is several times greater than the tidal prism. Even summer flows produce a volume nearly as large as the tidal prism, which is unusual for most estuaries in Oregon.

Salinity intrusion in the estuary is limited due to the steep river gradient and the high volume of river discharge. ODFW collected several years of salinity data in the late 1970s. The upstream extent of saltwater intrusion was usually river mile 2.7, although it was measured as high as river mile 3.6 in one instance. During winter flows, the salt wedge did not generally reach higher than the base of the north jetty at high tide. While seasonal salinity distribution and mixing patterns are not known, data show that the estuary is never fully mixed. Even during low flows, salinity in the bottom approached ocean levels at 28-31 parts per thousand, but salinity was less than 10 parts per thousand at the surface.

Habitat

The estuary can be divided into two subsystems: the marine and the riverine.

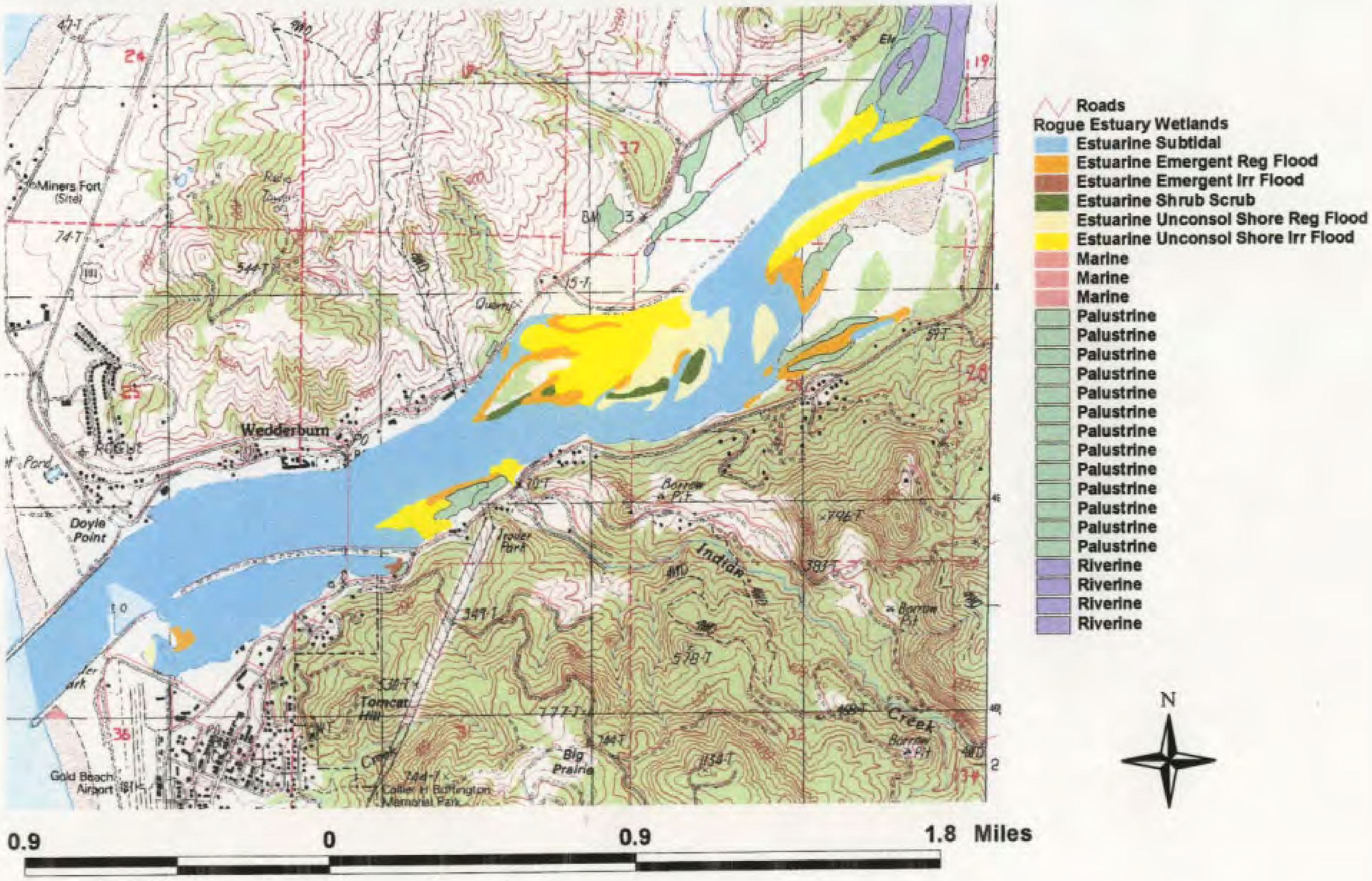
Marine

The marine subsystem accounts for 80% of the area of the estuary and extends from the mouth to the Highway 101 Bridge at river mile 1.0. This system has high salinity during the summer and strong currents throughout the year. The area is highly modified and most of the development in the estuary is located in this subsystem. Approximately 13 acres of intertidal and 14 acres of subtidal land was filled between 1960 and 1972. Fills included the dike (separating the boat basin from the main channel), marina, and the development and riprap along the north shore.

The main channel has a predominantly sand and sulfide mud substrate. River flow and shoal formation restrict deposition of ocean sands to the mouth of the estuary. High winter flows carry most river-born suspended sediments beyond the mouth of the Rogue River. During the summer, these sediments are deposited over the gravel bars in the upper estuary. Benthos are dominated by polychaetes. *Anisogammarus* spp. and *Corophium* spp., important in the diets of salmonids, were found in the sand and fine gravel substrate measured upstream of the Coast Guard dock.

Intertidal areas are found primarily behind the dike, and although the area is small, there is a high diversity of habitat types that may be significant in the productivity of the estuary. Sand and cobble/gravel shores, mud and mixed sand/mud flats, algal beds, and a low fringing salt marsh all provide shallow habitat for fish rearing, and habitat for a

Wetlands of the Rogue River Estuary



variety of birds. Two intertidal areas outside of the diked area were noted by ODFW as locations where marine and anadromous fish congregate. The first is a small tideland area along the north shore near the Coast Guard dock. It is the only undiked shoreland remaining in the marine subsystem, and the shore forms a cove protected from swift channel currents. The other area is along the eastern edge of the spit that forms inside the jetties, and is also out of the main current.

Riverine

The riverine subsystem extends from the Highway 101 bridge to the head of tide. High tides which are lower than mean high water do not extend beyond the second riffle above Elephant Rock, while higher high tides extend to a third riffle located at river mile 4.5.

There is twice as much subtidal area in the riverine subsystem than in the marine subsystem, with most of the substrate being cobble/gravel. Areas away from strong currents, where silt is deposited during the summer and fall and bottom salinities are sufficiently high, provide suitable habitat for amphipods. Benthic sampling by ODFW below river mile 2.2 found productive habitat for *Corophium* spp. and *Anisogammarus* spp. in the channel and lower intertidal areas. The subtidal habitat is important feeding and rearing areas for fish with juvenile chinook, coho salmon and cutthroat trout often abundant in this area.

More than 50% of the area in the riverine subsystem is gravel bars and shrub wetlands (Cowardin class) that lie above mean high water and only flood during higher tides and high river discharge. These areas are considered winter intertidal areas and are found as islands and along the shore. The shrub wetlands may contribute nutrients and organic matter to the estuary and provide habitat for terrestrial wildlife. The gravel flats are often sparsely vegetated and are probably more critical as a flood way and for providing interstitial flow.

Summer intertidal areas include a wider variety of habitat types than winter areas. At river mile 1.2, an intertidal island is a remnant of a larger peninsula that existed prior to floods and construction of the dike. The peninsula extended below the bridge and separated a slough from the main river, and emptied into the current boat basin area. Part of the current island is classified as an intertidal gravel marsh characterized by spike rush and scattered forbs growing on a gravel substrate—a marsh type unique to a few south coast estuaries. This is the largest remaining example in the Rogue River estuary.

Another major intertidal area is located on the north shore at Mail Boat Point, the tip of a larger island where juvenile salmon and cutthroat congregate. The point has a gravel substrate, but due to its location between the river channel and the mouth of the north slough and associated slowing of the current, has sediment deposition that supports *Corophium* amphipods and productive algal beds.

On the south shore at river mile 1.5, Snag Patch slough is the most densely vegetated marsh in the estuary and provides excellent habitat for juvenile fish, terrestrial wildlife, and waterfowl. God Wants You Creek feeds the slough. Prior to the 1996 flood, Saunders Creek would also empty into Snag Patch Slough during high winter flows through a channel that cut through the gravel flat currently owned by Freeman Rock, Inc. Now, and during normal flows previously, Saunders Creek enters at river mile 1.9. The gravel bars downstream from Elephant Rock are important estuarine habitats. Most of the remaining summer intertidal habitats are cobble/gravel shores, with freshwater predominating. These areas may be important for secondary production and fish rearing.

Fish productivity

Many south coast estuaries, including the Rogue River historically, form sills or shoals at the mouth that restricts river flow to the ocean. This increases the productivity of the estuary by inundating low shorelands and trapping nutrient-rich ocean water. A study on the Sixes River to the north found that juvenile fall chinook that reared in the estuary throughout the summer and fall had the highest adult returns to the river (Riemers 1973). A comparison of 1945 and 1975 adult fish scales from the Rogue River indicate that juvenile spring and fall chinook spend much less time rearing in the Rogue estuary than they did 20 years ago. These data suggests that physical and hydrologic modifications in the Rogue River estuary discussed above may have had significant impacts on chinook populations in the river.

Little information is available on other fish species using the estuary. Marine fish such as shiner perch, surf smelt, and starry flounder come into the estuary in the summer to feed, with some perch species spawning or bearing their young in the estuary. Smelt, lamprey, and sturgeon migrate through the estuary and spawn in the river systems. Shad, lingcod, stickleback, and herring also use the estuary.

Management

The estuary inventory report produced by the Oregon Department of Fish and Wildlife had several management recommendations:

- Do not alter the few undisturbed intertidal and shallow subtidal habitats in the lower estuary except as part of a restoration project. Two such areas are the spit forming inside the jetties and the shore near the Coast Guard station.
- Do not dredge or fill the shallow subtidal land outside the basin dike that is the area of the remnant island.
- The boat basin may contribute significantly to the productivity of the estuary and more information is needed to determine if improved flushing is necessary to maintain high quality water and sediments.

- Tidelands within the boat basin, particularly along the eastern end, should not be dredged or filled.

- Wastewater outfalls within the marine subsystem should be eliminated.

- The moorage area of the boat basin should only be expanded if demand for boat storage can not be accommodated at adjacent shoreland facilities.

REFERENCES

Frick, R. 2005. Fisheries Biologist, United States Forest Service—Rogue/Siskiyou National Forest. Personal communication.

Ratti, F. 1979. Natural Resources of the Rogue Estuary. Estuary Inventory Project. Oregon Department of Fish and Wildlife.

Reimers, P. E. 1973. The length of residence of juvenile fall chinook salmon in the Sixes River, Oregon. Fish Comm. Oreg. Res. Rep. 4(2) *In* Ratti, F. 1979 (above).

XI HYDROLOGY

A BACKGROUND (GWEB 1999)

Hydrologic Cycle

The hydrologic cycle describes the circulation of water around the earth, from ocean to atmosphere to the earth's surface and back to the ocean again. Oceans, covering 70% of the earth's surface, play a large role in the movement of water through this cycle. Solar energy evaporates water from the ocean, wind carries the water over land, and water is precipitated by gravity back to the earth. Rain is the most common form of precipitation, but snow, hail, dew, fog, drip, and frost all can bring water into a watershed. Precipitation that reaches the earth can move through three different pathways. Water can:

- Be intercepted by vegetation and evaporated or transpired back to the atmosphere
- Move down-slope on the surface or through soil to a stream system, eventually returning to the ocean
- Be stored in snowpack, groundwater, ponds, or wetlands for a variable period of time.

Land Use Impacts on Hydrology

Land use practices can modify the amount of water available for runoff, the routing of water to the streams, the lag time (delay between rainfall and peak streamflow), the flow velocity, or the travel distance to the stream. Land use practices that affect the rate of infiltration and/or the ability of the soil surface to store water are typically most influential in affecting the watershed's hydrology. Using this as an indicator for comparison among land uses, the act of forest harvesting produces the smallest impacts to the hydrologic regime of a basin given evolved harvesting methods that can minimize compaction; however, roads decrease the infiltration rate. In contrast to forest harvest, agricultural practices and rangeland utilization for grazing, and urban development can all involve compaction of the soils and/or paved surfaces, resulting in substantial alteration of the infiltration rate. Agricultural practices and urban development directly involve altering the shape of the drainage system by ditching, channelizing, or using piped stormwater networks, which decrease the infiltration and the travel time of subsurface flow to reach the channel. This effect can be much worse in high-flow conditions. While forest harvest practices are not always practiced at sustainable rates, they are temporary conversions of vegetation, and the hydrologic effects diminish as vegetative regrowth occurs. Conversion of lands to agriculture or urbanization produces generally longer-lasting effects. Road construction, associated with all land uses, alters the rate of infiltration and replaces subsurface flow pathways with surface pathways resulting in quicker travel time to the channel network.

B INTRODUCTION

The hydrologic condition assessment is a "screening" process designed to identify land use activities that have the potential to impact the hydrology of the Lower Rogue Watershed. Alterations to the natural hydrologic cycle potentially cause increased peak flows and/or reduced low flows resulting in changes to water quality and aquatic ecosystems. The degree to which hydrologic processes are affected by land use depends on the location, extent, and type of land use activities. When potential impacts are recognized, best management practices can be followed to minimize some of the hydrologic impacts. Mitigation will be necessary to address other impacts.

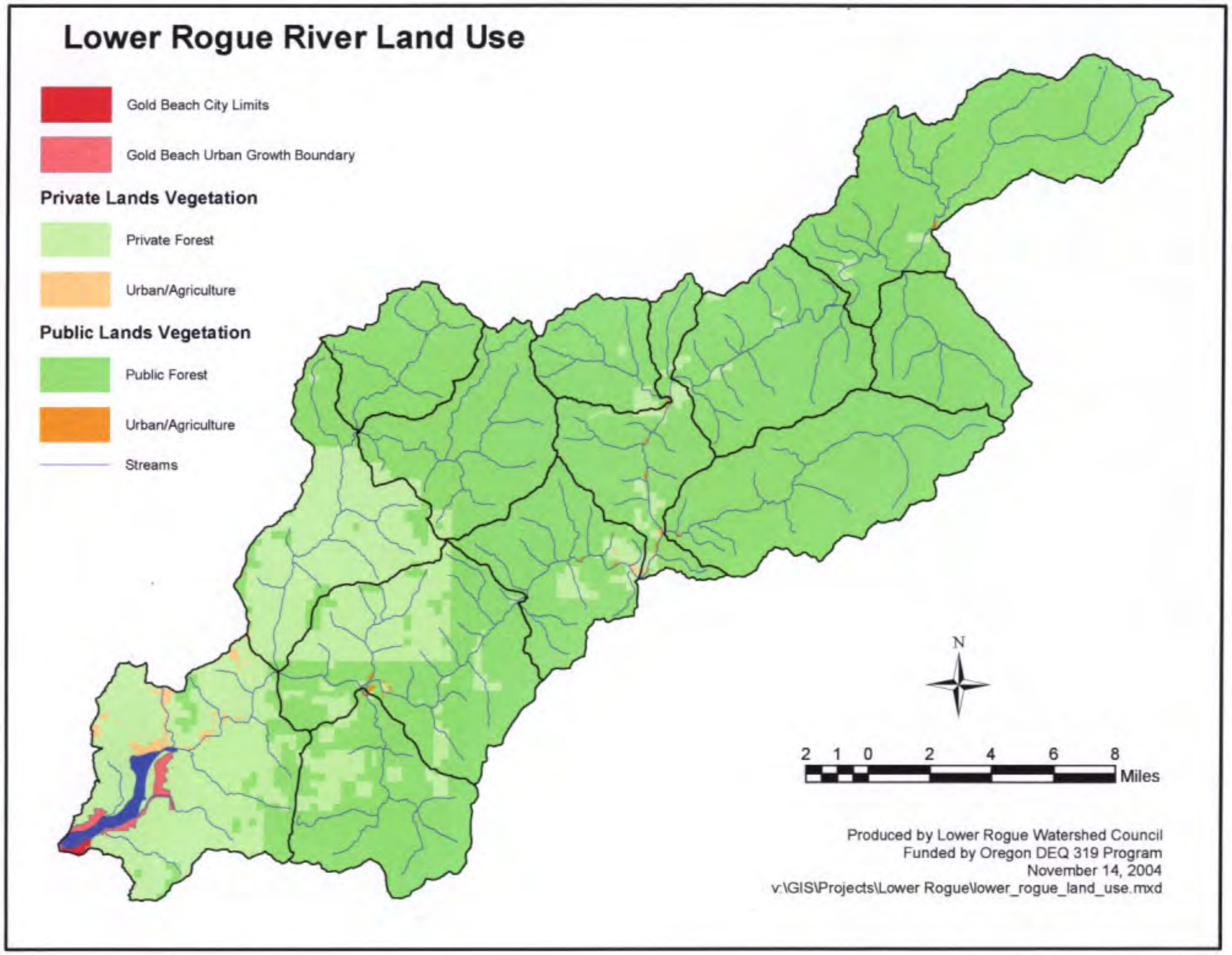
The GWEB Oregon Watershed Assessment Manual provides a set of methods to prioritize those subwatersheds most likely to need restoration from a hydrologic perspective. Because hydrology is such a complex subject, the screening process only deals with the most significant hydrologic process affected by land use. The assessment does not attempt to address every hydrologic process potentially affected; the goal is to gain an understanding of the major potential impacts.

General Watershed Characteristics

A Geographic Information System (GIS) analysis was conducted to provide general watershed characteristics pertaining to the Hydrologic Condition Assessment (Table 11.1). The GIS shapefile used is titled "Precipitation, Average Annual", available from the Southwest Oregon Province GIS Data DC. Minimum and maximum elevations were determined using 10M digital elevation models.

Table 11.1 General Watershed Characteristics

Subwatershed	Subwatershed Area (acres)	Mean Annual Precipitation (inches)	Mean Elevation (feet)	Minimum Elevation (feet)	Maximum Elevation (feet)
Lower Rogue Mainstem	25,905	90	1500	0	3512
Lower Middle Rogue Mainstem	25,274	95	1500	60	3778
Upper Middle Rogue Mainstem	13,921	105	1400	70	3468
Lower Upper Rogue Mainstem	13,765	95	1600	110	3467
Middle Upper Rogue Mainstem	17,727	90	1400	170	4325
Upper Upper Rogue Mainstem	27,699	85	2200	230	4319
Lower Lobster Creek	18,219	105	1200	35	3264
South Fork Lobster Creek	16,123	115	1700	440	3966
North Fork Lobster Creek	9,904	110	1800	440	3325
Quosatana Creek	16,378	105	1600	60	3720
Foster Creek	7,735	85	2200	160	3968
Shasta Costa Creek	23,436	105	2200	120	5298
Stair Creek	10,582	100	2200	300	4973


Lower Rogue River Land Use
Gold Beach City Limits
Gold Beach Urban Growth Boundary
Private Lands Vegetation
Private Forest
Urban/Agriculture
Public Lands Vegetation
Public Forest
Urban/Agriculture
Streams
N
2 1 0 2 4 6 8
Miles
Produced by Lower Rogue Watershed Council
Funded by Oregon DEQ 319 Program
November 14, 2004
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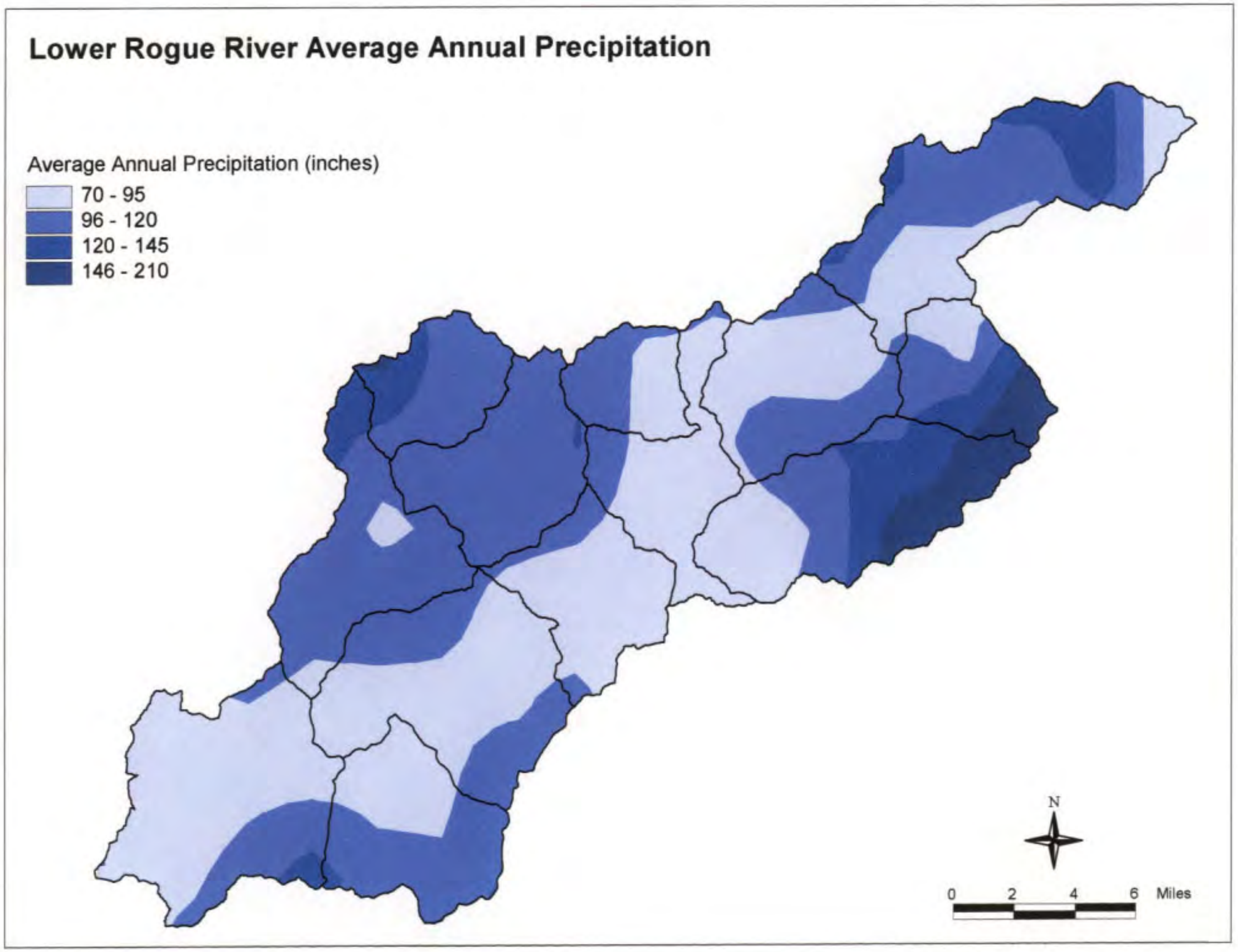

Lower Rogue River Average Annual Precipitation
Average Annual Precipitation (inches)
70 - 95
96 - 120
120 - 145
146 - 210
N
0
2
4
6
Miles

Peak Flow History

The United States Geological Survey maintains a real-time streamflow gauge (14372300) near Agness, downstream of the confluence of the Illinois River and Rogue River. The drainage area for this stream gauge is 3,939 square miles. Peak stream flows by water year were obtained from the USGS web site at http://waterdata.usgs.gov/nwis-w/OR and are shown in Figure 11.1. The month during which a peak flow occurred is shown in Figure 11.2 (1961-2004). The recurrence intervals associated with these flows were calculated and are shown in Table 11.2 for two different time periods: pre- Lost Creek Dam (completed 1977), post- Applegate Dam (completed in 1980).

Figure 11.1. Peak Streamflows for USGS Gauge 14372300 for Water Years 1961-2004.

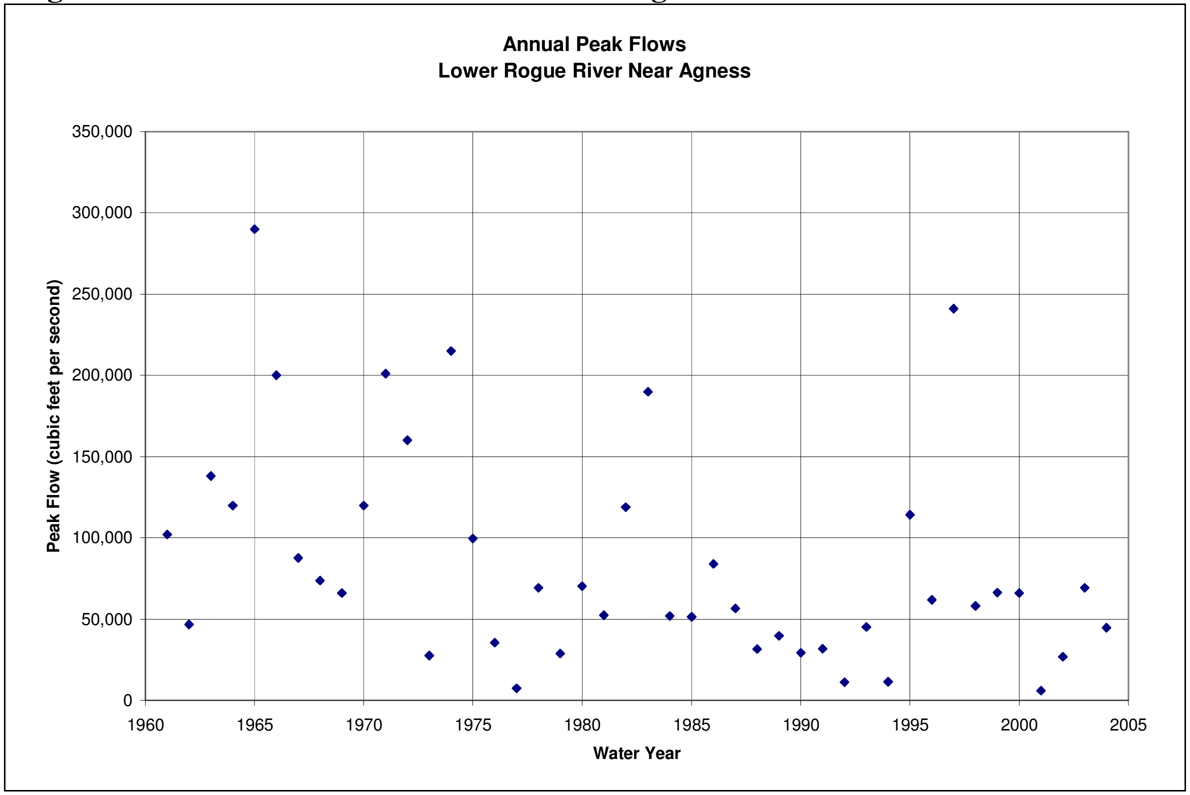


Table 11.2. Return Periods associated with peak annual flows for the Rogue River below Agness for periods of water years.

Return Period	Flow (cfs)	
	1961-1976 (pre-dams)	1981-2004 (post-dams)
2	103,509	49,528
5	187,296	107,703
10	250,679	151,711
25	334,466	209,886
50	397,849	253,894
100	461,232	297,902

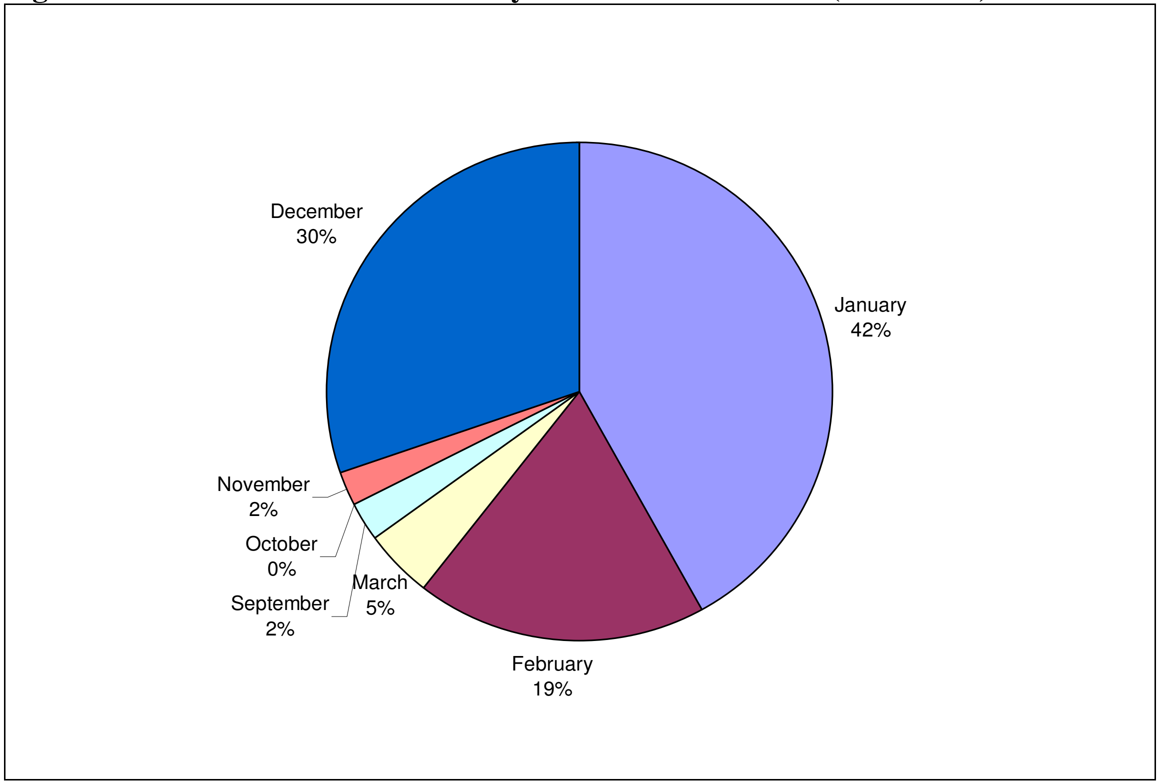
Land Use Summary

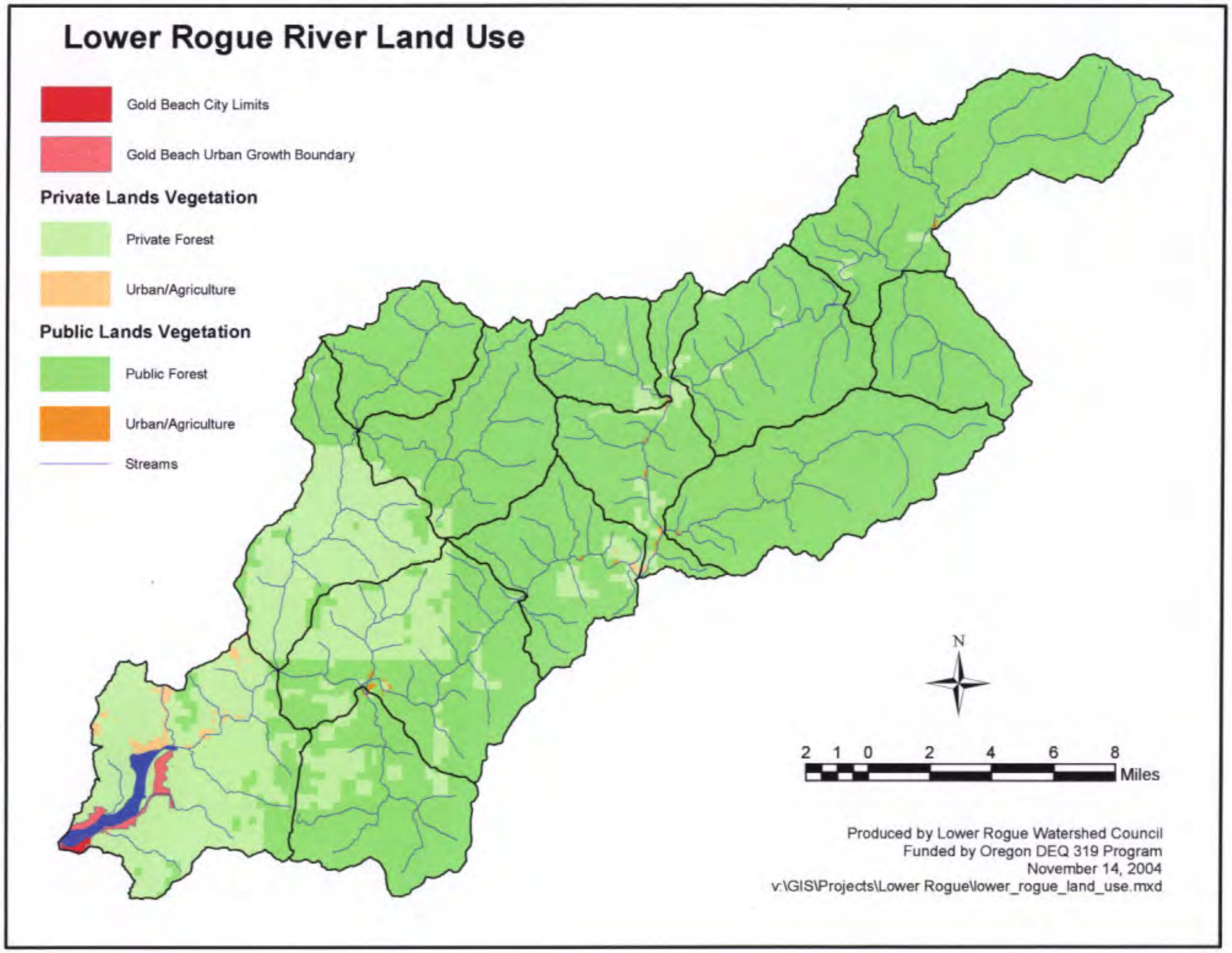
Land use was determined using a digital shapefile titled "Vegetation" from the Southwest Oregon Province GIS Data CD (Table 6.3). Public lands information was obtained from the Oregon State Service Center for GIS (2003). Within the Lower Rogue Assessment Area as a whole, 75% is public lands, 25% is private lands, and 0.14% is within the urban growth boundary of Gold Beach.

Public lands include 87% forest, 13% young nonforest, and <0.5% each urban/agriculture and water. Private land was divided into forested and urban/agriculture in Table 6.2.

Private lands include 74% forest, 22% young nonforest, 3% urban/agriculture, and 2% water. The private lands urban/agriculture acreage excludes the urban growth boundary acres. The urban growth boundary lands include 12% forest, 45% young nonforest, 40% urban/agriculture, and 3% water.

Figure 11.2 Peak Flow Occurrence by Month: Water Years (1961-2004)




Lower Rogue River Land Use
Gold Beach City Limits
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Streams
N
2 1 0 2 4 6 8
Miles
Produced by Lower Rogue Watershed Council
Funded by Oregon DEQ 319 Program
November 14, 2004
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Table 11.3 Land Use Summary

Subwatershed Name	Public Lands		Private Lands				Urban Growth Boundary of GB	
			Forested		Urban/Agriculture			
	Acres	%	Acres	%	Acres	%	Acres	%
Lower Rogue Mainstem	3,640	14	22,157	86	1,124	4	307	1
Lower Middle Rogue Mainstem	16,231	64	9,034	36	10	<1	0	0
Upper Middle Rogue Mainstem	12,467	90	1,401	10	53	<1	0	0
Lower Upper Rogue Mainstem	12,506	91	1,225	9	41	<1	0	0
Middle Upper Rogue Mainstem	17,312	98	416	2	0	0	0	0
Upper Upper Rogue Mainstem	27,345	99	352	1	0	0	0	0
Lower Lobster Creek	4,315	24	13,950	77	10	<1	0	0
South Fork Lobster Creek	15,404	96	719	4	0	0	0	0
North Fork Lobster Creek	9,904	100	0	0	0	0	0	0
Quosatana Creek	13,692	84	2,682	16	4	<1	0	0
Foster Creek	7,352	95	378	5	5	<1	0	0
Shasta Costa Creek	23,436	100	0	0	0	0	0	0
Stair Creek	10,583	100	0	0	0	0	0	0

Individual Screening Procedures

Four separate screening procedures were developed to evaluate land use impacts on hydrology in the Lower Rogue Watershed:

C FORESTRY
D RESIDENTIAL/RANGE LAND USE
E FOREST AND RURAL ROADS

C1 FORESTRY IMPACTS ON HYDROLOGY

The potential effects of forest practices on hydrology include changes in runoff timing, water yield, and sediment delivery processes. There are two primary mechanisms by which forest practices in the Pacific Northwest watersheds impact hydrologic processes: (1) the removal and disturbance of vegetation, and (2) the road network and related harvesting systems.

Removal of vegetation reduces interception and evapotranpiration, both of which allow additional water to reach the soil surface during rainstorms. Additionally, open areas accumulate more snowpack, which can potentially produce an increase in water yield. Forestry-related effects on peak flows may be a function not only of harvest and vegetative cover issues, but also of the type of hydrologic process that occurs in a basin. Increased peak flows, associated with rain on snow events present the greatest likelihood of problems caused by timber harvest. While rain on snow conditions can occur at almost any elevation, given a specific combination of climatic variables, the probability of rain-on-snow enhancement of peak flows differs with elevation and, to a lesser degree, aspect. The highest probability of encountering rain-on-snow conditions occurs at mid-elevations where transient snowpacks develop but not at great depths. The lowest probability occurs in the lowlands, where snowpack rarely occurs, and at the higher elevations, where winter temperatures are too cold to melt the snow. The elevation of the lower boundary of the rain-on-snow zone will vary geographically and often by ecoregion.

C2 METHODOLOGY

1. The screen for potential forestry impacts on hydrology was focused on timber harvest. A GIS analysis was conducted to determine total area of transient snow elevation zones by subwatershed. The GIS shapefile used is titled “Transient Snow Zone”, available from the Southwest Oregon Province GIS Data CD.

2. Peak flow generating processes were identified for each subwatershed by estimating the acres and percent area in each subwatershed falling into three elevation categories: rain (<2500 feet), rain-on-snow (2500 to 4000 feet), and spring snowmelt (>4000 feet) (Figure 6.4). Subwatersheds with more than 75% of their area within the rain zone were identified as having low potential risk of peak-flow increases.
3. Subwatersheds with less than 75% of their area within the rain zone were evaluated for changes in crown closure in the rain-on-snow areas. The GIS shapefiles used are "1900 Vegetation" and "Veg_r" from the Southwest Oregon Province GIS Data CD. All subwatersheds were assumed to have had more than 30% historic crown closure based on USFS watershed analysis documents and ecoregion information. The percent of rain-on-snow area with less than 30% current crown closure, and the percent of forest land use area above rain-on-snow elevation were used to assign either a low risk or potential risk of peak-flow enhancement based on Figure 3 of the OWEB Watershed Assessment Manual (Section IV, 1999).
4. Lands within each subwatershed managed by the USFS were evaluated for peak flow enhancement due to harvest. A watershed analysis area (WAA) was deemed to have a potential risk of peak flow enhancement if more than 20 percent of the transient snow zone (>2500') area has been harvested (USFS, 1996).

C3 RESULTS

Table 11.4 Subwatershed Areas by Elevation Zone

Subwatershed Name	Area (acres)	Rain Zone (<2500')		Rain on Snow Zone (2500'-4000')		Spring Snowmelt (>4000')	
		Acres	%	Acres	%	Acres	%
Lower Rogue Mainstem	25,908	23882	92.2	1013	3.9	0	0
Lower Middle Rogue Mainstem	25,277	2580	79.6	2580	10.2	0	0
Upper Middle Rogue Mainstem	13,293	9945	71.4	1989	14.3	0	0
Lower Upper Rogue Mainstem	13,766	9927	72.1	1919	13.9	0	0
Middle Upper Rogue Mainstem	17,730	10653	60.1	3529	19.9	19	0.1
Upper Upper Rogue Mainstem	27,704	6511	23.5	10596	38.2	0	0
Lower Lobster Creek	18,221	16886	92.7	668	3.7	0	0
South Fork Lobster Creek	16,124	5831	36.2	5146	31.9	0	0
North Fork Lobster Creek	9,906	7030	71.0	1438	14.5	0	0
Quosatana Creek	16,380	8973	54.8	3704	22.6	0	0
Foster Creek	7,736	3100	40.1	2318	30.0	0	0
Shasta Costa Creek	23,439	3632	15.5	8379	35.8	3048	13
Stair Creek	10,584	1671	15.8	3953	37.3	1008	9.5

- Approximately 21% of the assessment area is located within the transient snow zone of 2500'-4000' where peak flow generating processes are dominated by rain on snow events. Less than 2% of the watershed is at elevations above 4000 feet.

- Subwatersheds having more than 25% area above 2500 feet were evaluated for harvest levels using the USFS Watershed Analysis for Shasta Costa Creek, Lobster Creek, Rogue River Marial to Agness, and Rogue River Below Agness (USFS, 1996, 1999, 1999 and 2000, respectively). Harvest has been minimal in elevations >2500'. It is therefore assumed that the percent of rain-on-snow area with less than 30% crown closure is well within the low risk category (Figure 3, OWEB Assessment Manual) for all subwatersheds.
- Public lands managed by the USFS were evaluated for peak flow increase potential. Table 11.5 shows WAAs having more than 20% harvest.

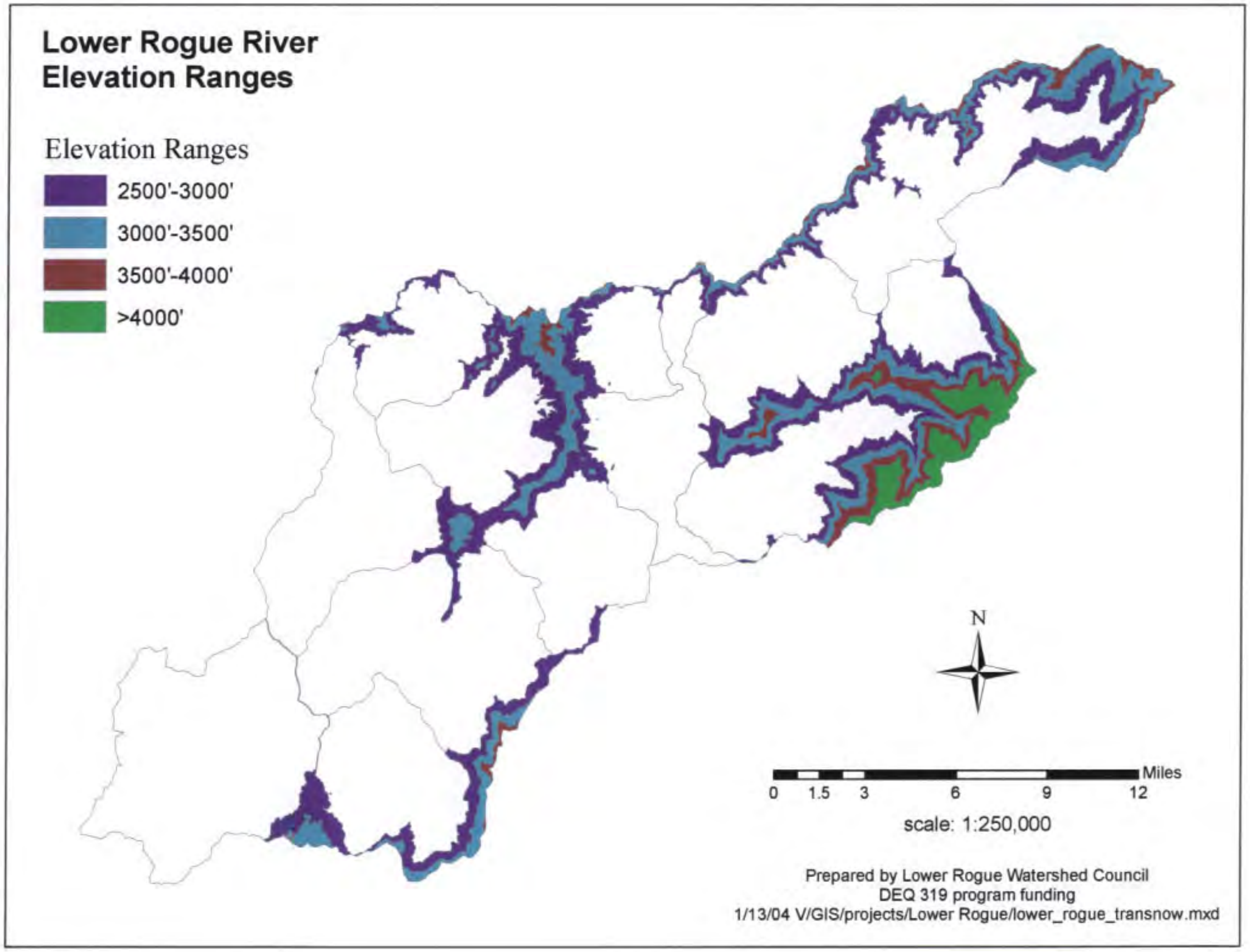

Lower Rogue River
Elevation Ranges
Elevation Ranges
2500'-3000'
3000'-3500'
3500'-4000'
>4000'
N
Miles
0 1.5 3 6 9 12
scale: 1:250,000
Prepared by Lower Rogue Watershed Council
DEQ 319 program funding
1/13/04 V/GIS/projects/Lower Rogue/lower_rogue_transnow.mxd

Table 11.5 WAAs with >20% Harvest in the Transient Snow Zone

Subwatershed	Watershed Analysis Area		Percent of Transient Snow Zone Harvested
	Code	Name	
Quosatana	19Q	Quosatana Creek	21
Lower Middle Rogue Mainstem	21L03W	Bradford Creek	34
	21L05W	Wakeup Rilea Creek	53
	21L06F	Rogue face above Wakeup Rilea Creek	37
Upper Middle Rogue Mainstem	21U02F	Rogue face above Nail Keg	20
	21U05F	Painted Rock Creek	36
	21U06W	Rogue face above Painted Rock Creek	56
Foster Creek	22F05W		20
	22F06W		41
Shasta Costa	22S09W		20
	22S10W		25
Lower Upper Rogue Mainstem	22M03W	Waters Creek	21
	22M06W	Twomile Creek	58
	22M07W	Twomile Creek	24
	22M08F		26
Middle Upper Rogue Mainstem	23L08F	East Creek	38
Lower Lobster Creek	20L06W	Deadline Creek	71
	20L07F	Fall Creek	65

Table 11.5 continued

Subwatershed	**Watershed Analysis Area**	**Percent of Transient Snow Zone Harvested**	**Subwatershed**
	Code	**Name**	
North Fork Lobster Creek	20N01F		72
	20N02F		27
	20N03F		42
	20N04F		37
	20N05F		37
	20N07F		36
South Fork Lobster Creek	20S04W	Boulder Creek	22
	20S06W		25
	20S07W		48
	20S08W		77

D1 URBAN AND RESIDENTIAL LAND USE

Agricultural practices have most often been implemented along valley bottoms, floodplains, and other adjacent low-gradient lands. An often long-lasting change in the vegetative cover occurs from the conversion of the landscape from forested woodlands, prairie grasslands, or other natural environs, to agricultural use. Clearing for pasture or crop production has also entailed land-leveling of topographic changes of the landscape. Leveling and field drainage has resulted in the elimination of many wetlands and depressions that previously moderated flood peaks by providing temporary storage. Without wetlands and depressions, surface and subsurface runoff move more quickly to the channel network.

Common channel modifications such as ditches, constructed to drain land, and channel straightening were created to maximize agricultural land use. These practices result in increased velocities of surface and subsurface flows that correspondingly decrease infiltration opportunities. Decreased infiltration produces increased runoff and subsequent decreased baseflows during the low-flow season.

The impact of agriculture on hydrology is dependent on specific practices such as the type of cover and management treatments, as well as the characteristics of the soil being farmed. Practices that change infiltration rates are most likely to change the hydrologic regime. The infiltration rates of undisturbed soils vary widely. Agriculture has a greater effect on runoff in areas where soils have a high infiltration rate compared to areas where soils are relatively impermeable in their natural state (USDA 1986).

The Natural Resouces Conservation Service (NRCS) has characterized and mapped the soils throughout the state. As part of the mapping process, soils are classified into one of the four hydrologic soil groups primarily as a function of their minimum infiltration rate on wetted bare soil. As part of the NRCS methods (USDA 1986), runoff curve numbers are assigned to areas for each of the combination of three parameters: (1) soil group, (2) cover type, and (3) treatment or farming practice.

Runoff curve numbers are used as part of a simplified procedure for estimating runoff in small agricultural and urban watersheds (USDA 1986). Curve numbers are assigned based on factors such as soils, plant cover, and impervious area. Rainfall is converted to runoff using curve numbers.

Certain soil conditions can make farming difficult, so amending the soil structure by adding organic matter becomes a way in which farmers can maximize the use of their land. This practice can actually change the hydrologic soil group from, say, a C to a B. To detect these changes at this screening level of assessments will be difficult. Voluntary actions and implementation of best management practices to improve the soil texture and water holding capacity can be a benefit to the farmer as well as to the hydrology of the watershed.

Impacts associated with the use of range lands can be assessed similarly to agricultural lands. Grazing animals can impact the infiltration rate of rangelands by removing protective plant material and compacting the soil surface. Cattle grazing on sparsely forested lands can have similar impacts. In general, moderate or light grazing reduces the infiltration capacity to 75% of the ungrazed condition and heavy grazing reduces the infiltration by 50% (Gifford and Hawkings 1979). There is no statistical distinction between the impact of light and moderate grazing intensities on infiltration rates and therefore they are combined for purposes of assessment (Gifford and Hawkings 1979).

NRCS Hydrologic Soil Group Classification (USDA 1986)

Low Runoff Potential	**Hydrologic Soil Group**	**Soil Characteristics**	**Minimum Infiltration Rate (mm/hr)**
	A	High infiltration rates even when thoroughly wetted. Deep, well-drained sands or gravels with a high rate of water transmission. Sand, loamy sand, or sandy loam.	8-12
	B	Moderate infiltration rates when thoroughly wetted. Moderately deep to deep, moderately well-drained to well-drained, moderately fine to moderately coarse textures. Silt loam or loam	4-8
	C	Slow infiltration rate when thoroughly wetted. Usually has a layer that impedes downward movement of water or has moderately fine to fine textured soils. Sand clay loam.	1-4
High Runoff Potential	D	Very low infiltration rate when thoroughly wetted. Chiefly clay soils with a high swelling potential; soils with a high permanent water table; soils with a clay layer near the surface; shallow soils over near-impervious materials. Clay loam, silty clay loam, sandy clay, silty clay, or clay.	0-1

D2 METHODOLOGY

Only the Lower Rogue Mainstem subwatershed has a sufficient percentage of rangeland to make an impact on hydrology at a subwatershed scale. The majority of this land is used for grazing cattle.

- Hydrologic soil groups were identified for the Lower Rogue Watershed using a GIS shapefile titled "Soils" (SWOP CD).
- Range land in the subwatershed was determined using the shapefile "Vegetation." (SWOP CD). Vegetation codes "urban agriculture" and "Young non-forest" were used to represent the total possible acres of range, and aerial photos and land ownership maps were used to exclude acreage if a different land use was present.
- Present conditions of range lands were classified as pasture, grassland, or range in continuous forage for grazing. The hydrologic condition was classified as fair based on the criteria of 50-75% cover and not heavily grazed. A curve number was assigned based on these conditions.
- The background, or historical, vegetation was determined from the shapefile "1900 vegetation" (SWOP CD). Based on these codes, the majority of the present day rangeland was classified as a Brush (brush-weed-grass mixture) cover type in "good" condition based on the criteria of >75% ground cover. A curve number was assigned to background vegetation based on these conditions.
- The 2-year, 24 hour precipitation (i.e. annual maximum 24-hour precipitation with a recurrence interval of 2 years, or 50% probability of occurring in any given year) was estimated for each subwatershed. This information was obtained from a GIS shapefile titled "Precipitation Intensity in/24 Hr" (SWOP CD).
- Using the current curve number and rainfall depth, runoff depths were identified for background and current cover types.
- Change in runoff depth from background conditions to current conditions was calculated for each soil group.
- The weighted average change in runoff depth from background was computed using the soil groups showing the largest change. These were soil groups A, B, and D. This was calculated as the sum of the percent occurrence of each hydrologic soil group multiplied by its change from background.
- A potential risk was assigned based on the change in runoff depth from background from the following guidelines.

Potential Risk for Peak-Flow Enhancement in Agriculture and/or Rangelands

Change in Runoff from Background (inches)	Relative Potential for Peak-Flow Enhancement
Westside watersheds	
0 to 0.5	Low
0.5 to 1.5	Medium
>1.5	High

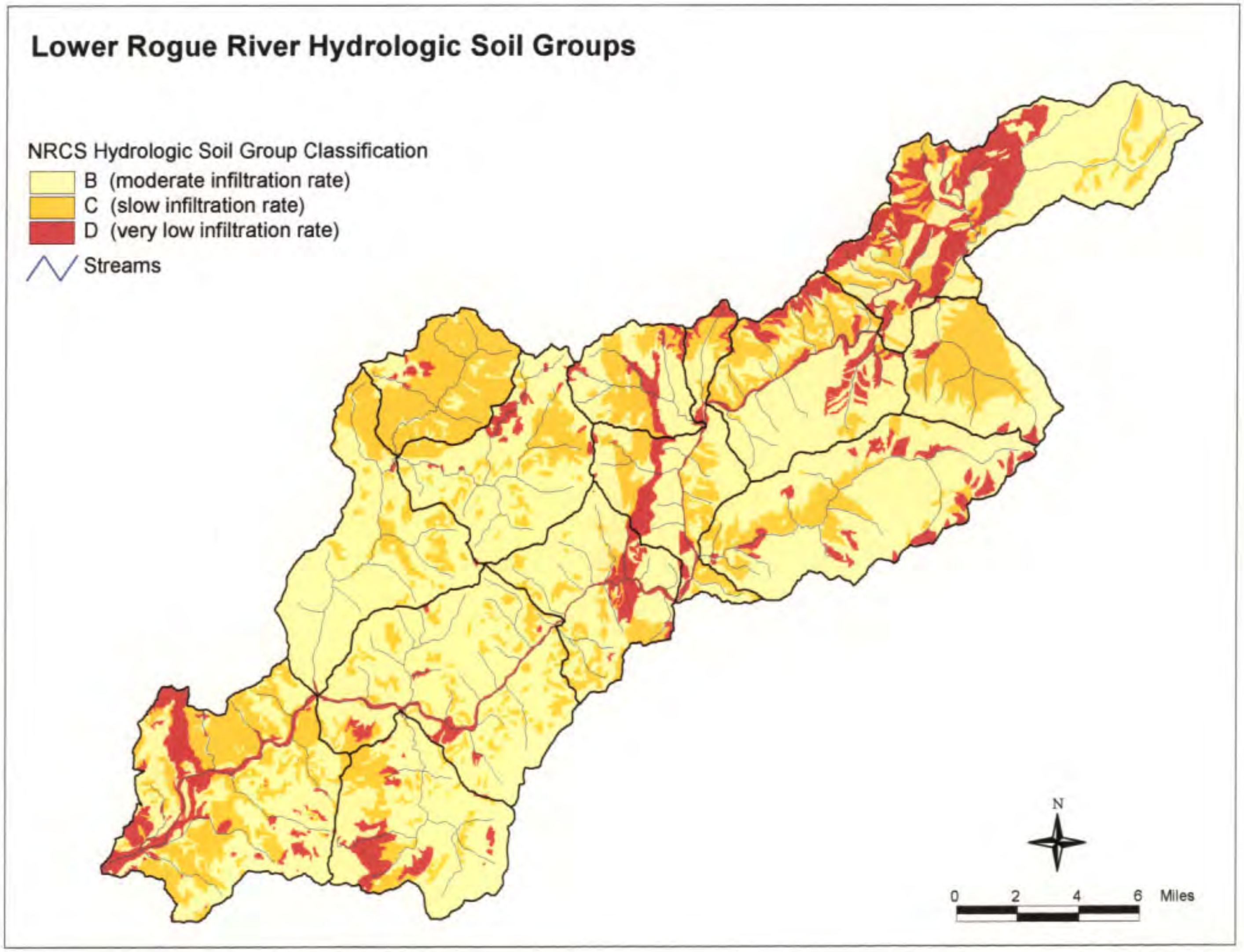
D3 RESULTS

Table 11.6 Agriculture/Range Land Use Summary for the Lower Rogue Mainstem

Subwatershed	Total Area (Acres)	Area in Range		Hydrologic Soil Groups in Range							
				A		B		C		D	
Lower Rogue Mainstem	25,905	**Ac.**	**%**	**Ac.**	**%**	**Ac.**	**%**	**Ac.**	**%**	**Ac.**	**%**
		7,834	29	5	<1	3,584	46	1,887	24	2,359	30

Area in B (%)	Change from background	Area in C (%)	Change from background	Area in D (%)	Change from background	Weighted average change	Risk
45.75	1.48	24.08	1.05	30.11	0.84	1.18	Mod-erate

- Historic land use within current range lands in the Lower Rogue Mainstem included: Willow Swamp, Shore Pine Forest, Upland and Xeric Prairie, and Mixed Xeric Conifer. Runoff curves for woods in good condition were used as the background curve numbers for each hydrologic soil group.
- The potential risk of changing land use to range in the Lower Rogue Mainstem subwatershed is moderate.


Lower Rogue River Hydrologic Soil Groups
NRCS Hydrologic Soil Group Classification
B (moderate infiltration rate)
C (slow infiltration rate)
D (very low infiltration rate)
Streams
N
0 2 4 6 Miles

E1 FOREST AND RURAL ROAD IMPACTS ON HYDROLOGY

Road networks can alter the rate of infiltration on the road surface and potentially change the shape of the natural drainage. The surfaces of most forest roads are compacted soil that prevents infiltration of precipitation. Forest road networks primarily change runoff timing by replacing subsurface with surface runoff pathways (e.g., roadside ditches) (Bowling and Lettenmaier 1997). Roads can also intercept and divert overland flow and shallow subsurface flow, potentially rerouting the runoff from one small sub-basin to an entirely different subbasin (Harr et al. 1975 and 1979). Roads can potentially impact peak flows during rainfall events, rain-on-snow events, or spring snowmelt; therefore, the determination of percent of basin occupied by roads provides useful information regardless of the way in which peak flows are generated.

Rural roads associated with either agriculture or rangelands can also affect streamflow and will be characterized in a similar manner as forest roads. Roadside ditches are more structured and maintained along rural roads and can significantly extend the stream network density, because their presence is additional to the natural channel. However, if natural channels are altered through straightening or channelizing, the stream network length may decrease. Channelizing streams results in increased velocities and potentially increases erosion rates of the banks and bed.

Roads along stream channels restrict lateral movement and can cause a disconnection between the stream or river and its floodplain. Restricting lateral movement can result in down-cutting of the channel and decreased accessibility of flood waters to over-bank storage, resulting in decreased flood peak attenuation.

E2 INTRODUCTION

The focus of the first part of the road assessment is to determine the quantity of roads within the watershed but does not account for the condition of the roads.

E3 METHODOLOGY

1. Total watershed area and total area of forestry (total, public, and private), and urban/agricultural use of each subwatershed was determined using GIS analysis. See Land Use Summary for details.
2. Total linear distance of forest roads and rural roads were determined using GIS analysis of the shapefile “Sixhucs” (SWOP CD) that additional road information was added to.
3. The roaded area of each subwatershed was determined assuming an average width of 25 feet for forest roads and 35 feet for rural roads as suggested in the OWEB Watershed Assessment Manual (1999).

4. The percent of area occupied by roads in each subwatershed was computed.
5. A relative potential for forest and rural road impacts was assigned. Areas with <4% were determined to be low risk, those with 4-8% moderate risk, and >8% high risk.
6. Watershed Analysis Areas within public ownership and managed by the USFS were evaluated for potential peak flow enhancement. Areas with less than 3.0 miles per square mile are considered low risk, 3.0-5.0 miles per square mile as moderate risk, and over 5.0 miles per square mile as high risk for contribution to increased peak flows.

E4 RESULTS

- All subwatersheds had a "Low" potential risk of hydrologic impacts from forest roads when all forested land was considered.
- Public forest lands within all subwatersheds had a "Low" potential risk of hydrologic impacts when evaluated according to the OWEB Watershed Assessment Manual protocol (1999). USFS Analyses were evaluated, and Table 6.7 lists watershed analysis areas at moderate risk for peak flow enhancement. There were no watersheds in the high risk category.
- Private forest lands within the Lower Middle Rogue and Quosatana subwatersheds both had a "High" potential risk of hydrologic impacts with 53% and 13% of the area in roads, respectively. The Lower Middle Rogue has 73.2 miles of road in an area of 0.7 mi^2. The majority of this area is in the Silver Creek drainage. The Lower Rogue Watershed Council has completed road inventories on 34.0 road miles within this drainage.
- Road area within Urban/agriculture land uses resulted in a "moderate" potential risk of hydrologic impacts in the Lower Rogue Mainstem, and "high" ratings in the Upper Middle Rogue and Foster Creek subwatersheds. Both the Upper Middle Rogue and Foster Creek have less than 10 acres in this land use.

F KEY FINDINGS

- Private timber lands within the Silver Creek drainage (Lower Middle Rogue Mainstem) should be a priority for completing road inventories and road repairs in the next few years.
- Urban/agriculture lands in the Upper Middle Rogue Mainstem and Foster Creek subwatersheds have a high risk for road impacts within small areas (<10 acres). These areas should also be a priority for completing road inventories and associated road repairs.
- Harvest in the transient snow zone and with road construction may have affected the hydrology of some forested areas as shown above. When both of these factors are present in a watershed area, it may give us a way to prioritize hydrologic restoration activities such as road decommissioning, vegetation planting, or precommercial thinning in riparian areas where it

is beneficial to restore the flow regime and stabilize banks (USFS 1996). Ranks were assigned to each WAAs for percent harvest in the transient zone and road density (1 indicating the highest combined harvest and road density). The top five areas are shown in Table 6.8. Other factors should also be considered such as geology, soil depth, slope, configuration of drainages, and proximity to fish bearing streams and may affect these rankings.

Table 11.7 Road densities >3.0 miles per square mile on USFS managed lands in the assessment area.

Subwatershed	**Watershed Analysis Area**		**Road Density (Mi/Sq Mi)***
	Code	**Name**	
Lower Middle Rogue Mainstem	19F04F	Face between Quosatana and William Miller	4.0
	21 L01F	Rogue face above Quosatana	3.3
	21L05W	Wakeup Rilea Creek	5.0
	21L06F	Rogue face above Wakeup Rilea Cr.	3.3
Upper Middle Rogue Mainstem	21U03W	Bridge Creek	3.3
	21U05F	Painted Rock Creek	3.3
	21U06W	Rogue face above Painted Rock Creek	4.0
	21U08W	Rilea Creek	3.7
Foster Creek	22F01W		3.3
	22F02W		4.2
	22F05W		3.2
	22F06W		3.3
Shasta Costa	22S03W		5.0
	22S9W		4.1
	22S17W		4.0

Table 11.7 continued

Subwatershed	**Watershed Analysis Area**		**Road Density (Mi/Sq Mi)***
	Code	**Name**	
Lower Upper Rogue Mainstem	22M02W	Snout Creek	3.8
	22M06W	Twomile Creek	3.8
	22M07W	Twomile Creek	3.3
Lower Lobster Creek	20L01W		3.3
	20L03W		3.7
	20L05W		3.1
	20L06W	Deadline Creek	3.1
	20L07F	Fall Creek	3.7
	20L010W		3.3
North Fork Lobster Creek	20N04F		3.2
South Fork Lobster Creek	20S02W		4.0
	20S03W		3.5
	20S09W		3.3

*Based on USFS managed lands only.

Table 11.8 Watershed Analysis Areas combined rankings for harvest and road density.

Subwatershed	WAA	Rank
Lower Middle Rogue Mainstem	Wakeup Rilea Creek*	1
Lower Upper Rogue Mainstem	Twomile Creek (22M06W, 22M07W)	1 and 2, respectively
Upper Middle Rogue Mainstem	Rogue face above Painted Rock Cr.*	2
Lower Lobster Creek	Fall Creek*	2

*Private lands are also present in these WAAs. Fall Creek is mostly private with some public lands managed by the Bureau of Land Management.

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XII WATER USE

A BACKGROUND (GWEB 1999)

Water Law and Water Use

Any person or entity withdrawing water from a stream or river must have a water right from the Oregon Water Resources Department (OWRD). These water rights are in various levels of use and certification or adjudication. For example, there are certificates, applications for certificates, water rights on record and not being used, and rights not using their entire full entitlement. Each water right has an instantaneous flow amount (the maximum rate at which water can be withdrawn at any point in time), an annual volume restriction (water duty), and a designated beneficial use, including agriculture, domestic, urban, industrial, commercial, fish and wildlife, power, recreation, etc. Water law in the State of Oregon is based on the Prior Appropriation Doctrine or "first in time, first in right," subject to the physical availability of water and the ability to put it to beneficial use without waste. The most senior appropriator (the right with earliest date) has a right to divert water prior to any junior right (a later date). The most senior right is the last one to be shut off from diverting water during low stream flows.

In general, agriculture places the greatest demand on our state water resources compared to other uses. Water is required for irrigation of crop lands (e.g., cranberry production), pasture and stock watering. In most cases, the period of high demand for irrigation coincides with the period of low streamflow; crop water requirements tend to peak in August, when streamflows are usually the lowest. Water withdrawals are applied to the crop lands for irrigation, and part of that water is used by the crop (evapotranspiration), a portion percolates to deep ground water, and a portion may be returned to another watershed. The total portion not returned to the river is called consumptive use. The portion of the diversion that returns to the stream system through surface and subsurface avenues at points downstream is called return flow.

Urban water supply can provide for residential, commercial, and some industrial uses. Water is diverted, treated, and then distributed throughout a municipality. Subsequently, the wastewater is delivered to a sewage treatment facility where it is treated to a "primary" or "secondary" level and discharged to a stream or bay at a distinct location.

In residential settings, for example, water is not actually consumed but returned to the stream network from wastewater facilities. An exception to this is lawn watering which may infiltrate to groundwater. Lawn-irrigation return flow occurs through subsurface avenues.

National Forests, National Parks, US Bureau of Land Management lands, Indian reservations, etc., are federal reservations. These entities maintain federal reserved rights for the purposes for which the reservations were established. Their priority date is the date the reservation was created. In many cases, reservations were established in the mid to latter part of the 19th century. Many of the federal reservation rights have been tried in the courts of law, and, more often than not, case law has set precedent of adjudicating (to settle judicially) federally reserved water rights. (Winters Doctrine).

Water Rights

There are three primary types of surface water rights: (1) out-of-stream rights, (2) storage rights, and (3) in-stream rights. Out-of-stream rights are also called "direct flow" or "run of the river" diversions. These rights entail withdrawing water directly from the channel with subsequent application for a specific beneficial use such as irrigation, domestic or urban water supply, industrial use, etc. Storage rights can be for on-stream or off-stream reservoirs. On stream reservoirs capture water as it flows into the reservoir. Water is stored until it is needed for the specified beneficial use, at which time it is released either into the channel and withdrawn downstream or released into the river to the storage site, and subsequent release and conveyance to the point of use. In-stream rights are those that require a designated quantity of water to remain in the stream or river for a specified beneficial use, most often for aquatic resources, wildlife, or aesthetics.

Water withdrawals reduce streamflows, potentially resulting in a negative impact on the biologic resources, particularly during the low-flow season. In recent years, in-stream water rights have become more common as a means of protecting the biologic resources. In-stream water rights did not exist in Oregon prior to 1955. Minimum flows were established by administrative rule in 1955, but they did not carry the full weight of a water right. Between 1955 and 1980, the Oregon Department of Fish and Wildlife conducted basin investigations from which minimum flows were recommended and adopted by rule. In 1987, the legislature changed the administrative rulemaking into an application process for a water right. OWRD holds the water right, but ODFW, Department of Environmental Quality, and State Parks can apply for an in-stream right. Minimum flows were changed into in-stream rights, and the date minimum flows were adopted became the priority date. The in-stream rights can have the value up to but not exceeding the median flow. In-stream rights tend to be junior to the majority of the out-of-stream water rights; this reduces their ability to maintain effective streamflows in the channel. If federal reserved rights for in-stream flows have been adjudicated, they would usually have the most senior right in the basin, because federal reservations were established before the implementation of the Prior Appropriation Doctrine.

Water users with large demands generally have storage rights, because reservoirs provide a more certain supply during low-streamflow conditions. The ability to capture streamflow during the high flows and use it during low flows can be a significant benefit to water users. In some instances, reservoirs are constructed as flood control facilities to provide attenuation of the peak flows and reduce downstream flooding and damage.

Groundwater rights are those attached to the withdrawal of water from a well. With some exceptions, all water users extracting groundwater as the source of supply must have a water right for the legal use of water. There are exempt uses that do not require a right. The most significant of these is rural residential water users; these users are limited to 15,000 gallons per day for noncommercial use and irrigation of less than 0.5 acres.

Groundwater has the potential to influence surface water by what is called hydraulic continuity. Depending on the location of the well and the geology in the area, water withdrawn can have a corresponding effect on the streamflow. In other words, it is possible for the extraction of groundwater to dry up a nearby stream during low flows. Consequently, the State of Oregon manages surface and groundwater rights conjunctively, which means there are times at which groundwater withdrawals will be shut down due to low flows in the channel.

Storage

Man-made storage facilities such as water supply reservoirs, flood control reservoirs, or multipurpose reservoirs impact the peak flows downstream of the impoundment. Each reservoir has its unique operating scheme, and therefore requires more detailed hydrologic investigations, often including release schedules, reservoir routing, etc.

Water Availability

The OWRD has developed a computer model, Water Availability Report System (WARS), which calculates water availability for any of their designated water availability basins (WABs) in the state. Water availability, as defined by the OWRD, refers to the natural streamflow minus the consumptive use from existing rights. It is the amount of water that is physically and legally available for future appropriation. If water is available, additional in-stream or out-of-stream rights may be issued. This value is dynamic and is often updated to account for issuance of new water rights.

The WARs program produces both the 80% exceedance and the 50% exceedance flows, along with the associated water availability under each condition. The 50% exceedance flow is the same as the median flow value. The median flow value means half the time the natural flows are above this value and half the time flows are below this value. The 50% exceedance flows were those used as an upper limit in developing in-stream rights for aquatic species and other in-stream beneficial uses. Water rights for out-of-stream use are issued only when water is available at the 80% exceedance level. (*This assessment considered only water availability at the 50% exceedance flows.)*

Salmonid Fish Considerations

Potential channel dewatering (zero flow in the channel) can present problems for spawning and fish passage. Typically, the spawning period that coincides with the lowest flow begins on approximately September 1 and extends through October. Rearing habitat in the summer also requires flow levels to be maintained. While these are the critical times of the year, flow levels throughout the year need to be maintained to cover all life stages of all species present in a watershed.

Streamflow Restoration Priority Areas

Oregon's Departments of Fish and Wildlife and Water Resources collaborated to develop the Streamflow Restoration Priority Areas (SRPA). This effort was an outcome of the Oregon Plan (1997), which is the broader framework for the Coastal Salmon Restoration Initiative (CSRI). The CSRI mission is to restore coastal salmon populations and fisheries to sustainable levels. Three major factors were identified in CSRI as exacerbating the loss of fish populations: (1) fish resources, (2) fish habitat, and (3) loss of streamflow. The loss of streamflow is the focus of the SRPA analysis.

The identification of priority areas was based on a combination of biological factors and water use. ODFW identified priority areas to enhance fish populations. A rank was assigned to three categories under fisheries: (1) fish resources; (2) habitat integrity; and (3) risk factors such as listing under the Endangered Species Act, in-stream flow protection, or natural low-flow problems. OWRD identified areas in which an opportunity existed to enhance in-channel flows, situations under which water could by saved through conservation, efficiency of use, etc. The criteria for water resources were assigned to two categories: (1) consumptive use by percentage of the median (50% exceedance) streamflow, and (2) number of months an in-stream water right is not met. A priority was established based on the combination of the two resulting factors: "need" (fisheries) and "optimism" (water resources). Determination of the Flow-Restoration Priorities requires that the "need" rank 3 or 4 and the "optimism" rank 2, 3, or 4. In the need and optimism column, 1 is the lowest rank and 4 is the highest.

B INTRODUCTION

Water use is generally defined by beneficial use categories such as municipal, industrial, irrigation, etc. The water use assessment summarizes the water rights in the Lower Rogue area using the OWRD Watershed Analysis Basins. These basins may not correspond to the subwatersheds outlined elsewhere in this document.

Water rights information was compiled from the OWRD Water Rights Information System (WRIS) files. Information was summarized and sorted by use and priority date for use in the assessment.

C METHODOLOGY

Water rights

- Water rights information was accessed through the OWRD Water Rights Information System (WRIS) files. Individual rights by WAB were collected and sorted by beneficial use. Out-of-stream and storage rights are summarized in Table 12.1. In-stream rights are summarized in Table 12.2.

Point of Use

- Point of use (POU) information was collected from the Southwest Oregon Province Resource Information GIS Data CD Set for the Rogue/South Coast Assessment Unit. POUs greater than one acre for a water right are summarized by subwatershed.

Water Availability Summaries

- Water Availability Reports were obtained from the OWRD web site.
- Net water available at the 50% and 80% exceedance levels for each WAB in the assessment area is summarized in Tables 12.3 and 12.4, respectively.

Streamflow-Restoration Priority Areas

- Streamflow Restoration Priority Areas for the assessment area was accessed from the Southwest Oregon Province Resource Information GIS Data CD Set for the Rogue/South Coast Assessment Unit and is summarized in Table 12.5. Table 12.6 summarizes ODFW's ranking of habitat status in the context of streamflow restoration.

D RESULTS

Table 12.1. Water Rights Summary

Water Use Category	CFS				Acre-Feet (Storage)			
	Rogue	Foster	Mule	Illinois	Rogue	Kelsey	Mule	Illinois
Wildlife			0.033		0.1163	0.1866		
Recreation	0.015	0.005			2			
Power	0.0014							
Municipal	12.72							
Miscellaneous					1.5106	0.3732	0.3522	0.5
Mining	15			0.03				
Livestock	0.043				8.77			
Irrigation	1.858	1.887	0.067	0.787	83.397			
Industrial							0.334	
Domestic	1.3311	0.09	0.01	0.157	4			
Commercial	0.544							

Note: **Rogue** includes WABs 266 and 31531008. WABs not listed do not have water rights beyond in-stream.

Table 12.2. In-Stream Water Rights

Date of Allocation	Rogue River	Rogue River	Kelsey Creek	Stair Creek	Foster Creek	Mule Creek	Lawson Creek	Illinois River
Date of Right →	5/22/1959	2/24/1966	10/1/92	10/1/1992		12/7/90	12/7/1990	10/1/92
Description →	Rogue and its tribs above mouth	Rogue and its tribs above mouth					River Mile 4 to mouth	River Mile 25 to mouth
JAN-MAR	735.0	935.0	34.0	34.0	34.0	42.0	120.0	850.0
APR	735.0	935.0	34.0	34.0	34.4	42.0	120.0	850.0
MAY 1-15	735.0	935.0	18.3	33.6	42.0	32.9	72.5	850.0
MAY 16-31	735.0	935.0	18.3	20.0	11.1	25.0	70.0	500.0
JUN	735.0	935.0	6.8	16.7	6.4	17.2	36.8	500.0
JUL	735.0	935.0	2.8	5.8	2.0	6.0	20.2	335.0
AUG	735.0	935.0	1.5	2.6	0.8	2.9	12.6	249.0
SEP	735.0	935.0	1.6	2.0	0.4	2.4	10.0	208.0
OCT	735.0	935.0	3.0	4.9	0.9	5.7	17.3	352.0
NOV	735.0	935.0	15.8	20.0	12.6	42.0	114.0	850.0
DEC	735.0	935.0	34.0	34.0	42.0	42.0	120.0	850.0

Table 12.3. Water Availability at the 50% Exceedance Level for the 8 Water Availability Basins (WABs) in the Lower Rogue Watershed.

Month	Rogue River-At Mouth	Rogue River-AB Shasta Costa	Foster Creek	Stair Creek	Kelsey Creek	Mule Creek	Illinois River-At Mouth	Lawson Creek
	266	31531008	73386	72850	72849	71029	71031	71031
JAN	8790.0	2560.0	27.8	88.0	32.9	141.0	3550.0	132.0
FEB	11300.0	3680.0	47.6	121.0	52.8	191.0	4680.0	212.0
MAR	8540.0	2270.0	21.8	88.0	31.8	130.0	3690.0	141.0
APR	7020.0	2010.0	-0.3	45.6	8.7	62.0	2240.0	46.0
MAY	4970.0	2110.0	-0.2	0.0	0.0	7.0	1060.0	00.0
JUN	1760.0	222.0	-0.3	0.0	0.0	0.0	407.0	0.0
JUL	179.0	-583.0	-583.0	-583.0	-583.0	-583.0	21.4	0.1
AUG	-876.0	-1391.0	-1391.0	-1391.0	-1391.0	-1391.0	-24.6	-876.0
SEP	-837.0	-1350.0	-1350.0	-1350.0	-1350.0	-1350.0	-16.7	-837.0
OCT	700.0	-37.3	-37.3	-37.3	-37.3	-37.3	-6.2	-6.2
NOV	1370.0	-978.0	-978.0	-978.0	-978.0	-978.0	528.0	0.0
DEC	8490.0	2740.0	10.3	60.9	14.50	97.0	3160.0	113.0

Table 12.4. Water Availability at the 80% Exceedance Level for the 8 Water Availability Basins (WABs) in the Lower Rogue Watershed.

Month	Rogue River-At Mouth	Rogue River-AB Shasta Costa	Foster Creek	Stair Creek	Kelsey Creek	Mule Creek	Illinois River-At Mouth	Lawson Creek
	266	31531008	73386	72850	72849	71029	72845	71031
JAN	2560.0	-265.0	-265.0	-265.0	-265.0	-265.0	638.0	-17.0
FEB	4660.0	286.0	-2.8	40.0	7.4	66	1950.0	57.0
MAR	3940.0	108.0	-4.3	41.5	6.8	63	1460.0	19.0
APR	2990.0	-40.4	-40.4	-40.4	-40.4	-40.4	579.0	-35.5
MAY	2840.0	766.0	-3.0	-10.7	-6.5	-7.3	404.0	-25.4
JUN	288.0	-778.0	-778.0	-778.0	-778.0	-778.0	171.0	-9.9
JUL	-431.0	-1003.0	-1003.0	-1003.0	-1003.0	-1003.0	-62.6	-431.0
AUG	-1206.0	-1571.0	-1571.0	-1571.0	-1571.0	-1571.0	-66.6	-1206.0
SEP	-1187.0	-1590.0	-1590.0	-1590.0	-1590.0	-1590.0	-53.7	-1187.0
OCT	20.0	-317.0	-317.0	-317.0	-317.0	-317.0	-141.0	-141.0
NOV	-931.0	-1868.0	-1868.0	-1868.0	-1868.0	-1868.0	-892.0	-931.0
DEC	1940.0	-423.0	-423.0	-423.0	-423.0	-423.0	328.0	-29.3

Table 12.5. Streamflow Restoration Priority Area Rankings

WAB	Stream	Summer		Fall		Winter		Spring	
		Needs	Optimism	Needs	Optimism	Needs	Optimism	Needs	Optimism
266	Rogue at Mouth	1	1	1	1	1	1	1	1
31531008	Rogue-AB Shasta Costa	3	1	1	1	1	1	2	1
73386	Foster Creek	4	2	2	1	1	1	2	1
72850	Stair Creek	1	1	1	1	1	1	1	1
72849	Kelsey Creek	1	1	1	1	1	1	1	1
71029	Mule Creek	2	1	1	1	1	1	1	2
72845	Illinois River	4	1	1	1	1	1	1	1
71031	Lawson Creek	4	1	1	1	1	1	1	1

Table 12.6. Habitat status for WABs in the assessment area.

WAB	Stream	Current				Potential			Potential Future			
		5-7	8-9	10-11	12-15	0-1	2	3	5-8	9-11	12-13	14-18
266	Rogue at Mouth				X			X				X
31531 008	Rogue-AB Shasta Costa		X			X				X		
73386	Foster Creek			X				X				X
72850	Stair Creek			X		X				X		
72849	Kelsey Creek						X					
71029	Mule Creek			X			X					
72845	Illinois River				X		X					
71031	Lawson Creek				X		X				X	

E KEY FINDINGS

- The out-of-stream rights for the Lower Rogue Watershed total 33.6 CFS and <1 CFS for the Illinois and its tributaries within Curry County. The majority of out-of-stream water rights allocated are storage for irrigation (83.397 acre-ft.).
- Out-of-stream water rights allocated on the Lower Rogue before the establishment of the 1959 in-stream right total 19.657 CFS. Rights allocated between 1959 and the 1966 in-stream right total 2.56 CFS. Thus, 11.383 CFS are junior to the in-stream rights established for aquatic life and minimizing pollution.
- There are 0.892 cfs allocated within the Illinois River WAB in Curry County that are junior to the in-stream water rights on the Illinois.
- There are no allocated water rights on Lawson Creek besides the in-stream right.
- Points of use greater than 1 acre are located primarily in the Lower Rogue Mainstem subwatershed.
- Water is available at the 80% exceedance level for some months in some WABs. No water is available during the summer in any of the WABs.
- None of the WABs in the assessment area are a state priority for streamflow restoration. Foster Creek showed a "highest" need/priority ranking by the Oregon Department of Fish and Wildlife with a "moderate" ranking for flow restoration opportunities by the OWRD.

REFERENCES

GWEB 1999. Oregon Watershed Assessment Manual. Governor's Watershed Enhancement Board, July 1999.

I WATERSHED SYNTHESIS

The Lower Rogue Watershed is within the Coastal Uplands, California Coast Range Extension, and Coastal Siskiyou ecoregions. It shares many characteristics with other watersheds in Curry County, but is unique in being part of the Rogue Basin, and having the second largest drainage basin in Oregon. The Lower Rogue is 75% public ownership and primarily a forested landscape.

Channel habitat types are mostly steep and confined in 70% of the channels evaluated. These areas are important sources of future large wood. A little over 6%, or 31 miles, of stream are identified as highly responsive/sensitive types, with most of these being in the Lower Rogue Mainstem subwatershed, which is 86% private land.

Stream habitat surveys indicate the lack of wood is a limiting factor for fish habitat in the watershed. Future large wood from riparian areas may be limited by the extensive alder and hardwood regeneration that occurred after timber harvest in the 1960s and 1970s before current forest practices were in place that required replanting. Hardwood thinning in some areas with underplanting of shade-tolerant conifers might be an option.

Water quality in the Lower Rogue Watershed is generally good. The Lower Rogue mainstem is limited by temperature, dissolved oxygen, biochemical oxygen demand, nutrients, and total solids from non-point sources and upstream land uses. Interestingly, the total solids standard is set at a higher limit for the Rogue Basin than South Coast streams, and this includes tributaries in the Lower Rogue subwatershed. This is not because we expect higher total solids coming from the tributaries, but because the standard is set on a basin scale. Nearly all of the total solids measurements on tributaries fail to meet the stricter South Coast standard, but only Tom Fry, Quosatana, Foster and Hicks Creeks are limited under Rogue Basin standard.

Foster, Indian, Quosatana and Shasta Costa Creeks, as well as the Rogue River are listed with the State of Oregon as being limiting for temperature. While there is argument in some areas whether temperatures ever met the standard, increased sedimentation and associate widening of the channel and changes in the quality of riparian shade are the primary reasons for increased water temperatures. Sedimentation can also impact fish habitat through loss of spawning gravel, filling of pools, and smothering redds.

Sedimentation in the Lower Rogue Watershed is contributed to naturally and through land-uses. The geology and abundant precipitation in many of the ecoregions can lead to high erosion rates and landslides, especially due to slump-earthflows, and are often the dominant erosion processes in many areas of the basin. The Lower Rogue had extensive logging with associated road building in the 1960s and 1970s. Timber removal from landslide prone areas, and associated roads crossings, has been a problem.

The Lower, Upper Middle, and Lower Upper Rogue Mainstem subwatersheds, as well as Lower Lobster Creek and Foster Creek subwatersheds ranked high for potential road sediment impact on private lands. The Upper Middle Rogue Mainstem ranked the highest for potential road related impacts. Sedimentation problems are noted in macroinvertebrate surveys on Stair, Foster, Lobster, Quosatana and Shasta Costa Creeks and are affecting riffle habitats (based on stream surveys) in Shasta Costa, the east fork of Quosatana, Foster, and Nail Keg Creeks. Total solids, another indicator of sedimentation, were "moderately impaired" on the mainstem Rogue River, Tom Fry, Quosatana and Foster Creeks and "impaired" on Hicks Creek (enters Rogue at RM 37). Macroinvertebrate and stream habitat surveys have not been conducted on most streams in the watershed, but results of sedimentation were found to be limiting in Foster, Lobster, Quosatana, and Shasta Costa Creeks.

Riparian shade was over 40% on more than 75% of the streams evaluated (private lands). Low shade areas were concentrated on streams low in the watershed with residential and agricultural land uses. Lobster Creek is primarily forested land and has a water quality management plan to address temperature limitations through decreasing sediment inputs and good management of the riparian areas. According to temperature and vegetation modeling, the Lobster Creek watershed has a potential shade increase of 4%, with most of the increase predicted on private timber lands. Riparian areas in Saunders Creek have conifer or mixed forest composition higher in the watershed, although this area has been heavily harvested. Riparian composition is mostly brush and shade is low as the creek runs through the residentially developed areas. Indian Creek is undeveloped higher in the watershed, except for roads, but riparian forest composition is small hardwoods.

Conifer planting along riparian areas within the California Coast Range Extension may be particularly important to address large wood and temperature issues. This ecoregion covers the entire Lobster Creek watershed, the lower mainstem of Quosatana Creek, Silver Creek in the Lower Middle Rogue subwatershed, and portions of Libby, Indian, Saunders, Jim Hunt and Kimball Creeks within the Lower Rogue Mainstem subwatershed. Historic vegetation in these areas was described as a "Mixed Xeric Conifer" forest in the Government Land Office Survey with western red cedar, western hemlock, and seral Douglas-fir. Today, Douglas-fir plantations are prevalent and riparian areas are often dominated by hardwoods, especially red alder. Natural conifer regeneration is uncommon in the riparian areas unless the streamside areas are disturbed and competing hardwoods and brush are controlled. These areas may be a good candidate for hardwood thinning and brush control with conifer underplanting, especially on areas with low shade. Other ecoregions in the watershed are noted as commonly having natural riparian conifer regeneration, except where tanoak becomes established.

Stream habitat surveys have not been completed on channels that are highly sensitive to disturbance, most of which lie in the Lower Rogue Mainstem subwatershed and have been subject to the most disturbance from development and agricultural development. Large woody debris removal, sedimentation, and changes in land use that increase peak flow runoff can result in loss of channel roughness, pool filling and loss of complexity of bed form, and channel widening or deepening. From the assessment we know that the Lower Rogue Mainstem had large wood removal, has a high density of roads on steep slopes and has been heavily harvested in many areas, and has a moderate risk of increased peak-flows from a change in land use to range. Residential development in some areas has also likely impacted peak flows, although this was not thought to be significant on the scale of the Lower Rogue Mainstem subwatershed.

There are few major wetlands in the basin aside from the estuary, and these have been modified to various extents from agriculture and development. Questions remain as to the how limiting the estuary is to fish production in the basin. Chinook are the main species of concern since they spend 3-4 months growing in the estuary before migrating out to the ocean. Some unanswered questions include changes in fish use in the estuary since development, what habitats have been lost, how seal populations impact the salmon, what water quality issues might exist, how current land use planning is succeeding at protecting remaining habitats, and what opportunities exist to protect or restore habitat.