Watershed Analysis of the

Sixes and New River Area

Coos and Curry County, OR

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Introduction and Purpose

The Sixes River- New River Frontal Watershed Analysis contains information that describes the past and present conditions of the two 5th field watersheds. This document incorporates data and analysis previously compiled within the Sixes River Watershed Analysis (USFS, 1997) and two Watershed Assessments (Maguire, 2001; 2001a) compiled by the South Coast Watershed Council in addition to new information that has become available since. The Sixes River and Floras Creek Watershed Assessments were prepared following the guidelines described in the *Governor's Watershed Enhancement Board's 1999 Draft Watershed Assessment Manual*. The assessments were accomplished through the combined effort of private citizens, watershed council members, contracted technical specialist and local state and federal government agencies. The Sixes River Watershed Analysis was conducted through an interdisciplinary team from the US Forest Service from the Powers Ranger District, Powers Oregon but did not include private lands. To fill that informational void The Sixes Assessment was conducted only on private lands.

The purpose of this analysis was to compile, summarize and synthesize existing data and information pertaining to Sixes River, Floras Creek and the New River Frontal watershed conditions. The interdisciplinary team focused on two Key Issues most relevant to the management of Riparian Reserves on Federal lands: The building of roads and the harvest of trees within the Riparian Reserves. Through the synthesis and interpretation of the information gathered, specific recommendations focusing on management within the Riparian Reserves, in addition to monitoring activities, will be the conclusion of this document.

All acreage determinations were developed from current Geographical Information Systems databases contained on USDI BLM servers. Some discrepancies occur between prior watershed delineations and the current database due to remapping and standardization of fifth and sixth field sized areas. Due to the geographical locations of BLM managed lands across the above landscape and the low percentage of the overall land base under the agency's control, this combined area has been chosen to summarize the processes found on the landscape.

I. WATERSHED CHARACTERAZATION

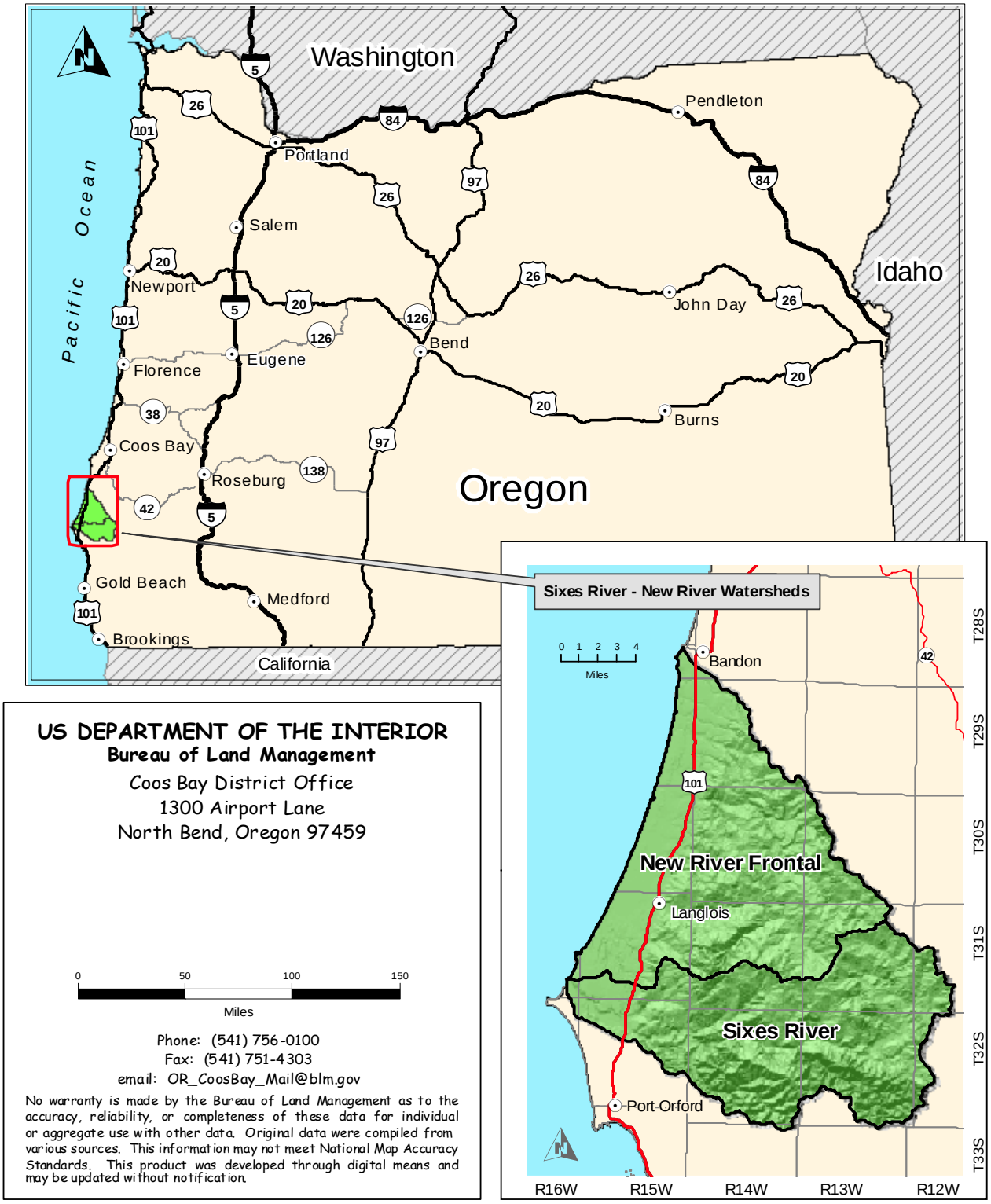
Introduction

The Sixes River watershed drains approximately 85,832 acres (134 square miles). Sixes River is situated almost entirely within Curry County except for a small area of the Upper Sixes Mainstem sub-watershed that extends into Coos County. This basin is among the larger watersheds on the southern Oregon coast. Flowing in a westerly direction Sixes River crosses Highway 101 and drains into the Pacific Ocean just north of Cape Blanco. Elevations in the watershed range from sea level to approximately 3,315 feet. The upper portion of the basin is characterized by steeply sloped forested areas with narrow valleys and tributary streams that have moderately steep to very steep gradient. Grazing, rural residential development and other agricultural uses are dominant in the lower portion of the basin. Approximately 69% of the watershed is in private ownership.

The New River Frontal watershed drains approximately 99, 375 acres (155 square miles). It is a combination of true frontal watersheds draining to the ocean and sixth field sub-watersheds located further inland. This watershed area is located in Coos and Curry Counties. The majority of the sub-watersheds are located within Floras Creek, a tributary of the New River basin. Floras Creek in combination with Floras Lake Frontal drains approximately 51,652 acres (70 and 11square miles respectively) of the basin.

Elevations in this watershed range from sea level to approximately 2,786 feet on Edson Butte. The upper portion of the basin is characterized by steeply sloped forested areas with narrow valleys and tributary streams that have moderately steep to very steep gradient. Grazing, rural residential development and other agricultural uses (including cranberry bogs) are dominant in the lower portion of the basin. Streams throughout the lower watershed have been diked, ditched, and drained for the past several generations to provide grazing land for sheep and cattle. Flow regimes have been considerably altered (through breaching to the ocean) in order to confine or reduce the impact of winter flooding and/or to increase areas available for pasture and cranberry production (ODFW 1995). Over 95% of the watershed is in private ownership.

Watershed areas are normally delineated as a series of nested areas with an ever larger area that drains to a common point. For the purposes of this analysis two Fifth field watersheds Sixes River and New River Frontal, with a common ridge top between them is the scale of analysis. Within the greater Sixes-New River Watershed Analysis area, private lands compose 84% of the total ownership. Federal lands amount to 15% of which the USFS manages 11.5% and the BLM manages 3.5%, 0.5% of lakes and shorelines are managed by the state and county. The Bureau of Indian Affairs manages one 6 acre parcel in the city of Bandon, an indiscernible area.



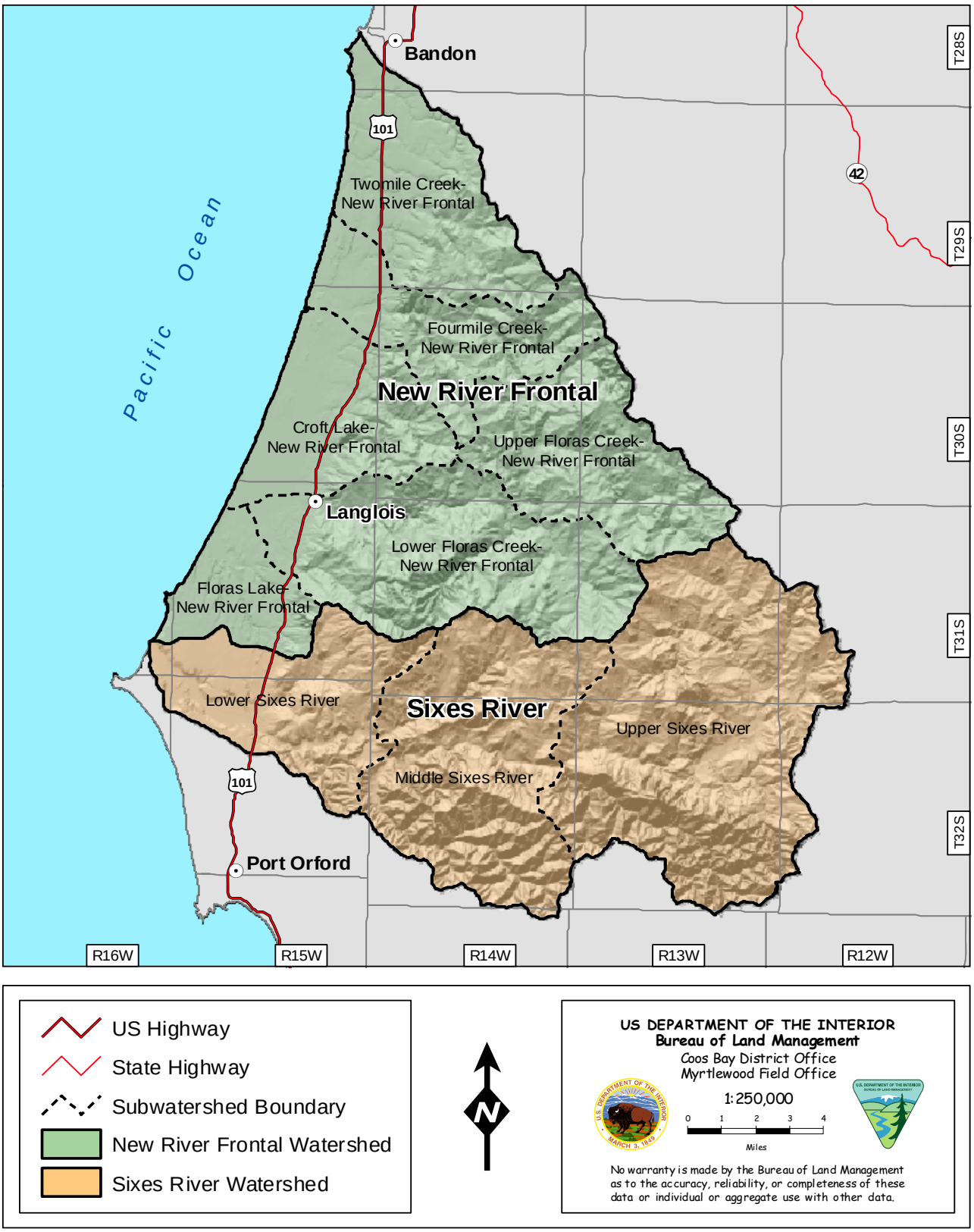
Map 1. General Vicinity Map of Sixes-New River Watersheds

Sub-watersheds

The two 5th field watersheds of this analysis area were broken down to the next level, the sub-watersheds (6th fields). Most of the data contained within previous documents was available at this level. The Sixes River watershed was divided into three sub-watershed areas and fourteen drainages (7th field) for the purpose of this analysis. New River Frontal watershed was divided into five sub-watersheds and fourteen drainage sized areas.

Table 1 Sixes-New River Areas

Watershed 5th Field	*Sub-Watershed 6th Field*	*Drainage 7th Field*	*Square Miles*	*Acres*
Sixes	Lower Sixes	Beaver Cr	10.1	6,463
		Crystal Cr	7.36	4,710
		Squaw Bluff	8.65	5,539
		Sub-Total	*26.11*	*16,712*
Sixes	Middle Sixes	Dry Cr	5.78	3,699
		Edson Cr	10.72	6,859
		Elephant Rock Cr	6.47	4,140
		NF Dry Cr	10.19	6,525
		Plum Trees	9.72	6,221
		Sub-Total	*42.88*	*27,444*
Sixes	Upper Sixes	Carlton Cr	7.42	4,746
		Dement Ranch	13.89	8,888
		MF Upper Sixes	7.71	4,936
		North Fork	9.59	6,139
		Otter Cr	11.35	7,264
		SF Upper Sixes	15.11	9,668
		Sub-Total	*65.07*	*41,641*
New River Frontal	Croft Lake	Croft Lake	*23.12*	*14,795*
New River Frontal	Upper Floras	EF Floras	16.34	10,458
		NF Floras	7.96	5,095
		Sub-Total	*24.30*	*15,553*
	Lower Floras	MF Floras	10.19	6,523
		SF Floras	12.24	7,835
		WF Floras	12.47	7,979
		Willow Cr	11.41	7,302
		Sub-Total	*46.31*	*29,639*
New River Frontal	Floras Lake	Floras Lake	*12.21*	*7,816*
	Four Mile	Laurel Lake	10.9	6,978
		NF Four Mile	6.44	4,119
		SF Four Mile	4.81	3,079
		Sub-Total	*22.15*	*14,176*
	Two Mile	Crooked Cr	11.64	7,448
		Lower Two Mile	8.31	5,316
		Upper Two Mile	7.23	4,625
		Sub-Total	*27.18*	*17,389*
		Total All Areas	**289.33**	**185,165**



Map 2. Watershed and Subwatershed Boundaries

Ecoregions

This section partially compiles information contained within the ecoregion sections of the watershed Sixes River and Floras Creek assessments. Development of that information was guided by the Oregon Watershed Assessment Manual. In addition, new information of the New River Frontal system is included here. For additional information about specific ecoregion characteristics, maps or methodology, refer to the three above mentioned documents.

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. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. There are four levels to the ecoregion characterization. The Sixes-New River Frontal watershed is located in the Level-III **Coast Range** ecoregion, and is subdivided into two Level-IV ecoregions – **Coastal Lowlands** and **Southern Oregon Coastal Mountains**. The following characterization will be at the Level-IV watershed scale.

Coastal Lowlands

The Sixes River watershed only has a small portion (8%) that is characterized as Coastal Lowlands, while the New River Frontal has 38% of its area in this ecoregion type.

The geology of this ecoregion consists of alluvial deposits on low terraces or dunes (spits) of wind-blown sand. Streams are very low gradient and often meander widely. Tidal marshes and flats and lower meandering streams flow through flat floodplains. Streams sometimes enter shallow coastal lakes with outlets to the ocean. The stream side coniferous vegetation would consist of thickets of wind-stunted shore pine and Sitka spruce if not altered. (citation GWEB)

Within the New River Frontal, much of this ecoregion has been altered from the conditions described above. This lowland depositional area is highly conducive to agriculture use, and many private lands reflect this productivity. There has been extensive diking and straightening of stream channels to facilitate grazing, water drainage and many wetland areas have been converted to cranberry production. So it is appropriate to discuss wetlands here as they are a critical component of the two coastal lowland areas of these watersheds. Additional wetland information is contained in a separate section later in this document.

Wetlands

Wetlands were once considered to be an impediment to development. The Swamp Land Acts of 1849, 1850, and 1860 encouraged landowners to drain them and put the lands under more essential production, such as grazing and farming. This coincided with much of the settlement of the New River/Sixes areas, so the current landscape reflects this practice.

However, the change of perception about the value of wetlands changed. As described in Oregon's Wetland Conservation Strategy (Oregon Division of State Lands, 1993, Oregon's wetland conservation strategy: Salem, Oregon Division of State Lands, 100 p.)

Increased awareness of the public value of wetlands led to legislative actions in the 1970s. The Removal-Fill Law, enacted by the Oregon Legislature in 1971, found that "unregulated filling in the waters

of the state for any purpose may result in interfering with or injuring public navigation, fishery and recreational uses of the waters." During 1973, Oregonians expressed their concern about protecting wetlands in landmark land-use legislation; Statewide Planning Goals 5, 15, 16, and 17 all specifically mention wetland resources. The, in 1989, the Oregon Legislature adopted a policy stressing the importance of wetlands (ORS 196.668 and 196.672); the legislature focused on integrating wetland planning and permitting. From these origins, Oregon's wetland management program has emerged.

The "no net loss" strategy has a benchmark of maintaining at least 100 percent of the 1990 wetland acreage.

In response to a need recognized by the Coos Watershed Association, a guidebook was published in 2005 with the compilation assessment of Oregon's tidal wetlands. Within our analysis area, three drainage areas were assessed and include the following information:

Two Mile

Tidal wetlands comprise about 34% of this tiny estuary's area. One tidal wetland (# Wetland 3729) was assessed in 2003, totaling 37 acres, or about 13% of the tidal wetland area of the estuary. It is comprised of about 80% high marsh and 20% low marsh. *Carex obnupta* dominates the high marsh and *Eleocharis palustris* the low marsh. A 1939 aerial photograph shows it being slightly more extensive; drifting sand has apparently reduced its size somewhat. The site is on public land (BLM).

New River

Tidal wetlands comprise about 41% of the area of this geologically-dynamic backdune estuary. BLM has designated its land in the estuary an "Area of Critical Environmental Concern." The importance of this estuary for migratory shorebirds is recognized by the Northern Pacific Coast Regional Shorebird Management Plan (Drut & Buchanan 2000) and it is designated as an Important Bird Area (IBA) by National Audubon Society. Up to 15,000 Aleutian Canada *(now Cackling)* geese use the New River estuary and adjacent pasturelands as a last major stopover area in the spring and fall. One tidal wetland was assessed in 2003, totaling 12 acres. It is about 35% high marsh and 65% low marsh. *Carex obnupta* dominates the high marsh and *Eleocharis palustris* the low marsh. The site is on public land (BLM).

Sixes River

The Sixes River estuary is approximately 330 acres in area and has a watershed of approximately 129 square miles. Head of tide is about 2.5 miles from the mouth. The estuary is designated as a Natural estuary under the Oregon Estuary Classification system, and it is listed by The Wetlands Conservancy as one of "Oregon's Greatest Wetlands." Opportunities for wetland restoration have been identified and ranked by Brophy (2004). No tidal wetlands in this estuary were assessed in 2003.

Sothern Oregon Coastal Mountains

The Sixes River watershed has 92% of its land base in this ecoregion while the New River Frontal is lower with 62%.

These watersheds have a high stream density due to high precipitation and fractured geology. Streams are usually high gradient and waterfalls are common. Erosion rates are high due to abundant precipitation, high uplift rates, frequent 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. Riparian vegetation consists of western hemlock, Western Red cedar, Port-Orford cedar, grand fir, red alder, Douglas fir, and herbaceous shrubs.

Land Ownership and Use

Land Ownership

For the Sixes and New River areas the ownership distribution of the land base is similar. Approximately 72% of the land in the Sixes River and 95% in the New River watershed are in private ownerships. Private lands are both industrial and non-industrial lands. Industrial private lands account for approximately 42% of the basin in Sixes River and 23% in Floras Creek whereas non-industrial private lands comprise about 27 and 69% of the total area in the respective basins. No assessment of private lands was conducted for the larger Sixes-New River watershed.

Industrial private lands are divided among a moderate number of stakeholders that own relatively large tracts of land. The major industrial private landowners in the basins include Al Pierce Timber Co., Crook Estate Land Trust, Roseburg Forest Products, Moore Mill Co., Plum Creek Timber Co. (formally Georgia Pacific Co.), Sun Studs, Seneca, Westbrook Timber Co., and Menasha Corporation.

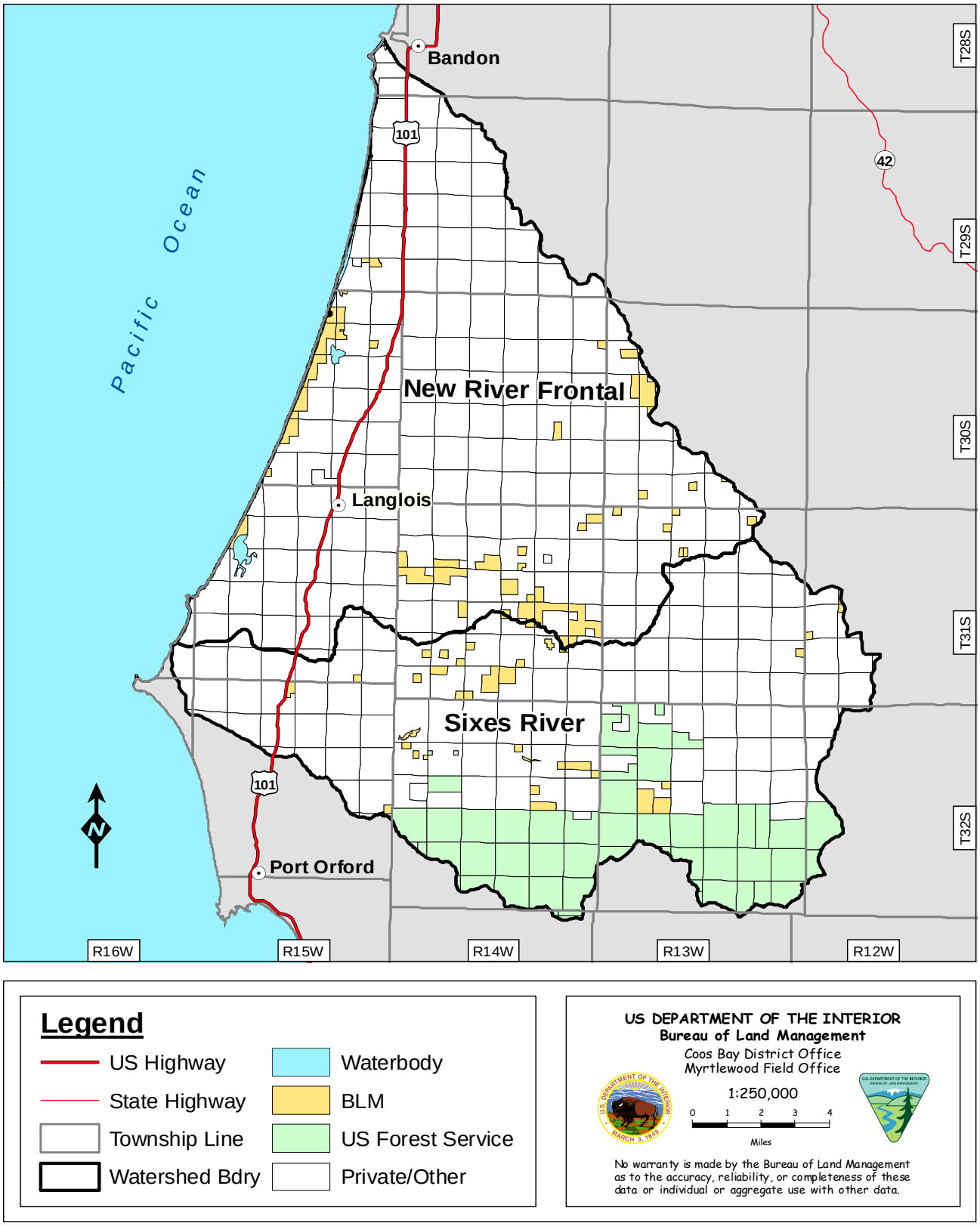
Public ownership in the two watersheds is slightly skewed with about 28% of the Sixes River but only 5% for the New River watershed. Public land, managed by the United States Forest Service (USFS) is highest in Sixes River but nonexistent in the New River areas. Bureau of Land Management (BLM) manages roughly 2.5% of the basin in Sixes River and 4.5% in New River watershed. State and County lands comprise less than 1% of the total watershed area.

The two fifth field watersheds encompass forested areas managed privately and publicly, several large ranches, a multitude of owners cultivating cranberries, and the southwest portion of the city of Bandon. Individual ownership would be difficult to discern and not undertaken for this analysis.

Table 2 Land Ownership within 5th Field Watershed

Watershed	BLM		USFS		Private		State and County		Total Acres
	Acres	% of Total	Acres	% of Total	Acres	% of Total		% of Total	
New River Frontal	4,354	4.3	0	0	94,093	94.7	923	1	99,371
Sixes River	2,107	2.5	21,692	25.3	62,025	72.3	9	>1	85,833
Combined	6,461	3.5	21,692	11.7	156,118	84.3	932	>1	185,204

Acres calculated from ownership database from BLM GIS



Map 3. Land Ownership in the Sixes-New River Watersheds

Land Use

Land use in the combined watershed is divided into two major activities with some minor uses overlaid on top the major types. The development (use) of these lands for forestry, agriculture or range purposes makes up the base of the land use. The use of some of these same lands for the purposes of mining, recreation, and rural residential lands is common. Being able to distinguish the difference between a strictly agriculture/range residence and a rural residential occupation was beyond the scope of this assessment; and therefore, the two are lumped into one land use. The bulk of the residential homes are within the city limits of Bandon.

(1) Forestry is the most dominant land use in the Sixes River and Floras Creek watersheds. A smaller total land area in the New River Frontal areas provides some forestry related activity; however the actual land area is hard to determine. Within Sixes River 93% of the watershed area can be identified as forest land and used for this purpose. This includes private industrial, private non-industrial lands, as well as those lands managed by the USFS and BLM. Forestry use also dominates the Floras Creek watershed, accounting for 76% of the watershed area. Although forestry use is common throughout the entire basins it is most prevalent in the middle and upper portions of the watershed. Much of the two basins were harvested 40 to 50 years ago and are currently being managed on short rotation forestry practices. The exception is the USFS lands within the Sixes River area. Prior to 1993, 14% of the Matrix lands (those dedicated to intensive forest practices) of the National Forest were available for commercial timber harvest and now it is less than 2%. Some opportunities for forest management on Late Successional Lands (those lands expected to provide old growth characteristics on the land) do exist, but it must enhance the Late Successional characteristics of the forest.

(2) Agriculture/range and rural residential areas account for approximately 7% of the watershed in Sixes River and 23% in Floras Creek. The New River Frontals are considerably higher but no actual percentage was calculated. Most residents reside in the western and northern portions of the New River frontal area. Some communities are present in the lower portions of Sixes River and Floras Creek, primarily the town of Langlois. There is some range use of the lands in the Upper Sixes Mainstem and North Fork Sixes sub-watersheds as several ranches are established there. Major types of livestock include sheep and cattle.

In Floras Creek most lands support rangeland activities; the exceptions are the West Fork and South Fork sub-watersheds where forestry is the dominant use. The lower near coastal portions of the frontal areas of New River provide the best agricultural use of the land. Berry production is largely for cranberries, but some growers also produce blueberries and caneberries. Dairy operations, although once common, are no longer in operation.

(3) Recreation is spread throughout the watersheds when public access is granted. The majority of the use is at developed campgrounds and day use areas such as Cape Blanco State Park, Boice Cope County park, Edson and Sixes River Campgrounds (BLM) or New River ACEC. The majority of the Dry Creek sub-watershed is designated wilderness of the Grassy Knob Wilderness area managed by the USFS. Camping, hiking, fishing and hunting are the major recreational activities within these watersheds. Guided fishing occurs on the Sixes River but is not part of the other rivers. Windsurfing

and kite boarding are activities that are confined to the Floras Lake area in conjunction with camping at Boice Cope County Park.

(4) Mining and rock quarries are isolated across the landscape. Sixes River has a history of gold mining and dredging in the small community of Summersville, which is now the Sixes River Campground. Dry Creek, Crystal Creek and the beach sands have supported mining activities as well. Several quarries located in the Lower Floras Creek and Floras Lake sub-watershed support commercial operations for rock and gravel removal. In addition, use of local hard rock outcroppings across the watersheds for timber management and county road construction needs has produced numerous small excavations.

II. WATERSHED ISSUES

Identification of issues was conducted through public meetings conducted in 1999for each of the watershed councils in place at the time. Watershed issues were also identified by technical specialists who reviewed this assessment document. Practices that potentially impacted salmonid fish habitat and water quality were noted during the development of the watershed assessments. This was the primary focus for the analysis process under the Oregon Watershed Assessment manual. Increases of sediment, increased runoff, reduced quantity of large wood (both now and future), and conversion of riparian areas to hardwood types by timber harvest practices were of prime importance. The removal of vegetation using herbicides was considered a lesser practice but still considered. Similarly, fish habitat and passage associated with road construction and maintenance along with road and culvert failures that produce sediment was of concern. Mining activities that increase turbidity during low flows in the river or increase water temperature were also an issue that could reduce fish habitat or water quality. All the above issues were addressed within the scope of the Sixes River and Floras Creek Watershed Council Assessments and details can be found within the documents.

This analysis focuses only on those issues that trigger the need to do this analysis. Limited public land within the watershed that will be managed for forestry purposes is an overarching issue that serves to focus the scope and detail of the analysis. The potential that public lands, managed under current accepted plans to affect overall future watershed conditions is relatively minor. Accordingly, issues to be analyzed in this watershed analysis will be limited to those of merit and related to proposed management activities. In order for the decision maker/manager to make the best decision, implement resource programs or design a project, two issues not previously addressed in past documents need investigation and analysis. These are (1) the appropriate analysis prior to construction of new roads or landings in Riparian Reserves, and (2) the application of silvicultural practices for Riparian Reserves to control stocking, re-establish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives.

III. HISTORIC AND CURRENT CONDITIONS

Past Use

Human Settlement

According to the Floras Creek Assessment, the watershed has been inhabited for over 8,000 years. It is very likely that the entire coastal region of this watershed was inhabited by the Qua-to-mah native peoples as suggested by the shell midden piles found along the ocean and stream estuary areas. By the mid 1850's, most of the native population had

been removed and Euro-American settlement of the basin became the predominant influence on the landscape.

Mining

In the late 1850's Euro-Americans were drawn to the area for trapping fur bearing animals. Upon finding gold in the local area, mining became the focus of settlement, first at the mouth of Crystal Creek then creating the small community of Summersville at the mouth of South Fork and main stem Sixes River. The Floras Creek area also contained some areas of gold (at least claims were made) from the south side of Floras Creek and north to New Lake. Mining activities did not last long in Floras Creek as little wealth was found there; however, the extraction of gold continued from Sixes River until about the middle of the 1940's.

Agriculture

The need to produce food for miners led to the development of agriculture and fish harvesting in the watershed. Land was cleared for ranches in the Upper Sixes River area and in the lower flood plains and swampy areas of Floras Creek and New River. Conversion of land from wet areas to productive pastures required ditching and diking to drain the areas, then clearing of trees, and cultivating grasses. Much of the clearing was for dairy ranches which supported cheese factories in the Denmark area. Export of cheese products to the gold rush communities in California, and even to Europe, was common.

Cranberries were introduced into the area in 1915 with the development of a unique variety in the New River area that is adapted to the coastal environment. Development of new "bogs" was evident in the New River Frontal area during the 1980 to 90's with an approximate increase of 35% of previous acres being cultivated, as per the Ocean Spray Cooperative.

Timber

Timber harvest followed agricultural development and community demands. The removal of timber from the lowland flats near the ocean, then up the gentle slopes to the east, occurred in both the Sixes River and Floras Creek areas. Extensive Sitka spruce swamps in the New River area provided raw materials for building around the town of Langlois and other towns. As demand for timber products grew, private lands were harvested. The upper portions of both watersheds contained vast stands of White cedar and Douglas fir. The Siskiyou National Forest was established in 1906 but not actively managed until after World War II. The lack of harvest from the National Forest provides a stark contrast to the present condition of the rest of the landscape managed under an intensive industrial forest ownership.

Several sawmills were supported by the timber from the Floras Creek basin. Adolphsen's mill on Elk River used the Port Orford cedar (white cedar) of the area. Mills in Langlois and on Langlois Mountain provided lumber to the local community, and logs may have been sent over a road to Myrtle Point by way of Catching Creek.

Harvest of timber from private and federal lands has been occurring for the last 100 years. Harvest from federal lands peaked in the 1960's with a decline through today. Since the 1994 Record of Decision for the Northwest Forest Plan and the subsequent Resource Management and Land and Resource Management Plans for the BLM and USFS, the harvest level has been substantially curtailed in these watersheds. Private industrial forest managers have continued to cut timber with short rotations (40-50 years) under the regulations of the Oregon Forest Practices Act.

Fisheries

Prior to the arrival of Euro-Americans, the Qua-to-mah and the people of the lower Coquille gathered annually to praise, as well as harvest, salmon that entered the Floras Creek estuary, wherever the river met the ocean. This activity may have been occurring up and down the coast on all river mouths that supported returning fish populations.

Commercial removal of fish occurred from both the Sixes River and Floras Creek watersheds. Canneries in Bandon processed fish from the Floras Creek area. It is unclear if fish from the Sixes, and the more productive Elk River to the south, were processed in town of Port Orford.

Recreation

Most of the historical information for recreational use is tied to the sport fisheries throughout the watershed. Established camping areas at the two county parks, as well as the state and federal campgrounds, may have provided opportunities in the more recent past. The Grassy Knob Wilderness area would also have provided numerous recreational opportunities. Hunting deer and elk in the past may have offered dispersed recreational camping in the fall of the year.

Current Use

Human Presence

From the town of Bandon south to Port Orford, HWY 101 traverses the watershed in a north to south direction. Residential homes are closely tied to access to the main highway and off the county road system. A scattering of homes/ranches are located in the middle and upper watersheds in Floras Creek and Sixes River. Active ranching still occurs in the lower portions of the watershed and the community of Langlois still has active schools, a Post Office and markets and restaurants. No single large employer can

be found, but the cultivation of cranberries among the cooperative growers and independents is the likely the largest source of income. Livestock cultivation is a likely second to the berry production for income related purposes.

Mining

Sixes River provides recreational dredging within the Sixes River Campground operated by the BLM. There are still placer and lode claims in the watershed; however, no large scale operation is present. The removal of sand, rock and gravel still occur and have recently increased in production from the Floras Creek Sullivan pit operated by LTM, Inc. Coastal Division.

Agriculture

As agriculture is one of the mainstays in the watershed, it is expected to continue at its current level of use. Floras Creek has 23% of land in agriculture or ranch/residential status. The Sixes River has only 7%. No firm estimate exists from the New River Frontal area, but based on 2005 aerial photos, it appears that 30% of the area supports agriculture, range or residential land uses. The amount of land dedicated to this use is expected to increase slightly under conversion from forest land to berry production in the next decade.

Timber

The timber harvest occurring in the watershed continues to demonstrate the private land domination in this area. No harvest from the National Forest lands has been demonstrated in the last decade and no harvest is planned for LSR or 450 acres of matrix lands (pers. comm. Brian Robbins, Powers Ranger District).

Harvest from private lands has removed many of the stands as they approach 50 years of age. Commercial thinning of some stands is occurring, but the remaining harvest is cut as allowed under Oregon Forest Practices Act. New road construction is evident as access to previously harvested stands may not be possible due to the large areas cut or harvested with ground based equipment. Newer standards for road construction and use may dictate surfacing old routes or providing new ones.

Fisheries

Use is confined to recreational sport fishing with no commercial removal occurring. Seasonal and take limitations change yearly under Oregon Department of Fish and Wildlife regulations.

Recreation

Dispersed hunting and camping still occur where public access is available. Some areas of the watershed are closed to the public with a series of gates or berms that limit entry. Hunting is allowed with landowner permission only. The Grassy Knob Wilderness, the BLM campgrounds, Boice Cope County Park and Cape Blanco State Park are the major providers for recreational use currently within the watershed.

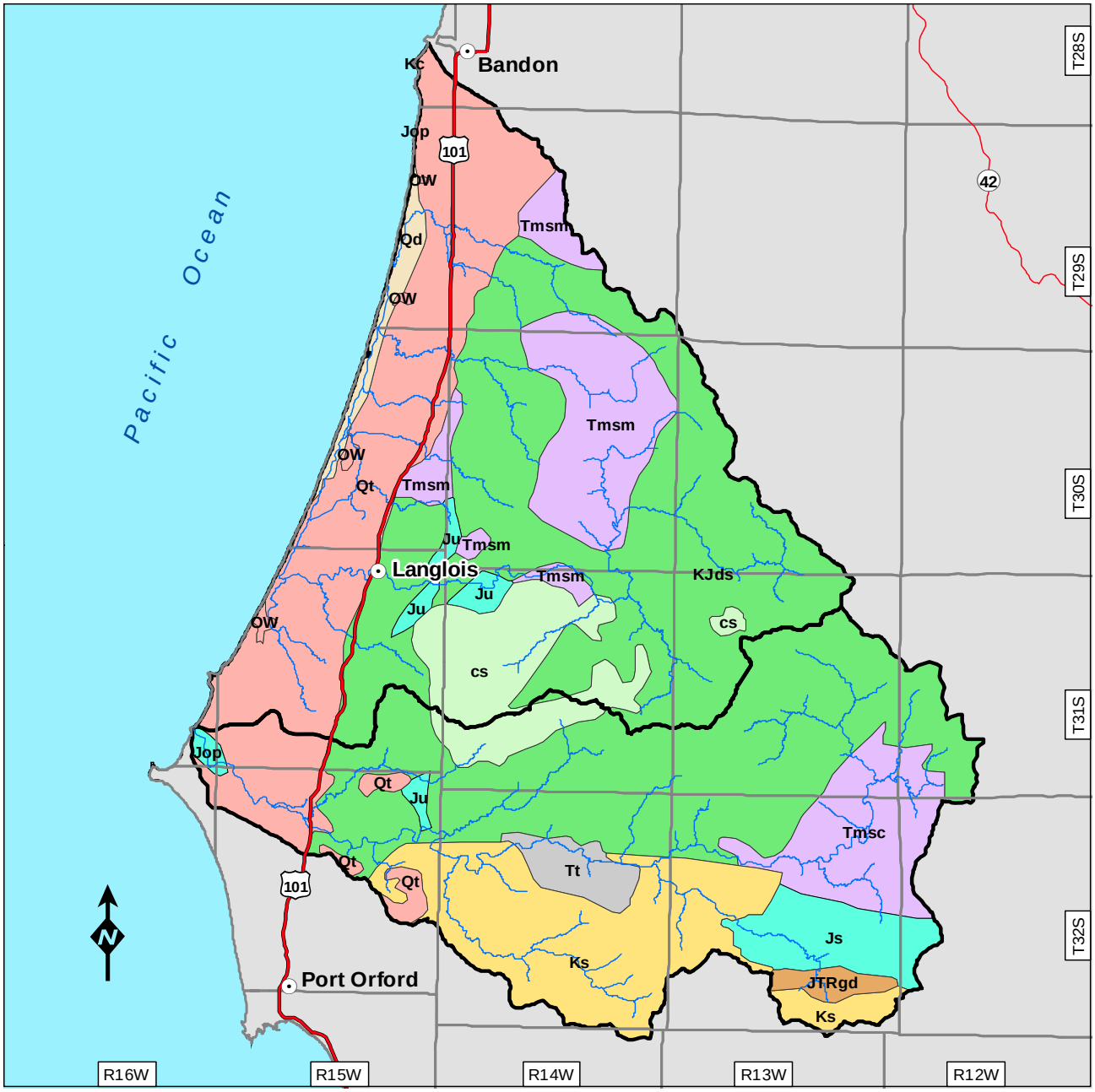
IV. EROSIONAL PROCESSES ACROSS THE LANDSCAPE

Erosional processes are largely driven by type of parent material (geology), climate (precipitation and wind), and past disturbance activities across the landscape. Within this watershed the geology is diverse and thus provides several contrasting soil forming environments that provide very different aged soils. The climate is typical of coastal Oregon with a strong marine influence, high winds and amounts of winter precipitation, but moderate year-round temperatures. Map 4 displays the Geology of the Sixes-New River watershed on a broad scale.

Geological Influence

The geology of the area can best be envisioned as three distinct areas within the watershed. Along the coastal strip west of Highway 101 the Quaternary terraces and depositional areas predominate. These are the youngest geological features formed through weathering and routing processes over time. A strip of the Cretaceous Formation (primarily Ks) and the Klamath Mountains rocks are along the southern most end of the watershed in the Upper Sixes subwatershed. These rocks include the metamorphosed sedimentary and volcanic rocks of the Galice Formation. It is the intrusion of diorites into the volcanic rocks that produces gold in the upper headwaters of the South Fork of the Sixes River drainage and possibly the Dry Creek drainage. The very southern portion of the watershed is underlain by Cretaceous age Rocky Point Formation sandstones and siltstones and thus is more like the Elk River watershed to the south in that it is very steep and weathers in a similar manner.

From Sixes River north to the town of Bandon the Otter Point Formation influences the parent material. The sheared mélange of mudstone, sandstone, volcanic rocks, chert, serpentinite, and blueschist have generally less slope (30-50%) but have finer textures (silt or clay loam). Some areas of serpentine soils provide a uniquely low ratio of calcium to magnesium and are the areas most likely to contain unique plants. These are the meadow areas found on the northern ridge of Elephant Creek and the adjacent western Crystal Creek drainage. Within this large block of Otter Point Formation are scattered medium sized areas of Tertiary aged mudstones (Tmsm and Tmsc) that are younger than the surrounding formation. These young sediments are weakly resistant to weathering and form gentle hillslopes. Also within the larger Otter Point block is a substantial piece of the highly folded Colebrooke Schist of late Jurassic age. This terrane is a blueschist that was originally a mixture of tuffs, cherts, and pillow lavas in a deep sea, oceanic setting that was later uplifted onto the Otter Point formation. For a more in-depth discussion of the geology of the area see either the Sixes Watershed Analysis (Sixes WA) or the Klamath Mountains discussion in Orr, Orr and Baldwin, 1964.



Legend

- US Highway
- State Highway
- 3+ Order Stream

Geology

- JTRgd
- Jop; Js; Ju
- Kc
- Ks
- OW; Qt
- Tmsc; Tmsm
- Qd
- Tt
- KJds
- cs

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Map 4. Geology of the Sixes-New River Watersheds

Climatic Influence

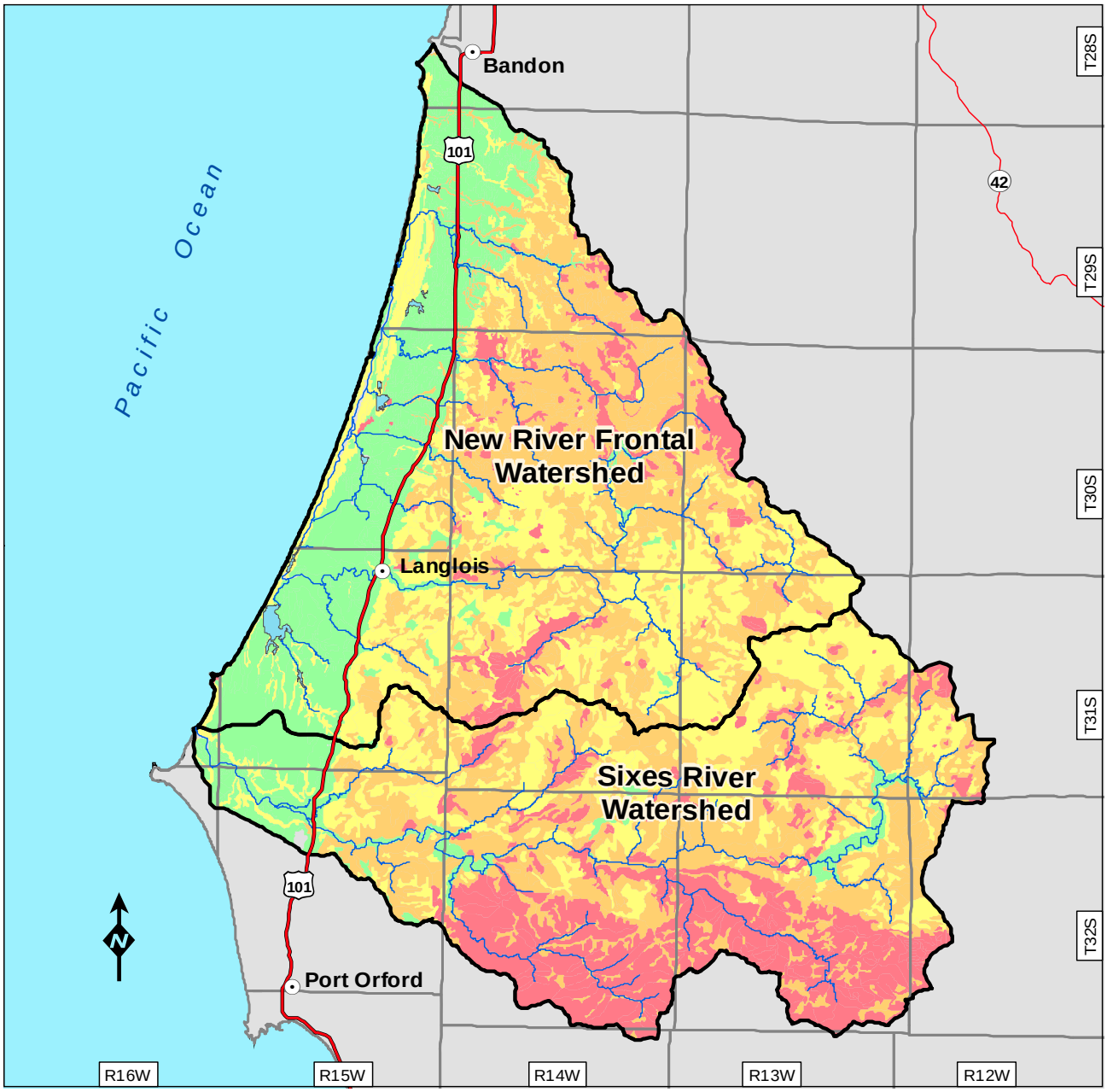
The climate across the area can be described as marine influenced along the coast and Mediterranean inland. Precipitation across the area ranges from 60-85 inches/yr on the coastal areas to 70-140 inches/yr in the upper elevations of the watershed. Temperatures range from mid 30s to 50s on the coast in January and in July mid 50s to 70s. North winds prevail in the summer with some East wind events creating extreme fire conditions with temperatures over 100 degrees and winds in excess of 35 mph. South winds prevail in the winter and wind speeds over 100 mph can result in catastrophic wind storms and blowdown of timber. Precipitation comes from frontal rainstorms during the months of October through April. Snows are a normal part of each winter with duration and amount being light. The watershed is rain-dominated with 95% of the area being below the transitory snow zone.

Sediment Delivery Mechanisms within the Watershed

Sediment delivery mechanisms in this watershed are controlled by parent material and provide different coarse, and fine grained sediment to the aquatic system. On the Cretaceous aged sedimentary rocks, landslides or chronic rock ravel is the predominate source of large or coarse material. If soil is present, debris avalanches or slides are the source. On the Otter Point formation the primary mechanism for providing materials both coarse and fine is through earth flow or earth creep mechanisms. On this formation surface runoff becomes an important mechanism as gullies, toes of slopes and exposed land areas become eroded without the influence of steep slopes.

Based on NRCS soil data, the watershed has a moderate to very severe erosion hazard rating from off trail areas (areas exposed to rainfall effects, See Map 5 Erosion Hazard). Severe ratings need BMP's (Best Management Practices) applied to protect soil from exposure and loss of soil material according to NRCS criteria. Very Severe ratings show areas where erosion can degrade the overall productivity of the soil over time. Given the amount of precipitation and intensity that occurs each winter in this watershed, the soil loss caused by sheet or rill erosion in off-road or off-trail areas could produce excessive fine sediment delivery. This would occur where 50 to 75 percent of the surface has been exposed by logging, grazing, mining, or other kinds of disturbance.

In the USFS Sixes WA document, harvest and road building activities were inventoried in an effort to get at total quantities of material delivered. The analysis concluded that stopping construction practices of side-casting and crossing unstable channels either on mid-slope, or headwall areas in the watershed, has led to greater stability of the transportation network and less input of fine sediment since the 1980's. Within the Floras Creek and New River area the same construction techniques were used to construct much of the transportation network in the late 1950's through the early 1970's and similar failures of mid-slope roads and stream crossing areas are visible today. As these old roads are once again being opened for use the current techniques of excavation, cut-bank and slump area stabilization are being employed. End haul versus side-cast disposal is employed on repairs and new construction. Relocation of failed roads to areas of stable land features is often employed.



Erosion Hazard

- Slight
- Moderate
- Severe
- Very Severe

- US Highway
- State Highway
- 3rd+ Order Stream
- Waterbody
- Watershed Boundary

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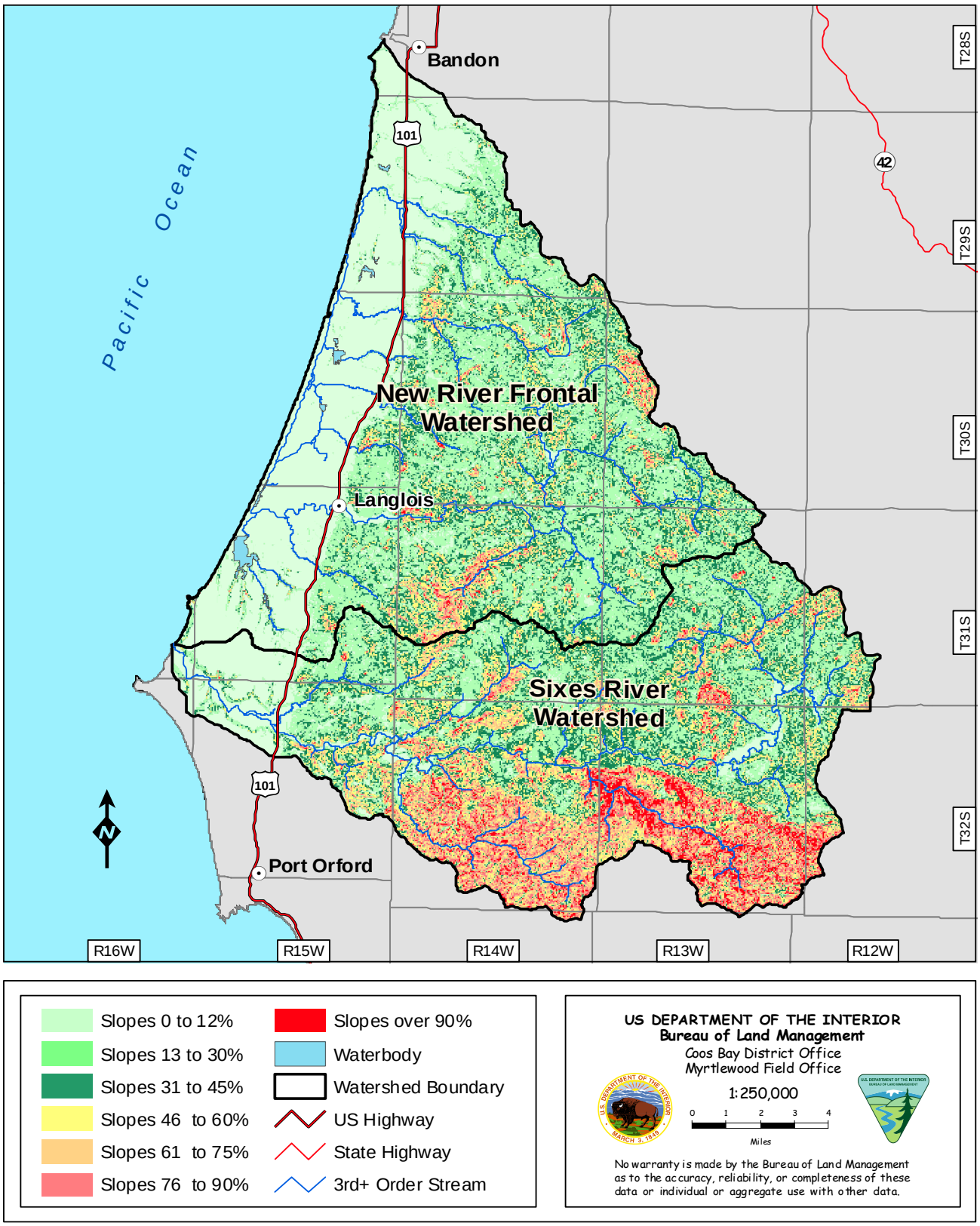
Map 5. Erosion Hazard in the Sixes-New River Watersheds



Map 6. Slope Classes in the Sixes-New River Watersheds

One of the main drivers of sediment delivery is slope of the land surface (See Map 6. for Slope Classes within the watershed). This watershed is unique, in that the geology of the area produces an uplifted area south of Sixes River that is much steeper than areas to the north. However, the capacity to erode the less steep geological units north of the Sixes River still provides a high potential for erosion to occur as demonstrated by the erosional risk rating. Note the amount of land surface north of the Sixes River that is rated Severe or Very Severe for erosion hazard.

This watershed has the capacity to deliver large quantities of fine materials from two sources. One is the surface soils that contain roughly 40 to 60% silt sized particles; those could be removed through surface runoff processes. The second source is the high percentage of clay sized particles that reside in the upper 20 inches of most soils throughout the watershed. As streams down cut or diversions from culverts and roads develop new channels across the land, the high amounts of clay particles could find their way to the stream network.

Sediment Capture Mechanisms

The watershed has well to moderately well drainage classes for the most of the land areas according to NRCS data. Only those soils on the coastal terraces have poor drainage classes and can pond water during the winter. The well drained ratings demonstrate the ability of the undisturbed soil to infiltrate the large amount of rain the area receives. This is the main method of capturing sediment on site and what is normally found in a forested environment. Due to the extensive use of the landscape for ranching of animals the ability to infiltrate water into the soil is suspect.

A second process to capturing sediment is vegetational filtering. The growth of plants both tall and short is needed to arrest the movement of sediment entrained in a water solution prior to delivery to a stream channel. Where such vegetation is removed by disturbance there is the potential to deliver sediment to a stream.

Transportation Network- Roads

One of the major contributors to the sediment delivered to the stream network across this landscape was the development of a transportation network. Road construction, location, maintenance and use all have been identified as past sources of coarse and fine sediment on landscapes both flat and steep. The watershed assessments used two measures to assess sediment sources within the watershed. These indicators include an analysis of road density on steep slopes (>50%) rather than a more generalized density per square mile and an analysis of road and stream crossing density. The most useful and easily understood indicator is the amount of road on steep slopes. This indicator identified the relative risks of sediment impacts for each subwatershed throughout the watersheds on private lands in the basin. If USFS lands and roads had been incorporated into the assessment calculations some risk ratings within the subwatersheds (particularly the South Fork of the Sixes River) may have been greater. This would be due to the USFS lands being the steeper than 50% where the private lands in the same subwatershed were less than 50%. See Map 6.

From Council Watershed Assessments: Definition for Density of Roads on Slopes Greater Than 50%

> For each subwatershed and each indicator a rating of sediment impacts was assigned based on comparisons of all south coast subwatersheds considered in this assessment.
> 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. The percentile rating was further divided in the following categories: 0-19 (low); 20-39 (moderately-low); 40-59 (moderate); 60-79 (moderately high) and 80-100 (high).

Road Condition Assessment

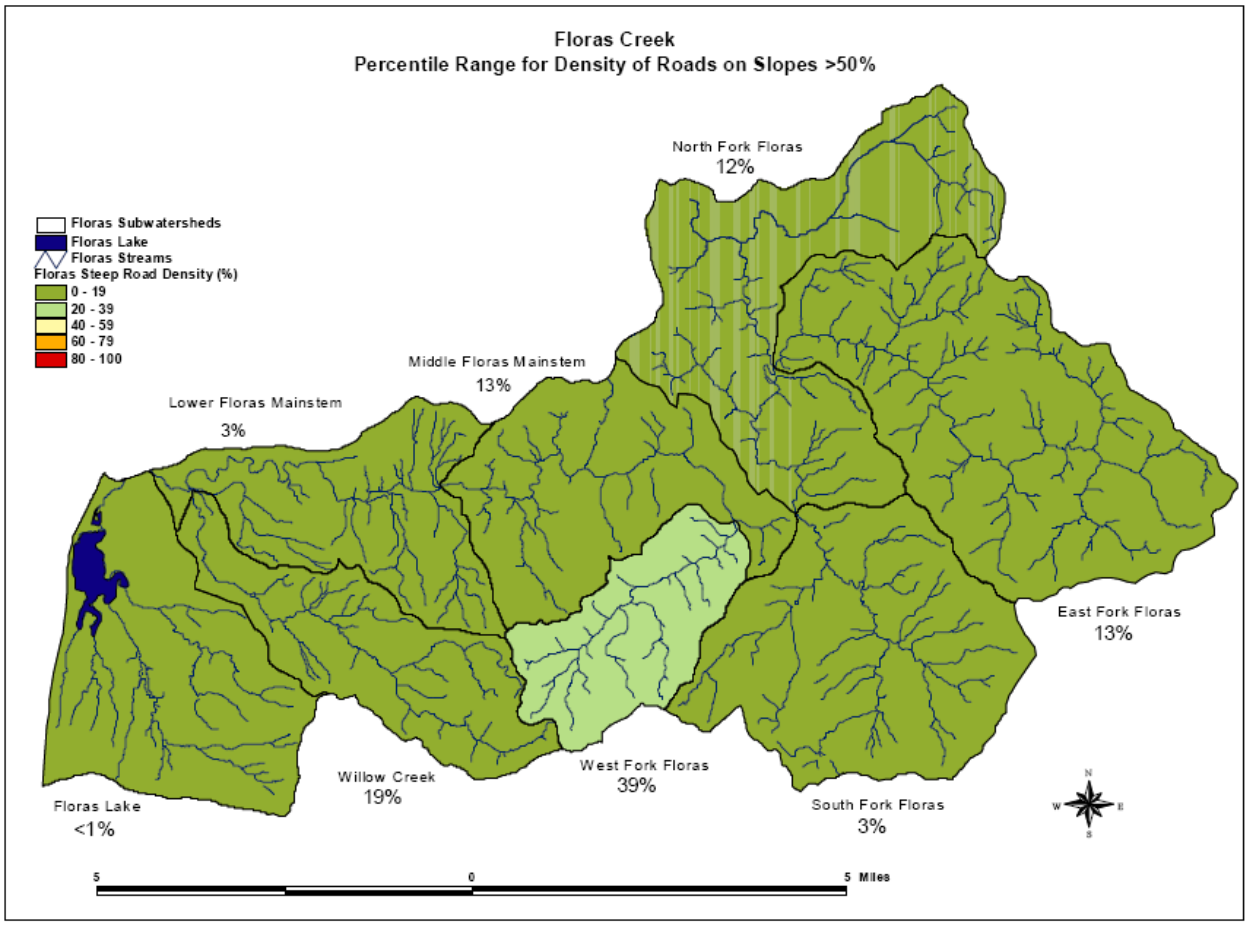


Figure 1. Roads on Steep Slopes in Floras Creek
Graphic taken from Floras Creek Watershed Assessment courtesy of South Coast & Lower Rouge Watershed Councils.

Road conditions in the watershed have been reviewed in select subwatersheds on both private and federal lands but not been extensively inventoried. The Sixes WA inventoried landslides within the Siskiyou National Forest between the years of 1943 to 1986. No assessment of roads on private lands was conducted in that analysis. Landslides from roads generally followed the disturbance (road construction and harvest) within a few years. Roads in the Dry Creek and Benson Creek had the highest incident of failure in the Sixes WA inventory. Watershed Road-Related Restoration Opportunities of the Sixes WA (Appendix D) identifies known sites where past failures and erosion are evident.

A review of roads in the West Fork, South Fork, Edson and Plum Trees subwatersheds on both private and federal lands was conducted in the winter of 2007. It was noted that several legacy road systems built in the mid 1960's had failed stream crossings and diversions. Bridge failures and undersized culverts in addition to slumping side-cast construction techniques were also noted in the review. Subgrades and running surfaces were still in stable and good condition overall. However, the 31-14-4.0 road starting in section 9 and continuing into sections 16 and then 15, has been closed by extensive stream crossing failures. The worst sediment delivery area starts in section 15 where a culvert failure, combined with a diversion produced a gully of at least one thousand feet long in a storm event in early to mid-1996. The culvert diversion was repaired but the road grade was completely removed by the event and not rebuilt. A similar sized road related landslide was produced in the upper headwaters of the West Fork from the 31-14-21.4 road. The sediment

derived from both of these failure events was routed and stored in the West Fork of Floras Creek and continues to move down stream during flood events.

Other roads exhibiting extensive degradation are the 31-14-23.0, 26.0 and the 24.0 across BLM managed lands. These were initially constructed with small diameter pipes in the mid-1960's and have experienced blockages, are at the end of their life, and experiencing side-cast slumping and diversions. Similar conditions exist on an unnumbered road that at one time linked the Plum Trees road 32-14-4.0 and the Dement Creek, Coos County road system. Plum Creek Timber Co. is currently (summer of 2007) rebuilding a portion of the un-numbered road to haul timber from section 25 but will not repair the full length to the Plum Trees road and are pursuing other means to ingress and egress their holdings.

Within the Plum Tree drainage (7th field), road rebuilding by Plum Creek has met with mixed success. Stream crossings that failed in the past were repaired, but after harvest, ditches, road grades and surfacing continue to be a source of sediment delivery. Sloughing of the ditches, traffic across waterbars and gullying of the road are the primary agents for the delivery. Conditions are similar in sections 12 and 13 of T32S, R14W. Old road construction on steep slopes underlain by weakly resistant rocks and thin soil of the Cretaceous geology seems prone to ravel and increase the natural rate of debris flows.

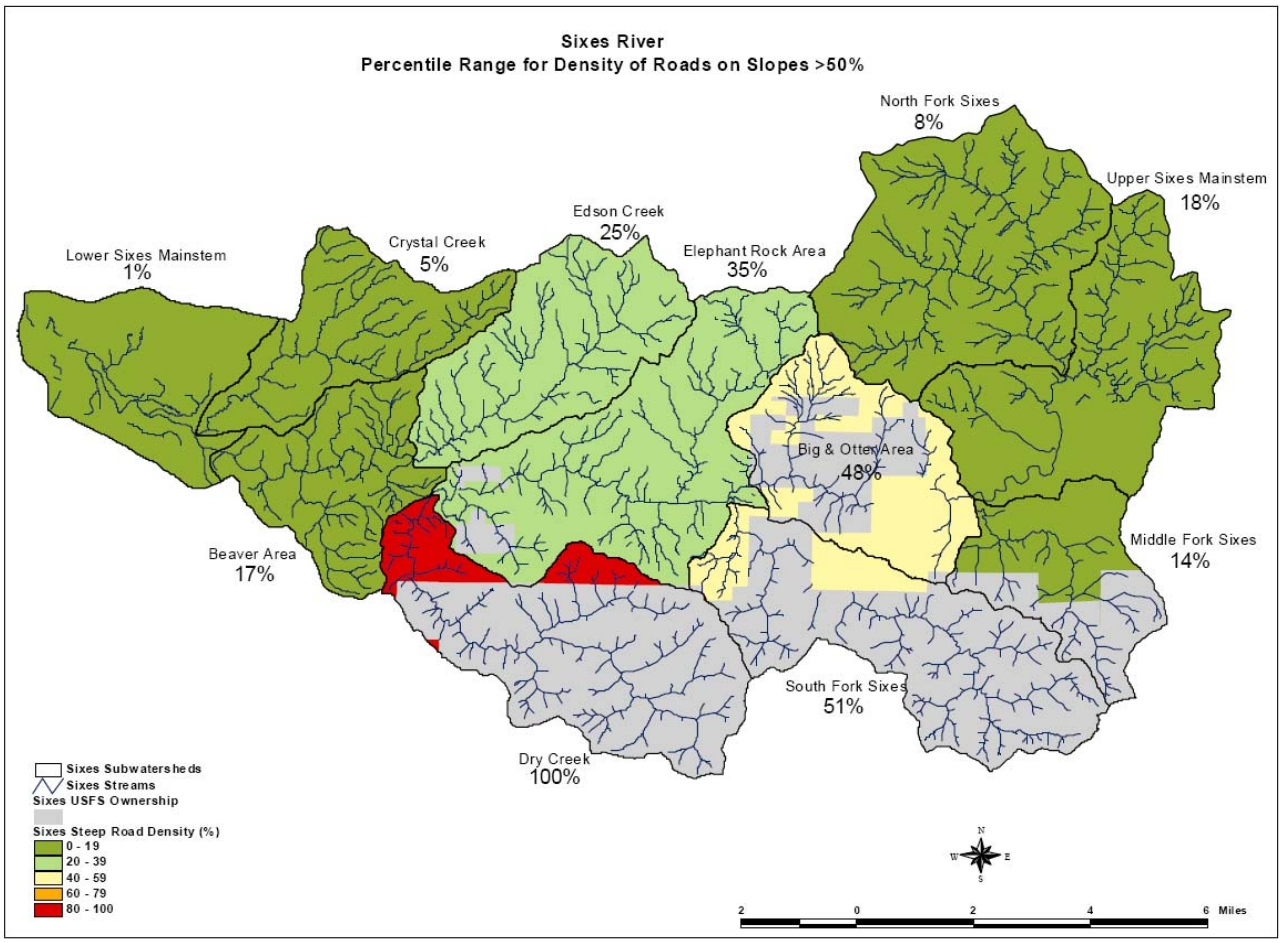


Figure 2. Roads on Steep Slopes in Sixes River
Graphic taken from Sixes River Watershed Assessment courtesy of South Coast & Lower Rouge Watershed Councils.

Road Risk Rating

A suggested risk rating method outlined in the watershed assessments was to assess the risk of roads on all lands by calculating the mileage of roads within 100 feet of the streams. It is suggested that roads this close or closer have a better opportunity to contribute sediment from ditches, the surface and fill slopes. Roads that intersect the toe of the slope may deliver materials more often as they are in a wet condition and prone to some increased rate of failure. Table 3 displays this information and the miles of roads that the BLM "controls" and can effectively manage for sediment delivery through application of BMP's during management activities.

From the table, the subwatersheds containing the most road miles within 100 feet of a stream are the Upper and Middle Sixes River and the Lower Floras Creek subwatersheds. The BLM controls very few miles of road within any subwatershed. The same is true for control of BLM roads within the NFP Riparian Reserves across the landscape. On average the BLM controls only 1.2% of the total miles of road present within the Riparian Reserve network. There would be a low risk associated with actions within this zone on this amount of land area.

Table 3 - Roads Associated with Streams and Riparian Reserves

Subwatershed Name	All Roads Within Watershed	Road Density	Roads Controlled by BLM within Riparian Reserves		All Roads within 100 feet of Streams		Roads Controlled by BLM within 100 feet of Streams	
	Miles	Mi/ Mi^2	Miles	% of watershed	Miles	% of watershed	Miles	% of watershed
Upper Sixes R.	141.7	2.18	.30	0.2	33.0	23.3	0	0
Middle Sixes R.	114.2	2.66	2.58	2.2	12.0	10.5	0	0
Lower Sixes R.	70.4	2.70	.14	0.2	10.3	14.6	0	0
Upper Floras Crk.	80.1	3.30	.37	0.5	17.3	21.6	.88	1.0
Lower Floras Crk.	122.1	2.64	6.48	5.3	22.6	18.5	2.8	2.2
Floras Lake	28.8	2.40	0	0	2.2	7.6	0	0
Croft Lake	48.1	2.08	.13	0.3	8.1	16.8	.13	0.1
Four Mile Crk.	96.5	4.36	.03	0	13.2	13.7	0	0
Two Mile Crk.	147.8	5.44	0	0	14.1	9.5	0	0
Total	849.7*	--	10.03	--	133	--	3.81	--
Average	94.4	2.94	1.11	1.2	14.75	15.6	.42	0.4
SD	41.0		2.17	--	8.89	--	.93	--

* Does not include 25.2 total miles of state highway across 6 of the 9 subwatersheds but does include County road miles

Based on GIS GTRN data (circa 1996)

The results of the watershed assessment are summarized in the Key Findings of the sediment source section, of the assessments. Listed below are those findings:

KEY FINDINGS

Density of Roads on Slopes >50%

 Dry Creek received the highest risk rating (percentage) among all south coast subwatersheds considered in the Sixes River assessment. This is primarily due to the fact that the drainage is steep, the number of miles is low (3.39) and all miles are on slopes greater than 50%. The actual road density calculated for this drainage is 1.24 miles/miles^2 . For the assessment, only of private acres of land were used to calculate the risk rating of the subwatershed and this subwatershed contains a large percentage of USFS managed lands.

 Subwatersheds that received a moderate risk include South Fork Sixes and Big & Otter Area.

 Moderately low risk ratings were assigned to Elephant Rock Area and Edson Creek and the West Fork Floras Creek.

 Low risk ratings were assigned to the remaining Sixes River subwatersheds and all but one in Floras Creek.

V. VEGETATION AND TYPES ACROSS THE LANDSCAPE

General Description

Overall the watershed vegetation conditions of the watershed can best be described as more or less distinct areas of Douglas-fir (*Pseudotsuga menziesii*), grass pastures with some meadows or agricultural lands (cranberry bogs). The Douglas-fir stands are either plantations approaching 50 years of age on BLM and private lands or old-growth stands on USFS lands south of the Sixes County road. The plantations are normally densely stocked; however, some thinning for density reduction has been applied to some private lands. Single-storied Douglas-fir plantations range in age from about 36 to 60 years old. Western hemlock (*Tsuga heterophylla*) is also a major component of the overstory in most of the young stands and, to a greater degree, in the old-growth stands. Scattered pockets of grand-fir (*Abies grandis*) are also present, and in areas where understory trees are present, they are predominantly western hemlock and red alder (*Alnus rubra*) with widely scattered Port-Orford-cedar (*Chamaecyparis lawsoniana*) and a few pockets of red cedar (*Thuja plicata*).

Red alder tends to dominate the overstory along roadsides and in drainages that have had some past disturbances. Other more widely scattered understory tree species include grand fir, chinkapin (*Chrysolepis chrysophylla*), tan oak (*Lithocarpus densiflorus*), and big-leaf maple (*Acer macrophyllum*). These species tend to predominate on the mature forest stands on USFS lands where intensive timber management has not changed that portion of the landscape. Where such management has occurred understory shrub and herbaceous plant communities are generally under-developed within the younger plantations due to dense canopy cover.

Aspect and topographic position in the landscape are important factors effecting what species dominate in the shrub and forb layers. On the drier ridgetops, upper slopes, and south and west aspects the dominant shrub often is rhododendron (*Rhododendron macrophyllum*) with the dominant forbs frequently being Oregon grape (*Mahonia nervosa*) and salal (*Galtheria shallon*).

Evergreen huckleberry (*Vaccinium ovatum*) and red huckleberry (*Vaccinium parviflorum*) can be found in varying amounts. Salmonberry (*Rubus spectabilis*) is often dense under red alder pockets and can be found throughout the managed timber stands. In older stands that have dense canopy cover, understory shrubs are often dominated by varying densities of sword fern (*Polystichum munitum*) with only minor amounts of other shrub species. The following shrub and herb species are local and can be found scattered as isolated populations across the landscape: bear grass (*Xerophyllum tenax*), vine maple (*Acer circinatum*), chitum (*Frangula purshiana*), ocean spray (*Holodiscus discolor*), running-pine (*Lycopodium clavatum*), and blue-blossom (*Ceanothus thrysiflorus*).

The overall bryophyte and lichen diversity is low in the densely stocked, conifer-dominated plantations. Uncharred, down wood class 3, 4, and 5 logs and roadside and riparian red alder trees harbor the majority of the bryophyte diversity. Lichens are typically more abundant on the edges of the young managed stands, in areas where there is a hardwood component, or in stands with remnant old-growth trees (USFS lands), and where there are canopy gaps that allow sunlight to penetrate into the lower canopy and onto the forest floor. Early seral green-algal lichens dominate the lichen community in plantations, with alectorioid lichens being uncommon and cyanolichens almost absent except when adjacent to older forests where the older trees have been able to seed the adjacent young plantation.

Special Status Species

In Oregon and Washington, a SSS policy identifies two tiers: Bureau Sensitive and Bureau Strategic (USDI 2007). Bureau Sensitive species are those that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as threatened or endangered (T & E); are on an official state list; or are recognized by the implementing agencies as needing special management to prevent their being placed on federal or state lists. Bureau Strategic species are those which may be come threatened or endangered in the future. The sensitive species designation is normally used for species that occur on Bureau administered lands for which BLM has the capability to significantly affect the conservation status of the species through management.

The following table lists the special status plant species that have been documented within this watershed analysis area.

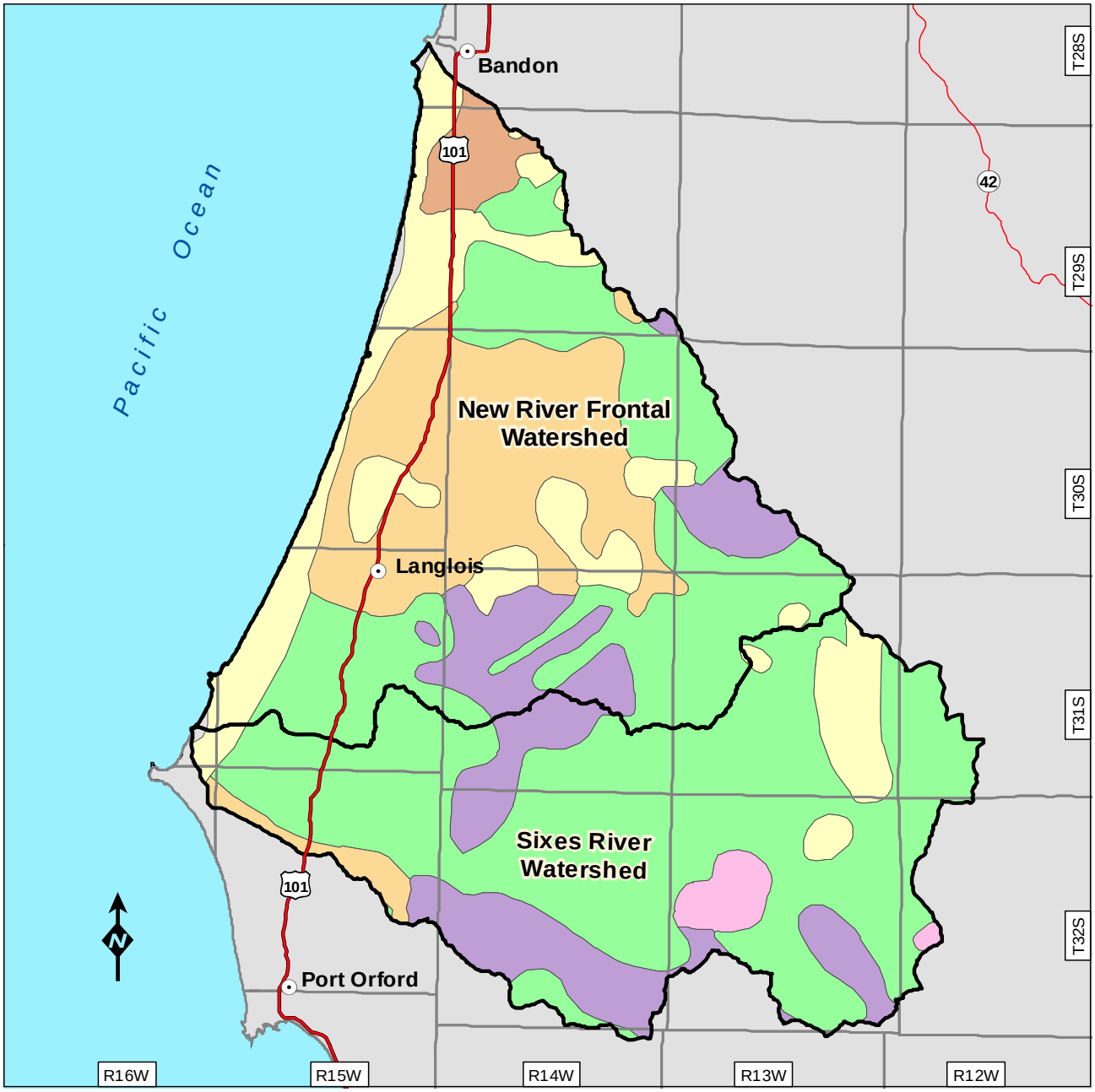
Table 4. Documented Special Status Plants within the Sixes-New River Watershed

Common Name	Scientific Name	Federal Status	ODA Status	ORNHIC List	Bureau Status
Vascular Plants					
pink sand verbena	*Abronia umbellate* ssp. *breviflora*	SOC	LE	1	BS
coastal sagewort	*Artemisia pycnocephala*	---	---	2	BS
dwarf brodiaea	*Brodiaea terrestris*	---	---	2	BS
short-stemmed sedge	*Carex brevicaulis*	---	---	2	BS
Crawford's sedge	*Carex crawfordii*	---	---	2	BS
timwort	*Cicendia quadrangularis*	---	---	2	BS
seaside cryptantha	*Cryptantha leiocarpa*	---	---	2	BS
russet cotton-grass	*Eriophorum chamissonis*	---	---	2	BS
pacific wallflower	*Erysimum menziesii* ssp. *concinnum*	SOC	---	2	BS
seaside gilia	*Gilia millefoliata*	SOC	---	1	BS
short-leaved evax	*Hesperevax sparsiflora* var. *brevifolia*	---	---	3	S
whorled marsh pennywort	*Hydrocotyle verticillata*	---	---	2	BS
large-flowered goldfields	*Lasthenia ornduffii*	SOC	C	1	BS
western lily	*Lilium occidentale*	LE	LE	1	
northern bog clubmoss	*Lycopodiella inundata*	---	---	2	BS
coast microseris	*Microseris bigelovii*	---	---	2	S
Wolf's evening-primrose	*Oenothera wolfii*	SOC	LT	1	BS
silvery phacelia	*Phacelia argentea*	SOC	LT	1	BS
white beakrush	*Rhynchospora alba*	---	---	2	BS
water clubrush	*Schoenoplectus subterminalis*	---	---	2	BS
coast checker bloom	*Sidalcea malviflora* ssp. *patula*	SOC	C	1	BS
humped bladderwort	*Utricularia gibba*	---	---	2	BS
Non-vascular Plants	**Plant Type**				
Anaptychia setifera	Lichen	---	---	3	S
Bryoria pseudocapillaris	Lichen	---	---	2	BS
Bryoria spiralifera	Lichen	---	---	2	BS
Calypogeia sphagnicola	Liverwort	---	---	2	BS
Erioderma sorediatum	Lichen	---	---	2	BS
Heterodermia leucomela	Lichen	---	---	2	BS
Kurzia makinoana	Liverwort	---	---	2	BS
Niebla cephalota	Lichen	---	---	2	BS
Ramalina pollinaria	Lichen	---	---	2	BS
Teloschistes flavicans	Lichen	---	---	2	BS

Vegetational Disturbance and Type Changes

This watershed has had both large and small scale vegetational changes over the years. There are reports that in the last 150 years there have been four large fires in the Sixes and Elk River drainages. The most altering would have been the 1868 fire that burned up and down the Southern Oregon Coast. In 1898 a large fire occurred on Salmon Mt. In 1929 the Barklow Mountain fire and the Elk River fire burned approximately 18, 600 acres; the majority of the area that became the Grassy Knob Wilderness, and the Dry Creek area were consumed at that time. A smaller fire in the mid-1960's burned the Otter Creek area as a result of a logging operations fire. Most fire activity has been suppressed as part of timber management activities in the last 70-80 years.

Just what the landscape looked like prior to these large or small fires can only be guessed at. Three maps describing the vegetation are available from our GIS database, one from 1914, 1930 and a 1995 capture of satellite data classified into vegetational types (WODIP). The fire maps (Maps 7&8) show extensive removal of vegetation but coarse mapping of this sort can not always describe the actual burn conditions when a mosaic style of burn occurs as recently encountered in the Biscuit fire of 2002 just to the south between Gold Beach and Brookings, OR.

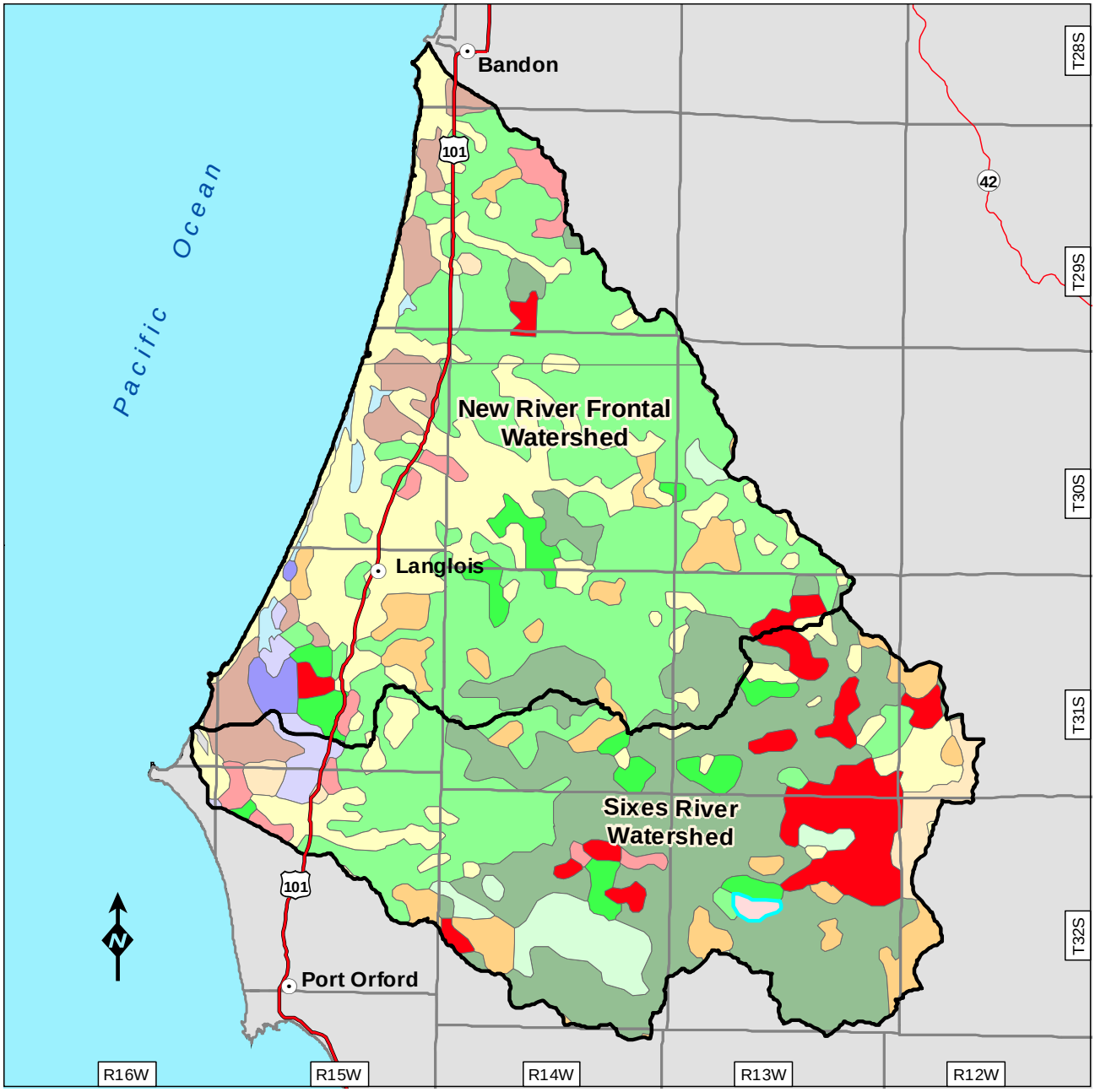


Brush
Burned Areas Not Re-Stocking
Burned Areas Re-Stocking
Cutover Areas Re-Stocking
Merchantable Timber
Non-Timber Areas
US Highway
State Highway
Watershed Boundary

US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1:250,000
0 1 2 3 4
Miles

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data or individual or aggregate use with other data.

Map 7. 1914 Fire and Vegetation Classes in the Sixes-New River Area



Water
Non-forest Land
Recent Cut-Overs
Deforested Burns
Lodgepole Pine
Spruce Hemlock Cedar Small
Spruce Hemlock Large
Douglas-fir Seedling Sapling
Douglas-fir Small Second Growth
Douglas-fir Large Second Growth
Douglas-fir Old Growth
Hardwoods Oak Madrone
Hardwoods Alder Ash Maple
Cedar Redwood Large

US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1:250,000
0 1 2 3 4
Miles

No warranty is made by the Bureau of Land Management as to the accuracy, reliability, or completeness of these data or individual or aggregate use with other data.

Map 8. 1930 Fire and Vegetation Classes in the Sixes-New River Area

Vegetation Type Classification

An attempt to classify the watershed vegetation into 5 seral stages was conducted in the Sixes WA, See Figure T-4 of that document. The defined seral stages were based on age more than vegetation types; thus a more rigorous analysis was conducted for this Sixes-New River area. Due to the large ownership of private lands for which data is unavailable within this watershed, no attempt will be made to determine specific age classes across the watershed. What can be derived from WODIP data are the forest cover types. The non-forest (urban or agricultural lands) and the detectable forest canopies are identified. For the overall watershed, the percentage of each type of land cover based on pixel count is as follows:

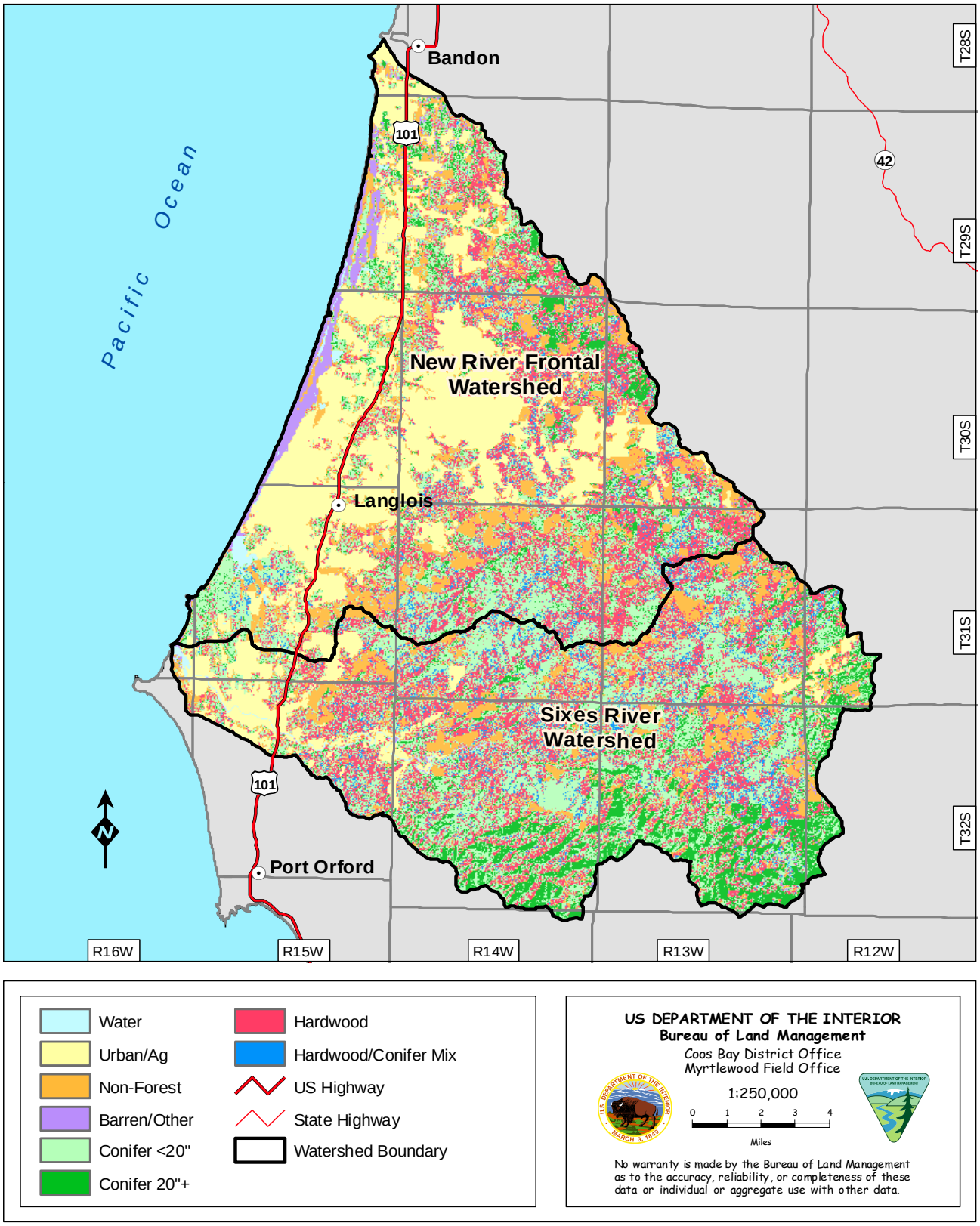
Non-Forest Areas - 34.9 % Conifer Canopy – 39.6% Hardwood Canopy – 21.4%
Mixed Hardwood and Conifer canopy – 4.1%

Additional reclassification of the WODIP vegetation data using GIS was conducted based on the type of forest canopy (conifer or hardwood, or a mix of the two) and the expected diameter of the stands. This provides the available forest stand data for the entire watershed. This data was analyzed to provide the riparian and landscape vegetational information in the tables below. The data is not current (captured in 1995), nor is it completely accurate, as classification of such data is prone to interpreter error. Aerial photos for the area from a 2002 flight, and recently a 2005 satellite composite show harvest areas that were considered forested in 1995. Due to time constraints, mapping and interpreting individual stands for timber type, ownership and age of the stand can not be conducted on the 2005 composite. Thus, the 1995 WODIP GIS information becomes the best option for vegetational typing at this scale. Knowing that recent harvesting on many of the private lands is under represented, more acreage would now be classified as barren or non-forest on private lands.

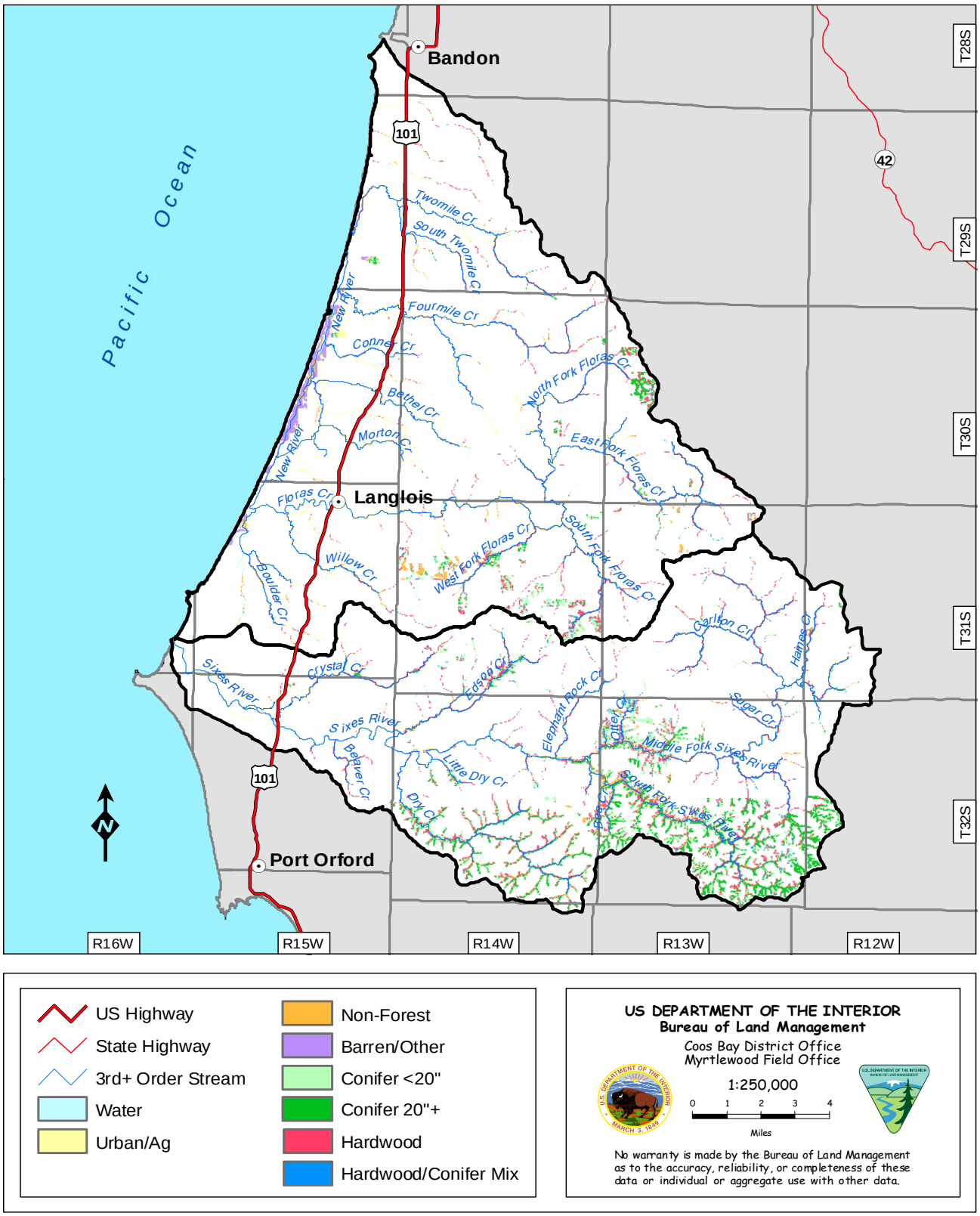
Overall, Table 5 displays the distribution of vegetation types within the watershed. The 10 to 19 inch diameter conifers and hardwoods and Urban or agricultural areas are dominating the landscape (23+17+19 = 59% of the entire watershed, column 1). The barren and non-forest lands cover an additional 15% of the Sixes-New River area. The remaining land area is composed of small diameter Doug-fir plantations, small and large diameter hardwoods and large diameter conifers.

On lands managed by the two federal agencies, medium sized conifers are still a major vegetation type but the larger conifers and hardwood types are the next major types represented. The urban and non-forested types are different depending on which federal ownership being considered (Columns 3 and 4). Overall, 70% or more of federal lands can be found in a forested vegetation type. The amount of conifer over 20 inches in diameter is very different between the federal agencies as the USFS lands have more than twice the percentage of the BLM lands.

Considering only the BLM managed lands; a slightly different distribution of timber types replaces the general lands picture. Thirty one percent of BLM lands are medium sized conifers (10-19”) and make nearly half of the total contribution to the forested landscape. The barren lands, non-forest areas, large conifers (< 20+”) and the medium sized hardwoods are all at low to moderately low levels (10-15%). The distribution away from the large conifers (< 20+”), as compared to the USFS lands is due to the past management of the BLM managed lands. Current timber management would focus on the thinning of the 10 to 19 inch diameter conifers or final harvest of those stands that contain trees over 20 inches in diameter. Those are the directives for Matrix lands under the current Resource Management Plan.



Map 9. Vegetation Classes Based on WODIP in the Sixes-New River Area



Map 10. WODIP Vegetation Classes of Riparians in the Sixes-New River Area

Table 5 Sixes-New River Watershed Area Vegetation Information

Vegetational Classification Based on 1995 WODIP Data

Vegetation Type and Diameter	Percentage of Types			
	Across Entire Watershed	Private Lands	USFS Managed Lands	BLM Managed Lands
Water Bodies	<1	<1	0	1.4
Urban/ Agriculture	19.3	22.7	<1	2.1
Non-Forest	12.9	14.2	4.7	9.9
Barren	2.2	1.8	<1	11.0
Conifer < 10 “	7.5	7.6	6.7	7.4
Conifer 10-19 “	22.7	21.3	31.4	31.0
Conifer > 20+”	9.4	5.6	35.9	14.6
Hardwood < 10”	3.9	3.9	4.0	4.4
Hardwood 10-19 “	17.0	17.6	14.0	14.4
Hardwood < 20+”	<1	<1	<1	<1
Mixed Forest <10”	2.2	2.4	1.2	<1
Mixed Forest 10-19”	1.9	1.9	1.5	<1
Mixed Forest >20+”	0	0	0	0
Developed Lands	<1	<1	0	0

Percentages based on the following data: BLM lands total 6,461 acres USFS lands total 21,692 acres
Private land total 156,118 acres Entire watershed 185,204 acres

Table 6 Sixes-New River Riparian Reserve Vegetation Information

Based on 1995 WODIP Data

Vegetation Type and Diameter	Percentage of Riparian Reserves				
	All Riparian Reserves Private and Federal	All Federal Lands[1] as interim Riparian Reserves	Federal Riparian Reserves under BLM Management[2]	Federal Riparian Reserves under USFS Management[4]	Private Land as Reserves[3]
Water Bodies	2.6	<1	2.6	0	4.7
Urban/ Agriculture	10.9	1.0	2.8	<1	27.2
Non-Forest	8.6	6.2	9.4	4.5	12.5
Barren	4.3	5.4	15.6	<1	2.3
Conifer < 10 "	5.3	5.4	6.1	5.1	5.3
Conifer 10-19 "	20.3	26.6	25.2	27.6	10.0
Conifer > 20+"	20.2	30.4	15.3	38.3	3.4
Hardwood < 10"	3.3	3.4	3.9	3.1	3.0
Hardwood 10-19 "	20.5	17.1	15.8	18.0	26.1
Hardwood < 20+"	<1	<1	<1	<1	1.8
Mixed Forest <10"	<1	1.2	1.3	1.3	2.8
Mixed Forest 10-19"	<1	1.5	1.8	1.4	1.0
Mixed Forest >20+"	<1	0.0	0	0	0
Developed Lands	<1	NA	0	0	<1

1 Complex of BLM and USFS RR's total of 10,660 acres
2 BLM riparian areas total 3,575 acres 3 USFS riparian areas total 7,085 acres
4 Private land in reserves total 6,524 acres

Riparian Reserve information

Determining the type of vegetation within the riparian area on private lands or as part of the interim Riparian Reserves (RR's) outlined in the NFP was conducted based on several key items. On Federal lands the RR's are part of the land base withdrawn from intensive forest practices (Not Matrix lands) and differ in width based on perennial or intermittent flow of the streams and the presence or absence of fish species. On private lands, vegetation retention is required by the Oregon Forest Practices Act based on fish presence or absence in addition to stream order. First and second order streams require a vegetational leave strip on federal lands whereas third order and greater streams require leave strips on private lands. Fish distribution was updated to current knowledge and stream order was determined from the GIS watercourses data. Reserves on Federal lands were based on a potential tree height of 164 ft. for the Sixes 5th field watershed but 192 feet for the New River 5th field. This is a reflection of our 1995 Resource Management Plan (RMP) assumptions that the potential site tree in Curry Co. is less than that in Coos Co.

The data within Table 5 & 6 and the associated Maps 9, and 10 provide a description of the vegetation types and the riparian network across this analysis area. The extensive riparian coverage of streams in the southern portion of the analysis area is due to the consolidated USFS lands. The streams within Elephant Creek and Dry Creek are not delineated with the same level of detail as the remaining portions of the analysis area. Thus, the reserve network in those areas may be under-represented. The scattered parcels of BLM managed lands in the middle section of the watershed do not and can not provide all of the functions as outlined in the NFP. Corridor connectivity and refuge areas are drastically reduced when the adjacent ownership is private land. This is the reality of two different land use requirements, one by the state and the other by the federal agencies.

Connections to and through private lands is dependent on riparian areas adjacent only to perennial streams. Whereas federally managed lands have mandated riparian associated vegetation leave areas adjacent to both perennial and intermittent streams. The high percentage of private lands (84%) within the analysis area provides 38% of the total riparian vegetation acres (6,524 acres) across the landscape. These reserves are primarily adjacent to the higher order downstream portions of in the individual subwatersheds. In contrast, federally managed lands make up only 15% of the watershed but contain 10,413 acres of Riparian Reserve lands (62% of the total).

There are several vegetational patterns reflected in Table 6, note the percentage of the various classes as one considers the riparian areas across the entire landscape in contrast to those areas managed by federal agencies. Percentage of medium and large sized conifers and medium sized hardwoods within the riparian areas across all lands of the landscape are nearly equal at 20. However, the riparian areas on private lands are composed primarily of urban/ agricultural lands, medium sized hardwoods and to a lesser extent non-forest lands. Conifers of any size comprise less than 20% of the riparian areas. Federal lands contain mostly large and medium sized conifers, and to a lesser extent medium sized hardwoods.

Specifically on BLM Riparian Reserve lands, the percent of area as large conifers (over 20 inches) is half what exists on all federal lands. The percentage of the riparian reserves that are medium sized conifers and medium sized hardwoods (approx. 40%) is only slightly less than what is found on all federal lands. This amount of medium sized conifer stands as riparian reserves demonstrates the need to thin these stands to encourage the growth of the residual trees into larger diameter trees for RR habitat purposes.

BLM managed riparian areas have three times the water, urban and barren land within them compared to the overall federal holdings. The large component of barren land and water within the RR's is due to the proximity of BLM lands near New River. The sand is classified as barren and there are numerous lakes and wetlands in the lower New River Frontal watershed. Nearly 20% of the BLM RR's lands will never support large conifers even though they are designated as NFP RR's. Approximately 10% of the non-forest lands in Table 6 are misclassified and are actually in the conifer less than ten inch diameter class at this time.

Noxious Weeds

This watershed contains Gorse (*Ulex europaeus*), Scotch broom (*Cytisus scoparius*) and French broom (*Genista monspessulana)* as the principle invading weed species. Other notables are Japanese knotweed (*Polygonum cuspidatum*), tansy ragwort(*Senecio jacobaea*), Yellow Flag Iris (*Iris pseudacorus*) and several aquatic plants in the Floras Lake and New River areas. The overall distribution is low for all species in the uplands east of Highway 101 and control measures are being taken for most sites by both the private and federal land managers. The largest concentrations of weeds are near the town of Bandon. Extensive pastures, fence lines and undeveloped areas contain Gorse and Brooms primarily. Private land owners and government agencies are in the process of developing an eradication and inventory of weeds in the watershed through the local Weed board. Sixes River Watershed council has embarked upon a planning and control effort to reduce new starts of Gorse and Brooms in the watershed and keep current populations to the south, in Elk River. Private ranchers are controlling weeds as part of the pasture improvement activities they oversee.

Wetlands

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. This regulatory definition of a wetland as used by the U.S. Army Corps of Engineers and the Oregon Division of State Lands was used for the two watershed assessments prepared by the Watershed Council.

The two council assessments provide the highest detail of information about the wetlands within Sixes or Floras Creek watersheds. 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. Using the NWI database for the entire New River/ Sixes watershed area allows incorporation of wetlands north of Floras Creek but some loss in detail (restoration potential and condition assessments) must be accepted.

Wetlands provide a variety of important functions, including water quality improvement, flood attenuation and desynchronization, groundwater recharge and discharge, carbon sinks, and fish and wildlife habitat. Large wetlands are protected by federal, state, and local regulations. In addition, wetlands can contribute to critical functions in the health of a watershed and they play a role disproportionate to their size in supporting endangered species and maintaining biodiversity (Ecological Resources, 1994). Determining the approximate location and extent of wetlands may be essential in solving problems within the watershed.

NWI maps contain information on wetland 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. Data available for the GIS Wetlands Inventory is limited to location (spatial), Cowardin unit, and acreage of the feature. Map 11 illustrates the extent and location of wetlands for this watershed area and Appendix C describes the classification scheme.

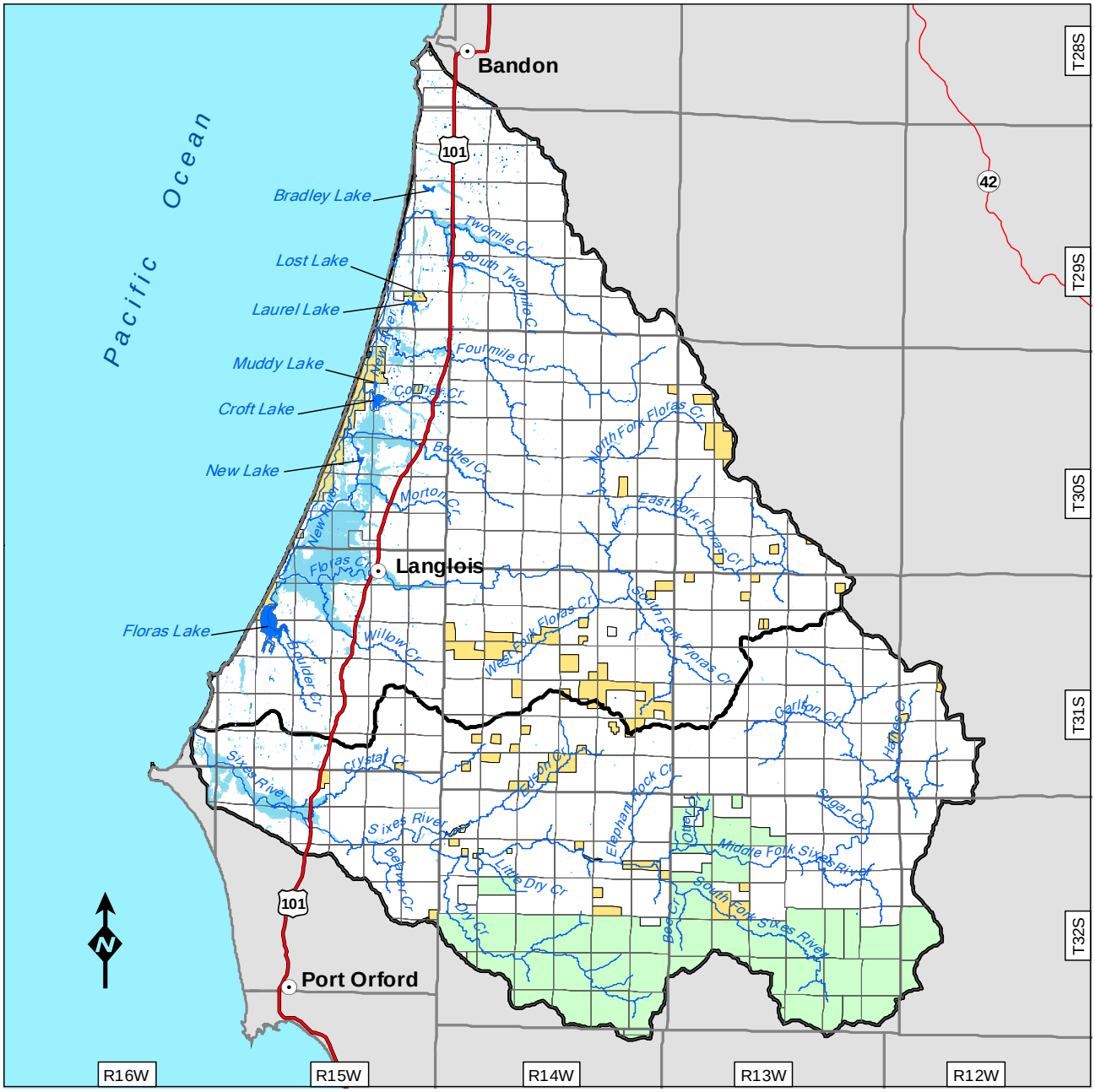
Most of the functional wetlands are located in the lower portions of the Sixes River and Floras Creek drainages adjacent to the ocean. New River Frontal contains the bulk of the NWI identified wetlands in the watershed area, and again they are in the lowland areas. These identified areas meet the definition for a wetland in that they have the necessary period of wetness, vegetational characters and soil indicators. However, they are now converted to pastures and/or cranberry bogs for agricultural purposes. Cranberry production far outweighs the off stream watering areas for raising cattle or sheep.

Using NWI data for the entire Sixes- New River watershed area it is necessary to note that some scattered upland wetlands do appear on the data base and many are associated with forest management activities, either as water sources for suppression of fires or as low spots created from borrow operations. Naturally occurring wetlands can be found in this watershed on flat benches or in depressions on soils that have high clay contents.

In the lower river drainages, development for agricultural purposes is most evident. The PEMA and PEMC wetlands continue to dominate the landscape (81%) however the PFOA (6%) and PSSA or PSSC (8%) contribute significantly to the 6,801 acres inventoried across the watershed (South Coast Watershed Assessments).

Table 7. The Classification System of Cowardin et al. (1979, FWS/OBS-79/31)

System	Class	Water Regime Modifier
Non-wetland		
Palustrine	Emergent Wetland	Temporarily flooded (A)
Palustrine	Emergent Wetland	Seasonally flooded (C)
Palustrine	Emergent Wetland	Semi permanently flooded (F)
Palustrine	Emergent wetland or Aquatic bed	Permanently flooded (H) or Intermittently exposed (Z)
Palustrine	Unconsolidated shore	Intermittently flooded (J)
Palustrine	Emergent Wetland	Saturated (B)



Waterbody
Wetland
BLM
US Forest Service
Private/Other
US Highway
State Highway
3+ Order Stream
Watershed Bdry

US DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Coos Bay District Office
Myrtlewood Field Office
1:250,000
0 1 2 3 4
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Map 11. Wetlands/Waterbodies in the Sixes-New River Watersheds

VI. HYDROLOGY

Introduction

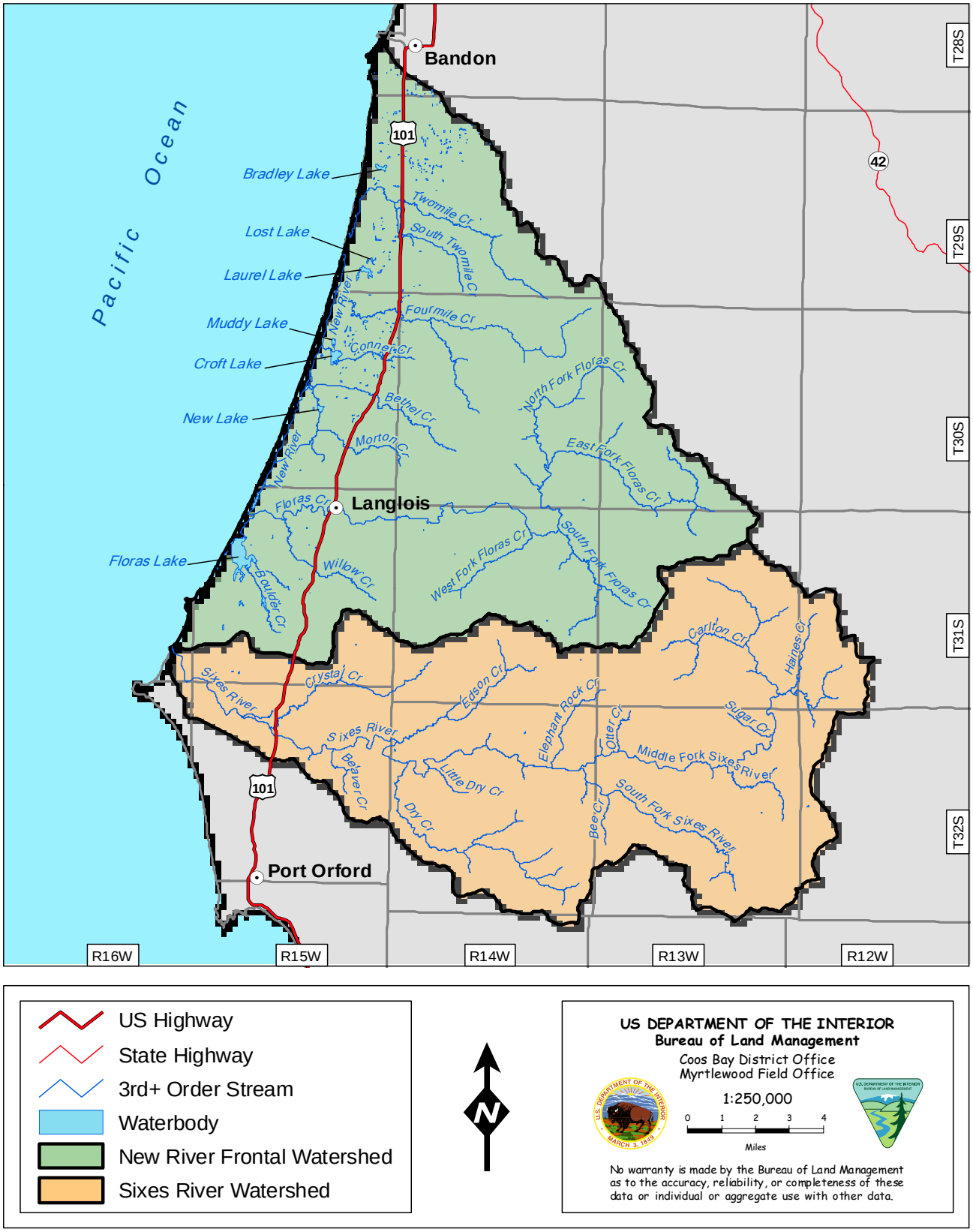
The Sixes-New River watershed area is heavily influenced by rain dominated climate. Only a small percentage of the landscape is influenced by snow during the winter. Water flowing into the main channel of Floras Creek will then flow north through the New River frontal area as a component of New River. See Map 12. Streams and Waterbodies below. The Sixes River has higher elevations in the east and snowfall will stay for a longer period of time on the ground compared to Floras Creek but the majority of the landscape is considered rain dominated. All water entering Sixes River exits directly into the ocean with little estuary interaction compared to New River.

Flow

This analysis combines two individual stream systems under one analysis as the BLM lands overlap a ridge joining the two. Generally the watershed of interest has one flow path of the water towards the ocean, as does the Sixes River. However, Floras Creek transitions into New River as it turns north and empties into the ocean seven or more miles to the north. Thus within the context of this analysis there are two outlets and flow paths to the ocean. The local climate affects the two areas in a similar manner but the flow of each is somewhat different. New River is greatly influenced by tidal mechanisms, whereas Sixes River is less so.

The quantity of water derived from this watershed is difficult to assess. Gauge stations were functional on the Sixes River from 1968 to 1970. Additional measurements in the local area come from Elk River to the south and Floras Creek to the north. The gauge at Floras Creek was constructed in 1995 and was damaged in a flood in November of 1996, with removal in 1997. According to the Sixes River WA the average annual water yield for the Sixes River is estimated to be 480,600 acre feet. The low monthly flows of 36 to 180 cubic feet per second (cfs) occur between June and October. High flows between 1,800 to 10,500 cfs occur from November to April. Increases in peak flow would not be common from rain on snow events because less than 1% of the Sixes and Floras Creek watershed areas are in the transient snow zone.

The assessments of the Sixes River and Floras Creek provided by the Watershed Council rated the risk of altering peak flows based on OWEB criteria. There is a low risk of roads altering peak flows across the watersheds, except for the Four Mile and Two Mile Creek subwatersheds. See Table 5 below for comparisons between watersheds and road densities. The large number of roads associated with the rural population surrounding the Bandon area raises the risk ratings. Ratings for this portion of the watershed were derived separately from the council assessments but followed the methods outlined therein.



Map 12. Streams and Waterbodies in the Sixes-New River Watersheds

Summary from the watershed assessments is as follows:

 Results indicate that over 99% of the Floras Creek and Sixes River watersheds are located within the lowest elevation zone of 0’ to 2,500’. Peak flow generating processes in this elevation zone are rain dominant. Elevation zones of the remaining area (<1%) of the watershed are located within the rain on snow zone of 2,500’ to 3,500’.

 The GWEB Oregon Watershed Assessment Manual suggests characterizing subwatersheds with more than 75% in the rain category as low potential risk of peak flow enhancement. Since all subwatersheds fall within the rain category, a low potential risk of peak flow enhancement was assigned throughout the entire basin.

 Further investigation of peak flow increases based on percent of land in a forested condition >30 years of age needs to be conducted for further analysis.

 Further analysis of forestry and surface runoff effects should be conducted on those subwatersheds where >50% of the hydrologic soil groups are in classes C and D.

Upon further investigation, the areas where hydrologic soil groups are in Class C or D are found in the lowland terraces west of Highway 101 in the Lower Floras Creek and Floras Lake subwatersheds.

Table 8 Road Density within Subwatersheds

Subwatershed	Area (Sq Miles)	Road Miles Assessment Data (1991)	BLM Data (1994)	Road Density Mi/Mi^2		Probability of Effects on Peak Flows
				Assessment	BLM	
Upper Sixes River	65.1	122.2	141.7	1.9	2.2	LOW
Middle Sixes River	42.9	104	114.2	2.4	2.7	LOW
Lower Sixes River	26.1	65.2	70.4	2.5	2.7	LOW
Upper Floras Creek (includes N&E Fk Drainages)	24.3	89.7	80.1	3.7	3.3	MOD
Lower Floras Creek (includes Willow, Mid Fk, W & S Frks)	46.3	114.9	122.1	2.5	2.6	LOW
Floras Lake	12.2	24.0	28.8	2.3	2.8	LOW
Croft Lake	23.1	--	48.1	--	2.1	LOW
Fourmile Creek	22.2	--	96.5	--	4.4	MOD
Twomile Creek	27.2	--	147.8	--	5.4	HIGH

Rating system for Road Density and Risk as per Council Assessment Methods. <3 mi/mi^2 is low, 3-5 is moderate, over 5 is high risk.

Road miles from assessments includes both rural and forest roads, BLM uses all roads

Channel Habitat Typing

The OWEB assessments followed a classification system, entitled Channel Habitat Types (CHTs), based on several existing stream classification systems including Rosgen and Montgomery & Buffington (Rosgen1993; Montgomery and Buffington 1993). CHT's enable users to make inferences of how land use impacts can alter physical channel form and processes and, therefore, change or impact fish habitat. A description of each Channel Habitat Type is presented in Table 6 below.

Sixes River and its tributaries represent the greatest diversity of CHT's of any watershed in the Southwestern Oregon coast area. The majority of stream miles are found within three CHT's, but the distribution across types is much greater than Floras Creek. Floras Creek stream channels are almost equally divided into three general types: low gradient confined channels, moderate gradient confined channels and steep gradient confined channels.

Table 6 Channel Habitat Type Attributes *(GWEB 1999)*

CHT Code	Type	Gradient	Valley Shape	Channel Pattern	Channel Confinement	OR Stream Size	Position in Drainage
ES	Small Estuarine Channel	0 to 1%	broad	sinuous single or multiple	unconfined	small-med	bottom, mouth of stream
EL	Large Estuarine Channel	0 to 1%	broad	sinuous single or multiple	unconfined	large	bottom, mouth of stream
FP1	Low Gradient Large Floodplain Channel	0 to 1%	broad floodplain	sinuous single or multiple	unconfined	large	bottom, low in drainage
FP2	Low Gradient Floodplain Channel	0 to 2%	broad, flat or gentle landforms	sinuous single or multiple	unconfined	med-large	middle to lower end of drainage
FP3	Low Gradient Small Floodplain Channel	0 to 2%	broad	single or multiple	moderate to unconfined	small-med	variable
AF	Alluvial Fan Channel	1 to 12%	where hillslope opens to broad valley	single or multiple spread like a fan	variable	small-med	lower end of small tributaries
LM	Low Gradient Moderately Confined Channel	0 to 2%	broad, generally much wider than channel	single w/ occasional multiple channels	variable	variable, usually med-large	variable, often mainstem & low end of main tribs.
LC	Low Gradient Confined Channel	0 to 2%	low-mod gradient hillslope w/ limited floodplain	single channel, variable sinuosity	conifined by hillslope/terrace	variable, usually med-large	variable, generally mid to lower in large basin
MM	Moderate Gradient Moderately Confined	2 to 4%	narrow valley w/ flood-plain or narrow terrace	single, low to moderate sinuosity	variable	variable, usually med-large	middle to lower portion of drainage
MC	Moderate Gradient Confined Channel	2 to 4%	gentle to narrow V-shaped valley, little to no floodplain	single, relatively straight or conforms to hillslope	confined	variable	middle to lower portion of drainage
MH	Moderate Gradient Headwater Channel	1 to 6%	open, gentle V-shaped valley	low sinuosity to straight	confined	small	upper, headwater
MV	Moderately Steep Narrow Valley Channel	4-8%	narrow, V-shaped valley	single channel, relatively straight	confined	small-medium	middle to upper
BC	Bedrock Canyon Channel	>4%	canyons, gorges, very steep side slopes	single channel, straight	tightly confined by bedrock	variable	variable
SV	Steep Narrow Valley Channel	8 to 16%	steep, narrow V-shaped valley	single, straight	tightly confined	small, small to medium	middle upper to upper
VH	Very Steep Headwater	>16%	steep, narrow V-shaped valley	single, straight	tightly confined	small, small to medium	middle upper to upper

Table taken from Floras Creek Watershed Assessment conducted by Mike Maguire

Table 6 from the council assessments provides a comparison of 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 species. Eight of these different channel types were identified throughout approximately 127 miles of streams in the Floras Creek basin. Fourteen of these CHT's (see Table SSS below) were identified throughout approximately 177 miles of streams in the Sixes River basin. The two assessments concluded with the following key findings.

Sixes River

 Of the 177 stream miles evaluated in this assessment, 41 percent are classified as steep (SV) to very steep (VH) narrow valleys. These streams are typically the small headwater streams across the Sixes River subwatersheds. The channels are stable and not highly responsive to either disturbance or restoration. Their stable banks support riparian vegetation, making them good candidates for riparian planting or thinning.

 Moderate gradient confined and headwater streams (MC, MH, and MV) comprise 24 percent of the channels, and low gradient confined channels (LC) are 17 percent, for a total of 41 percent. These are typically located in small to medium size streams. Channels are fairly stable, moderately responsive to disturbance, and not highly responsive to restoration activities except for riparian planting or thinning. In non-forested areas, channels may be deeply incised and prone to erosion by livestock, so they may benefit from livestock access control measures.

 Sixes River has the greatest diversity of CHTs and the most miles of LM and MM channels among those assessed in Curry County. LM and MM channels are scattered throughout the watershed with significant opportunities to protect and restore adjacent riparian areas.

Floras Creek

 Of the 127 stream miles evaluated in this assessment, 35 percent are classified as steep (SV) to very steep (VH) narrow valleys. These are typically the small headwater streams in all of the Floras Creek subwatersheds. Channel segments that are accessible to fish offer only limited rearing for anadromous fish and limited rearing and spawning for resident fish, but they can be valuable sources of cool water and large woody debris to downstream fish habitat. The channels are stable and not highly responsive to either disturbance or restoration. The stable banks support riparian vegetation, making them good candidates for riparian planting or thinning.

 Moderate gradient confined and headwater streams (MC, MH, and MV) comprise 30 percent of the channels, and low gradient confined channels (LC) are 32 percent, for a total of 62 percent.

 A natural barrier to chinook and coho migration is located in the Middle Floras mainstem in a MV channel type, approximately one mile upstream of the segment boundary with Lower Floras mainstem.

 Floras Creek contains the most LC habitat of all the South Coast Watersheds. Fall chinook are found primarily in LC channels in the Lower Floras Mainstem. Coho are prevalent in these channels as well as throughout Floras Lake subwatershed channels and certain tributaries.

 Floras Creek had the fewest miles of the MM and LM channel types of the South Coast watersheds in this assessment.

Table 9. Channel Habitat Types within Subwatersheds

CHT	Channel Description	Percent of Miles Sixes River	Percent of Miles Floras Creek	Response to Disturbance Riparian Treatment	Opportunities
ES	Small estuarine	2	0	Moderate	Limit human structures
EL	Large estuarine	0	0	Low	Few opportunities
FP1	Low gradient large floodplain	2	0	Moderate	Few opportunities
FP2	Low gradient medium floodplain	1	0	High	Respect lateral movement
FP3	Low gradient small floodplain	4	0	High	Respect lateral movement
AF	Alluvial fan	9	0	Variable	Few opportunities
LM	Low gradient moderately confined	7	2	High	Good candidates
LC	Low gradient confined	17	32	Low Mod	Manage livestock access
MM	Moderate gradient moderately confined	2	1	High	Good candidates
MC	Moderate gradient confined	9	10	Mod	Manage livestock access
MH	Moderate gradient headwater	2	<1	Mod	Manage livestock access
MV	Moderately steep narrow valley	13	20	Mod	Manage livestock access
BC	Bedrock canyon	<1	0	Low	Few opportunities
SV	Steep narrow valley	32	28	Low	Few opportunities
VH	Very steep headwater	9	7	Low	Few opportunities

The New River and Tributaries Proper Functioning Condition Assessment (Massingill, 2003) surveyed the reaches of the New River area in addition to the lower Floras Creek channel. In the New River watershed between the Pacific Ocean and Highway 101, over 23 miles of stream including 42 separate reaches were assessed for their functional condition and restoration potential. Fieldwork was completed between June and October 2002. This project addressed flowing water systems only, with lower reaches often ending in wetlands.

Of the 42 reaches surveyed (Table 1 of the report), 12 were rated as Properly Functioning Condition (PFC). Seven of those reaches are on New River channel, and three were on a proposed (at the

time, now implemented) Bethel Creek relocation project channel. Nine reaches were rated as non-functional (NF) and clearly not providing watershed functions relative to their potential. Of those nine reaches, two are on Butte Creek, two are on Morton Creek, two are on Langlois Creek, two on North Langlois and one is on Floras Creek. Twenty-one streams were rated as functioning-at-risk, with eight trending downward (likely to get worse with no changes in management). Nine are trending upward at variable rates, and four reaches had no apparent trend.

The strongest concerns for stream functions in the watershed (Table 2 of the report) are channel form (sinuosity, width-to-depth ratio and gradient), connection to the floodplain, energy dissipation, and adequate woody vegetation. Half to two-thirds of the surveyed reaches had "no" answers to checklist questions. Adequate bank cover, vegetative vigor, point bar revegetation, riparian widening and age-class distribution are secondary concerns, rating a "no" response on the checklist for 20 to 44 percent of the surveyed reaches. These values do not reflect the N/A responses, but only those with a "yes" or "no" answer.

Surveyed stream reaches showed a number of strengths that are very encouraging for watershed restoration and fish habitat (Table 2). Upland watershed conditions and water/sediment coming from the upper watersheds are favorable in all but two of the reaches (95% "yes" answers). The appropriate vegetative types were present in all but one reach (98% "yes" answers). Only one reach of the 42 showed vertical instability, and that was due to recent ditch cleaning. Vegetative composition, lateral stability and riparian moisture all showed a 100 percent "yes" response. The vegetative composition considers only stream function and requires only 2 or more species present on site (considerably less than any desirable plant community). Many reaches would benefit from some community diversification. Beaver dams were present on eight reaches, with five judged to be active and stable, and three active but not likely to persist through winter flows.

Water Quality

Water quality information for this analysis area is available from several sources. The two council assessments, the Sixes River WA, studies of New River, the watershed council Storm Chasers program and a Water Quality Management Plan (WQMP) of the Floras Creek Watershed. In addition the State of Oregon maintains a list of streams impaired across the state (303d) at the following web address: http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp. The complexity of this watershed area (Sixes-New River) makes specific assessment of the overall water quality very difficult. Timing during the seasons (winter versus summer), flow, temperature, turbidity, land use, breaching and land use practices all impact the overall water quality. According to the Sixes Watershed Analysis (pg A-13), "Water quality will never reach the level of quality it was under natural conditions." Some natural conditions within the landscape (high clay and silt contents to native soils) are now being recognized as problems to providing assumed water quality (low turbidity in winter) during parts of the year. It was noted in the council assessments that both Sixes and Floras Creek tend to run more turbid due to sediment delivery, with longer recovery time compared to the Elk River just to the south.

Water quality is defined based on beneficial uses of the water and at a minimum the consideration of the stream temperature, turbidity and chemical composition. Those uses encompass the rearing and spawning of fish species, recreation at developed as well as dispersed areas throughout the basin, domestic and municipal consumptive use, and agricultural use for livestock and irrigation purposes. Oregon Department of Environmental Quality identified Bald Mountain, Cedar, Crystal, East Fork Floras, Edson, Floras, North Fork Floras, South Fork Floras, Swamp, and Willow Creeks

and the Sixes River as not meeting the criteria for water temperature. In addition to temperature, aquatic weeds in Boulder Creek, ph in Floras Creek and Dissolved Oxygen in Sixes River are parameters of concern (see DEQ 2004 listing in appendix). The WQMP of Floras Creek Watershed describes the specific monitoring of stream temperatures from 1996 – 1998. In addition to describing stream channel types, stream gradients, and current amount of shade over streams the overall potential increase in shade that is possible was described for the watershed assuming no harvest of trees adjacent to stream channels. Increases greater than 30% are distributed throughout the entire watershed from headwater areas to along the mainstem itself. Table 4-1 of the WQMP notes interim benchmarks for shade development to range from 2026 to 2046, with objectives being reached across the entire Floras Creek watershed by 2056.

From the WQMP (Table 2-1) the West and South Fork of Floras Creek have 63 and 59% shade in the current condition. The potential value based on lack of disturbance is 88 and 85% respectively. In contrast is the mainstem current shade condition of 28% with a 51% potential. Due to harvest in the upper watersheds the time frame to reach these conditions is 57 years for the West and South Forks and 38 years if the channel conditions become more stable. No distinction between federal and private style management or inventory of forest lands was noted in the plan however given that the watershed is largely private lands and the federal lands have not been harvested for the better portion of 40 years, it is not likely that the shade component can be increased over the current value by an appreciable amount. The plan calls for an increase of 26% in the South Fork drainage and 25% in the West Fork.

Stream temperatures have been collected on the Sixes River at Hwy 101 from 1965 to the present. Stream temperatures increased 6 to 8 degrees (F) shortly after the 1964 storm (Sixes WA, 1997). This was due to significant loss of stream shade on the tributaries from timber harvest, the widening of the channel and a loss of depth to the river, and not a change in stream flow. Current stream temperature data shows a cooling trend where temperatures are 3 to 5 degrees (F) cooler than those collected in the late 1960's.

Temperature Discussion

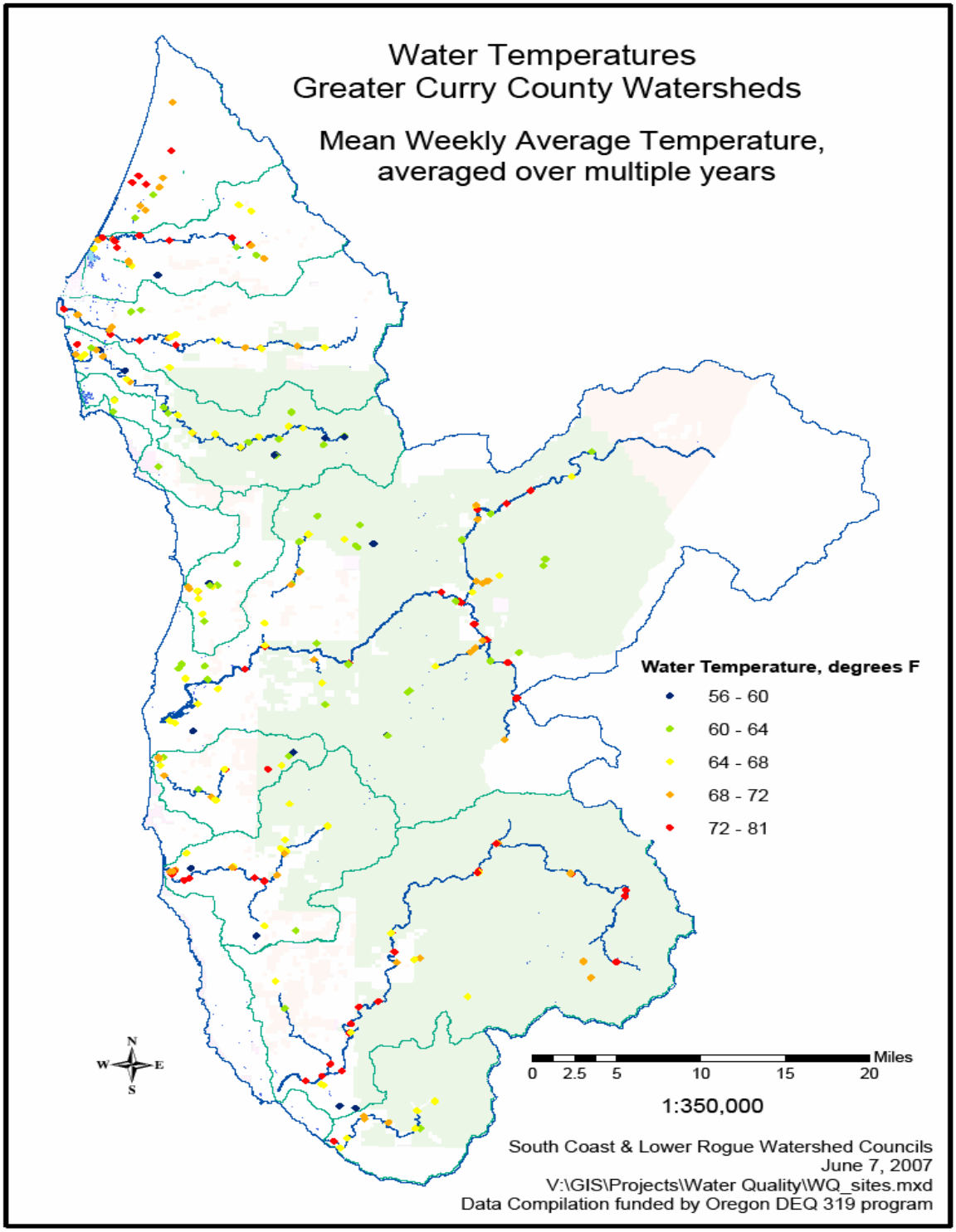
Recent data analysis by the watershed council staff using some of the same sites DEQ uses for temperature determinations in addition to new sites throughout the watersheds shows the current average temperature over multiple years. (See Fig 3)

All three watersheds in this analysis have temperatures that range from 64 to 81 degrees Fahrenheit. Most of the mainstem readings are in the 72-81 range.

Each of the Assessments conducted by the Watershed Council lists detailed information on the temperatures of the individual water courses. The Oregon Department of Environmental Quality has developed an Oregon Water Quality Index for the entire state. The classification scheme was derived from application of the OWQI to describe general water quality conditions. OWQI scores that are less than 60 are considered very poor; 60-79 poor; 80-84 fair; 85-89 good; and 90-100 excellent. To account for differences in water quality between low-flow summer months (June-September) and higher-flow fall, winter, and spring months (October-May), average values for summer and fall, winter, and spring were calculated and compared. Rankings were based on the minimum seasonal averages. Results for the Sixes River, during years 1986-1995, revealed a summer average score of 91 (excellent) and a fall, winter, and spring score of 62 (poor). Results during years 1989-1998 revealed a summer average of 91 (excellent) and a fall, winter, and spring

score of 67 (poor). No trend analysis was conducted due to insufficient data. Floras Creek results revealed a summer average score of 87 (good) and a fall, winter, spring score of 64 (poor).

Figure 3. South Coast Watershed Temperatures



Turbidity Discussion

Across the watershed, watercourses are adversely affected by the high clay and silt contents of the soils and the level of turbidity appears to be higher than streams and rivers to the south (see erosional processes section above). Data collected as part of the watershed councils Storm Chaser and Phase 1 DEQ programs is presented in Figure 4. The Storm Chaser program is a voluntary collection of water samples intended to capture the first intense storms of the water year (first fall flush). In addition, collections are made once the soils are saturated with a heavy precipitation event or two and another event is forecasted. Collections are taken during the peak of the final storm. This sampling is intended to monitor the response of all watersheds across the southwest Oregon area at the same two hour interval as a means to reduce variation. The collection years span from 2002 to 2006, with some sites being sampled more often than others.

From the data it is clear that a true first fall flushing event was captured in November of 2006 with measurements near 1000 NTU's on Floras Creek. The trend of the water quality is demonstrated from 2002 to 2006 on Figure 4; winter peaks with summer lows are the normal trend. Most winters have one or more extreme events that flush considerable sediment into the stream network as evidenced by the NTU measurements over 100.

The watersheds in the Sixes-New River analysis area tend to produce turbid waters during the winter months but run clear during the summer. Recovery between heavy precipitation events appears to occur fairly rapidly with clarity returning within a week of a disturbance event. Only by combining the data of the scheduled DEQ sampling with the storm specific sampling can the extreme turbidities be noted. Otherwise a less turbid system is presented.

Figure 4. Combined DEQ and StormChaser Data 2002-2006

Missing data in 05 entered as 1.0 to allow log values to be plotted.

Nutrients

Drawing from the two watershed assessments and a study conducted within the New River area and surrounding tributaries the following information is available on nutrients within the watercourses of this watershed.

Floras Creek

- Within Floras Creek seven water quality parameters were evaluated by comparing available water quality data to the Oregon Water Quality Standards. Among the seven, one parameter (Total Nitrates) was rated as impaired; three parameters were rated as moderately impaired (Total Phosphate, Fecal Coliform, and Turbidity); and three were not impaired (Dissolved Oxygen, pH, and E. coli). Collection of data on 12/12/95 indicates a storm event was occurring and the highest values of Biological Oxygen Demand, Total Phosphorous, Fecal Coliform, E. coli and Turbidity all occurred on the same day (12/12/95). The evaluation of 13 turbidity samples, 18 total phosphorous samples, and 16 fecal coliform samples resulted in Moderately Impaired ratings.
- Biological Oxygen Demand values are lowest in summer and highest in winter.
- Total Nitrate values are lowest in fall and highest in winter.

Sixes River

- Within the Sixes River area water quality is moderately impaired in the Sixes River due to high nitrate, phosphorous, and fecal coliform levels.
- Dissolved oxygen occurs in August and September during the lowest recorded flows and highest recorded temperatures.
- Nitrate levels tend to exceed water quality standards during the early winter sampling period. This may correlate with high flow events. One exception was a sample taken in March that also exceeded the standard.
- High phosphate and fecal coliform levels tend to occur from fall through early spring. This may be correlated with high flow events.

The 1997 watershed analysis conducted by the USFS for Sixes River mentions nitrogen and mercury as pollutants of concern. Results of DEQ water chemistry sampling since 1965 show that nitrogen levels are lowest during the summer and increase during the winter. Winter nitrogen levels were noted to be elevated (double) above pre-1984 levels from 1984-95. Forest management activities that add organic matter, sediment and urea as fertilizer were suspected to be the cause. Mercury was noted to be present and removed during mining operations on the river and found at very small levels, well below those considered to by health risk to humans. Subsequent sampling by BLM and DEQ (Environment and Ecology, 2006) has determined low levels of mercury exist in the river from natural sources upstream but present no health risk.

A Baseline Water Quality of the New River Watershed Report began in the summer of 2003 by the staff of the South Coast Coordinating Watershed Council. The report was concluded in the later part of 2004 with the following summary and write-up.

> Baseline water quality sampling on New River tributaries and mainstem was initiated in summer 2003. On tributaries to New River, EPA ambient water quality criteria recommendations are not met for summer reference conditions on 90% of samples for total phosphorus, and at least 62% of samples for nitrate+nitrite.

> DEQ standards for dissolved oxygen for summer rearing of juvenile salmonids were not met on 66% of the samples flowing from Croft Lake, New Lake, and Bono Ditch to the New River mainstem. Sampl(ing) times ranged from 11:00 AM to 4:30 PM, and did not include the early morning minimum. Afternoon supersaturation of oxygen exceeded 120% on the New River mainstem south of Storm Ranch (1x) and north of the take out (2x). Elevated pH values exceeded DEQ standards on the mainstem, south of Storm Ranch (1x) and north of the take out (2x). Excessively high pH corresponds with the timing and location of oxygen supersaturation, within the areas most affected by non-native aquatic weeds.
>
> Additional monitoring to identify limiting nutrients, estimate nutrient loads, locate sources, quantify diurnal dissolved oxygen and pH ranges, and characterize biological response is recommended.

The report concluded as follows:

> Based on sampling in larger rivers in the Sixes Basin, it appears that winter and spring nutrient concentrations and streamflows provide the highest nutrient loads to the wetlands, lakes, and mainstem of New River. Nutrient sampling thus far has been limited to summer. Total phosphorus levels are interpreted as Good to Excellent, and nitrate+nitrite levels are interpreted as Fair to Excellent, based on a DEQ Water Quality Index.
>
> No consistent impairment of dissolved oxygen or pH was measured in the tributaries to New River. In the New River mainstem, pH impairment corresponded with the timing and location of oxygen supersaturation within the areas most affected by aquatic weeds. However, sampling to date has not captured diurnal maxima for dissolved oxygen or pH.

VII. AQUATIC SPECIES AND HABITAT:

Habitat Distribution and Use

General Characterization

New River Frontal

Just prior to the establishment of the New River system, the majority of smaller streams and lake outlets in the area drained directly into the Pacific Ocean. Based upon the relative small size of these drainages, it is not likely there were large amounts of estuarine or freshwater lagoon habitats associated with them. The estimated combined total area of lagoon habitat provided by these individual drainages was less than 20 acres, based on aerial photo interpretation, not including distinct lake habitats.

Within the two assessments and the Sixes River Watershed analysis there are discussions of the various habitats within the Sixes River and Floras Creek systems. New River shares some of the same river habitat qualities but also contributes several large bodies of perennial water in New, Croft and Laurel Lakes. With the development of New River, this situation has dramatically changed. Conservative estimates indicate that New River currently contains over 100 acres of freshwater lagoon habitat, not including distinct lake habitats. This is a substantial increase in the amount of rearing habitat available for salmonids, and may represent a potentially substantial increase in the number of juvenile fish surviving to the smolt stage (time of ocean entrance) USDI, 2004.

The estuary contribution of the New River area is many times (perhaps as much as 10 times) larger than either Sixes or Floras Creek. The Four Mile and Two Mile Creeks have headwater areas that contribute fewer habitats than either of the above mentioned assessments. However, known use is still important and habitat quality has been altered from past practices.

The following creeks all flow to New River: Twomile Creek, Fourmile Creek, Connor Creek and Davis Creek (through Croft Lake), Bethel Creek, Butte Creek (through New Lake), Morton Creek (through Bono Ditch), Langlois Creek, Floras Creek, Willow Creek, and Boulder Creek (through Floras Lake). Floras Creek is by far the largest stream within the watershed, draining 52.2 % of the total watershed. Three smaller creeks, Johnson Creek, Crooked Creek, and China Creek, flow directly into the ocean north of the New River system, but are part of the analytical watershed.

Floras Creek has a natural barrier between Johnson and Clear Creeks. Abundance of Coho was historically higher than the present and more abundant than Chinook. In addition to the natural barrier at river mile 8.0 unnatural barriers are mostly in the lower basin with two in the upper basin. Three adult barriers and one considered a restriction as well as 3 juvenile barriers have been identified. Three of these barriers were corrected with pipe replacements by 2003. Additional habitat has been opened and verified use is ongoing as part of the project monitoring requirements.

Within the New River system the habitat is deemed to provide migration and some rearing and estuary use for both out migrating or returning fish. The upper stream systems of Two and Four Mile Creeks, in addition to Bethel, Morton and Conner Creeks provide a contribution to the overall habitat in the watershed.

Sixes

The Sixes River has a very small estuarine component compared to New River. It is known as a "blind" estuary, where low river flow in the summer results in a sand bar completely closing off the mouth of the estuary (Inforain, 1996). It is also one of only five "Natural" estuaries on the Oregon Coast. These are defined as lacking maintained jetties or channels, with little development for commercial or industrial activities. The associated shorelines are generally used for agriculture, forestry, or recreation (Ocean-Coastal Management Program, 2001).

The Sixes River Assessment concludes with several additional findings regarding fish species and habitats. The data supporting the characterization of the watershed is limited and noted in the key findings. There is one migration barrier mentioned in the USFS analysis. Additional barriers (3) exist within the Sixes basin, two in the Elephant Rock drainage and one in the Lower Sixes Mainstem. None are located on major tributaries and access only approximately 3 miles of stream. Pool habitat conditions have undesirable depths, few have complexity, and the area and frequency are desirable or better than undesirable on the scale used. The riparian conditions have very scarce large conifers near channels in all reaches, but have good amounts of shade and bank stability. Large wood is generally lacking in all parameters, but gravel is adequate in most reaches, width to depth ratios are all in the moderate range.

Summarizing the findings of the USFS Sixes River Watershed analysis shows that the salmonid populations are depressed over historic levels. Land management activities and ocean conditions are considered the reason for the decline. New requirements on Federal lands have been enacted since the adoption of the NFP that will keep key aquatic and terrestrial components in place on the landscape; the same can not be said for the State regulations. Dry Creek is the most important tributary in the Sixes River system for spawning and rearing habitat and the estuary is an important component for salmonid life history. The South Fork is a barrier to sea run cutthroat and winter steelhead distribution.

Fish Distribution

Fish species present or likely to be present within the Sixes – New River analysis area are shown in the table below. This information is based on valid historical data, ODFW presence/absence information, seining surveys, smolt trap operation, electro-fish surveys, and information collected by BLM Fisheries Biologists. Maps 13 and 14 show the salmonid and non-salmonid fish distributions within the watershed. These maps are based on the most current knowledge (October, 2007) as compiled by the Oregon Department of Fish and Wildlife, information found in the two previous Watershed Council assessments, and on presence/absence surveys conducted by BLM personnel. The BLM acknowledges that fish distribution is underestimated in this figure as there are many streams in this watershed that have not been surveyed for the upper limits of fish distribution.

Table 10. Fish Species Documented Within the Sixes – New River Watershed Area

FISH SPECIES		
Category	**Common Name**	**Scientific Name**
Salmonids	Coho salmon	*Onchorhynchus kisutch*
	Chinook salmon	*Onchorhynchus tshawytscha*
	Cutthroat trout (sea-run and resident)	*Onchorhynchus clarki clarki*
	Steelhead trout	*Onchorhynchus mykiss*
	Rainbow trout	*Onchorhynchus mykiss*
Others	Pacific lamprey	*Lampetra tridentata*
	Western brook lamprey	*Lampetra richardsoni*
	Prickly sculpin	*Cottus asper*
	Staghorn sculpin	*Leptocottus armatus*
	Sculpin species[1]	*Cottus sp.*
	Three-spined stickleback	*Gasterosteus aculeatus*
	Redside shiner	*Richardsonius balteatus*
	Largemouth bass	*Micropterous salmoides*
	Brown bullhead	*Ameiurus nebulosus*
	Largescale sucker	*Catostomus macrocheilus*
	Starry flounder	*Platichthys stellatus*
	Shiner perch	*Cymatogaster aggregata*
	Bay Pipefish	*Sygnathus leptorhynchus*
	Smelt	family *Osmeridae*

[1] Other sculpin species may include, but are not limited to, mottled, reticulate and coast-range sculpin. Bluegill are suspected to exist but have not been documented.

Habitat Conditions Relative to ODFW Benchmarks

The Oregon Department of Fish and Wildlife and associated sponsors began developing an aquatic inventory project in 1989. The project "is designed to provide quantitative information on habitat condition for streams throughout Oregon." These aquatic habitat surveys assess current condition of the habitat available for aquatic organisms in the stream and in the surrounding riparian areas. These surveys are used to provide basic information for biologists and land managers, to establish monitoring programs, and to direct or focus habitat restoration programs. By using individual reach data, restoration may be developed based on the presence, absence or quality of certain habitat components such as shade, large wood, and pools.

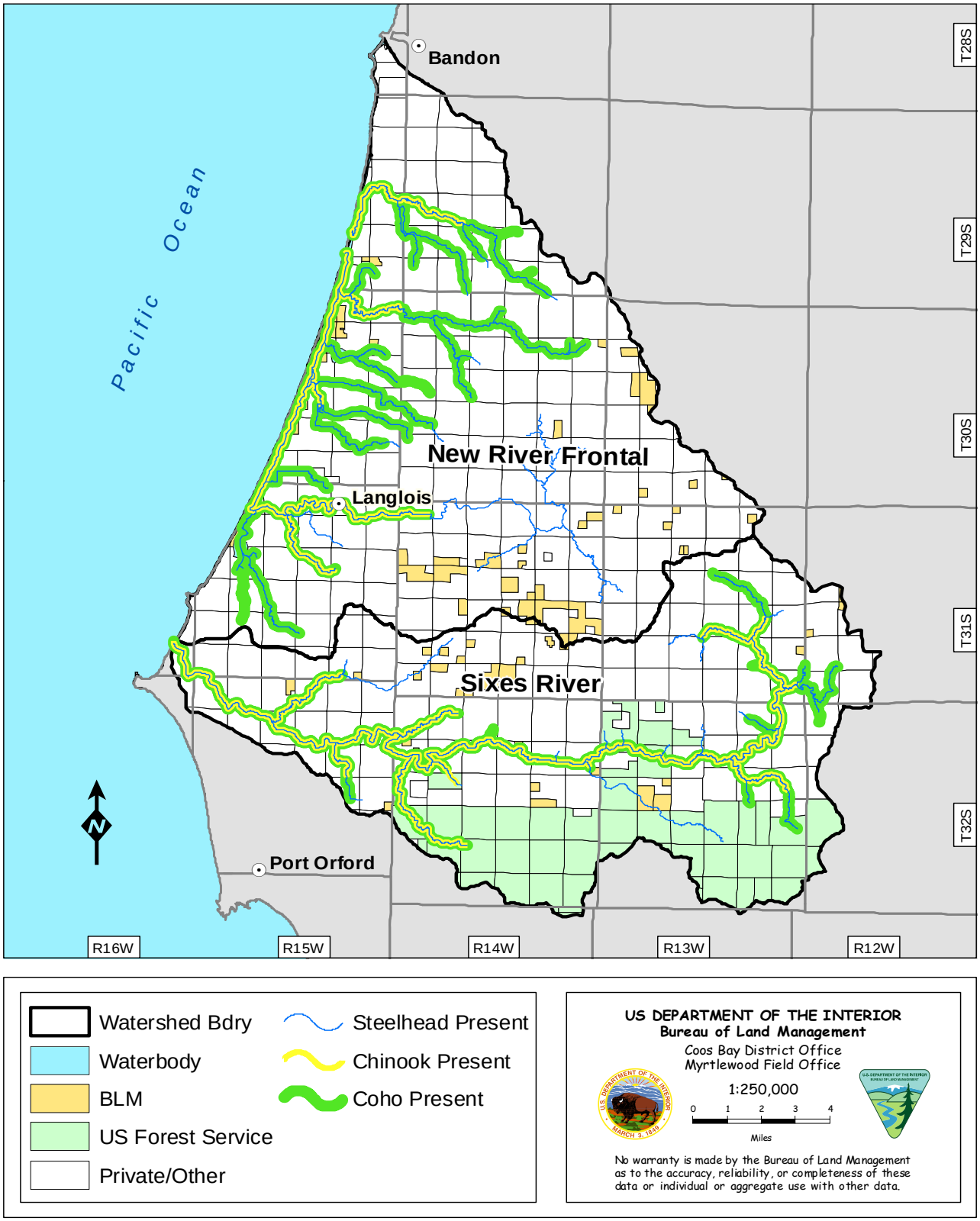
New River Frontal

Stream surveys have been conducted on Four Mile, South Fork Four Mile, Butte, and Bethel Creeks (See Map 15 ODFW Aquatic Habitat Inventory by Stream Reach and Inventory Data Appendix B). As no surveys have been conducted on Floras Creek, the largest basin within the watershed, these surveys give only a small picture as to the habitat condition within the larger watershed. The habitat surveys show one area of real concern amongst all of the reaches surveyed. There is a lack of large wood in all stream channels and the riparian tree condition shows that future large wood recruitment from stream side sources is not currently available, nor would be over the long term. There are some reaches with large conifers (2 on Four Mile, the upper reach on Bethel, and the two upper reaches on Butte) that could serve as a future source of large wood, but their capacity to serve all of the needed contributions throughout their entire stream lengths is doubtful because the conifers available still equate to an undesirable rating according to the benchmark scale.

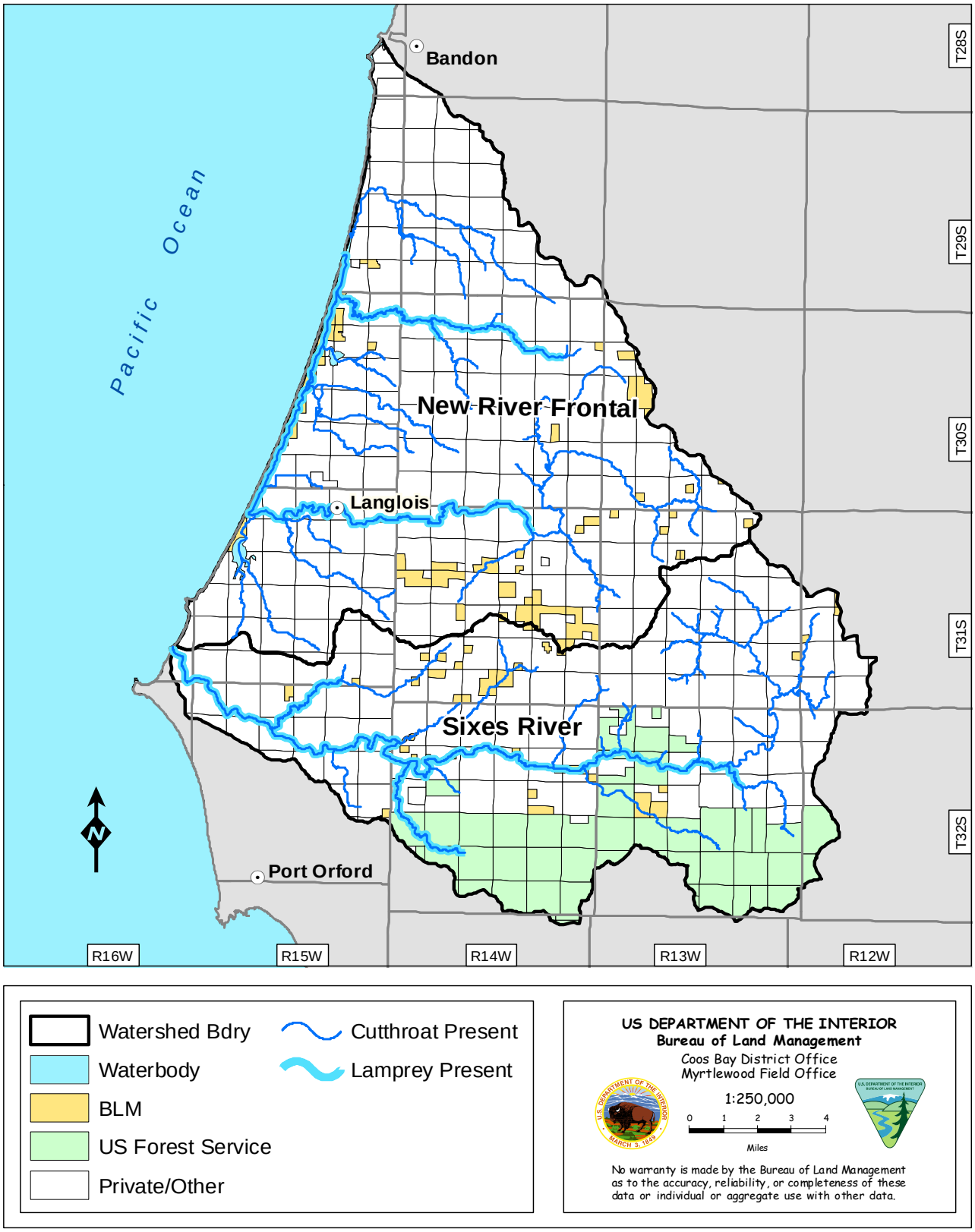
Historically, most of the Coastal Lowland stream channels had a spruce dominated riparian zone that likely contributed large wood. Since settlement of this area, most of the land use was converted for agricultural production purposes. The lack of future large wood contribution from conifers reflects this, as pastures are maintained for grazing purposes. This being said, the South Coast Watershed Council has been working with willing landowners to place large woody debris through restoration projects to improve the habitat of these stream channels.

Sixes

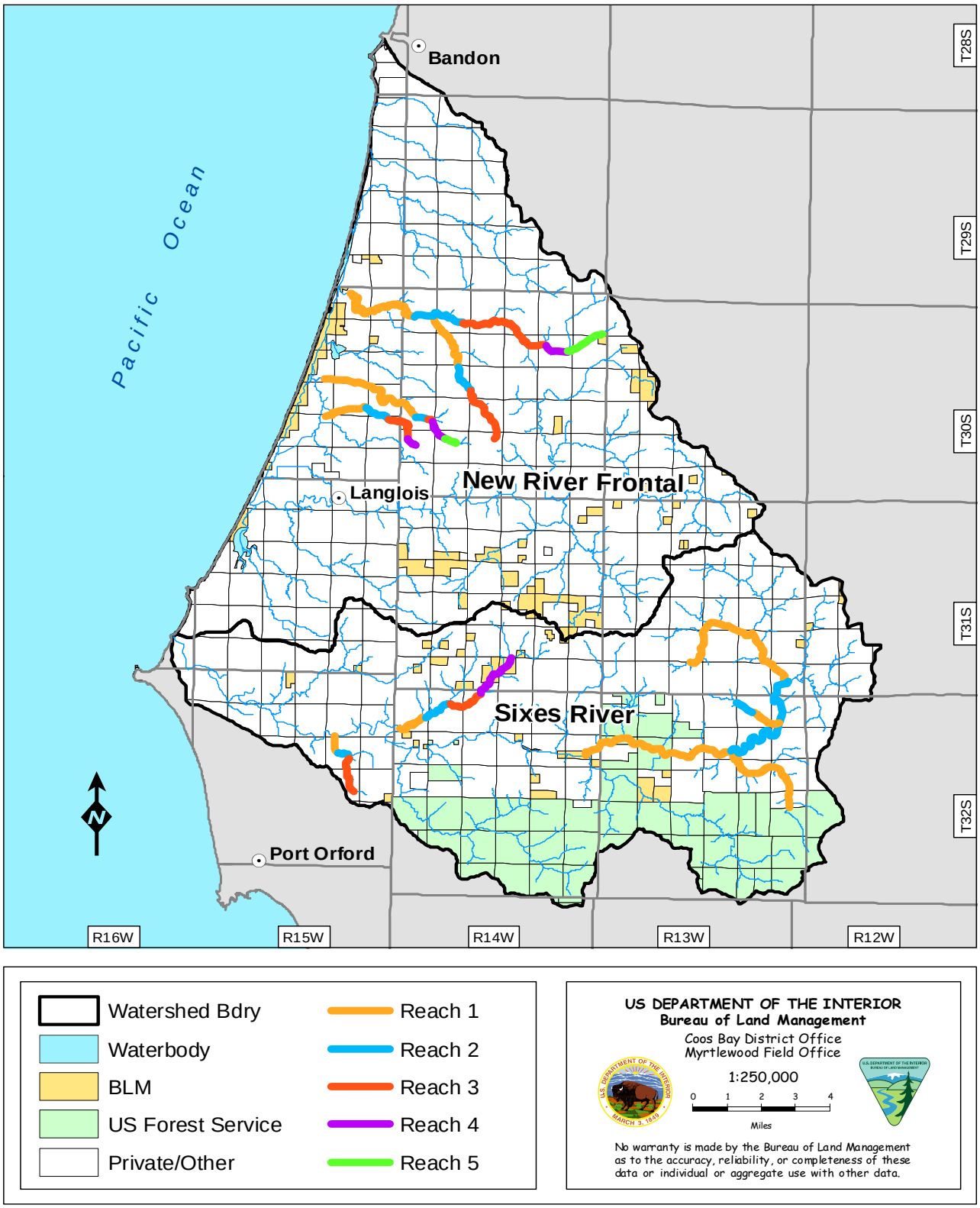
Surveys have been conducted on the following waterways: Beaver Creek, Edson Creek, Sixes River mainstem, Carlton Creek, North Fork Sixes, Middle Fork Sixes, and Sugar Creek. Again, the surveys show current large wood levels and future recruitment from adjacent riparian stands is a concern. Only Carlton Creek had adequate current wood levels in the channels, but the current riparian condition is not on a trajectory to contribute more over the long term. One stream reach that rated "poor" in every category is Sugar Creek, Reach 2. While the outlook for the large wood categories is not good, there is relatively little sediment in riffles in all but Sugar Creek Reach 2.



Map 13. Salmonid Fish Distribution in the Sixes-New River Watersheds



Map 14. Non-Salmonid Fish Distribution in the Sixes-New River Watersheds



Map 15. ODFW Aquatic Habitat Inventory by Stream Reach

Species Life History

Included in the previous two assessments is an extensive discussion of the life cycle of the salmonids within these basins. Rather than repeat these here, please refer to these two documents for said life cycle information.

Pacific lamprey

This species is anadromous and parasitic, spawning in gravel in freshwater streams, residing for many years, and then migrating to the ocean where it attaches to a host. Information about the current distribution of this species was taken from the ODFW steelhead spawning surveys within the basin. These surveys recorded lamprey redds while monitoring for Steelhead activity. Because not all streams have been surveyed and there are end points to the surveys, it is highly likely that the current known distribution is a small portion of the habitat they actually occupy. Pacific lamprey were caught in the Floras creek smolt trap (operated in 2002), but as to what stream above Floras lake they are using is unknown.

Western brook lamprey

This species is resident and non-parasitic, residing in freshwater streams for their entire life-cycle. The only documentation of this species was also with the operation of the Floras Creek smolt trap. Their distribution is likely throughout these watersheds.

Listed Fish Species

The Sixes – New River analytical watershed is located within the Oregon Coast (OC) Evolutionary Significant Unit (ESU), which extends from the Columbia River to Cape Blanco. Thus, this is the southernmost area of this ESU. The following summarizes the Endangered Species Act status of species within the ESU;

Oregon Coast Coho salmon:

The NOAA Fisheries Service issued an open letter to the United States Congress on May 14th, 2004, stating that "after re-evaluating the listing of 26 species of salmon and steelhead, and considering the science on hatcheries, we have preliminarily determined to propose relisting at least 25 of the 26 species." As a result, Oregon coast coho salmon (*O. kisutch*) were proposed for listing as threatened under the ESA on June 14, 2004 (50 CFR Parts 223 and 224). The NOAA Fisheries Service made a decision on January 19, 2006 that this ESU was not warranted for listing. This decision was challenged by a group of plaintiffs. On July 13, 2007, a Magistrate Judge in the U.S. District Court issued findings and recommendations. On October 5, 2007 U.S District Judge Garr M. King ruled that the NOAA Fisheries Service must issue a new final listing rule consistent with the Endangered Species Act. This decision is expected February 4, 2008. Currently, the coho are considered as *Proposed Threatened*.

Oregon Coast Steelhead trout:

The Oregon Coast Steelhead trout have the same ESU boundary as OC coho salmon. Oregon Coast Steelhead trout were listed as "candidate" species on March 19, 1998. On April 15, 2004, NOAAF published new guidelines and clarifications to their definition of "candidate" species. "Candidate" species that have undergone an ESA biological review determining a "not warranted" listing, but there still remain questions significant concerns or uncertainties regarding their extinction risk and/or threats are now considered "Species of

Concern." This status does not carry any procedural or substantive protections under the ESA.

Lamprey Species:

On December 27, 2004 The U.S. Fish and Wildlife Service (FWS) announced a 90-day finding on the petition to list three species of lampreys (Pacific, western brook, and River) of "*not warranted*." However, they are currently listed as a "Species of Concern." Species of Concern are categorized as "taxa whose conservation status is of concern to the U.S. Fish and Wildlife Service (many previously known as Category 2 candidates), but for which further information is still needed." Pacific lamprey is also listed by the Oregon Department of Fish and Wildlife as a "Strategy Species."

As shown in the three species above, the status of fish species under the Endangered Species Act is in constant flux. This information is only valid upon the day it was written (October, 2007). Check with the NOAAF web site (http://www.nwr.noaa.gov/), FWS web site (http://www.fws.gov/), or ask a fisheries biologist for the most current information on the ESA status of *any* fisheries species located within this watershed.

Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) identified under the MSA. The MSA defines adverse effects as any impact which reduces the quality and/or quantity of EFH. Adverse effects include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative or synergistic consequences of actions. EFH is defined as habitat which is currently available or was historically available to Coho or Chinook salmon.

Special Status Species

The Oregon/Washington BLM policy defines "special status species" as those that are federally proposed, listed, or candidate, are State listed, or are included in the BLM sensitive species program.

The sensitive species designation is normally used for species that occur on Bureau administered lands for which BLM has the capability to significantly affect the conservation status of the species through management.

Oregon Coast Coho salmon (*Onchorhynchus kisutch*) is listed as Oregon-Sensitive and Oregon Coast Steelhead trout is listed as Oregon-Strategic. Oregon-Sensitive species must comply with the BLM National Manual and OR/WA State Policy (BLM 6840). This includes considering the species in land use plans and analyzing effects and project Decisions must not contribute to the need to list. Oregon-Strategic species do not have the application of BLM 6840 and analysis in NEPA documents is not required.

Three invertebrate species, categorized Oregon-Sensitive, have not been documented within these watersheds, but habitat is available for their presence. The Robust walker snail (*Pomatiopsis binneyi*) requires perennial seeps, shallow mud banks and marsh seeps leading into shallow streams.

They are currently only documented in the Chetco river drainage. The Pacific walker snail (*Pomatiopsis californica*) requires wet leaf litter and vegetation near flowing or standing water in shaded areas with high humidity. They are currently only documented in the lower Millicoma River sub-basin. Newcomb's Littorine snail (*Algamorda newcombianai*) occurs in Salicornia marshes on the roots of this plant in coastal areas with sandy beaches and flats. They are currently only documented on the North Spit in the Dredge Lobe area.

Aquatic Amphibians

Foothill yellow-legged frog

This species is categorized as Oregon-Sensitive as it has a Global Status of G3 –Vulnerable. NatureServe.org describes the species as "declining rapidly apparently due to habitat alteration, impacts of airborne agrochemicals, and/or effects of exotic species, and because recolonization abilities may be greatly restricted by local extirpation patterns." (citation) The habitat requirements include permanent (some types of intermittent), low-gradient, medium sized streams (4th-6th order) or side-channels of larger creeks or rivers with pools and pebble size or larger streambed substrates. Their entire life cycle is closely associated with water.

The foothill yellow legged frog has been documented within Edson Creek and within the Sixes River Campground.

Aquatic Macroinvertebrates

The CD-ROM "Stream bugs as biomonitors- Guide to Pacific Northwest macroinvertebrate monitoring and identification published by the Xerces Society, Adams, J.et al. 2004, is the source of the following discussion.
More than 400 species of aquatic macroinvertebrates have been identified in the Coast Range Ecoregion, which includes the Sixes-New River Watershed. Not all of these species inhabit in this watershed, and it is unknown as to how many would be likely to occur. The range and life histories of most of these species are unknown as interest/knowledge in this field has just started to grow. The categories of macroinvertebrates include mayflies, stoneflies, caddisflies, true flies, beetles, crustaceans, true bugs, mollusks, annelids, aquatic moths, dragonflies/damselflies, and dobsonflies/alderflies.

The use of macroinvertebrates as indicators of water quality is finally being fully recognized. "Benthic macroinvertebrates (aquatic animals that lack an internal skeleton, are large enough to be seen by the unaided eye, and live among the substrate) 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." Macroinvertebrate sampling is an excellent method to use in future monitoring of this watershed both for water quality and aquatic habitat quality.

From field visits to assess aquatic habitat on BLM lands in 2006, there was a profound lack of macroinvertebrates within stream channels. This is surprising considering the coolness of the water, general good condition of in-stream habitat, and available food sources. However, in headwater areas, numerous Pacific Giant salamanders were found. As insects are a key component of their diet, it must be assumed that there are some benthic macroinvertebrates on BLM lands.

New Zealand Mudsnail

The New Zealand mudsnail (*Potamopyrgus antipodaru)* is an exotic invasive species that was first found in the Snake River, ID in the late 1980's. It has since spread to 10 western states. The New Zealand mudsnail (nzms) is extremely small (>5 mm), and nearly impossible to eradicate once present. The following is taken from the Montana State website, http://www.esg.montana.edu/dlg/aim/mollusca/nzms/, an excellent source of information about this species:

> It is a parthenogenic livebearer with high reproductive potential. The New Zealand mudsnail often reaches densities greater than 100,000/m² in suitable habitat and has been reported to approach densities as high as 750,000/m² in sections of rivers in Yellowstone National Park. Frequently, these mudsnails will comprise over 95% of the invertebrate biomass in a river. To date, limited research has documented decreases in native macroinvertebrate populations in several rivers where the mudsnail has invaded. *Potamopyrgus antipodarum* has also been shown to drastically alter primary production in some streams. Its invasion has generated much concern about the potential effects it may have on native species, fisheries, and aquatic ecosystems in the western USA. Its spread into new systems is considered to be primarily human caused.

The human cause of this spread is due to its hitchhiking (clinging) properties. All types of aquatic equipment such as boasts, waders, nets, and buckets are all known to be carriers of nzms. Snails readily attach to or are wedged in cracks and seams. They can live for weeks in damp, cool conditions; can easily survive on field gear for long periods of time; and can be transferred to a new environment when that gear is reused (http://seagrant.oregonstate.edu/sgpubs/onlinepubs/g06006_highres.pdf).

New Zealand mudsnails were first discovered in New River in 2003, in four samples collected by the U.S. Environmental Protection Agency. The density for these rated moderate, meaning all sites collected >500 specimens each. These sites were all located near the northern-most area of New River, likely near the Storm Ranch boat ramp. In 2006, the South Coast Watershed Council took another sample that was verified for nzms, this time the collection was from muddy substrate near the mouth of the Hanson Slough tributary into New River. It is unknown what the extent of the infestation is or if it is affecting other aquatic organisms within the New River system at this time.

In response, interpretive signs and brochures have been displayed at the Storm Ranch and Floras Lake County Parks boat ramps.

VIII. WILDLIFE SPECIES AND HABITAT

The only available data on the multitude of mammals, birds and other terrestrial creatures is found within the Sixes River Watershed analysis and those few surveys conducted by federal agencies in compliance with the NFP. For a complete listing of species see Appendix H of the Sixes River WA document.

In summary, the Sixes River historically had an abundance of western hemlock- Douglas-fir late seral habitats, non-forested meadows along the ridges and low elevation river bottoms, and large

stands dominated by hardwoods on drier, south facing slopes. Unique habitats such as; cliffs, grass meadows, talus slopes, hardwood stands, ponds and lakes comprise a small portion of the landscape. Changes to all these habitats occurred from natural and man-induced disturbances; such as: fire, wind, sedimentation, flooding, fire suppression, harvesting and mining.

Historically, large numbers of sea otters, elk, deer, bear and other fur bearing mammals existed prior to settlement by Europeans. Fur traders and hunters depleted, and locally extirpated in some cases, those species. Approximately 60 species of mammals are presently found in the watershed, including estuarine marine mammals such as harbor seals and California sea lions. Common mammals in the watershed are elk, deer, black bear, bats, mice, voles, tree and ground squirrels, mountain beaver, skunks, river otters, bobcats, raccoons, and coyotes. Uncommon animals are the cougar, American marten, gray fox, and ringtails. Known introduced mammals are: Virginia opossum, nutria and possibly red fox, house mice, feral pigs, black and/or Norway rats exist around human dwellings and communities.

The Sixes River analysis reports that approximately 154 bird species reside in the watershed and are listed in Appendix I of that document. The species, frequency of occurrence, special and unique habitats and the type and seral stage of forest that they require, are noted in the same appendix. Wild turkeys were introduced into the watershed by the Oregon Department of Fish and Wildlife (ODF&W) and breeding populations currently exist. Other common exotic bird species include European starling, rock pigeon, and house sparrow all of which are restricted to the coastal lowland areas.

The New River ACEC was designated an Important Bird Area by the National Audubon Society in the fall of 1996. Snowy plovers, a threatened species, have one of their most productive coastal Oregon breeding areas at New River. In addition to having nesting snowy plovers, this area the adjacent private pasturelands in the New River bottoms area are host to tens of thousands of Aleutian cackling geese in April each year. These birds stage on rocks offshore of Bandon during this period and feed in the pasture lands surrounding New River. Thousands of geese can be seen flying overhead New River during most days in April. Shorebird migration peaks in late April and early May and again in September when hundreds of thousands of shorebirds pass through New River. When river conditions expose mudflats, this is an excellent area to view shorebirds. Allen's Hummingbird, an Oregon species restricted in distribution to the coastal portions of SW Oregon and California, reach the northern limits of their breeding range at New River.

The analysis for Sixes states that 12 reptile and 13 amphibian species occur in the Sixes watershed. It is likely that these also occur across the greater area of land encompassed within this analysis. The occurrence of sharp snakes and western terrestrial garter snakes, along with the eastern bullfrog, and western toad is unknown. The bullfrog is the only exotic herptile commonly found within the analysis area.

Species which are listed under the ESA or are BLM Sensitive Species are discussed in more detail below, if they are known or likely to be present

Threatened and Endangered (T&E) Wildlife Species and Their Habitats

Four species listed as federally threatened (FT) under the Endangered Species Act (ESA) are known to occur or have habitat present within the analysis area. They are: marbled murrelet (murrelet),

northern spotted owl (spotted owl), American bald eagle (bald eagle), and the western snowy plover (plover).

Marbled Murrelets (Brachyramphus marmoratus)

Declining population was the primary reason for listing the murrelet as threatened in 1992 (USDI 1992). The Marbled Murrelet Recovery Plan identified the primary threats to the species as: 1) predation; 2) loss of nesting habitat; 3) by-catch in gill-nets; and 4) oil pollution from both chronic and major spills.

At-sea surveys are used to monitor murrelet populations in each of the 5 murrelet conservation zones. The watershed is within Zone 4, and population densities have declined since 2002, with rising and falling modulations (Huff 2005). This is not yet a statistically valid trend, but the population density in Zone 4 of 3.14 birds per square kilometer for 2005 is below the 2002 benchmark of 4.21 birds per square kilometer.

Murrelet suitable habitat and occupied sites (sites where behaviors indicative of nesting have been observed) generally contain large trees greater than 18 inches DBH, multi-storied canopies with moderate closure, sufficient limb size and substrate (moss, duff, etc.) to support nest cups, flight accessibility, and protective cover (Manley 1999, Burger 2002, and Nelson & Wilson 2002). Within the combined watersheds of the Sixes and Floras Creek 25% of all BLM acres and 97% of all USFS managed lands are suitable murrelet habitat. Critical habitat (Unit #OR-07-a) is along the southern edge of the watershed, comprised of the 21,692 acres of Forest Service managed lands.

Suitable habitat within 35 miles of the coast (Zone 1) has a higher likelihood of occupancy as access to the ocean for foraging is easier. This Sixes-New River watershed extends east from the ocean by approximately 21 miles at its most eastern point with an ever decreasing length as one travels north and a more rapidly decreasing distance along the south edge. There are six known occupied murrelet sites within the Floras Creek and Sixes River watersheds. There is one site south of the ridge between Sixes and Elk Rivers. The suitable habitat on USFS lands is also likely to be occupied.

Northern Spotted Owls (Strix occidentalis caurina)

The spotted owl was listed as federally threatened in 1990 due to declining populations, decreases in suitable nesting habitat, and the lack of regulatory mechanisms to protect it (USDI, 1990).

The forested areas within the watershed are considered spotted owl dispersal habitat, but much of it is poor quality due to small tree size, dense stocking levels, and low levels of snags and down wood. Dispersal habitat is generally forests greater than 40 years of age with canopy cover above 40%, which offers cover from predators, some foraging opportunities, and adequate space for flying.

In the Oregon Coast Range and Klamath Provinces, old-growth forest was the only forest type used for roosting and foraging in greater proportion than its availability at the landscape scale (Carey et al. 1992). However, at a finer scale, owls used portions of young forests for foraging in greater proportion than its availability, especially where woodrats were present. In the Western Cascades of Oregon, 50 percent of spotted owl nests were in late-seral/old-growth stands and none were found in stands less than 40 years old (Irwin et al. 2000). Spotted owls do not generally appear to select stands of intermediate or younger ages (Solis and Gutiérrez 1990).

Stand characteristics which spotted owls rely on include: a multi-layered, multi-species canopy dominated by large overstory trees; moderate to high canopy closure; a high incidence of trees with large cavities and other types of deformities; numerous large snags; an abundance of large, dead wood on the ground; and open space within and below the upper canopy for spotted owls to fly (Thomas et al. 1990). There is one known occupied owl site in the Sixes-New River watershed area. There is one owl site assumed to be occupied on Forest Service lands south in the adjacent Elk River watershed. The area of Forest Service managed lands are within N. Spotted Owl Critical Habitat Unit #OR-66.

Within the Sixes River and Floras Creek watersheds 82% of all BLM acres are considered suitable owl dispersal habitat. Suitable owl nesting, roosting and foraging habitat consists of 35% of all BLM acres and 97% of the USFS acres.

Bald Eagle (Haliaeetus leucocephalus)

Bald eagles are listed as threatened by both the State of Oregon and USFWS. Population declines at time of listing were the result of environmental contaminants, habitat destruction, a declining food base, disturbance, electrocution, and illegal killing.

Bald eagles nest in mature or old-growth trees, snags, cliffs and on man-made structures. Nests typically include at least one perch with a clear view of water (USFWS 2006). In Oregon, bald eagles nest within 4.5 miles of a major water body, although most are within one mile (Isaacs et al. 1983). No critical habitat has been designated for the bald eagle.

Known nests occur near Four Mile Creek and near Floras Lake, Oregon (Isaacs and Anthony 2007). There are no confirmed bald eagle nests in the Sixes River watershed, but there are frequent sightings along the river. There is some evidence that eagles may be nesting in the Dry Creek sub-watershed, but no nest has been confirmed to-date[2].

Western Snowy Plover (Charadrius alexandrinus nivosus)

The United States Fish and Wildlife Service (FWS) has summarized the taxonomy, ecology, and reproductive characteristics of the Western Snowy Plover (plover) and have determined the Pacific coast population of the plover to be threatened (USFWS 1993, 2001).

The FWS designates critical habitat in areas that have the physical and biological features necessary to conserve a threatened or endangered species. The USFWS first designated critical habitat for the Pacific coastal population of the plover (USFWS 1999) and the ruling became effective in January 2000. In 2004, the FWS was sued regarding the economic analysis of the critical habitat ruling. A new analysis was completed and published in 2005 (USFWS 2005). The 2005 ruling reduced the size of the Critical Habitat Unit (CHU) OR-10A (formerly called OR-7) within the Sixes-New River watershed by approximately one mile.

Today, CHU OR-10A encompasses about 351 acres within a 14.5 mile long area between China Creek in Bandon Beach State Park and Floras Lake. The 139 acres of the Habitat Restoration Area (HRA) within the New River ACEC are included within the CHU OR-10A. The remaining 173 acres are State Park, county, and private lands. Critical Habit Unit OR-10A contains three main

[2] Heaney, J. 2007. Personal communication. Wildlife Biologist, Coos Bay District BLM, 1300 Airport Lane, North Bend, OR 97459.

plover nest areas: (1) Bandon Beach and New River [Bandon], (2) New River HRA, and (3) Floras Lake and New River Overwash. The numbers of nests, eggs, and fledglings are counted each year by Oregon Natural Heritage Information Center (ORNHIC) wildlife biologists. Between 1991 and 2006, CHU OR-10A produced 25% (243 of 958) of the total Oregon Coast plover fledglings.

A draft recovery plan outlines various goals and objectives needed to recover and maintain a future, self-sustaining plover population coast-wide (USFWS 2001). The draft recovery plan set a goal of 54 adult plovers for the CHU OR-10A located within the Sixes-New River watershed. Habitat restoration was noted as key to accomplishing that goal. During the 2006 nesting season plover biologists documented 47 breeding adults in this CHU (Lauten et al. in lit. 2006). As of 2006 the New River HRA has fledged 31 chicks. An additional 15 chicks were fledged in 2007 with a record high number of a minimum of 123 across all Oregon nesting areas. 2007 marked a record high for plover nesting success in Oregon[3].

The New River foredune is one of the most important plover breeding sites remaining along the Oregon coast. At New River, plovers have historically nested along the entire length of the beach between the boat ramp at Storm Ranch to the open spit near the mouth of New River. Plovers rear their broods on the beach, in the overwashes, and along the river on the extensive mudflats where food is available (Castelein et al. 1998).

Former Survey & Manage Species

Former survey and manage species were moved to the Bureau Special Status Species Program in March of 2004 (USDA and USDI 2004b). That 2004 Record of Decision (ROD) was found to be deficient and the January 2001 ROD was reinstated (including amendments or modifications that were in effect as of March 21, 2004).

Oregon Red Tree Voles (Arborimus longicaudus longicaudus)

The young forests across the watershed likely support low levels of red tree voles. Knowledge from past surveys done in other young forests on the Coos Bay District has found that RTVs are known to build nests in young, broken-top trees with platforms at the top. The role of young forests on RTV population dynamics is largely unknown, but RTVs are known to be more abundant in older forests (USDA and USDI 2004a). There are no confirmed RTV nests within the watershed, but two probable nests were observed in proposed thinning units near the Edson Butte communications tower.

Del Norte Salamander (Plethodon elongatus)

Del Norte Salamanders were moved to Category D under the Survey and Manage program January 2001. Del Norte habitat (talus protected by overstory canopy) is present throughout portions of the watershed as small patches distributed throughout the forest. Del Norte salamanders were confirmed in talus adjacent to a proposed thinning unit in the winter of 2007. Known sites also occur in Sixes River and Edson Creek Recreation Sites.

[3] Vander Heyden, M. 2007. Personal communication. Wildlife Biologist, Coos Bay District BLM, 1300 Airport Lane, North Bend, OR 97459.

Special Status Species (Bureau Sensitive)

There is limited knowledge of the distribution, abundance, and life history of many of the Bureau special status species. Participation in regional monitoring programs has increased our understanding of some species (peregrine falcons, bald eagles, bats, mollusks, fisher, and butterflies). Project area surveys for SSS are conducted as part of general wildlife surveys and are neither intensive nor to established protocols.

Special status species analyzed in depth: Based on Table WL-2A and the species' habitat needs, the following special status species could be within the Sixes-New River watershed.

Foothill Yellow-legged Frog (Rana boylii)

This species has been documented in Sixes River Recreation Site (T32S-R14W Sec. 12) (personal observation) and are noted to be common in the Sixes River WA. There are no documented sightings in the Floras Creek watershed.

These frogs require permanent (and some types of intermittent), low-gradient, medium size streams (4th-6th order). They also use streams that are reduced to waterholes connected by trickles during the dry season (Nussbaum et al. 1983); however, they are less abundant than in mid-sized streams (Applegarth 1994). Newly transformed juveniles migrate upstream during fall and winter (Twitty et al. 1967 *in* Applegarth 1994). Breeding and egg-laying generally occurs during the spring in streams and rivers.

Green Sideband Snail (Monadenia fidelis beryllica)

This species has been documented in Sixes River Recreation Site and is primarily a Curry County, Oregon species (BLM 2007). This is the northern-most record of this species on the Coos Bay District. All remaining sightings (15) have occurred between approximately Sixes River and Hunter Creek.

This snail is associated with deciduous trees and brush in wet, undisturbed forest at low elevations. Little is known about the life history of this species.

Fringed Myotis Bat (Myotis thysanodes)

The nearest known site is in T32S-R12W-Sec. 26; outside of the analysis area. This species is rare along the Oregon coast, but it regularly uses the Oregon Caves National Monument in Josephine County, Oregon (Maser et al. 1984).

Fringed myotis depends on old-growth conditions with abundant, large roosting snags. It also roosts in caves, buildings, and mines. Bridges and rock crevices are used as solitary day and night roosts and crevices may be used for hibernation (Keinath 2004). This bat has been captured along the Oregon coast in alder/salmonberry habitat near immature conifers. Females produce one offspring per year, so population increases are slow to occur. They are highly colonial, and maternity colonies of several hundred individuals are common (Maser et al. 1984).

Northwestern Pond Turtle (Clemmys marmorata marmorata)

This species has been documented in Floras Creek/New River. This turtle is rare otherwise throughout the Coos Bay District. The pond turtle inhabits marshes, sloughs, moderately deep ponds, and slow-moving portions of creeks and rivers. It requires basking sites such as partially submerged logs, mats of vegetation, and rocks (Nussbaum et al. 1983). Nest sites are in open areas

with a clay soil component, usually within 100m of water and usually in a southern exposure (Rathburn et al 1991).

Migratory Birds:

Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 FR 3853), of January 17, 2001, directs federal agencies to conserve migratory birds to meet obligations under the migratory bird conventions and the Migratory Bird Treaty Act.

There are 143 species of neo-tropical migratory and resident birds likely to have historical presence in the Coos Bay BLM District (ODFW 1993, National Geographic Society 1991). Neo-tropical migrants include a large group of bird species with diverse habitat needs spanning nearly all successional stages of most plant community types (Niles 1992), including those found within the analysis area.

In the Pacific Northwest, migrants typically arrive from late April to early May, are breeding by late May, fledging young in July and August, and have departed for their wintering grounds sometime in late August/early September.[4] Nationwide there is concern for the declining numbers of neo-tropical migratory birds (Terborgh 1989, Line 1993, Peterjohn et al. 1991). One purported cause for the decreasing trend is habitat alteration and a change in the structures of forest habitats (Altman 1999). Table 11 lists population trends for migratory birds associated with mid-seral and older forests in southwestern Oregon based on breeding bird surveys. Those surveys showed the population of 25 species of birds declining and 4 species increasing.

Table 11: Land bird population trends for coniferous forest species in the Southern Pacific Rainforest Breeding Bird Survey Physiographic Regions (Altman 1999)

SIGNIFICANTLY DECLINING TRENDS [a]	SIGNIFICANTLY INCREASING TRENDS [a]
S. Pacific Rainforest	S. Pacific Rainforest
Blue grouse (L)	***Steller's Jay (L,R)***
Band-tailed pigeon (L)	***Turkey vulture (R)***
Common nighthawk (L)	***Black-headed grosbeak (R)***
Vaux's swift (L)	***Cassin's finch (R)***
Rufous hummingbird (L,R)	
Willow flycatcher (L)	
Olive-sided flycatcher (L.R)	
Western wood-pewee (L)	
Pacific-slope flycatcher (L,R)	
Winter wren (R)	
Chestnut-backed chickadee (R)	
Wrentit (L,R)	
Golden-crowned kinglet (L,R)	
Western bluebird (L,R)	
Varied Thrush (R)	
Yellow-rumped warbler (R)	
MacGillivary's warbler (L)	
Orange-crowned warbler (L,R)	
Wilson's warbler (R)	
Dark-eyed junco (L,R)	
White-crowned sparrow (L,R)	
Chipping sparrow (L,R)	

[4] Rodenkirk, T. 2006. Personal communication. Botanist, Coos Bay District BLM, 1300 Airport Lane, North Bend, OR 97459.

Evening grosbeak (R)	
Purple finch (R)	
Pine siskin (L,R)	

[a] L=long-term (1966-1996); R=recent trend (1980-1996)

Table 12: Special Status Species expected within the Sixes-New River area

Common Name	Key Habitat / Species Notes / Range
Amphibians	
Foothill Yellow-legged Frog *(Rana boylii)*	Perennial streams with rock or sand substrate. Occupies perennial streams, especially class 4+.
Birds	
Bald Eagle *(Halieaeetus leucocephalus)*	Late-seral forest. Nests near large bodies of water.
Marbled Murrelet *(Brachyramphus marmoratus*)	Late-seral forest
Northern Spotted Owl (*Strix occidentalis caurina)*	Late-seral forest
Invertebrates	
Green Sideband (*Monadenia fidelis beryllica)*	Deciduous trees & brush in wet, undisturbed forest at low elevations.
Spotted Tail-dropper (*Prophysaon vanattae pardalis)*	Moist, mature forests w/deciduous/shrub layer. Coastal fog zone.
Mammals	
Fringed Myotis (*Myotis thysanodes)*	Requires caves, mines or rock crevices.
Reptiles	
Northwestern Pond Turtle (*Clemmys marmorata marmorata)*	Lentic water (ponds, slow sections of rivers). Nests in open areas adjacent to water, can overwinter in forest

Table 13: Special Status Species (including their key habitat) potentially within the watershed area but not discussed in detail.

Common Name	Key Habitat / Species Notes / Range
Amphibians	
California Slender Salamander	Late-seral forests, large down logs (especially class 3-4). Somewhat coastal. Tightly associated with down wood.
Birds	
Aleutian Cackling Goose	Coastal grasslands- stages in spring in New River bottoms; also a fall migrant.
American Peregrine Falcon	Nests on cliffs.
Arctic Peregrine Falcon	Generalist; Cliffs (in breeding range). Occasional winter migrant.
Bobolink	Coastal grasslands- rare coastal migrant.
Burrowing Owl	Open country along immediate coast. Occasional fall migrant; rarely over-winters.
Dusky Canada Goose	Coastal grasslands and wet meadows-uncommon to rare, status not well known?
Lewis' Woodpecker	Recently burned areas w/snags, very rare coastal vagrant.
Northern Goshawk	Late-seral forest. Rare migrant.
Oregon Vesper Sparrow	Grasslands on or adjacent to the coast. Small breeding population on private ranchland in Curry Co.- has bred at New River ACEC also. Otherwise a rare migrant.
Purple Martin	Snags in early-seral habitats.
Streaked Horned Lark	Coastal dunes and grasslands; open beach; open ground with short grass or scattered bushes. Rare migrant.
Trumpeter Swan	Marsh, wet meadows, bogs, ponds. Rare migrant with only one wintering record.
Tule Goose	Marsh, open grasslands, coastal lowlands. Rare migrant.
Upland Sandpiper	Open coastal grasslands. Very rare migrant.
Western Snowy Plover	Coastal sand.
White-tailed Kite	Open areas in coastal and valley lowlands. Probably breeds in these areas also.
Invertebrates	
Hoary Elfin Butterfly	Closely associated with kinnikinnik (Arctostaphylos uva-ursi). Coastal species.
Insular Blue Butterfly	Open areas, clover. Coastal species.
Mardon Skipper	Grass openings with native grasses and serpentine.
Klamath Tail-dropper	Habitats unknown. Possibly like other tail-droppers. Range: Douglas, Jackson, Josephine, Klamath Counties
Newcomb's Littorine Snail	Areas of *Salicornia virginica* (pickleweed/glasswort) along tidal line in Coos Bay.
Oregon Shoulderband	Rocky & talus substrates. Many mollusk surveys, but no Coos Bay records. Range: Douglas, Jackson Josephine Counties
Salamander Slug	Mature conifer forest w/leaf litter. Range: Lane County
Sisters Hesperian	Under rocks or logs on grassy slope with small talus and shrubs. Habitat influenced by fog and maritime climate. Known range: Sisters Rock, Curry County.
Tillamook Westernslug	Habitats unknown. Range: Douglas, Lane, Tillamook Counties
Mammals	
Fisher	Forest w/shrub layer & riparian: nests/snags, dead parts of live trees, large live branches
Gold Beach Pocket Gopher	Open meadows, open forests, recent forest plantings (not dense forest). Range: mouth of Rogue River.
Pacific Pallid Bat	Xeric area; possible in SE edge of Coos Bay district. Strategic surveys have not located species on district.
Pistol River Pocket Gopher	Generally open grassy areas. Range: Pistol River, Curry County
Townsend's Big-Eared Bat	Breed in caves/mines; bridges for night roosts

VIII AQUATIC CONSERVATION STRATEGY (ACS)

Introduction

The components of the Aquatic Conservation Strategy, as introduced in the FEMAT (1993) document, are[5]:

- A network of 162 Key Watersheds. These Key watersheds provide refuge areas critical for maintenance and recovery of at-risk stock of anadromous and resident fish[6].
- Riparian Reserves where riparian dependent resources receive primary emphasis and where special standards and guidelines apply.
- Watershed Analysis would be used to evaluate geomorphic and ecological processes operating in specific watersheds. The watershed analysis should enable watershed planning supportive of ACS objectives. Watershed analysis provides a basis for monitoring and restoration programs, and is the foundation for delineating the Riparian Reserves.
- Watershed restoration is an integral part of a program to aid recovery fish habitat, riparian habitat and water quality. "The most important elements of a restoration program are (1) to control and prevent road-related runoff and sediment production, (2) to improve the condition of riparian vegetation, and (3) to improve habitat structure in stream channels."

These components are designed to work together to maintain and restore the productivity of and resilience of riparian and aquatic ecosystems (FEMAT 1993 pg II-37 to II-40; V-32).

The Aquatic Conservation Strategy Implementation in the Sixes-New River Watershed:

- The Dry Creek Subwatershed is the Tier 1 Key Watershed in the Sixes River Watershed it is managed by USFS and Private land managers.

- There are 6,461 total acres or 3.5% of the Sixes-New River watershed as BLM managed lands. BLM lands contain 3,575 acres of Riparian Reserves, 2% of the entire Sixes-New River watershed. Combining the Riparian Reserve (RR) acres and the Connectivity land use allocated acres, as there are no LSR allocated lands on BLM, the BLM reserve status lands amount to 4,425 acres. These reserved status lands make up 16% of the federally managed (USFS & BLM) reserves of the watershed and 2.4% of the larger Sixes-New River area.

- The interim Riparian Reserves in the Sixes-New River Watershed includes 10,660 acres or 38.0% of the total 28,153 acres of federally managed lands in the Watershed. In total the combined Late-Successional Reserve (LSR) acres, Connectivity, Supplemental Resource Management Area, and Grassy Knob Wilderness Area acres, equal 22,542 acres or 80.0% of the federally managed acres in the Sixes-New River Watershed.

- The initial watershed analysis work in the Sixes-New River Watershed consists of one watershed analysis completed in 1997. Two Watershed Assessments using a different analysis format (OWEB), were completed by the South Coast Coordinating Watershed Council in 2002. These documents were the Floras Creek and Sixes River Watershed Assessments. This

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[5] This section includes information and discussions from FEMAT (1993) in order to present the source of concepts, the logic track, and administrative record behind the standards and guidelines in subsequent decision documents. The FEMAT document is an assessment and is not decision document. The decision documents are the result of NEPA analyses. As a result of NEPA analysis, many concepts were brought forward into the decision documents from FEMAT, while others were refined. While most of FEMAT's recommendations were incorporated into the standards and guidelines, some were modified and a few dropped.

[6] In addition, no new roads would be built in inventoried roadless areas inside Key Watersheds. This affects National Forest lands only. The roadless area component was listed as a separate component used in developing options to be analyzed, but was included as part of the Key Watershed component in the description of ACS in chapter V of FEMAT.

document, the Sixes-New River Watershed Analysis is a first iteration document that combines all the earlier documents and new area of New River Frontal.

- Watershed restoration is on going, and accomplishments to date are summarized later in this chapter.

The Dry Creek Tier 1 Key Watershed

The Dry Creek Key Watershed encompasses two seventh field drainages (Dry Creek and North Fork Dry Creek) within the sixth field, Middle Sixes River Subwatershed. Table 14 shows the acres of private land, BLM land and BLM land use allocations in the Tier 1 Watershed. This watershed is largely composed of USFS and private lands. The USFS has designated this area the Grassy Knob Wilderness Area under the Wilderness Act in 1964.

Table 14: Key Watershed Acres in the Dry Creek Key Watershed

Key Watershed	BLM Land by Land Use Allocation:							Total all lands
	GFMA	Connectivity	LSR	RR	Total BLM	Private Land	USFS Land	
Dry Creek	81	0	0	4	81	1,648	8,495	10,224

Riparian Reserves

FEMAT (1993) identified several functions provided by the Riparian Reserve component of ACS. Table 15 shows how the Riparian Reserve functions tie to the ACS objectives. Table 16 shows width of streamside stand influence for each Riparian Reserve Function.

Table 15: Riparian Reserve Functions and Meeting Aquatic Conservation Strategy Objectives

Riparian Reserve Functions	ACS Objectives to Maintain and Restore:								
	1: diversity & complexity of watershed & landscape	2: spatial & temporal connectivity	3: physical integrity	4: water quality	5: sediment regime	6: instream flows	7: flood patterns & watertable levels	8: riparian & wetland plant species com-position & structural diversity	9: habitat for riparian-dependent species
Root strength pro-vided streambank stability			X	X	X	X		X	
Large wood delivery to the streams	X	X	X	X	X	X	X	X	
Large wood delivery to the riparian area	X	X						X	X
Leaf & particulate organic matter input to the stream		X							X
Water quality: tem-perature as affected by shade	X			X					X
Riparian microclimate	X							X	X
Water quality: sedi-ment			X	X	X	X		X	
Wildlife habitat	X	X		X				X	X

Table 16: Width of Stream Side Stand Influence for Each Riparian Reserve Function
(Summarized from FEMAT 1993 pg V-26 to V-29. Additional discussion in the Density Management and ACS Chapter)

Riparian Reserve Functions	width of the zone of influence under current conditions	width of zone of influence in the old-growth forest
Root strength provided streambank stability	½ tree crown diameter	½ tree crown diameter
Large wood delivery to the streams	Within one tree height of stream	Within one site potential tree height of stream
Large wood delivery to the riparian area	Within one tree height of riparian area	Within one site potential tree height of riparian area
Leaf & particulate organic matter input to the streams	Within ½ a tree height of stream	Within ½ a site potential tree of stream
Water quality: temperature as affected by shade	Within ½ a tree height of stream. Narrower under certain circumstances.	Within ½ a site potential tree of stream. Narrower under certain circumstances.
Riparian microclimate	Up to three tree heights. Narrower under many circumstances.	Up to three site potential tree heights. Narrower under many circumstances.
Water quality: sediment	Dependent on slope, soil type, and vegetation cover.	
Wildlife habitat	Size and continuity can be species dependent. Quality of habitat is important.	

The original vision of the FEMAT scientists was watershed analysis would provide a geomorphic and ecological basis for stratifying the landscape into areas that would require Riparian Reserves, which are wider or narrower than those prescribed for the interim. The FEMAT scientists observed that in the Oregon Coast Range debris flows, originating in channel headwalls, are the dominant mass movement process, whereas in portions of the western Oregon Cascades rotational slumping is the primary form of mass movement. Given this difference, Riparian Reserves on intermittent streams, on the typical Coast Range landscape, would tend to be narrow and distributed throughout the watershed. In contrast, locally extensive Riparian Reserves extending out from earth flows would be more appropriate for some Cascade landscapes. Consequently, the post-analysis Riparian Reserve boundaries on intermittent streams needed to meet ACS objectives can be larger or smaller than the interim widths (FEMAT 1993, pg. V-39, V-44).

This vision that the Riparian Reserve widths would be adjusted following watershed analysis was brought forward into the Record of Decision for the Northwest Forest Plan (USDI; USDA 1994b, pg. 7). This is clarified in the standards and guidelines: "Post-watershed analysis Riparian Reserve boundaries for permanently-flowing streams should approximate the boundaries prescribed in these standards and guidelines. However, post-watershed analysis Riparian Reserve boundaries for intermittent streams may be different from the existing boundaries. The reason for the difference is the high variability of hydrologic, geomorphic and ecological processes in a watershed affecting intermittent streams" (USDA; USDI 1994b, pg. B-13). Figure V-14, in the FEMAT document, indicates the range of post-watershed analysis Riparian Reserve widths what would provide the ecological protection needs for intermittent streams based on slope and rock type. The figure showing the ecological protection widths was brought forward into the basis for the standards and guidelines for the Northwest Forest Plan (USDA; USDI 1994b, pg. B-15). The dominant geologic formations in the Watershed are Quaternary terraces and depositional areas, the Cretaceous Formation, the Klamath Mountains rocks and the Otter Point Formation

Thus the composition of materials that compose these areas range from the youngest geological features formed through weathering and routing processes over time (depositional areas) to some of the oldest in the western United States. These rocks include the metamorphosed sedimentary and volcanic rocks of the Galice Formation. Whereas the Otter Point formation consists of a sheared mélange of mudstone, sandstone, volcanic rocks, chert, serpentinite, and blueschist have generally less slope (30-50%) but have finer textures (silt or clay loam). The very southern portion of the

watershed is underlain by Cretaceous age Rocky Point Formation sandstones and siltstones[7]. See Geology Map 4 for the locations of these geologic features. Table 17 summarizes information from the FEMAT figure V-14 indicating the ecological protection widths for the common rock types in the Watershed.

Table 17: Ecological Protection Widths for the Common Rock Types

	<30% slopes	30-50% slopes	50-70% slopes	>70%slopes
Resistant sediment (sandstone)	~35 feet	~50 feet	~80 feet	~100 feet
Intermediate sediment (siltstone, mudstone)	~38 feet	~63 feet	~100 feet	~125 feet
Other resistant (marine basalt)	~38 feet	~75 feet	~110 feet	~125 feet
Unconsolidated material (landslide debris, floodplains)	~80 feet	~110 feet	~150 feet	~175 feet*

* Floodplains are either flat or gently sloping. Landslide debris is the result of over-steepened slopes failing and trying to attain a stable slope (Easterbrook 1993). Consequently, landslide debris material rarely exceeds the angle of repose, which is about 68% for most soils in this area.

The interim Riparian Reserve widths for Sixes River area are based a 164-foot tall site potential tree and in the New River area a 192-foot tall tree. Watershed analysis and appropriate NEPA compliance is required to change Riparian Reserve boundaries in all watersheds (USDA, USD1 2004). No attempt to change these widths was conducted within this analysis.

Riparian Reserve Widths and Objectives for Riparian Reserves in Addition to the Aquatic Conservation Strategy Objectives:

The FEMAT Terrestrial Group noted the "Riparian Reserves, especially those that provide buffers equal to a site potential tree on intermittent streams, provide ribbons of connectivity across landscapes. Just as important, for the many non-riparian dependant organisms, they serve as an additional amount of acreage of Late-Successional Reserves" (FEMAT 1993, pg. IV-189). For example, Hershey and coauthors (1998) found 36% of northern spotted owl nest sites on the lower third of slopes, 58% on the middle third, and only 6% of the nest sites on the upper third. Riparian Reserves generally include all of the lower and much of the midslope positions, in the Oregon Coast Range, due to the combination of tall site potential trees, short slope lengths, and high stream density. The Northwest Forest Plan includes objectives for the Riparian Reserves that are in addition to the Aquatic Conservation Strategy. These are providing habitats and connectivity for late-successional associated species. The land use allocation description in the Northwest Forest Plan Record of Decision notes that in addition to protecting riparian and aquatic species and habitats, the Riparian Reserves " . . . also provide incidental benefits to upland species. These reserves will . . . enhance habitat conservation for organisms dependent on the transition zone between upland and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants, and provide for greater connectivity of late-successional forest habitat" (USDA; USDI 1994b, pg. 7). The basis for the standards and guidelines for the components of the Aquatic Conservation Strategy states "Watershed analysis should take into account all species that were intended to be benefited by the prescribed Riparian Reserve widths. These species include fish, mollusk, amphibians, lichens, fungi, bryophytes, vascular plants, American marten, red tree voles, bats marbled murrelets, and northern spotted owls" (USDA; USDI 1994b, pg. B-13). Many of these species are not restricted to riparian forest habitat, but they do use a variety of habitats inside the Riparian Reserve for drinking, feeding, roosting, nesting (Riparian Reserve Technical Team 1997). The additional species analysis, contained in FSEIS Appendix J2 concluded that the viability of several species, which are assumed to benefit from late-successional forest conditions, is provided by Riparian Reserves widths of a site-potential tree either side of intermittent streams but not

[7] The rock types are defined in Appendix V-G of FEMAT (1993).

provided by widths equal to half a site potential tree (Holthausen *et al.* 1994). In the Sixes-New River watershed the connections discussed above will be provided on USFS managed lands for those lands are contiguous and blocked in the southern part of the watershed. The ability of Riparian Reserves to function as assumed in the NFP is greatly hampered on BLM managed lands by the dispersed nature of the lands and the lack of connection from neighboring private lands where reserves on private lands are not required on first and second order drainages.

Based on the administrative record cited above, the ecological protection needs would be typically met on intermittent streams on federally managed lands within this watershed with Riparian Reserve widths of about 38 to 125 feet. However, when certain Appendix J-2 listed late-successional associated plant, and wildlife species are found at a site where Riparian Reserve width reduction is considered, an assessment of the species' watershed scale distribution and abundance would be needed. That assessment would determine if reducing the interim Riparian Reserve widths on that site would be consistent with the underlying assumptions for viability of the Appendix J-2 species under the Northwest Forest Plan.

Restoration through Stand Treatments in the Riparian Reserves:

The most important components of the restoration part of the Aquatic Conservation Strategy ". . . are control and prevention of road-related runoff and sediment production, restoration of the conditions of the riparian vegetation, and restoration of in-stream complexity. Other restoration opportunities exist, such as meadow and wetland restoration and mine reclamation, and these may be quite important in some areas" (USDA; USDI 1994b, pg. B-31).

The basis for the standards and guidelines elaborates on the riparian vegetation restoration component as follows: "Active silvicultural programs will be necessary to restore large conifers in Riparian Reserves. Appropriate practices may include planting unstable areas such as landslides along streams and flood terraces, thinning densely-stocked young stands to encourage development of large conifers, releasing young conifers from overtopping hardwoods, and reforesting shrub and hardwood-dominated stands with conifers. These practices can be implemented along with silvicultural treatments in upland areas, although the practices will differ in objective and, consequently, design"[8] (USDA; USDI 1994b, pg. B-31). This is translated into the following standard and guideline: "Apply silvicultural practices for Riparian Reserves to control stocking, reestablish and manage stands, and acquire desired vegetation characteristics needed to attain Aquatic Conservation Strategy objectives" (USDA; USDI 1994b, pg. C-32).

The Riparian Reserves embedded in the Late-Successional Reserves are managed to meet both Riparian Reserve and Late-Successional Reserve objectives (USDA: USDI 1994b, pg. C-1). The FEMAT scientists concluded that management intervention within Reserves[9] may hasten restoration of late-successional conditions. They also concluded management activities are appropriate where past activities, like fire suppression, jeopardize old forest conditions and supported treating plantations to put them on a trajectory to develop late-successional forests conditions (FEMAT 1993, pg. IV-187). The option of relying on passive restoration in the Late-Successional Reserves was incorporated into alternative 1 and analyzed in the FSEIS. While

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[8] Experience to date shows that while the management objectives for the Matrix and the Riparian Reserves may be different, many habitat restoration practices initially prescribed for the Riparian Reserve are also applied to the Matrix sites when those treatments do not prevent attainment of Matrix objectives.

[9] The source sentence in the FEMAT document neither specifies Riparian Reserve nor Late-Successional Reserve. The larger context is a discussion on the Late-Successional Reserves. However, the Riparian Reserves were observed in that discussion to provide linkage among the Late-Successional Reserves (FEMAT 1993, pg IV-186 to IV 188).

alternative 1 was found to provide a high level of protection for late-successional habitat, it was ultimately rejected because the assessment team believed that without restoration silviculture, the development of additional late-successional conditions would be retarded (USDA; USDI 1994a, ch. 2 pg. 69).

Large diameter trees, down wood, and snags are characteristic of late-successional forests (Franklin *et al.* 1986; Franklin & Spies 1991). The value of thinning is to concentrate growth on selected trees (Daniel *et al.* 1979, pg 419-420). Age class distributions and growth rates observed by examining stumps suggested to Franklin and Hemstrom (1981) that old-growth stands developed at low densities and had long regeneration periods. They concluded that either extensive repeated fire reduced the seed sources, or partial burns could account for the low stocking condition and age ranges observed by counting and measuring old-growth tree rings. Tappeiner *et al.* (1997) observed old-growth trees often averaged 20-inches dbh at age 50, and 40 inches at age 100. This individual diameter growth rate is higher than observed in plantations today. By running stand development simulations, Tappeiner and coauthors (1997) found 31-46 trees/acre, at age 20-years, resulted in the better fit to observations made in old growth stands with respect to the estimates of total densities and densities of the larger diameter classes. This suggests that the old-growth stands developed with low density, regenerated over time, and had little inter tree competition. Poage (2000) came to similar conclusions after examining data for the Coast Range, Oregon Cascades, and Willamette Valley.

Riparian Reserve Functions, Late-Successional Conditions, and Meeting the Aquatic Conservation Strategy:

The Standards and Guidelines (USDA; USDI 1994b) do not specifically direct managing the Riparian Reserves for late-successional forest conditions to meet the Aquatic Conservation Strategy. However, when the FEMAT team defined the functions of streamside vegetation, with respect to benefits to in-stream and riparian habitats, they used research on late-successional forest influences on stream and riparian habitats (primary sources cited in FEMAT 1993, pgs. V-26 to V-29). Indeed, the interim Riparian Reserve widths are defined as a function of the "average maximum height of the tallest dominant trees (200 years or older)" (USDA; USDI 1994b, pg. C-31). Consequently, obtaining the functions of the Riparian Reserve requires managing for late-successional forest attributes, if we are to maintain consistency with the conditions and assumptions used in the FEMAT document to develop and support the Aquatic Conservation Strategy.

Three functions of the Riparian Reserve are contingent on the presence of large diameter trees: large wood delivery to streams, large wood delivery to riparian areas and wildlife habitats (FEMAT pgs V-26, V-29). Wildlife habitats associated with large diameter trees include large diameter snags, large diameter down wood, prey substrates provided by large surface areas of coarse deep fissured bark, deep canopies, large limbs, and large platforms, cavities and other structures found in damaged or injured large trees (Brown *et al.* 1985; Weikel & Hayes 1997). Large trees, large snags, large down wood and large deep crowns are all attributes associated with late-successional forests (Franklin *et al.* 1986) and spotted owl habitat (North *et al.* 1999).

The ability of the Riparian Reserve to maintain cool water temperatures by shading streams depends on stream width, vegetation height, and the angular density of foliage. Tall vegetation will provide more shade to a wide stream than short vegetation. On streams where the vegetation heights are sufficient to cast shadows across the channel, the canopy of a stand in the stem exclusion stage of stand development will provide more shade than the more open overstory canopy typical of a late-

successional stand. However, multi-canopy-layered, multi-species late-successional forests provide redundant layers of foliage intercepting light. These species are diverse and structurally complex stands are more robust in their ability to continue to provide shade following disturbance than are stands in the stem exclusion stage of stand development that have only a single vegetation layer and limited species diversity. In a study on the H. J. Andrews, Levno and Rothacher (1969 cited in Adams; Ringer 1994) found stream temperatures increased 12 to 14°F following clearcut logging of old-growth, slash burning, and stream cleaning. However following logging, but before the understory vegetation was removed by burning, the maximum stream temperatures increased 4°F. In contrast, few if any understory herbs and shrubs are present under a stand that is the stem exclusion stage of stand development that could provide shade following removal of streamside trees, or the loss of those trees by a natural disturbance.

Similarly, late-successional forest conditions are not essential to the function of the Riparian Reserve to provide root strength for stream bank stability or protect water quality from erosion. These functions can be met by stands in earlier seral stages. However, the multiple vegetation layers and higher species richness do provide redundant mechanisms that allow late-successional stands to tolerate disturbance better and thus retain the ability to fulfill these functions following disturbance better than stands in the stem exclusion stage of stand development.

Another function of the Riparian Reserve is to provide leaf and other particulate organic matter input to streams. This too is benefited by a diverse range of plant species (conifers and hardwoods alike). In addition, the greater the range of plant species, there is a greater variety of arthropods likely present that could also fall into the stream along with particulate plant matter. The multi-vegetation layered late-successional forests inherently have a greater abundance of understory tree shrub and herb layer plants and typically greater species richness than stand in the stem exclusion stage of stand development.

Watershed Restoration

Two of the major points of the Aquatic Conservation Strategy stress restoration of watershed processes to recover degraded habitat and to focus on removing and upgrading roads (USDA; USDI 1994b, pg. B-32). Road treatments were intended to span a range of work from simple road upgrading to full decommissioning. Up grading would remove soil from locations where there is a high potential of triggering landslides, modifying road drainage systems to reduce the extent to which the road functioned as an extension of the stream network. Reconstructing steam crossings to reduce the risk and consequences of a road failure or washing out was intended.

Active Restoration Accomplishments:

There have been many and diverse restoration projects in the Sixes-New River area. See the Watershed Restoration Figures 5-7 at the end of this section of the document for particulars within each of the three areas; New River, Sixes River and Floras Creek. Culvert replacements, where fish passage barriers were identified on both state and county roads, removed barriers at culverts under Highway 101. New culverts at South Two Mile, Lower Two Mile, Swanson, and Boulder creeks in addition to a bridge across Bethel Creek were recently replaced by the Oregon Department of Transportation. Several culverts on county roads (4 Floras and 6 in Sixes) were also replaced and now allow fish passage.

A stream relocation project on the lower portion of Bethel Creek moved the flow of the creek from an old dysfunctional drainage ditch to a perennial stream across pasture and adjacent to wetland habitat. Throughout the watershed approximately 30 off-channel stock watering structures have been installed to provide water in pastures after fencing the stream. Fencing, planting of conifers and maintenance of planted trees has occurred throughout the watershed. Two Mile, Floras, Crystal, Sixes, Morton, Butte and Willow creeks all have had extensive riparian plantings that date from 1994 to the present.

Large wood was placed in the lower estuary of New River between Floras creek and Hansen Slough as a habitat and debris catching tool to prevent flood situations from removing the fences constructed along New River. In addition large wood has been added to Crystal Creek and its lower tributaries, Dry Creek and Dement Creek in the Sixes River watershed. In the Floras Creek watershed and New River frontal most of the Floras Lake tributaries, Willow, North Fork, Butte, and Four Mile all have received wood in varying amounts.

Noxious weeds have been removed from the New River ACEC and other federal lands in the lower estuary and agricultural practices have also treated many road ditches and fence lines in an effort to remove the weeds. Road renovation and decommissioning have not been a major focus within this watershed on federal lands (a mere .7 mi in West Fork Floras) but through the watershed council, work on approximately 18 miles in the Sixes, 20 miles in Floras Creek and 9 miles in the New River frontal watersheds have been upgraded or closed to correct sediment delivery mechanisms.

Passive Restoration Potential:

Riparian Reserves encompass 10,660 acres, or 38% of the federally managed land (BLM + USFS) in the Watershed. Compiling acreages for all reserved lands on USFS and BLM lands equals 22,542 acres or 80.0% of the federally managed lands, 12% of the entire watershed. Private lands contribute reserved lands along those streams that are considered perennial and have fish present, those acres total 6,524 or 3.5% of the entire Sixes-New River watershed.

More specifically there are 3,575 acres of Riparian Reserve lands on BLM lands. This amounts to 2% of the entire watershed area. The portion of the Connectivity Reserve outside the Riparian Reserves encompasses 850 acres. Combining these lands together amounts to 4,475 acres or 2.4% of the Sixes-New River watershed are in a reserve land use allocation on BLM managed lands. Alder stands that came in following management associated disturbance on sites formerly occupied by conifers in the Riparian Reserves are available for regeneration harvest if done to restore conifers to those sites. An estimated maximum of 112 acres of alder stands in this Watershed are likely to be regeneration harvested. About half, or 55 acres of these alder conversion acres are in the Riparian Reserve[10]. Based on that assumption, at least 3,520 acres could provide the passive restoration benefits associated with a continuous forest cover. That represents a little less than 2% of all lands in the Watershed. The Riparian Reserves are managed for late-successional old-growth habitat, and for protection of hydrologic function and aquatic habitats respectively.

[10] The FOI data base shows 1878 acres of mixed forest stands containing both conifer and hardwood species in various percentage compositions on BLM land in the Watershed. Of that, 112 acres are considered pure hardwood stands and have birth dates after 1940 and likely regenerated following harvest or road construction. The FOI data generally includes polygons that are 5 acres and larger. Some stands recorded as conifer in FOI have patches of hardwoods that are less than 5 acres, which were not broken out as separated FOI units. Operational considerations will result in most alder conversion work occurring in stands that are 5 acres or larger, few if any in stands 2 acres or smaller will be targeted for conversion using a regeneration cut. Conversions of alder stands that are less than 5 acres generally will not be done as stand alone projects but rather as a part of other projects

This Watershed includes no acres of Late-Successional Reserve land on BLM lands which support 80-year old and older stands. Within the Connectivity LUA there are approximately 700 acres of 80 year old or greater stands that have no treatments within them. Since implementation of the Forest Plan in 1994, active manipulation of stream side stands in the Myrtlewood Resource Area, which are older than 80-years, has been limited to cutting and line pulling trees to restore large coarse wood to those streams. No such treatments of that sort have been conducted on BLM lands in the Sixes-New River watershed.

The rate at which we attain restored conditions through passive management depends on the function considered. Table 18 contains estimates of when we will attain recovery of various Riparian Reserve functions and the basis for those estimates.

Table 18: Estimated Recovery Rates of Riparian Reserves with Regards to Function Assuming Passive Restoration (No Active Management to Shorten Recovery Time)

Riparian Reserve Function	Condition	Estimated Recovery Rate and Supporting Notes
Slope stability/ sediment delivery	Increased landslide risk associated with loss of root strength following clearcutting Highest risk sites are characterized by shallow soils on steep slopes.	Increased risk of landsliding occurs during the 10 to 15 years following clearcutting (Swanson et al. 1977). Coast Range data indicates the greatest risk of in-unit landsliding occurs in first 3 years following clearcutting (Gresswell et al. 1976). The peak risk period (first 3 years after cutting) has passed for the units that were clearcut harvested before the initiation of the Forest Plan in 1994. Root strength will recover to preharvest levels in about 15 years. Shallow rapid type landslides are unlikely on land with deep soils on slopes that are less than the angle of repose.
Shade	Harvesting to the stream edge exposes the stream to solar heating	Stream width controls the rate of passive recovery. Ten years after clearcutting, vegetation regrowth along Coast Range streams that are less than 10-feet wide (generally 1st, 2nd, and 3rd order streams) will provide shade levels equal to that in mature stands (Summers 1982 cited in Skaugset 1992). During the 1970's hardwood buffers and hardwood-cedar-hemlock buffers were left next to fish bearing streams following clearcutting on BLM land. Beginning in the early 1980's, BLM timber sales units next to all 3rd order and larger streams, and next to fish bearing 2nd order streams included no-cut stream buffers. These buffers were 80-feet and wider on either side of the stream. These buffers provide passive restoration, with respect to shade and sediment filtering on those streams (Brazier; Brown 1973). Before the 1970's, clearcutting down to the stream edge was a common practice on all streams. The youngest of these 2nd growth stream side stands is about 30-years. A 30-year old Douglas-fir stand on an average site will be 74 feet tall, based on a 160 site index (McArdle 1961). Full recovery of vegetation, for shade purposes, has occurred along those 1st to 5th order streams over the last 30 years. The 6th order Sixes River is too wide to be effectively shaded by streamside vegetation in some portions of the watershed. Review of 1955 aerial photographs show the pre-logged stand condition for streamside forests. These photos indicate the 6th order Sixes River and Floras Creek, and some portions of the 3rd through 5th order streams with floodplains did not have full canopy closure overhead prior to timber harvesting because channel migration across the floodplains created canopy gaps.
Coarse woody debris	Harvesting and land clearing to the stream edge and aggressive stream cleaning has resulted in a loss of instream structure and a lost potential to recruit new large structure from the streamside stand.	See the cell above for stream buffer history. Without active management, green tree average of dbh of 20-inches is attained at stand age 70 to 110-years. Passive recovery of the potential to regularly recruit dead trees that average 20-inches dbh and larger from stream side stands will take approximately 120 to 180 years from the time the streamside stand was regenerated. Recovery rates controlled by initial stand density, uniformity and site quality. The assumptions and analysis are in Density Management and Conversion Treatments and attaining Riparian Reserve Functions section of this document. We expect passive recovery of the potential to regularly recruit large wood; along non-fish bearing 1st and 2nd order streams, to occur between the years 2080 and 2140 as most BLM acres are currently 50-60 years of age. We expect passive recovery along fish bearing streams approximately 20 years sooner. Large diameter wood is attainable earlier in low stocked sites. The Riparian Reserve areas adjacent to New River contain 673 acres of beach sand, dune grass and pasture like vegetation that established after land use and wetland conversion. These acres are not growing trees or delivering wood to the stream, and without disturbance, that will not change.

Riparian Reserve Function	Condition	Estimated Recovery Rate and Supporting Notes
Edge effect	Placing a regeneration cut next to an established stand results in an edge. This in turn causes microclimate changes that reach into the established stand. Given certain site conditions (gentle uniform slopes, little understory, favorable aspect), wind can penetrate into an old-growth stand for a distance equal to 3 tree heights. Chen (1991) found edge influences on biological variables ranged from essentially none to 450 feet for hemlock seedlings <10 cm tall.	No new streamside regeneration units were to be created under the Forest Plan except where brushfield and hardwood conversions are accomplished to restore Riparian Reserve function. Fire, blowdown, or other natural disturbances will create new stand edges and may necessitate future regeneration units next to streams. Where we have existing cuts, we attain passive recovery from microclimate changes due to edge effect in older stands as the adjacent cut reforests and that new stand grows tall enough to shield the gap between the ground and the base of the crowns of the trees in the older stand (Harris 1984). The establishment and growth of understory trees beneath the older trees along the edge also facilitate passive recovery. The time required for a young plantation to grow tall enough to block the gap below the crown of an adjacent stand depends on the size of the gap and the site quality. Assuming a Kings 50-year site index of 126 ft, and assuming the older stand is 192 feet tall, an adjacent plantation will shield the gap below the older stand's crown in 47-years if the older stand has a 40% crown depth and in 23-years if the older stand has a 70% crown depth. The analysis is in the Density Management and Conversion Treatments and attaining Riparian Reserve Functions section of this document.

The Passive/ Active Roles of Density Management:

Density management affords a means to do both active management (speed or assure attainment of late-successional stand attributes and large trees that are suitable for recruitment as large riparian/instream structures), and provide passive restoration through maintenance of continuous forest cover (thus assuring the benefits of root strength for streambank and hill slope stability, nutrient cycling, and shade).

Density management treatments applied to younger stands are more effective at setting stands on a trajectory to become old growth, at attaining large stem diameters, for developing wind firmness, and retaining deep crown depths than are late entries. Density management in older stands is more appropriate for attaining a strong size contrast between the overstory and understory trees in a stand, and to manipulate the stand to assure attainment of attributes such as large snags, large down wood, and canopy gaps. Density management for habitat benefits is a relatively young concept. Thus, techniques are evolving, and treatment objectives can change from project to project depending on what we learn from earlier treatments and from the current literature, and on the site-specific conditions.

The science behind retaining untreated buffers along streams and other areas of concern, to provide passive protection, is rooted in research done in the 1960s and 1970s to protect streams from the impacts that clearcuts had on aquatic/riparian habitats. Consequently, much of the underlying science supporting buffers is based on studying the contrast between conditions inside a buffer zone and an adjacent clearcut. These studies may have limited relevance in determining the value of buffers within thinned stands, which in effect, result in only variations in canopy density on sites with a continuous forest cover.

A review of literature concerning buffers, and an analysis of a range of treatments that may apply next to streams, suggests a light treatment area equal in width to half the height of the dominant trees in the current stand will insure near term attainment of the passive restoration benefits of shade and litter input, and a no treatment buffer equal to about half the average tree crown width will provide stream bank protection via root strength. Conversely, this suggests we can use a more aggressive active management, such as wide-spaced thinning prescriptions, in those parts of stands that are farther back from the stream edge. This would allow more rapid attainment of desired late-successional stand conditions in the long term without adversely affecting short term attainment of

those streamside functions attainable through passive management. Some sites have slope, topographic shading, aspect, or other physical attributes that shade or otherwise protect streams. On these sites, where physical features protect streams from direct sun, narrower buffers can provide passive protection of other riparian functions. For example, since the sun travels across the southern sky, trees on the north side of a stream are unable to shade the stream from direct sunlight. Considering these physical features would allow the flexibility to use active management to restore coarse wood debris recruitment potential, species diversity, and structural complexity nearer to the streams on that north side of the stream sites.

Thinning/ density management are partial cut systems where live trees are retained on the site. These live trees provide a live root mass that binds the soil together and thus these cutting systems do not increase the risk of mass movement on slide prone ground associated with clearcutting. The amount of live root mass, following a partial cut, is greater than would be indicated by the number of live trees alone. Eis (1972) found 45% of the selectively cut Douglas-firs were root grafted and half those stumps were still alive 22 years later. In addition, the roots of different trees in the stand are intertwined, unlike the tree crowns, which are spatially distinct. Consequently, thinning does not kill all the roots in the discrete areas of soil below the cut trees (Stout 1956 cited in Oliver & Larson 1990).

Effects of "no-action alternatives" and "wide no-treatment buffers" on Attainment of ACS Objectives:

The Douglas-fir old-growth forests, along with the associated aquatic habitats, are disturbance dependent ecosystems (Agee 1981, Reeves *et al.* 1995). The optimal conditions for the development of late-successional/old-growth habitats include disturbances that cause short term detrimental impacts on habitat attributes used by individual species. However, disturbances provide snags and down wood, and create the gaps that provide additional growing space for plants that survived the disturbance or that germinate in on the newly created seed beds. Consequently, maximizing attainment of existing individual habitat attributes by excluding or avoiding disturbance can delay attainment of overall late-successional/old-growth conditions for decades to a century or more. In other terms, selecting the "no-action alternative" for a densely stocked stand would in the long term have a "likely to adversely affect" on species that benefit from late-successional forest conditions. These late-successional conditions include the large diameter down wood that contribute to instream structure and aquatic habitats.

Lack of disturbance on sites with wetter climates or deeper soils, dense canopies, or on sites with stands of clonal shrubs can result in the loss of the less competitive endemic species and a corresponding loss of plant species diversity. "No-touch" buffers, therefore, will likely protect plant species diversity only if natural disturbance regimes are intact. Where natural disturbance regimes no longer functioning, for example as a result of fire suppression, active management may be warranted to allow for the persistence of less competitive native species (Hibbs and Sarr 2001).

Density management can be used to emulate low to moderate severity natural disturbances without the associated risk of stand replacement that accompanies wildfire. Avoiding the risk of stand replacement fire is particularly important on landscapes where uncontrolled fire poses a risk to both the remaining old-growth patches on BLM land and to adjacent private property values. Density management effects can be highly controllable, allowing managers to target those parts of the landscape that can best benefit from treatment. Managers can also selectively control treatment intensity or leave some areas untreated, and by that moderate or avoid short term impacts to

particularly sensitive areas. This allows attainment of several objectives across a stand that would be mutually exclusive at the acre scale. The problem for biologists designing density management projects is deciding where in the stand to apply the different intensities of treatment in order to avoid short term risks to sensitive areas and still attain the long term objectives. A decision to use a no-treatment buffer around sensitive areas may to be prudent in light of short term effects, and using an extra wide buffer can seem good insurance. However, wider than necessary no-treatment buffers do not provide additional short term protection, and carry the cost of delaying attainment of those stand conditions associated with late-successional forest that benefit aquatic systems.

The following describes one example of the tradeoff between short term protection of a habitat attribute and long-term restoration of an ecosystem: Overhead shading of the streams by streamside vegetation is desirable for maintaining the aquatic habitat attribute of cool water temperatures. Maximum shading, resulting in the lowest possible solar heating of streams, occurs during the stem exclusion stage of stand development. Stands do not develop many of the attributes of old-growth, like deep multilayered, multi-aged, multi-species canopies, until after the stands emerge from the stem exclusion stage and enter the understory reinitiation stage. The understory reinitiation stage is made possible by the formation of canopy gaps that allow enough light to reach the forest floor to support survival and growth of understory trees shrubs and herbs (Oliver and Larson 1990, pgs. 252-254). The longer the stand remains in the stem exclusion stage, the later the stand will develop late-successional attributes. The stem exclusion stage is also a period of intense competition, which slows tree diameter growth rates. Work by Tappeiner and coauthors (1997) suggests the Coast Range stands that survived to become old-growth grew under low stocked conditions when young. Low stocking levels allowed those stands to accrue much of their diameter growth when young. That suggests maintaining high stocking levels causes the current stands to develop along a different trajectory than did the stands that survived to become old-growth under unmanaged conditions. These more open growing conditions probably allowed for earlier recruitment of understory vegetation, and development of deeper crowns associated with old-growth than would be possible for the current well-stocked and overstocked stands if those stands were left to develop without either thinning or moderate severity natural disturbance.

If we were to ignore effects of managing for habitat attributes at the expense of restoring ecosystem processes, we would still have situations where maximizing the attainment of one desired habitat attribute can delay attainment of other desired habitat attributes. Returning to the example above, managing for the lowest possible solar heating of streams by retaining high streamside stocking levels in streamside stands to can delay attainment of large average diameter streamside trees. This in turn delays regular attainment of another habitat element, the large instream key pieces of wood. How big an impact this is depends in large part on the width of the no-treatment area. Based on work by McDade and coauthors (1990), 11% of all debris found in streams originated within 1 meter (~3 feet) of the stream and was likely recruited by streambank erosion undermining and toppling trees. Wood originating from more than 1 meter away from the stream was likely delivered to stream by windthrow or other processes unrelated to stream bank erosion. More than 83% of the hardwood pieces and 53% of the conifer pieces originated within 10-meters (33-feet) of the stream. More than 70% of all instream debris originated within 20-meters (66-feet), and 85% would come from within 30-meters (98-feet) of the stream. The probability that a tree will fall into a stream decreases with increasing distance from the stream. This data indicates a 100-foot no-treatment buffer on streams would only allow about 15% of the trees that will eventually contribute wood to a stream to benefit from the additional growing space provided by the density management

treatment. With a 66-foot no-treatment buffer, only 30% of the trees that will eventually provide wood to the stream would benefit from the increased growing space provided by the thinning.

The distance that a tree is from a stream will also affect the size of the part of the bole where the tree intersects the stream when the tree falls into the stream. The relation of tree dbh to the diameter of the part of the tree bole entering the stream, assuming the fallen tree does not slide down the slope[11], is shown in Table 19 below.

Table 19: The Bole Diameter in Inches at 16-foot Intervals up the Tree for the Average Tree in Each DBH Class
- Data is based on log taper and board foot tables for Douglas-fir on Coos Bay District-BLM Diameters below the heavy line are >20-inches.

DBH	16 ft.	32 ft.	48 ft.	64 ft.	80 ft.	96 ft.	112 ft.	128 ft.	144 ft.	160 ft.	176 ft.	192 ft.	208 ft.
12 in.	10	9	9	6	5								
16 in.	13	12	11	9	8	5							
20 in.	16	15	14	12	11	9	6						
24 in.	19	18	17	15	14	12	10	7					
28 in.	22	21	19	18	16	13	11	7					
32 in.	24	23	22	20	18	16	14	11	8				
36 in.	29	28	27	25	24	23	20	18	15	12	9		
40 in.	32	31	30	28	27	25	23	21	19	16	13	10	
44 in.	33	32	31	29	28	26	25	23	21	19	16	13	10
48 in.	37	36	34	33	31	29	27	25	23	21	18	15	11

In a project where a 66-foot wide no-thin buffer is used between a stream and the thinned area, the thinned trees adjacent to the buffer will need to be about 32-inches dbh before they can be expected to deliver 20-inch diameter piece of wood debris into the stream, based on the information in Table ACS-9 above. In a project where a 98-foot no-thin buffer is used between a stream and the thinned area, the thinned trees adjacent to the buffer will need to be about 36-inches in diameter before they can be expected to deliver 20-inch diameter piece of wood debris to the stream.

The following diameter growth data are from stand development simulations they illustrate the time required to grow large diameter trees in thinned and unthinned stands on Site II ground:

Time to obtain 20 and 24-inch average green tree diameters at breast height-

- Trees in the **thinned** part of the streamside forest will average 20 inches dbh about age 50 to 60- years, and 24 inches dbh about age 70 to 90-years.
- Trees in an **unthinned** buffer will average 20 inches dbh about age 70-years, and 24 inches about age 120-years on a similar site.
- Time to obtain 20 and 24-inch average diameter dead trees-
- The **thinned** area will produce 20-inch dbh and greater average size dead trees about age 50 to 80 years, and 24-inch dbh size average dead trees by age 70 to 160 years depending on spacing.
- An **unthinned** buffer will produce 20-inch dbh and greater average size dead trees about age 120-years, and 24-inch dbh by 190 years.

Summary of effects of wide no-treatment buffers on attainment of large wood to streams:

- Diameter growth is slower in the unthinned buffer than in the thinned areas delaying attainment of large diameter wood recruited to streams from the unthinned buffers.
- Wide no-treatment buffers reduce the number of trees delivering wood to streams that had benefited from the growing space provided by the thinning treatment.
- Wide no-thin buffers, delay attainment of large diameter debris produced by the trees in the thinned areas because the desired diameter woody debris has to come from a height on the bole that is directly

[11] While doing their 1992 study on wind damage to stream buffer strips, Andrus and Froehlich also observed that root wads, even on very steep ground, rarely slid down hill more than 20 feet (McGreer & Andrus 1992).

proportional to the source tree's distance from the stream.

Regeneration cutting, without retaining a buffer next to streams can raise stream temperature, which stresses fish. However, leaving streamside shrubs and small trees can greatly reduce the stream temperature increases associated with removing all commercial trees next to a stream when compared with temperatures observed following removing all sources of shade from the stream edge by a combination of clearcutting, burning and stream cleaning (Levno and Rothacher 1969 cited in Adam and Ringer 1994). Ten years after clearcutting, vegetation regrowth along Coast Range streams that are less than 10-feet wide will provide shade levels equal to that in mature stands (Summers 1982 cited in Skaugset 1992). Another study showed 50% of a Coast Range stream shaded within 5 years of harvesting and burning (Beschta *et al.* 1987).

In contrast, a forest canopy is retained following a density management treatment and thus the exposure to sunlight is less than following clearcutting. One near term effect of thinning a stand that is in the stem exclusion stage is to increase the amount of light reaching the forest floor (and potentially streams) from 2 or 3% of full sunlight to light levels that more closely approximate those under a mature stand in the understory reinitiation stage of development. The leave tree crowns will expand to occupy the canopy gaps left by the thinning operation. Following thinning, the period until the canopy gaps are reoccupied by expanding tree crowns above and by an invigorated shrub layer below would be much less than the 10-year recovery time observed following clearcutting next to small streams. The alternative to thinning next to streams, with its short term effects on light levels, is not to thin. Not thinning carries the long term effect of the delay in attainment of large key pieces of durable wood from the untreated areas to the stream. This delay in attainment can be as short as 10 to 20 years if we wait until we have green trees that we can cut or pull over into the stream, or as long as 40 to 70 years if we wait for recruitment of 20-inch diameter key pieces through natural mortality.

Effects of Light- Treatment Approaches to Restoring Conifers to Hardwood Dominated Stream Side Stands and Attainment of ACS:

Emmingham and coauthors (2000) evaluated 34 riparian restoration projects done by the Forest Service and BLM in the Coast Range. The following is from their discussion section:

> [S]*uccessful restoration of conifers* [to streamside stands] *will require an active approach, including marked reduction of competing shrub and overstory trees, at least in patches. The conservative nature of the silvicultural approaches applied in many projects suggests that some managers ignored the high probability of failure without aggressive and effective control of competing vegetation. Our survey of competing vegetation revealed a basic conflict in carrying out the objective of growing large conifers: one-quarter of the projects were at the same time trying to minimize impact on the existing overstory. In addition, we observed that thinnings or creating gaps were done so conservatively that they failed to provide adequate release of existing conifers. The message is clear: It is a waste of time and resources to attempt restoration of conifers in areas where other resource values will preclude an aggressive approach to establishing conifer dominance. Since conifer restoration can be applied in patches, such conflicts should be easy to avoid.*
>
> *Unfortunately, the growing conditions provided by the conservative treatments applied in many restoration projects will not lead to development of large conifer trees [dbh 60 cm (>2 ft)] in the 21st century. Most of the conifers will not survive the combination of poor growing conditions and animal damage. Active management of both overstory and understory to give*

conifers plenty of growing space is the only way to promote conifers into a dominant (free-to-grow) position.

The potential conflict between protecting streams from the near term effect of direct sunlight heating streams and obtaining large trees that can supply large durable wood to the stream is greater for hardwood conversion projects than for density management. This conflict stems from the biological necessity for green plants, like conifers, to receive a threshold level of sunlight just to meet respiration needs for survival, and a need for higher light levels to produce net growth. As noted in the discussion on density management above, the wider the no-treatment buffer between a conversion project and the stream, the longer the time needed before the conifers in the converted area can deliver large diameter wood to the stream. One approach to developing an effective hardwood conversion project includes:

- Use the narrowest streamside buffer consistent with providing shade in the near term and obtaining large wood in the long term.
- Provide sufficient sunlight to the conifers to insure survival and good growth.
- Do not advocate cutting to the stream edge. Research indicates that ten years after cutting, vegetation regrowth along Coast Range streams that are less than 10 feet wide will provide shade levels equal to that in mature stands (Summers 1982 cited in Skaugset 1992). This suggests that if a streamside buffer on a small stream turns out to be too narrow to provide maximum protection from solar heating then the impact will at worst, last 10-years.

The Effects of Retention of Red Alder Stands and Attainment of Riparian Reserve Functions:

- Alder and understory shrub roots maintain streambank stability.
- Little or no durable large wood delivered to the stream or to the riparian forest floor. Small and moderated sized nondurable alder wood delivered to the stream and forest floor with the largest pieces provided between stand ages of 90 to 130-years (Newton & Cole 1994). No wood delivery after the alder stand completely breaks up. A disturbance would be necessary to reestablish trees on the site.
- The alders provide shade until stand senescence. Stand will start breaking up when it is about 100-years-old and will be gone about age 130-years. If present, residual conifers may provide partial shade. Salmonberry may provide full shading over narrow streams following stand break-up.
- Riparian microclimate is maintained until stand breakup. Stand breakup will create a hard edge resulting in microclimate edge effects reaching into the adjacent stands. Brush competition will maintain the edge conditions by preventing successful regeneration of a replacement stand.
- Understory forbs, herbs and shrubs filter sediment.
- An alder stand provides habitat for species associated with hardwoods and disturbed sites. After stand breakup, the site only provides habitat for species associated with shrubs.

The Effect of Conversion of Red Alder Stands to Conifer Stands and Attainment of Riparian Reserve functions:

- A narrow buffer along the stream would retain the alder and understory shrub roots that provide streambank stability.
- Depending on site quality and subsequent thinning intensity, delivery of large durable wood from 20-inch diameter conifers to the stream and forest floor begins between stand ages of 50 and 90 years. An alder buffer strip next to the stream will deliver some nondurable wood to the stream from those trees retained. A pulse of alder wood could be placed in the stream and retained for down wood habitat as part of the project design for the conversion project. Conversion will result in forgoing the pulse of wood to the stream and forest floor associated with alder stand senescence.
- Buffer strips would provide shade. If a buffer strip next to a small stream blows down or is inadequate, then recovery of stream shading would be provided by the young conifers and shrubs in about 10-years. Blow down into and across the stream would provide shade from the dead or blown over tree boles and

canopy. Very small streams can be fully shaded by salmonberry or other shrub species. A conifer stand can shade a stream for several centuries.

- Riparian microclimate would be recovered when the new conifer stand grows tall enough to block gap below the canopy of adjacent older stands. The time to full microclimate recovery is dependent on the height to the base of the adjacent stand's canopy.
- Buffer strip filters sediment. The recovery of the herb and shrub layer on Coast Range sites following disturbance is rapid. Sediment delivery is a risk only if site is compacted and gullied.
- Stocking control can put the conifer stand on a trajectory to develop into late-successional habitat.

Density Management:

Density management is similar to commercial thinning in that a portion of the trees are cut in younger stands. The difference is that commercial thinning is designed to obtain an optimum combination of volume yield and economic value over the life of the stand. Density management treatments are designed to assure and/or speed attainment of habitat attributes associated with late-successional forests and riparian forests. Depending on the site and the project objectives, stands as young as 25-years may be treated. The Forest Plan emphasizes density management treatments in younger stands. An REO review and exemption are required before density management can be applied to stands older than 80-years in the Late-Successional Reserve. An REO review is not required before applying density management to stands older than 80-years that are in the Riparian Reserve but outside a Late-Successional Reserve. However, younger stands generally have a more rapid growth response and develop desired overstory stand characteristics quicker than older stands following thinning. Since young stands generally respond more rapidly to density management than older stands, and since older stands of natural origin often have some late-successional characteristics, as a result of legacy elements, preferential selection of young stands will result in a more rapid attainment of late-successional characteristics across the landscape for a given amount of effort.

Stands receiving density management treatments will provide larger diameter trees and snags to the riparian area, and larger diameter wood debris to both the aquatic and riparian systems in a shorter time than will untreated stands, as shown in Table 20. According to the GIS Forest Operations Inventory (FOI) data on hand there are approximately 642 acres of stands between the ages of 30 and 50 years old within the RR's on BLM lands. Density management of these stands would provide the larger diameter trees and stand conditions expected in older less dense forest stands.

Table 20: Stand Age When 20 Inch Diameter Live and Dead Trees Are Attained
(From the Density Management and Conversion Treatments and Attaining Riparian Reserve Function section)

	Pre-commercially thinned stand with no subsequent density management treatment	Pre-commercially thinned stand receiving a density management treatment at age 40 leaving 120 trees per acre	Pre-commercially thinned stand receiving a density management treatment at age 40 leaving 60 trees per acre
Stand age when the average newly dead tree has a dbh >20 inches:	120 to 180 years	80 to 90 years	50 to 60 years
Stand age when the average live tree has a dbh >20 inches:	70 to 110 years	60 to 70 years	50 to 60 years

Shortening the time taken by a stand to produce large diameter wood, which is able to deliver to the stream channel and riparian areas, will speed restoration of terrestrial habitat components and provide instream large wood debris sooner. Earlier recruitment of large instream wood debris is needed because large wood can store sediments, and trap gravel deposits. Large wood debris can

modify the stream hydrology in ways favoring formation of deep pools, backwaters and off-channel habitats. These benefits are accrued both next to the treated stand and downstream.

Thinning reduces suppression mortality, which reduces the recruitment rate of small wood debris and snags in the short term. Thinning would also allow more light to reach the forest floor. This can be viewed both as a negative effect or a positive effect depending on which habitat attribute is considered. Increased sunlight could cause a short term undesired drying of habitats used by moisture dependent species. However, increased sunlight would also allow for the reestablishment of the herb and shrub layers where they are currently inhibited due to the lack of light penetration. This results in greater live structural diversity and would benefit many riparian species dependent on multilayered forest habitats over time. In the near term, forgoing density management favors species and habitats associated with mid seral stand conditions. In the long term, applying density management favors species and habitats associated with late-successional forest conditions.

Density management affects on temperature and humidity levels last only until canopy closure occurs. Widely spaced thinnings can result in a rapid recruitment of an understory stand, early attainment of complex deeply fissured bark, and development of deep canopies. Wide spacing would affect the in-stand temperatures and humidity more than a conservative thinning. Thinnings would have little to no effect on the stream flows as the residual trees would use any increased soil moisture that becomes available following harvest.

Short term impacts from density management would be avoided in unthinned riparian areas, and by incorporating no-cut buffers along streams and no thin patches in density management projects. Thinned and unthinned areas would provide a variety of habitat connectivity levels within but not necessarily between watersheds. Unthinned areas would provide continual input of snags and down wood of a smaller than potential size in the short and long term. Additional benefits from unthinned areas may include greater shade retention along streams in the short term. Stream side vegetation maintains the physical integrity of stream banks.

Based on current knowledge and recent experience, density management prescriptions that include thinned and unthinned patches across the landscape would provide habitat complexity, and allow for retention of those desirable elements currently present on the project site while putting the stand on a path toward late-successional forest stand development. The levels of both beneficial and detrimental impacts associated with thinning are correlated with the post-treatment stand density, how creative the ID team was at managing for various habitat characteristics, and where they apply a particular treatment in the Watershed.

Salvage Following a Catastrophic Event (10 acres and larger):

Post-catastrophic event salvage is expected to occur in the Watershed as the weather conditions provide the combination of large rain events and unusually strong wind patterns necessary to create a large blowdown areas such as those caused by the 1962 Columbus Day Storm. Individual tree and small patch blowdown do occur during typical winter storms. Given current access and fire suppression efforts, large fires are rare and small fires are rapidly controlled. However, the Biscuit fire covering more than 500,00 acres stands as one of the largest wildfires in recent times and is located just to the south approximately 35 miles. While there are no Late Successional Reserve lands on BLM managed lands there are Connectivity lands which have a longer rotational cycle than the matrix lands that cover the majority of the BLM lands. The LSR lands in the watershed are on USFS managed lands and would be subject to the recommendations within The South Coast -

Northern Klamath Late-Successional Reserve Assessment (USDI; USDA 1998). Salvage on Connectivity lands would likely follow the recommendations for dealing with salvage in the Late-Successional Reserve portion of the Watershed. Salvage may only take place in disturbed sites greater than 10 acres that have a canopy closure less than 40%. All green trees likely to survive should be retained. Following salvage operations, at least 24 snags per acre of the largest diameter will be retained. Requirements for down wood retention are to be based on plant community, seral stage, site conditions, risk of future disturbances, and other factors (USDI; USDA 1998 pg. 72-73). Coarse woody debris retention guidelines for Coast Range sites are as follows (USDI; USDA 1998, pg.90):

- First site potential tree height – 3,600 to 9,400 cubic feet/ acre
- Second site potential tree height – 1,600 to 2,300 cubic feet/ acre

The data used to develop the recommendations for salvage following a catastrophic disturbance in the Late-Successional Reserve is also applicable to the Riparian Reserves that are outside the Late-Successional Reserve. Therefore, we recommend following the LSR Assessment guidelines for post-catastrophic event salvage should the need arise in the Riparian Reserves.

The Coos Bay District Resource Management Plan/Record of Decision allows salvage inside the Riparian Reserve only if it is required to attain ACS objectives, and if present and future woody debris needs are met (USDI 1995). The Best Management Practices section provides additional guidance that states "Naturally-occurring down logs or trees will not be removed from the Riparian Reserves except for the benefit of the stream or Riparian Reserve. Potentially floatable debris that may be mobilized during infrequent high floods and may reasonably damage downstream users' improvements may be removed after watershed analysis" (USDI 1995 pg D-2). Given this context, salvage activities may be justified to the extent needed to obtain sufficient planting spaces for rapid reforestation, and to reduce hazards created by catastrophic events that may further threaten the function of the Riparian Reserve. For example following a fire, we may need to use a salvage operation to create a fuel break between remnant green patches of trees and down slope heavy fuel concentrations so to reduce the risk that a reburn might destroy those green patches of trees. Salvage logging may be needed to moderate a bark beetle epidemic and to allow access to the ground for reforestation following an extensive blowdown event across the landscape. The recommended snag and down wood retention levels designed to provide for large wood structure in the replacing stand while reducing the risk of additional green tree and structural losses due to reburns and insects. The recommended snag and down wood retention levels still represent a sizable fuel load. Consequently for salvage to be effective at protecting the function of the Riparian Reserve, the treatment should be designed to break up fuel continuity and not just reduce the volume of fuel on the site. The retention levels would also result in increases in bark beetle populations breeding on freshly killed trees left on shady sites but not on sunny sites (Smyth 1959). Post catastrophic event salvaging will not necessarily prevent the loss of additional green trees to bark beetles, but would reduce the numbers of green trees lost compared with the no treatment alternative[12]. Retention of fire charred trees, and some charred snags and down wood would benefit those wildlife species[13] that consume insects that specialize in colonizing fire injured or killed trees (Murphy; Lehnhaysen 1998).

[12] The Vegetation and Disturbance Processes Appendix includes the epidemiology of the Douglas-fir bark beetle.

[13] The black backs characteristic of many woodpecker species may be an adaptation that allows those species to be less conspicuous when they are foraging on the charred surfaces of burned trees, snags and down wood.

Salvage Following a Fine-Scale, or a Small Non-catastrophic Event (Less than 10 acres with less than 40% canopy cover remaining)

Past salvage operations outside the road prisms but inside what is now the Riparian Reserve have resulted in the loss of certain habitat components associated with several ACS objectives. Those ACS objectives for structural diversity, habitat complexity, nutrient cycling, large wood recruitment and subsequent instream and riparian habitat development are the most affected. To prevent the further loss of these components, salvage outside road prisms is not recommended except in those cases where reduction of the size of large accumulations of dead trees is necessary to protect the Riparian Reserve from greater injury by fire, insects or other damaging agents. Salvage may also be necessary to expose sufficient plantable ground to allow reforestation when the size of the opening created by blowdown or other such disturbance is large enough to allow regeneration of shade intolerant trees provided the trees to be planted are appropriate for the site and rapid regeneration is necessary to restore one or more of the functions of the Riparian Reserve. In both cases, leave all green trees, 24 of the largest snags/ acre, and the following down wood amounts:

- First site potential tree height – 3,600 to 9,400 cubic feet/ acre
- Second site potential tree height – 1,600 to 2,300 cubic feet/ acre

This is consistent with the standards and guidelines of:

> *Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions allow salvage and fuelwood cutting if required to attain Aquatic Conservation Strategy objectives.*
>
> *Remove salvage trees only when watershed analysis determines that present and future woody debris needs are met and other Aquatic Conservation Strategy objectives are not adversely affected.* (USDI 1995, pg 13).

Single tree and small patch mortality immediately next to roads or blowdown across roads can block or limit the safe use of roads and can be a hazard to human life, property and capital improvements. Removal of large wood debris that has fallen across roads is a necessary action to maintain access for timber hauling, restoration activities, administrative and recreational access, and provide access for resource protection. In the Riparian Reserve, moving large wood debris from where it has fallen into a road right-of-way to another part of the Riparian Reserve where it can provide a greater benefit is consistent with meeting ACS objectives. Examples include but not limited to moving the large wood debris from right-of-ways:

- To streams where the large wood can provide instream structure and habitat
- To floodplains where the large wood can interact with high flows
- To upland areas away from roads inside the Riparian Reserve that have below average amounts of large wood debris. Moving the wood debris to areas where traffic associated disturbance of wildlife is lower would allow a higher level of use of the down wood than if that wood were left near the road.

When money is unavailable to pay to move large wood that is blocking roads, selling of a portion of the wood to provide a means to move the rest of the wood to another part of the Riparian Reserve should be considered as a viable option. The assumes that moving of the wood results in a net benefit with respect to attaining the functions and benefits that the Riparian Reserve is intended to provide. Current literature documents the mean and range of coarse wood debris found in Oregon Coast Range forests (Spies et al. 1988; Spies and Franklin, J.F. 1991; Ursitti 1990). However, recent analysis of coarse wood debris data collected from natural stands on the Coos Bay District

indicates the amounts of coarse wood debris do not exhibit a normal of bell-shaped distribution about the mean (Diane White, Ecologist, USFS Grants Pass, OR). Rather, the graphed amounts of coarse wood debris form a J-shaped curve with a few sites having very high levels of coarse wood debris and many sites having very little. Consequently, at the small scale characteristic of one or a few trees that have fallen into a road right-of-way, managing for an average or a range of large wood debris amounts in the immediate vicinity of the right-of-way may be less effective than if a portion of that wood could be if placed where it can directly interact with water or provide habitat in a area less subject to disturbance and harassment.

Hazard tree removal along BLM roads, which is different from road side salvage, occurs infrequently and is necessary to provide safe driving conditions for the public. The Record of Decision/Resource Management Plan allows for the removal of these hazard trees (USDI 1995: pg.70). The Record of Decision/Resource Management Plan also recommends leaving trees on the site when CWD amounts are inadequate or the topping of trees as an alternative. In Riparian Reserves, retention would help to attain ACS objectives over the long term.

Figure 5. Restoration Projects within the Floras Creek Area

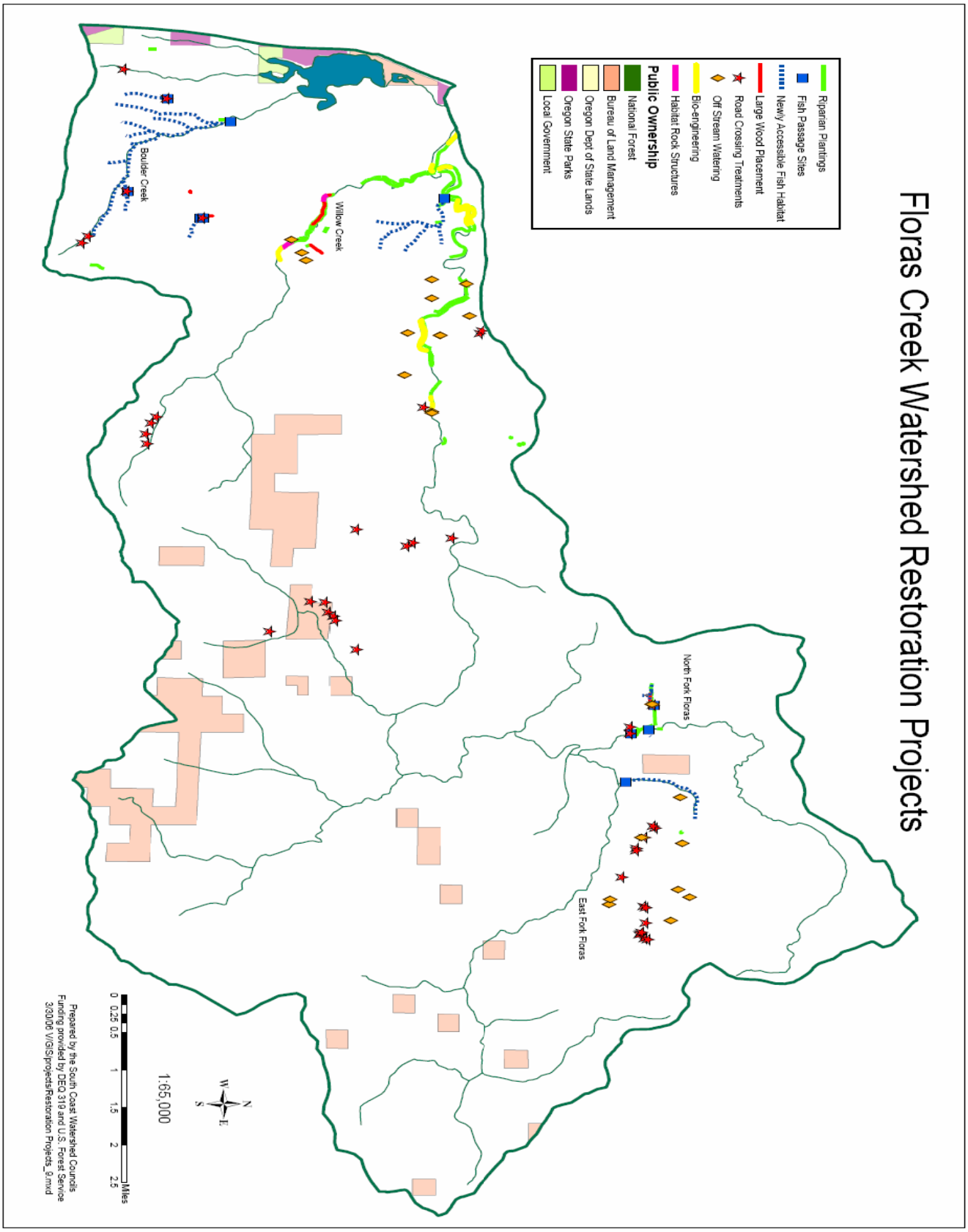


Figure 6. Restoration Projects within the Sixes River Area

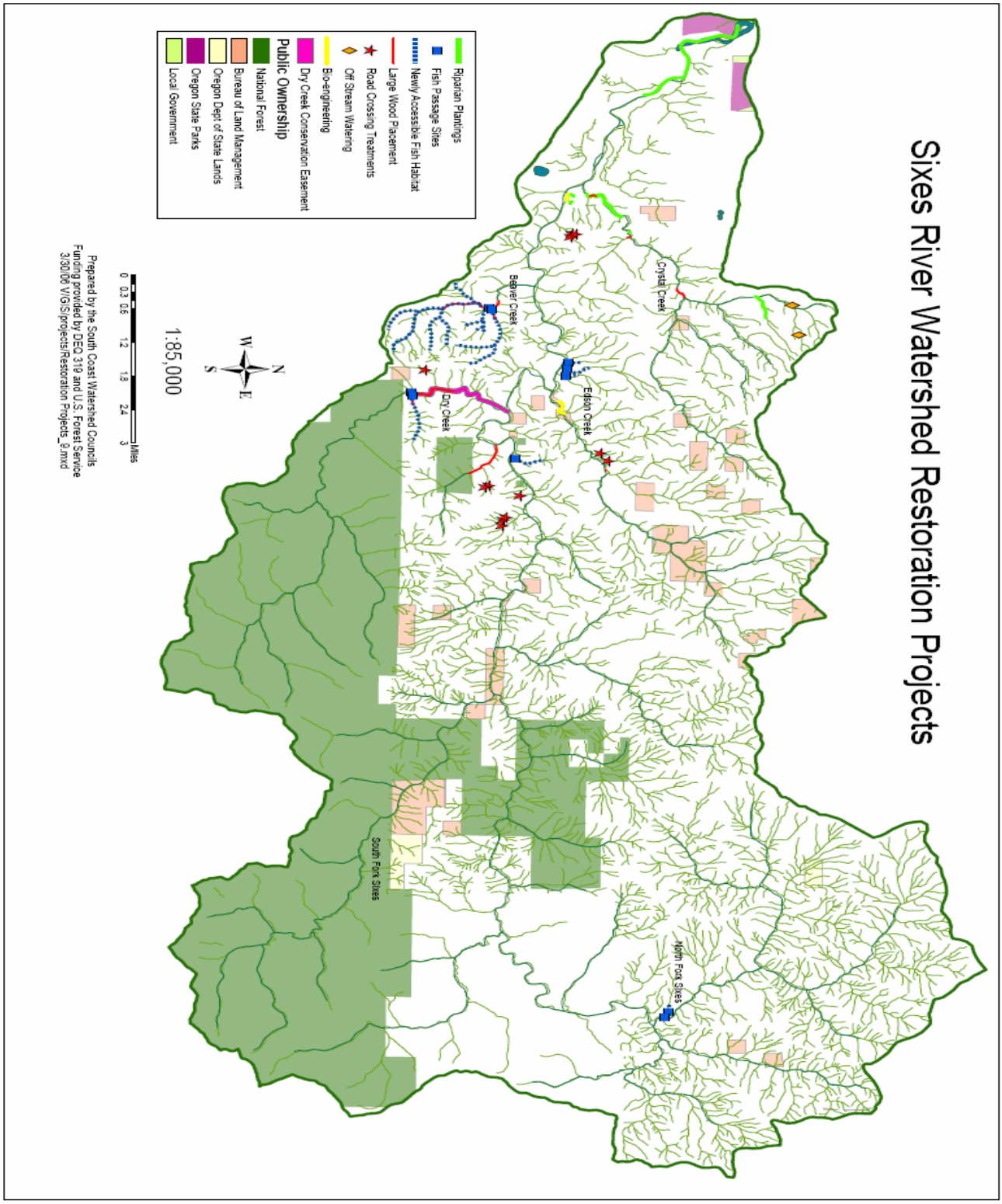
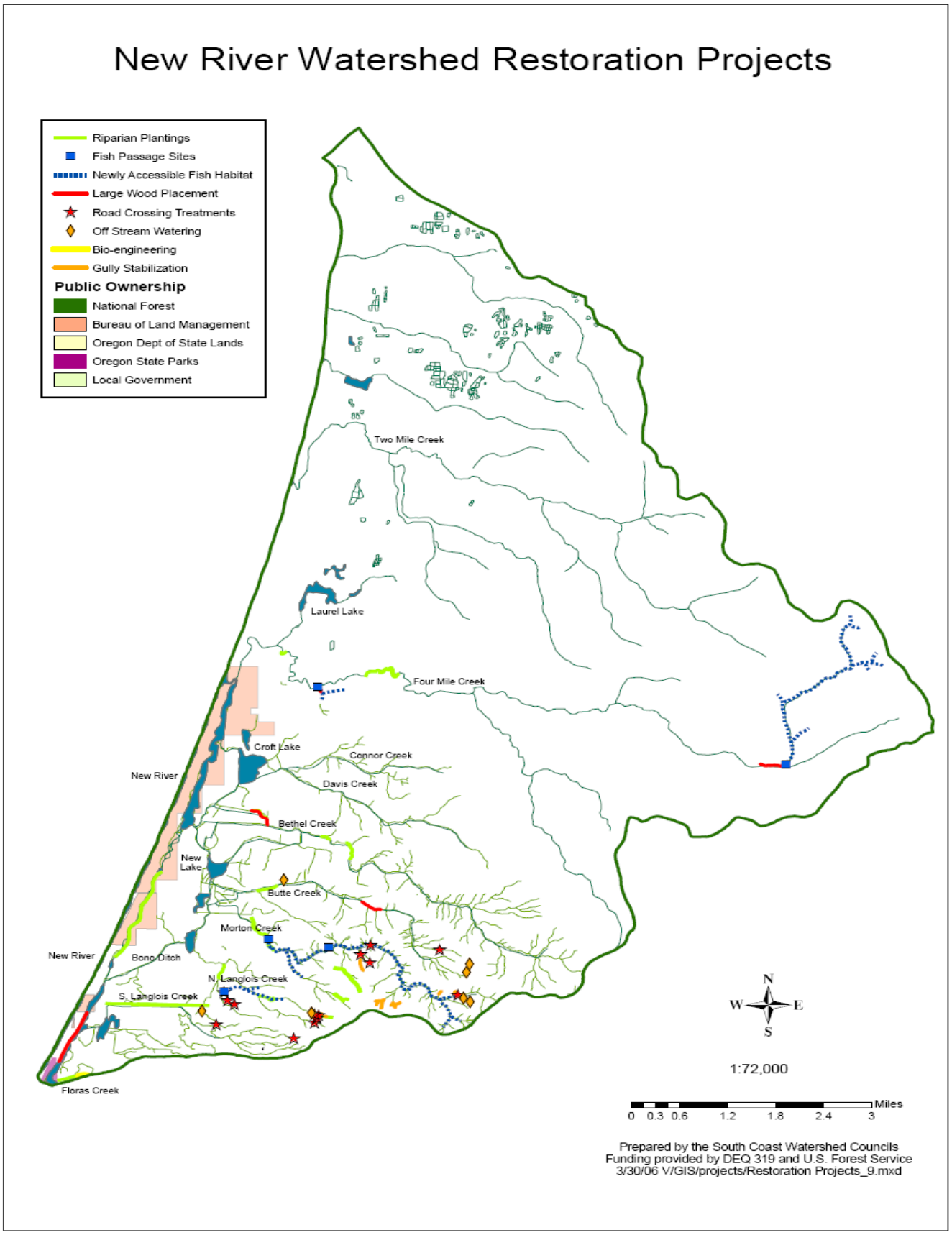


Figure 7. Restoration Projects within the New River Area



IX. Synthesis and Interpretation

Erosion Processes- What are the natural and human causes of change between historical and current erosional processes in the watershed?

Natural causes of change between the historical and current erosional processes are few within this watershed. Vegetative growth and successional changes or wide spread wild fire reducing vegetation growth are the type of natural changes that would alter the erosional processes in the watershed. As growth changes from early seral stages to those more tolerant of shade and low light conditions the type but not necessarily the amounts of cover increases across the watershed. Those areas that were grass covered or even barren land would not contribute sediment as root strength became established, canopy closure occurred and the overall exposure of soil to wind, rain and disturbance was lowered. This is a short timeframe change and can be readily reset in a short amount of time particularly with a fire event.

Lightning in this watershed is not prevalent now but, fires have been reported that encompassed the entire watershed area. Fire intensity, severity and extent are varied with large scale events. Not all areas receive the same treatment. As fire removes portions of the vegetation it exposes the land surface to erosional processes, most frequently surface runoff. Over the course of time fire has been removed from this landscape by suppression activities. The forested areas or grazing potential of the land required that vegetation be protected for human use, either currently (for grazing) or in some distant future (in the case of timber harvest). Thus, exposure of the land in a mosaic pattern or stand replacement fire has not occurred in the last 100+ years. Some burning for access to plantable sites after timber harvest has occurred. This lack of fire within the watershed has kept those processes that rely on such a disturbance mechanism to create landslides, snags across the landscape or south facing slopes that are slow to revegetate producing open grass areas are all processes that have been altered from the historic perspective.

This landscape does have a large area, South Fork of Sixes River, which is steep and contributes sediment through landslides. What is more prevalent across this watershed as the erosional process is slow earth creep. This continued slow methodical delivery of material into the stream network has been altered by the road building throughout the watershed. Rather than the delivery point for sediment being at the toe of the hill adjacent to the stream, as it normally is in undisturbed landscapes. Creation of cutbanks on a hillside prone to move under the force of gravity contributes additional fine and coarse sized material to the streams from nick points where streams and roads cross. The need to remove material from ditches, sloughing banks and slump failures from road surfaces has increased the normally slow process into one that is higher than normal.

Human causes (timber harvest, grazing and road building) that alter the erosional processes may outweigh the natural sources as they are more frequent in number, provide a continued supply of sediment, are dispersed across the landscape, and are not often easy to reset back to a natural state. Road building is perhaps the clearest example of this. Once use begins even poorly located roads are hard to relocate or abandon.

The construction of roads within this watershed appears to have occurred rather quickly once human use demanded it. Roads were few in the 1850's; trails connected the coast to the city of

Powers, Port Orford and Bandon, OR. (USFS, Sixes WA). The original roads traversed streams and meadow areas first and only later were mid-slope roads developed for the purpose of timber harvest or grazing. Changes to the erosional processes by the installation of a road network introduced both a chronic and episodic delivery mechanism to the watershed. Culvert installations can either trap or accelerate sediment storage mechanisms. Pipes on grade but too small in diameter to carry peak flows or woody debris can become overwhelmed and divert or plug and become traps on the upstream side. Pipes that are perched above stream grade erode bed and banks below the culvert and accelerate stream channel erosion.

Before vegetation removal (grazing and timber harvest) became a large part of the watershed, mining was affecting the channel bed, banks, flood plains and storage of sediment. Hydraulic mining scoured the banks of the mainstem of Sixes, Dry Creek and other lower tributaries such and Crystal Creek to extract the gold within the settled alluvium of past geologic events. The displacement of material and its' subsequent settling out farther downstream, potentially changed the ability of the watershed to transport material through it.

Removing either the forested areas or the grassed lands through grazing has caused erosional processes to change from the historic perspective. Fire would have provided this removal in the past but suppression activities keep that from occurring at the present time. Lands are covered with vegetation but what is left does not undergo the natural processes of succession. Animals and to some extent machines have compacted and exposed the land surfaces to the elements of high rainfall amounts, intensity and wind.

Large areas of exposed lands coupled with high amounts of precipitation produce abnormal amounts of silt, sand and clay into the watershed. Even temporary exposure (3-5 years) causes noticeable extended periods of turbid waters during the winter months. In a more natural system on such a landscape high turbidity would be associated with very high and intense rainfall that would be considered a major flood event. These events would happen once in ten years and produce the majority of the sediment delivery and routing in the watershed.

Converting from long term vegetation growth cycles to shorter periods introduces the land exposing processes sooner than would have occurred under a non-managed system and changes the vegetation types available on the landscape. Moving away from an older growth multistoried stand to younger homogeneous plantation produces the different vegetation types. Providing a simplified forest also is providing a simpler stream environment. Woody debris becomes limited in size and species under short growth cycle systems and storage of sediment can become limited. Large wood is predominately Douglas-fir under the changing short rotation land management practice and not the large diameters of the past. Hardwood species can dominate in disturbed areas such as the steep areas adjacent to streams.
Decomposition of the hardwood species is fast compared to conifers and the logs are not retained in an aquatic environment as long as some conifer species, especially Port Orford cedar.

Hydrology:

Natural causes of change would be those related to climate, particularly the amount and type of rainfall that the watershed receives. Although it is difficult to determine if climate has changed much in the last 200 years our understanding of what to expect has become more refined as research and observation techniques have improved. For many decades, scientists have known about the oscillation in atmospheric pressure across the tropical Pacific at the heart of both El Niño and La

Niña. However, La Niña's effects on fisheries along the immediate coast of South America, where El Niño was named, are benign rather than destructive, so La Niña received relatively little attention there. Research on La Niña increased after its wider impacts were recognized in the 1980s.

In the Pacific Northwest, La Niña often is more likely to be wetter than normal in the late fall and early winter with the presence of a well-established La Niña. Additionally, on average La Niña winters are warmer than normal in the Southeast and colder than normal in the Northwest. With more moisture early in the fall and early winter flows are higher than normal and fish may not be able to access traditional spawning areas. In the same vein it may allow access to other areas and allow additional habitat to be used as rain in other areas of the coast come sooner or are greater in amount. Storm intensity is generally greater during the La Niña events which could increase erosion from exposed or marginally covered areas increasing the sediment load in the stream system.

Human causes are tied to water diversions and use. These have some impact on streamflows in New River area where agricultural uses are higher but not on the Sixes River system. Ditching and drainage of pastures has removed a large wetland component and spruce forest from the landscape and replaced it with pasture lands or cranberry bogs. Most of the riparian vegetation and protection is gone in the lower river system where it once was great. Estuary connections that are now being understood and valued for habitat and water quality have been greatly reduced in this watershed. Increased stream temperatures in the lower portion of the New River, the lower Sixes River and Floras Creek are common now where they would not have been high prior to the vegetation removal.

Road building activities have altered the normal flow pattern in those areas where culverts have been installed. The culverts were installed with the original thought that they just need to pass water efficiently and not plug up with gravel during the winter, large wood passage was not always a consideration. Only of late has the emphasis been on creating stream crossings with a simulated channel for the benefit of aquatic species.

Many of the culverts in this watershed have a placement error. They are not placed on the same grade as the natural channel and have outlets above the natural channel (shot gun or perched). Many of the larger stream culverts have a diameter that is smaller than one that would be more conducive to passage of aquatic organisms. The distance between smaller ditch relief culverts is also suspect, the rainfall and runoff amounts in the ditches was not adequately considered and the distance between ditch relief culverts is to large. This allows greater volumes of water to collect in the ditch system and without proper maintenance the water ends up routing down the running surface instead.

The stream environment becomes disconnected through pipes located with outlets above the natural channel, constrictions in channel widths increasing flow velocities and inlets of pipes that have accumulated debris or sediment from upstream. Inadequate maintenance of culverts has also caused diversions, loss of road fill materials and disconnected the stream network as well.

The use of this landscape for housing, agriculture, grazing and forestry purposes has likely changed the stream flow (total flow and peak flows) in some locations. Where compacted ground from grazing, harvest or developed areas are a significant portion of any one particular drainage area, changes in hydrologic functions occur. This usually is noted as an increase in streamflows of small

streams with more normal flows returning down stream as more water enters the overall system. Increasing stream flows, even over a few years in time, can disrupt the stream bed and banks and produce different stream habitat conditions for aquatic life forms. Maintaining the habitat within a stream generally requires streamside vegetation to filter overland flow runoff, provide integrity of bed and banks and provide the shading necessary to protect stream temperatures.

Vegetation

This watershed would tend to have three climax vegetation types if no disturbances in the watershed occurred. One would be a Spruce forest and wetlands complex along the coastal strip primarily in the New River Frontal area and the other would be a Western hemlock\Port Orford cedar and Douglas fir mix in the uplands. The uplands would also contain grasslands in those areas where the soil is either to shallow to provide adequate moisture for trees to grow or is to wet and tree roots become inundated during the winter. Wildfire or climate change would be considered the only natural cause that would keep this trend from occurring.

Due to the human need for habitation, to produce timber and food across this landscape human use has affected this watershed in a variety of ways. The use of the watershed for grazing, growing timber on a short (less than 50 year rotation) and growing crops of cranberries or blueberries are some of the human caused changes to this landscape. Therefore the vegetation within it will not likely reach its climax vegetational type, with the exception of the USFS areas managed for wilderness and Late Successional Reserves.

The short rotation forestry uses on private and some federal lands will keep Douglas-fir, hardwoods and some Port Orford cedar growing on the lands they manage. This in some respect will reduce the potential sediment delivering mechanisms that occur across the watershed. Forested landscapes are better at water infiltration, sediment capture and water storage than grazed lands. Grazing for the purposes of raising cattle and sheep will retard the Spruce forest complex in the lowlands and terraces. Without replacement of the vegetation along the lower reaches of the two main rivers, lowered stream temperatures and overall water quality can not be expected to return to the watershed. Agriculture, primarily production of cranberries has impacted the ability of the watershed to reach its wetland vegetational endpoint and will continue to remove wetlands.

One of the largest changes between the current vegetational state and what existed prior to human activities is the vegetational component of habitat for wildlife. At one time elk inhabited this part of the coast in large numbers. Now they are confined to areas in the uplands and no longer seek the coastal terraces for habitat. Changing the type of forest, from one that is complex in structure and diverse in vegetation type to a more simplified forest vegetation type has removed or reduced populations of birds, mammals and amphibians.

Stream Channels-

If this landscape had not been altered by human intervention there would still be changes to the stream channels through natural causes. The natural rate of erosion, especially on the Otter Point geology would continue to provide coarse and fine sediment to stream channels in high amounts across the watershed. The delivery of large wood under the influence of the slow earth creep mechanism would have provided a potential capture means to store much of the larger material. The fines would have been routed downstream to the ocean, estuary or settled out on the lower gradient portions of the lower river system. The Cretaceous Formation and Klamath Mountains rocks along the southern most end of the watershed in the Upper Sixes River subwatershed would

maintain their steep slope character with occasional landslide events as the primary form of sediment input. Large wood generally associated with such failures provides the storage means to prevent large inputs to the stream system. Along the coastal strip the wetlands and sand deposition areas would continue to filter upper watershed sediment from the stream system and the possibility of New River being created at all would be low. More streams would have ended in an extensive wetland area or developed their own outlets to the ocean.

Human caused management activities that have altered stream banks and beds such as mining, road building, grazing or harvesting (particularly with ground based systems) are the causal agents that have changed the historical stream channel conditions to what we see today. The current condition of the channels is best defined as one of disturbed state. Because of past practices (harvest and road building) the channels have been altered and the sediment transport mechanism is no longer in balance between the input and the export of material across the landscape. Thus, delivery of sediment is now high from the Otter Point formation. It may overwhelm some channels if delivery is accelerated or goes unchecked due to lack of woody material within the creeks or filtering capacity of the upslope areas.

Allowing cattle to remove vegetation along the stream banks or intentionally removing it to gain additional pasture lands destabilizes banks and produces an overabundance of sediment, both coarse and fine into streams. Because this sediment is routed through the stream system at different flow regimes not all the material is distributed evenly. Not in time or in space, “flood flows” produce the most dramatic routing of the large materials and embedded wood within a stream channel. Once the flow begins to reduce in velocity the large materials settle out of the water column and produce dikes, berms, or pointbars that redefine the channel at most all lower velocity flows. Maintaining the new configuration is dependant on future vegetation anchoring the recent deposition.

Water Quality-

The geology of the watershed is complex and diverse and provides an over-riding fine sediment source to the waters of both Floras Creek and Sixes River. With intact stream channels, intact riparian vegetation and proper sediment routing mechanisms in place the water quality would be much higher than currently measured. The historical accounts of water clarity claim that the river was much clearer in the winter than it is now.

It is not certain if those accounts were discussing the time it took for the river to clear after a storm or the degree to which the river became turbid. At the current time it is clear that the streams within the watershed are easily affected by rain events and that once the waters become “muddied” they stay that way for a longer period of time than the streams to the south. That comparison is difficult to accept as the geology between the watersheds is drastically different and the fine sediment delivery mechanism is not evident in those watersheds. Comparisons with watersheds to the east where similar landforms and parent material exist produce a different set of problems that prevents comparison as well. Those watersheds do not receive the intensity and amount of rainfall that the Sixes-New River area does annually. A rain shadow effect is known to occur in the South Fork Coquille River watershed that abuts this watershed. Thus what can be stated is that the streams in the Sixes-New River watershed become turbid in the winter after rain events that contribute to the stream system. This occurs when active management of the land is ongoing or not.

The introductions of nutrients, particulate matter and increasing the temperature of the water have all been accomplished in this watershed. Management activities that remove vegetation such as:

grazing and harvesting timber, with little or no regard to stream environments will decrease the water quality in this manner. This watershed is now intensively managed with the exception of the USFS lands south of the Sixes River area. The reduction of current stream temperatures has been noted to be attainable through planting of the private lands in the lower watershed. Some land owners have started planting and fencing of pastures through Watershed Council efforts and funding.

Limiting the introduction of fine sediment could be problematic in the current watershed condition. Stream channels, erosional processes and vegetation management are all tied to turbidity measurements. This watershed has little ability to filter excess fine sediment from the stream channels. If such material enters the water it most often is routed to the extremely flat lowlands along the coast or delivered to the ocean. Arresting the fine sediment on upland slopes or preventing erosion in the first place is necessary to keep within the historical balance for sediment.

Wildlife Species and Their Habitats-

Fires and floods that cause temporary or permanent loss of vegetation or water courses would be viewed as natural causes that would cause a change between the historic and current species distribution and habitat quality for species of concern in the watershed. Tables WL-2A and 2B list special status species that are potentially present in the watershed and their key habitats. In addition, Federal agencies are directed to conserve migratory birds to meet obligations under the migratory bird conventions and the Migratory Bird Treaty Act. Surveys within habitats similar to those in the watershed show up to 25 different species of birds may be declining and 4 species increasing in population numbers.

The changes between historic and current vegetation have altered the habitat for species associated with mid-seral and older forests. Removal by fire, of the older forest component across the watershed and replacement with young or mid-seral forests most likely will change distribution and use by wildlife species dependent on mature forests. Flooding along mainstem rivers would displace for a time and possibly remove those species associated with the aquatic environment. Wind events both historically and currently, create openings and gaps within the forest. The increased number of edges between openings and young, densely-stocked stands has likely increased the risk of blown down.

The removal of the older forest component in this watershed by harvest and human caused fire has changed the vegetation from mature to young or mid-seral forests. Northern Spotted Owls, Marbled Murrelets, and other old-growth dependant species would have the greatest decrease in suitable habitat historic condition. Conditions most like historic forests are located south of Sixes River in the Dry Creek and South Fork Sixes watersheds. Tallus areas where forest harvest has changed the cover type may have reduced numbers of Del Norte Salamanders. Removal of open sand area by in-growth of European beach grass planted by humans in the New River area has altered Western Snowy Plover use and nesting success. Ditching, draining and converting wetlands to pasture use has removed habitat for aquatic species such as Western Pond turtle in the lower Floras Lake area north to Two Mile Creek.

Aquatic Species and Their Habitats

<u>New River Frontal</u>

Many of the frontal Creeks support all life stages of salmon and steelhead. However, a natural barrier prevents coho and chinook salmon from accessing >65% of the Floras drainage. Steelhead

can access approximately an additional 10 miles of habitat more before also being blocked by natural barriers or increased stream gradients. Resident cutthroat are found throughout the watershed. Aquatic habitat ranges from lowland wetland agricultural areas to higher gradient forested streams. Problem areas include increased stream temperatures, lack of habitat complexity, and the current condition of riparian vegetation.

The only salmon habitat on BLM lands is within New River. Steelhead and resident cutthroat include New River and two isolated stream reaches on the West Fork Floras. Because of these factors, the BLM has little impact on listed species recovery within the watershed.

Sixes River

Fish distribution for all species is much greater in this watershed, resident and anadromous fish having access to almost the entire watershed. Natural barriers limit distribution for salmonids on Crystal Creek and the South Fork Sixes. Dry Creek has very high quality spawning habitat. Large woody debris levels are low, but improving. Of more concern is water temperatures and water quantity, as there are many out-of-stream water rights.

The BLM manages even more scattered parcels when compared to the New River Frontal. Isolated parcels on Crystal Creek, Edson Creek, Sixes River, and South Fork Sixes River are the extent of BLM influence on fish bearing stream channels within the watershed.

Human Uses-

The causes of change between the historical and current human uses for this watershed are centered on land ownership and deriving a product from it. The historical use of the watershed by native peoples was centered on the marine environment more so than the uplands. Trade with others located along the South Fork of the Coquille River or south towards the Rogue River was conducted along trails that traversed the ridges and grasslands of the watershed. This historical use left the watershed intact for the most part and little commodity extraction was conducted. Perhaps hunting and gathering of berries and other plant materials not found within the wetlands areas they inhabited.

Housing, primarily in the northern part but scattered throughout the watershed has defined a different value set on the land. It is a place to settle or build upon for investment purposes. The ability for land owners to graze the land, grow timber and sell it, or convert wetlands to grow cranberries to provide a monetary output is a reoccurring use of the land in the analysis area. This societal need has changed the watershed from one of little use to one of intensive use by humans.

X. Management Recommendations Specific to BLM Managed Lands

Road Construction and Use-

Road Densities within the watershed are considered low with the exception of those populated areas in the north portion surrounding the town of Bandon. Past construction techniques employed to build the transportation system left the watershed in a sediment rich condition. Culvert failures and side-casted slumps provided excessive amounts of material that may still be routing to the respective mouths of the streams. Current construction techniques have been found to prevent such sediment delivery and provide stable road surfaces.

Road Construction

For constructing permanent roads within Riparian Reserves in this watershed it will be necessary to limit the height of fill over the culverts as well as the amount of disturbed area adjacent to the stream channel. Locate crossings where landform gradient is less steep to minimize steep stream banks and fills. All culverts should be properly sized for the local rainfall and runoff conditions and may be larger diameter than other watersheds further to the east. All culverts should be placed on grade rather than have large outfalls with energy dissipaters placed in the stream channel. Install a ditch relief culvert approximately 200 feet prior to the actual stream crossing culvert to minimize the ditch runoff sediment to the stream. Actual location will be limited by slope infiltration rate and sediment filtering vegetation prior to the stream. The intent is to have sediment filter out on the hillslope prior to the stream channel rather than deliver into it. Limiting fine sediment delivery after construction by using vegetation or artificial barriers should also be employed. Place and process a high quality of rock on the road surface in the dry season of the year not the winter. Newly constructed subgrades may require geo-textile placement to increase bearing strength to support rock surfacing.

For temporary use roads in Riparian Reserves, after use, the road surface should be broken up to allow infiltration of water into the ground water zone. Protect the surfaces from erosion by placing woody material or mulch on the surface in an amount that would cover the disturbed area to at least a 50% level initially. Mulching of the surface should be accompanied by seeding with an appropriate erosion control seed mix, at rates that will prevent fine sediment delivery from occurring during the first rainy season. Block the road to prevent traffic; using either berms, rock or terrain and log features that can not be compromised without substantial effort using machinery. Remove culverts in the upper reaches of the drainage (1st and 2nd order draws) and assess if removal in the lower reaches (3rd-5th order streams) would cause further degradation of the aquatic environment during removal. Assess if management needs in the near future (5-10 yrs) will require reinstallation of the culvert, if so leave in place.

When constructing permanent roads outside of the Riparian Reserve as necessary to manage the land for it's intended purposes, locate roads on ridges where possible and on lower gradient mid-slope areas. Roll the grade on long sections to facilitate water routing from the ditches or water dips. Install ditch relief culverts or water dips on spacing based on soil textures, grade and expected rainfall runoff amounts. Outslope roads if at all possible. Surface and process rock prior to rainy season and use high quality hard rock. If necessary use geo-textile fabric to increase bearing strength of sub-grade prior to placement of rock. For temporary roads in the upslope areas, not within the Riparian Reserves, the same level of effort to limit access, prevent sediment delivery and increase the infiltration of water as those roads within a Riparian Reserve should be the goal.

Road Use

Provide a stable surface at all times especially during winter haul to prevent introduction of sub-grade materials into the gravel surfacing (pumping of sub-grade). Maintain ditches with light grading techniques but still produce a ditchline, to limit the amount of fine material that will become part of the ditch runoff later. If necessary install sediment containment fencing between the road and the ditch to arrest fine sediment developed during winter haul. Develop sediment traps and settling basins as needed to prevent stream sediment delivery. Keep roads brushed to allow full use of the road surface and provide for safe sight distances. Maintain crowns, outsloping and drainage features during use and repair to proper function upon completion of haul or other uses.

Stand Density Treatments

Density management treatments within the Riparian Reserves are designed to assure and/or speed attainment of habitat attributes associated with late-successional forests and riparian forests. Providing wide no treatment zones adjacent to the stream will slow diameter growth and the number of trees delivering wood to the streams. Thus it is recommended that the narrowest streamside buffer consistent with providing shade in the near term and obtaining large wood in the long term be developed. Provide a sufficient amount of sunlight to assure growth and development of conifer and understory shrubs. Research indicates that ten years after cutting, vegetation regrowth along Coast Range streams that are less than 10 feet wide will provide shade levels equal to that in mature stands (Summers, 1982 cited in Skaugset, 1992).

For treatments outside of the Riparian Reserve areas, providing for the maximum growth of the conifer stand is the goal on Matrix lands. Developing some late successional character to the stand is the long term goal on Connectivity lands. Thus apply treatments that provide the necessary sunlight to allow growth in both diameter and height of trees in the upslope areas. Develop a pattern of wide and narrow or unthinned portions of the stand when operations are not on Matrix lands. This will benefit those populations and functions that require a constant source of small materials on the ground and as well as within the forest stand.

Forest Management Actions

When entering this watershed for the purposes of forest management the following priority areas and tasks should be undertaken:

> Remove noxious weed populations through pulling or spraying in the spring of the year before construction activities begin. Partner with adjacent land managers to treat populations within watershed as a whole not just BLM managed lands. Inventory for weeds at least every two to three years for new sites and treatment success of old sites.
>
> Repair the degraded roads within Sections 7, 14, 15, 17, 18, & 22-25 of T31S, R14W. Re-establish running surfaces, properly sized and spaced culverts and remove in growth of trees and brush species.
>
> Build the necessary road network to allow economical stand density treatments to occur.

Treat stands capable of supporting commercial removal of forest products. Continue to treat stands that have been established in the past (plantations) to encourage them to increase in volume and height. Convert those stands that have become stagnant or under stocked due to lack of management in the past. Hardwood stands capable of producing commercial products should be evaluated for economic return prior to conversion to conifer species.

Close roads not needed for future management activities. Generally thinned stands will not be entered for a period of time between 10-20 years. Build water management structures on road surfaces to prevent degradation of surfaces or loss of surfacing.

Monitor the stand treatments where necessary to schedule future maintenance, thinning or final harvest of commercial products.

Recreational Management Actions

For the purposes of recreation management the following priority areas and tasks should be undertaken:

Maintain the Sixes River, Edson Creek and Storm Ranch areas to provide a variety of interactive recreational and educational experiences on BLM lands. Provide Camp Hosts to reduce vandalism and provide presence.

Remove noxious weeds from within BLM lands and partner with adjacent land owners to remove weeds from these high use areas.

Continue to provide boat access to both New River and Sixes River from BLM lands. Encourage users to remove potential weed species and animals from trailers, props and gear.

Aquatic Habitat Management Actions

For the purposes of maintaining and improving aquatic habitats the following priority areas and tasks are recommended:

Improve failing roads through maintenance or closure. Focus efforts on roads with the greatest amounts of road-related sediment run-off into stream channels.

Enhance tree diameter growth trajectories within the Riparian Reserves through density management and hardwood conversion. Hardwood conversion should only be undertaken in areas historically growing conifers.

Continue to work collaboratively with watershed councils and private landowners to enhance aquatic habitats on private lands.

Continue monitoring the main stem of New River for noxious weeds, fish composition and habitat use, and water quality.

Prevent the spread of the New Zealand mudsnail through education and eradication programs.

For Habitat Management for Federally Listed Wildlife Species

For the purposes of Western Snowy Plover management the following priority areas and tasks should be undertaken:

> Continue to educate users and post plover nesting areas during breeding season to increase population levels to recovery levels.
>
> Maintain an open sand environment within the New River Habitat Area by removing the European beach grass using an economical means as outlined in management plan.
>
> Monitor the New River channel for response to breaching or the open sand maintenance program, channel width and depth are primary components to assess.

Response to these recommendations over the next 10 years should provide the forested environment, stream habitat and visitor use that is desired within this watershed. Some level of uncertainty is involved with the forest stand treatments as natural environmental factors such and strong winds accompanied by heavy precipitation events or fire across the landscape could change the success of said forest treatments.

The stream environments have been recovering over the last several decades from past harvest activities and it is the road system failures that have recently developed that have impacted that recovery. Improving the transportation network and developing fine sediment filtering mechanisms will aid the aquatic habitat development in this watershed.

The recreational use in this watershed is expected to increase as the area becomes noted for better fishing and hiking opportunities. Populations to the north developing around the Bandon or south to the Port Orford areas will enjoy these benefits. Continued funding of maintenance and facilities of campgrounds and day use areas in the watershed should allow successful visitation to occur.

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Appendix A
Water Quality 303d list
From State of Oregon
Department of Environmental Quality (DEQ)

State of Oregon Department of Environmental Quality 303d List 2004/2006

Watershed USGS 4th Field HUC **Record ID**	**Name** **River Mile**	**Parameter**	**Season**	**Criteria**	**Beneficial Uses**	**Status**	**Assessment:** Year **Action**	**[Data Source] Supporting Data**
SIXES 17100306 4660	Bald Mountain Creek 0 to 2.3	Temperature	Summer	Rearing: 17.8 C	Anadromous fish passage Salmonid fish rearing	303(d)	1998 Added to database	Previous Data: USFS Data (Site near mouth): 7 day average of daily maximum of approximately 65.5 exceeded temperature standard (64) in both 1990 and 1992 (USFS, 1990, 1992).
SIXES 17100306 4975	Boulder Creek / Floras Lake 0.8 to 2.1	Aquatic Weeds Or Algae	Undefined	The development of fungi or other growths having a deleterious effect on stream bottoms, fish or other aquatic life, or which are injurious to health,recreation or industry may not be allowed.	Aesthetics Fishing Water contact recreation	303(d)	1998 Added to database	Previous Data: Floras Lake Limnological Survey (PSU, 1995): Extensive growth of Elodea densa, a non-native aquatic plant and a "B" designated weed by ODA, dominates the macrophyte assemblage and interferes with beneficial uses.
SIXES 17100306 13333	Cedar Creek 0 to 4.5	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 28289 River Mile 0.5: From 7/2/2000 to 8/28/2000, 10 days with 7-day-average maximum > 18 degrees Celsius.
SIXES	Crystal Creek	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004	2004 Data:

State of Oregon Department of Environmental Quality 303d List 2004/2006

Watershed USGS 4th Field HUC Record ID	Name River Mile	Parameter	Season	Criteria	Beneficial Uses	Status	Assessment: Year Action	[Data Source] Supporting Data
17100306 13342	0 to 7.3						Added to database	[WSC South Coast] LASAR 28312 River Mile 0.2: From 6/25/2000 to 8/28/2000, 54 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13327	East Fork Floras Creek 0 to 7.5	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 24090 River Mile 0.8: From 7/3/2000 to 7/23/2000, 15 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13338	Edson Creek 0 to 5.8	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 28313 River Mile 0.1: From 6/26/2000 to 8/28/2000, 12 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13345	Elk River 0 to 29.9	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 11905 River Mile 4: From 7/22/2000 to 9/5/2000, 46 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 25434 River Mile 7.5: From 6/26/2000 to 8/28/2000, 64 days with 7-day-average maximum > 18 degrees Celsius.
								[WSC South Coast] LASAR 28302 River Mile 3.2: From 6/25/2000 to 8/28/2000, 65 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28303 River Mile 13.7: From 6/26/2000 to 8/28/2000, 21 days with 7-day-average maximum > 18 degrees Celsius.
SIXES	Euchre Creek	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004	2004 Data:

State of Oregon Department of Environmental Quality 303d List 2004/2006

Watershed USGS 4th Field HUC Record ID	Name River Mile	Parameter	Season	Criteria	Beneficial Uses	Status	Assessment: Year Action	[Data Source] Supporting Data
17100306 13335	0 to 12.8						Added to database	[WSC South Coast] LASAR 25437 River Mile 1.6: From 7/2/2000 to 8/28/2000, 12 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 25440 River Mile 3: From 7/2/2000 to 8/28/2000, 0 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28386 River Mile 2.4: From 7/2/2000 to 8/28/2000, 0 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28387 River Mile 2.5: From 7/2/2000 to 8/28/2000, 3 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 25436 River Mile 1.5: From 7/2/2000 to 8/28/2000, 44 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 20776	Floras Creek 12 to 12.8	pH	Summer	pH 6.5 to 8.5	Resident fish and aquatic life Water contact recreation	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 29542 River Mile 11.2: From 6/13/2002 to 9/17/2002, 3 out of 11 samples (27%) outside pH criteria range 6.5 to 8.5.
SIXES 17100306 13343	Floras Creek 0 to 12.8	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 24089 River Mile 1.1: From 7/3/2000 to 8/28/2000, 57 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28298 River Mile 11.9: From 7/31/2000 to 9/5/2000, 0 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 24084 River Mile 6.2: From 7/3/2000 to 9/5/2000, 61 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 23932 River Mile 1.2: From 7/3/2000 to 9/5/2000, 65 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 23931 River Mile 0.3: From 7/3/2000 to 9/5/2000, 65 days with 7-day-average maximum > 18 degrees Celsius.

State of Oregon Department of Environmental Quality 303d List 2004/2006

Watershed USGS 4th Field HUC Record ID	Name River Mile	Parameter	Season	Criteria	Beneficial Uses	Status	Assessment: Year Action	[Data Source] Supporting Data
								[WSC South Coast] LASAR 23930 River Mile 0.1: From 7/3/2000 to 7/23/2000, 21 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 25853 River Mile 3.9: From 7/22/2000 to 7/23/2000, 2 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13326	North Fork Floras Creek 0 to 10.9	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 25851 River Mile 0.1: From 7/3/2000 to 9/5/2000, 58 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 12492	Sixes River 4.4 to 29.4	Dissolved Oxygen	October 15 - May 15	Spawning: Not less than 11.0 mg/L or 95% of saturation	Salmon and steelhead spawning	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [DEQ/ODA - Salem] LASAR 10533 River Mile 5.1: From 3/29/1994 to 11/5/2003, 3 out of 28 samples (11%) < 11 mg/l and applicable % saturation.
SIXES 17100306 13346	Sixes River 0 to 30.1	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 10533 River Mile 5.1: From 6/25/2000 to 9/5/2000, 73 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28314 River Mile 9.6: From 6/26/2000 to 8/28/2000, 64 days with 7-day-average maximum > 18 degrees Celsius. [DEQ] LASAR 21794 River Mile 17.7: From 6/14/1999 to 10/10/2003, 288 days with 7-day-average maximum > 18 degrees Celsius. [DEQ] LASAR 26830 River Mile 13.1: From 6/30/2002 to 8/10/2002, 42 days with 7-day-average maximum > 18 degrees Celsius.
SIXES	South Fork Floras Creek	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004	2004 Data:

State of Oregon Department of Environmental Quality 303d List 2004/2006

Watershed USGS 4th Field HUC Record ID	Name River Mile	Parameter	Season	Criteria	Beneficial Uses	Status	Assessment: Year Action	[Data Source] Supporting Data
17100306 13325	0 to 3.7						Added to database	[WSC South Coast] LASAR 25852 River Mile 0.1: From 7/3/2000 to 9/5/2000, 32 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 23929 River Mile 0.9: From 7/3/2000 to 9/5/2000, 0 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 23933 River Mile 1.5: From 7/3/2000 to 9/5/2000, 38 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13344	Swamp Creek 0 to 1.5	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 28299 River Mile 0.3: From 6/25/2000 to 8/28/2000, 65 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28300 River Mile 1.1: From 6/25/2000 to 8/28/2000, 65 days with 7-day-average maximum > 18 degrees Celsius.
SIXES 17100306 13341	Willow Creek 0 to 6.9	Temperature	Year Around (Non-spawning)	Salmon and trout rearing and migration: 18.0 degrees Celsius 7-day-average maximum	Salmon and trout rearing and migration	Cat 5: Water quality limited, 303(d) list, TMDL needed	2004 Added to database	2004 Data: [WSC South Coast] LASAR 25854 River Mile 2.1: From 7/9/2000 to 8/28/2000, 45 days with 7-day-average maximum > 18 degrees Celsius. [WSC South Coast] LASAR 28297 River Mile 0.5: From 7/9/2000 to 8/28/2000, 51 days with 7-day-average maximum > 18 degrees Celsius.

Appendix B
ODFW Aquatic Habitat Inventory Data
Sixes – New River Watersheds

5th Field Watershed	6th Field Watershed	Stream Name	Reach #	% Fines in Riffles	LWD pieces/ 100 m	LWD volume/ 100m	Key pieces/100 m 60cm dbh by 10m long	Pool area %	Wetted W/D ratio	Trees most common in riparian zone	Conifer >20 dbh/ 1000 ft of stream
New River Frontal	*Fourmile Creek/ New River Frontal*	**Fourmile Creek**	1	**25**	10.4	**3.7**	**0.1**	87	18.1	G	**0**
		6/23 – 7/10 1997	2	2	**4.8**	**2.2**	**0**	86.8	27.8	30-50 cm HW	**30**
			3	7	**9**	**10.3**	**0.4**	74.8	18.2	30-50 cm HW	**0**
			4	10	**9.6**	**18.3**	**0.5**	64.8	19.7	30-50 cm HW	**0**
			5	6	12.4	29.3	**0.5**	37.6	10.5	30-50 cm HW	**30**
		S.F. Fourmile	1	14	**3.1**	**1.7**	**0**	75.1	**38.4**	30-50 cm HW	**0**
		7/17-22/1997	2	permission not granted for survey							
			3	**29**	**6.7**	**7.8**	**0.1**	43.4	18.4	30-50 cm HW/Con	**0**
	Croft Lake/ New River Frontal	**Bethel Creek**	1	9	**2.8**	**2.4**	**0**	69.3	15.6	G	**12**
		8/26 – 9/3 1997	2	20	**0.3**	**0.4**	**0**	**3.8**	0	G	**0**
			3	0	**0.8**	**1.2**	**0**	45	14.3	G	**0**
			4	15	**5.6**	**10.9**	**0.3**	11.6	15.8	30-50 cm HW	**0**
			5	5	**0.1**	**0.3**	**0**	**1.4**	0	15-30 cm HW	**61**
		Butte Creek	1	**21**	**3.6**	**0**	**0**	55.7	24.2	G	**0**
		9/5-17/1997	2	14	**5.2**	**0**	**0**	55.8	27	G	**0**
			3	17	**4**	**0.1**	**0.1**	26.5	20.1	15-30 cm HW	**24**
			4	2	**3.1**	**0.2**	**0.2**	**9.7**	9.1	30 - 50 cm HW	**61**
Sixes River	*Lower Sixes*	**Beaver Creek**	1	2	**2.9**	**0**	**0**	22	16.2	30-50 cm HW/Con	**0**
		9/22-23/1997	2	2	**6.1**	**0.1**	**0.1**	38.8	23.9	30-50 cm HW	**0**

5th Field Watershed	6th Field Watershed	Stream Name	Reach #	% Fines in Riffles	LWD pieces/ 100 m	LWD volume/ 100m	Key pieces/100 m 60cm dbh by 10m long	Pool area %	Wetted W/D ratio	Trees most common in riparian zone	Conifer >20 dbh/ 1000 ft of stream
			3	9	**6.7**	**0.6**	**0.6**	36.7	17.7	30-50 cm HW	**0**
	Middle Sixes	**Edson Creek**	1	12	21	**8.4**	**0.3**	64.7	25	3-15 cm HW	**30**
		8/7-14/2000	2	13	10	**6.8**	**0.1**	44.9	21.7	3-15 cm HW	**0**
			3	14	18	**11.5**	**0.2**	27.5	18.9	3-15 cm HW	**0**
			4	8	17	**19.6**	**0.5**	24.6	19.2	3-15 cm HW	**0**
		Sixes River campground reach - Annual survey									
		9/15/1998	1	19	**0.1**	**0.2**	**0**	36.2	26.2	15-30 cm HW	**61**
		7/29/1999	1	*	**1.5**	**1.4**	**0**	78.8	14.6	3-15 cm HW	**61**
		8/1/2000	1	*	**0.7**	**2.5**	**0.3**	73.7	16.9	30-90 cm HW/Con	**0**
		8/14/2001	1	*	**1.4**	**0.9**	**0**	84.9	24.9	3-15 cm HW	**41**
	Upper Sixes	**Carlton Creek**	1	1	29.8	47.6	29.8	49.2	18.4	30-50 cm HW	**0**
		8/3-11/1993									
		N. F. Sixes	1	7	**1.9**	**3.2**	**1.9**	65.4	22.3	30-50 cm HW	**0**
		8/1-2/1993									
		M.F. Sixes	1	10	16.1	**18.7**	16.1	35.1	21.1	3-50 cm HW	**18.1**
		8/17-24/1993									
		Sugar	1	19	**6.3**	**2.7**	**0**	21	20.2	15-30 cm HW	**0**
			2	**25**	**8.6**	**2.9**	**0**	**9.8**	18.2	15-30 cm HW	**0**
		Sixes - Mainstem									
		7/20-8/10 1993	1	9	**3.7**	**4.8**	**3.7**	56.9	21.6	90+ cm HW/Con	**6**
			2	3	**2.7**	**4.1**	**2.9**	51.1	22.4	30-50 cm Conifer	**0**

Appendix C

Summary of Cowardin Classification Codes

The National Wetlands Inventory 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 Floras Creek 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.