SOUTH FORK COQUILLE WATER QUALITY MANAGEMENT PLAN (WQMP)

September 2000

State of Oregon
Department of Environmental Quality

Water Quality Management Plan

Siskiyou National Forest
Georgia-Pacific West Inc. d/b/a The Timber Company
Oregon Department of Environmental Quality, Coos Bay Office

Watershed at a Glance	
Watershed	South Fork Coquille (157,660 acres) Above NF Boundary (84,750 acres) Federal Ownership (60,670 acres)
Stream Miles Above NF Boundary	Total Perennial (331 miles) Federal Ownership (264 miles) Private Ownership (67 miles)
Watershed Identifier	17100332&33 (Hydrologic Unit Code)
303(d) listed Parameters ▪ South Fork: Mouth to Headwaters ▪ Rock Creek: Mouth to RM3 ▪ Johnson Creek: Mouth to Headwaters ▪ Rock Creek	 Temperature Temperature Temperature Habitat Modification
Key Resources and Uses	Salmonids, Domestic, Agricultural, Recreation, Mining
Known Impacts	Roads, Timber Harvest, Water Withdrawals, Mining, Fire, Floods

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Statement of Purpose

This water quality management plan is prepared to meet the requirements of Section 303(d) of the 1972 Federal Clean Water Act.

Table of Contents

List of Figures

List of Tables

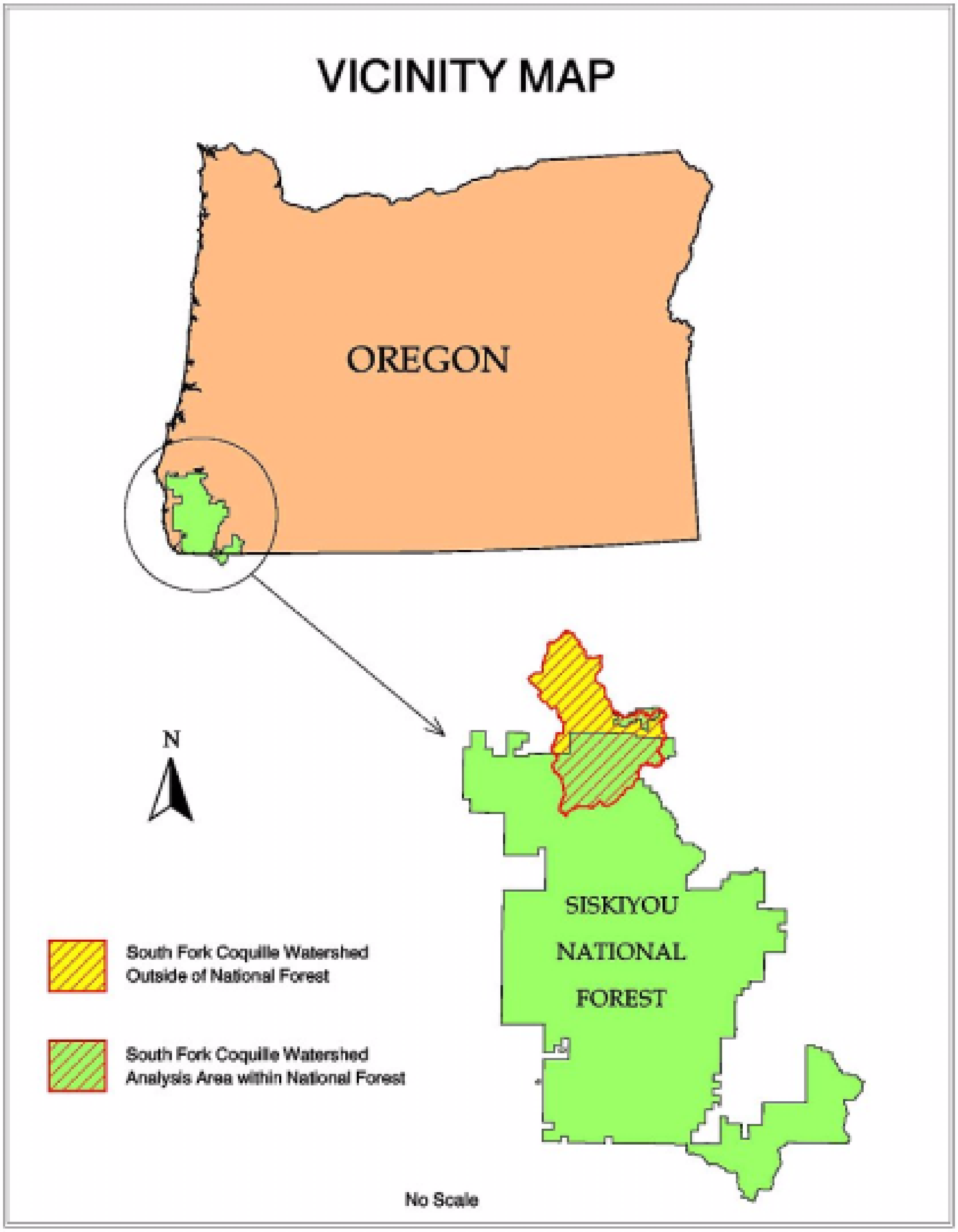

Figure 1: South Fork Coquille River Vicinity Map.

<u>Element One:</u> *Condition Assessment and Problem Description*

I. Project Overview

The South Fork Coquille is a 246 square mile watershed in southern Coos County of southwest Oregon. The headwaters are in Eden Valley and its confluence with the Middle Fork Coquille is near Myrtle Point. This plan addresses only the 132 square miles (84,750 acres of the basin) above the National Forest boundary, beginning approximately 29 river miles above the Middle Fork Confluence. Within this study area, approximately 80 percent of the land is under federal management. The remainder is privately owned and concentrated mainly in the Coal Creek and Wooden Rock Creek drainages. See Figure 2.

Much of the South Fork Coquille within the plan area flows in a deeply incised valley and has moderate stream gradients. However in the upper portion of the drainage (from about Panther Creek upward) the stream's valley is broader and its gradient is less. The upper Eden Valley area of this upper section has a number of natural meadows and was settled in the late 1800s and contained 7-10 families, engaged in subsistence farming and ranching, up until the 1930s. During this time a school and post office existed (Joe Hallett; personal communications). The meadows and pastures used during this time are still evident and include Ash Swamp, Foggy Creek, and Eden Valley meadows. The combination of relatively open topography and historic land usage in the Eden Valley area may have had an impact on riparian and upslope vegetation continuing into modern times. For instance, the upper Eden Valley area is known for its frost pocket conditions that have forced landowners to alter their seedling planting mixes (Steve Wickham; personal communications). Beaver are also common on some tributaries in the upper valley. Large beaver dam complexes have resulted in a number of wide, exposed reaches with little adjacent shade in the upper South Fork, Foggy Creek, and Clear Creek tributaries.

Beneficial uses for the analysis area include domestic water use, recreation, mining and cold water biota (salmonid).

This Water Quality Management Plan is being written as a cooperative effort between the US Forest Service and Georgia-Pacific West Inc. d/b/a The Timber Company. The Timber Company is the major private landowner in the upper South Fork Coquille drainage.

Federal Lands

The South Fork Coquille River is a tier 1 key watershed as defined in the President's Northwest Forest Plan (USDA,USDI, 1994). Several streams and tributaries within the South Fork Coquille drainage have been placed on the 1998, 303(d) list of water quality limited streams (DEQ, 1998). The following table shows the listed parameters and locations. Although the South Fork Coquille is listed for stream temperature from "mouth to headwaters", a number of tributaries do not exceed the state's temperature listing criteria, including Clear and Coal Creeks (Oregon Department of Environmental Quality 1994/1996 Decision Matrix).

Table 1. South Fork Coquille River 303d Listed Parameters.

Listing Parameter	Location	Supporting Data
Stream Temperature	Mainstem (mouth to headwaters)	USFS Data. See Table 2.
	Johnson Creek (mouth to headwaters)	USFS Data. See Table 2.
	Rock Creek (mouth to RM 3)	USFS Data. See Table 2.
Habitat Modification	Rock Creek	USFS (Chen, 1991)

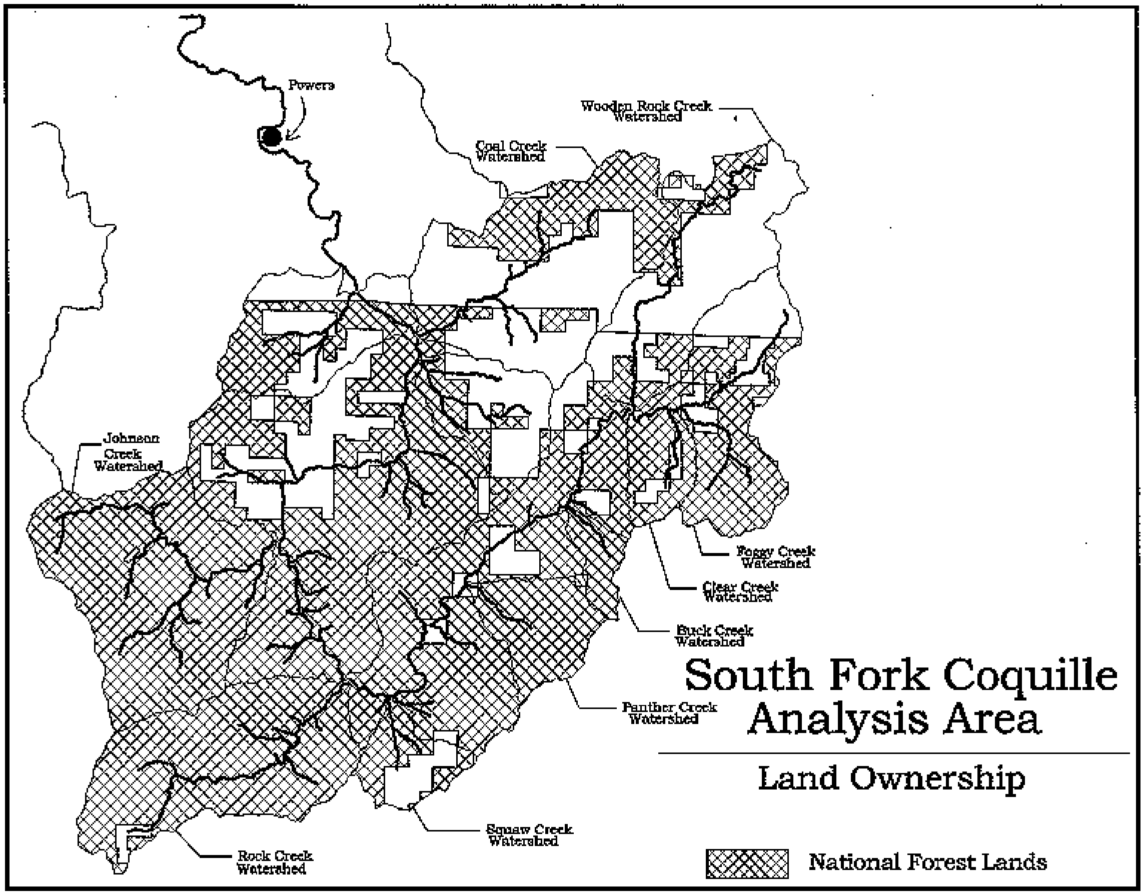

Figure 2: South Fork Coquille Land Ownership.

The South Fork Coquille supports a variety of resident and anadromous fish. The list includes coho and chinook salmon, steelhead, searun and resident cutthroats, and resident rainbow trout. The known present distribution of these species is shown in Figure 3.

Within the National Forest, management activities are limited by the management theme assigned to that area. The primary federal management themes are shown in Figure 4 and their definition and percent of the land base are shown below.

Late Seral Reserve	56 % of analysis area
Matrix	14 %
Riparian Reserve	5 %

The remaining percentages encompass land designated as wilderness, research natural areas, botanical areas, visual retention corridors, etc.

Figure 3: South Fork Coquille Fish Distribution.

Late Seral Reserves (LSR) are areas designed to serve as habitat for late-seral and old-growth related species. They are to be managed to protect and enhance old-growth forest conditions. No programmed timber harvest is allowed inside the reserves. However, thinning or other silvicultural treatments inside these reserves may occur in stands up to 80 years of age if the treatments are beneficial to the creation and maintenance of late-seral forest conditions.

Matrix designated land is the area in which most timber harvest and other silvicultural activities will be conducted. However, standards and guidelines assure appropriate conservation of ecosystems as well as provide habitat for rare and lesser known species. Riparian Reserves are applied to all harvest activities on Matrix land.

Riparian Reserves are areas within Matrix lands that are along all streams, wetlands, ponds, lakes, and unstable or potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Under the Aquatic Conservation Strategy, Riparian Reserves are used to maintain and restore riparian structures and functions of intermittent streams, confer benefits to riparian dependent and associated species other than fish, enhance habitat conservation for organisms that are dependent on the transition zone between upslope and riparian areas, improve travel and dispersal corridors for many terrestrial animals and plants, and provide for greater connectivity of the watershed. The Riparian Reserves also serve as connectivity corridors among the LSR's. As such, the scope and intensity of management activities within the reserves are limited to those measures which will enhance the desired characteristics. Thinning can be an appropriate activity within the reserves. Interim widths necessary to meet the Aquatic Conservation Strategy objectives for different water bodies are established based on ecological and geomorphic factors. These widths are designed to provide a high level of fish habitat and riparian protection until watershed and site analysis can be completed. Initial boundary widths for Riparian Reserves are as follows:

Fish Bearing Streams: Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream channel), whichever is greater.

Permanently flowing nonfish-bearing streams: Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to the outer edges of riparian vegetation, or to a distance equal to the height of two site-potential trees, or 150 feet slope distance (300 feet total, including both sides of the stream channel), whichever is greater.

Seasonally flowing or intermittent streams, wetlands less than one acre, and unstable and potentially unstable areas: This category applies to features with high variability in size and site-specific characteristics. At a minimum the Riparian Reserves must include:

- The extent of unstable or potentially unstable areas (including earthflows),
- The stream channel and extend to the top of the inner gorge,
- The stream channel or wetland and the area from the edges of the stream channel or wetland to the outer edges of the riparian vegetation, and
- Extension from the edges of the stream channel to a distance equal to the height of one site-potential tree, or 100 feet slope distance, whichever is greatest.
- A site potential tree is the average maximum height of the tallest dominant trees (200 years or older) for a given site class.

Intermittent streams are defined as any non-permanent flowing drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria.

It is clear from Figure 4 and the requirements for riparian buffers that the majority of National Forest land is protected from intensive management that might directly affect the 303(d) listed parameters. Where timber harvest other than thinning is scheduled to occur (matrix lands), large riparian buffers should guarantee the integrity of the riparian system.

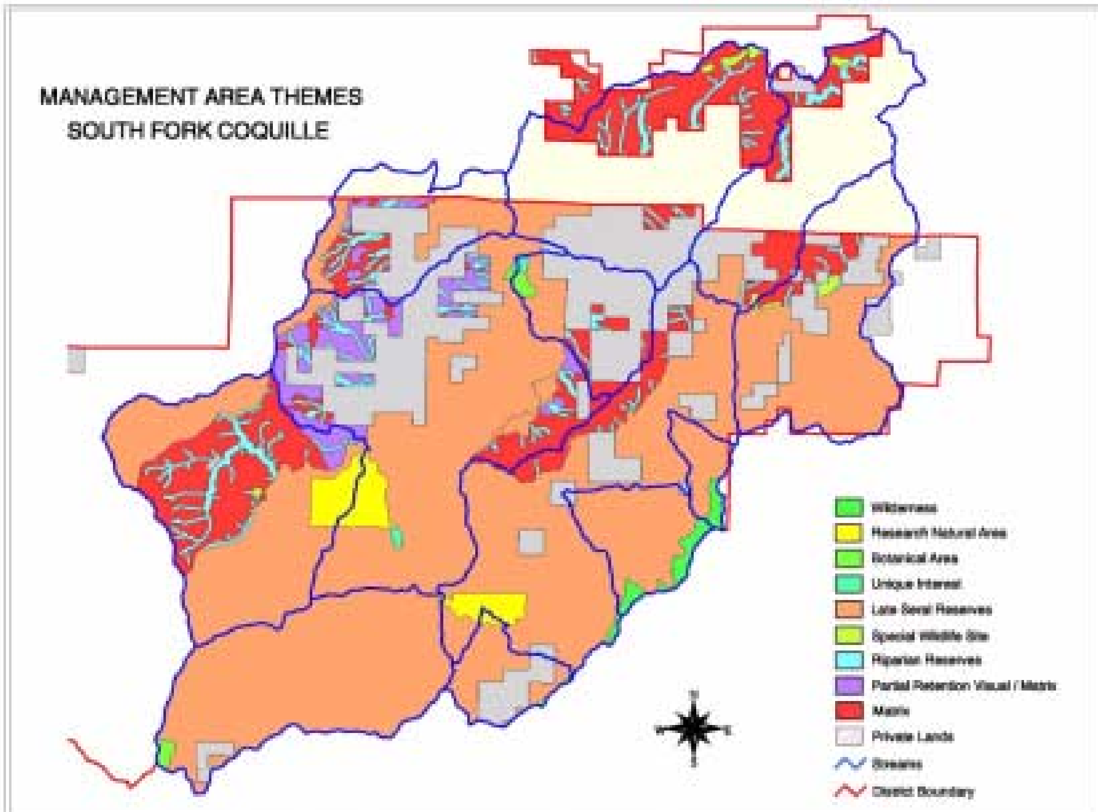

Figure 4: National Forest Management Themes.

The Timber Company

The Timber Company owns and manages approximately 16,000 acres within the WQMP assessment area. Management emphasis on this land is maximizing wood fiber production consistent with environmental protection standards dictated by state Forest Practice Rules and company guidelines.

The Oregon Forest Practice Rules affect forest management on company lands in a number of manners that may potentially have implications for waterbodies and water quality, including:

1) **Clear-cut size limitations**. Clear-cut harvest units can generally not exceed 120 acres in size.

2) **Clear-cut adjacency restrictions**. Planned clear-cut harvest units can not be located adjacent to an existing clear-cut area until the prior harvested area has been successfully regenerated with seedlings four feet or taller in average height or at least four years of age.

3) **In-unit leave tree retention**. Two trees per clear-cut harvest acre must be retained following harvest.

4) **Riparian retention zones**. Riparian management areas (RMAs) must be retained on all "Large"- and "Medium"- sized streams, as well as "Small" streams bearing fish and having domestic use.

RMA width is a function of size of stream (based upon drainage acreage), presence/absence of fish, and existing basal area of conifers. In most cases the buffer distances are the default width of:

Large Fish--100 feet
Medium Fish--70 feet
Medium No Fish--50 feet
Small Fish--50 feet

Non-fish bearing streams occur throughout the Upper South Fork Coquille drainage. Excessive stream gradient and/or outright barriers, such as waterfalls, are responsible for their lack of fish. “Small” streams without fish have no state riparian retention requirements. Landowners are encouraged to retain understory vegetation, non-merchantable trees, and leave trees. Operators are required to minimize disturbances to soils during logging or site preparation.

5) **Domestic water source protection**. Streams serving as registered domestic water sources require protection that is determined on a site-specific basis.

6) **Significant wetlands protection**. Significant wetlands (greater than 8 acres in size) require buffers with retention of 50 percent of live trees by species and size categories.

7) **Written plan requirements.** Approved written plans are required before conducting forest operations within 100 feet of fish use or domestic use streams, 300 feet of significant wetlands, or 100 feet of large lakes. These plans must describe practices and methods to be used to prevent sediment from entering waters of the state.

8) **Site preparation considerations**. Site preparation must be done so that sediment and debris do not enter waters of the state.

9) **Riparian hardwood conversion opportunities**. Landowners have the option of harvesting portions of hardwood-dominated riparian areas, following state review and approval, with a goal of establishing conifers in the riparian areas.

10) **Skidding and yarding considerations**. Methods and equipment of skidding and yarding will be selected to minimize erosion and protect water quality.

11) **Landing size considerations**. Size and location of landings will be selected to minimize risk of material entering streams.

12) **Road construction and reconstruction rules**. New road construction must incorporate a number of environmental mitigations, including: installing stream culverts capable of passing 50-year floods; installing culverts in fish streams capable of passing fish; avoiding, where possible, high slide-risk slopes; avoiding, where possible, roads paralleling close to streams; and requiring, on steep slopes, excavation and endhaul of material to stable disposal sites.

13) **Assessment of “High Risk” slide areas**. Written plans are required when considering harvest or road constructions in high risk slide areas. Field reviews and conducted and mitigation, including foregoing of proposed activities may be required.

14) **Drainage control of landings and trails**. Drainage systems of landings, skid trails, and fire trails are to disperse and filter runoff to minimize sediment entering waters of the State.

In addition to state Forestry Practice Rules, the Oregon Salmon Plan was initiated in 1997 and includes a number of elements that potentially lead to improvements in fisheries and water quality. Pertinent elements include:

1) **Legacy road inventory**. Oregon Forest Industry Council (OFIC) members, including The Timber Company, agreed to voluntarily inventory roads built prior to the Oregon Forest Practice Rules (1972). The inventories focus on identifying culverts posing fish passage problems or inability to pass 50-year flood events; road-related sedimentation sources; opportunities to reduce sediment discharge from roads; and identifying fill-slopes having landslide potential.

2) **Legacy road improvement**. Following legacy road inventories, problems are prioritized for correction. Work can be completed during normal maintenance, reconstruction, or on an individual site basis.

3) **In-unit leave tree retention in Riparian Management Areas**. OFIC members are encouraged to locate their harvest unit in-unit leave trees in or adjacent to riparian areas, especially in those streams classified high value to anadromous fish ("Core Area streams").

4) **Voluntary additional riparian protection and enhancement actions**. The Oregon Salmon Plan encourages timberland owners to convert riparian hardwood stands into conifers; retain conifers above and beyond required forest practice rule requirements along both "Fish" and "No Fish" streams; and complete habitat enhancement projects in streams.

II. Condition Assessment

STREAM TEMPERATURE

One component of the stream temperature standard for western Oregon has been established at 64 degrees Fahrenheit to protect general trout and salmon rearing during warm summer months (OAR 340-41-025). This criterion applies where those uses occur or are designated beneficial uses for the stream segment. The unit of measurement in the standard is the 7-day moving average of the daily maximum temperatures. Figure 5 shows the stream system in the analysis area of the South Fork Coquille River above the town of Powers as well as current and historic stream temperature monitoring locations. Temperature data collected within the analysis area are shown in Table 2.

Table 2. Analysis Area Stream Temperature Monitoring Data.

Site No.	Location	Years of Record	Min 7-day of record	Max 7-day of record	Avg 7-day of record	Avg Delta T of record	Data Source
	Mainstem South Fork Coquille						
*	at Gaylord	1994 - 95	72.4 F	79.4 F	76.0 F	13.4 F	USFS
1	at fish trap	1994 - 95, 97	78.5 F	82.3 F	80.6 F	12.3 F	USFS
2	at Forest Boundary	1990 - 98	68.8 F	70.8 F	69.8 F	5.9 F	USFS
3	above Coal Creek	1995	67.3 F	67.3 F	67.3 F	14.1 F	USFS
4	at Sand Rock Flat	1997 - 98	72.6 F	75.4 F	74.0 F	9.3 F	USFS
5	above Rock Creek	1992, 1994 - 98	65.6 F	69.2 F	67.4 F	7.1 F	USFS
6	at Lockhart Bridge	1994 - 95, 97-98	69.9 F	74.7 F	72.1 F	11.6 F	USFS
7	below Buck Creek	1990 - 98	64.7 F	68.5 F	67.0 F	7.7 F	USFS
8	above Wooden Rock	1995 - 98	69.5 F	73.8 F	72.2 F	12.7 F	USFS
9	at Eden Valley Bridge	1995 -98	55.9 F	60.4 F	58.7 F	3.5 F	USFS
	Tributaries to South Fork						
10	Coal Creek at Mouth	1994			60.9 F	5.0 F	The Timber Co., USFS
11	Johnson Creek at Mouth	1990 - 98	63.4 F	67.9 F	66.0 F	8.4 F	USFS
12	Sucker Creek at Mouth	1998	67.3 F	67.3 F	67.3 F	9.6 F	USFS
13	Johnson Creek above Sucker	1998	61.8 F	61.8 F	61.8 F	7.0 F	USFS
14	Rock Creek at Mouth	1990 - 98	65.7 F	70.9 F	68.6 F	9.5 F	USFS
15	Rock Creek at Bridge	1991	68.3 F	68.3 F	68.3 F	11.9 F	USFS
16	Lockhart Creek at Mouth	1998	57.2 F	57.2 F	57.2 F	2.8 F	USFS
17	Wooden Rock Crk at Mouth	1994			68.7 F	10.6 F	USFS
18	Clear Creek at Mouth	1995 - 96	58.6 F	61.5 F	60.1 F	5.5 F	The Timber Co., USFS
19	Foggy Creek at Mouth	1994 - 98	64.8 F	69.0 F	66.6 F	8.0 F	USFS

* Site located too far below forest boundary to be shown on Figure 5.

Stream temperature is driven by the interaction of many variables. Energy exchange with the stream may involve solar radiation, longwave radiation, evaporative heat transfer, convective heat transfer, conduction, and advection (e.g. Beschta, 1984). While the interaction of these variables is complex, certain of them are much more important than others. For a stream with a given surface area and stream flow, any increase in the amount of heat entering a stream from solar radiation will have a proportional increase in stream temperature (Brown, 1972). Solar radiation is singularly the most important radiant energy source for the heating of streams during daytime conditions (Brown, 1984, Beschta, 1997).

Management activities can increase the amount of solar radiation entering a steam by harvesting riparian shade trees and through the introduction of bedload sediment resulting in increases in the stream's surface area. In addition to increases in solar radiation, water withdrawals during the dry season may exacerbate maximum temperatures as demonstrated by Brown's equation (Brown, 1972). The South Fork Coquille Water Quality Management Plan was developed to address stream shade, changes in channel form, and changes in stream flow as the three management factors contributing to water temperature problems.

Disturbance of the riparian area and stream channel from wild fires and storms can also lead to increases in summer stream temperatures. This is considered part of the natural processes and are expected change agents considered for federal lands in the Aquatic Conservation Strategy (USDA,USDI, 1994). Recovery of riparian vegetation in areas disturbed by fire and flood will most likely be offset by future events. The gain or loss of riparian vegetation by natural processes will fluctuate within the range of natural variability for this watershed and is outside the scope of this assessment. The plan focuses on areas where management activities have exacerbated natural disturbance and affected water quality.

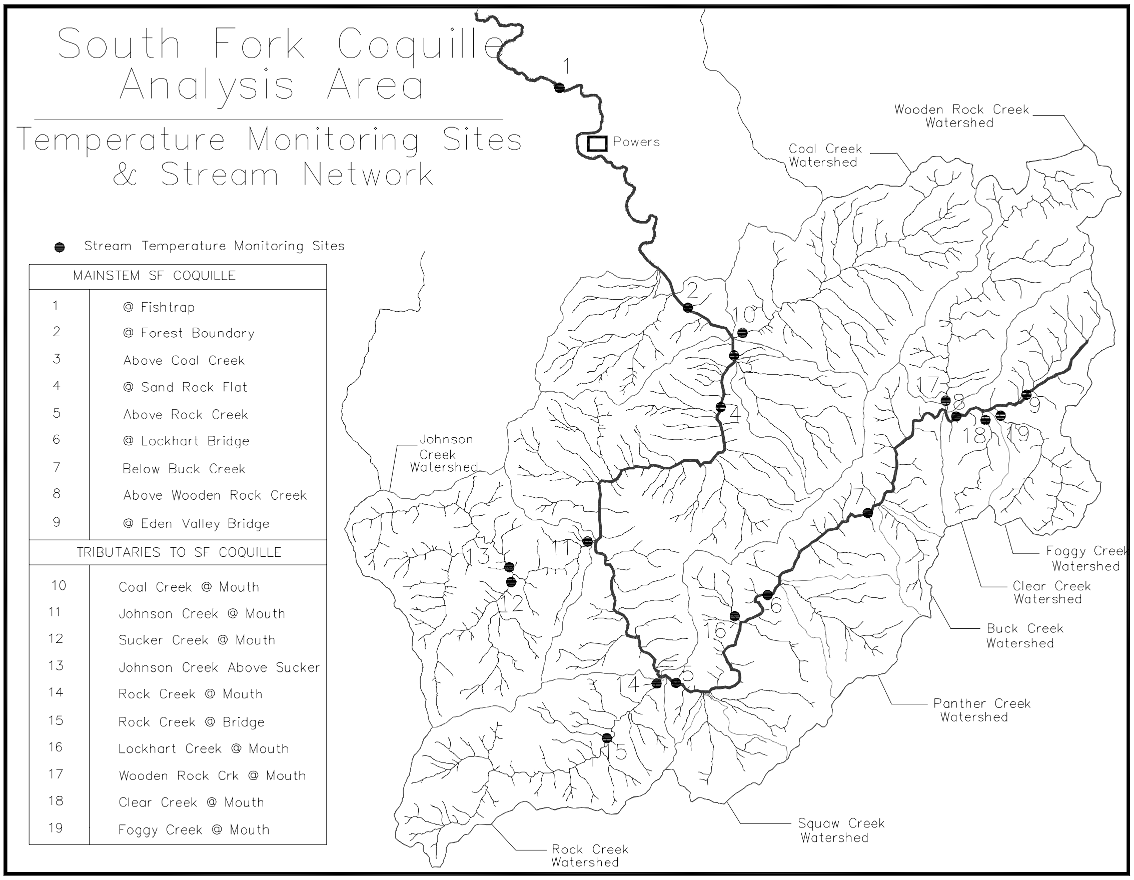

Figure 5: Temperature Monitoring Sites and Stream Network.

Figure 6 shows the longitudinal profile of the South Fork Coquille mainstem and the amount of temperature change per mile (data from USFS records). Areas of significant heating per mile suggest those locations in which stream shade increases will be most productive. Initial areas of opportunity are the 6.8 degree per mile increase between the Eden Valley bridge and Wooden Rock Creek and the 1.2 degree per mile increase between Buck Creek and Lockhart bridge.

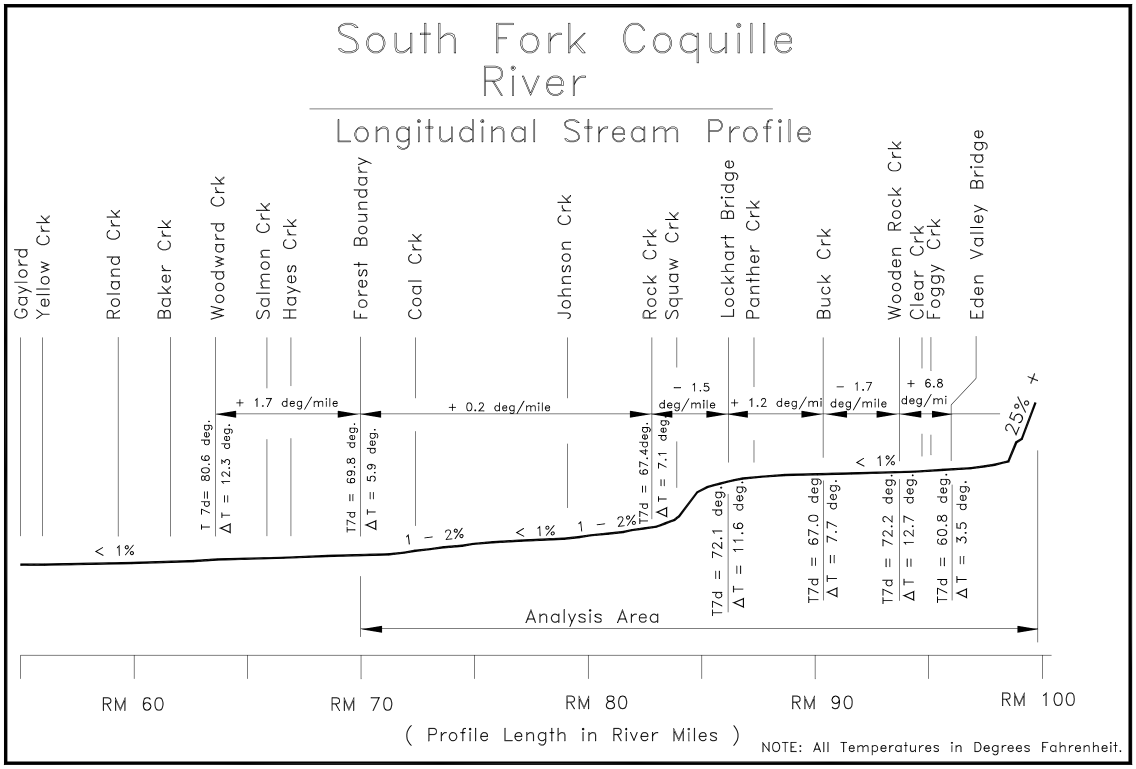

Figure 6: South Fork Coquille Longitudinal Profile.

Temperature Factor: Stream Shade

Federal Lands

When a stream is exposed to midday solar radiation, large quantities of heat energy will be imparted to the stream system, usually resulting in an increase in water temperature. Riparian shade trees play a significant role in reducing this exposure. This assessment systematically determined the existing stream shade conditions and then calculated the resultant total daily solar loading. Aerial photos and field reconnaissance were both used to quantify shade values as well as the potential for recovery and over what time frame. To determine the amount of shade affecting the stream, shade curves were developed using a stream shade model called SHADOW (Park, 1993). See Appendix A for details. Input variables to shade curves used for analysis include low flow wetted stream width, riparian tree height, shade density, and stream orientation. For modeling purposes, these curves assumed a common hillslope gradient and offsets from edge of wetted channel to beginning of riparian vegetation. Two sets of curves were developed. The first set addressed the majority of the streams in the area and assumed an average hillslope gradient of 50% and a 10-foot offset between the edge of the low flow channel and the riparian vegetation. The second set of curves targeted the wider, more exposed reaches of the lower South Fork Coquille and Rock Creek. These assumed a hillslope gradient of 70% and a vegetation offset of 25 feet.

The South Fork Coquille was then divided into representative reaches based on orientation and riparian condition. Tributaries contributing 5 percent or more of the drainage area to the mainstem, as measured at the point of confluence, were assumed to influence mainstem temperatures and were included in the assessment. The mainstem and primary tributaries accounted for approximately 190 evaluation reaches.

Existing shade values were calculated from the existing conditions of shade density, stream wetted width, and tree height. Forest Service personnel determined values for stream segments on public lands and The Timber Company personnel determined values for stream segments on their lands. "Target" shade values were also predicted for the same reach based on expected future riparian tree type and growth rate. The model SHADOW was again used for this projection. The difference in these two values represents the target shade increase. It is understood that human and natural disturbances will likely occur within riparian stands in the future; however, these changes would be very difficult to predict or model. Given the likelihood of future riparian area disturbances, especially from flood and/or fire, the "target" shade increase values predicted by the SHADOW model should be assumed to be a theoretical goal, based on the potential of undisturbed riparian stands to develop shade. Table 3 displays the existing and target shade values for the mainstem South Fork Coquille and its primary tributaries. The values shown are weighted averages based on the reach length and total length of perennial stream analyzed.

Table 3: South Fork Coquille Shade Condition Assessment

Location	% Area of Mainstem South Fork	Existing Shade (%)	Target Shade (%)	(%)Predicted Shade Increase Assuming No Riparian Disturbances	Sources of Historical Disturbance
Mainstem	100	49	75	+ 26	Road/Harvest
Coal Crk	14	64	82	+ 18	Harvest
Johnson Crk	23	72	84	+ 12	Harvest/Fire
Mainstem only	-	63	79	+ 16	
Poverty Crk	-	75	86	+ 11	
Sucker Crk	-	78	84	+ 6	
Nickel Crk	-	70	89	+ 19	
Two Bit Crk	-	83	86	+ 3	
Rock Crk	28	65	83	+ 18	Harvest
Mouth to RM 3	-	53	76	+ 23	
RM 3 to hdwtr	-	71	86	+ 15	
Squaw Crk	7	75	86	+ 11	Harvest
Panther Crk	13	70	85	+ 15	Harvest
Buck Crk	6	86	86	0	Recovered
Wooden Rock	92	66	83	+ 17	Harvest
Clear Crk	23	77	87	+ 10	Harvest
Foggy Crk	76	67	85	+ 18	Harvest/Fire

Loss of shade from management has been primarily due to timber harvest activities prior to the 1990's and possibly from agricultural activities in Eden Valley dating back into the 1800s (see Project Overview).

Small scale suction dredging occurs over a wide area in the basin but has resulted in relatively little damage to riparian shade or channel form. Recreational mining is concentrated in the Johnson Creek watershed and to a lesser extent along the mainstem SF Coquille River. Current State law limits suction dredges to a maximum 4-inch diameter nozzle size.

Floods and fires have also played a role in disturbing riparian vegetation and reducing stream shade values. A summary of natural and anthropogenic disturbance to the riparian area is captured in Figure 7. This figure shows the seral stage of the vegetation within the riparian buffers throughout the basin. Definitions and descriptions of the various seral stages are given in Appendix B.

Based on the analysis of shade values throughout the system, especially as they relate to temperature increases in the basin, specific reaches identified for priority treatment are identified in Appendix E.

Solar energy can be used to give a numeric value for a Total Maximum Daily Load (TMDL). A load value has been derived (BTU's per square foot per day) based on the calculated shade values. Table 4 displays the existing solar loading and target loading. The target value is the load capacity (TMDL) and provides a reference for calculating the amount of pollutant reduction predicted (solar energy). The methodology used to derive this value is illustrated further in Appendix A.

Table 4. Target Solar Loading or TMDL

Target Shade Value	**Existing Shade Value**	**Increase Predicted**
82 %	62 %	20 %
Target Solar Loading or TMDL	**Existing Solar Loading**	**Reduction Predicted**
439 BTU/sqft/day	927 BTU/sqft/day	488 BTU/sqft/day

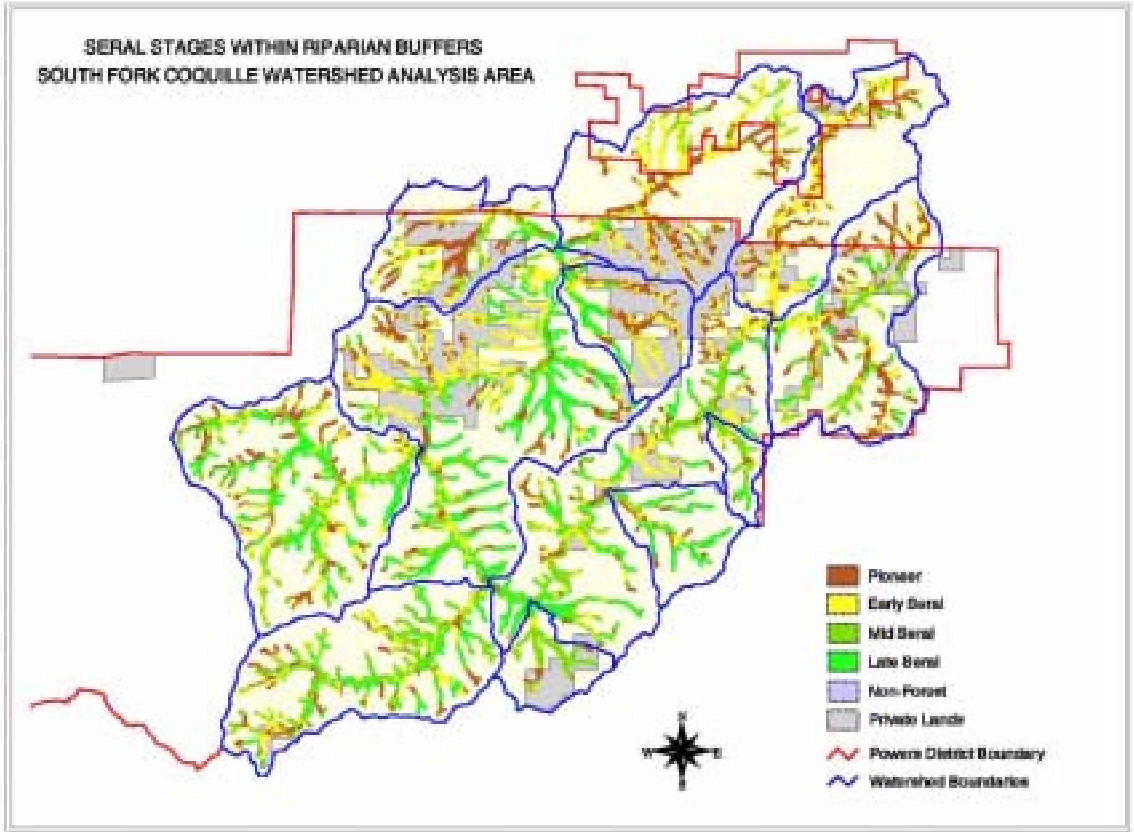

Figure 7: Riparian Buffer Seral Stage.

The Timber Company

The Timber Company used 1997 resource aerial photography and ground-truthing to supply shade density, stream wetted width, and tree heights used for model projections on company-owned stream reaches. During the course of data collection two sizable beaver dam complexes were identified in the Clear and Foggy Creek drainages. These complexes have a significant effect on stream shade in the affected reaches.

Temperature Factor: Channel Form (Sediment)

Changes in either sediment input or stream discharge can lead to changes in channel form (Leopold et al., 1964). When the amount of sediment entering a reach exceeds the transport capacity of a stream, deposition of the sediment results. This can lead to the channel becoming shallower and/or wider. And for the same discharge, a wide, shallow stream will heat up faster than a narrow, deep stream (Brown, 1972). Management activities can exacerbate this process by increasing sediment inputs over natural levels.

Federal Lands

The effects of sediment on channel form (and eventually temperature) were identified and analyzed with historic air photos and direct field measurement of width to depth ratios and pool depth. The objective was to find areas where aggradation and channel widening have occurred and to what extent are they recovering. The primary focus was on specific low gradient reaches along the mainstem of the South Fork Coquille and the lower portion of Rock Creek. These are reaches where impacts have occurred and considerable amounts of solar radiation hit the water surface because shading does not reach the stream. It should be noted that most stream reaches within the South Fork Coquille above the Forest Boundary have significant sediment transport capacity for sand and gravel sized materials. Consequently, the effects from these sediment sizes are likely seen lower in the system.

The South Fork Coquille below the falls and within the National Forest flows through a confined valley that varies in width from around 100 to 300 feet. The valley bottom is primarily young deciduous vegetation that colonizes after floods, then grows for a couple decades before being removed by the next large flood. Aerial photos dating back to 1940 show large gravel bars and wide stream reaches all along the South Fork Coquille, particularly from Delta Creek to Rock Creek. These same reaches appear relatively unchanged through photos of 1957, 1969, 1986, and 1997. The wide, exposed reaches appear to be directly attributable to inputs of large, coarse sediment to the mainstem from a variety of sources, the majority of which are naturally occurring. Many are associated with deposits from reoccurring debris flows from tributaries off the Tyee Sandstone bluff line. Some are associated with high bedload inputs from tributaries such as Johnson Creek and Rock Creek. Several others are immediately below very large, old stream side landslides. These landslides are common along the serpentinite contact running along the west bank of the South Fork Coquille above Johnson Creek.

The low flow channel of the South Fork has shown only slight width variations detectable on aerial photos since 1940. Variations in seasonal timing (and thus discharge) of photos make absolute comparisons difficult. Based on data before and after the November 1996 flood, changes in maximum pool depths in low gradient reaches appears to be significant. Following this flood, the average maximum depth of five pools in the mainstem monitoring reach near Sand Rock Creek decreased from 6 to 47 percent from pre flood conditions. This decrease in depth is likely offset by incremental increases in width, both of which may contribute to temperature increases. The pools are slowly recovering but are still 4 to 36 percent shallower in depth than the pre flood condition.

The presence and activity level of many large, naturally occurring mass wasting features most often overshadow management related sediment inputs. Thus it is difficult to definitively say that management related sediment is the cause of any channel form issues in the South Fork Coquille in the analysis area. The assumption made here is that management related sediment will have an impact on the system, although probably below the Forest Boundary, and that efforts to reduce management related inputs will be implemented.

Temperatures in the upper South Fork Coquille are also affected by channel form, but in a different way. The channel above the falls in Eden Valley is dominated by flat, shallow, horizontally bedded sandstone. The channel is relatively wide and shallow owing to the lack of scour. Beaver dam complexes with scant surrounding tree cover also occur in scattered locations in Eden Valley.

Lower Rock Creek is also quite wide and exposed, particularly above Manganese Creek. This condition may be attributable to the Rock Creek slide just upstream. Stream surveys over the past decade have shown a decrease in pool frequency. As with the South Fork Coquille, the young deciduous vegetation colonizing the large bars was removed by the November 1996 flood. Vegetative succession in these reaches has already begun with seedling alders emerging throughout. Because this process will continue to occur, shade recovery immediately adjacent to the stream is unlikely. Rather, available shade will come from very large, old conifers growing on the margins of the floodplain and on the adjacent hillslopes.

Furniss et al. (1991), concluded that forest roads contributed more sediment than all other forest activities combined on a per unit area basis. Roads are primary sources of sediments to streams, both through chronic erosion and as trigger points of mass failures (Spence et al., 1996). To reduce potential channel plan and profile adjustments initiated by increased sediment loading, potential sources of management related sediment are being identified and treated. The November 1996 storm caused significant management related failures in the watershed and highlighted the need for treating potential management related sediment sources. Within the SFC there were nearly 60 road failures associated with the storm, the majority of which occurred in Rock Creek and along the lower mainstem between Delta Creek and Johnson Creek. The vast majority of these failures were the result of culverts plugging from wood or large pulses of sediment. Key findings from the 1998 Flood Report related to road failures are included in Appendix F. Landslide inventories for Rock Creek and Johnson Creek watersheds showed that nearly 80 landslides were initiated by the November 1996 storm. Approximately half of these sites were located in areas where either road construction or timber harvest had occurred.

Reducing management related sediment input in the basin is a primary focus of the District. Since 1990 nearly 55 miles of roads have been obliterated on federal lands in the watershed. Culvert upgrades are common place and occurring continuously. The 1998 Watershed Analysis revision for the South Fork Coquille basin focuses entirely on the existing road network. The aim is to determine what roads are necessary for the long term goals of the district. Needed roads will be upgraded and storm proofed and unneeded roads will be analyzed as to what are the best options available for their management. All of this is occurring as funding permits.

The Timber Company

The Timber Company, as a member of the Oregon Forest Industries Council (OFIC), has agreed to inventory company roads built prior to the 1972 Oregon Forest Practices Act. These "legacy roads" will be evaluated for potential fillslope failures and sediment discharge. Significant problems identified will be corrected during maintenance or re-construction efforts. Examples of completed and expected corrective actions or mitigation procedures include: placing additional ditch-relief culverts; upgrading and enlarging stream culverts; pulling fills on sidecast road sections; constructing sediment catchment basins; and placing straw bales in ditchlines to trap sediment. Yearly summaries of completed projects will be conveyed to the Governor's Watershed Enhancement Board (GWEB).

Temperature Factor: Stream Flow

Temperature change for a given amount of heat is inversely proportional to the volume of water heated, or in other words, the discharge of the stream (Brown, 1985). A stream with less flow will heat faster than a stream with more flow given all other channel and riparian characteristics are the same.

Within the South Fork Coquille above the forest boundary, there are very few consumptive water withdrawals. Most consumptive use occurs near and below the town of Powers. The following table shows the known existing water rights above the Forest boundary within the Coquille basin.

Table 5. Water Rights on National Forest in South Fork Coquille

Location/Stream	Cert./Permit #	Use	Allotment (CFS)	Priority Date
Hosposki Creek	14018	Campground	0.072	05-16-1940
Hall Creek	14280	Campground	0.110	05-16-1940
Dry Creek	28279	Campground	0.100	07-13-1962
China Creek	14017	Campground	0.040	05-16-1940
Azalea Lake	50346	Reservoir	0.200 Diversion	10-10-1988
			1.0 ac-ft Storage	05-15-1989
Cedar Swamp	50365	Reservoir	0.200 Diversion	10-10-1988
			4.5 ac-ft Storage	05-15-1989

The reservoirs at Azalea Lake and Cedar Swamp were permitted for recreation and fish habitat enhancement. The total known consumptive use on both federal and private lands within the forest boundary is only 0.322 CFS compared to a 1998 measured discharge on August 27 (two weeks after peak annual temperature) at the Forest Boundary of 35.3 CFS. Since consumptive use within the forest boundary only accounts for 0.9 percent of the total low flow discharge at the forest boundary, water withdrawals above the Forest boundary in the South Fork Coquille are not considered a major contributor to stream temperature increases.

<u>HABITAT MODIFICATION</u> (Rock Creek)

Federal Lands

Chen, (1991) suggested that relatively small amounts of large wood in the lower portion of Rock Creek and the high amount of bedload contributed to a lack of deeper pool habitat and high amounts of shallow, non-complex riffles. He suggested that past management activities have increased upstream sediment delivery. When sediment inputs exceed the transport capacity of a stream, changes in channel form can occur (see Temperature Factor: Channel Form). The excess bedload is most evident where it is stored in unconstrained reaches. Aerial photo interpretation illustrates aggradation has buried large boulders and created wide gravel bars, literally filling pools and swallowing riparian vegetation in their growth. In addition, recent fisheries habitat projects involving boulder weirs and cabled logs were buried by as much as three feet of gravel following the November 18th storm of 1996. The main concern with the Rock Creek subwatershed is an abundance of sediment and a lack of large wood to help buffer the effects on maintain habitat.

There is little doubt that management actions have altered aquatic habitat and water quality, however, natural earthflows and debris slides are likely the largest contributor of sediments in Rock Creek (SFC Watershed Analysis, 1995). One debris slide located at RM 3.5 on the mainstem has been active since the earliest aerial photographs. This slide has been progressively enlarging and is currently estimated to be 90 acres. Since we have no control over natural sediment inputs and their effects upon aquatic habitat, they will be beyond the scope of this analysis. It is assumed the 130 acre parcel of private land in the south fork of Rock Creek (Figure 8) will be managed for timber production and applicable State laws regarding harvest guidelines will be applied. For this analysis, we will evaluate several management activities on National Forest Lands that have contributed to modification of the aquatic environment. Past management activities such as stream clean-out, timber harvest and road building will be examined in detail.

Habitat Modification Factor: Stream Clean-out

During the 70's and through much of the 80's land managers and fisheries biologists removed numerous wood jams in fish bearing streams. It was determined these wood jams impeded upstream migration of anadromous salmonids. In retrospect, removal of these jams severely degraded fisheries habitat. Forest Service records indicate a considerable amount of stream clean-out occurred during the mid-1970's adjacent to the 3347 and 3347.020 roads. One salvage sale removed approximately 100,000 board feet of wood from the floodplain and channel, primarily to protect adjacent bridge supports (Chen, 1991). Removal of large wood decreases channel stability, decreases pool depth and simplifies channel hydraulics. In addition, large wood retains nutrients, buffers sediment pulses and provides suitable substrate for numerous aquatic invertebrates (Spence et al., 1996). Although, this practice has been discontinued for over a decade, the effects upon Rock Creek are still evident today.

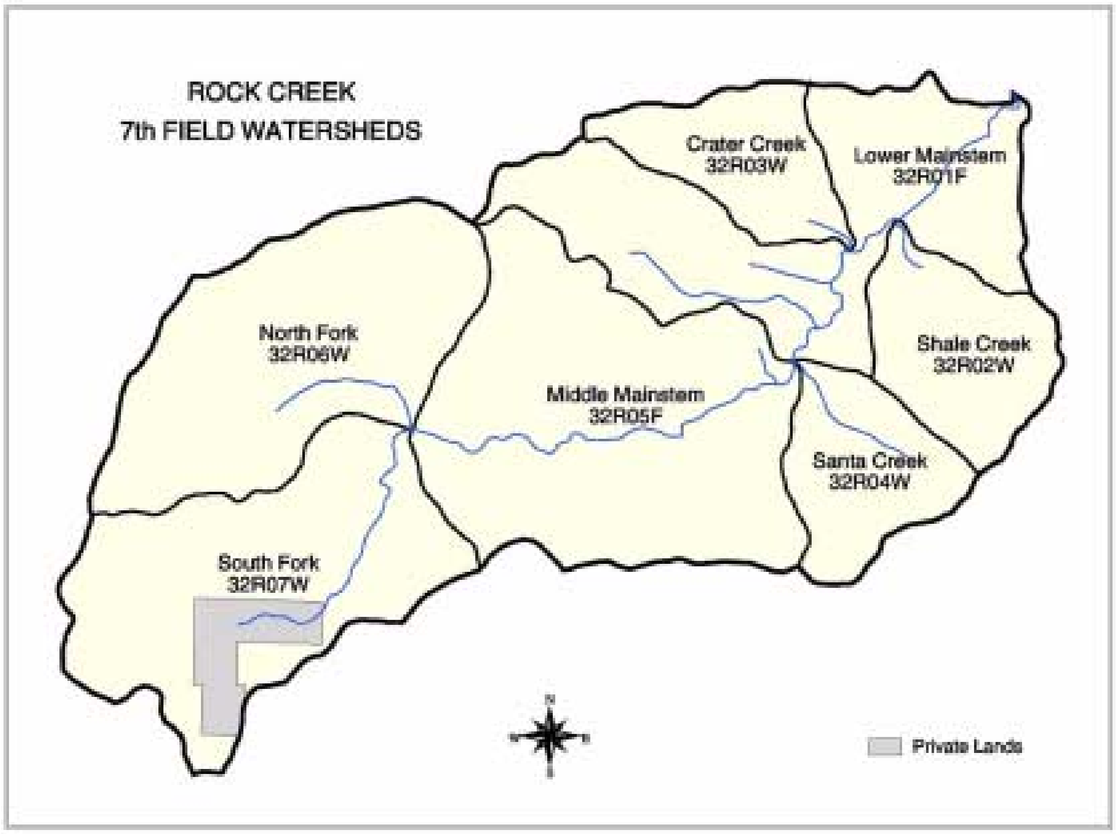

Figure 8: Rock Creek Watershed

Table 7 illustrates the amount of large wood present in Rock Creek from 1992 to 1997. Large wood is defined as instream pieces greater than 24 inches in diameter and greater than 50 feet in length (R6 stream survey protocol). The present levels are below a desired condition of 25 pieces per mile (LSRA, 1995). Natural additions of large wood on the South Fork of the Coquille River tend to average 1 piece/year, every four miles (M. Yager, personal observation). Additions are not evenly distributed. Landslides and debris flows constitute the bulk of the input in localized areas. Large wood levels are dynamic and reach amounts will change over time. Many of the accumulated pieces are concentrated in jams or routed downstream during flood events. Therefore, net increases of large wood in Rock Creek will be sporadic, but should gradually increase over time.

Habitat Modification Factor: Timber Harvest

Timber management activities in Rock Creek have occurred on approximately 1/4 of the watershed. Timber removal, especially regeneration harvests, can result in modification of the physical characteristics of stream habitats. Commercial removal of conifers from the riparian zone directly alters shade, nutrient inputs, bank stability, LWM sources, mechanisms for delivery, distribution patterns, and stability of wood in stream channels (Spence et al., 1996). Timber harvest outside of riparian areas can indirectly alter streamflow regime, peak flows and sediment inputs.

Table 6. displays timber harvest within the Rock Creek drainage by 7th field watershed. Both Shale Creek and Santa Creek have had approximately one half of their upslope and Riparian Reserve harvested. Based on GIS harvest data for Rock Creek, 24% of the watershed (17% of which is in the Riparian Reserves) have been affected by timber harvest. Once these areas are covered with mature conifers (> 24 inches DBH), seral stages in Rock Creek will be similar to pre-management levels. Recovery time periods for managed stands based on site index (King, 1966), will be discussed later.

Table 6. Rock Creek Watershed Timber Harvest

7th Field	Name	Total Acres	Acres Harvested	Total RR Acres	RR Acres harvested	Road Density
32R01F	Lower Mainstem	1,603	316 Ac (20%)	495	43 Ac (9%)	3.6 mi/mi2
32R02W	Shale Creek	641	311 Ac (49%)	157	70 Ac (46%)	2.7 mi/mi2
32R03W	Crater Creek	527	77 Ac (15%)	100	1 Ac (1%)	2.4 mi/mi2
32R04W	Santa Creek	573	299 Ac (52%)	137	64 Ac (47%)	3.8 mi/mi2
32R05F	Middle Mainstem	2,116	385 Ac (18%)	489	86 Ac (18%)	1.7 mi/mi2
32R06W	North Fork	1,605	481 Ac (30%)	313	43 Ac (14%)	3.2 mi/mi2
32R07W	South Fork	1,641	211 Ac (13%)	371	49 Ac (13%)	2.8 mi/mi2
Totals		8,706	2,081 (24%)	356	356 Ac (17%)	2.8 mi/mi2

Habitat Modification Factor: Roads

King and Tennyson (1984), observed altered hydrology when roads constituted 4% or more of the catchment area. This threshold correlates to approximately 4 miles of road per square mile of area. However, road surface, location and number of stream crossings are often more critical elements in determining road effects upon the stream channel.

Table 6 displays road density in miles of road per square mile of area by 7th field watershed. Three subwatersheds contain road densities above a 3 miles per square mile. Although below the threshold, restoration efforts should focus upon high risk factors in these areas. A concurrent analysis to this document (SFC WA revision) is examining the transportation system on National Forest Lands within the south fork of the Coquille River basin. Results of this analysis will help identify unnecessary or high risk roads that could be decommissioned. Main arterial roads will be upgraded utilizing the most current design and construction techniques that are devoted to maintaining natural drainage patterns. Restoration efforts in Rock Creek are ongoing. In 1995, 3.5 miles of road in the Middle Mainstem of Rock Creek was decommissioned. Undersized culverts on main access roads have been upgraded to withstand 100 year flood events. These past and future efforts will help reduce the impacts of the transportation system upon Rock Creek.

Current Conditions and Trends:

Stream survey data from 1992 to 1997 for the 1.2 mile low gradient section below the Rock Creek bridge are displayed in Table 7. Data indicate a range of 4-12 pieces of LWM (>24 inches diameter and >50 ft in length) per mile. Pool frequency has ranged from 0.15 (1992) to 0.07 (1997). Pool area has ranged from 54% (1994) to 34% (1992). Pools per mile greater than 3 feet in depth have ranged from 12 ppm (1997) to 10 ppm (1994). Many of the current values are well below the minimum benchmarks for evaluating stream survey data (Appendix D). Many of the minimum values were recorded in 1997 which followed a 75 year flood event that triggered numerous natural and management related landslides in Rock Creek (Siskiyou National Forest, 1998).

Table 7. Rock Creek Habitat Features - Comparison From Stream Surveys.

Year Surveyed	Gradient	Length (Miles)	Avg. Riffle Width (ft)	Pool Frequency- Pools per Riffle Width *(expected condition ≥0.1)*	Percent of Surface Area - Pools *(expected conditions > 30%)*	Wood Key Pieces ≥ 24 inches diameter/mile *(expected ≥ 25 per mile)*	Pools greater than 3 feet per mile	Riparian Forest Seral Stage in Outer Rip. Zone *(25 ft. - 100 ft.)*
1992 (ODFW)	2 %	1.2	21.4	0.15	34 %	9	11 ppm	No Data
1994	2 %	1.2	24.2	0.10	54 %	12*	10 ppm	No Data
1997	2 %	1.2	22.0	0.07	36 %	4	12 ppm	85 % LT 15 % ST

***** = Protocol for this year included wood that was green and leaning towards the channel. Therefore, counts included potential recruitment pieces and are expected to be higher.

Effects from the November 18th flood of 1996 are most evident in data collected in 1997. Especially notable are the amount of large wood that left the system (9 to 4 pieces per mile), the decrease in Pool Frequency (0.10 to 0.07), and the decrease of Pool Surface Area (54% to 36%). Pools per mile greater than 3 feet deep increased from 10 ppm (1994) to 12 ppm (1997). This increase is likely due to high flow energy that created local scour around immovable obstructions, primarily boulders. As sediment is routed downstream, these attributes are expected to improve over time.

With only three comparable data sets, it is difficult to determine trends when considering the short time period, the sampled length differences, the variability of sampler error and the variability of environmental conditions. Plus, there is often a delay or threshold from a response being measured from any given management action. Future monitoring of physical habitat in Rock Creek will be critical in determining long term trends.

A dependable biological indicator of aquatic health is the diversity of macroinvertebrates present in a stream. A benthic invertebrate survey was conducted near the mouth of Rock Creek during the fall of 1995. Results from this survey indicated a moderate to low Index of Biotic Integrity score (Appendix C). The data suggests that aquatic diversity in Rock Creek is currently below it's biological potential. The report summarized that the macroinvertebrate community is evidently limited by a low frequency of large wood, abundance of sediments and a moderate degree of scour during high annual flows. Large wood abundance can be directly or indirectly correlated to past management actions that have negatively affected aquatic habitat. However, due to the geomorphology of Rock Creek, it is questionable whether the abundance of sediments and high degree of annual scour is related to management activities or simply within the range of natural conditions (USDA, 1995).

Since the implementation of the Northwest Forest Plan, all Federal land within the Rock Creek subwatershed will be managed as Late Successional Reserves and Riparian Reserves (see Project Overview). Under current guidelines, there are no planned timber sale activities or associated road construction. Since Rock Creek is 97% Federal ownership, little to none of the watershed will be impacted by future management activities. Ongoing and planned restoration activities such as road decommissioning, culvert upgrades on main access roads, riparian planting, silvicultural release and large wood additions will aid in recovery efforts. Therefore, through passive and active efforts, Rock Creek will be recovering from past floods and management actions. All future actions will be directed towards restoring processes and key components in Late Successional Reserves and Riparian Reserves. All actions will be consistent with Aquatic Conservation Strategy objectives.

The Timber Company owns no land in the Rock Creek watershed.

Element Two: ***Goals and Objectives***

Goals:

Federal Lands

- Reduce low flow stream temperatures leaving the National Forest on the South Fork Coquille River. Accomplish this by decreasing management related sediment inputs and by increasing stream shade in the mainstem, Rock Creek, Johnson Creek as well as other "non listed" tributaries that have been impacted by past management practices.

- Increase habitat quality, quantity and diversity in Rock Creek to reach its full biological potential.

Both the Siskiyou National Forest Land and Resource Management Plan (Forest Plan) and the Presidents Forest Plan, specifically the Aquatic Conservation Strategy, provide the policy framework and direction for accomplishing these goals.

The Timber Company

- Reduce low flow stream temperatures flowing from company lands. Accomplishment will occur by shade canopy development along perennial streams following Oregon Forest Practice Rules and voluntary and discretionary aspects of the Oregon Salmon Plan.

Objectives:

Federal & Private Lands

Given existing federal and state laws and rules, and assuming SHADOW riparian stand growth projections, the following water quality objectives are proposed:

Table 8. SF Coquille Water Quality Objectives.

Element (Factor)	Location	Current Condition	Projected Value, Based on Lack of Disturbance	Time Frame	Resp. Party
Temperature-Shade	Mainstem*	Shade = 49 %	Shade = 75 %	120 years	USFS/PRVT
	Coal Creek*	Shade = 64 %	Shade = 82 %	60 years	USFS/PRVT
	Johnson Creek	Shade = 72 %	Shade = 84 %	60 years	USFS
	Rock Creek	Shade = 65 %	Shade = 83 %	120 years	USFS
	Squaw Creek*	Shade = 75 %	Shade = 86 %	55 years	USFS/PRVT
	Panther Creek*	Shade = 70 %	Shade = 85 %	55 years	USFS/PRVT
	Wooden Rock*	Shade = 66 %	Shade = 83 %	85 years	USFS/PRVT
	Clear Creek*	Shade = 77 %	Shade = 87 %	60 years	USFS/PRVT
	Foggy Creek*	Shade = 67 %	Shade = 85 %	80 years	USFS/PRVT
Temperature-Channel Form	Basin Wide, esp. Rock Crk	Mgmt Related Sed input in lrg Storms	Reduced Mgmt Related Sed. Input	20 years	USFS
	Basin Wide	Roads in High Sensitivity Areas	Upgrade/Eliminate These Roads	20 years	USFS
	Basin Wide	High Risk Stream Crossings	Upgraded Crossings w/o Diversion Pot.	10 years	USFS
Habitat Modification	Rock Creek	Pools per Riffle Width = 0.07	Pools per Riffle Width > 0.1	20 years	USFS
	Rock Creek	Surface Area of Pools = 36%	Surface Area of Pools > 30%	current	USFS
	Rock Creek	Lg Wood per Mile = 4 pieces	Lg Wood per Mile > 25 pieces	40 years	USFS
	Rock Creek	Pools/Mile Deeper than 3 ft = 12	Pools/Mile Deeper than 3 ft = 15	20 years	USFS

* The Timber Company owns land in these drainages.

The time frame for recovery varies for each stream system. This value was determined for each reach in a watershed as the amount of time for the riparian vegetation to adequately shade the stream. The time required for the trees to reach this stage is a function of the site class (productivity) of the soils/local environment. The longest time period for any reach within a given stream system was used as the time frame for full recovery in the previous table.

Projected shade values, assuming no future disturbance, are based on species specific shade densities and and tree heights. Reaches along the mainstem South Fork Coquille have projected shade values that are lower than typical due to the influence of the Agness road and the Eden Valley road. In both cases the road parallels the river, often within a close distance. This road surface effectively eliminates a swath of vegetation that might otherwise be shading the stream, depending on proximity, aspect, etc. The net effect is a reduction in the potential future shade value that may be attained along the mainstem South Fork Coquille.

Interim benchmarks, where applicable, between the current and desired future conditions are listed in Table 10 of Element 4: Timeline for Implementation.

Element Three: *Proposed Management Measures*

Federal Lands

Recovery of the degraded water quality parameters listed on the 303(d) list on federal lands was largely initiated in 1994 with the amendment of the Siskiyou National Forest Land and Resource Management Plan by the Northwest Forest Plan (NWFP). This guidance document provided means and direction for both active and passive restoration measures. The philosophy of which focuses heavily on protecting areas with high quality aquatic and terrestrial resources and focusing restoration efforts on areas with the greatest potential for recovery. Thus the intact areas serve as core areas to build out from in the restoration process as well as providing a blue print for desired future conditions. The following standards and guidelines from the NWFP will be used to attain the goals of the South Fork Coquille Water Quality Management Plan:

Stream Temperature - Shade
Aquatic Conservation Strategy: B-9 to B-11, C-30
Standards and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30

Stream Temperature - Channel Form
Aquatic Conservation Strategy: B-9 to B-11, C-30
Standards and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30
Roads: B-19, B-31 to B-33

Flow Modification
Aquatic Conservation Strategy: B-9 to B-11, C-30
Roads: C-32

Habitat Modification
Aquatic Conservation Strategy: B-9 to B-11, C-30
Standards and Guidelines for Key Watersheds: C-7
Riparian Vegetation: B-31
Riparian Reserves: B-12 to B-17 and ROD 9
Watershed Restoration: B-30
Roads: B-19, B-31 to B-33
In-stream Habitat Structures: B-31

The following table presents the general management measures addressing each listing parameter along with active and passive restoration approaches required to meet that goal.

Table 9: Proposed Management Measures & Active/Passive Restoration.

Element	Goal/Objective	Passive Management	Active Management
Temperature - Shade	Achieve maximum shade value possible per stream reach.	Allow riparian vegetation to grow to reach target height and density. Follow standards and guidelines in NWFP for riparian reserves.	Treatments that increase growth rates. Treatments that insure long term health. Plant conifers for future tall shade trees.
Temperature - Channel Form	Reestablish width/depth ratios in aggraded reaches. Decrease management related bedload contributions during large storms. Increase amount of large wood delivered in mass wasting events.	Allow natural channel evolution to continue toward equilibrium. None Allow historic failures to revegetate.	None Identify and treat roads with high failure potential to reduce risk and magnitude of failure. Insure that unstable sites retain large wood to increase wood to sediment delivery ratio.
Habitat Modification	Increase size and number of wood pieces in channel. Increase depth, volume and frequency of pools.	Allow large wood to remain in channel (no longer salvage at road crossings). Allow channel to recover with time.	Riparian treatments to increase growth rates and establish conifers. Place wood in channels where appropriate. Reduce management related sediment.

The evaluation process associated with this plan has identified site specific reaches and locations where the general management measures will be applied. These locations and treatments are described in more detail in Appendix E. Each of the management measures are very straight forward in their intent, application, and expected outcome. These types of treatment have been/are widely used and accepted as viable means of attaining the stated objective. With that in mind, no additional data-based analysis to demonstrate the effectiveness of these measures is provided.

Each of the detailed management measures are designed to have a specific measurable result that can easily be verified by monitoring. This follow-up monitoring process (See Element Seven: Monitoring and Evaluation) will determine the effectiveness of the management measures. Based on that monitoring, it will be determined whether the recovery is occurring as desired or if the management measures need adjustment to produce the desired future outcome. Adjustment of the management measures could be as simple as slight field modifications of the type or locations of the proposed measures. More significant modifications on federal lands, if different from the original proposed action, may require additional public comment and a new decision notice from the District Ranger.

For an explanation of the mechanisms by which the application of these measures will be assured, see Element Six: Reasonable Assurance of Implementation.

The Timber Company

Additional Oregon Forest Practice Rules, enacted in 1994, were designed to buffer streams in manners that effectively provided sediment filtering, retained stream shading, and maintained healthy summer-time water temperatures. The Oregon Department of Environmental Quality (DEQ) has accepted the Forest Practices Rules as the WQMP for private forest lands and has signed an agreement with Oregon Department of Forestry that provides the basis for new rules, if needed, on a watershed-by-watershed basis. Adhering to the Forest Practice Rules in the future will continue to provide water temperature and water quality protection to assessment area streams. Following existing riparian rules are predicted to result in increases in stream shading levels over time, as shown on Table 8. In addition, The Timber Company, in strong support of the Oregon Salmon Plan, will consider a number of voluntary and discretionary actions, on a case-by-case basis. These actions have the potential of speeding shade recovery and improving water quality, including:

1) Locating in-unit leave trees along the edges of streams where possible and appropriate. Highest priority will be along streams or stream-segments flowing North-South or quartering at North-west to South-east or North-east to North-west directions.

2) Avoidance of hardwood conversions in riparian areas on south side of streams or along streams having the greatest potential of summer-time warming (e.g., North-South flowing stream segments).

3) Inventory "legacy roads" (those constructed prior to 1972) and fish passage potential of stream culverts; potential sediment discharge to streams; and fillslope landslide potential. Significant problems will be prioritized for improvement with the work being accomplished during either regular maintenance operations, periodic road reconstruction activities, or specific contracts to deal with individual problems.

4) Place straw bale and/or construct sediment catchment basins along roads.

5) Replace culverts creating fish passage problems.

6) Install cross-drains to divert ditchflow to gentle sediment settling areas rather than streams.

7) Limit use of unsurfaced roads during wet seasons.

During the course of riparian assessment for the South Fork Coquille Water Quality Management Plan, four potential sites were identified in headwater areas where riparian vegetation appeared scant and potential may exist for riparian area enhancement. These locations are delineated in Appendix E The Timber Company proposes to evaluate each site and identify if feasible restoration options exist. If so, a restoration prescription and timeline will be developed, following TMDL approval.

<u>Element Four:</u> *Timeline for Implementation* ***:Federal Lands and The Timber Company***

Time frame for accomplishing the interim benchmarks and objectives of the WQMP are shown in the following table. Both interim benchmarks and plan objectives are based on the assumption of no natural or man-caused disturbances to riparian areas that would affect their shade-producing attributes. It is possible that natural disturbances may affect predicted riparian canopy development or that SHADOW may not precisely predict riparian shade development. If so, it is understood that either the interim benchmarks and plan objectives may require adjustment.

Table 10. SF Coquille Timeline for WQMP Implementation.

Element (Factor)	**Location**	**Objective**	**Start Date**	**Interim Benchmark**	**Time to Reach Objective**
Temperature- Shade	SFC Mainstem*	Increase shade 26 %	Current	Increase shade 18 % by year 2010	Year 2120
	Coal Creek*	Increase shade 18 %	Current	Increase shade 14 % by year 2018	Year 2060
	Johnson Creek	Increase shade 12 %	Current	Increase shade 11 % by year 2018	Year 2060
	Rock Creek	Increase shade 18 %	Current	Increase shade 15 % by year 2018	Year 2120
	Squaw Creek*	Increase shade 11 %	Current	Increase shade 10 % by year 2018	Year 2055
	Panther Creek*	Increase shade 15 %	Current	Increase shade 13 % by year 2018	Year 2055
	Wooden Rock*	Increase shade 17 %	Current	Increase shade 14 % by year 2018	Year 2085
	Clear Creek*	Increase shade 10 %	Current	Increase shade 8 % by year 2018	Year 2060
	Foggy Creek*	Increase shade 18 %	Current	Increase shade 14 % by year 2018	Year 2080
Temperature - Channel Form	Basin Wide	Complete Transprtn Management Plan	Current		March 1999
Element (Factor)	**Location**	**Objective**	**Start Date**	**Interim Benchmark**	**Time to Reach Objective**
	Basin Wide	Reduce Mgmt Related Sediment in Large Storms	Current		Continuous
	Basin Wide	Eliminate/Upgrade Roads in Unstable Terrain	1999		2020
	Basin Wide	Eliminate High Risk @ Stream Crossings	Current		2020
Habitat Modification	Rock Creek	Increase Pools per Riffle Width	1999		2020
	Rock Creek	Increase Surface Area of Pools	1999		1999
	Rock Creek	Increase Lg Wood per Mile	1999		2040
	Rock Creek	Increase Pools >3 ft Deep per Mile	1999		2020

* The Timber Company owns lands in these drainages.

The implementation plan for federal ownership targets treatment at the sources of the water quality problems prior to expending funds elsewhere. Management activities that adversely affect shade characteristics in riparian zones have been discontinued so that current planting and thinning operations can be expected to be functional and effective over the long term. Similarly, anthropogenic sediment sources affecting channel form are being identified and treated prior to any instream treatments or channel side planting.

Federal operations are targeted at the watershed at a whole, with priority actions going to areas with high impact to water quality and high recovery potential. This does not always coincide with the concept of working from the top of the watershed to the bottom.

Element Five: *Identification of Responsible Participants*

Federal Lands

As shown previously in Table 8, the Siskiyou National Forest will be responsible for implementing the practices aimed at improving water quality within the National Forest. The commitments, benchmarks and timelines were listed previously.

The Timber Company

There is considerable land in the basin owned by private timber companies, each of which will be responsible for the practices implemented on their own land. Responsibility for actions on The Timber Company lands will be with The Timber Company. Other private lands are considered beyond the scope of The Timber Companies' stated intentions.

Element Six: *Reasonable Assurance of Implementation*

Federal Lands

The US Forest Service is responsible for the implementation of the WQMP for the Siskiyou National Forest land of the South Fork Coquille River. Implementation of the plan is insured by the amendment of the Siskiyou National Forest Land and Resource Management Plan by the Northwest Forest Plan in 1994. The standards and guidelines set forth in the Record of Decision implemented the Aquatic Conservation Strategy which encompasses the objectives and practices laid out in this WQMP. As such, the protective elements of this plan have been in effect since 1994 and many of the restorative elements are already under way. Action by the Legislative or Executive branch of the Federal Government would be necessary to change the policy aspects of the NWFP. As such, addressing the issue of enforcement on "bad actors" is not relevant to the federal ownership. Financial conditions will determine the rate of the restorative aspects. See Element 10: Discussion of Costs and Funding for more details regarding budgets.

As previously stated, the model and assumptions used in predicting riparian shade development over time are based on the notion of neither anthropogenic or natural disturbances to riparian stands. This assumption used for this WQMP's shade development objectives, even considering their inherent flaws, was used due to the difficulty of incorporating impacts of stochastic disturbance events into the model.

Hence, the predicted shade increases depicted in this WQMP should be considered as goals to be striven toward and that monitoring will indicate if these goals are actually attainable.

The Timber Company

Many of The Timber Company actions proposed in this document are currently required by existing Oregon Forest Practice Rules. The Oregon Department of Forestry reviews harvest, reforestation, and road-related projects on private lands to ensure these rules are followed. If violations are identified, citations and repair orders may be issued. In addition, prosecution and civil penalties are possible.

The Timber Company is a strong supporter of the Oregon Salmon Plan and expects to continue with the voluntary and discretionary actions covered in that plan. Potential projects covered under this voluntary plan were discussed in previous sections.

Element Seven: *Monitoring and Evaluation*

The goal of the monitoring program is to insure treatments are being implemented properly and to detect improvements in water quality conditions as well as progress toward reaching the water quality standard. The parameter of evaluation will vary depending on the treatment.

TEMPERATURE

Federal Lands

The Powers Ranger District will continue to monitor stream temperatures throughout the National Forest lands of the South Fork Coquille basin in order to detect any changes in temperature from long term data sets. The district maintains several long term monitoring sites as well as several other project-specific, short term sites. Core long term monitoring sites are maintained at the following locations:

Mainstem South Fork Coquille
- @ fishtrap (RM 63.5)
- @ forest Boundary (RM 71)
- above Rock Creek (RM 83.0)
- @ Lockhart Bridge (RM 86.4)
- below Buck Creek (RM 90.3)
- above Wooden Rock Creek (RM 93.7)
- @ Eden Valley Bridge (RM 94.5)

Tributaries to South Fork Coquille
- Johnson Creek @ mouth
- Rock Creek @ mouth
- Clear Creek @ mouth
- Foggy Creek @ mouth

Monitoring will continue annually by district personnel using automatic temperature recorders (hobo, stowaway & Ryan). Data reported typically includes 7-day maximum, instantaneous peak and day, days over standard for July & August, and maximum diurnal fluctuation (delta t). Sampling methods and quality control will follow DEQ protocol. Sampling strategies and QA/QC are reviewed annually at a regional meeting in Coos Bay with DEQ, BLM, USFS, and private landowners.

The Timber Company

The Timber Company will continue long-term monitoring of stream temperatures at Coal and Wooden Rock Creeks. In addition, evaluations will be made of beaver dam impacts to water temperatures in Clear, Foggy, and the upper South Fork Coquille. Monitoring of stream temperatures flowing from other small tributaries of the South Fork and modeling of natural stream warming potential may be initiated to test model predictions regarding the relationship between riparian area shade density and stream temperatures. Data will be collected using accepted protocol.

Temperature, Shade Component

Federal Lands

Stream side shade will be monitored directly using a solar pathfinder. Measurements will be taken at five year increments beginning in 1999 to measure progress of shade recovery as compared to the interim goals discussed previously. Representative sites selected for this type of monitoring include

- Mainstem South Fork Below China Flat (EW aspect)
- Mainstem South Fork Below Johnson Creek (NS aspect)
- Mainstem South Fork above Lockhart Bridge (EW aspect)
- Johnson Creek below bridge (EW aspect)
- Rock Creek below bridge (NS aspect)
- Wooden Rock Creek above bridge (NS aspect)

Monitoring will be managed by district personnel. Sampling methods and quality control will follow published protocol for the solar pathfinder.

Riparian stand treatments will continue to occur in the future along perennial streams (active restoration). These stands will be surveyed using Region 6 Stand Exam Standards prior to, and following treatment. These data will determine whether silvicultural prescriptions are accelerating growth rates and/or maintaining stand health such that shade and large wood supply objectives are met.

Future iterations of watershed analyses will also consider a basin-wide context for the health of riparian stands such that our ability to maintain and/or improve shading and large wood supply is addressed.

The Timber Company

The Timber Company may monitor stream shade development over time in representative stream reaches. Also, if identified potential riparian project sites (listed in Appendix E) have the potential for enhancement, and projects are initiated, the project sites will be monitored for shade development. Any shade monitoring will follow established protocol.

Existing summertime water temperatures result from the existing riparian vegetation conditions. Changes in water temperature as riparian vegetation develops in the future can only be predicted by models.

Because of the importance of these predictive models, The Timber Company may test existing models regarding their applicability in the upper South Fork Coquille drainage. It is possible that existing models can be improved over time. In that case, The Timber Company may re-evaluate the shade development projections stated in this document and the water temperature change-predictions to be displayed in the subsequent Total Maximum Daily Load document.

Temperature, Channel Form Component

Federal Lands

Channel form will be directly monitored through a series of permanent channel cross sections, pebble counts, and aerial photographs. There are currently 16 permanent cross sections on the South Fork Coquille near Sand Rock Creek and nine on Rock Creek. This will allow comparison of yearly lateral and vertical adjustments of the channel bed from inputs of sediment and runoff. Wolman pebble counts are performed at each cross section to characterize the stream bed material and infer changes in sediment delivery over time. Cross sections and pebble counts will be resurveyed at intervals of 3 to 5 years, or following large, channel forming discharge events.

Efforts to reduce the anthropogenic sources of bedload will focus on reducing the number and effects of road failures and in increasing the proportion of wood to sediment delivered during mass failures. The District will monitor and report the miles of road decommissioned and/or storm proofed along with the number of stream crossings treated for capacity or diversion potential on an annual basis. This data will be entered and stored on a GIS layer for the Powers Ranger District. Because watershed restoration is an evolving science, it is anticipated that other techniques will be introduced during the recovery period that this plan covers. These new techniques will be included in this plan as appropriate.

The Timber Company

Road improvement and habitat enhancement projects completed each calendar year will be summarized and conveyed to the Governor's Watershed Enhancement Board. Oregon GWEB manages a state-wide database and produces a yearly report summarizing private and state land accomplishments.

The Timber Company follows the American Forest and Paper Association (AF&PA) Sustainable Forestry Initiative (SFI) and has an in-house 11-Point Environmental Plan. Watershed and water quality enhancement projects accomplished each year are reported to the AF&PA and The Timber Company.

Habitat Modification

Federal Lands

Standard Level II and III stream surveys will be conducted in Rock Creek according to Region 6 Stream Inventory Handbook on a recurring basis (3 - 4 year cycle) to document changes in channel morphology, distribution of fish habitat units, and pieces of large wood in channels. Stream surveys will also monitor approximate densities of juvenile salmonids and riparian vegetation. Surveys are typically done by contract with fisheries consultants with field verification done by USFS fish biologists.

Benthic Macroinvertebrate surveys (ABA protocol) will be conducted every five years near the mouth of Rock Creek to determine trends of aquatic health by using a standardized Index of Biotic Integrity Score. These surveys have historically been done by consulting ecologists.

The following table connects monitoring frequencies, goals and objectives, and interim benchmarks identified in this plan with management measures from Table 9 and specific treatments from Appendix E.

Table 11. Interim Benchmarks and Monitoring Frequencies for South Fork Coquille.

Element	Site Identification	Management Measure	Interim Benchmark	Monitoring Parameter	Monitoring Frequency
Temperature (Shade)	SFC Mainstem	Passive plus conifer planting & treatments to increase growth and insure long term health	See Table 10	Stand surveys (growth & health) Shade w/solar pathfinder Low flow stream temps	5-yr intervals post treatmnt 1999 then at 5-yr intervals Annually
Temperature (Shade)	SFC Tribs: Wooden R. Johnson Crk Rock Crk	Passive plus conifer planting & treatments to increase growth and insure long term health	See Table 10	Stand surveys (growth & health) Shade w/solar pathfinder Low flow stream temps	5-yr intervals post treatmnt 1999 then at 5-yr intervals Annually
Temperature (Shade)	All streams in basin not listed above	Passive - no active treatment	See Table 10	Check shade with curves Low flow stream temps	At interim benchmark Annually
Temperature (Channel Form)	Basin wide	Passive channel recovery Eliminate high risk stream x-ings Eliminate/ upgrade roads in unstable terrain	Pre 1996 pool depths in Mainstem by 2000	Stream xsects on mainstem & Rock Cr. # sites treated # miles treated	2 - 5 years or post large storm Annually Annually
Habitat Modification (Lack of	Rock Creek	Passive - no treatment.	Percent of full biological potential	Level 2 & 3 assessments	3 - 4 year interval

Complexity)			Improve condition from fair to good by 2040	Pool freq. Pool Area Large Wood (Pieces/Mile) Riparian Trees (%)	

Data from all monitoring on the National Forest will be analyzed, managed, and stored at the district office by aquatic physical scientists or biologists in the Resources Department. Data is stored both as electronic and hard copy. Data summaries are made available to anyone interested.

Collected data will either confirm or disprove the effectiveness of the actions being implemented. If recovery indicators are not appearing, adjustment of the treatment measures may be required. However, treatment measures proposed such as increasing shade, riparian thin/release, and reduction of anthropogenic sediment sources are widely accepted to be effective. Consequently, improvement of water quality parameters is expected.

Funding for monitoring has historically been covered under the annual allocation of salaries. Although a specific line item for monitoring does not exist, it is required under the forest plan and is conducted annually as time and priorities dictate.

Element Eight: *Public Involvement*

Federal Lands

Preparation of this WQMP is a procedural step that focuses on water quality using elements of the Northwest Forest Plan (NWFP). It tiers to and appends the South Fork Coquille Watershed Analysis. Such watershed analyses are a required component of the Aquatic Conservation Strategy under the NWFP. The Record of Decision (ROD) for the NWFP was signed in April of 1994 following extensive public review.

The DEQ procedure for public review of TMDL and WQMP documents includes a minimum 30 day public comment period prior to submission of the document to EPA. A 60 day comment period is proposed for the South Fork Coquille. DEQ will provide appropriate public notice requesting comments on the information contained in the document and stating that the document is pending submission to EPA. EPA provides review of WQMPs and has approval authority over TMDLs. The public notice provides opportunity for public hearings for persons to appear and submit written or oral comments if:

- Submitted comments indicate significant public interest, or
- Written requests from 10 or more persons are received, or
- An organization representing at least 10 persons requests a public hearing

Additionally, any proposed active restoration measures will be subject to public review and comment as required in the National Environmental Protection Act (NEPA).

The Timber Company

The Timber Company plans to continue active management on its lands and follow the requirements of the Oregon Forest Practice Act. The Timber Company has proposed in this WQMP a combination of efforts on company lands to enhance water quality. These include:

1) Follow existing state riparian management rules. This will ensure shade density improvement over existing conditions.
2) Riparian areas with scant vegetation cover will be assessed for potential enhancement. Areas having a moderate or higher possibility of success will be planned for reforestation.
3) Company roads will be inventoried for potential sediment input into streams. Corrective actions will be taken during maintenance or reconstruction projects.
4) Monitoring of riparian and stream conditions will be continued to compare actual changes, over time, with those changes predicted by models.

Element Nine: *Maintenance of Effort Over Time*

This WQMP outlines a long range plan for recovery of impacted water quality parameters throughout the SF Coquille River basin. This plan is congruent with the Northwest Forest Plan (particularly the Aquatic Conservation Strategy), the Siskiyou National Land and Resource Management Plan, and the Oregon Forest Practice Rules. As such, long term maintenance of effort directed at implementation and monitoring of the WQMP is guaranteed as long as the previously listed documents are in effect to direct management activities on federal and private lands

Element Ten: *Discussion of Costs and Funding*

Federal Lands

The amount of restoration funds distributed to the Forest depends on the amount of money appropriated each year by the Regional Office. In the past Siskiyou National Forest has received about a one million dollar annual budget for watershed restoration. Annually each of the five ranger districts submit a list of prioritized restoration projects. Prioritization is based on if sites are located in a key watershed and the benefits to the resources the project provides. The submitted projects for all the districts are then evaluated at the forest level using similar criteria. The amount of funds distributed to the districts are based on a forest wide priority.

In addition to the appropriated restoration funds, timber sales provide restoration funds from the Knudsen-Vanderburg (KV) Program. In fiscal year 1998 the Forest received a quarter of a million dollars from the KV program for watershed restoration. The limitation on this money is that it must be spent within the timber sale area from which it was collected.

The South Fork Coquille watershed is a key watershed under the NWFP and is therefore a high priority for restoration. Siskiyou National Forest will seek necessary funds for the implementation and monitoring components of the WQMP as a high priority. However, due to the limitations of the federal budget process, these funds cannot be guaranteed.

The Timber Company

The Timber Company will seek a continuing source of funding for the voluntary monitoring, project implementation, and planning efforts discussed in this WQMP. However, due to the limitation of the private budget process, and the possibility of unforeseen future events, this funding cannot be guaranteed.

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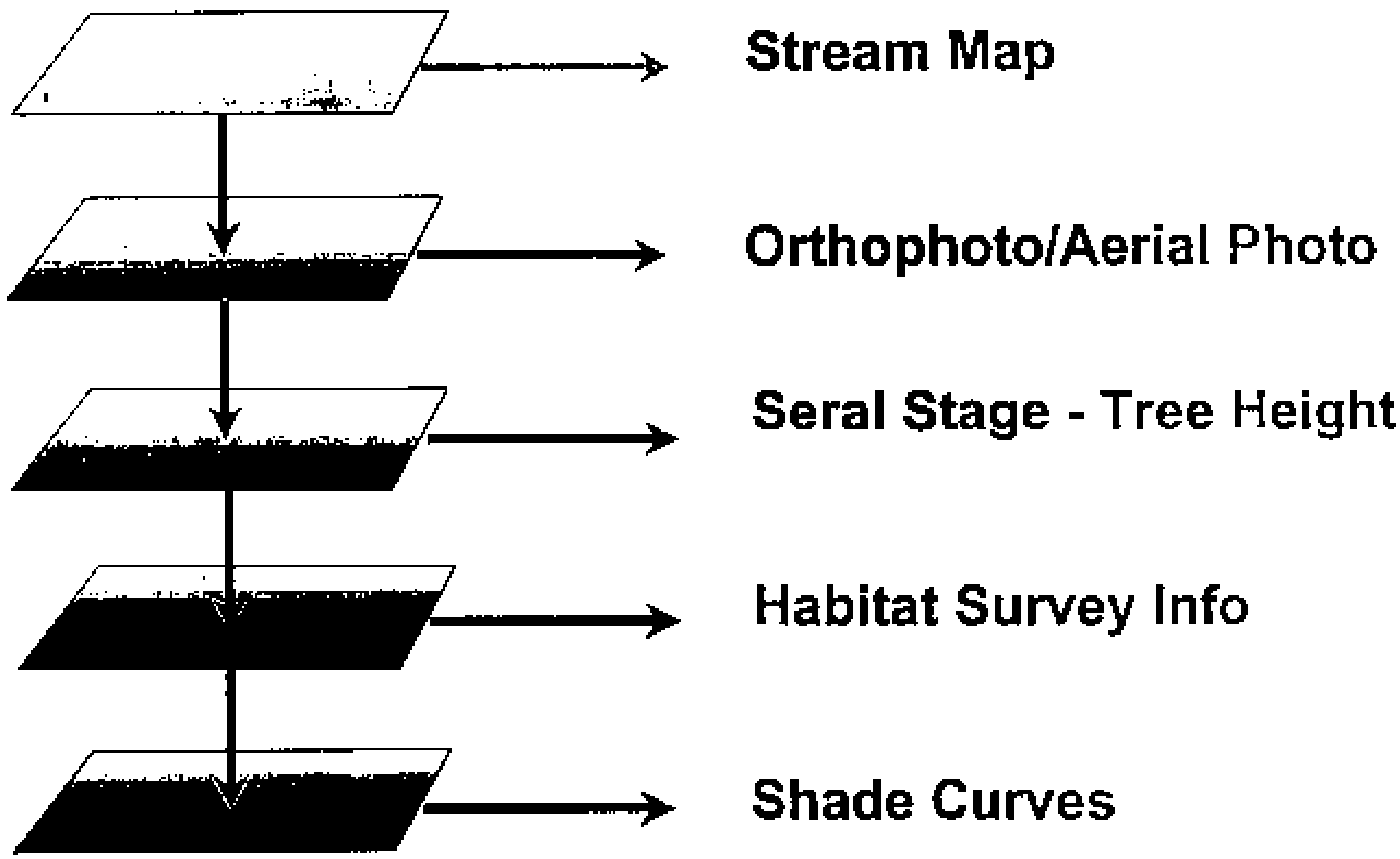
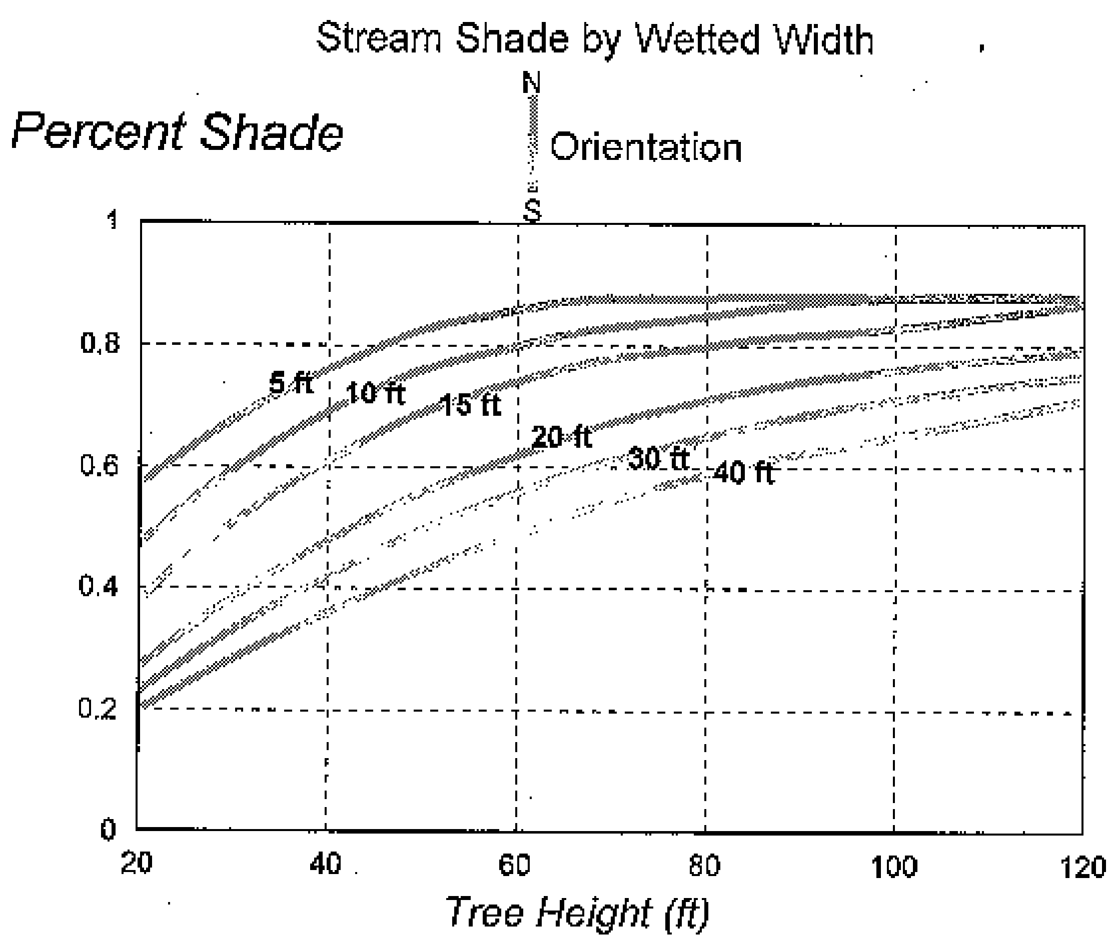
Appendix A

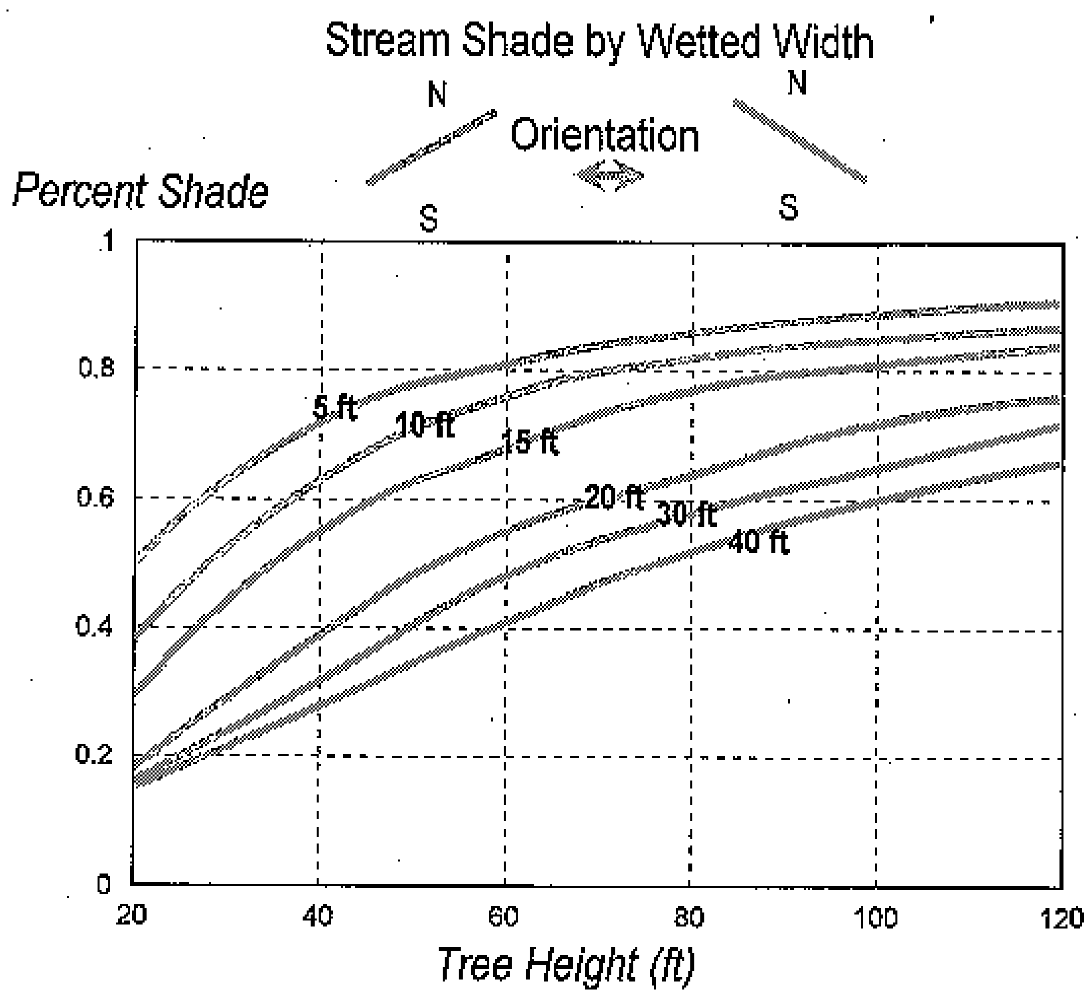
Stream Shade Curves

Stream Shade Information

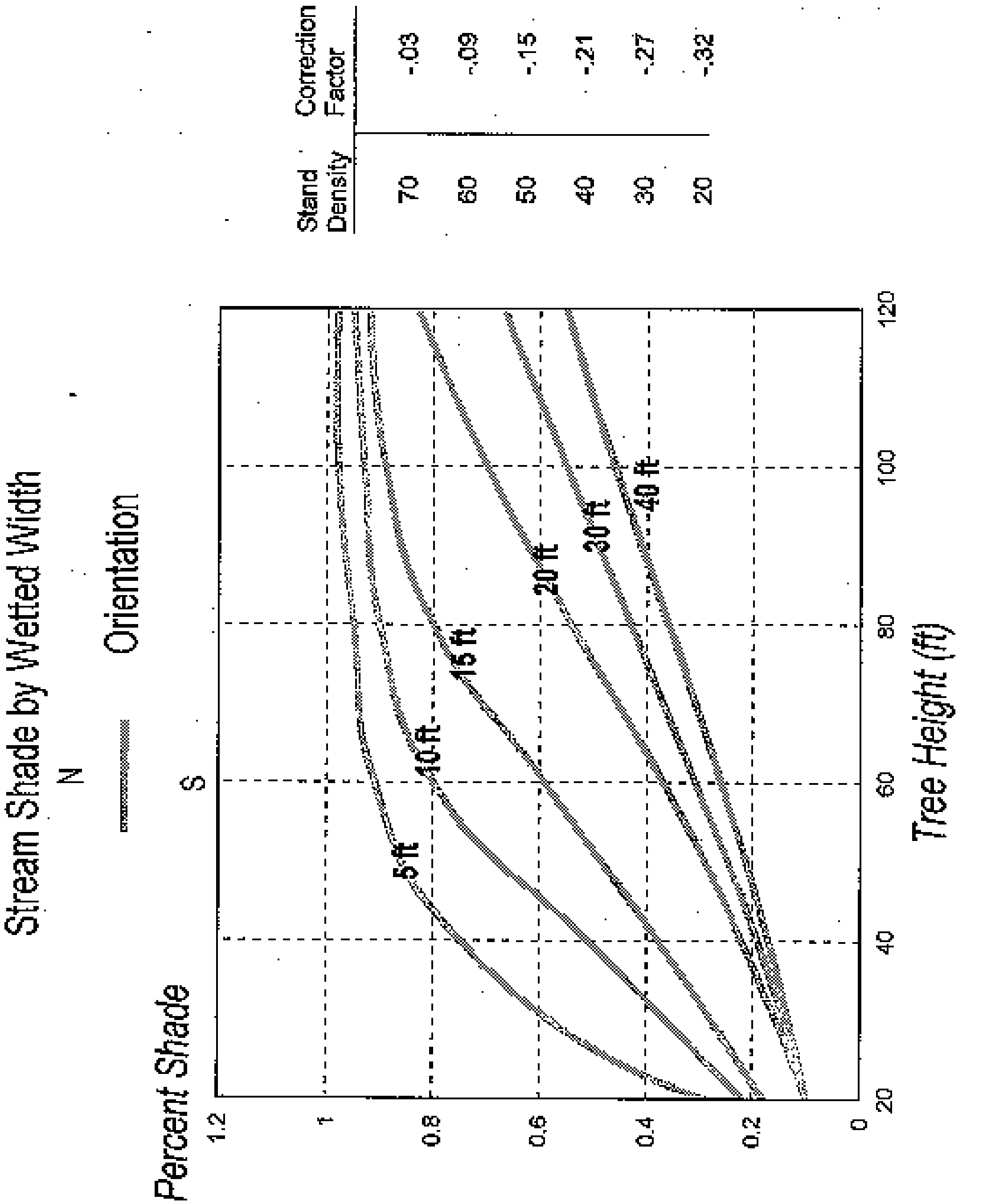




Stand Density	Correction Factor
70	-.03
60	-.06
50	-.09
40	-.15
30	-.23
20	-.34



Stand Density	Correction Factor
70	-.02
60	-.04
50	-.09
40	-.16
30	-.24
20	-.34



Total shade values and solar loading for the South Fork Coquille River above the Forest Boundary (reproduction of Table 4) :

Target Shade Value	Existing Shade Value	Increase Needed
82 %	62 %	20 %
Target Solar Loading or TMDL	**Existing Solar Loading**	**Reduction Needed**
439 BTU/sqft/day	927 BTU/sqft/day	488 BTU/sqft/day

Calculation of TMDL for Solar Energy

The solar loading on the system is determined from the amount of unshaded stream and the available solar radiation. The amount of unshaded stream was calculated as a weighted average of all the reaches in the basin, including the major tributaries. For the South Fork Coquille above the Forest boundary, the table above shows the existing and target shade values and the increase desired. That is,

Current percent of stream that is **unshaded** = (100%) - (existing shade value)
= 100% - 62% = 38%

Target percent of stream that is **unshaded** = (100%) - (target shade value)
= 100% - 82% = 18%

The available solar radiation is a constant value for a given lattitude on a given day assuming clear sky conditions. For 42 degrees lattitude on August 1, the available solar radiation is 2440 BTU's per square foot per day.

The existing solar loading is calculated as the existing unshaded area multiplied by the available solar radiation.

Existing solar loading = (existing shade value) X (available solar radiation)
927 BTU/sf-day = 38% X 2440 BTU/sf-day

The target solar loading is calculated as the target unshaded area multiplied by the available solar radiation.

Existing solar loading = (target shade value) X (available solar radiation)
439 BTU/sf-day = 18% X 2440 BTU/sf-day

Current exceedence of TMDL = (Existing solar loading) - (Target solar loading)
= 927 BTU/sf-day - 439 BTU/sf-day
= 488 BTU/sf-day

Appendix B

Seral Stage Definition

Definition of Seral Stages

VERY EARLY, PIONEER - Consists of species capable of coming in in open, disturbed areas. Clear dominance of seral species. PNC (see definition below)species absent or in very low numbers. Change may be slow if seed sources for PNC species are distant. Generally less than 50 years old.

EARLY SERAL - Usually rapidly changing plant community. Some PNC species present but seral species dominate. Rate of PNC species colonization of the site may be slow. Stage in forest development that includes seedling, sapling, and pole-sized trees. Average age is 100 years old, with a range from 50 to 150 years old.

MID SERAL - Climax species dominates regeneration and understory layer and some are starting to make it into the overstory layer. Rather rapidly changing plant community. PNC species are increasing and colonizing the site. They are at about equal proportions with seral species. Average age is 150 years old, with a range from 100 to 200 years.

LATE SERAL - Often slowly changing plant community. PNC species are dominant but some seral species still persist. Greater than 200 years old.

CLIMAX - End point of succession (same as potential natural vegetation) where neither plant composition nor stand structure changes. The potential natural plant community that appears to be self-perpetuating in the absence of disturbance and there is no concrete evidence it is followed by a different subsequent community. It usually is not completely stable but fluctuates around a modal composition and dominance of species. Greater than 300 years old.

PNC - Potential Natural Community. The biotic community that one presumes would be established if all successional sequences of its ecosystem were completed without additional human-caused disturbance under present environmental conditions.

Appendix C

Macroinvertebrate Survey Results

Rock Creek, at transect

Siskiyou National Forest - Powers Ranger District, 1994

SITE SUMMARY AND GENERAL HABITAT NOTES:
Based on an analysis of the macroinvertebrate community and a visual habitat assessment, limiting factors to biotic/habitat integrity appear to be:

Water temperature: Several warm-water indicators are present, but in low abundance. Few cool/cold-water indicators present.

Channel cross-section: moderately wide and shallow

Channel roughness and stepping: low. Large woody debris and boulders are absent. Potential for substrate resorting and scour at higher flows is high. Lack of scour-intolerant organisms and low long-lived taxa richness support this observation.

Embedding of riffle armor layer rocks; plus filling in of pools, pockets and alcoves with sand/fine gravel: moderate. Sand is embedding the armor layer in all habitat areas (25-35%) but does not appear to be filling all available crevice space, as crevice dwellers are present in moderate abundance.

Shading from riparian vegetation: low

Siltation: low. Minor deposits noted in margin areas.

Rare or sensitive taxa: absent

Comments: Scour is a problem during high flows, as evidenced by the lack of scour-intolerant taxa. Substrate resorting, though not serious, is having some effect on benthic community (few long-lived taxa) as well. However, the invertebrate community does not appear to be fully exploiting the habitat available at this site.

EROSIONAL HABITAT (Riffle): Main points that can be made about erosional habitats are:

Total Score= 56.56%, low
Primary Metric Score= 44.44%, low
Positive Indicator Score= 35.71%, very low
Negative Indicator Score= 85.42%, high

Total abundance= 1231, high
General taxa richness= 38 (total), 21 (EPT), low to moderate
Dominance of community by a single taxon= 48.32%, very high

Positive Indicator feeding groups: very low predator, shredder, and scraper richness
Cool-cold water adapted taxa (Intolerant) are: moderate richness and abundance
Positive Indicator taxa and taxa assemblages: Poorly developed, with several notable absences (including: tolerant caddisflies, dipterans, and *Cricotopus (Nostococladius) sp.*)

Negative Indicator feeding groups: low collector abundance, parasites absent
Negative Indicator or tolerant taxa: poorly developed, a few Oligochaetes, tolerant snails, and tolerant beetles present.

Diversity or erosional habitat is: moderate. More large woody debris would reduce scour and substrate resorting, increase retention capability, and increase overall habitat diversity.

MARGIN HABITAT: Main points that can be made about margin habitats are:

Total Score= 56.12%, low
Primary Metric Score= 50%, low
Positive Indicator Score= 26.67%, very low
Negative Indicator Score= 83.33%, high

Total abundance= 86, very low
General taxa richness= 20 (total), 12 (EPT), low
Dominance of community by a single taxon= 19.77%, low

Positive Indicator feeding groups: high scraper abundance, but low richness
Cool/cold water adapted taxa (Intolerant) are: essentially absent
Positive Indicator taxa and taxa assemblages: essentially absent

Fouling of margin by silt, FPOM or filamentous algae is: low
Shading from riparian vegetation is: low
Exposure, desiccation, and waterline fluctuation during warm months is: moderate
Embedding of margin rocks is: ? moderate
Winter scour appears to be: moderate to high

DETRITUS HABITAT (CPOM): Main points that can be made about detrital habitats are:

Total Score= 58.33%, low
Primary Metric Score= 35%, very low
Positive Indicator Score= 17.86%, very low
Negative Indicator Score= 91.67%, very high

Total abundance= 256, very low
General taxa richness= 20 (total), 11 (EPT), very low
Dominance of community by a single taxon= 43.36%, high

Positive Indicator feeding groups: low shredder richness
Cool/cold water adapted taxa (Intolerant) are: essentially absent
Positive Indicator taxa and taxa assemblages: essentially absent

Inputs of deciduous or herbaceous detritus is: moderate
Inputs of more recalcitrant coniferous detritus is: moderate
Detrital habitat diversity is: moderate

Retention capability of the stream channel is: moderate

Rock Creek at transect, 10/12/94

Siskiyou National Forest, Oregon

BENTHIC INVERTEBRATE BIOASSESSMENT-ABA, January 1995 Version

	File: ROCKBIO	RIFFLE		MARGIN		CPOM	
	METRIC	Value	Score	Value	Score	Value	Score
1	PRIMARY METRICS						
2	Total abundance	1231	2	86	0	256	0
3	Total taxa richness	38	1	20	1	20	1
4	EPT Taxa richness	21	1	12	1	11	1
5	%Dominant taxa	48.32	0	19.77	4	43.36	1
6	Community Tolerance	1.53	4	3.69	4	2.62	4
7	POSITIVE INDICATORS						
8	Predator richness	9	0				
9	%Scraper			67.44	4		
10	Scraper richness	13	1	7	1		
11	Caddis scraper richness			2	1		
12	Shredder richness	4	0			5	1
13	Caddis SH richness					2	1
14	Stonefly SH richness					3	2
15	Xylophage richness	0	0			0	0
16	%Intolerant mayflies	7.24	4	0	0		
17	%Intolerant stoneflies	0.26	1	0	0	0	0
18	%Intolerant caddisflies	0	0	0	0		
19	%Intolerant dipterans	0	0				
20	Intol. mayfly richness	2	2				
21	Intol. stonefly richness	1	1			0	0
22	Heptageniidae richness	2	2	1	0		
23	Ephemerellidae richness	3	3				
24	Nemouridae richness	2	1			1	0
25	*Pteronarcys*	0	0			0	0
26	%Glossosomatidae	0.52	1	0	0		
27	%Philopotamidae	0	0				
28	% Arctopsy/Psychomyiid	0	0	0	0		
29	*Rhyacophila* richness	4	3				
30	%*C. Nostococladius*	0	0	0	0		
31	Long-lived taxa richness	2	1	3	1	4	1
32	Class 0 taxa richness	0	0	1	1	0	0
33	NEGATIVE INDICATORS						
34	%Collector	23.55	4	10.45	4	9.37	4
35	%Parasite	0	1	0	1	0	1
36	%Oligochaeta	0.52	2	0	2	0	2
37	%Leech	0	1	0	1	0	1
38	%Tolerant snails	0.26	3	0	4	18.75	0
39	%Tolerant amphipods	0	1	0	1	0	1
40	%Tolerant odonates	0	2	0	2	0	2
41	%Tolerant mayflies	0	4	1.16	2	0	4
42	%Tolerant caddisflies	0	4	0	4	0	4
43	%Tolerant beetles	6.46	1	9.3	1	0	4
44	%Tolerant dipterans	0	4	0	4	0	4
45	Tol. mayfly richness	0	2	1	1	0	2
46	Tol caddisfly richness	0	2	0	2	0	2
47	Tol. beetle richness	3	1	1	3	0	4
48	Tol. dipteran richness	0	4	0	4	0	4
49	%Simuliidae	0.52	1	0	1	0	1
50	%Chironomidae	4.13	4	10.47	3	4.3	4

SUMMARY SCORES	Score	%
RIFFLE TOTAL	69	56.1
Primary subtotal	8	44.4
Positive Indicators	20	35.1
Negative Indicators	41	85.4
MARGIN TOTAL	58	59.2
Primary subtotal	10	50.0
Positive Indicators	8	26.7
Negative Indicators	40	83.3
CPOM TOTAL	56	58.3
Primary subtotal	7	35.0
Positive Indicators	5	17.9
Negative Indicators	44	91.7

80-100% High habitat/biotic integrity

60-79% Moderate habitat/biotic integrity

40-59% Low habitat/biotic integrity

<40% Severe habitat/water qual. limited

Aquatic Biology Associates, 3490 NW Deer Run Rd., Corvallis, OR 97330, 503-752-1568 FAX 503-754-2460 File: BIO

Rock Creek at transect, 10/12/94, Riffle

Siskiyou National Forest, Oregon
Benthic invertebrate biomonitoring samples.
Abundance per m2. ABA Protocol-5 point composite

IDENTIFICATION CODE	
CORRECTION FACTOR	3.18

Taxon	Abun.	%
Oligochaeta	6.36	0.52
Juga	3.18	0.26
TOTAL: NON INSECTS	9.54	0.78
Acentrella	22.26	1.81
Baetis tricaudatus	19.08	1.55
Caudatella hystrix	3.18	0.26
Drunella doddsi	85.86	6.98
Ephemerella inermis/infrequens	6.36	0.52
Epeorus-early instar	3.18	0.26
Rhithrogena	594.7	48.32
Paraleptophlebia heteronea	9.54	0.78
Ameletus	3.18	0.26
TOTAL: EPHEMEROPTERA	747.3	60.72
Capniidae-early instar	3.18	0.26
Leuctridae-early instar	3.18	0.26
Malenka	6.36	0.52
Zapada cinctipes	3.18	0.26
Calineuria californica	111.3	9.04
Perlodidae-early instar	41.34	3.36
TOTAL: PLECOPTERA	168.5	13.70
Glossosoma	6.36	0.52
Hydropsyche	101.8	8.27
Rhyacophila Betteni Gr.	12.72	1.03
Rhyacophila Brunnea Gr.	3.18	0.26
Rhyacophila Hyalinata Gr.	12.72	1.03
Rhyacophila narvae	3.18	0.26
TOTAL: TRICHOPTERA	139.9	11.37
Cleptelmis	3.18	0.26
Heterlimnius	3.18	0.26
Optioservus quadrimaculatus	60.42	4.91
Ordobrevia nubifera	3.18	0.26
Zaitzevia parvula	15.9	1.29
TOTAL: COLEOPTERA	85.86	6.98
Diptera	6.36	0.52
Ceratopogoninae	3.18	0.26
Maringodixa	3.18	0.26
Simulium	6.36	0.52
Antocha	3.18	0.26
Dicranota	3.18	0.26
Hexatoma	3.18	0.26
TOTAL: DIPTERA	28.62	2.33
Chironomidae-pupae	12.72	1.03
Eukiefferiella	28.62	2.33
Orthocladius Complex	9.54	0.78
TOTAL: CHIRONOMIDAE	50.88	4.13
GRAND TOTAL	1231	100.00

Rock Creek at transect, 10/12/94, Margin

Siskiyou National Forest, Oregon
Benthic invertebrate biomonitoring samples.
Abundance per m2. ABA Protocol-5 point composite

IDENTIFICATION CODE	
CORRECTION FACTOR	1

Taxon	Abun.	%
Hydrobiidae	17	19.77
TOTAL: NON INSECTS	17	19.77
Acentrella	1	1.16
Centroptilum	1	1.16
Nixe criddlei	3	3.49
Rhithrogena	15	17.44
Paraleptophlebia debilis	1	1.16
TOTAL: EPHEMEROPTERA	21	24.42
Capniidae-early instar	4	4.65
Calineuria californica	4	4.65
Perlodidae-early instar	3	3.49
TOTAL: PLECOPTERA	11	12.79
Micrasema	2	2.33
Hydropsyche	1	1.16
Limnephilidae	1	1.16
Neophylax	14	16.28
TOTAL: TRICHOPTERA	18	20.93
Eubrianax edwardsi	8	9.30
TOTAL: COLEOPTERA	8	9.30
Dicranota	2	2.33
TOTAL: DIPTERA	2	2.33
Chironomini	1	1.16
Eukiefferiella	3	3.49
Orthocladiinae	3	3.49
Orthocladius Complex	1	1.16
Tanytarsini	1	1.16
TOTAL: CHIRONOMIDAE	9	10.47
GRAND TOTAL	86	100.00

Rock Creek at transect, 10/12/94, CPOM

Siskiyou National Forest, Oregon

Benthic invertebrate biomonitoring samples.

Abundance per m2. ABA Protocol-5 point composite

IDENTIFICATION CODE	
CORRECTION FACTOR	1

Taxon	Abun	%
Juga	48	18.75
Pacifasticus	1	0.39
TOTAL: NON INSECTS	49	19.14
Baetis tricaudatus	3	1.17
Cinygmula	3	1.17
Rhithrogena	14	5.47
Paraleptophlebia debilis	10	3.91
TOTAL: EPHEMEROPTERA	30	11.72
Capniidae-early instar	30	11.72
Malenka	6	2.34
Calineuria californica	10	3.91
Hesperoperla pacifica	1	0.39
Taeniopterygidae	1	0.39
TOTAL: PLECOPTERA	48	18.75
Lepidostoma-early instar	111	43.36
Hydatophylax hesperus	4	1.56
TOTAL: TRICHOPTERA	115	44.92
Dixa	2	0.78
Meringodixa	1	0.39
TOTAL: DIPTERA	3	1.17
Brillia	1	0.39
Corynoneura	5	1.95
Tanypodinae	2	0.78
Thienemanniella	2	0.78
Tvetenia	1	0.39
TOTAL: CHIRONOMIDAE	11	4.30
GRAND TOTAL	256	100.00

Appendix D

Fisheries Habitat Benchmarks

Benchmarks for Evaluating Stream Survey Data
Rock Creek - Siskiyou National Forest

	Poor	Good
Pools		
Pool Area (% of total surface area)	< 10%	> 30%
Pool Frequency (pools per channel width)	0.05	0.12

Source of Values: ODFW Benchmarks (1992/93), Siskiyou National Forest Monitoring
Source of Data: Interagency Aquatic Database and GIS CD, Stream surveys, monitoring surveys.

Large Wood Material		
Wood Key Pieces/Mile	<5/mile	20/mile

(24 inches diameter X 50 feet in length or twice the active channel width in length)*Source of Values*: Siskiyou Mtns. Matrix of Factors and Indicators (1996), Siskiyou National Forest Monitoring.
Source of Data: Interagency Aquatic Database and GIS CD, Stream surveys, Monitoring surveys.

Riparian Vegetation		
Percent of Trees in Seral Stage by Age Class (Small Tree, Large Tree)	<25% LT	75% LT

Outer Riparian Zone (Zone 2),Vegetation 25 feet to 100 feet from active channel margin.
(Small Tree = <20 inches diameter, Large Tree = >20 inches diameter) *Source of Values:* Professional judgement
Source of Data: Forest Service, BLM and ODFW stream surveys, air photo interpretation, forest stand surveys

Individual Attribute Discussion

Average Riffle Width: This attribute is the average wetted riffle width of the stream reach surveyed. Riffle width was used here to calculate pool frequency.

Pool Frequency: Pool frequency was calculated by dividing the number of pools in the reach by the number of riffle widths in the reach length. Therefore, a pool frequency of 1/10 or 0.1 would translate to one pool per ten wetted widths. A pool frequency of 0.1 or higher would be expected in a functioning low gradient reach (<3% gradient) with pool/riffle morphology.

Percent Pool Area: Pool area is calculated by dividing the surface area of pool habitat by the total surface area of the wetted habitat surveyed.

Large Wood Material: Large wood is included in this rating only if the dimensions are large enough to serve as a key piece to collect smaller pieces of wood in complexes. Diameters of these key pieces are equal to or greater than 24 inches and the length is 50 feet or twice the bankfull width.

Pools Greater Than 3 Feet Per Mile: This attribute was calculated utilizing residual pool depth (the depth of the pool minus the depth at the pool tail crest). All pools greater than 3 feet in residual pool depth were tallied and divided by the length in miles of the survey reach.

Riparian Forest Seral Stages: Forest Service stream surveys measure the relative size of trees in the riparian zones along fish bearing streams. The inner zone, from bankfull width to 25 feet is typically alder and hardwood dominated. The outer riparian zone, 25 feet to 100 feet from the bankfull edge was used here for rating the health of the riparian zones. The expected range of seventy-five percent (75%) large trees greater than twenty inches (20") diameter are designated as Large Trees (LT). Trees less than twenty inches (20") diameter are designated Small Trees (ST).

Appendix E

Site Specific Treatment Areas

Restoration Priorities for Federal Lands

Silviculture/Shade:

Subwatershed	***Reaches***	***Action***
Mainstem	2-19, 21-25 27-33, 35, 41-42	Interplant conifers between floodplain and encroaching road.
Johnson Creek		
Poverty Crk	3,5,6,7	Manual release of existing conifers.
Nickel Crk	1,2	Interplant conifer in alder dominated areas.
Rock Creek	1	Reestablish vegetation on existing slides.
	2	Plant conifers between floodplain and encroaching road.
	7	Reestablish vegetation on existing slide.
Wooden Rock Crk	3,7,11,12	Manual release of existing conifers and plant conifers in open areas.

Sediment Reduction:

Subwatershed	***Location***	***Action***
Mainstem	Road 33 MP 51.75	Provide rock overflow protection at debris flow prone crossing.
	MP 52.61	Upgrade culvert.
	MP 53.1	Buttress unstable fill slope adjacent to river.
	MP 59.45	Upgrade culvert.
	Road 3348.080 0.08	Upgrade Culvert
	Road 3358 MP 1.1	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 1.3	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 2.5	Realign road to eliminate fill slope, provide additional surface drainage.

	MP 2.85	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 3.3	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 5.13	Construct retaining wall to eliminate side-cast fill, provide additional surface drainage.
	MP 5.95	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 6.6	Construct retaining wall to eliminate side-cast fill, provide additional surface drainage.
	MP 6.7	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 7.3	Realign road to eliminate fill slope, provide additional surface drainage.
	MP 11.19	Upgrade culvert.
	Road 3358.180, 3.28	Upgrade culvert.
	Road 5560, MP 0.17	Realign road to eliminate fill slope.
	MP 2.95	Upgrade culvert.
Johnson Creek	Road 3353, MP 1.81	Upgrade culvert.
	MP 8.0	Buttress unstable fill adjacent to river.
	MP 11.33	Upgrade culvert.
	MP 12.10	Upgrade culvert
	MP 12.40	Upgrade culvert.
	MP 12.70	Upgrade culvert.
Rock Creek	Road 33, MP 44.47	Upgrade culvert.
	MP 44.48	Upgrade culvert.
	MP 44.50	Buttress fill slope to protect against future overflows.
	MP 45.32	Upgrade culvert.
	MP 46.0	Upgrade culvert. Buttress fill slope.
	MP 46.2	Upgrade culvert. Buttress fill slope.
	MP 46.6	Realign road to eliminate fill slope.
	MP 46.7	Build retaining wall to eliminate fill slope.
	MP 46.75	Realign road to eliminate fill slope.
	MP 47.07	Upgrade culvert.
	MP 47.14	Build retaining wall to eliminate fill slope. Buttress unstable cut slopes.
	MP 47.25	Buttress unstable cut slope.
	MP 47.31	Build retaining wall to eliminate fill slope. Provide additional surface drainage.
	Road 3347, MP 1.75	Add overflow culvert.
	MP 5.08	Upgrade culvert.
	Road 3347.020 0.40	Upgrade culvert.
	Road 5325, MP 25.9	Upgrade culvert.

Road Decommissioning:

A transportation management plan is currently being prepared and is scheduled for completion in March 1999. This plan will identify the expected long-term transportation network required to provide the multiple uses of the National Forest. A by product of this effort will be the identification of roads that have limited future need/value. This subset will be evaluated in concert with identified areas of high watershed sensitivity to develop a prioritized list of roads to be removed from the system. Treatment of these high risk road systems will be accomplished as funding allows.

Potential Water Quality, Fishery, and Riparian Inventory and

Habitat Enhancement Project Sites
The Timber Company Lands

1) **Legacy Road Inventory--TTC roads in the Upper South Fork, Foggy Creek, Clear Creek, and Wooden Rock Creek drainages.**
2) **Fish Passage Culvert Replacement**--Coordinate and cooperate with USFS on replacement or removal of culvert on tributary to Wooden Rock Creek (T.32S.; R.11W.; Section 1).
3) **Riparian Enhancement Project Sites**--

Reach Number	Reach Length	Current Situation	Potential Enhancement Prescription
SFC (Various--China Flat Campground Area)	Approx. 10,000'	Wide, sunny stream channel with small conifers/hardwoods on adjacent hillsides	Thin/release conifers; potential small hardwood conversion blocks
SFC43.2	1,200'	Beaver dam complex; dead/dying riparian vegetation	Plant conifers; intensive vegetation and beaver control
WOO3.1	2,900'	Open areas in riparian canopy; heavy herbaceous vegetation	Plant conifers; intensive vegetation control and protection from animals
CLE6.1	500'	Beaver dam complex; dead/dying riparian vegetation	Plant conifers; intensive vegetation and beaver control
FOG2	550'	Open areas in riparian vegetation	Plant conifers; intensive vegetation control and protection from animals
SFC (Various above Foggy Creek)	1,500'	Open areas in riparian zone; heavy herbaceous growth and beaver population; frost pocket conditions	Plant frost-resistant conifers; heavy competition and beaver control; protection from animal damage

Appendix F

Road Failure Key Findings from 1996 Floods

ROAD DAMAGE

KEY FINDINGS

Diversions

1. Many mid and upper slope road/stream crossings have the potential to divert water out of its channel, so that it flows along the road. Diversion of small intermittent or ephemeral streams resulted in some of the most extensive erosion damage.

2. Diversions greatly increase the effects of road failure sites. At the sites evaluated, diversions increased sediment delivery an average of nearly ten times over sediment that is delivered if the water is not diverted and erodes only the road fill at the crossing.

3. Ditch flow and diversions are often carried long distances where the road surface angle inslopes, or dips toward the cutbank. Some diversions were up to 1400 meters long.

4. Treatments designed to prevent diversions may not be totally effective. One diversion with major effects occurred at a site where the road had a broad-based dip. A debris flow deposited material in the dip, and the flow diverted around it and down the road.

Debris Flows

1. Roads prisms often stop or significantly reduce the size of debris flows. Inlet basins are typically completely filled with debris and sediment, and the road fill eventually is eroded. Large wood was often captured at road crossings and was not delivered downstream.

2. Landslides initiating debris flows that damaged roads often move again; material trapped behind debris dams in stream channels is often released when the dam breaks or decomposes. Repair designs should plan for these future movements of landslides and reactivation of debris dams.

3. Road crossings that survived debris flows with least damage had paved surfaces and no diversion potential. Paved surfaces minimized the amount of erosion caused by water flowing over the fill after the crossing overtopped.

Road Design, Maintenance, and Reconstruction Factors

1. Most forest roads have not been designed to minimize severe erosion.

2. Several repairs made immediately after the storm were simple replacements of what failed and did nothing to reduce the likelihood of future failure (i.e. same size culvert, no diversion prevention measures). Many of the damage sites exposed old buried culverts at a lower elevation in the road fill, indicating that the sites had failed in previous storms and may fail again.

3. There are ephemeral channels on each district that have no drainage structure where they intersect a road. Some of these caused road failures; others contributed to failures at larger stream crossings.

4. Small pieces of wood commonly initiated debris plugging of culverts[1].

5. Both the number and the size of failures increase with lower hillslope position.

6. Relatively few road failures can be attributed to inadequate maintenance, based on evidence after the event.[2] Where lack of maintenance was apparent as a cause of failure, the symptoms were rusted out pipes or live vegetation blocking culvert inlets or outlets. Increased maintenance during storms, as drainage problems develop, greatly decreases damage.

Stream Channels

1. Road failures greatly increased storm effects on some channels, but left no visible effects on others.

2. Sediment delivery to streams from road damage varied by site from none to 100 percent. The average amount delivered was 75% of the total failed volume.

3. On Gold Beach and Chetco Districts little sediment was delivered directly into fish bearing streams. On the Powers District, 35 percent of the total sediment volume was delivered directly into fish bearing streams, compared to less than 10 percent on the Illinois Valley District.

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[1] Finding consistent with those of the Region 6 Pacific Northwest Floods of 1996 summary.