Lower Sucker Creek
Illinois River Subbasin

TOTAL MAXIMUM DAILY LOAD
and
WATER QUALITY MANAGEMENT PLAN

(Lower Section of Sucker/Grayback Watershed: 1710031103)
(USFS boundary at Mile 10.4 to the Mouth)

April 2002

DEQ
State of Oregon
Department of Environmental Quality

Prepared by:	The Oregon Department of Environmental Quality
With submissions from :	Bureau of Land Management, Medford District; Oregon Department of Agriculture; Oregon Department of Forestry; and Oregon Department of Transportation.

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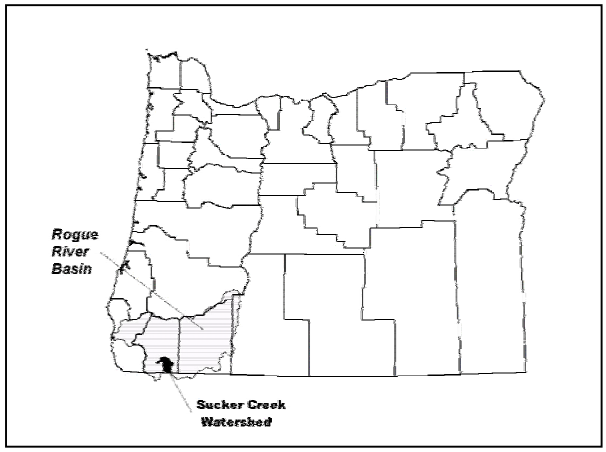
Lower Suc ker Creek Executive Summary



Summary Introduction

Section 303(d) of the Federal Clean Water Act (CWA) requires that a list be developed of all impaired or threatened waters within each state. This list is called the 303(d) list after the section of the CWA that requires it. In Oregon, the Oregon Department of Environmental Quality (DEQ) is responsible for this work. Section 303(d) also requires that the state establish a Total Maximum Daily Load (TMDL) for any waterbody designated as water quality limited (with a few exceptions, such as in cases where violations are due to natural causes). TMDLs are written plans and analyses established to ensure that waterbodies will attain and maintain water quality standards.

The Lower Sucker Creek Watershed has stream segments listed on the 1998 Oregon 303(d) list for temperature, habitat, and flow modification. Lower Sucker Creek, located in southwest Oregon in the Illinois River Subbasin, is defined in this report as the area that includes all BLM managed lands below the USFS boundary at mile 10.4 on Sucker Creek, and all private and county managed lands in the watershed – both above and below mile 10.4. The DEQ is proposing to establish a TMDL for temperature for the listed streams in the Lower Sucker Creek Watershed. For streams in the Sucker Creek Watershed above mile 10.4, managed by the BLM and USFS, a TMDL has been developed and is currently being implemented (March 1, 1999 Sucker/Grayback TMDL and WQMP).

TMDL Summary

<u>Temperature:</u> The temperature water quality standard uses numeric and qualitative triggers to invoke a condition that requires "no measurable surface water increase resulting from anthropogenic activities." The temperature TMDL targets anthropogenic sources of heat from two sources: 1. point source warm water discharges, 2. nonpoint source increases due to increased solar radiation loading. In the Lower Sucker Creek watershed there are no permitted point sources with temperature impacts thus 100% of heat load is assigned to nonpoint sources. The amount of solar radiation that reaches the stream when the steam is at *System Potential* conditions in terms of riparian vegetation and channel morphology is the *Loading Capacity*.

The numeric temperature standard for cold water salmonids in Sucker Creek during the rearing period is a seven-day moving average of daily maximums not to exceed 64^{o}F (17.8^{o}C). Under current conditions approximately 100% of the stream network modeled (mainstem of Sucker

Creek from mouth to Mile 10.4) experiences maximum daily temperatures above the standard under worst case conditions (usually occurring in early August).

The results of temperature modeling using a future conditions scenario termed *System Potential*, one that minimizes the effect of human sources of heat, demonstrates that significant improvements in temperature can be attained. The modeling predicts that by increasing the amount of effective shade on the stream and by narrowing the active channel, for the entire system (both Upper Sucker and Lower Sucker Creek) peak temperatures at the mouth of Sucker Creek can be expected to drop by approximately 10.5°F from those currently experienced (76.3°F current versus 65.8°F at *System Potential*). In addition when the *System Potential* condition is attained, over 50% of the modeled reach (mile 10.4 to mouth) was below 64°F (17.8°C).

However, since Sucker Creek at *System Potential* is not expected to reach the temperature standard of 64°F (17.8°C) during the hottest time of year, there are no temperature load allocations available to give to anthropogenic sources. 100% of the load allocation for Lower Sucker Creek is assigned to natural sources. Any activity that results in anthropogenic caused heating of the stream is unacceptable. To achieve the temperature TMDL, loading capacities (BTU/ft^2/day) and surrogate percent effective shade targets have been set for the watershed.

TEMPERATURE LOADING CAPACITY

- Lower Sucker Creek at *System Potential*: 927 BTU/ft^2/day
- Bear, Little Grayback, White Rock, and Windy Creeks at *System Potential*: 98 BTU/ft^2/day

TEMPERATURE SURROGATE TARGET

- Lower Sucker Creek at *System Potential*: 62% effective shade
- Bear, Little Grayback, White Rock, and Windy Creeks at *System Potential*: 96% effective shade

Percent effective shade is used as a surrogate target for nonpoint source temperature loading because it provides a measurable parameter to monitor. It can also be more directly translated into site specific restoration targets. Note: The 1999 Sucker/Grayback plan set a target loading for temperature of 634 BTU/Ft^2/day or 74% effective shade for the upper section of Sucker Creek.

Habitat and Flow Modification: The modification of habitat and flow is not the direct result of a pollutant although it does affect the beneficial uses of the Lower Sucker Creek Watershed. Because a pollutant is not the cause, the concept of establishing a loading capacity and allocations through the development of a TMDL does not apply. There is the expectation that the improvements in riparian vegetation that will be necessary to meet the temperature surrogate shade targets and the resulting changes in channel wetted width, and width-to-depth ratio, will also lead to improvements in habitat. Targets for flow as defined by current instream water rights are also recognized and recommended.

Water Quality Management Plan (WQMP) Summary

To address the TMDL a WQMP has been developed which addresses the 10 required elements:

1. Management measures
2. Time-line for implementation
3. Timeline for attainment
4. Responsible participants
5. Reasonable assurance of implementation
6. Monitoring and evaluation
7. Public involvement
8. Maintenance of effort over time
9. Discussion of costs and funding
10. Citation to legal authorities

A restoration strategy has been proposed which focuses on meeting TMDL surrogate measures for temperature by 1. Establishing, maintaining and improving riparian area vegetation and 2. decreasing wetted channel and zone of disturbance widths. The restoration strategy is included to provide guidance in the development and implementation of the Designated Management Agencies (DMA) specific Implementation Plans.

Each DMA in the watershed has or will be submitting an Implementation Plan designed to meet the requirements of the TMDL. The DMAs for the Lower Sucker Creek Watershed include: Oregon Department of Forestry, Oregon Department of Agriculture, Josephine County, Bureau of Land Management and Oregon Department of Transportation. Highlights of the plans are included in the WQMP as well as a time-line for implementation and monitoring. For those DMAs where Implementation Plans do not yet exist or are incomplete, the DMAs will be required to prepare and submit such a plan following the time-line once the Lower Sucker Creek TMDL is approved by the U.S. Environmental Protection Agency (EPA).

<table>
<tr><th colspan="2">Lower Sucker Creek TMDL Component Summary</th></tr>
<tr><td colspan="2">State/Tribe: <u>Oregon</u>
Waterbody Name(s): <u>Lower Sucker Creek Watershed defined as all streams within the 5th field HUC (hydrologic unit code) 1710031103 flowing through non-federal lands plus all federal lands from Sucker Creek river mile 10.4 (USFS boundary) to the mouth.</u>
Point Source TMDL:_____ Nonpoint Source TMDL:__X__ (check one or both)
Date: April 2002</td></tr>
<tr><th>Component</th><th>Comments</th></tr>
<tr><td>Pollutant Identification</td><td>Stream temperature is an expression of Heat Energy per Unit Volume and is expressed in English Units as BTU per cubic feet.

$$Temperature = \frac{Heat \quad Energy}{Volume} = \frac{Btu}{ft^3}$$
Pollutant: Heat Energy
Anthropogenic Contribution: Excessive Solar Energy Input</td></tr>
<tr><td>Target Identification

Clean Water Act: 303(d)(1)
40 CFR 130.2(f)</td><td><u>Applicable Water Quality Standards</u>
Temperature: OAR 340-41-365(1)(b)(A)
The seven day moving average of the daily maximum water temperature shall not exceed the following values unless specifically allowed under a Department-approved basin surface water management plan:

64°F (17.8°C) or 55°F (12.8°C).

Where 55°F (12.8°C) applies during times and in waters that support salmon spawning, egg incubation and fry emergence from the egg and from the gravel.

<u>Loading Capacities</u>
Temperature
Main Stem Sucker Creek (USFS boundary to the mouth)
No more than <u>927 BTU/ft²/day</u> climax solar loading or 62% effective shade as an average measured value over perennial stream length.
Bear Creek (mouth to headwaters)
No more than <u>98 BTU/ft²/day</u> climax solar loading or 96% effective shade as an average measured value over perennial stream length.
Little Grayback, White Rock, and Windy Creeks (Private lands)
No more than <u>98 BTU/ft²/day</u> climax solar loading or 96% effective shade as an average measured value over perennial stream length.

Habitat modification
Not viewed as a water quality pollutant under the Clean Water Act although it is recognized that habitat modifications may cause impairments which could lead to exceedance of water quality criteria. Measures to address the listed parameter causes are detailed in the goals and objectives portion of the WQMP.

Flow modification
Not considered a water quality pollutant but it is recognized that flow modifications may cause water quality impairments which could lead to exceedance of water quality criteria.</td></tr>
</table>

Existing Sources *CWA 303(d)(1)*	*Anthropogenic sources of thermal gain from riparian vegetation removal:* • Inappropriate forest management within riparian areas • Inappropriate riparian management within agricultural land use areas. • Inappropriate riparian management within non resource (rural residential) land use areas. *Anthropogenic sources of thermal gain from channel modifications:* • Mining, roads, inappropriate forest management within riparian area • Inappropriate riparian management within agricultural land use areas. • Inappropriate riparian management within non resource (rural residential) land use areas.
Seasonal Variation *CWA 303(d)(1)*	*Flow*: Low flow associated with maximum stream temperatures. Over allocation of flows in watershed, most prevalent during maximum stream temperature window. *Critical Conditions*: Increase desirable riparian vegetation height, density and width to System Potential conditions. Decrease wetted widths and near stream disturbance zone (NSDZ) to System Potential conditions. Increase low flows to meet instream rights. *Inputs*: Solar radiation increased by more exposed stream surface area as a result of decreased effective shade, decreased flow, and increased channel width.
TMDL/Allocations *40 CFR 130.2(g)* *40 CFR 130.2(h)*	*WLA*: No NPDES permitted point sources exist within the watershed *LA:* 100% of load allocation for temperature is given to natural sources. No additional allocations are available.
Margins of Safety *CWA 303(d)(1)*	Margins of Safety (MOS) demonstrated in critical condition assumptions regarding improvements upstream and on tributaries, groundwater inflow, shade and channel assumptions.
WQS Attainment Analysis *CWA 303(d)(1)*	Demonstration of temperature changes related to current and future channel and shade conditions at System Potential. Analytical assessment of simulated temperature change related to allocated solar loading.
Public Participation *40 CFR 25*	See Section 10 of the TMDL and Section 11 of the WQMP.

CHAPTER I

TOTAL MAXIMUM DAILY LOAD SUMMARY

Lower Sucker Creek, Illinois River Subbasin

(Lower Section of 1710031103 Sucker/Grayback Watershed)

Prepared by

Oregon Department of Environmental Quality – Rogue Basin Team

April 2002

Statement of Purpose: This Total Daily Maximum Load (TMDL) summary has been prepared to meet the requirements of Section 303(d) of the 1972 Federal Clean Water Act

1. INTRODUCTION

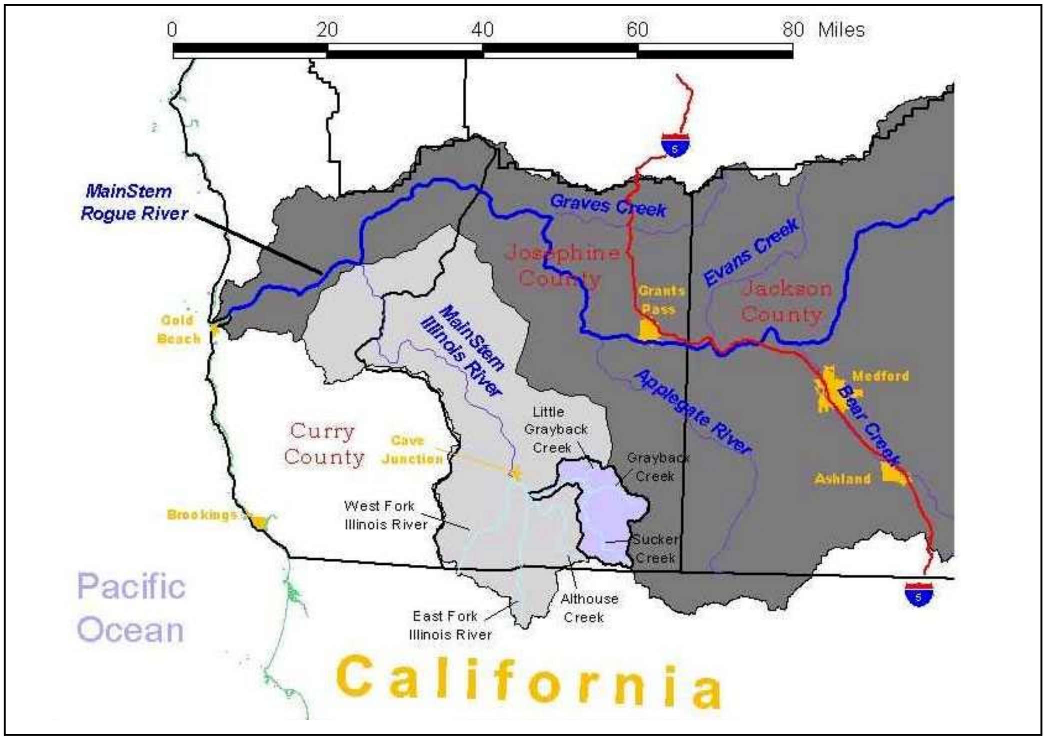
The Total Maximum Daily Load document was prepared by the Oregon Department of Environmental Quality (DEQ) with assistance from local partners. It seeks to clearly address the TMDL elements as defined and required by EPA and includes references to the accompanying Water Quality Management Plan (WQMP) where appropriate.

Oregon's TMDL Program

The quality of Oregon's streams, lakes, estuaries, and groundwaters is monitored by DEQ and partners. This information is used to determine whether water quality standards are being violated and whether the beneficial uses of the waters are being threatened. Beneficial uses include fisheries, aquatic life, drinking water, and recreation. Specific State and Federal plans and regulations are used to determine if violations have occurred: these regulations include the Federal Clean Water Act of 1972 and its amendments 40 Codified Federal Regulations131, and Oregon's Administrative Rules (OAR Chapter 340**)** and Oregon's Revised Statutes (ORS Chapter 468). The term water quality limited is applied to streams and lakes where required treatment processes are being used, but violations of State water quality standards still occur. With a few exceptions, such as in cases where violations are due to natural causes, the State must establish a TMDL for any waterbody designated as water quality limited. A TMDL is the total amount of a pollutant (from all sources) that can enter a specific waterbody without violating the water quality standards. The total permissible pollutant load is allocated to point, nonpoint, background, future sources of pollution and a margin of safety. Wasteload Allocations (WLA) are portions of the total pollutant load that are allotted to point sources of pollution, such as sewage treatment plants or industries and are used to establish effluent limits in discharge permits. Load Allocations are portions of the TMDL that are attributed to either natural background sources, such as natural runoff or background solar loading, or from nonpoint sources, such as agriculture or forestry activities. Allocations can also be set aside in reserve for future uses. Simply stated, allocations are quantified measures that assure water quality standard compliance. The TMDL is the sum of all developed allocations. Recently, several agencies have been mandated to take proactive roles in developing management strategies in the Illinois River Subbasin. Water Quality Management Plans for forested, agricultural, and rural residential lands that address the sources of pollution for Lower Sucker Creek have been, or are currently under development. It is imperative that these plans consider the relatively robust data that describe water quality, instream physical parameters and landscape features. These management efforts will require stakeholders, land managers, public servants and the general public to become knowledgeable of the water quality issues in the Illinois River Subbasin and to work together to solve them.

2. GEOGRAPHIC DESCRIPTION

Map 1 Location of Illinois Subbasin and Sucker Creek Watershed



The Sucker Creek Watershed is one of 13 watersheds (5th-fields) that make up the Illinois River Subbasin Map 1. Located entirely in Josephine County in Southwest Oregon, Sucker Creek covers an area of approximately 62205 acres (97 square miles) Table 1. Sucker Creek flows into the East Fork Illinois River at approximately river mile 4. The terrain within the watershed is rugged and steep with elevations varying from approximately 1400 to 5200 feet. The area is subject to warm, dry summers similar to the Mediterranean climates of California. Most precipitation falls between the winter months of November and April in the form of rain below 4000ft and snow above 4000 feet. Where the terrain is steep, precipitation runs off rapidly. This is particularly true in areas of heavy clay soils overlying bedrock, areas of sparse natural vegetation, or areas where vegetation has been removed (Illinois Valley Watershed Council, 1995)

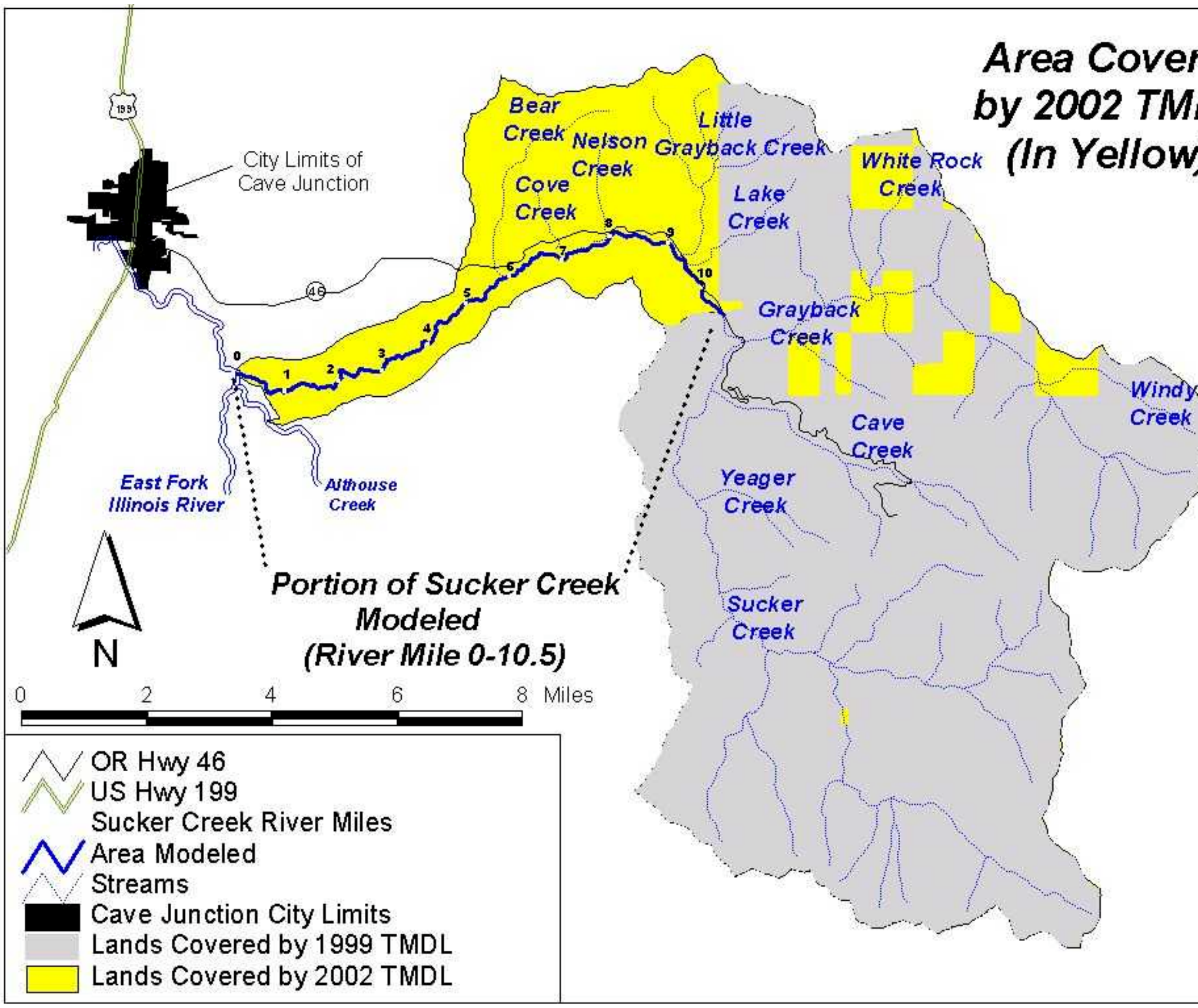
In 1999, DEQ prepared a TMDL for the federal lands in the Sucker Creek Watershed above the USFS boundary at Sucker Creek river mile 10.4. The March 1, 1999 Sucker/Grayback TMDL-WQMP addressed the 48,992 acres (77 square miles) of federally managed lands in the watershed. The lower portion of Sucker Creek is submitted as a separate landscape piece to facilitate planning efforts in the lower watershed. It includes all lands below the USFS boundary at river mile 10 plus all private holdings contained in the upper watershed (approximately 13427 acres total). Approximately 63% of the land in the area covered by the Lower Sucker Creek TMDL is under private ownership. The remainder is under BLM, State, and Josephine County jurisdiction (Table 1, Map 2, Map 3).

Table 1. Sucker Creek Ownership Covered by TMDL

Ownership	Total Watershed Acres	Sucker/Grayback TMDL/WQMP 1999 Acres	Lower Sucker Creek TMDL/WQMP 2002 Acres
USFS*	44,178	44,178	0
BLM	5,805	1,530	4,275
Private	11,014	0	11,014
State	62	0	62
County	682	0	682
Caves National Monument*	465	465	0
Totals	62,205	46,173	16,033

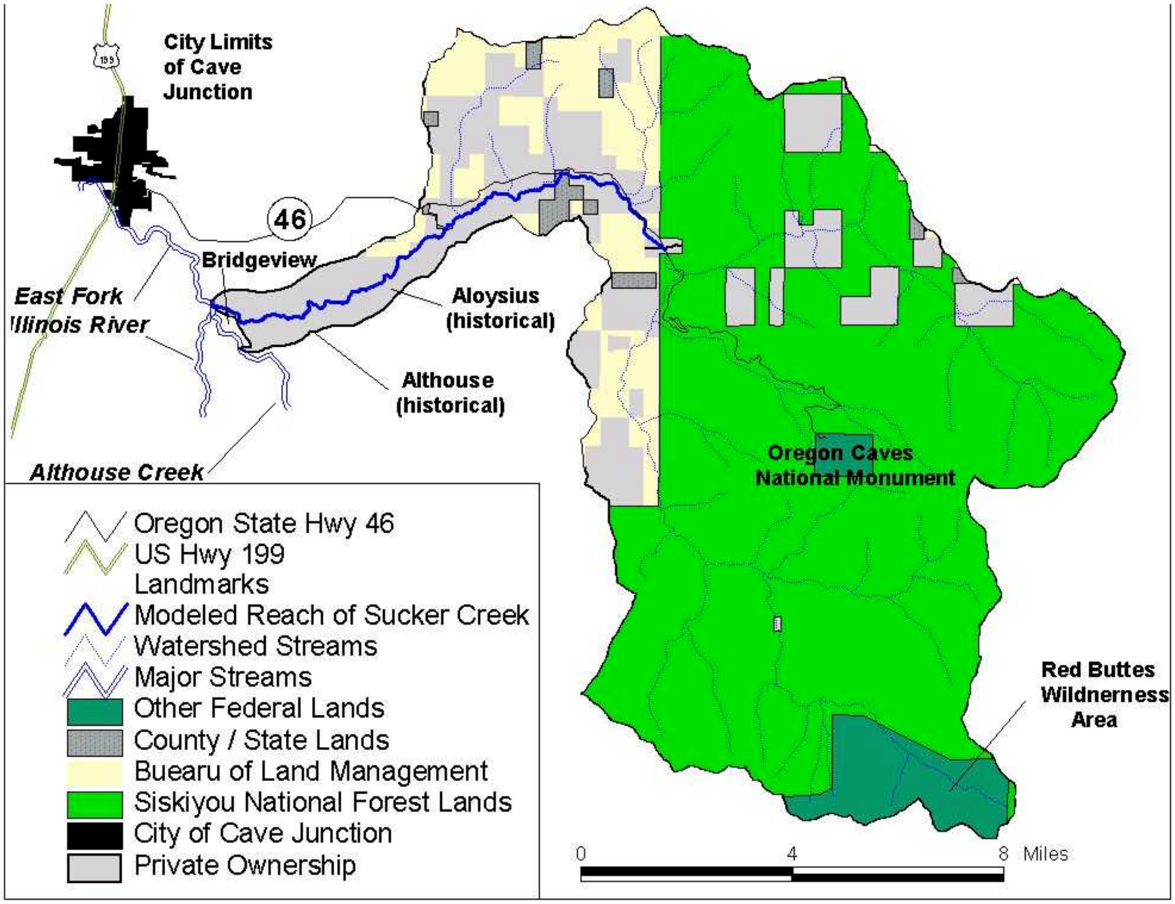
***Note:** all USFS and Oregon Caves National Monument lands in the Sucker Creek Watershed are covered in the 1999 Sucker/Grayback TMDL.

Map 2. TMDL Areas in the Sucker Creek Watershed



Sucker Creek is recognized as a very high priority for protection and restoration. It is one of the more important anadromous fish containing watersheds in the Rogue River Basin and contains 12 miles of fall chinook habitat, 15 miles of coho habitat, 18 miles of winter steelhead habitat. The watershed contains Core coho habitat (as defined by ODFW) in the mainstem, (upstream of Bear Creek river mile 5.8) and in Grayback Creek. The American Fisheries Society has designated Sucker Creek an *aquatic diversity area* and the BLM Medford District Resource Management Plan designates it a *key watershed*. It is one of the few watersheds in the Siskiyou Mountains with substantive snowpack most years and good cold water flow. Despite the changes caused by mining, inappropriate forest management, and downstream agriculture uses, Sucker Creek typically has good spawning numbers of coho salmon, fall chinook salmon, and winter steelhead.

Map 3. Ownership in Sucker Creek Watershed



3. APPLICABLE WATER QUALITY STANDARDS

Beneficial Uses
Oregon Administration Rule 340–041–362 designates the beneficial uses for the Rogue Basin including Sucker Creek (Table 2).

Table 2. Beneficial uses in the Sucker Creek Watershed

Beneficial Use	*Occurring*	*Beneficial Use*	*Occurring*
Public Domestic Water Supply	✓	Anadromous Fish Passage	✓
Private Domestic Water Supply	✓	Salmonid Fish Spawning	✓
Industrial Water Supply	✓	Salmonid Fish Rearing	✓
Irrigation	✓	Resident Fish and Aquatic Life	✓
Livestock Watering	✓	Wildlife and Hunting	✓
Boating	✓	Fishing	✓
Aesthetic Quality	✓	Water Contact Recreation	✓
Commercial Navigation & Trans.		Hydro Power	✓

The Oregon Environmental Quality Commission has adopted numeric and narrative water quality standards to protect designated *beneficial use*s. In practice, water quality standards have been set at a level to protect the most sensitive uses. Seasonal standards may be applied for uses that do not occur year round. Cold-water aquatic life such as salmon and trout are the most sensitive *beneficial uses* in the Sucker Creek Watershed.

Temperature Standard OAR 340-041-365(2)(b)(A)

A seven-day moving average of daily maximums (7-day statistic) was adopted as the statistical measure of the stream temperature standard. Absolute numeric criteria are deemed action levels and indicators of water quality standard compliance. Unless specifically allowed under a DEQ-approved surface water temperature management plan (as required under (OAR 340-041-0026(3)(a)(D)), no measurable surface water temperature increase resulting from anthropogenic activities is allowed in State of Oregon Waters determined out of compliance with the temperature standard. A much more extensive analysis of water temperature related to aquatic life and supporting documentation for the temperature standard can be found in the *1992-1994 Water Quality Standards Review Final Issue Papers (ODEQ, 1995)*.

The temperature standard applicable in the Sucker Creek Watershed specifies that "no measurable surface water temperature increase resulting from anthropogenic (human induced) activities is allowed" unless specifically allowed under a DEQ-approved management plan, when trigger temperatures are exceeded (see temperature standard below - i through vii).

It is important to understand the State of Oregon's temperature standard and that there is more to it than just a 64^{o}F criterion. Specifics for the Sucker Creek Watershed temperature standard can be found in the Rogue Basin Temperature Standard OAR 340-041-0365(2)(b)(A).

Table 3. Applicable Water Temperature Standards for Sucker Creek

Rogue Basin Temperature Standard - OAR 340-041-0365(2)(b)(A)(i-vii)
A) To accomplish the goals identified in OAR 340-041-0120(11), unless specifically allowed under a Department-approved surface water temperature management plan as required under OAR 340-041-0026(3)(a)(D), no measurable surface water temperature increase resulting from anthropogenic activities is allowed: (i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0°F (17.8°C); (ii) In waters and periods of the year determined by DEQ to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C); (iii) In waters determined by DEQ to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0°F (10.0°C); (iv) In waters determined by DEQ to be ecologically significant cold-water refugia; (v) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population; (vi) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/l or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or subbasin; (vii) In natural lakes.

Temperature Target Identification – CWA §303(d)(1)
The stream temperature TMDL targets protection of the most sensitive beneficial use: salmonids. Oregon's stream temperature standard, which is based on the temperature requirements of salmonids, is designed for protection during all salmonid life stages. Several numeric criteria and other triggers for the temperature standard establish factors for designating surface waters as water quality limited. The temperature standard specifies that anthropogenic (i.e. human caused) impacts that cause stream heating should be removed. The TMDL targets this no anthropogenic warming condition. A stream condition that has no anthropogenic induced warming is considered to be at the system potential.

Salmonid Stream Temperature Requirements

Salmonids, often referred to as cold water fish, and some amphibians are highly sensitive to temperature. In particular, Chinook salmon (*Oncorhynchus tshawytscha*) and bull trout (*Salvelinus confluentus*) are among the most temperature sensitive of the cold water fish species. Oregon's water temperature standard employs logic that relies on using these *indicator species,* which are the most sensitive. If temperatures are protective of *these indicator species*, other species will share in this level of protection.

Stream temperatures above 64°F (17.8°C) are considered sub-lethal and can be stressful for cold water fish species, such as salmon and trout.

If stream temperatures become too hot, fish die almost instantaneously due to denaturing of critical enzyme systems in their bodies (Hogan, 1970). The ultimate *instantaneous lethal limit* occurs in high temperature ranges (upper-90°F). Such warm temperature extremes have not been recorded in the Sucker Creek Watershed (see Table 5: Stream Temperature Monitoring Data).

More common and widespread within the Sucker Creek Watershed, however, is the occurrence of temperatures in the mid-70°F range (mid- to high-20°C range). These temperatures cause death of cold-water fish species during exposure times lasting a few hours to one day. The exact temperature at which a cold water fish succumbs to such a thermal stress depends on the temperature that the fish is acclimated to, and on life-stage of development. This cause of mortality termed the *incipient lethal limit*, results from breakdown of physiological regulation of vital processes such as respiration and circulation (Heath and Hughes, 1973).

The most common and widespread cause of thermally induced fish mortality is attributed to interactive effects of decreased or lack of metabolic energy for feeding, growth or reproductive behavior, increased exposure to pathogens (viruses, bacteria and fungus), decreased food supply (impaired macroinvertebrate populations) and increased competition from warm water tolerant species. This mode of thermally induced mortality, termed indirect or *sub-lethal*, is more delayed, and occurs weeks to months after the onset of elevated temperatures (mid-60°F to low-70°F). **Table 4** summarizes the modes of cold water fish mortality.

Table 4. Modes of Thermally Induced Cold Water Fish Mortality

(Brett, 1952; Bell, 1986, Hokanson et al., 1977)

Modes of Thermally Induced Fish Mortality	**Temperature Range**	**Time to Death**
Instantaneous Lethal Limit – Denaturing of bodily enzyme systems	> 90°F > 32°C	Instantaneous
Incipient Lethal Limit – Breakdown of physiological regulation of vital bodily processes, namely: respiration and circulation	70°F - 77°F 21°C - 25°C	Hours to Days
Sub-Lethal Limit – Conditions that cause decreased or lack of metabolic energy for feeding, growth or reproductive behavior, encourage increased exposure to pathogens, decreased food supply and increased competition from warm water tolerant species	64°F - 74°F 20°C - 23°C	Weeks to Months

Sensitive Beneficial Use Identification

Salmonid fish spawning, incubation, fry emergence, and rearing are deemed the most temperature-sensitive beneficial uses within the Sucker Creek Watershed.

Beneficial uses and the associated water quality standards are generally applicable throughout the Sucker Creek Watershed (Table 2). Some uses require further delineation. At a minimum, uses are considered attainable wherever feasible or wherever attained historically. In applying standards and restoration, it is important to know where existing salmonid spawning locations are and where they are potentially attainable. Salmonid spawning and the quality of the spawning grounds are particularly sensitive to water quality and streambed conditions. **Map 4** identifies occurrence of anadromous salmonids (*Oncorhynchus*) in the Sucker Creek Watershed. **Table 5** details the various lifestages present in the watershed at certain times of the year (migration, spawning, egg incubation, smolt out-migration, and rearing) for four important salmonids (three of them anadromous) present in the Tillamook Bay Watershed (ODFW data):

- Chinook Salmon (Fall) – *Oncorhynchus tshawytscha*
- Coho Salmon (Silver Salmon) - *Oncorhynchus kisutch*
- Steelhead (Winter and Summer) - *Oncorhynchus mykiss*
- Rainbow Trout (resident) - *Oncorhynchus mykiss*

Insufficient data were available for use in determining system compliance with temperature criteria designed to be applied at times and in waters that support salmon spawning, egg incubation and fry emergence from the egg and from the gravel (55°F Standard OAR 340-041-0365(2)(b)(A)(ii)) October 1-May 30 for Sucker Creek (See Table 5). DEQ is committed to determining the status of this system for these criteria through future monitoring efforts.

Map 4: Chinook Salmon, Coho Salmon, and Steelhead Trout Distributions in the Sucker Creek Watershed. (ODFW).

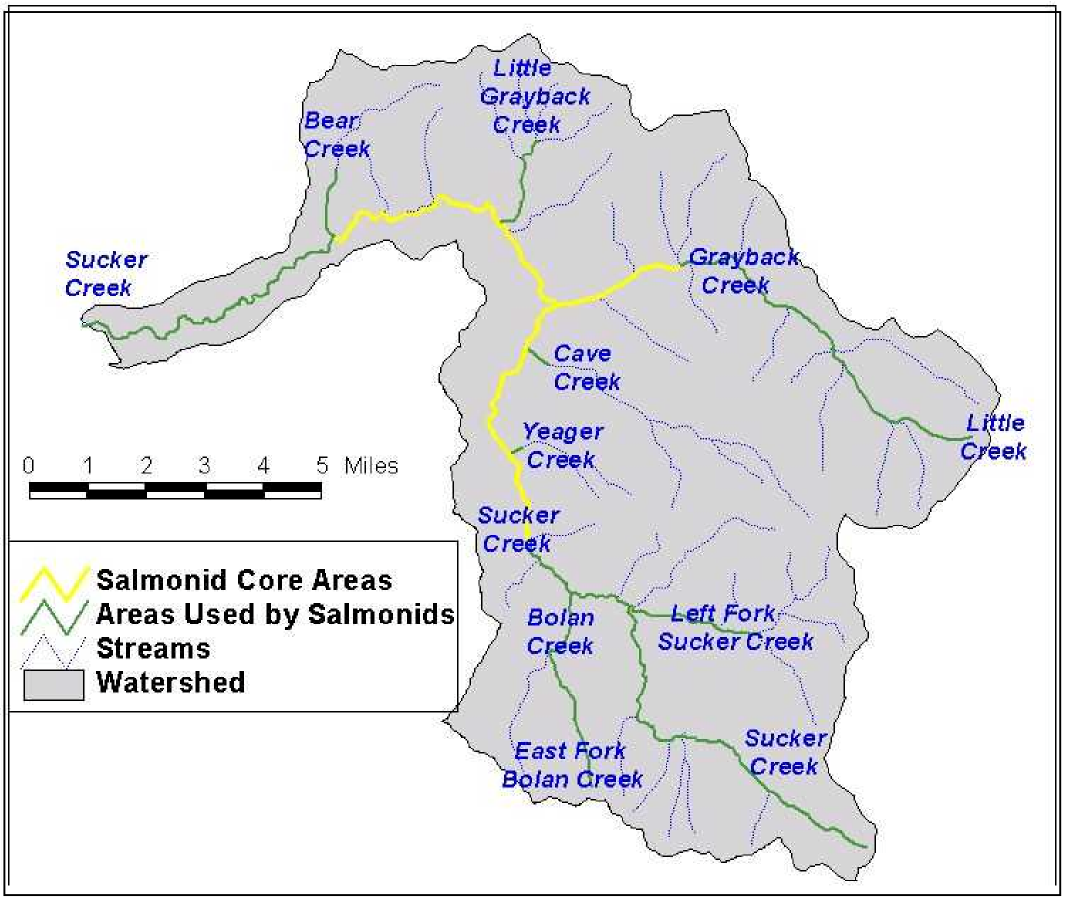


Table 5. Sucker Creek Watershed Salmonid Use by Month.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Adult Migration/Holding												
Coho	Range									Range	Peak	Peak
Fall Chinook										Range	Peak	Range
Winter Steelhead	Range	Peak	Peak	Peak								Range
Resident Rainbow	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Spawning												
Coho	Peak	Range								Range	Range	Peak
Fall Chinook	Peak									Range	Range	Peak
Winter Steelhead		Range	Range	Peak	Range							
Resident Rainbow	Range	Range	Peak	Peak	Peak							
Incubation												
Coho	Peak	Peak	Range	Range	Range					Range	Range	Peak
Fall Chinook	Peak	Peak	Range							Range	Range	Range
Winter Steelhead		Range	Range	Range	Peak	Peak	Peak					
Resident Rainbow		Range	Peak	Peak	Peak	Range						
Rearing												
Coho	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Fall Chinook	Range	Range	Range	Range	Range	Range	Range					
Winter Steelhead	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Resident Rainbow	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range	Range
Peak Smolt Outmigration												
Coho				Peak	Peak							
Fall Chinook			Range	Range	Peak	Peak						
Winter Steelhead			Range	Range	Peak	Range						
Resident Rainbow	Grow to Adulthood and Remain in River											

Peak Use Period (Peak)
Range of Use (Range)

Habitat Modification: OAR 340-041-0365 (2)(i), OAR 340-041-0027
The beneficial uses affected by habitat modification include Resident Fish and Aquatic Life, Salmonid Fish Spawning & Rearing. The standards that apply are: OAR 340-041-0365 (2)(i) *The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life, or affect the potability of drinking water, or the palatability of fish or shellfish shall not be allowed; or:* OAR 340-041-0027 *Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.*

Habitat modification is not the direct result of a pollutant although it does affect beneficial uses. Because a pollutant is not the cause, the concept of establishing a loading capacity and allocations through the development of a TMDL does not apply. There is the expectation, however, that the improvements to riparian vegetation that will be necessary to meet the temperature surrogate shade targets and the resulting changes in channel wetted width, and width to depth ratio, will also lead to improvements in habitat.

Flow Modification: OAR 340-041-0365 (2)(i), OAR 340-041-0027
The beneficial uses affected by flow modification include resident fish and aquatic life and salmonid Fish Rearing. A stream is listed as Water Quality Limited (WQL) if flow conditions are documented that are a significant limitation to fish or other aquatic life. The standards that apply are: OAR 340-041-0365 (2)(i) *The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life, or affect the potability of drinking water, or the palatability of fish or shellfish shall not be allowed; or:* OAR 340-041-0027 *Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.*

Flow modification is not the direct result of a pollutant although it does affect beneficial uses. Because a pollutant is not the cause, the concept of establishing a loading capacity and load allocations through the development of a TMDL does not apply.

Sediments OAR 340-041-0365(2)(j), (OAR 340-41-027), OAR 340-41-0365(2)(c)]
There are currently no streams in the Sucker Creek watershed listed on the 1998 303(d) list for sediment and as such the establishment of loading capacities as part of the TMDL process do not apply. However excessive sedimentation will be discussed in this TMDL because there is considerable concern about the impact of sediments on channel widening and therefore temperature. Oregon water quality standards related to sedimentation as applicable to Sucker Creek are included here for reference:

> *Sedimentation* OAR 340-041-0365(2)(j) - "The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed."
>
> *Biological criteria* OAR 340-41-027 - "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities."
>
> *Turbidity* OAR 340-41-0365(2)(c) - "No more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity."

4 PROBLEM ASSESSMENT

Monitoring has indicated that water quality in Lower Sucker Creek often does not meet state water quality standards. As a result of water quality standards (WQS) exceedances for temperature, habitat modification and flow modification, three stream segments in the Lower Sucker Creek Watershed are included in Oregon's 1998 §303(d) list (Table 6).

Table 6. Lower Sucker Creek 1998 303(d) Listed Segments

Stream Segment	Listed Parameter	Applicable Rule	Miles Affected		
Sucker Creek, Mouth to Grayback*	Temperature	OAR 340-41-365(2)(b)(A)	10.4		
Sucker Creek, Mouth to Bolan Creek*	Habitat Modification	OAR 340-41-62 OAR-41-365(2)(I)		10.4	
Sucker Creek, Mouth to Bolan Creek*	Flow Modification	OAR 340-41-62 OAR-41-365(2)(I)			10.4
Lake Creek, Mouth to diversion	Temperature	OAR 340-41-365(2)(b)(A)	1.0		
Bear Creek, mouth to headwaters	Temperature	OAR 340-41-365(2)(b)(A)	3.8		
		Total Stream Miles listed for Temperature	**15.2**		
		Total Stream Miles listed for Habitat Modification		**10.4**	
		Total Stream Miles listed for Flow Modification			**10.4**

***Note:** Only the lower 10.4 miles of Sucker Creek are addressed in this TMDL. The areas above mile 10.4 are addressed in the 1999 Sucker/Grayback TMDL

Section 303(d) of the Federal Clean Water Act (1972) requires water bodies that violate water quality standards, thereby failing to fully protect *beneficial use*s, be identified and placed on a 303(d)list. Following further assessment, TMDLs must be developed and implemented for each listed parameter to restore water quality. This TMDL covers the Lower Sucker Creek (defined as the USFS boundary at mile 10.4 to the mouth) and all of its tributaries which flow through private lands in the upper portion of the watershed. Allocations assigned in this TMDL will extend to all the waters of the Lower Sucker Creek Watershed. In addition to the TMDLs, a companion WQMP has been developed which identifies water quality goals and objectives, the designation of responsible parties, outlines the overall implementation plan to meet the TMDL, and provides some measure of assurance that the plan will actually be implemented (as per DEQ WQMP guidance 1997).

Temperature Assessment

The stream temperature numeric criterion for western Oregon has been established at 64° F (17.8°C) in order to protect trout and salmon use during warm summer months. The 64° F criterion applies June 1 through September 30 and the 55° F criterion applies October 1 through May 31. 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. Table 7 shows the stream temperature monitoring results for the Lower Sucker Creek area.

Table 7. Stream Temperature Monitoring Data: Lower Sucker Creek Watershed
Note: *the shaded column shows 7day maximum average temperature applicable to 64°°F standard. Abbreviations: IVSWCD = Illinois Valley Soil and Water Conservation, SNF-IV = Siskiyou National Forest Illinois Valley, SNF-G = Siskiyou National Forest Galice, DEQ,)*

Lower Sucker Creek Mainstem	Start	Stop	Seas. Max Value °F	Seas. Min Value °F	Seas. Max Delta T Value °F	7-Day Ave Max °F **	Days >64°F	Agency collecting data
Sucker (near upper bridge crossing)	06/18/1997	09/14/1997	73.5	50.6	14.5	72.6	78	IVSWCD
Sucker Creek ¼ mi upstream from mouth	07/02/1993	08/28/1993	70.2	54.6	10.2	69.7	54	SNF-IV
Sucker Creek 300' u/s Bridgeview Rd.	06/23/1999	09/02/1999	71.5	50.9	12.7	70.6	64	IVSWCD
Sucker Creek above Lake Creek	06/29/1993	09/12/1993	65.8	49.1	10	64.8	5	SNF-IV
Sucker Creek above Nelson Creek	06/28/1994	09/24/1994	83.1	70.9	7.8	82.7	89	SNF-IV
Sucker Creek at mouth	06/29/1994	09/23/1994	72.1	56.7	14.6	71.7	84	SNF-IV
Sucker Creek at mouth	06/18/1996	08/26/1996	73.2	51.4	10.8	72.5	59	SNF-IV
Sucker Creek at mouth	06/30/1999	09/27/1999	73.0	52.9	13.2	72.1	88	SNF-IV
Sucker Creek at RM 2.3	07/01/1999	09/02/1999	71.5	52.6	12.7	70.6	61	IVSWCD
Sucker Creek at RM 7.6	06/23/1999	09/02/1999	68.1	47.8	11.8	66.7	44	IVSWCD
Sucker Creek at USFS Boundary	06/23/1992	09/17/1992	63.9	47.8	7.1	63.3	0	SNF-G
Sucker Creek below Little Grayback Creek	06/23/1993	09/12/1993	65.5	46.6	10.1	64.6	5	SNF-IV
Sucker Creek below Little Grayback Creek	06/21/1994	09/15/1994	70.9	49.3	12.6	69.7	57	SNF-IV
Sucker Creek below Little Grayback Creek	06/23/1995	08/14/1995	70.3	49.6	17.6	65.4	12	SNF-IV
Sucker Creek below Little Grayback Creek	07/02/1996	09/24/1996	68	48.4	9.2	67.1	26	SNF-IV
Sucker Creek below Nelson	07/02/1993	08/28/1993	66.4	49.9	11.7	65.8	8	SNF-IV
Sucker Creek d/s USFS boundary	07/07/1999	08/24/1999	65.5	49.6	9.7	64.0	9	DEQ
Sucker Creek u/s Bear Crk	06/25/1999	09/02/1999	69.2	48.9	11.9	67.9	51	IVSWCD
Sucker Creek u/s Little Grayback	07/08/1999	08/24/1999	66.4	49.8	10.3	64.9	19	DEQ
Sucker Crk 100' u/s from Bridgeview Rd.	07/11/1997	09/14/1997	74.6	56.6	14.8	73.9	66	IVSWCD
Sucker Crk 100' u/s from Bridgeview Rd.	06/25/1997	07/09/1997	71.6	53.6	14.6	70.9	11	IVSWCD
Tributaries								
Bear Creek @ RM 0.2	07/07/1999	08/24/1999	68.4	55.9	7.7	66.4	36	DEQ
Bear Creek at mouth	06/18/1993	09/07/1993	65.7	51.3	6.9	64.5	4	SNF-IV
Bear Creek at mouth	06/28/1994	09/24/1994	80.2	72.3	3.8	79.8	89	SNF-IV
Lake Creek above diversion	06/16/1993	09/06/1993	57	44.2	5	56	0	SNF-IV

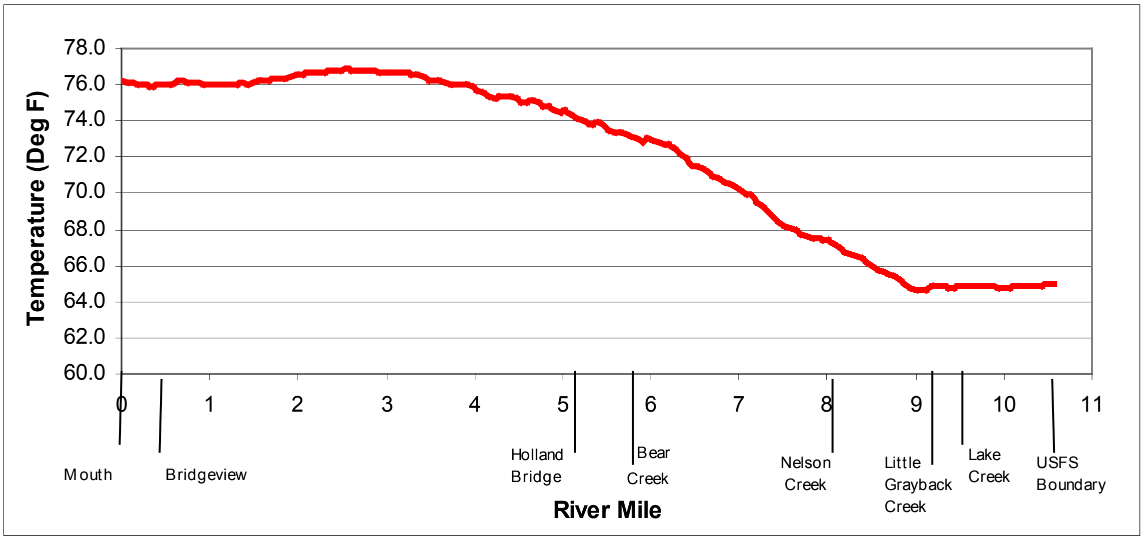
Lake Creek at mouth	07/05/1994	10/01/1994	77.6	69.1	4.2	76.9	89	SNF-IV
Lake Creek at mouth	07/07/1999	08/24/1999	61.7	51.1	4.3	60.0	0	DEQ
Little Grayback @ mouth	07/07/1999	08/24/1999	62.2	51.1	7.0	60.9	0	DEQ
Little Grayback Creek above diversion	06/16/1993	08/24/1993	63.1	47.8	8.4	59.4	0	SNF-IV

Modeled Climax Temperatures In Sucker Creek

In order to better understand the effect a mathematical model has been constructed of the Lower Sucker Creek system (The model is discussed in more detail in Section 5). In Figure 1, the model is used to predict longitudinal temperature profile of the Lower Sucker Creek mainstem under extreme conditions (August 3 was used since this day experiences the highest intensity solar load). As shown in the Figure the stream temperature increases from 64.9° (actual measured input at mile 10.4 at 4PM) to approximately 76° F at the mouth. In addition to estimating temperatures at the mouth, areas of significant heating per mile may suggest those locations where changes in channel and vegetation may have the greatest benefit.

Figure 1: Modeled Maximum Temperatures for Lower Sucker Creek.

Red line represents highest temperatures that could be expected under current vegetation and channel conditions.



Factors Affecting Stream Temperature

Riparian vegetation, stream morphology, hydrology, climate, and geographic location influence stream temperature. While climate and geographic location are outside of human control, the condition of the riparian area, channel morphology, and hydrology can be affected by land use activities. Human activities that have contributed to degraded water quality conditions in the Lower Sucker Creek Watershed include inappropriate forest management, road building, road management, excessive upland sediment loading, agricultural activities, instream mining, and others. These sources primarily increase temperature through: (1)decreasing shade, and (2)increasing the stream surface area exposed to solar radiation. Although many of these activities are still occurring in the Lower Sucker Creek Watershed, altered management practices that comply with the surrogate measures and load allocations presented in this document (as well as the management measures in the TMDL for Upper Sucker Creek) will result in an overall decrease in stream temperature.

An assessment of the elevated summertime stream temperatures attributed to anthropogenic causes in the Lower Sucker Creek Watershed included an analysis of the following factors:

1. *Riparian vegetation disturbance that compromises stream surface shading, riparian distance from the active stream channel (near stream disturbance zone), vegetation height and density (shade is commonly measured as percent effective shade)*
2. *Channel widening (increased width to depth ratios) that increases the stream surface area exposed to the sun.*
3. *Reduced summertime base flows that result from instream water withdrawl. Water withdrawals and subsequent instream flow reduction, are considered a significant contributor to stream temperature increases.*

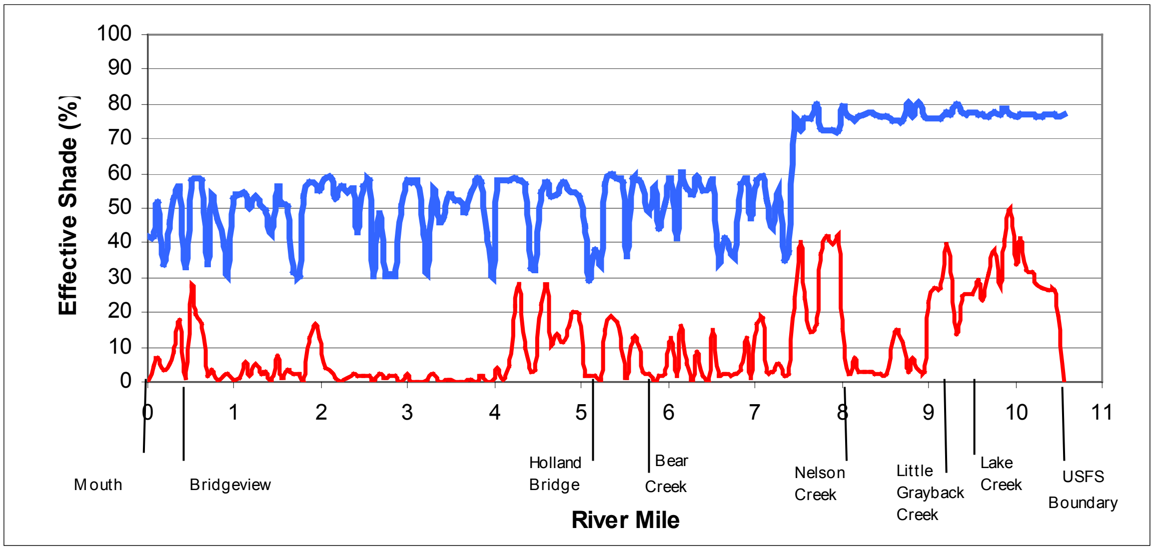
Temperature Factor 1. Riparian Vegetation Disturbance

When a stream is exposed to solar radiation, large quantities of heat energy will be delivered to the stream system, usually resulting in an increase in water temperature. Riparian vegetation can play a significant role in reducing this exposure and the resulting increase in temperature. An assessment was performed to systematically determine the total daily solar loading under existing stream shade conditions (Hydrodynamics, Appendix E). Aerial photos and field reconnaissance were used to quantify shade values as well as the potential for recovery and provide an estimate for recovery time-frames. To determine the amount of shade reaching the streams surface, shade curves were developed using a stream shade model called SHADOW (USDA Forest Service, 1993). Input variables to develop shade curves used for analysis include low flow wetted stream width, riparian tree height, shade density, and stream orientation. Table 8 below provides a summary of the shade assessment as a reach weighted average of existing shade and potential future shade for each segment analyzed in the Lower Sucker Creek watershed. Potential future shade is calculated based on the shade expected when site appropriate vegetation has grown to maturity. The summary shown in Figure 2 looks at the current (red line) and potential future (blue line) effective shade. It does not take into account land ownership. For the full shade assessment please refer to Appendix E.

Table 8. Summary of Shade Assessment Using SHADOW Model

Location	% Flow to Main stem	% Existing Shade	% Potential Shade
Main stem		**27**	**62**
Bear Creek	**5 %**	**88**	**96**
Little Grayback	**7 %**	**86**	**96**
White Rock	**15 %**	**81**	**96**
Windy Creek	**25 %**	**75**	**96**

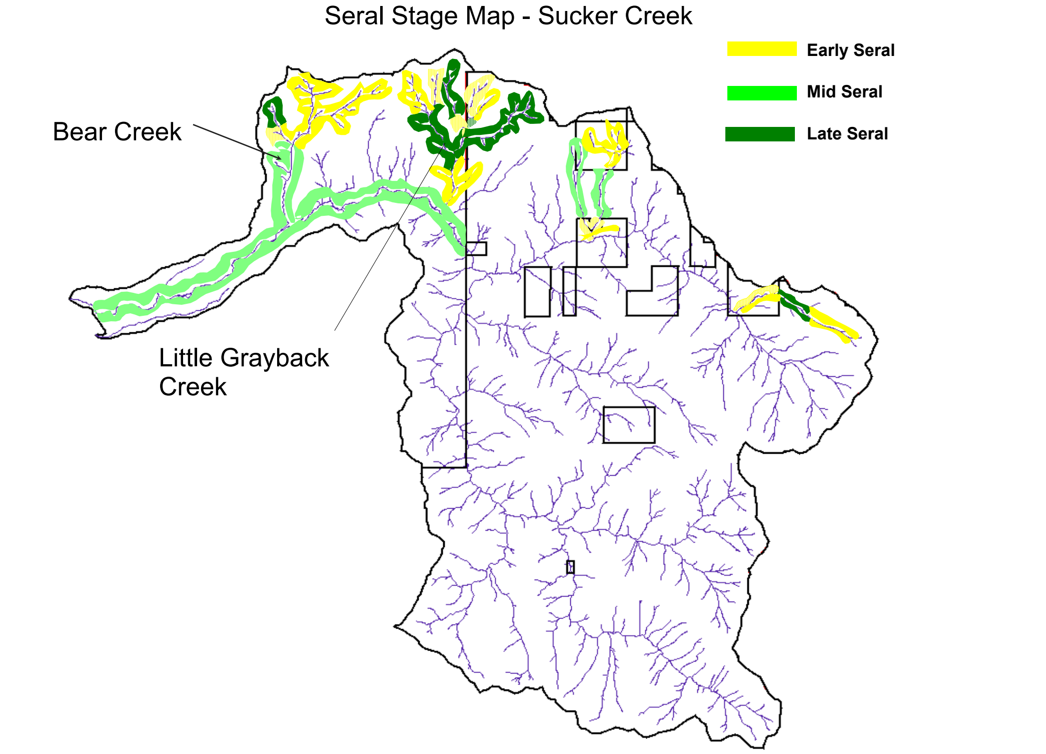
Figure 2. Current Shade and Potential Shade on Lower Sucker Creek



Seral Stage

As the result of past timber harvest, there is little mature (late seral) vegetation in the riparian areas on the lower main stem and its tributaries (Map 5). On Bear Creek, a small section managed by the Bureau of Land Management (BLM) contains the only remaining mature vegetation on that stream (noted on the figure as the dark green area). The BLM manages 4.4 miles of perennial stream within the Little Grayback analysis area. Approximately 39% of the riparian area managed by the BLM was harvested in the past. Those areas, as well as the small amount of private land, are in an early seral stage with vegetation consisting of 100% hardwoods (Map 2, yellow area). The remaining 61% of the riparian area managed by the BLM is in a late seral stage consisting of mature conifers. On Sucker Creek below mile 10.4, ownership is primarily private with a short section of land managed by the BLM. This lower section of Sucker Creek has the most serious shade problems in the watershed. All of the mature conifers in the riparian area have been harvested or cleared. The vegetation is growing back on most of the main stem, however the once predominately conifer vegetation is now a mixture of half hardwoods and half conifers. The conifers are in the mid stages of their growth cycle (bright green on Map 5) . A channel as large as Sucker Creek requires mature conifers to provide stream shade (150-160 feet tall). The hardwood component of the riparian vegetation will not reach a height sufficient to provide the needed shade and will delay shade recovery.

Map 5. Seral Stage Map of Lower Sucker Creek



Temperature Factor 2. Channel Widening (includes sedimentation)

A stream that is wide and shallow will potentially be subject to greater solar heating than one that is narrow and deep.

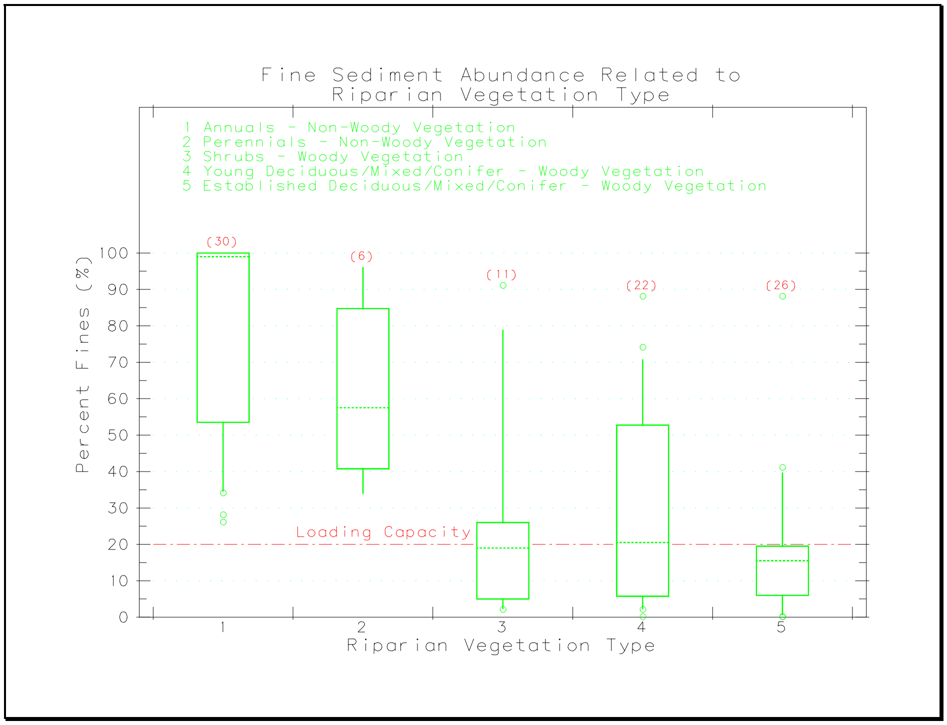
An assessment was performed using historic air photos and direct field measurement of zone of disturbance, active channel wetted width, and channel depth and used to determine current and future potential channel widths. Lower Sucker Creek has become wider due to increased sediment loads following extensive logging, mining, and the influence of roads. The removal of streamside vegetation has also reduced bank stability leading to increased sediment loads and a wider stream channel.

Many areas in the Upper Sucker Creek watershed (above mile 10.4) have significant sediment transport capacity for sand and gravel sized materials. The control of the management-related sediment inputs into the upper system (USFS lands above mile 10.4) will have an impact on the channel form and width in the lower system (mile 10.4 to the mouth).

A measure of sediment is percent streambed fines. Greater than 20% streambed fines has been utilized as an indicator of fine sediment impairment for salmonids (PACFISH). Percent streambed fines has been found to decrease with increases in woody riparian vegetation (Figure 3). Observed data indicate that when an established deciduous/mixed/conifer riparian community exists a value of less than 20% streambed fines may be attained.

The surrogate measures developed in the temperature TMDL provide for the establishment of a system potential riparian community (deciduous/mixed/conifer). The mature *System Potential* riparian community will not only provide shade but will also stabilize streambanks, resulting in a reduction in sediment inputs and subsequent decreases in channel width. Therefore the surrogate measures established for temperature will benefit channel width and sediments as well.

Figure 3. Stream Bed Percent Fines Related to Various Riparian Vegetation Types (ODFW data, 1996). Red line indicates PACFISH target of 20% fines.

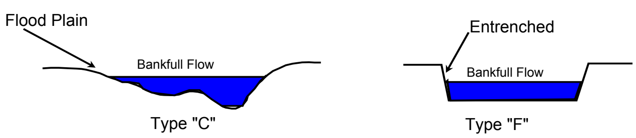


During recent floods, the main stem of Lower Sucker Creek has become wide with a flat bottom and steep stream banks (Rosgen type"F", Figure 4). A healthy stream in this segment would be a meandering "Rosgen type C" with connectivity to adjacent flood plains (Figure 4.A). Excessive sediment in the system and the lack of mature conifers in the riparian areas which provide streambank stability have led to the current condition of the stream channel. In addition as a stream becomes wider, mature trees provide less shade on the streams wetted surface which results in increased temperatures due to increased solar absorption (Figure 4.B).

Figure 4: Rosgen Channel Forms and Shade Channel Width Relationships

2.A. Rosgen Channel Types

2.B. Shade relationship to Channel Widths



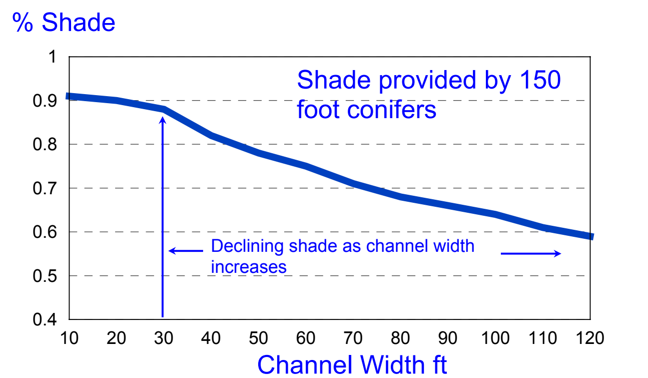


Figure 5. Shade decreases and channel width increases.

On the Lower Sucker Creek mainstem, restoring riparian vegetation will be of limited benefit in terms of temperature recovery because of excessive channel widths. An overall strategy for the restoration of Lower Sucker Creek is detailed in WQMP Section 6: Proposed Management Measures. The strategy includes protecting existing trees located in the primary shade zone and recommendations for re-establishing trees inward toward the stream channel, reducing the stream's wetted width. Three treatments are recommended for Lower Sucker Creek from mile 10.4 to the mouth (see section WQMP Section 6 for details):

Treatment 1 – Plant trees and maintain stand health and vigor in existing riparian areas

Treatment 2 – Reduce the slope on the steep unstable stream banks and plant trees to begin moving the riparian area inward toward the stream.

Treatment 3 – Construct wood debris fields on the leading edge of areas where point bars will naturally form.

Temperature Factor 3. Flow

Sucker Creek is listed as water quality limited for flow modification. The temperature change produced by a given amount of heat is inversely proportional to the volume of water heated or, in other words, a stream with less flow will heat faster than a stream with more flow given all other channel and riparian characteristics are the same (Brown, 1983).
Summer base flows in the lower reaches of Bear Creek and Sucker Creek are reduced by water withdrawals. Water is withdrawn from Lower Sucker, its tributaries, and nearby groundwater sources, primarily for industrial, irrigation and domestic uses (Table 9). The watershed has many water rights for mining use (mining is covered under industrial uses) which are not used resulting in water being available for junior water rights holders (personal communication, Norm Daft, OWRD). See Appendix C for a more detailed description of water rights in the Sucker Creek Watershed.

Table 9. Water Rights: Sucker Creek Watershed

Irrigation CFS	Agriculture CFS	Domestic CFS	Industrial CFS	Municipal CFS	Recreational CFS	Fish and Wildlife (instream) CFS	Total CFS
51.17	0.01	0.29	62.28	0.00	0.01	0.55 plus 50-135 varies by month	113.94

Appropriation of water is based on both water right seniority and water availability. As streamflows recede, those users with junior rights are the first required to curtail their water use. Senior water right holders are allowed to continue using water, even in dry years and low flow conditions, as long as water is available to meet the demand under their priority date. There are instream water rights on Lower Sucker Creek that are based primarily on flow requirements necessary to maintain fish habitat as determined by ODFW. These rights vary from month to month and have a priority date of 1989. Because these rights are junior, it is unlikely that they will be met, especially during the irrigation season.

No new consumptive water rights have been issued in Lower Sucker and tributaries since July 1934, when it was determined that natural stream flows were insufficient to meet existing consumptive rights during the irrigation season. Domestic (in-house human consumption) rights may still be obtained if the applicant can demonstrate that surface water is the only available source for their use. The Oregon Water Resources Department (OWRD) and Oregon Department of Fish and Wildlife (ODFW) have identified the Sucker Creek Watershed as a high priority for streamflow restoration efforts under the Oregon Plan for Salmon and Watersheds.

5 WATER QUALITY ATTAINMENT: TEMPERATURE CHANGE RELATED TO SOLAR LOADING CAPACITIES

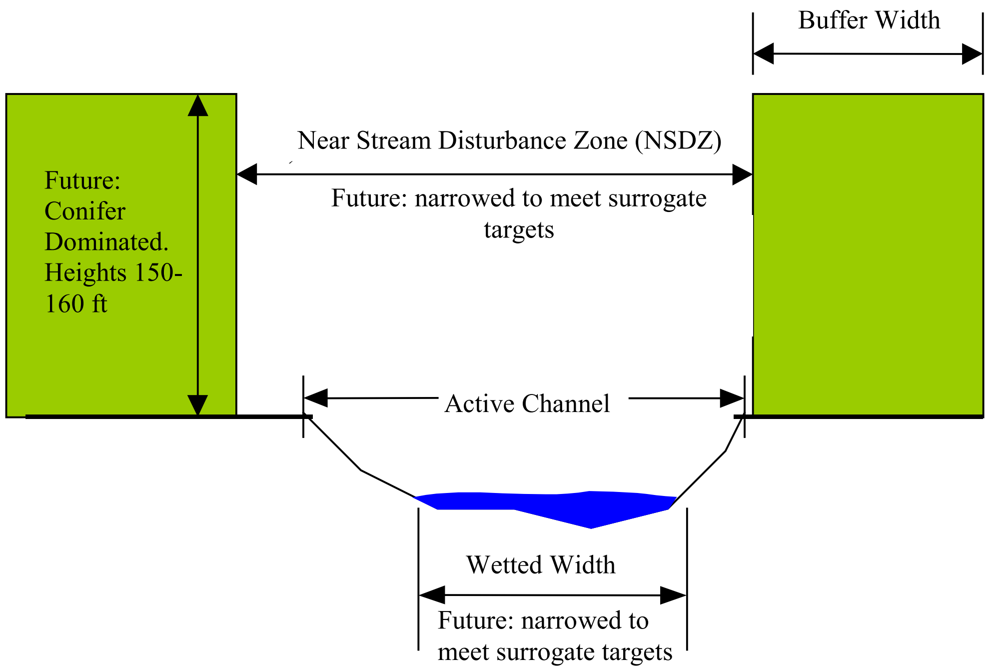
Predictive temperature modeling was conducted on Lower Sucker Creek from mile 10.4 to the mouth using the Heat Source model (Boyd,1996). The Heat Source methodology examines both the total energy transfer rates to the stream (i.e. the sum of heat energy transfer processes) and the response of water temperature to heat energy absorbed. Heat transfer processes considered in the analysis include solar radiation, longwave (thermal) radiation, convection, evaporation, and streambed conduction. The analysis was developed using measured stream flows, vegetation characteristics and channel forms from the creek and incorporates a number of conservative assumptions which are described in the Margin of Safety discussion (TMDL Section 7). The entire heat source analysis is included in Appendix B.

In order to determine Loading Capacity of Sucker Creek, that is the maximum amount of solar radiation the stream can receive and still meet the water quality standards, intensive field measurements were taken to determine the current conditions of the stream. Temperature patterns on the stream were measured, as were physical channel and vegetation characteristics. These data were used as inputs into Heat Source to calibrate the model. Once the model was calibrated, it was used to project future stream temperatures based on projected changes in vegetation and channel width.

Modeling was used to answer the question, "If shade targets are attained, along with a narrowing and deepening of the stream channel, what will be the resulting stream temperatures?"

The vegetation and channel conditions that were modeled are termed System Potential. For Lower Sucker Creek, it was determined that System Potential consists of a conifer dominated riparian zone with trees 150-160 feet tall, and a narrowing of the active channel and near stream disturbance zone to meet the targets described in Table 13. This scenario is shown graphically below in Figure 5.

Figure 5. System Potential Scenario for Lower Sucker Creek

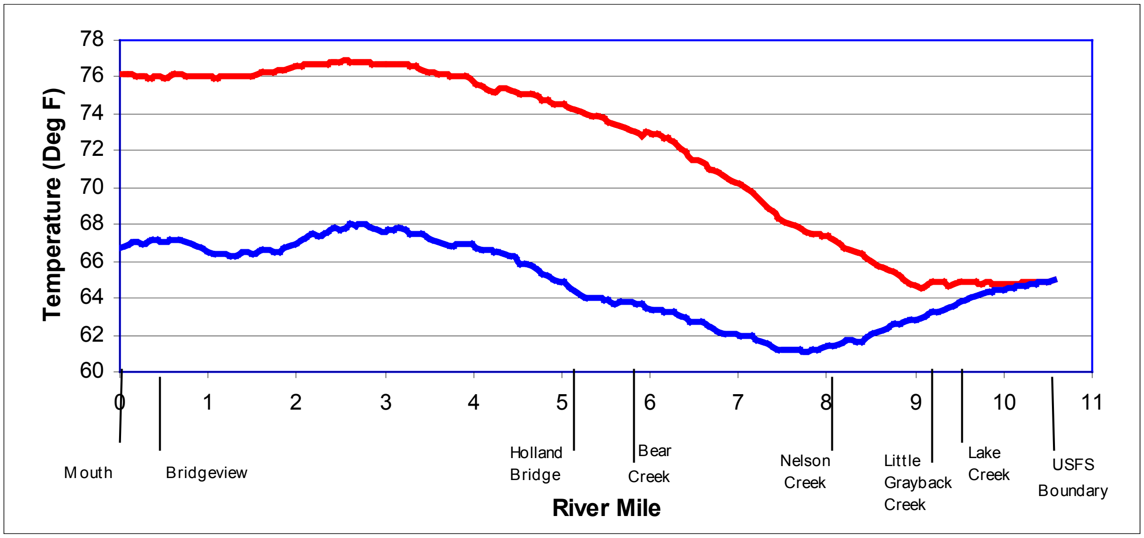


Under the System Potential scenario, the model predicts that the numeric temperature criterion of 64°F will NOT be met for the entire length of Sucker Creek during the hottest time of the year (Figure 6. Blue Line). Even at System Potential the creek can be expected to exceed the 64°F standard on the hottest days of the year. However the model does indicate that significant reductions in stream temperature (9.6°F at the mouth) will be realized by the shift to System Potential for both shade and channel structures.

- Current Conditions: maximum temperature at mouth of Sucker Creek 76.3 F
- System Potential Conditions: maximum temperature at mouth of Sucker Creek 66.7

The improvement in stream temperatures at System Potential is seen as the difference between the red line (current conditions) and the dashed line (System Potential) in Figure 4. It is important to note that the model-predicted stream temperatures are based on conservative estimates of watershed improvements. These conservative estimates of improvement provide for a Margin of Safety as defined in Section 7.

Figure 6. Modeled Temperatures: Current Conditions versus System Potential
Red Line represents modeled stream temperatures under current vegetation and channel conditions. Blue line represents modeled temperatures under System Potential conditions



Influence of Improvements in the Upper Sucker Creek Watershed
The March 1999 TMDL for the Upper Sucker Creek Watershed identifies a series of actions planned or in progress that will increase the effective shade of the upper watershed. Specifically the targets identified in that plan would reduce the average BTU loading in the creek from a current of 976 BTU/ft^2/day to 342 BTU/ft^2/day. In the modeling scenarios described previously (Figure 6) 64.9° F was used as the initial condition at the USFS boundary (mile 10.4). This is the actual stream temperature at that point in the river recorded at 4PM on August 3, 1999, the day that was modeled. As a result of improvements in shade and sediment reduction in the upper watershed, water temperatures in the future are expected to decrease by an estimated 2.6-3.0° F at the USFS boundary (Personal Communication: Chris Park, USFS). Table 10 shows the effect of lowering the input temperature at the USFS boundary (mile 10.4) on temperatures at the mouth of Sucker Creek. The positive effects of lowering the temperatures in the Upper Watershed have a positive effect on the lower watershed as well. In addition to lowering the temperature at the mouth of the stream, the cooler waters result in increases in the number of miles of instream habitat that is less than 64°F. However even with temperature reductions on the order of 2.6-3.0° F temperatures at the mouth of Sucker Creek will still exceed 64° F.

Table 10. Effect of Temperature Reductions at USFS boundary on Lower Sucker Creek

Input Temperature 4PM USFS Boundary (Mile 10.4)	Temperature Improvement[1]	Modeled Temperature at the Mouth of Sucker Creek at System Potential
64.9°F	0 °F	66.8 °F
63.9 °F	1 °F	66.5 °F
62.9 °F	2 °F	66.1 °F
61.9 °F	3 °F	65.8 °F
60.9 °F	4 °F	65.5 °F
59.9 °F	5 °F	65.2 °F

[1] USFS expects a 2.6-3°F reduction in peak temperatures at the USFS boundary mile 10.4) due to management/restoration activities as defined in the 1999 Sucker Creek TMDL.

Setting the Temperature TMDL
The Sucker Creek TMDL is expressed as both a BTU/ft^2/day and a percent effective shade target. The SHADOW model (USDA-FS, 1993) was used to estimate that when the stream achieves System Potential vegetation and channel width, the thermal load will be 927 BTU/ft^2/day (Appendix E). Similar calculations performed on Bear and Little Grayback Creeks (and the private sections of White Rock and Windy Creeks) predict a maximum loading of 98 BTU/ft^2/day at System Potential.

Percent effective shade is based on the percent reduction of the total Potential Solar Load. Potential Solar Loading is defined as the total load that could reach the stream if no shade were present. In the Sucker Creek Watershed the Potential Solar Load reaches its maximum in late July to early August and is approximately 2440 BTU/ft^2/day. At System Potential, the target load of 927 BTU/ft^2/day represents a 62% reduction in Potential Solar Load. This 62% reduction is termed percent effective shade. Similar calculations performed on Bear and Little Grayback Creeks (and the private sections of White Rock and Windy Creeks) predicted a maximum loading of 98 BTU/ft^2/day at System Potential, or a reduction in Potential Solar Load of 96% (i.e, 96% effective shade).

Loading Capacity for Lower Sucker Creek at System Potential

- 927 BTU/ft^2/day
- 62% effective shade (reduction in Potential Solar Load reaching the stream)

Loading Capacity for Bear, Little Grayback, White Rock, and Windy Creeks at System Potential

- 98 BTU/ft^2/day
- 96% effective shade (reduction in Potential Solar Load reaching the stream)

6. TMDL – LOADING CAPACITIES AND ALLOCATIONS

Loading Capacity: in the Lower Sucker Creek Watershed consist of (1) NPDES permitted point source effluent discharge temperature limits, and (2) solar radiation loading profiles based on potential near stream vegetation characteristics and channel morphology conditions without anthropogenic disturbance (i.e. at System Potential). Expressed numerically the loading capacity is: 927 BTU/ft^2/day for Lower Sucker, 98 BTU/ft^2/day for Bear, Little Grayback, White Rock, and Windy Creeks

Load Allocations (Nonpoint Sources) The numeric temperature criteria in Lower Sucker Creek is not expected to be met and therefore no measurable surface water temperature increases from anthropogenic activities are allowed.

Wasteload Allocations (Point Sources) Applies to NPDES permitted point source discharges. The numeric temperature criteria in Lower Sucker Creek is not expected to be met and therefore no measurable surface water temperature increases from anthropogenic activities are allowed. NPDES dischargers, currently and in the future, are allowed no measurable surface water temperature impacts.

3.1.7 Loading Capacity – 40 CFR 130.2(f)

The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring water into compliance with standards. EPA's current regulation defines loading capacity as "*the greatest amount of loading that a water can receive without violating water quality standards*." (40 CFR § 130.2(f)).

*The Water Quality Standard mandates a **Loading Capacity** based on the condition: "**no measurable surface water temperature increase resulting from anthropogenic activities when the temperature criteria is exceeded."** This condition is termed **System Potential** and is achieved when (1) non-point source solar radiation loading is representative of a near stream vegetation and channel morphology conditions without human disturbance and (2) point source discharges cause no measurable temperature increases in surface waters.*

The water quality standard states that ***no measurable surface water temperature increase resulting from anthropogenic activities*** is allowed in the Sucker Creek Watershed when the appropriate criteria are exceeded. The pollutants are human-caused increases in solar radiation loading (non-point sources) and warm water discharge (point sources).

Loading Capacities in the Sucker Creek Watershed consist of (1) NPDES permitted point source allocations (*Waste Load Allocations (WLA))* and (2) nonpoint sources inputs referred to as *Load Allocations(LA)*. Under the current regulatory framework for the development of TMDLs, identification of the loading capacity is an essential element. The loading capacity provides a reference for calculating the amount of pollutant reduction needed to bring water into compliance with standards. The loading capacities for temperature in the Lower Sucker Creek Watershed is defined as the solar radiation loading profiles based on potential near stream vegetation characteristics and channel morphology conditions without anthropogenic disturbance (i.e. at System Potential). Expressed in the form of heat energy (BTU/ft^2/day) from incoming solar radiation the loading capacity is: 927 BTU/ft^2/day for Lower Sucker, 98 BTU/ft^2/day for Bear, Little Grayback, White Rock, and Windy Creeks.

By definition, a TMDL or loading capacity is defined as the sum of its *Waste Load Allocations* (point source) and *Load Allocations* (nonpoint sources) [40 CFR 130.2(i)].

In this TMDL, the potential to provide measurable shade increases was evident, but even with a future shade increase to *System Potential* the system is not expected to meet the temperature criteria during the hottest days of the year. This triggers the allocation of “no measurable surface water temperature increases from anthropogenic activities are allowed”.

WLA: There are currently no permitted point sources (NPDES permits) in the watershed with allowed temperature impacts, all current permittees must meet “no measurable increase in surface water temperature’ requirement. All future point sources permits will be held to this standard as well. Note: All current and future recreational mining is permitted under the NPDES permit system and is held to the “no measurable increases in surface water temperature” requirement.

LA: Anthropogenic sources of pollution are allowed no measurable surface water temperature impacts. The *LA* is therefore the solar radiation loading at *System Potential* near-stream vegetation characteristics and channel morphology conditions without anthropogenic disturbance. This means that there can be no measurable surface water temperature impacts from Agriculture, Forestry, or Urban activities now and or in the future. 100% of the LA is given to natural sources. Therefore the heat energy in BTU/ft^2/day at *System Potential* becomes the loading capacity for the stream and all of the *LA* is assigned to natural sources (no thermal loads beyond those occurring naturally will be allocated) (Table 11).

Table 11. Temperature Load Allocations

Nonpoint Sources	
Source	*Load Allocation* *Distribution of Solar Radiation Loading Capacity*
Natural	100%
Agriculture	0%
Forestry	0%
Urban	0%
Future Sources	0%
Point Sources	
Source	*Waste Load Allocation* *Distribution of Solar Radiation Loading Capacity*
Current NPDES Permit holders	No Measurable Increase in Surface Water Temperatures
Future NPDES Permit holders including recreational mining	No Measurable Increase in Surface Water Temperatures

Surrogate Measures

The Lower Sucker Creek TMDL incorporates measures other than *“daily load*s” to fulfill requirements of the Clean Water Act. Although loading capacity for heat energy has been derived at 927 BTU/ft^2/day for Lower Sucker, 98 BTU/ft^2/day for Bear, Little Grayback, White Rock, and Windy Creeks, these loading values may be of limited value in guiding the management activities needed to solve temperature related water quality problems. To meet loading capacity targets, this TMDL relies upon surrogate measures which, when fully implemented, will meet the BTU/ft^2/day TMDL target. The surrogate measures are based on the future conditions used in the Heat Source model to define *System Potential* The surrogate measures listed below thus become the measurable targets to attain the TMDL Loading Capacity.

When the surrogate targets are attained, the system will be considered to have reached a full System Potential condition, defined as the channel charaterisitcs and vegetation and the resulting percent effective shade that could be expected given mature native riparian vegetation in the absence of human impact (Flow or changes in water withdrawals are not included in the System Potential scenario). The use of surrogate measures as targets for TMDLs is further defined under *"other appropriate measure*s" as provided under EPA regulations [40 CFR 130.2(i)].

Surrogate Measure #1: Increase Percent Effective Shade.
The percent effective shade targets highlighted in the table below will meet the Lower Sucker TMDL Load Allocations of 927 BTU/ft^2/day Lower Sucker, 98 BTU/ft^2/day for Bear, Little Grayback, White Rock, and Windy Creeks (Table 12). One of the advantages of percent effective shade targets is that they can be linked to specific areas and to management actions needed to solve problems that cause water temperature increases (USDA Forest Service, 1993). Section 6 in the WQMP " Proposed Management Measures", provides reach specific potential shade values which when achieved will lead to the attainment of the 927 BTU/ft^2/day target for Lower Sucker Creek.

Note: For purposes of this TMDL, shade is defined as the percent reduction in potential solar radiation load delivered to the water surface. For example on Lower Sucker Creek, the reduction from the total Potential Solar Load of 2440 BTU/ft^2/day *to 927* BTU/ft^2/day *represents a 62% reduction in potential solar load which is equivalent to 62% effective shade as shown in Table 10.*

Table 12. Percent Effective Shade Targets
(Future shade targets are shown in shaded columns)

Perennial Stream Reach	Current Condition Shade	**Target: System Potential Effective Shade[1]**	Increase Percentage Effective Shade	Time Frame to Target Years[3]
Sucker Creek	27%	62%	35%	70[4]
Bear Creek	88%	96%[2]	8%	35
Little Grayback	86%	96%[2]	10%	23
White Rock (Private Lands)	81%	96%[2]	15%	23
Windy Creek (Private Lands)	75%	96%[2]	21%	30

1 Targets are expressed as reach –weighted shade averages for the indicated stream reach
2 96% shade represents average effective shade for the riparian area at System Potential. Any shade greater than 80% will result in minimal temperature benefit and is considered a margin of safety. See Appendix E page 6 discussion of shade greater than 80% versus temperature.
3 Assuming absence of natural disturbances such as flood or fire.
4. Represents an average for the stream. Approximate restoration times are provided on a reach-basis in Table 13, on the next page.

Natural disturbances will likely occur within all riparian stands in the future; however, these changes are very difficult to predict or model. Given the likelihood of future riparian area disturbances, especially from flood and or fire, the surrogate shade targets and associated time-frames shown in Table 12 are based on the potential of undisturbed riparian stands to develop shade.

Surrogate Measure #2: Decrease Channel Widths.
Stream-wetted widths and near stream disturbance zones (NSDZ) will decrease over time to reach the target widths shown in Table 13. The target widths are for Lower Sucker Creek only and represent reach weighted averages. A detailed reach by reach description and associated strategies for reaching these targets is contained in the WQMP Section 6, Proposed Management Measures. The management strategies developed in the temperature TMDL provide for the establishment of a system potential riparian community (deciduous/mixed/conifer) that will provide shade, stabilize streambanks (reduce sediments), and reduce channel width throughout the watershed.

Table 13. Channel Targets for Lower Sucker System
(Channel targets are shown in shaded columns)

Lower Sucker Creek Reach[1]	Current NSDZ ft	Target NSDZ[2] ft	Current Wetted Width ft	Target Wetted Width ft	Time Frame For Recovery[3] Years
R1	90	65-70	40	30	55
R2	98	65-70	50	30	55
R3	70	65-70	60	30	55
R4	98	65-70	70	30	55
R5	100	75	70	35	90
R6	120	75	75	35	70+
R7	100	75	70	35	70+
R8	155	130	85	40	Channel: 20 Veg:80 Total time 100
R9	158	130	84	40	Channel: 20 Veg:80 Total time 100
R10	250	130	89	40	Channel: 20 Veg:80 Total time 100
R11	155	130	90	40	Channel: 20 Veg:80 Total time 100
R12 a,b,c,d,e	148	135	90	40	Channel: 20 Veg:80 Total time 100
R13	333	135	90	40	Channel: 20 Veg:80 Total time 100
R14	335	135	90	40	Channel: 20 Veg:80 Total time 100
R15	230	135	50	40	Channel: 20 Veg:80 Total time 100
R16	220	135	70	40	Channel: 20 Veg:80 Total time 100
R17	415	135	88	40	Channel: 20 Veg:80 Total time 100
R18	180	135	88	40	Channel: 20 Veg:80 Total time 100
R19	190	135	80	40	Channel: 20 Veg:80 Total time 100
R20	155	?	80	?	Channel: 20 Veg:80 Total time 100

1 Reaches are defined in Section 6 of the WQMP, Proposed Management Measures.
2 NSDZ = near stream disturbance zone.
3 Timeframes assume no natural disturbances. Time for channel stabilization where provided is the time to establish point bars and a stable bank system capable of supporting riparian hardwoods and conifers. Time for vegetation refers only to the time it takes to establish primary shade producing vegetation and for that vegetation to mature (it assumes a stable channel and stream bank).

Surrogate Measure #3: Meet Water Rights for Instream Flow.
Where feasible, maintain/increase flows to meet minimum instream rights at the mouth of Sucker Creek especially during the critical temperature periods of July through September (Table 14).

Table 14 Instream Water Rights for Lower Sucker Creek Watershed
Flow targets are shown in shaded column

Creek	Water Right	Priority Date	Rate (CFS)	Reach Point	Term
Sucker Creek	Oregon Water Trust	1857	0.14	RM 2.6 to mouth	Permanent
Sucker Creek	Oregon Water Trust	1857	0.16	RM 2.6 to mouth	Permanent
Sucker Creek	Oregon Water Trust	1857	0.25	RM 2.6 to mouth	Permanent
Sucker Creek	Oregon Dept Fish and Wildlife	Jan 20, 1989	10/1-31 80	Mouth	Instream
Sucker Creek	Oregon Dept Fish and Wildlife	Jan 20, 1989	11/1-5/15 135	Mouth	Instream
Sucker Creek	Oregon Dept Fish and Wildlife	Jan 20, 1989	5/16-6/30 80	Mouth	Instream
Sucker Creek	Oregon Dept Fish and Wildlife	Jan 20, 1989	7/1-9/15 54	Mouth	Instream
Sucker Creek	Oregon Dept Fish and Wildlife	Jan 20, 1989	9/16-9-30 80	Mouth	Instream

7. MARGIN OF SAFETY

The Clean Water Act requires that each TMDL be established with a margin of safety (MOS). This is intended to account for uncertainty in either the available data or in the actual effect controls will have on loading reductions and receiving water quality. A MOS may be either expressed as unallocated assimilative capacity or as conservative analytical assumptions used in establishing the TMDL (e.g., derivation of numeric targets, modeling assumptions or effectiveness of proposed management actions). The margin of safety may be implicit, as in conservative assumptions used in calculating the loading capacity, WLAs, and LAs. The MOS may also be explicitly stated as an added, separate quantity in the TMDL calculation. The MOS is not meant to compensate for a failure to consider known sources. The Lower Sucker Creek temperature TMDL relies upon implicit assumptions used in the temperature TMDL assessment methodology.

- Groundwater inflow was assumed to be zero and its cooling influence on stream temperatures via mass transfer/mixing was not accounted for. Further, cooler microclimates associated with late seral conifer riparian zones were not accounted for in the simulation methodology.

- The Heat Source model (Appendix B) did not change current vegetative shade overhang values as part of its future conditions prediction. The present overhang values are very low and are likely to increase in the future. This will provide a MOS as vegetative overhang will add additional effective shade to Lower Sucker Creek.

- Mainstem Sucker Creek modeling used current tributary temperatures as inputs into the future condition inputs. Improvements in effective shade on the tributaries is expected to have an effect on water temperatures. This additional cooling was not factored into the model and is considered a MOS.

- Modeling was conducted using worst case scenarios of low flow and seasonal maximum air temperatures.

- When interpreting the Heat Source model simulation results to determine Loading Capacity, an exceedance of a temperature of 64° F for 1 day was interpreted as a violation of the 7-day moving average of the daily maximum temperatures (the temperature criterion). One day maximums temperatures can be expected to be higher than a 7 day moving average of maximum temperatures. This conservative approach results in an additional margin of safety.

8. SEASONAL VARIATION

Section 303(d)(1) requires this TMDL to be "established at a level necessary to implement the applicable water quality standard with seasonal variations." Both stream temperature and flow vary seasonally from year to year. Water temperatures are coolest in winter and early spring months. Winter water temperature levels decrease dramatically from summer values as river flows increase and available solar energy is at an annual minimum. Stream temperatures exceed State water quality standards in summer and early fall salmonid rearing months (June, July, August and September). Warmest stream temperatures correspond to prolonged solar radiation exposure, warm air temperature, low flow conditions and decreased groundwater contribution. These conditions occur during late summer and early fall and promote the warmest seasonal instream temperatures. The analysis presented in this TMDL is performed during summertime periods in which controlling factors for stream temperature are most critical. The modeling date selected, August 3, 1999 represented the date that seasonal maximum water temperatures were recorded. This modeling effort hence reflects extreme temperature regimes in this system and clearly depicts the seasonal worst case temperature condition (climax solar loading). Modeling indicates that with system improvements in vegetation and channel form, future climax temperatures will be lower than those experienced today.

9. REASONABLE ASSURANCE OF IMPLEMENATION

The area covered by this TMDL includes private lands and lands managed by the BLM, the State of Oregon, and Josephine County. There are mechanisms already in place to help assure that this TMDL and its associated water quality management plan will be implemented for each management area type. The designated management areas include:

1. Rural Residential Areas
2. Federal Lands
3. Private Timber Lands
4. Agricultural Lands
5. Transportation
6. Oregon Plan

Rural Residential Areas

The responsibilities for the development of water quality management plans for the rural residential land use component of Sucker Creek is detailed in Section 7 of the WQMP. Upon approval of the Lower Sucker Creek Watershed TMDL by EPA, Josephine County has been directed to develop and submit to DEQ an Implementation Plan that will achieve the goals and objectives of the WQMP to meet the load allocations established by this TMDL. This activity will be accomplished in accordance with the Schedule in Section 8 of the WQMP –Time-line for Implementation.

The Josephine County water quality implementation plan will meet the requirements of a WQMP and contain the following elements:

1. Proposed management measures tied to attainment of the load allocations and/or established surrogates of the TMDLs, such as vegetative site potential for example.
2. Timeline for implementation.
3. Timeline for attainment of load allocations.
4. Identification of responsible participants demonstrating who is responsible for implementing the various measures.
5. Reasonable assurance of implementation.
6. Monitoring and evaluation, including identification of participants responsible for implementation of monitoring, and a plan and schedule for revision of the Implementation Plan.
7. Public involvement.
8. Maintenance of effort over time.
9. Discussion of cost and funding.
10. Citation of legal authority under which the implementation will be conducted.

DEQ of Environmental Quality has the authority to ensure compliance with this TMDL and associated WQMP.

Federal Lands

Federal land management is guided by the Northwest Forest Plan which includes the Aquatic Conservation Strategy. The Northwest Forest Plan created a range of alternatives comply with existing laws, maintaining the highest contribution of economic and social well being. The record of decision outlines the preferred alternatives and created a system of reserves to protect the full range of species. The biological objectives of the Northwest Forest Plan include assuring adequate habitat on Federal lands to aid the “recovery” of late-successional forest habitat-associated species listed as threatened under the Endangered Species Act and preventing species from being listed under the Endangered Species Act.

Private Timber Lands

The state Forest Practices Act (FPA), implemented by the Oregon Department of Forestry (ODF), regulates forest activities. An interdepartmental review of the FPA will provide the assurance that standards will be met. The ODF is the designated management agency for regulation of water quality on nonfederal forest lands. The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describe BMP's for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness.

The Oregon Forest Practices Act contains regulatory provisions that include the following objectives: classify and protect water resources, reduce the impacts of clearcut harvesting, maintain soil and site productivity, ensure successful reforestation, reduce forest management impacts to anadromous fish, conserve and protect water quality and maintain fish and wildlife habitat, develop cooperative monitoring agreements, foster public participation, identify stream restoration projects, recognize the value of biodiversity and monitor/regulate the application of chemicals. ODF has adopted Forest Practice Administrative Rules (1997) that clearly define allowable actions on State, County, and private forestlands. Forest Practice Administrative Rules allow revisions and adjustments to the regulatory parameters it contains. Several revisions have been made in previous years and it is expected that the ODF, working with DEQ, will continue to monitor the success of the Forest Practice Administrative Rules. In addition, monitoring activities identified in Section 10 of the WQMP will help determine if management actions are sufficiently protective to meet the effective shade targets set by this TMDL and make appropriate revisions that address water quality concerns.

Agricultural Activities
It is the Oregon Department of Agriculture's (ODA) statutory responsibility to develop agricultural water quality management (AWQM) plans and enforce rules that address water quality issues on agricultural lands. The AWQM Act directs ODA to work with local farmers and ranchers to develop water quality management area plans for specific watersheds that have been identified as violating water quality standards and having agricultural water pollution contributions.

The AWQM plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct those problems. These water quality management plans are developed at a local level, reviewed by the State Board of Agriculture, and then adopted into the Oregon Administrative Rules by ODA. It is the intent that these plans focus on education, technical assistance, and flexibility in addressing agriculture water quality issues. These plans and rules will be developed or modified to achieve water quality standards and will address the load allocations identified in the TMDL. In those cases when an operator refuses to take action, ODA can take enforcement action. DEQ will work with ODA to ensure that rules and plans meet load allocations.

Transportation (ODOT)
The Oregon Department of Transportation (ODOT) has been issued an NPDES MS4 waste discharge permit. Included with ODOT's application for the permit was a surface water management plan which has been approved by DEQ and which addresses the requirements of a TMDL allocation for pollutants associated with the ODOT system. Both ODOT and DEQ agree that the provisions of the permit and the surface water management plan will apply to ODOT's statewide system. This statewide approach for an ODOT TMDL watershed management plan addresses specific pollutants, but not specific watersheds. Instead, this plan demonstrates how ODOT will incorporate water quality protection into project development, construction, and operations and maintenance of the state and federal transportation system that is managed by ODOT, thereby meeting the elements of the National Pollutant Discharge Elimination System (NPDES) program, and the TMDL requirements.

The MS4 permit and the plan:
- Streamlines the evaluation and approval process for the watershed management plans
- Provides consistency to the ODOT highway management practices in all TMDL watersheds.
- Eliminates duplicative paperwork and staff time developing and participating in the numerous TMDL management plans.

Temperature and sediment are the primary concerns for pollutants associated with ODOT systems that impair the waters of the state. As TMDL allocations are established by watershed, rather than by pollutants, ODOT is aware that individual watersheds may have pollutants that may require additional consideration as part of the ODOT watershed management plan. When these circumstances arise, ODOT will work with DEQ to incorporate these concerns into the statewide plan.

Oregon Plan

There are also many voluntary, non-regulatory, watershed improvement programs (activities) that are already in place and are helping to address the water quality concerns in the Illinois River Subbasin. Both technical expertise and funding are provided through these integrated programs. Examples of activities promoted and accomplished through these programs include: riparian enhancement, relocating legacy roads that may be detrimental to water quality, replacing problem culverts with adequately sized structures, and improvement/ maintenance of legacy roads known to cause water quality problems. These activities have been and are being implemented to improve watersheds and enhance water quality. Many of these efforts are helping resolve water quality related legacy issues.

The State of Oregon has formed a partnership between Federal and State agencies, local groups and grassroots organizations, that recognizes the attributes of aquatic health and their connection to the health of salmon populations. The Oregon Plan considers the condition of salmon as a critical indicator of ecosystems (OCSRI, 1997). The decline of salmon populations has been linked to impoverished ecosystem form and function. Clearly stated, the Oregon Plan has committed the State of Oregon to the following obligations: an ecosystem approach that requires consideration of the full range of attributes of aquatic health, focuses on reversing factors for decline by meeting objectives that address these factors, develops adaptive management and a comprehensive monitoring strategy, and relies on citizens and constituent groups in all parts of the restoration process.

The intent of the Oregon Plan is to conserve and restore functional elements of the ecosystem that supports fish, wildlife and people. In essence, the Oregon Plan is distinctly different from the traditional agency approach, and instead, depends on sustaining a local-state-federal partnership. Specifically, the Oregon Plan is designed to build on existing State and Federal water quality programs, namely: Coastal Zone Nonpoint Pollution Control Programs, the Northwest Forest Plan, Oregon's Forest Practices Act, Oregon's Senate Bill 1010 and Oregon's TMDL program.

10. PUBLIC PARTICIPATION

During the development and drafting of this TMDL and WQMP, attempts have been made to include the interested parties across Josephine County. The draft of this document has been made available during development for input and discussion by resource agencies as well as private entities.

Public participation is also addressed in Section 11 of the WQMP.

To follow is a copy of the public notice and notice of public hearing for the draft plan issued October, 2001.

A responsiveness summary document will be prepared by DEQ in reply to comments received at the public hearing and written comments received within the comment period.

NOTICE OF PUBLIC HEARING

Oregon Department Of Environmental Quality

Notice Issued: October 5, 2001
Close of Comment Period: December 14, 2001

Lower Sucker Creek Watershed
Total Maximum Daily Load and Water Quality Management Plan

PUBLIC PARTICIPATION:

Public Hearing
The public hearing will be held in **Cave Junction, at 7:00 p.m. on November 13, 2001** at the **Josephine County Building, 102 South Redwood Highway, Cave Junction, Oregon.** Before the hearing, there will be an informational presentation beginning at 6:00 p.m. at the same location.

Written comments:
Written comments on the proposed Total Maximum Daily Load and/or Water Quality Management Plan (WQMP) must be received at the Oregon Department of Environmental Quality (DEQ) by **5 p.m. on December 14, 2001**. Written comments should be mailed to Oregon Department of Environmental Quality, Attn: Bill Meyers, 210 West Main St. Suite 2D, Medford Oregon 97501. ***People wishing to send comments via e-mail should be aware that if there is a delay between servers or if a server is not functioning properly, e-mails may not be received prior to the close of the public comment period.*** People wishing to send comments via e-mail should send them in Microsoft Word (through version 97), WordPerfect (through version 6.x) or plain text format. Otherwise, due to conversion difficulties, DEQ recommends that comments be sent in hard copy. E-mails should be sent to: **Meyers.Bill@deq.state.or.us**

WHO IS PROPOSING AN ACTION

Oregon Department of Environmental Quality
811 SW 6th Avenue
Portland, Oregon 97204-1390

AREA COVERED BY ACTION

The Lower Sucker Creek Watershed covers all public lands from the USFS boundary at mile 10.4 to the mouth of Sucker Creek as well as all private lands in the Sucker Creek Watershed.

WHAT IS PROPOSED: DEQ proposes to submit the Lower Sucker Creek TMDL and WQMP to the U.S. Environmental Protection Agency (EPA) for approval as a total maximum daily load (TMDL) for federal and private lands within the Lower Sucker Creek Watershed. EPA approval would remove water quality limited streams covered by the TMDL/WQMP from DEQ's "303d" list of impaired waterbodies.

The Lower Sucker Creek TMDL/WQMP is based on the Clean Water Act, the Northwest Forest Plan, the Oregon Forest Practices Act, ODOT Best Management Practices, and the Rogue Basin Agricultural Water Quality Management Plan. *This public hearing addresses only the TMDL and WQMP that are being submitted to EPA.*

WHO IS AFFECTED: Local public and private land managers, people interested in water quality and fisheries, and people interested in DEQ's implementation of Section 303(d) of the federal Clean Water Act.

NEED FOR ACTION: Section 303(d) of the federal Clean Water Act requires development of TMDLs for waterbodies included on a state's "303(d)" list. EPA must approve TMDLs submitted by a state.

WHERE TO FIND DOCUMENTS: The WQMP is available for examination and copying at DEQ's Medford Office at 201 West Main, Suite 2D, Medford Oregon 97501 and at DEQ's Headquarters Office at Oregon DEQ, Water Quality Division, 811 S.W. 6th Avenue, Portland, OR 97204. Documents are also available on DEQ's web site at http://www.deq.state.or.us. Click on "water quality" then on "water quality program public notices".

While not required, scheduling an appointment will ensure documents are readily accessible during your visit. To schedule an appointment in Medford contact Bill Meyers at 776-6010. For an appointment in Portland call Dianne Eaton at 503-229-6756 (toll free at 1-800-452-4011) or DEQ's TTY at 503-229-6993. To request copies of the TMDL and WQMP call Bill Meyers or Dianne Eaton at the above numbers.

In addition, copies of the WQMP can be found at the following location:

Josephine County Building
102 South Redwood Highway
Cave Junction, Oregon

Questions on the proposed TMDL and WQMP should be addressed to Bill Meyers at the above phone number.

WHAT HAPPENS NEXT: DEQ will review and consider all comments received during the public comment period. Following this review, the TMDL and WQMP may be sent to U.S. EPA for approval as a TMDL or may be modified prior to submission. You will be notified of DEQ's final decision if you present either oral or written comments during the comment period. If you do not comment but wish to receive notification of DEQ's final decision, please call or write DEQ at the above phone numbers/addresses.

ACCOMODATION OF DISABILITIES: DEQ is committed to accommodating people with disabilities. Please notify DEQ of any special physical or language accommodations you may need as far in advance of the hearing date as possible. To make these arrangements, contact Bill Meyers at 776-6010. People with hearing impairments can call DEQ's TTY at 503-229-6993.

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CHAPTER II

WATER QUALITY MANAGEMENT PLAN

Lower Sucker Creek, Illinois River Subbasin

(Lower Section of 1710031103 Sucker/Grayback Watershed)

Prepared by

Oregon Department of Environmental Quality – Rogue Basin Team

April 2002

Statement of Purpose: This Water Quality Management Plan (WQMP) describes how the Lower Sucker Creek TMDL will be implemented to meet the requirements of Section 303(d) of the 1972 Federal Clean Water Act.

1. INTRODUCTION

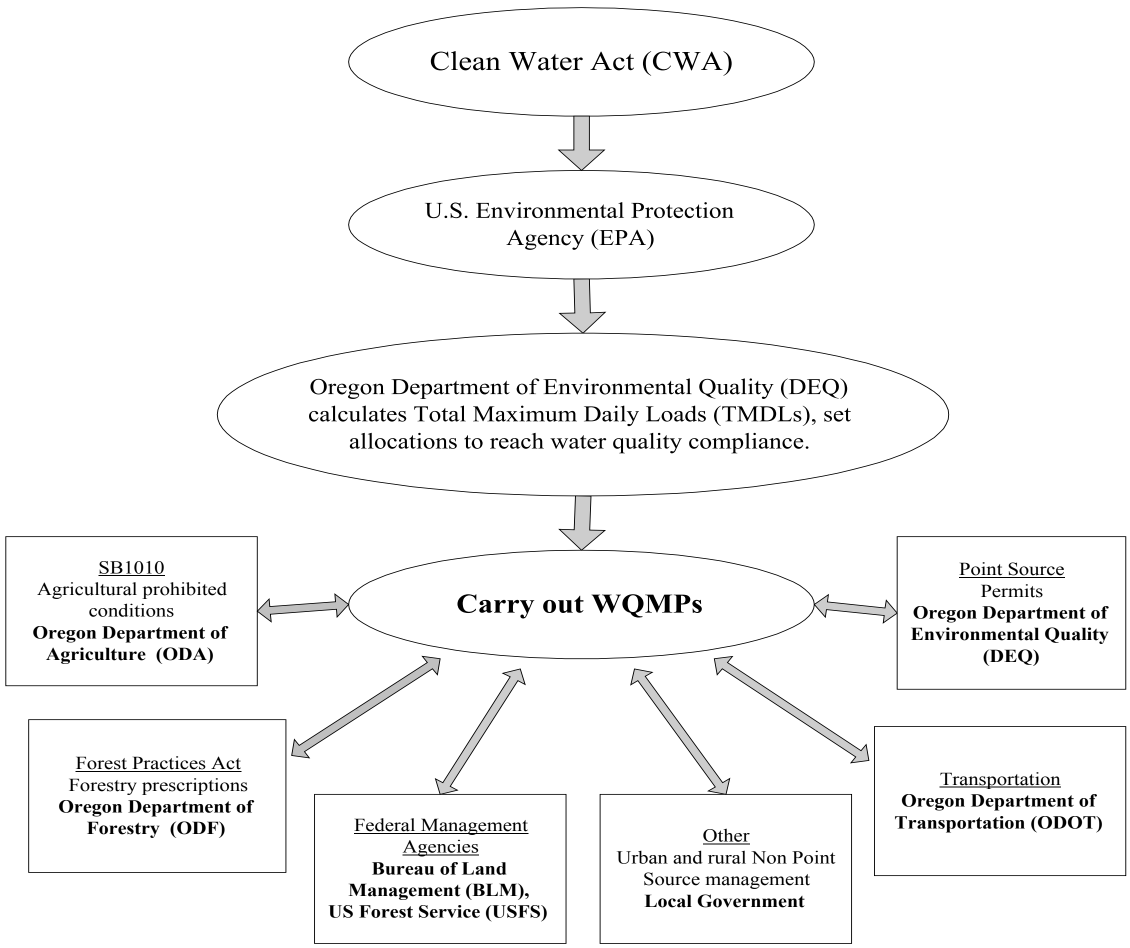
In 1999 the USFS and DEQ completed an assessment and prepared a TMDL and associated Water Quality Management Plan (WQMP) for the federal lands in the Sucker Creek Watershed above the USFS boundary at Sucker Creek river mile 10.4. The results of this work can be found in the March 1, 1999 Sucker/Grayback WQMP and will not be included in this document. This Lower Sucker Creek WQMP is focused on all lands below the National Forest boundary at river mile 10.4 (13,770 acres) and includes all private lands (both above and below the USFS boundary) in the watershed (8,500 acres). Within the area covered by this plan, approximately 44% percent of the land is under private ownership, the remainder is under USFS, State of Oregon, Josephine County, and BLM management.

This document describes strategies for implementing and achieving the Lower Sucker Creek Watershed Total Maximum Daily Load (TMDL). The main body of this text has been compiled by the Oregon Department of Environmental Quality (DEQ) with assistance from the Illinois Watershed Council, USFS, and BLM and includes a description of activities, programs, legal authorities, and other measures for which DEQ and other management agencies have regulatory responsibilities. This WQMP provides the overall framework describing the management efforts which will be implemented to attain the Lower Sucker Creek Watershed TMDL. Appended to this document are specific Implementation Plans which describe each management agencies existing or planned efforts to implement their portion of the TMDLs. This relationship is presented schematically in Figure 1, below.

The focus of this WQMP is to demonstrate how TMDLs will be implemented in the Lower Sucker Creek Watershed. It builds upon existing point and nonpoint source management plans to outline a management approach for all land uses in the Lower Sucker Creek Watershed. Its organization reflects the 10 plan elements described in a Memorandum of Agreement (MOA) between DEQ and the US Environmental Protection Agency (EPA). Designated Management Agencies (DMAs) are recognized by the Sate of Oregon as being those entities responsible to ensure that the targets set forth in the TMDL are met. What follows is a listing of the DMAs in Lower Sucker Creek by land use and their responsibilities under the TMDL. Also included are contacts for more information.

NOTE: The term "zoning" may be used synonymously with "land use" in this document. However it is the land use itself which determines which Management Plan is applicable.

Figure 1 : TMDL/WQMP/Implementation Plan Schematic



Rural/Non-Resource Land Use in Lower Sucker Creek
DMA: Josephine County

Urban/Non-resource land uses are covered in the Implementation Plan for Josephine County to the extent of their authority. Contact Josephine County Planning 541-474-5421 for more information. The land uses where Josephine County may have authority includes:

- All non-agricultural, non-forestry related land uses including transportation uses (road, bridge, and ditch maintenance and construction practices)
- Sewer and septic systems as related to human habitation
- Designing and siting of housing/home, commercial, and industrial sites in urban and rural areas
- Golf Courses

Agricultural Land Use
DMA: Oregon Department of Agriculture

Agricultural land uses are addressed in the *Inland Rogue Agricultural Water Quality Management Area Plan as required by Senate Bill 1010.* Contact Tim Stevenson, Oregon Department of Agriculture, 541-471-7838 or the Illinois Valley Soil and Water Conservation District for more information. The land uses falling under this category include:

- Agricultural or farm related activities, both commercial and non-commercial including livestock stable and pastures, both inside and outside of municipal boundaries
- Confined animal feeding operations (CAFO) and container nursery operations

Forestry Use, Private Lands
DMA: Oregon Department of Forestry
Private lands forestry uses are addressed in Forest Practices Act. Contact Dan Thorpe, Oregon Department of Forestry, 541-664-3328 for more information. The forest management activities covered under the Forest Practices Act are included in the following general categories:

- Harvesting or Salvaging Trees
- Site Preparation and Reforestation
- Chemical Application
- Clearing Forest Land for Non-Forest Uses
- Road Construction and Improvements
- Pre-commercial Thinning Slash Disposal

Federal Lands – USFS and BLM
DMAs: USDI-Bureau of Land Management, USDA-Forest Service
Land uses on Federal Lands are addressed in the Northwest Forest Plan, associated Aquatic Conservation Strategy, and Water Quality Management Plan for Sucker Creek. Contact Jon Brazier USFS (541) 858-2200 or Laurie Lindell BLM 541-618-2200 for more information.

State Roads
DMA: Oregon Department of Transportation
State road issues are addressed in "Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices July 1999. Contact ODOT District Manager, John Vial: (541) 774-6355 for more information.

Point Source Discharges
DMA: NPDES Permitted Operations
Point sources are addressed through the National Pollution Discharge Elimination System (NDPES). Permits are issued by DEQ of Environmental Quality. Contact Brad Prior DEQ: (541) 776-6010 for more information.

Required Elements of a WQMP
In February 2000, DEQ entered into a Memorandum of Agreement (MOA) with the U.S. Environmental Protection Agency (EPA) that described the 10 basic elements needed in a TMDL Water Quality Management Plan (WQMP). That MOA was endorsed by the Courts in a Consent Order signed by United States District Judge Michael R. Hogan in July 2000. These elements, as outlined below serve as the framework for the Lower Sucker Creek WQMP.

1 Management measures
2 Time-line for implementation
3 Timeline for attainment
4 Responsible participants

5 Reasonable assurance of implementation
6 Monitoring and evaluation
7 Public involvement
8 Maintenance of effort over time
9 Discussion of costs and funding
10 Citation to legal authorities

WQMP Development Process
A schematic of the WQMP process is shown in Figure 2 below. The TMDLs, as established by DEQ, set the load allocation targets for each Designated Management Agency (DMA) *Note: temperature Load Allocations in the Lower Sucker Creek Watershed are allocated 100% to natural sources – no anthropogenic caused increases in temperature are allowed (see TMDL Section 6)*. The DMAs (ODA,ODF, Josephine County, Federal Lands, ODOT) are each required to develop an implementation plan to meet the TMDLs. In the case of the ODA, ODF, ODOT and Federal Lands, Implementation Plans have been enacted which address the pollutants in the TMDL (*see WQMP Section 7*). Josephine County is expected to develop an Implementation Plan to meet the TMDLs according to the timelines outlined in this document. DEQ recognizes that TMDL implementation is difficult, but it is a critical step in the attainment of water quality standards. The first iteration of an Implementation Plan is therefore not expected to completely describe management efforts but describe the beginning of an adaptive management process that will lead to the attainment of water quality standards.

2. CONDITION ASSESSMENT AND PROBLEM DESCRIPTION

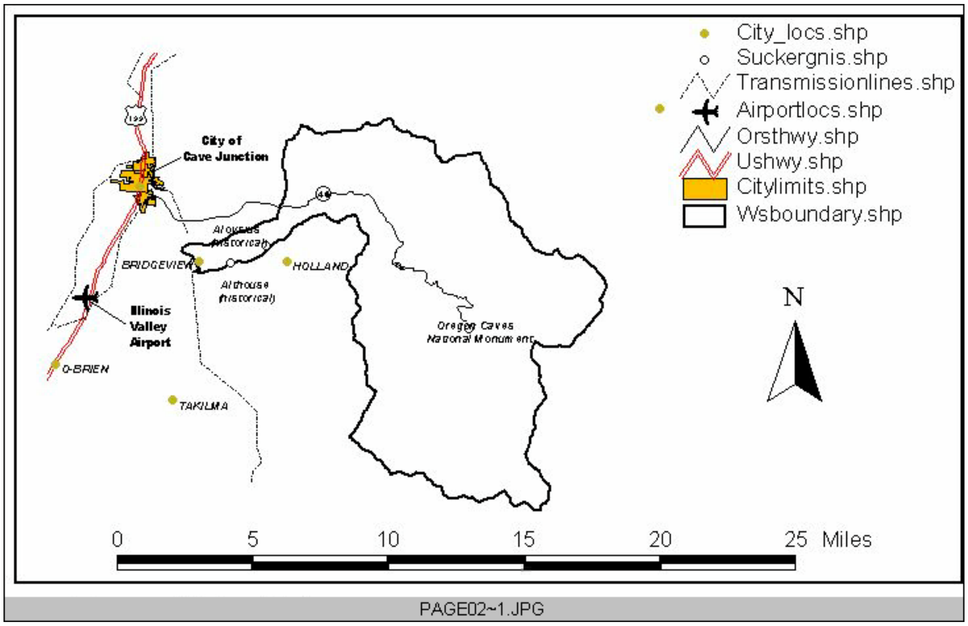
Project Overview
Sucker Creek is a 97 square mile watershed in southern Josephine County located in southwest Oregon. The lower portion of Sucker Creek is submitted as a separate landscape piece to facilitate planning efforts in the lower watershed. It includes all lands below the USFS boundary at river mile 10 plus all private holdings contained in the upper watershed (approximately 13427 acres total). Approximately 63% of the land in the area covered by the Lower Sucker Creek TMDL is under private ownership. The remainder is under BLM, State, and Josephine County jurisdiction (See Map 1).

Federal Lands
In 1999, the USFS prepared a WQMP for the federal lands in the Sucker Creek watershed. The BLM in conjunction with the USFS completed a shade and channel assessment of the 1.8 miles of BLM lands administered on the main stem of Sucker Creek above the confluence of Grayback Creek. The results of this assessment can be found in the March 1, 1999 Sucker/Grayback WQMP and will not be included in this document. The federal component of this WQMP covers the remaining 4,190 acres of BLM land in the lower Sucker Creek watershed.

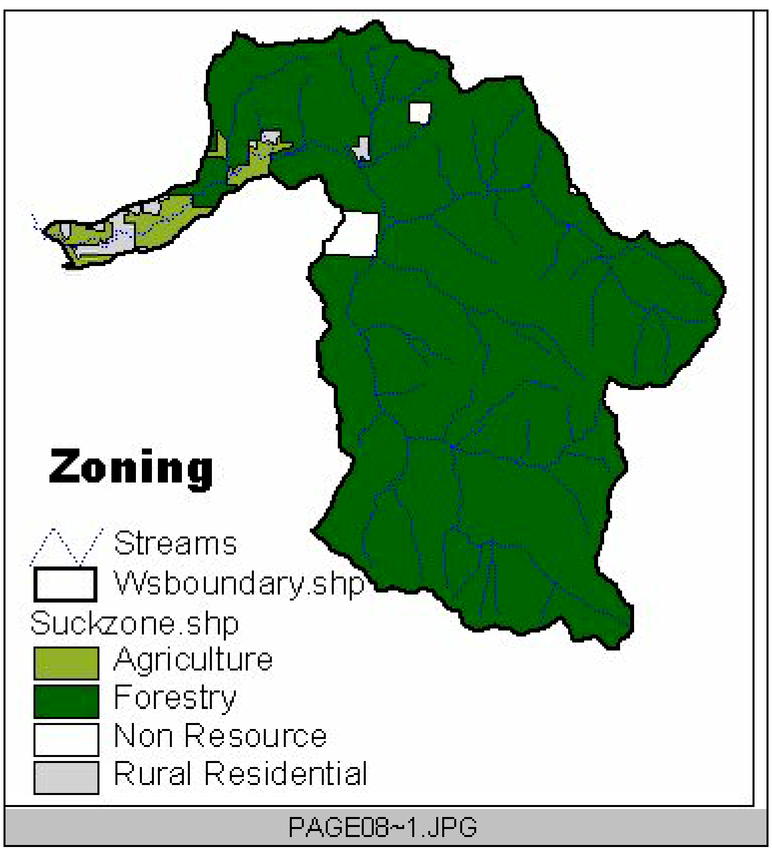
Private Lands
Privately owned lands make up approximately 63% of the area covered in this Lower Sucker Creek WQMP (or 14% of the entire watershed is privately owned). Land zoning for private lands includes: timber resource, agriculture, and rural residential.
NOTE: The term "zoning" may be used synonymously with the term "land use" in this document. However, it is the land use itself which determines the designated management agency with primary responsibility

Figure 2. TMDL/WQMP Planning Process

Map 1: Sucker Creek Vicinity Map.



Map 2: Lower Sucker Creek Zoning.



Fish Usage in Sucker Creek

The Sucker Creek Watershed is recognized as a very high priority for protection and restoration, one of the more important anadromous fish containing watersheds in the Rogue River Basin. It contains core area habitat as defined by the Southern Oregon Salmon Restoration Initiative in addition the Cave/Grayback Creeks Key Watershed and Upper Sucker Creek Key Watershed are recognized in the Northwest Forest Plan and Medford District Resources Management Plan (RMP). The American Fisheries Society has also designated Sucker Creek an *aquatic diversity area*. It is one of the few watersheds in the Siskiyou Mountains with substantive snowpack most years and good cold water flow. Despite the changes caused by mining, inappropriate forest management, and downstream agriculture uses, Sucker Creek has good spawning numbers of wild fish: coho salmon, fall chinook salmon, and winter steelhead.. The Sucker Creek watershed contains 12 miles of fall chinook habitat, 15 miles of coho habitat, 18 miles of winter steelhead habitat. See TMDL Section 3 for distribution maps and a more complete discussion of salmonids in the Sucker Creek Watershed.

Beneficial Uses

Oregon Administrative Rules (OAR Chapter 340, Division 41) lists the Beneficial Uses occurring within the Sucker Creek Watershed as Public Domestic Water Supply, Private Domestic Water Supply, Industrial Water Supply, Irrigation Livestock Watering, Boating, Aesthetic Quality, Anadromous Fish Passage, Salmonid Fish Spawning, Salmonid Fish Rearing, Resident Fish and Aquatic Life, Wildlife and Hunting, Fishing, Water Contact Recreation (Section 3, Table 2 in the TMDL)**.**

Deviation from Water Quality Standards

Section 303(d) of the Federal Clean Water Act (1972) requires that water bodies that violate water quality standards, thereby failing to fully protect *beneficial uses*, be identified and placed on a 303(d) list. Three stream segments in the Lower Sucker Creek Watershed have been put on the 1998 303(d) list for water quality impairments which include temperature violations, habitat modification, and flow modification (Table 1). For specific information regarding Oregon's 303(d) listing procedures, and to obtain more information regarding the Illinois Subbasin's 303(d) listed streams, visit DEQ of Environmental Quality's web page at **http://www.deq.state.or.us/**. (An analysis of the current conditions, and an explanation of each listed parameter for Lower Sucker Creek can be found in the TMDL, Section 4: *Problem Assessment*).

Table 1: Lower Sucker Creek, 1998 303(d) listed segments

Creek Segment	Listed Water Quality Parameter
Sucker Creek, Mouth to Grayback Creek	Temperature
Sucker Creek, Mouth to Bolan Creek	Habitat Modification
Sucker Creek, Mouth to Bolan Creek	Flow Modification
Lake Creek, Mouth to diversion	Temperature
Bear Creek, mouth to headwaters	Temperature

Water Quality Standards for Sucker Creek: Temperature

Rogue Basin Temperature Standard - OAR 340-041-0365(2)(b)(A)(i-vii)
A) To accomplish the goals identified in OAR 340-041-0120(11), unless specifically allowed under a Department-approved surface water temperature management plan as required under OAR 340-041-0026(3)(a)(D), no measurable surface water temperature increase resulting from anthropogenic activities is allowed: (i) In a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0°F (17.8°C); (ii) In waters and periods of the year determined by DEQ to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C); (iii) In waters determined by DEQ to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0°F (10.0°C); (iv) In waters determined by DEQ to be ecologically significant cold-water refugia; (v) In stream segments containing federally listed Threatened and Endangered species if the increase would impair the biological integrity of the Threatened and Endangered population; (vi) In Oregon waters when the dissolved oxygen (DO) levels are within 0.5 mg/l or 10 percent saturation of the water column or intergravel DO criterion for a given stream reach or subbasin; (vii) In natural lakes.

Loading capacities in the Sucker Creek Watershed are expressed as heat energy from incoming solar radiation expressed as BTU/ft^2/day. The temperature simulations described in the TMDL, using the Heat Source model, indicate that the Sucker Creek system is not expected to attain the temperature 64°F standard for the entire length of the stream during the warmest months of the year (typically late August/early July). However modeling does indicate that enhancements in riparian vegetation and a narrowing of the stream channel can have a marked effect on decreasing stream temperatures. The vegetation and channel width targets listed in the TMDL will result in maximum shade on Lower Sucker Creek and describe a scenario termed *System Potential*. Since the system is not expected to reach the temperature standard, any human activity that may result in an increase in stream temperatures will not be allowed (i.e. 100% of thermal loads are allocated to those occurring naturally).

Loading Capacity for Lower Sucker Creek at System Potential

- 927 BTU/ft^2/day
- 62% effective shade (reduction in Potential Solar Load reaching the stream)

Loading Capacity for Bear, Little Grayback, White Rock, and Windy Creeks at System Potential

- 98 BTU/ft^2/day
- 96% effective shade (reduction in Potential Solar Load reaching the stream)

Note: TMDL Section 5 and 6 detail the results of the temperature modeling for the Lower Sucker Creek Watershed and define the solar loading targets and explain the surrogate measures to reach those targets

Habitat Modification: OAR 340-041-0365 (2)(i), OAR 340-041-0027
The beneficial uses affected by habitat modification include Resident Fish and Aquatic Life, Salmonid Fish Spawning & Rearing. The standards that apply are: OAR 340-041-0365 (2)(i) *The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life, or affect the potability of drinking water, or the palatability of fish or shellfish shall not be allowed; or:* OAR 340-041-0027 *Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.*

Habitat modification is not the direct result of a pollutant although it does affect beneficial uses. Because a pollutant is not the cause, the concept of establishing a loading capacity and allocations through the development of a TMDL does not apply. There is the expectation, however, that the improvements to riparian vegetation that will be necessary to meet the temperature surrogate shade targets and the resulting changes in channel wetted width, and width to depth ratio, will also lead to improvements in habitat.

Flow Modification: OAR 340-041-0365 (2)(i), OAR 340-041-0027
The beneficial uses affected by flow modification include resident fish and aquatic life and salmonid Fish Rearing. A stream is listed as Water Quality Limited (WQL) if flow conditions are documented that are a significant limitation to fish or other aquatic life. The standards that apply are: OAR 340-041-0365 (2)(i) *The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life, or affect the potability of drinking water, or the palatability of fish or shellfish shall not be allowed; or:* OAR 340-041-0027 *Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.*

Flow modification is not the direct result of a pollutant although it does affect beneficial uses. Because a pollutant is not the cause, the concept of establishing a loading capacity and load allocations through the development of a TMDL does not apply.

Sediments OAR 340-041-0365(2)(j), (OAR 340-41-027), OAR 340-41-0365(2)(c)]
There are currently no streams in the Sucker Creek Watershed listed on the 1998 303(d) list for sediment and as such the establishment of loading capacities as part of the TMDL process do not apply. However excessive sedimentation will be discussed in this TMDL because there is considerable concern about the impact of sediments on channel widening and therefore temperature. Oregon water quality standards related to sedimentation as applicable to Sucker Creek are included here for reference:

> *Sedimentation* OAR 340-041-0365(2)(j) - "The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed."

Biological criteria OAR 340-41-027 - "Waters of the State shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities."

Turbidity OAR 340-41-0365(2)(c) - "No more than a ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity."

3. EXISTING SOURCES OF POLLUTION

See TMDL Chapter 4 for more detailed description.

Point Sources of Pollution

There are no NPDES permitted facilities that discharge into the surface water in the Sucker Creek Watershed during the critical summer temperature period.

Nonpoint Sources of Pollution

Anthropogenic sources of increased summertime stream temperatures in the Lower Sucker Creek Watershed include riparian vegetation disturbance, excessive sediments, and channel widening. Decreased riparian vegetation height, width and/or density, increases the amount of solar radiation reaching the stream surface. Increasing stream width also increases the surface area of the stream exposed to the sun.

4. GOALS AND OBJECTIVES

The overall goal of this TMDL WQMP is to achieve compliance with water quality standards for each of the 303(d) listed parameters and streams in the Lower Sucker Creek Watershed. Specifically this WQMP combines a description of all DMA plans that are or will be in place to address the load allocations in the TMDL. The specific goal of this WQMP is to describe a strategy for reducing discharges from nonpoint sources to the level of the load allocations described in the TMDL. This plan is preliminary in nature and is designed to be adaptive as more information and knowledge is gained regarding the pollutants, allocations, management measures, and other related areas.

The overarching goals of this WQMP are to:

GOAL 1: Maintain water quality to protect the beneficial uses that are currently being met and to prevent future declines in water quality.

GOAL 2: Implement management measures that will achieve the pollutant load allocations necessary for streams to be brought into compliance with all water quality standards.

All recovery goals and plans are strongly linked to the philosophy of maintaining those components of the ecosystem that are believed to be currently functioning, and to improving those sites that show the greatest potential for improvement in the shortest time frame. This philosophy maximizes recovery while minimizing expensive, extensive, and risky restoration treatments.

The objective of this WQMP is to meet water quality standards by eliminating the anthropogenic causes of nonpoint source pollution within this watershed. When the standards are met, they will protect the beneficial uses identified for the Rogue Basin under Oregon Administrative Rules (OAR) 340-41-362. The Josephine County Sucker Creek Water Quality Implementation Plan, Oregon Forest Practices Act, SB1010 Inland Rogue Agricultural Management Area plan, ODOT Operations and Maintenance Plan, and the BLM Medford Resource Management Plan (which tiers to the Northwest Forest Plan), will provide the policy framework and direction for the accomplishment of these goals.

5. IDENTIFICATION OF RESPONSIBLE PARTICIPANTS

This section identifies the organizations and agencies responsible for the implementation of this plan and lists the major responsibilities of each organization. This is not intended to be an exhaustive list of every participant that bears some responsibility for improving water quality in the Sucker Creek Watershed. Because this is a community-wide effort, a complete listing would have to include every business, every farm, and ultimately every citizen living or working within the watershed.

Oregon Department of Environmental Quality

- National Pollutant Discharge Elimination System (NPDES) Permitting and Enforcement
- Water Pollution Control Facility (WPCF) Permitting and Enforcement
- Inspection and permitting of septic systems
- Technical Assistance
- Financial Assistance

Josephine County

- Development and implementation of water quality management plans that will achieve the load allocations established by the TMDL.
- Construction, operation, and maintenance of county roads and county storm sewer system.
- Land use planning/permitting

- Maintenance, construction and operation of parks and other county owned facilities and infrastructure
- Riparian area protection

Oregon Department of Agriculture
- Agricultural Water Quality Management Area Plan (WQMAP) implementation and enforcement
- Confined Animal Feeding Operations (CAFO), container nursery permitting and enforcement
- Technical Assistance
- Revise Agricultural WQMAP as needed to address rules under Senate Bill (SB) 1010 to clearly address TMDL and Load Allocations as necessary.

Oregon Department of Forestry
- Forest Practices Act (FPA) Implementation
- Conservation Reserve Enhancement Program
- Revise statewide FPA rules and/or adopt watershed specific rules as necessary.

Oregon Department of Transportation
- Implementation of *Routine Road Maintenance, Water Quality and Habitat Guide Best Management Practices, July 1999*
- Development and implementation of pollution and erosion control plans

Federal Land Management Agencies (US Forest Service and BLM)
- Implementation of BMPs and Management Measures as described in the Northwest Forest Plan
- Follow the standards and guidance listed in the Aquatic Conservation Strategy (ACS)

Table 2 below shows the Lower Sucker Creek Watershed with current 303(d) listed segments and the associated Designated Management Agencies.

Table 2. Geographic Coverage of Designated Management Agencies

Stream	Segment	TMDL Parameters	Designated Management Agencies[1]
Sucker Creek,	Mouth to Grayback Creek	Temperature	JoCo, ODA, ODF, ODOT, BLM, USFS
Sucker Creek,	Mouth to Bolan Creek	Habitat Modification	JoCo, ODA, ODF, ODOT, BLM, USFS
Sucker Creek	Mouth to Bolan Creek	Flow Modification	JoCo, ODA, ODF, ODOT, BLM, USFS
Lake Creek	Mouth to diversion	Temperature	JoCo, ODA, ODF, ODOT, BLM, USFS
Bear Creek	mouth to headwaters	Temperature	JoCo, ODA, ODF, ODOT, BLM

[1] The determination of appropriate DMA is based on land use, not necessarily zoning.

6. PROPOSED MANAGEMENT MEASURES

This section outlines a restoration strategy for the mainstem of Sucker Creek, from mile 10.4 to the mouth. The objective of this section is to provide examples of how Lower Sucker Creek can be restored to meet the TMDL Surrogate Targets (See Section 6 in the TMDL for a description of *Surrogate Targets and System Potential*) and to provide realistic milestones for the re-establishment of channel stability and riparian vegetation.

NOTE: *The proposed restoration strategy shown below is a suggested approach to meet the TMDL. It is not the only approach and should not be misinterpreted as the required approach under the TMDL. Any restoration strategy should be developed in consultation with local experts. Please contact DEQ, the IVSWCD, or Illinois Valley Watershed Council for more information.*

Proposed Restoration Strategy for Lower Sucker Creek Lands

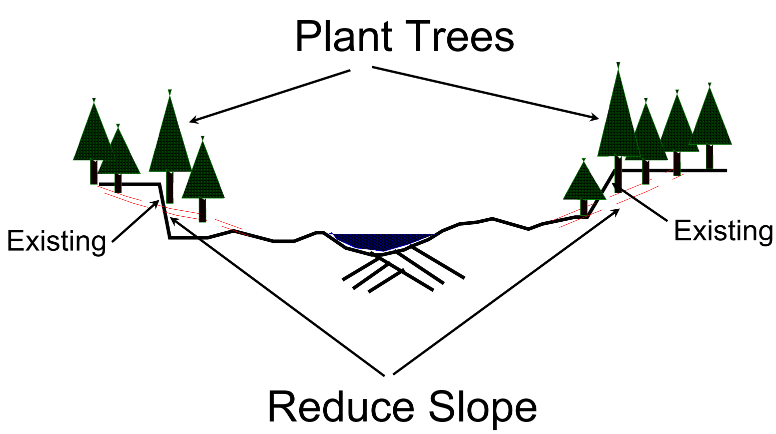
This section of the WQMP is based on the work of:
Hydro Dynamics, P.O. Box 633
Grants Pass, Oregon,
dynamics@internetcds.com.

Please Note: that recovery times where provided, are for growth of the shade producing streamside vegetation and do not take into account storm intervals or other natural disturbances nor the time for point bar development and associated channel changes prior to vegetation establishment.

During recent floods, the main stem of Sucker Creek has down-cut and become wide with a flat bottom and steep stream banks (Rosgen Type "F"). This has been caused by excessive sediment in the system and the lack of large vegetation with established root masses in the riparian areas to provide streambank stability. As a stream widens, mature trees provide less shade and the wetted surface area of the creek is exposed to increased solar radiation resulting in increased temperatures. Recovering riparian vegetation on the main stem will provide little benefit in temperature recovery without reducing the excessive channel width present on the mainstem of Sucker Creek. The overall restoration strategy is to protect existing trees located in the primary shade zone and begin to reestablish trees inward toward the stream channel, reducing the stream's width. This can be done by working to restore the stream's natural meander pattern by building point bars to act as flood plains and establishing trees to provide shade and stability. To accomplish this, the following three treatments are recommended

Restoration Treatment #1 – Plant trees and maintain stand health and vigor in existing riparian areas
Restoration Treatment #2 – Reduce the slope on the steep unstable stream banks and plant trees to begin moving the riparian area inward toward the stream (Figure 3).

Figure 3. Restoration Treatment #2



Restoration Treatment #3 – Construct wood debris fields on the leading edge of areas where point bars will naturally form. This is a cost effective method to stabilize the leading edge of a point bar and increase the roughness coefficient to begin sediment deposition. It uses logs between 10 and 15 feet in length with random widths. It is preferable to have root wad attached, but it is not necessary. The logs are dug into the streambed a minimum of 8 feet with the butt end protruding above the bottom. The logs are randomly placed (Figure 4).

Figure 4. Restoration Treatment #3

Wood Debris Field

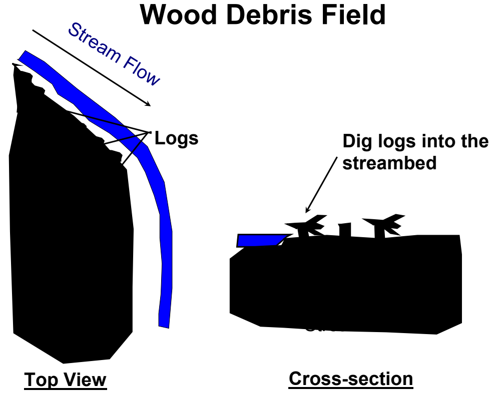
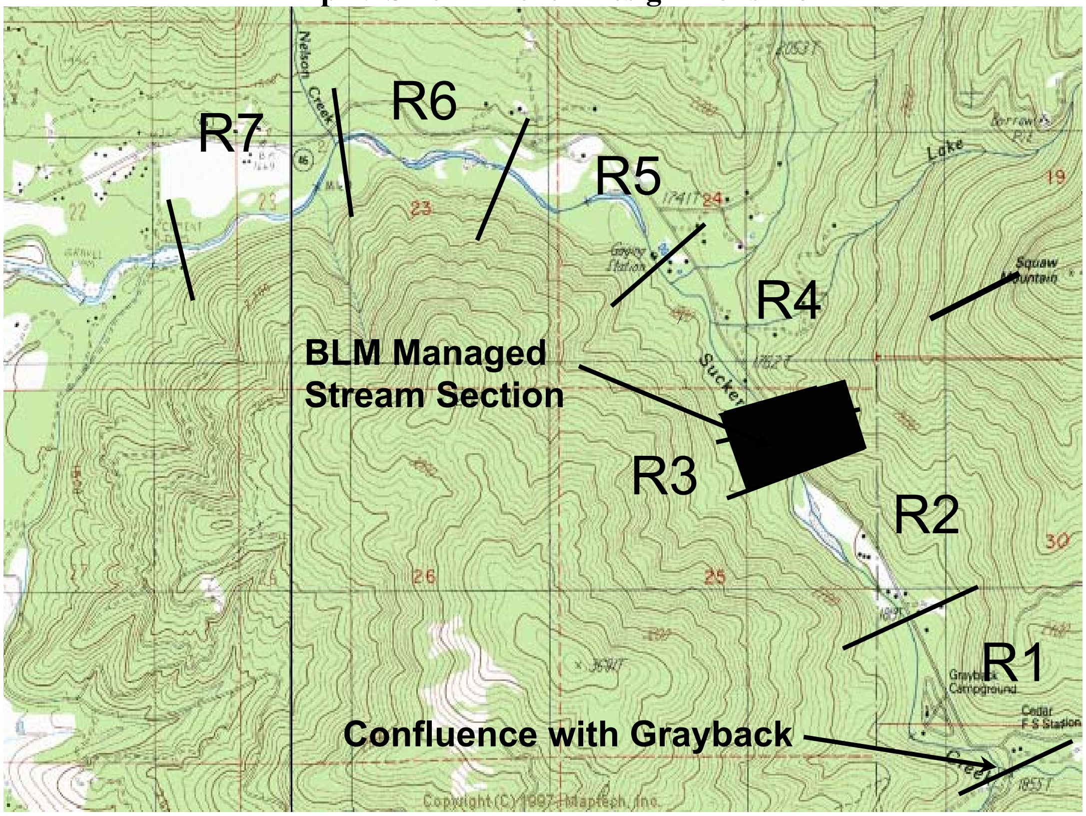


Table 2 Reach Definitions and Current Attributes

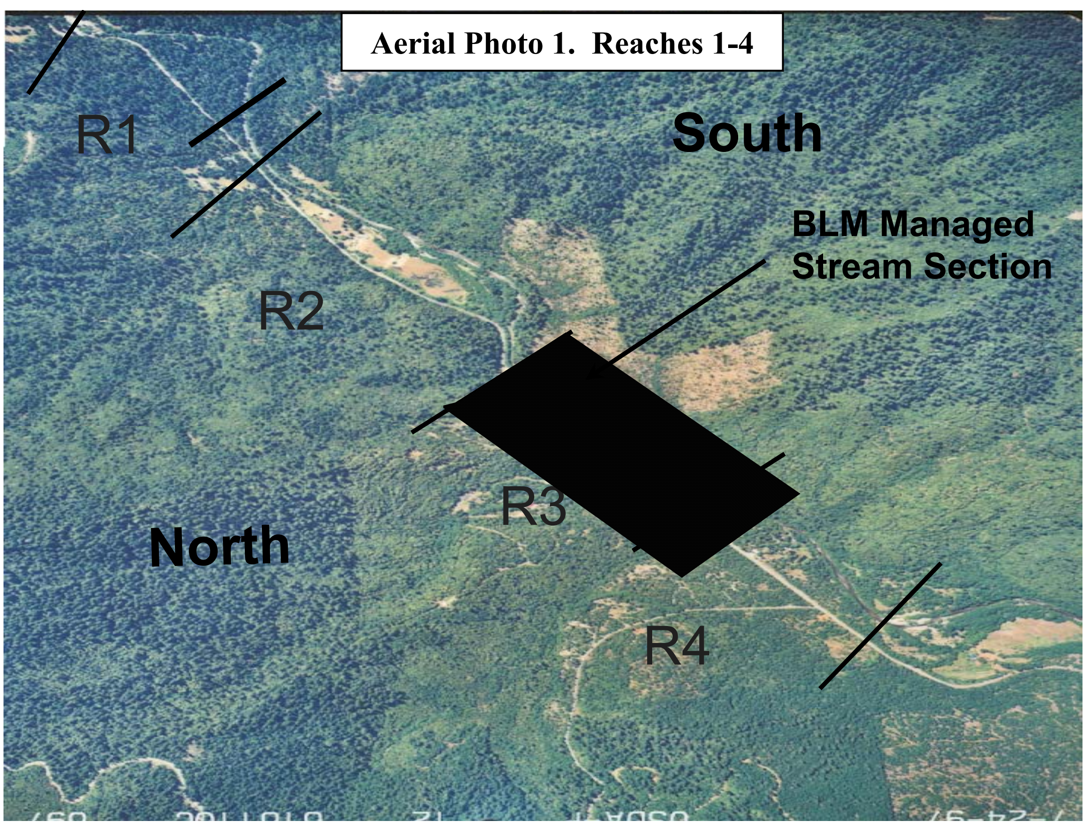
Reach Number	Owner-ship*	Current % TREE OVERHANG	Current WETTED WIDTH	ACTIVE CHANNEL WIDTH	LENGTH	Current TREE HEIGHT	TERRAIN SLOPE	STREAM ORIENT	Current TREE CHANNEL Distance	Current SHADE DENSITY
R1	PVT	0.05	40	80	3000	100	0.2	-40	10	0.75
R2	PVT	0	50	88	2800	60	0.2	-45	10	0.8
R3	BLM	0.05	60	65	800	60	0.3	-45	10	0.6
R4	BLM PVT	0	70	88	360 3240	60	0.2	-45	10	0.8
R5	PVT	0	70	90	2200	40	0.1	-77	10	0.8
R6	PVT	0	75	105	2200	40	0.1	-86	15	0.8
R7	PVT	0	70	90	3100	70	0.1	45	10	0.65
R8	PVT	0	85	135	3200	70	0.1	80	20	0.5
R9	PVT	0	84	133	2400	70	0.05	45	25	0.3
R10E	PVT	0	89	135	2100	70	0.05	45	100	0.6
R10W	PVT	0	89	135	2100	70	0.05	45	15	0.6
R11	PVT	0	90	135	1200	70	0.05	45	20	0.65
R12a	PVT	0	90	133	350	70	0.05	45	15	0.65
R12b	BLM	0	90	133	350	70	0.05	45	15	0.65
R12c	PVT	0	90	133	1130	70	0.05	45	15	0.65
R12d	BLM	0	90	133	980	70	0.05	45	15	0.65
R12e	PVT	0	90	133	590	70	0.05	45	15	0.65
R13	PVT	0	90	133	1000	70	0.05	45	200	0.3
R14	PVT	0	90	135	4000	70	0.05	55	200	0.1
R15	PVT	0	50	220	1600	70	0.05	45	10	0.8
R16	PVT	0	70	210	400	70	0.05	60	10	0.6
R17	PVT	0	88	400	200	70	0.05	75	15	0.55
R18	PVT	0	88	170	1000	70	0.05	30	10	0.7
R19	PVT	0	80	180	5500	70	0.05	90	10	0.5
R20	PVT	0	80	140	3000	70	0.05	-60	15	0.7

* Ownership is described as PVT = Private, BLM = Bureau of Land Management

Map 4. Stream Reach Designations 1-7



Aerial Photo 1. Reaches 1-4



Reach 1
Existing Stream Effective Shade 53 percent
Potential Stream Effective Shade 76 percent

Recommend Restoration Strategy – *PASSIVE*
Reach 1 is well vegetated with conifers 100 feet in height. The trees are approximately 10 feet from the active channel and the channel has a slightly oversized channel width of 80 feet. Prior to human disturbance in the watershed, the active channel width was most likely 65 to 75 feet in width. As the trees grow, the shade will continue to recover. Recovery should occur in 55 years.
Riparian Width – Protect existing riparian shade trees
South Side - The trees on the south side provide most of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 130 feet from the edge of the stream channel. Primary shade trees are 85 feet from the edge of the channel.
North Side – There are no primary shade trees located on the north side (trees that provide shade during high solar radiation output). The riparian secondary shade tree width on the north side is 35 feet from the edge of the channel.
BLM – Manages 800 feet within Reach #1. Existing effective shade in the reach is 40% and potential shade is 80%. Currently the reach has an average wetted width of 40 ft with a NSDZ of 80 ft. Future channel targets include an average wetted width of 30 an a NSDZ of 65-70feet. See Appendix E, Reach 2, Table 3 for more detail.

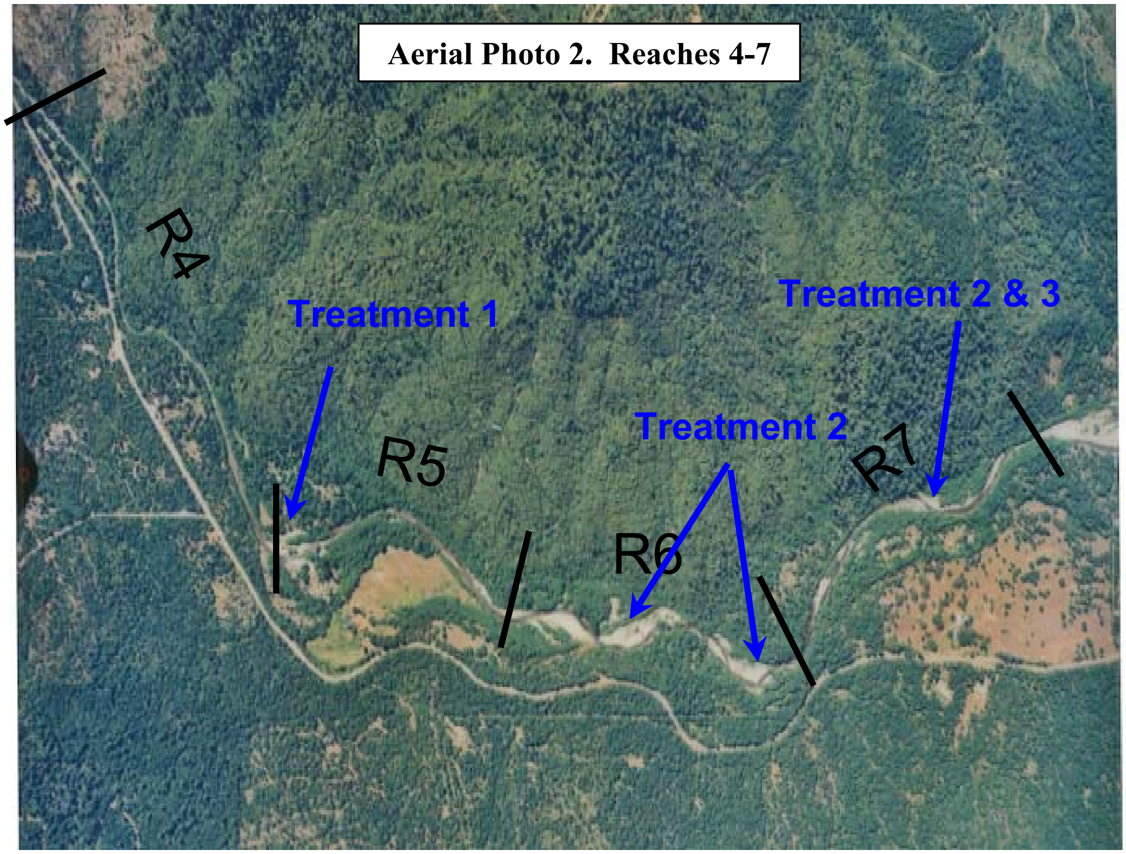
Reach 2
Existing Stream Effective Shade 31 percent
Target Stream Effective Shade 71 percent
Recommend Restoration Strategy – *PASSIVE*
Reach 2 is well vegetated on the south side with conifers 50 to 75 feet in height and some hardwoods. Clearing has occurred on the north side leaving a strip of riparian trees approximately 50 to 80 feet in width. The trees are approximately 10 feet from the active channel and the channel has an oversized channel width of 88 feet. Prior to human disturbance in the watershed, the active channel width was most likely 65 to 75 feet in width. The channel is fairly straight with high energy. It has down cut and has a flat bottom with steep banks. Because of the high energy in this section, channel restoration would probably not be successful. As the trees grow, the shade will continue to recover. Recovery should occur in 55 years.
Riparian Width – Protect existing riparian shade trees
South Side - The trees on the south side provide most of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 130 feet from the edge of the stream channel. Primary shade trees are 85 feet from the edge of the channel.
North Side – There are no primary shade trees located on the north side, or tree that provide shade during high solar radiation output. The riparian secondary shade tree width on the north side is 35 feet from the edge of the channel. The existing width is adequate.

Reach 3
Existing Stream Effective Shade 30 percent
Potential Stream Effective Shade 77 percent

Note: BLM manages all 800 feet of Reach 3.

Recommend Restoration Strategy – *PASSIVE*
Reach 3 is well vegetated on the south side with conifers 50 to 75 feet in height and some hardwoods. The trees are approximately 10 feet from the active channel (NSDZ of 65 ft) with a wetted channel width of 60 feet. Prior to human disturbance in the watershed, the NSDZ width was most likely 65 to 75 feet in width with a wetted channel width of 30 feet As the trees grow, the shade will continue to recover. Recovery should occur in 55 years.
Riparian Width – Protect existing riparian shade trees
South Side - The trees on the south side provide most of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 130 feet from the edge of the stream channel. Primary shade trees are 85 feet from the edge of the channel.
North Side – There are no primary shade trees located on the north side, or trees that provide shade during high solar radiation output. The riparian secondary shade tree width on the north side is 35 feet from the edge of the channel.
BLM – Manages all 800 feet within Reach 3. Current effective shade in this reach is between 26 and 50% with potential effective shade between 55 to 80%. See Appendix E, Table 3, Reaches 3 and 4, for more detail.

Reach 4
Existing Stream Effective Shade 26 percent
Potential Stream Effective Shade 72 percent
Recommend Restoration Strategy – *PASSIVE*
Reach 4 is well vegetated on the south side with conifers 50 to 75 feet in height and some hardwoods. The trees are approximately 10 feet from the active channel and the channel has an oversized channel width of 90 feet. Prior to human disturbance in the watershed, the active channel width was most likely 65 to 75 feet in width. The channel is fairly straight with high energy. It has down cut and has a flat bottom with steep banks. Because of the high energy in this section, channel restoration would probably not be successful. As the trees grow, the shade will continue to recover. Recovery should occur in 55 years.
Riparian Width – Protect existing riparian shade trees
South Side - The trees on the south side provide most of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 130 feet from the edge of the stream channel. Primary shade trees are 85 feet from the edge of the channel.
North Side – There are no primary shade trees located on the north side, or tree that provide shade during high solar radiation output. The riparian secondary shade tree width on the north side is 35 feet from the edge of the channel.
BLM – Manages the first 360 feet within Reach 4. See Appendix E, Reach 4, Table 3 for more detail.



Reach 5
Existing Stream Effective Shade 5 percent
Potential Stream Effective Shade 50 percent
Recommend Restoration Strategy – ***ACTIVE****:* South Side: #1 Planting
Reach 5 is well vegetated with conifers 40 feet in height and some hardwoods. The trees are approximately 10 feet from the active channel and the channel has an oversized channel width of 90 feet. Prior to human disturbance in the watershed, the active channel width was most likely 75 feet in width. There is a small area on the south side where waters washed out the riparian vegetation. Recommendations are to replant this area. As the trees grow, the shade will continue to recover. Recovery should occur in 70 years.
Riparian Width – Protect existing riparian shade trees.
South Side - The trees on the south side provide all of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 85 feet from the edge of the stream channel. Primary shade trees are 75 feet from the edge of the channel.
North Side – No shade trees.

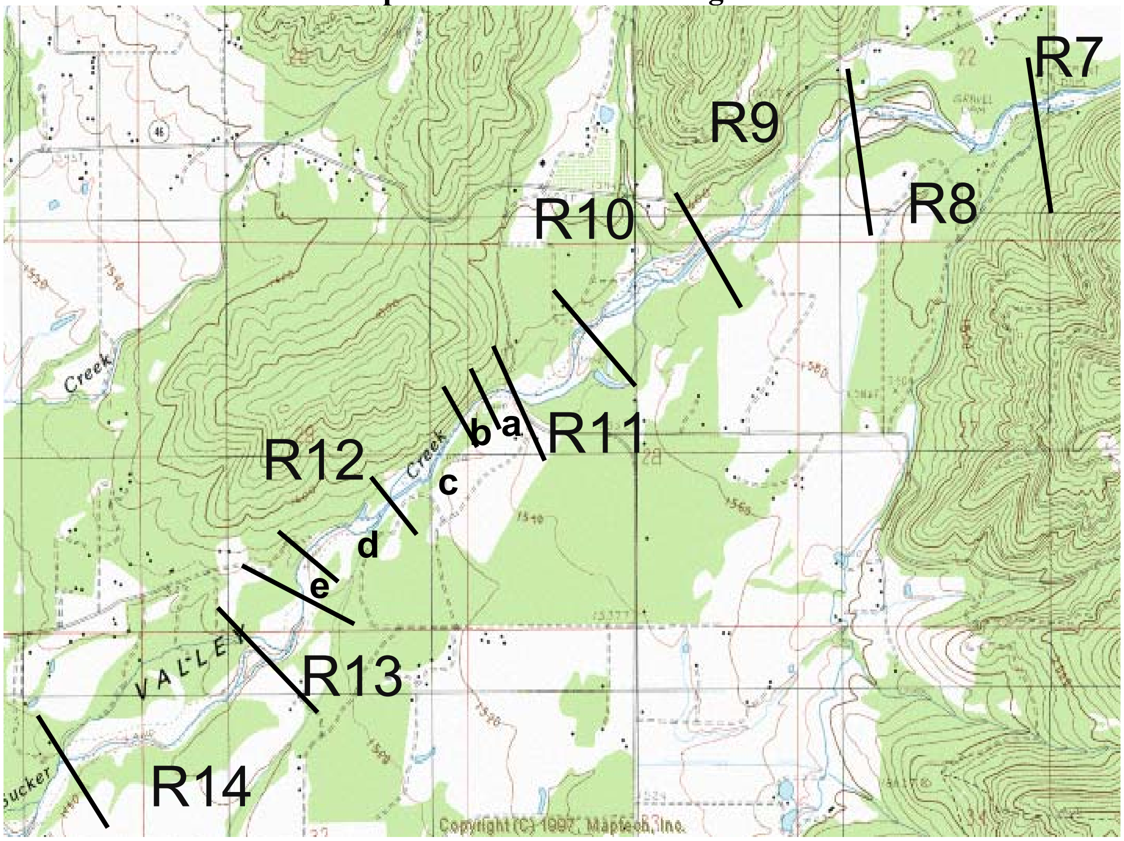
Reach 6
Existing Stream Effective Shade 1 percent
Potential Stream Effective Shade 50 percent
Recommend Restoration Strategy – *ACTIVE****:*** **#2 –**Slope back stream bank and plant.
Reach 6 is well vegetated with conifers 40 feet in height and some hardwoods. The channel has a width of 105 feet. Prior to human disturbance in the watershed, the active channel width was most likely 75 feet in width. There is an area on the south side where the stream bank could be sloped back and planted. The strategy is to recover 100 + feet of riparian primary riparian

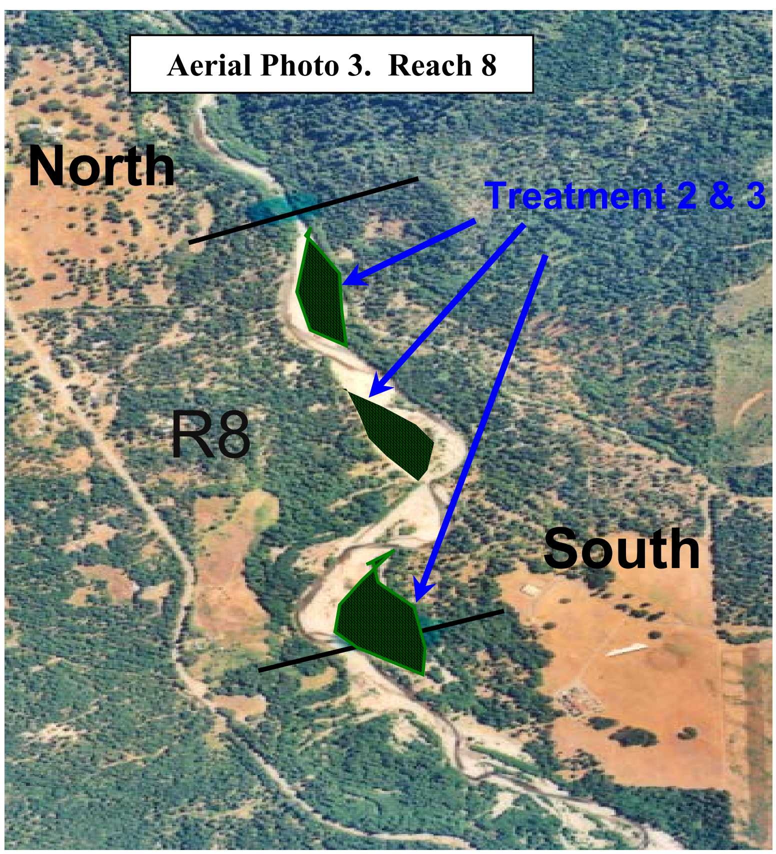
vegetation. As the trees grow, the shade will continue to recover. Recovery should occur in 70 + years.
Riparian Width – Protect existing riparian shade trees.
South Side - The trees on the south side provide all of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 85 feet from the edge of the stream channel. Primary shade trees are 75 feet from the edge of the channel.
North Side – No shade trees.

Reach 7

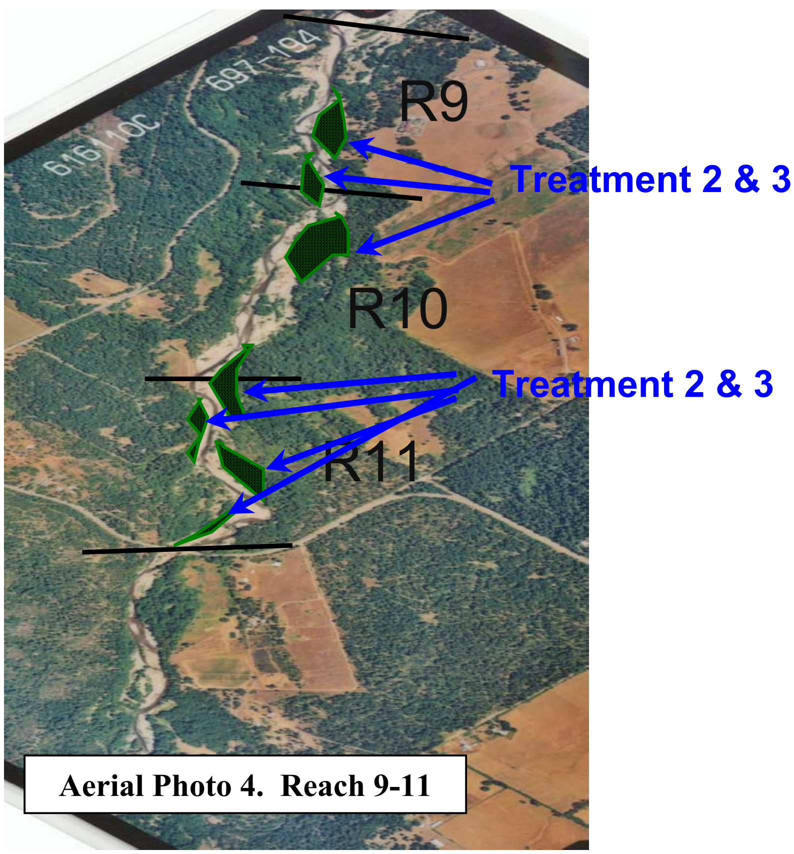
Existing Stream Effective Shade 1 percent
Potential Stream Effective Shade 57 percent
Recommend Restoration Strategy – *ACTIVE* South Side: #2 –Slope back stream bank and plant, #3 – Install small wood debris field.
Reach 7 is well vegetated with conifers 40 feet in height and some hardwoods. The trees are approximately 10 feet from the active channel and the channel has an oversized channel width of 105 feet. Prior to human disturbance in the watershed, the active channel width was most likely 75 feet in width. There is an area on the south side where the floodwaters have washed out a small pocket of riparian vegetation. The strategy is to install a small wood debris field on the leading edge of the point bar to stabilize it, protect new planting and existing re-growth. As the trees grow, the shade will continue to recover. Recovery should occur in 70 + years.
Riparian Width – Protect existing riparian shade trees.
South Side - The trees on the south side provide most of the stream shade. Assuming a recovered tree height of 150, trees providing stream shade are located 110 feet from the edge of the stream channel. Primary shade trees are 80 feet from the edge of the channel.
North Side – There are no primary shade trees on the north side. Assuming a recovered tree height of 150, trees providing stream shade are located 25 feet from the edge of the stream channel.

Map 5. Stream Reach Designations 7-14





Reach 8
Existing Stream Effective Shade 3 percent
Potential Stream Effective Shade 30 percent
Recommend Restoration Strategy – *ACTIVE:* South Side: #2 – Slope back stream bank and plant, #3 – Install wood debris field
Reach 8 is of typical of the lower main stem. The floodwaters, excessive sediment, and the lack of a mature riparian area have created a wide flat channel with steep stream banks (Rosgen "F"). The channel will continue to be unstable and migrate back and forth. Because of the channels wide width, trees are not effective in providing stream shade. The strategy in this area is to work with the natural channel meander and rebuild point bars. Using the existing riparian vegetation as a starting point, begin moving it inward to decrease the channel width. On the leading edge of point bars, install debris field to begin deposition and the building of flood plains. Reduce the slope of the steep stream banks located in the point bar areas and plant new vegetation to begin reclaiming the lost riparian area. The active channel width, with the volume of flow, should be approximately 135 feet with a summer-wetted width less than half of its current value or approximately 40 feet. With the installation of debris structures, point bars could be formed and the wetted width reduced in 20 years. The riparian vegetation will take 100 + years to recover.
South Side - The existing riparian vegetation is ineffective except on the outside of stream bends on the south side. With the streams orientation, the riparian vegetation should be protected for 80 feet from the edge of the stream channel.
North Side – While the north side does not provide stream shade, it is important to reestablish riparian vegetation to stabilize point bars and decrease stream width.



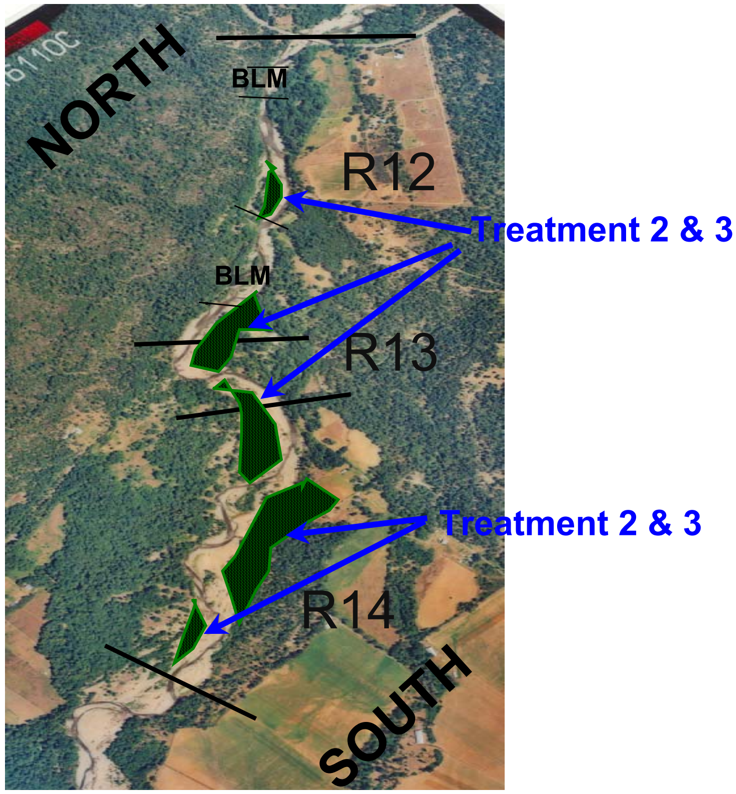
Aerial Photo 4. Reach 9-11

Reaches 9 - 11
Existing Stream Effective Shade 12 percent
Potential Stream Effective Shade 36 percent

Recommended Treatment:

Recommend Restoration Strategy – *ACTIVE:* #2 – Slope back stream bank and plant, #3 – Install wood debris field.
The floodwaters, excessive sediment, and the lack of a mature riparian area has created a wide flat channel with steep stream banks (Rosgen "F"). The channel will continue to be unstable and migrate back and forth. Because of the channels wide width, trees are not effective in providing stream shade. The strategy in this area is to work with the natural channel meander and rebuild point bars. Using the existing riparian vegetation as a starting point, begin moving it inward to decrease the channel width. On the leading edge of point bars, install debris field to begin deposition and the building of flood plains. Reduce the slope of the steep stream banks located in the point bar areas, and plant new vegetation to begin reclaiming the lost riparian area. The active channel width, with the volume of flow, should be approximately 135 feet with a summer-wetted width less than half of its current value or approximately 40 feet. With the installation of debris structures, point bars could be formed and the wetted width reduced in 20 years. The riparian vegetation will take 100 + years to recover.
South Side - The existing riparian vegetation is ineffective except on the outside of stream bends on the south side. With the streams orientation, the riparian vegetation should be protected for 110 feet from the edge of the stream channel. Primary shade trees are 80 feet from the active channel.
North Side – While the north side provides little stream shade, it is important to reestablish riparian vegetation to stabilize point bars and decrease stream width. There are no primary shade trees on the north side. On the outside of stream bends, trees providing shade are 20 feet from the active channel.

Aerial Photo 5. Reach 12-14



REACH 12 - 14

Existing Stream Effective Shade 12 percent
Potential Stream Effective Shade 36 percent

Note: Ownership on Reach 12 is approximately 2070 feet Private and 1330 feet BLM

Recommend Restoration Strategy – *ACTIVE:* Treatment: 2 – Slope back streambank and plant. 3 – Install wood debris field.
The flood waters, excessive sediment, and the lack of a mature riparian area has created a wide flat channel with steep stream banks (Rosgen "F"). The channel will continue to be unstable and migrate back and forth. Because of the channels wide width, trees are not effective in providing stream shade. The strategy in this area is to work with the natural channel meander and rebuild point bars. Using the existing riparian vegetation as a starting point, begin moving it inward to decrease the channel width. On the leading edge of point bars, install debris field to begin deposition and the building of flood plains. Reduce the slope of the steep streambanks located in the point bar areas, and plant new vegetation to begin reclaiming the lost riparian area. The active channel width, with the volume of flow, should be approximately 135 feet with a summer wetted width less than half of its current value or approximately 40 feet.

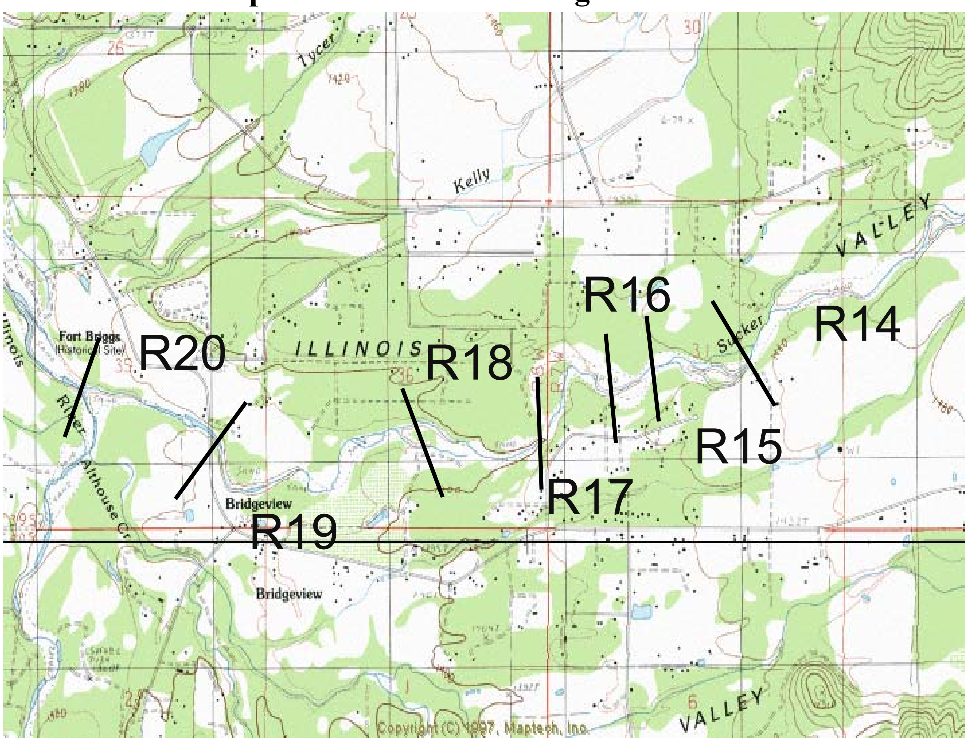
Riparian Width

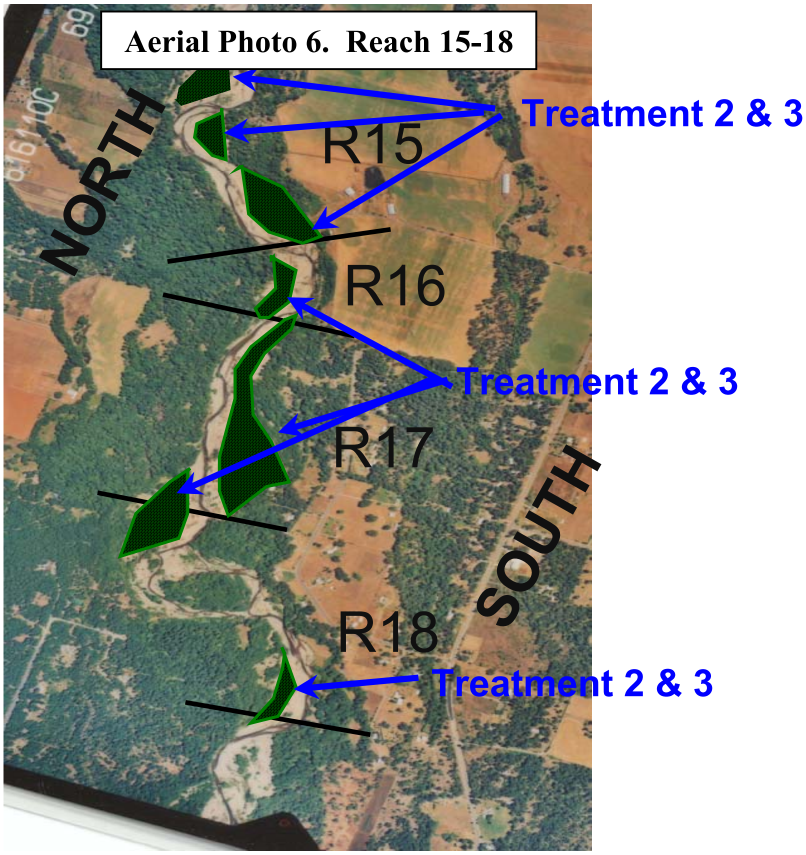
South Side - The existing riparian vegetation is ineffective except on the outside of stream bends on the south side. With the streams orientation, the riparian vegetation should be protected for 110 feet from the edge of the stream channel. Primary shade trees are 80 feet from the active channel width.

North Side – While the north side provides little stream shade, it is important to reestablish riparian vegetation to stabilize point bars and decrease stream width. There are no primary shade trees on the north side. On the outside of stream bends, trees providing shade are 20 feet from the active channel.

BLM – Manages 1330 feet within Reach #12. Existing effective shade in the combined BLM reaches is 25% and potential shade is 55%. Currently the reach has an average wetted width of 90 ft with a NSDZ of 135 ft. Future channel targets include an average wetted width of 40 feet with NSDZ to remain the same at 135 feet. See Appendix E, Reach 8, Table 3 for more detail.

Map 6. Stream Reach Designations 14-20

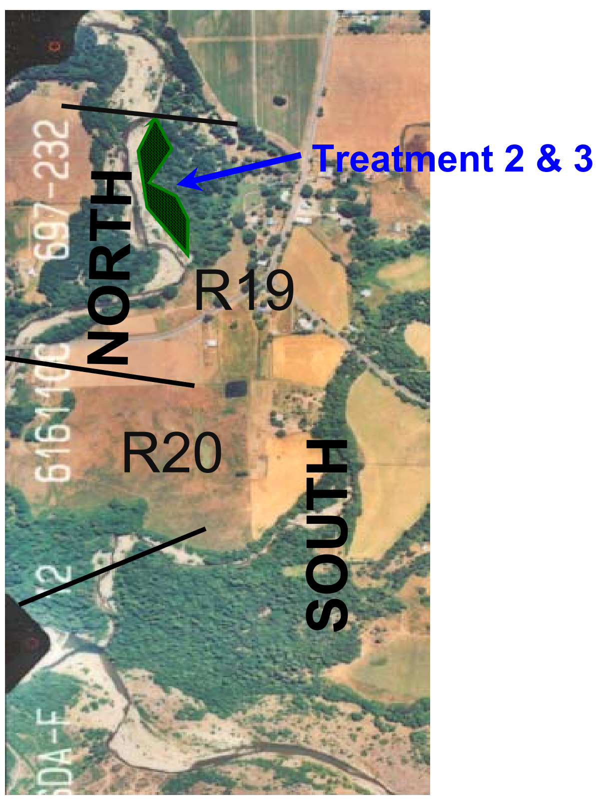




Reaches 15 - 18
Existing Stream Effective Shade 12 percent
Potential Stream Effective Shade 36 percent
Recommend Restoration Strategy – *ACTIVE: treatment #1&2* – Slope back stream bank and plant. #3 Install wood debris field
The floodwaters, excessive sediment, and the lack of a mature riparian area has created a wide flat channel with steep stream banks (Rosgen "F"). The channel will continue to be unstable and migrate back and forth. Because of the channels wide width, trees are not effective in providing stream shade. The strategy in this area is to work with the natural channel meander and rebuild point bars. Using the existing riparian vegetation as a starting point, begin moving it inward to decrease the channel width. On the leading edge of point bars, install debris field to begin deposition and the building of flood plains. Reduce the slope of the steep stream banks located in the point bar areas, and plant new vegetation to begin reclaiming the lost riparian area. The active channel width, with the volume of flow, should be approximately 135 feet with a summer-wetted width less than half of its current value or approximately 40 feet. With the installation of debris structures, point bars could be formed and the wetted width reduced in 20 years. The riparian vegetation will take 100 + years to recover.
South Side - The existing riparian vegetation is ineffective except on the outside of stream bends on the south side. With the streams orientation, the riparian vegetation should be protected for 110 feet from the edge of the stream channel. Primary shade trees are 80 feet from the active channel.
North Side – While the north side provides little stream shade, it is important to reestablish riparian vegetation to stabilize point bars and decrease stream width. There are no primary shade

trees on the north side. On the outside of stream bends, trees providing shade are 20 feet from the active channel.

Aerial Photo 7. Reach 19-20



Reach 19

Existing Stream Effective Shade 0 percent
Potential Stream Effective Shade 16 percent
Recommend Restoration Strategy – *ACTIVE: treatment #1&#2* – Slope back stream bank and plant. #3 – Install wood debris field.
The floodwaters, excessive sediment, and the lack of a mature riparian area has created a wide flat channel with steep stream banks (Rosgen "F"). The channel will continue to be unstable and migrate back and forth. Because of the channels wide width, trees are not effective in providing stream shade. The strategy in this area is to work with the natural channel meander and rebuild point bars. Using the existing riparian vegetation as a starting point, begin moving it inward to decrease the channel width. On the leading edge of point bars, install debris field to begin deposition and the building of flood plains. Reduce the slope of the steep stream banks located in the point bar areas, and plant new vegetation to begin reclaiming the lost riparian area. The active channel width, with the volume of flow, should be approximately 135 feet with a summer-wetted width less than half of its current value or approximately 40 feet. With the installation of debris structures, point bars could be formed and the wetted width reduced in 20 years. The riparian vegetation will take 100 + years to recover.
South Side - The existing riparian vegetation is ineffective except on the outside of stream bends on the south side. With the streams orientation, the riparian vegetation should be protected for 110 feet from the edge of the stream channel. Primary shade trees are 80 feet from the active channel.
North Side – While the north side provides little stream shade, it is important to reestablish riparian vegetation to stabilize point bars and decrease stream width. There are no primary shade trees on the north side. On the outside of stream bends, trees providing shade are 20 feet from the active channel.

REACH 20 – No Aerial Photo Coverage Available
Existing Stream Effective Shade 14 percent
Potential Stream Effective Shade 14 percent

7. DMA SPECIFIC IMPLEMENTATION PLANS

What follows is a brief description of the status and contents of Water Quality Management Plans for the Lower Sucker Creek Watershed:

Non-resource land use

Land Use: Rural/Non-Resource Land Use, County owned lands
Plan: Implementation Plan to be developed by Josephine County
DMA: Josephine County
Specific management measures are not provided at this time. The preceding Restoration Strategy for Lower Sucker Creek (WQMP Section 6) is provided as a guide to assist the county and community in the development of an Implementation Plan with realistic expectations. The guidance provided is not comprehensive and other management measures and approaches may be chosen by Josephine County where appropriate. For

each activity proposed by the County, a listing of the frequency and extent of application should be provided.

The types of management activities available to Josephine County that may positively effect the 1998 303(d) listed parameters on Lower Sucker Creek: temperature, habitat modification, flow modification are shown in Table 3. Again this list is not exhaustive and the management methods chosen for inclusion into any Implementation Plan will be at the discretion of Josephine County and its partners.

Table 4. Management Activities that Affect 1998 303(d) listed Parameters

Management Measure/Source Category	Parameter Addressed:		
	Temperature	Habitat Modification	Flow Modification
Public awareness/Education			
General outreach	X	X	X
New Development and Construction			
Planning Procedures	X	X	
Permitting and Design	X	X	
Education and Outreach	X	X	
Construction Control	X	X	
Post-construction control			
Storm Drain system construction	X	X	
Existing development			
Storm Drain System	X	X	
Streets and Roads O&M	X	X	
Parking Lots	X	X	
Riparian area Management			
Revegetation	X	X	X
Streambank Stabilization	X	X	X
Transportation			
Road Construction	X	X	
Road maintenance and repair	X	X	

Agriculture

Land use: Agriculture_
Plan: Inland Rogue Agricultural Water Quality Management Area Plan
DMA: Oregon Department of Agriculture
The *Inland Rogue Agricultural Water Quality Management Area Plan* provides guidance for addressing agricultural water quality issues in the Inland Rogue Agricultural Water Quality Management Area which includes the Sucker Creek Watershed. The purpose of the plan is to identify strategies to reduce water pollution form agricultural lands through a combination of educational programs, suggested land treamtents, management activities, and monitoring.

Note: *The following sections are excerpted from Inland Rogue Agricultural Water Quality Management Area Plan. The entire plan is available upon request from the Illinois Valley Soil and Water Conservation District: 541-592-3731*

Menu of Conservation Practices

The conservation practices listed below are intended to increase awareness, provide information, and educate the general public and the agricultural community. They are not intended to be mandates to land managers. Senate Bill 1010 was designed to maintain as much flexibility in farming and ranching as possible to achieve state water quality goals and objectives.

Optimal agricultural management for the Inland Rogue consists of those management practices that are generally accepted as the most effective, economical, and practical for the area and that address water quality issues. These activities should also maintain the economic viability of agriculture in the Subbasin. Appropriate management for individual farms and ranches may vary with the specific cropping, soils, topographical, environmental, and economic conditions existing at a given site. Because of these variables, it is not possible to recommend uniform Management Practices for every farm or ranch in the Inland Rogue. The Natural Resources Conservation Service's (NRCS) Field Office Technical Guide contains extensive lists of Management Practices to help an individual landowner meet his operational and conservation objectives.

What follows is a summary of some of the suggested practices that the Oregon Department of Agriculture, Soil and Water Conservation District, Oregon State University Extension Service, and the Local Advisory Committee will encourage landowners to consider, if they haven't already. Increased attention to these considerations may improve the water quality parameters of concern (temperature, habitat modification, flow modification) in the Illinois River Subbasin that are affected by agricultural activities.

Table 5. Management Conservation Practices taken from the Inland Rogue Agricultural Water Quality Management Area Plan

Practices	Potentially affected 303(d) listed parameter	Conservation Practices
Overwatering	Temperature Sediment Flow Modification a	-Use responsible set duration and nozzle size based on agronomic need and soil moisture holding/infiltration capacity Use retention ponds to collect and re-use surface returns Measure soil moisture with tensiometers, gypsum blocks etc..
Pooling and Stagnation	Temperature	-Maintain vegetated filter strips -Recover tailwater for recirculation or infiltration -Maximize vegetative cover
Overgrazing the riparian area	Temperature Bacteria Flow Modification	Fence where appropriate Plant native and non-native species to enhance properly functioning condition Manage grazing to restore properly functioning condition Water livestock off-channel Provide animals with shade away from riparian area
Overgrazing the uplands	Sediment Flow modification	Salt water and feed on a hardened area Match stocking rate to forage production capacity of the pasture Account of slope and soil type for management

Allowing noxious and invasive weeds to dominate riparian sites	Temperature Flow Modification	Interrupt seeding cycle Control root reproducers Control weed populations Plant competitive species
Riparian pastures managed in such a way as to degrade the shade density capability of near-stream areas (the result in inadequate vegetation cover).	Temperature Sediment bacteria	Attract livestock to upland areas with off- stream shade, water and salt Fence off riparian areas to facilitate proper management
Pastures managed in such a way as to reduce forage basal area coverage to lass than 50%	Temperature Bacteria	Rotate pastures: use the 8"and 3" rule to turn in and out. Use electric fences for flexibility in rotation schedule Balance livestock numbers with regrowth potential
Insteam livestock watering in such a way as to degrade bank stability, increase sediment yield, and increase introduction of bacteria into waters of the state	Bacteria Sediment Flow modification	Use Water gaps along fenced streams Provide off-stream watering Create visual barriers on far side of stream Harden Stream Crossings
Overuse of Water (indicators include growth of wetland species in fields: Baltic Rush, sedges, horsetails)	Temperature Flow Modification	Improve scheduling, timing and set changes Improve knowledge of crop needs Improve distribution methods Schedule irrigation with soil moisture measurements Improve diversion techniques and maintenance ie change location of diversion Consider leasing unneeded water rights to water resources department or Oregon Water Trust.
Excessive runoff/tailwater	Temperature Nutrients Sediment	Improve timing and integrate with livestock rotations to prevent compaction of pasture soils Consider collection and redistribution of tailwater Facilitate percolation of tailwater on vegetated area with well drained soils See scheduling requirements above.
Over application of irrigation water beyond replacement of soil water holding capacity and reasonable leaching factors	Temperature Flow Modification Sediment	Use soil moisture measurement to schedule irrigation application Match application rate with infiltration rate of the soil

Inadequate distribution ditch maintenance causing excessive leakage and/or forcing excess flow to compensate for ditch loss	Temperature Flow Modification	Clean and repair ditches on regular schedule to facilitate flow Line ditches Install pipe where applicable

Table 6. Vegetation Management Conservation Practices

Practices	Potentially affected 303(d) listed parameter	Conservation Practices
Grazing the riparian area	Temperature Bacteria Flow Modification	-Fence where appropriate to control utilization -Plant native and non-native species to enhance properly functioning conditions -Manage grazing to restore proper functioning condition
Grazing the uplands	Sediment Flow Modification	-Salt, water and feed on hardened area -Match stocking rate to forage production capacity of the pasture -Account for slope and soil type for management -Rotate pastures: use the 8” and 3”* rule to turn in and out.
Tillage on slopes and swales	Sediment	-Use settling basins consisting of depressions at the bottom of the field -Construct curtain drains at the bottom of the field -Put straw bales in unconstructed drainage ways -Plant grass filter strips designed for slope and sediment yield potential
Noxious and invasive weed control	Temperature Flow Modification	-Interrupt seeding cycle -Control root reproducers -Control weed populations systematically -Plant competitive species

*8” and 3” Rule - Turn animals into a pasture when forage averages 8 inches tall then take them out to allow regrowth when the forage has been utilized down to an average 3 inches of stubble height. Irrigated only.

Table 7. Livestock Management Conservation Practices

Practices	Potentially affected 303d listed parameter	Conservation Practices
Grazing in riparian pastures	Sediment Temperature Bacteria	-Use hardened crossings -Use culvert crossings or bridge streams and ditches -Install gates and rotate pasture use -Use drainage appropriate to site: ie. drain tile, curtain drains, etc. -Attract livestock to upland areas with off-stream shade, water and salt -Fence off riparian areas to facilitate proper management (permanent or temporary) -Water livestock off-channel -Provide animals with shade away from the riparian area
Grazing in upland areas	Temperature Bacteria Sediment	-Use electric fences for flexibility in rotation schedule -Balance livestock numbers with regrowth potential. -Rotate animals off of pastures during and right after irrigation sets -Construct buffer and filter strips
Intensive feeding areas	Bacteria Nutrients	-Store in covered, dry area away from surface water -Spread manure when runoff potential is minimal -Balance livestock numbers with area available
Livestock watering	Sediment Bacteria Flow Modification	-Use water gaps along fenced streams -Provide off-stream watering -Create visual barriers on far side of stream -Harden stream crossings

Table 8. Irrigation Management Conservation Practices

Practices	Potentially affected 303d listed parameter	Conservation Practices
Irrigation applications	Temperature Flow Modification	-Improve scheduling, timing, and set changes -Improve knowledge of crop needs, ie. specific crop water requirements -Improve distribution methods, ie. upgrade from flood to sprinkler where feasible, or upgrade ditch and lateral system -Schedule irrigation with soil moisture measurements using gypsum blocks or other simple moisture monitoring devices -Improve diversion techniques and maintenance ie. location of diversion -Consider leasing unneeded water rights to WRD or OWT
Irrigation runoff/tailwater	Temperature Nutrients Sediment	-Improve timing and integrate with livestock rotations to prevent compaction of pasture soils (OSU Extension recommends 4-5 days after irrigation before animals are allowed back on.) -Consider collection and redistribution of tailwater -Facilitate percolation of tailwater on vegetated area with well-drained soils -See scheduling requirements above

Federal Lands - BLM

Land Use: any use of Federally managed lands
Plan: Medford District Resource Management Plan (RMP) and the Northwest Forest Plan (NWFP)
DMA: Bureau of Land Management

The Medford District RMP tiers to the NWFP which includes the Aquatic Conservation Strategy. Summarized below are the management measures from the NWFP Standards and Guidelines that could be used in the Lower Sucker Creek area:

Stream Temperature - Shade
Aquatic Conservation Strategy - B-9 to B-11, C-30 to C-31
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17
Watershed Restoration - B-30

Stream Temperature - Channel Form
Aquatic Conservation Strategy - B-9 to B-11, C-30 to C-31
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17
Watershed Restoration - B-30
Roads - B-31, C-32 to C-33

Flow Modification
Aquatic Conservation Strategy - B-9 to B-11, C-30 to C-31
Watershed Restoration - B-30
Roads - B-31, C-32 to C-33

Habitat Modification
Aquatic Conservation Strategy - B-9 to B-11, C-30 to C-31
Riparian Vegetation - B-31
Riparian Reserves - B-12 to B-17
Watershed Restoration - B-30
Roads - B-31, C-32 to C-33
In-stream Habitat Structures - B-31

Active forest management, such as density management and fuels reduction, in the riparian reserve may be necessary to accelerate late-successional characteristics and maintain stand health and vigor. Port Orford cedar infected with *Phytopthera lateralis* exist in the Lower Sucker Creek area. Management may become necessary to prevent a catastrophic event from the spread of *P. lateralis* to uninfected trees.

Adaptive Management, Review, Prioritization and Revision
Monitoring will provide information as to whether standards and guidelines are being followed, and if actions prescribed in the WQMP are achieving the desired results. In addition to the monitoring identified in the WQMP, NWFP monitoring occurs annually to assess implementation of standards and guidelines. Information obtained from both sources of monitoring will ascertain whether management actions need to be changed. The monitoring plan itself will not remain static, but will be evaluated periodically to assure the monitoring remains relevant, and will be adjusted as appropriate.

Forestry Use on Private Lands

Land Use: any use on private lands that involves timber management.
Plan: Forest Practices Act
DMA: Oregon Department of Forestry
Private lands forestry uses are addressed in Forest Practices Act. The Environmental Quality Commission, Board of Forestry, DEQ, and ODF have agreed that these pollution control measurers will be relied upon to result in the achievement of state water quality standards. DEQ has recognized that the Forest Practices Act is the mechanism by which private timber management will achieve the standards of the TMDL. The Board of Forestry has adopted water protection rules, including but not limited to OAR Section 629,

Divisions 635-660, which describe BMPs for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness.

Transportation

Land use: any land use including roads, highways, bridges new construction, operations or maintenance or lands owned or operated by ODOT
Plan: Water Quality and Habitat Guide Best Management Practices July 1999
DMA: Oregon Department of Transportation
The Oregon Department of Transportation (ODOT) has been issued an NPDES MS4 waste discharge permit. Included with ODOT's application for the permit was a surface water management plan which has been approved by DEQ and which addresses the requirements of a Total Maximum Daily Load (TMDL) allocation for pollutants associated with the ODOT system. Both ODOT and DEQ agree that the provisions of the permit and the surface water management plan will apply to ODOT's statewide system. This statewide approach for an ODOT TMDL watershed management plan addresses specific pollutants, but not specific watersheds. Instead, this plan demonstrates how ODOT will incorporate water quality protection into project development, construction, and operations and maintenance of the state and federal transportation system that is managed by ODOT, thereby meeting the elements of the National Pollutant Discharge Elimination System (NPDES) program, and the TMDL requirements.

The MS4 permit and the plan:

- Streamlines the evaluation and approval process for the watershed management plans
- Provides consistency to the ODOT highway management practices in all TMDL watersheds.
- Eliminates duplicative paperwork and staff time developing and participating in the numerous TMDL management plans.

ODOT Programs

ODOT established a Clean Water program in 1994 that works to develop tools and processes that will minimize the potential negative impacts of activities associated with ODOT facilities on Oregon's water resources. The ODOT Clean Water program is based on developing and implementing Best Management Practices (MBPS) for construction and maintenance activities. ODOT has developed, or is developing the following documents, best management practices, or reviews, that reduce sediment and temperature impacts:

- **ODOT Routine Road Maintenance Water Quality and Habitat Guide, Best Management Practices, July 1999 (ESA 4(d) Rule)**

  ODOT has worked with National Marine Fisheries Service (NMFS) and Oregon Department of Fish and Wildlife (ODFW) to develop Best Management Practices (MBPS) that minimize negative environmental impacts of routine road maintenance activities on fish habitat and water quality. The National Marine Fisheries Service has determined that routine road maintenance, performed under the above mentioned guide, does not constitute a 'take' of anadromous species listed under the federal Endangered Species Act, and therefore additional federal oversight is not required. This determination has been finalized as part of the Federal Register, Volume 65, Number 132, dated Monday, July 10, 2000, pages 42471-42472. In addition, the Oregon Department of Fish and Wildlife has determined that the guide, and BMPs are adequate to protect habitat during routine maintenance activities.

- **NPDES Municipal Separated Storm Sewer System (MS4) Permit**

ODOT worked with DEQ to develop a statewide NPDES MS4 permit and stormwater management program that reduces pollutant loads in the ODOT stormwater system. The permit was issued to ODOT on June 9, 2000.

- **NPDES 1200CA Permit**

ODOT has developed an extensive erosion control program that is implemented on all ODOT construction projects. The program addresses erosion and works to keep sediment loads in surface waters to a minimum. ODOT currently holds 5 regional permits that cover highway construction.

- **Erosion and Sediment Control Manual**

ODOT Geotechnical/Hydraulic staff have developed erosion and sediment control manuals and training for construction and maintenance personnel. Included in the manual are designs for different types of erosion control measures.

- **National Environmental Policy Act (NEPA) Reviews**

ODOT is an agent of the Federal Highway Administration, consequently, ODOT must meet NEPA requirements during project development. Included in the project development process are reviews to avoid, minimize and mitigate project impacts to natural resources, including wetlands and waters of the state.

- **Integrated Vegetation Management (IVM) District Plans**

ODOT works with the Oregon Department of Agriculture and other agencies to develop activities that comply with regulations that pertain to the management of roadside vegetation. Vegetation management BMPs can directly effect watershed health. Each ODOT district develops an integrated vegetation management plan.

- **Forestry Program**

ODOT manages trees located within its right of way in compliance with the Oregon Forest Practices Act and other federal, state, and local regulations. Temperature, erosion, and land stability are watershed issues associated with this program. ODOT is currently working with ODFW on a prototype for managing hazardous trees along riparian corridors.

- **Cut/Fill Slope Failure Programmatic Biologic Assessment**

ODOT has been in formal consultation with the National Marine Fisheries Service, the US Fish and Wildlife Service and the Oregon Department of Fish and Wildlife Service in the development of a programmatic biological assessment for how ODOT will repair cut/fill slope failures in riparian corridors. The draft document outlines best management practices to be used in stabilizing failed stream banks, and bio-engineered design solutions for the failed banks.

- **Disposal Site Research Documentation and Programmatic Biological Assessment**

ODOT has been working with DEQ in researching alternatives and impacts associated with the disposal of materials generated from the construction, operation and maintenance of the ODOT system. ODOT has begun the process of entering into formal consultation with NMFS, USFWS, and ODFW on disposing of clean fill material.

ODOT TMDL Pollutants

ODOT and DEQ have identified temperature and sediment as the primary TMDL pollutants of concern associated with highways. While DEQ may identify other TMDL pollutants within the watershed, many historical pollutants, or pollutants not associated with ODOT activities, are outside the control or responsibility of ODOT. In some circumstances, such as historical pollutants within the right of way, it is expected that ODOT will control these pollutants through the best management practices associated with sediment control. ODOT is expecting that by controlling sediment load these TMDL pollutants will be controlled. Research has indicated that controlling sediment also controls heavy metals, oils and grease, and other pollutants.

Oregon's limited summer rainfall makes it highly unlikely that ODOT stormwater discharges elevate watershed temperatures. Management of roadside vegetation adjacent to waterways can directly effect water temperature. ODOT has begun to incorporate temperature concerns into its vegetation management programs and project development process.

Other TMDL concerns, such as dissolved oxygen, or chlorophyll A, can be associated with increased temperature. These TMDLs are not associated with the operation and maintenance of the transportation system, and are outside the authority of ODOT. Specific TMDL concerns that are directly related to the transportation system will be incorporated into the ODOT management plan.

ODOT NPDES characterization monitoring indicates ODOT pollutant levels associated with surface water runoff are below currently developed TMDL standards. This indication is based on ODOT 1993-95 characterization monitoring and current TMDLs.

8. TIME-LINE FOR IMPLEMENTATION

The purpose of this section of the WQMP is to demonstrate a time-based approach to this plan. Included in this section are timelines for the implementation of DMA as well as DEQ activities (Table 10). Each DMA is responsible for the development of Implementation Plans that will also include meeting the objectives and targets presented in this WQMP and the TMDL document. Timelines should be as specific as possible and should include a schedule for BMP installation and/or evaluation, monitoring schedules, reporting dates, and milestones for evaluating progress.

Each DMA-specific Implementation Plan will work to reduce pollutant loads from nonpoint sources to meet water quality standards. DEQ recognizes that where implementation involves significant habitat restoration or reforestation, water quality standards may not be met for decades. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in some cases, in the developmental stages and it may take one or more iterations to develop the most effective techniques.

For the TMDLs in the Lower Sucker Creek Watershed, pollutant surrogates (percent effective shade for temperature) have been identified as the targets for meeting the TMDL. It is the expectation that the DMA Implementation Plans will address how human activities will be managed to achieve these surrogates. It is recognized that full attainment of pollutant surrogates (System Potential vegetation, for example) at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the Implementation Plans should identify potential constraints, but should also provide the ability to mitigate those constraints should the opportunity arise. (For instance, at this time, the existing location of a road or highway may preclude attainment of System Potential vegetation due to lack of space for an adequate buffer. In the future, however, should the road be expanded or upgraded, consideration should be given to designs that support TMDL load allocations and pollutant surrogates such as System Potential vegetation).
The DEQ intends to regularly review the progress of the Implementation Plans. The plans, this overall WQMP, and the TMDLs are part of an adaptive management process (see Appendix A for a detailed description of adaptive management). Reviews of the TMDLs are expected to occur approximately five years after the final approval of the TMDLs, or as deemed necessary by DEQ.

Table 9: Water Quality Management Plan Timeline for Implementation
(Time-line assumes April 2002 adoption of plan)

DMA & Activity	2002	2003		2004		2005		2006	
Josephine County									
Implementation strategy/plan development	X	X							
Public participation			X	X					
Governing body approval and budget approval				X	X				
Rules and Ordinance development				X	X	X			
DMA Submittal of Annual Reports (September 30 of Each Year)	X		X		X		X		X
Oregon Department of Agriculture									
ODA: implementation of SB1010 plan (refer to specific timeline and activities in plan)	X	X	X	X	X	X	X	X	X
Results submittal to DEQ					X				X
Federal Agencies									
BLM: Implementation of WQ management plan as shown in Chapter 7	X	X	X	X	X	X	X	X	X
Implementation Summary					X			X	
Oregon Department of Forestry									
ODF: implementation of FPA (refer to specific timeline and activities in plan).	X	X	X	X	X	X	X	X	X
Sufficiency Analysis of FPA (every 5 yrs)	X								
Oregon Department of Transportation									
ODOT implementation of management plan	X	X	X	X	X	X	X	X	X
DEQ review of plan results				X					X

9. REASONABLE ASSURANCE OF IMPLEMENTATION

This section of the WQMP is intended to provide reasonable assurance that the WQMP (along with the associated DMA-specific Implementation Plans) will be implemented and that the TMDL and its targets will be met.

There are several programs that are either already in place or will be put in place to help assure that this WQMP will be implemented. Some of these programs were developed in response to the Sucker Creek TMDLs developed in 1999, other programs address nonpoint sources under the auspices of state law (for forested and agricultural lands) and voluntary efforts.

Point Sources
There are no point source permits in the Lower Sucker Creek system..

Nonpoint Sources
Rural Sources: Josephine County has the responsibility for the development of water quality Implementation Plans for the lands under its jurisdiction in the Sucker Creek Watershed. Upon approval of the Lower Sucker Creek Watershed TMDLs by EPA, it is DEQ's expectation that the County will develop and submit to DEQ an Implementation Plan that will achieve the goals and objectives of this plan and meet the load allocations established by the TMDL. These activities will be accomplished by Josephine County in accordance with the Schedule in Section 8 -Timeline for Implementation.

The DMA specific water quality management plans must address the following items:

1. Proposed management measures tied to attainment of the load allocations and/or established surrogates of the TMDLs, such as vegetative site potential for example.
2. Timeline for implementation.
3. Timeline for attainment of load allocations.
4. Identification of responsible participants demonstrating who is responsible for implementing the various measures.
5. Reasonable assurance of implementation.
6. Monitoring and evaluation, including identification of participants responsible for implementation of monitoring, and a plan and schedule for revision of Implementation Plan.
7. Public involvement.
8. Maintenance effort over time.
9. Discussion of cost and funding.
10. Citation of legal authority under which the implementation will be conducted.

Should the County fail to comply with their obligations under this WQMP, DEQ will take all necessary action to seek compliance. Such action will first include negotiation, but could evolve to issuance of Department or Commission Orders and other enforcement mechanisms.

Forestry
The Oregon Department of Forestry (ODF) is the designated management agency for regulation of water quality on non-federal forestlands. The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describe BMPs for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness.

The Environmental Quality Commission, Board of Forestry, DEQ, and ODF have agreed that these pollution control measurers will be relied upon to result in achievement of state water quality standards. ODF provides on the ground field administration of the Forest Practices Act (FPA). For each administrative rule, guidance is provided to field administrators to insure proper, uniform and consistent application of the Statutes and Rules. The FPA requires penalties, both civil and criminal, for violation of Statutes and Rules. Additionally, whenever a violation occurs, the responsible party is obligated to repair the damage. For more information, refer to the Management Measures (Section 6) of this Plan.

ODF and DEQ are involved in several statewide efforts to analyze the existing FPA measures and to better define the relationship between the TMDL load allocations and the FPA measures designed to protect water quality. Although it is anticipated that increased levels of shade on many of the forested stream reaches in the watershed would decrease solar loading and potentially lower maximum daily stream temperatures, insufficient information exists to determine if specific FPA revisions will be necessary to meet the TMDL load allocations. The information contained in the Lower Sucker Creek TMDL, as well as additional monitoring data, will be an important part of the body of information used in determining the adequacy of the FPA. As the DMA for water quality management on nonfederal forest lands, the ODF is also working with the DEQ through a Memorandum of Understanding (MOU) signed in June of 1998.

This MOU was designed to improve the coordination between the ODF and the DEQ in evaluating and proposing possible changes to the forest practice rules as part of the TMDL process. The purpose of the MOU is also to guide coordination between the ODF and DEQ regarding water quality limited streams on the 303d list. An evaluation of rule adequacy will be conducted (also referred to as a “sufficiency analysis”) through a water quality parameter-by-parameter analysis. This statewide demonstration of forest practices rule effectiveness will address the following specific parameters: temperature, sediment and turbidity, aquatic habitat modification, bio-criteria and other parameters.
Information from these efforts, along with other relevant information provided by the DEQ, will be considered in reaching a determination on whether the existing FPA BMPs meet water quality standards within the Lower Sucker Creek Watershed.

Agriculture

It is the Oregon Department of Agriculture's (ODA) statutory responsibility to develop agricultural water quality management (AWQM) plans and enforce rules that address water quality issues on agricultural lands. The AWQM Act directs ODA to work with local farmers and ranchers to develop water quality management area plans for specific watersheds that have been identified as violating water quality standards and having agricultural water pollution contributions.

The agricultural water quality management area plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct those problems. These water quality management plans are developed at a local level, reviewed by the State Board of Agriculture, and then adopted into the Oregon Administrative Rules. It is the intent that these plans focus on education, technical assistance, and flexibility in addressing agriculture water quality issues. These plans and rules will be developed or modified to achieve water quality standards and will address the load allocations identified in the TMDL. In those cases when an operator refuses to take action, the law allows ODA to take enforcement action. DEQ will work with ODA to ensure that rules and plans meet load allocations.

Recognizing the adopted rules need to be quantitatively evaluated in terms of load allocations in the TMDL and pursuant to the June 1998 Memorandum of Agreement between ODA and DEQ, the agencies have conducted a technical evaluation of the Inland Rogue Agricultural Management Area Plan. The agencies will establish the relationship between the plan and its implementing rules and the load allocations in the TMDL to determine if the rules provide reasonable assurance that the TMDLs will be achieved. The Local Advisory Committee (LAC) will be apprised and consulted during this evaluation. This adaptive management process provides for review of the AWQMP to determine if any changes are needed specific to the Lower Sucker Creek TMDL.

Oregon Department of Transportation

The Oregon Department of Transportation (ODOT) has been issued an NPDES MS4 waste discharge permit. Included with ODOT's application for the permit was a surface water management plan which has been approved by DEQ and which addresses the requirements of a Total Maximum Daily Load (TMDL) allocation for pollutants associated with the ODOT system. Both ODOT and DEQ agree that the provisions of the permit and the surface water management plan will apply to ODOT's statewide system. This statewide approach for an ODOT TMDL watershed management plan addresses specific pollutants, but not specific watersheds. Instead, this plan demonstrates how ODOT will incorporate water quality protection into project development, construction, and operations and maintenance of the state and federal transportation system that is managed by ODOT, thereby meeting the elements of the National Pollutant Discharge Elimination System (NPDES) program, and the TMDL requirements.

The MS4 permit and the plan:

- Streamlines the evaluation and approval process for the watershed management plans
- Provides consistency to the ODOT highway management practices in all TMDL watersheds.
- Eliminates duplicative paperwork and staff time developing and participating in the numerous TMDL management plans.

Temperature and sediment are the primary concerns for pollutants associated with ODOT systems that impair the waters of the state. As TMDL allocations are established by watershed, rather than by pollutants, ODOT is aware that individual watersheds may have pollutants that may require additional consideration as part of the ODOT watershed management plan. When these circumstances arise, ODOT will work with DEQ to incorporate these concerns into the statewide plan.

Federal BLM Lands

The recovery of habitat conditions for BLM lands in the Lower Sucker Creek area will be dependent on implementation of the BLM Medford Area Resource Management Plan. Paramount to recovery is adherence to the Standards and Guidelines of the NWFP to meet the Aquatic Conservation Strategy (ACS). Management of Northwest Forest Plan Riparian Reserves may involve proactive work such as density and fuels management work. Some instream large tree placement may be beneficial where there exists a conducive channel and riparian conditions.

State of Oregon

The Oregon Plan for Salmon and Watersheds represents a major effort, unique to Oregon, to improve watersheds and restore endangered fish species. The Oregon Plan is a major component of the demonstration of " reasonable assurance " that this TMDL WQMP will be implemented. The Plan consists of four essential elements:

1. Coordinated Agency Programs: Many state and federal agencies administer laws, policies, and management programs that have an impact on salmon and water quality. These agencies are responsible for fishery harvest management, production of hatchery fish, water quality, water quantity, and a wide variety of habitat protection, alteration, and restoration activities. Previously, agencies conducted business independently. Water quality and salmon suffered because they were affected by the actions of all the agencies, but no single agency was responsible for comprehensive, life-cycle management. Under the Oregon Plan, all government agencies that impact salmon are accountable for coordinated programs in a manner that is consistent with conservation and restoration efforts.

2. Community-Based Action: Government, alone, cannot conserve and restore salmon across the landscape. The Oregon Plan recognizes that actions to conserve and restore salmon must be worked out by communities and landowners, with local knowledge of problems and ownership in solutions. Watershed councils, soil and water conservation districts, and other grassroots efforts are vehicles for getting the work done. Government programs will provide regulatory and technical support to these efforts, but local people will do the bulk of the work to conserve and restore watersheds. Education is a fundamental part of the community based action. People must understand the needs of salmon in order to make informed decisions about how to make changes to their way of life that will accommodate clean water and the needs of fish.

3. Monitoring: The monitoring program combines an annual appraisal of work accomplished and results achieved. Work plans will be used to determine whether agencies meet their goals as promised. Biological and physical sampling will be conducted to determine whether water

quality and salmon habitats and populations respond as expected to conservation and restoration efforts.

4. Appropriate Corrective Measures: The Oregon Plan includes an explicit process for learning from experience, discussing alternative approaches, and making changes to current programs. The Plan emphasizes improving compliance with existing laws rather than arbitrarily establishing new protective laws. Compliance will be achieved through a combination of education and prioritized enforcement of laws that are expected to yield the greatest benefits for salmon.

Voluntary Measures

There are many voluntary, non-regulatory, watershed improvement programs (Actions) that are in place and are addressing water quality concerns in the Lower Sucker Creek Watershed. Both technical expertise and partial funding are provided through these programs. Examples of activities promoted and accomplished through these programs include: planting of conifers, hardwoods, shrubs, grasses and forbs along streams; relocating legacy roads that may be detrimental to water quality; replacing problem culverts with adequately sized structures, and improvement/ maintenance of legacy roads known to cause water quality problems. These activities have been and are being implemented to improve watersheds and enhance water quality. Many of these efforts are helping resolve water quality related legacy issues.

Landowner Assistance Programs

A variety of grants and incentive programs are available to landowners in the Lower Sucker Creek Watershed. These incentive programs are aimed at improving the health of the watershed, particularly on private lands. They include technical and financial assistance, provided through a mix of state and federal funding. Local natural resource agencies administer this assistance, including the Oregon Department of Forestry, the Oregon Department of Fish and Wildlife, DEQ, and the National Resources Conservation Service.

Field staff from the administrative agencies provide technical assistance and advice to individual landowners, watershed councils, local governments, and organizations interested in enhancing the sub-basin. These services include on-site evaluations, technical project design, stewardship/conservation plans, and referrals for funding as appropriate. This assistance and funding is further assurance of implementation of the TMDL WQMP.

10. MONITORING PLAN

Local watershed organizations as well as federal and state agencies have all contributed water quality data resulting in a better understanding of the interaction between land use and water quality in the Illinois Valley Sub-basin. These data have been used by land managers to design protective and enhancement strategies that are actively being applied to address water quality issues. The objectives of the monitoring effort for Sucker Creek are: 1. To track the implementation of the management measures chosen by the DMAs and all other plan participants, 2. Track the effectiveness of WQMP implementation in meeting the TMDL loading capacity.

The results of this monitoring effort will be provided by both DEQ and the Designated Management Agencies (DMAs) and used as a tool for adaptive management of the WQMP.

Monitoring will provide information as to whether standards and guidelines are being followed, and if actions described in the Implementation Plans are being applied and if they are achieving the desired results. Information obtained from monitoring will ascertain whether management actions need to be changed as a part of adaptive management.

Illinois Valley Soil and Water Conservation Service (IVSWCD)

The IVSWCD has undertaken extensive monitoring in the Illinois Valley within recent years. In addition to the sites listed below, the IVSWCD undertakes specific monitoring associated with projects. Please note that sample locations and frequency are subject to change as the needs of the watershed change. At the time of the writing of this plan, discussions were underway within the SWCD and Watershed Council to review sampling parameters and possibly begin sampling for fecal coliform or *E. Coli* in the near future.

LASAR# 25813, Sucker Creek 100 feet upstream from Bridgeview Rd Bridge: parameters tested: temperature, dissolved oxygen, pH, turbidity, conductivity. Frequency of sampling: continuous temperature loggers (one hour intervals) , other parameters sampled every 10-15 days June-October.

LASAR# 25814, Sucker Creek at Upper Bridge Crossing, Holland Bridge: parameters tested: temperature, dissolved oxygen, pH, turbidity, conductivity. Frequency of sampling: continuous temperature loggers (one hour intervals), other parameters sampled every 10-15 days June-October.

LASAR# 25816, Sucker Creek at river mile 7.6: parameters tested: temperature, dissolved oxygen, pH, turbidity, conductivity. Frequency of sampling: continuous temperature loggers (one hour intervals), other parameters sampled every 10-15 days June-October.

Temperature

The Siskiyou National Forest, with cooperators, will continue to monitor stream temperatures throughout the Illinois River Watershed and in Sucker-Grayback, specifically. We monitor to meet a variety of objectives, so site locations will vary over time. Our objectives are to monitor long-term temperature recovery, better understand the natural temperature variability, and to track potential project effects. There are five locations that are monitored annually during the summer months to establish long term records. The sites are:

- Sucker Above Bolan
- Bolan Creek
- Left Fork at Mouth
- Grayback at Mouth

- Sucker at the gage below Little Grayback.

Temperature, Shade Component
Streamside shade will be directly monitored in the headwaters of Grayback Creek just downstream of the Fan, Elk, Little confluences, and on Sucker Creek near its confluence with Johnson Gulch (BLM lands). The USFS will use a solar pathfinder to establish existing shade. Measurements will be taken every five years, beginning in 1998. This work will be used to track the interim shade goals.

It is very likely that over the next few years the USFS District will prescribe riparian stand treatments in stands located adjacent to perennially flowing water (active restoration). These stands will be surveyed using existing regional standards prior to and following treatment. Data should confirm that 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 provide 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.

Temperature, Channel Form Component
Channel form will be directly measured through the use of channel cross-sections and pebble counts (Potoyondy and Hardy, 1994; Bevenger and King, 1995). Cross-sections will be re-surveyed every three to five years, or following large, channel forming events. Cross-sections will be, or have been, established at the following locations:

- Left Fork Sucker Creek (established 1997)
- Sucker above Bolan (established 1997)
- Grayback near Mouth (established 1995)
- Sucker near Johnson Gulch (proposed for 1998)
- Sucker at the gage below Little Grayback (established 1997)

Work will be administered by the Illinois Valley Ranger District.

Bedload sediment storage and transport is reflected as channel form. Our 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. We will monitor and report the miles of road decommissioned and the number of pipes treated for diversion potential on an annual basis. Because watershed restoration is an evolving science, we anticipate that other techniques will be introduced during the recovery period that this plan covers. Those new techniques will be included in this plan as appropriate. Bankfull width-to-depth and general Rosgen classification will be monitored on a 10-year basis with stream surveys.

Changes in channel form are anticipated as a result of road treatments. In general, reductions in road-derived sediment will result in narrower and deeper channel cross-sections over time.

Habitat Modification
Standard Level II and III stream surveys will be conducted on a recurring basis to document changes in channel morphology, distribution of fish habitat units, and pieces of large wood in our channels. Stream surveys will also monitor approximate densities of juvenile salmonids and riparian vegetation. Extensive surveys will survey whole watersheds or sub-watersheds during a summer (Level II surveys), with an average seven-year cycle.

More intensive surveys (Level III) will be done in low-gradient and less confined stream segments. These are anticipated to have measurable responses to changes in watershed conditions.

Sites to be monitored include:
- Left Fork of Sucker (lower ½ mile)
- Sucker above the FS Boundary (near Mule/Cohen Creeks)
- Grayback Creek (lower ½ mile)

Flow Modification
US Geologic Survey has discontinued the Sucker Creek stream gauge because of lack of funding. The Oregon Department of Water Resources (WRD) is currently operating the gauge, and takes additional flow readings at three additional sites in the watershed during dry months. The Oregon WRD will report any changes in water rights and uses to the Medford DEQ office.
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11. PUBLIC INVOLVEMENT

To be successful in improving water quality, the Lower Sucker Creek Water Quality Management Plan (WQMP) must include a process to involve interested and affected stakeholders in both the development and the implementation of the plan.

The DEQ procedure for public review of this document includes a 60 day public comment period prior to submission of the document to EPA. 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. 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 on Federal lands will be subject to public review and comment as required in the National Environmental Protection Act (NEPA).

Continued public outreach during the implementation of this WQMP is the responsibility of the DMAs (urban, forestry, federal, agricultural) and will be addressed in the development of Implementation Plans.

12. CITATION TO LEGAL AUTHORITIES

Section 303(d) of the 1972 federal Clean Water Act as amended requires states to develop a list of rivers, streams and lakes that cannot meet water quality standards without application of additional pollution controls beyond the existing requirements on industrial sources and sewage treatment plants. Waters that need this additional help are referred to as water quality limited (WQL). Water quality limited waterbodies must be identified by the Environmental Protection Agency (EPA) or by a state agency which has been delegated this responsibility by EPA. In Oregon, this responsibility rests with DEQ. DEQ updates the list of water quality limited waters every two years. The list is referred to as the 303(d) list. Section 303 of the Clean Water Act further requires that Total Maximum Daily Loads (TMDLs) be developed for all waters on the 303(d) list. A TMDL defines the amount of pollution that can be present in the waterbody without causing water quality standards to be violated. A WQMP is developed to describe a strategy for reducing water pollution to the level of the load allocations and waste load allocations prescribed in the TMDL, which is designed to restore the water quality and result in compliance with the water quality standards. In this way, the designated beneficial uses of the water will be protected for all citizens.

DEQ is authorized by law to prevent and abate water pollution within the State of Oregon pursuant to the following statute:

ORS 468B.020 Prevention of pollution (1) Pollution of any of the waters of the state is declared to be not a reasonable or natural use of such waters and to be contrary to the public policy of the State or Oregon, as set forth in ORS 468B.015.

(1) In order to carry out the public policy set forth in ORS 468B.015, DEQ shall take such action as is necessary for the prevention of new pollution and the abatement of existing pollution by:

    (a) Fostering and encouraging the cooperation of the people, industry, cities and counties, in order to prevent, control and reduce pollution of the waters of the state; and
    (b) Requiring the use of all available and reasonable methods necessary to achieve the purposes of ORS 468B.015 and to conform to the standards of water quality and purity established under ORS 468B.048.

National Pollutant Discharge Elimination System (NPDES) and Water Pollution Control Facilities (WPCF) Permit Programs:
DEQ administers two different types of wastewater permits in implementing Oregon Revised Statute (ORS) 468B.050. Briefly, the statute requires that no person shall discharge waste into waters of the state or operate a waste disposal system without obtaining a permit from DEQ. Discharge and disposal are terms of art that characterize the means of discarding of waste.

Discharge pertains to getting rid of the waste by putting it into some kind of surface water. Disposal pertains to getting rid of the waste by other means, such as evaporation, seepage, or land application, among others. Consequently, DEQ administers National Pollutant Discharge Elimination System (NPDES) permits for waste discharge, and Water Pollution Control Facilities (WPCF) permits for waste disposal. The NPDES permit is also a Federal permit, which is required under the Clean Water Act for discharge of waste into waters of the United States. DEQ has been delegated authority to issue NPDES permits from EPA. The WPCF permit is unique to the State of Oregon. As the permits are renewed they will be revised to insure that all 303(d) related issues are addressed in the permit. There are no NPDES or WPCF permits issued in the Sucker Creek Watershed.

Oregon Administrative Rules
The following Oregon Administrative Rules provide numeric and narrative criteria for parameters of concern in the Lower Sucker Creek Watershed.

Forestry: The Oregon Department of Forestry (ODF) is the designated management agency for regulation of water quality on non-federal forest lands. The Board of Forestry has adopted water protection rules, including but not limited to OAR Chapter 629, Divisions 635-660, which describe Best Management Practices (BMPs) for forest operations. These rules are implemented and enforced by ODF and monitored to assure their effectiveness. The Environmental Quality Commission, Board of Forestry, DEQ and ODF have agreed that these pollution control measures will be relied upon to result in achievement of state water quality standards. ODF provides on the ground field administration of the Forest Practices Act. For each administrative rule, guidance is provided to field administrators to insure proper, uniform and consistent application of the Statutes and Rules. The FPA requires penalties, both civil and criminal, for violation of Statutes and Rules. Additionally, whenever a violation occurs the responsible party is obligated to repair damage. ODF and DEQ statutes and rules also include provisions for adaptive management that provide for revisions to FPA practices where necessary to meet water quality standards. These provisions are described in ORS 527.710, ORS 527.765, ORS 183.310, OAR 340-041-0026, OAR 629-635-110, and OAR 340-041-0120.

Agriculture: ODA has primary responsibility for control of pollution from agricultural sources. This is done through the Agricultural Water Quality Management (AWQM) program authorities granted ODA under Senate Bill 1010 adopted by the Oregon State Legislature in 1993. The AWQM Act directs ODA to work with local farmers and ranchers to develop water quality management area plans for specific watersheds that have been identified as violating water quality standards and having agricultural water pollution contributions. The agricultural water quality management area plans are expected to identify problems in the watershed that need to be addressed and outline ways to correct those problems. These water quality management area plans are developed at the local level, reviewed by the State Board of Agriculture, and then adopted into Oregon Administrative Rules. It is the intent that these plans focus on education, technical assistance, and flexibility in addressing agricultural water quality issues. There may be, however, situations that require corrective action. In those cases when an operator refuses to take action, the law allows ODA to take enforcement action.

Federal lands: Federal land management is guided by the Northwest Forest Plan. The Northwest Plan creates a system of reserves to protect the full range of species. Biological objectives of the Plan also include assuring adequate habitat on Federal lands to aid the recovery of late-successional forest habitat associated species and the prevention of species from being listed under the Endangered Species Act. The Aquatic Conservation Strategy is an essential component of the Northwest Forest Plan which ensures stream, lake, and riparian protection on Federal lands. The intent is to maintain and restore water quality and aquatic ecosystem functions.

Transportation: It is anticipated that the management practices for transportation sources identified in this document will be voluntarily implemented by the responsible agencies. All of those agencies were represented on the work group that identified the practices and actions to be implemented. There is incentive to voluntarily implement the practices not only to improve water quality and protect listed species but also to avoid any additional regulation.

Local Ordinances: Josephine County will be expected to describe their specific legal authorities to carry out the management measures they choose in their Implementation Plan to meet the TMDL allocations. Legal authority to enforce the provisions of a City's NPDES permit would be a specific example of legal authority to carry out management measures.

GLOSSAR Y

A

Abatement -- Reducing the degree or intensity of, or eliminating, pollution.
Acre -- A measure of area equal to 43,560 square feet (4,046.87 square meters). One square mile equals 640 acres.
Acre-foot (af) -- The volume of water that will cover one acre to a depth of 1 foot.
Active Channel: The width of a river or stream channel between the highest banks on either side of a stream – also described as bankfull width.
Adaptation -- Changes in an organism's structure or habits that allow it to adjust to its surroundings.
Adaptive management -- The process of implementing policy decisions as scientifically driven management experiments that test predictions and assumptions in management plans, and using the resulting information to improve the plans.
Alevin -- The developmental life stage of young salmonids and trout that are between the egg and fry stage. The alevin has not absorbed its yolk sac and has not emerged from the spawning gravels.
Allocation – Refers to the load allocation (nonpoint sources) and wasteload allocation (point sources). Specifically, an allocation is the division of the loading capacity between nonpoint and point sources of pollution.
Alluvial -- Deposited by running water.
Alluvium -- Sediment or loose material such as clay, silt, sand, gravel, and larger rocks deposited by moving water.
Anadromous -- Fish that hatch rear in fresh water, migrate to the ocean (salt water) to grow and mature, and migrate back to fresh water to spawn and reproduce.
Analytical watershed -- For planning purposes, a drainage Basin subdivision used for analyzing cumulative impacts on resources.
Anthropogenic Sources of Pollution: Pollutant deliver to a water body that is directly related to humans or human activities.
Aqueduct -- A pipe or conduit made for bringing water from a source.
Aquatic ecosystem -- Any body of water, such as a stream, lake or estuary, and all organisms and nonliving components within it, functioning as a natural system.
Aquatic habitat -- Habitat that occurs in free water.
Aquifer -- An underground layer of rock or soil containing ground water.
At-risk fish stocks -- Stocks of anadromous salmon and trout that have been identified by professional societies, fish management agencies, and in the scientific literature as being in need of special management consideration because of low or declining populations.
Augmentation (of stream flow) -- Increasing steam flow under normal conditions, by releasing storage water from reservoirs.

B

Backbar channel -- A channel formed behind a bar connected to the main channel but usually at a higher bed elevation than the main channel. Backbar channels may or may not contain flowing or standing water.
Backwater -- (1) A small, generally shallow body of water attached to the main

channel, with little or no current of its own.
Bankfull width -- The width of a river or stream channel between the highest banks on either side of a stream – also described as active channel
Bar (stream or river bar) -- An accumulation of alluvium(gravel or sand) caused by a decrease in water velocity.
Barrier -- A physical block or impediment to the movement or migration of fish, such as a waterfall (natural barrier) or a dam (man-made barrier).
Base flow -- The sustained portion of stream discharge that is drawn from natural storage sources, and not effected by human activity or regulation.
Beneficial Use: Approved use of water for the best interest of people, wildlife and aquatic species.
Braided stream -- A complex tangle of converging and diverging stream channels (Anabranches) separated by sand bars or islands. Characteristic of flood plains where the amount of debris is large in relation to the discharge.
BTU/ft^2/day – A measure of thermal load. A British Thermal Unit is the amount of energy required to raise 1 pound of water 1 degree Fahrenheit.
Buffer strip -- A barrier of permanent vegetation, either forest or other vegetation, between waterways and land uses such as agriculture or urban development, designed to intercept and filter out pollution before it reaches the surface water resource.

C

Canal -- A constructed open channel for transporting water.
Canopy -- A layer of foliage in a forest stand. This most often refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multistoried stand. Leaves, branches and vegetation that are above ground and/or water that provide shade and cover for fish and wildlife.
Canopy closure -- The degree to which the canopy (forest layers above one's head) blocks sunlight or obscures the sky.
Canopy density -- The degree to which the canopy (forest layers above one's head) covers a unit area. Commonly measured with a concave or convex densiometer or estimated from aerial photography.
Channel -- An area that contains continuously or periodically flowing water that is confined by banks and a stream bed.

Channelization -- The process of changing and straightening the natural path of a waterway.
Channel Complexity: Implied high pool frequency of pools and large woody debris (instream roughness).
Channel Simplification: The loss (absence) of pools and large woody debris that is important for creating and maintaining channel features such as: substrate, stream banks and pool:riffle ratios.
Clean Water Act: Established in 1977, is an amendment to the 1972 Federal Water Pollution Control Act which set the groundwork for regulating pollutant discharges into U.S. waters. The Clean Water Act makes discharging pollutants from a point source to navigable waters illegal without a permit. The Clean Water Act amendments of 1977 were aimed at toxic pollutants. In 1987, the Clean Water Act was reauthorized and focused on sewage treatment plants, toxic pollutants, and authorized citizen suit provisions. The Clean Water Act allows the EPA to delegate administrative and enforcement aspects of the law to the state agencies. In Oregon, EPA has given authority of Clean Water Act implementation to DEQ.

However EPA still plays the role of supervisor.
Climax Solar Load – The greatest flat-plane solar radiation load that can occur at our latitude. This typically occurs in late July to early August. In the Sucker Creek watershed climax load is approximately 2440 BTU/ft^2/day.

Coarse woody debris (CWD) -- Portion of a tree that has falled or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter.

Confluence -- (1) The act of flowing together; the meeting or junction of two or more streams; also, the place where these streams meet. (2) The stream or body of water formed by the junction of two or more streams; a combined flood.
Conifer -- A tree belonging to the order Gymnospermae, comprising a wide range of trees that are mostly evergreens. Conifers bear cones (hence, coniferous) and needle-shaped or scalelike leaves.
Conservation -- The process or means of achieving recovery of viable populations.
Conservation strategy -- A management plan for a species, group of species, or ecosystem that prescribes standards and guidelines that if implemented provide a high likelihood that the species, groups of species, or ecosystem, with its full complement of species and processes, will continue to exist well-distributed throughout a planning area, i.e., a viable population.
Contaminate -- To make impure or unclean by contact or mixture.
Core area -- The area of habitat essential in the breeding, nesting and rearing of young, up to the point of dispersal of the young.
Correlation Coefficient (R): Used to determine the relationship between two data sets. R-values vary between –1 and 1, where "–1" represents a perfectly inverse correlation relationship and "1" represents a perfect correlation relationship. A "0" R-value indicates that no correlation exists:
Corridor -- A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life-sustaining needs.
Critical habitat -- Under the Endangered Species Act, critical habitat is defined as (1) the specific areas within the geographic area occupied by a federally listed species on which are found physical and biological features essential to the conservation of the species, and that may require special management considerations or protections; and (2) specific areas outside the geographic area occupied by a listed species, when it is determined that such areas are essential for the conservation of the species.
Cubic feet per second (Cfs) -- A unit used to measure water flow. One cfs is equal to 449 gallons per minute.
Culvert -- A buried pipe that allows streams, rivers, or runoff to pass under a road.
Cumulative Effects -- The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects.

D

Designated Management Agencies (DMA) Those entities recognized by the State of Oregon as having legal responsibility to meet the requirements of the TMDL.
Determinate Coefficient (R^2): The R^2 value represents "goodness of fit" for a linear regression. An R^2 value of "1" would indicate that all of the data variability is accounted for by the

regression line. Natural systems exhibit a high degree of variability; R^2 values approaching "1" are uncommon. A value of "0" would indicate that none of the data variability is explained by the regression.
Dewatering -- Elimination of water from a lake, river, stream, reservoir, or containment. .
Discharge -- Volume of water released from a dam or powerhouse at a given time, usually expressed in cubic feet per second.

Distribution (of a species) -- The spatial arrangement of a species within its range.
Disturbance -- A force that causes significant change in structure and/or composition through natural events such as fire, flood, wind, or earthquake, mortality caused by insect or disease outbreaks, or by human-caused events, e.g., the harvest of forest products.
Ditch -- A long narrow trench or furrow dug in the ground, as for irrigation, drainage, or a boundary line.
Diversion -- The transfer of water from a stream, lake, aquifer, or other source of water by a canal, pipe, well, or other conduit to another watercourse or to the land, as in the case of an irrigation system.

Diversion channel -- (1) An artificial channel constructed around a town or other point of high potential flood damages to divert floodwater from the main channel to minimize flood damages. (2) A channel carrying water from a diversion dam.
Diversion Dam -- A barrier built to divert part or all of the water from a stream into a different course.
Dredging -- Digging up and removing material from wetlands or waterways, usually to make them deeper or wider.
Drought -- Generally, the term is applied to periods of less than average or normal precipitation over a certain period of time sufficiently prolonged to cause a serious hydrological imbalance resulting in biological losses (impact flora and fauna ecosystems) and/or economic losses (affecting man). In a less precise sense, it can also signify nature's failure to fulfill the water wants and needs of man.
Dry Wash -- A streambed that carries water only during and immediately following rainstorms.
Duff layer -- The layer of loosely compacted debris underlying the litter layer on the forest floor.

E

Early seral stage forest -- Stage of forest development that includes seedling, sapling, and pole-sized trees 0-39 years of age.
Ecologically significant -- Species, stands, and forests considered important to maintain the structure, function, and processes of particular ecosystems.
Ecosystem -- The biological community considered together with the land and water that make up its environment. Or a unit comprising interacting organisms considered together with their environment.
Ecosystem diversity -- The variety of species and ecological processes that occur in different physical settings.
Ecosystem management -- A strategy or plan to manage ecosystems to provide for all associated organisms, as opposed to a strategy or plan for managing individual species.
Effluent -- (1) Something that flows out or forth, especially a stream flowing out of a body of water. (2) (Water Quality) Discharged wastewater such as the treated wastes from municipal sewage plants, brine wastewater from desalting operations, and coolant waters from a nuclear power plant.

Egg-to-smolt survival -- The numerical difference between the number of fertilized eggs produced by a groups of fish and the number of smolts resulting from those eggs.
Elevation -- Height in feet above sea level.
Embankment -- An artificial deposit of material that is raised above the natural surface of the land and used to contain, divert, or store water, support roads or railways, or for other similar purposes.
Embeddedness -- The degree to which dirt is mixed in with spawning gravel.
Embryo -- The early stages of development before an organism becomes self supporting.
Emergence -- The process during which fry leave their gravel spawning nest and enter the water column.
Empirical -- (Statistics) Based on experience or observations, as opposed to theory or conjecture.
Endangered species -- Any species of plant of animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion or its range, and published in the Federal Register.
Endangered Species Act (ESA) -- A 1973 Act of Congress that mandated that endangered and threatened species of fish, wildlife, and plants be protected and restored.
Endemic -- Native to or limited to a specific region.
Energy -- The ability to work (i.e., exert a force over distance). Energy is measured in calories, joules, KWH, BTUs, MW-hours, and average MWs.
Enhancement -- Emphasis on improving the value of particular aspects of water and related land resources.
Entrainment -- (Streams) The incidental trapping of fish and other aquatic organisms in the water, for example, used for cooling electrical power plants or in waters being diverted for irrigation or similar purposes.
Ephemeral Streams -- Streams which flow only in direct response to precipitation and whose channel is at all times above the water table.
Erosion -- Wearing away of rock or soil by the gradual detachment of soil or rock fragments by water, wind, ice, and other mechanical, chemical, or biological forces.

Escapement (Spawning) -- The portion of a fish population that survives sources of natural mortality and harvest to reach its natal spawning grounds.
ESU -- "Evolutionarily Significant Unit; a ""distinct"" population of Pacific salmon, and hence a species, under the Endangered Species Act."
Eutrophic -- Usually refers to a nutrient-enriched, highly productive body of water.

Evolutionarily significant unit (ESU) -- "A definition of ""species"" used by NMFS in administering the Endangered Species Act. An ESU is a population (or groups of populations) that (1) is reproductively isolated from other conspecific population units, and (2) represents an important component in the evolutionary legacy of the species."
Exotic species -- Introduced species not native to the place where they are found (e.g., Atlantic salmon to Oregon or Washington).

F

Federal land managers -- This category includes the Bureau of Indian Affairs; the Bureau of Land Management; the National Park Service, all part of the U.S. Department of the Interior; and the Forest Service, U.S. Department of Agriculture.
Fine Sediment: Sand, silt and organic material that have a grain size of 6.4 mm or less.

FLIR Thermal Imagery: Forward looking infrared radiometer thermal imagery is a direct measure of the longer wavelengths emitted by all bodies. FLIR monitoring produces continuous stream and stream bank temperature information. Accuracy is limited to 0.5°C. FLIR thermal imagery often displays heating processes as they are occurring and is particularly good at displaying the thermal impacts of shade, channel morphology and groundwater mixing.
Flood Plain: Strips of land (of varying widths) bordering streams that become inundated with floodwaters. Land outside of the stream channel that is inside a perimeter of the maximum probable flood. A flood plain is built of sediment carried by the stream and deposited in the slower (slack waters) currents beyond the influence of the swiftest currents. Flood plains are termed "living" if it experiences inundation in times of high water. A "fossil" flood plain is one that is beyond the reach of the highest current floodwaters.
Floodplain (100-year) -- The area adjacent to a stream that is on average inundated once a century.
Flow -- The amount of water passing a particular point in a stream or river, usually expressed in cubic-feet per second (cfs).
Fluvial -- Migrating between main rivers and tributaries. Of or pertaining to streams or rivers.
Forest canopy -- The cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

G

Gabion -- A wire basket or cage that is filled with gravel and generally used to stabilize stream banks and improve degraded aquatic habitat.
Gaging station -- A particular site in a stream, lake, reservoir, etc., where hydrologic data are obtained.
Gallons per minute (Gpm) -- A unit used to measure water flow.
Geographic information system (GIS) -- A computer system capable of storing and manipulating spatial (i.e., mapped) data.
Gradient -- Vertical drop per unit of horizontal distance.
Groundwater -- Subsurface water and underground streams that can be collected with wells, or that flow naturally to the earth's surface though springs.

H

Habitat -- The local environment in which a organism normally lives and grows.
Habitat conservation plan (HCP) -- An agreement between the Secretary of the Interior and either a private entity or a state that specifies conservation measures that will be implemented in exchange for a permit that would allow taking of a threatened or endangered species.
Headwater -- Referring to the source of a stream or river .
Healthy stock -- A stock of fish experiencing production levels consistent with its available habitat and within the natural variations in survival for the stock.
Heavy metals -- Metallic elements with high atomic weights, e.g., mercury, chromium, cadmium, arsenic, and lead. They can damage living things at low concentrations and tend to accumulate in the food chain.
Hyporheic zone -- The area under the stream channel and floodplain that contributes to the stream.

I

Impaired waterbody: Any waterbody of the United States that does not attain water

quality standards (designated uses, numeric and narrative criteria and antidegradation requirements defined at 40 CFR 131), due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment.
In-situ -- In place. An in-situ environmental measurement is one that is taken in the field, without removal of a sample to the laboratory.
Intermittent stream -- Any nonpermanent flowing drainage feature having a definable channel and evidence of scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two criteria.
Irrigation diversion -- Generally, a ditch or channel that deflects water from a stream channel for irrigation purposes.

J

K

Key watershed -- As defined by National Forest and Bureau of Land Management District fish biologists, a watershed containing (1) habitat for potentially threatened species or stocks of anadromous salmonids or other potentially threatened fish, or (2) greater than 6 square miles with high-quality water and fish habitat.

L

Large woody debris -- Pieces of wood larger than 10 feet long and 6 inches in diameter, in a stream channel.
Langley: A unit of solar radiation equivalent to one gram calorie per square centimeter of irradiated surface.
Late seral stage forest -- Stage in forest development that includes mature and old-growth forest. 100+ years of age.
Load Allocation (LA): A term referred to in the Clean Water Act that defines the portion of a receiving waters *loading capacity* attributed to each nonpoint source (ie Agriculture, Forestry, Urban etc).
Loading Capacity: portions of the Total Maximum Daily Load that are attributed to either natural background sources, such as natural runoff or background solar loading, or from nonpoint sources, such as agriculture or forestry activities. Allocations can also be set aside in reserve for future uses. Simply stated, allocations are quantified measures that assure water quality standard compliance.

M

Macroinvertebrate -- Invertebrates visible to the naked eye, such as insect larvae and crayfish.
Mainstem -- The principle channel of a drainage system into which other smaller streams or rivers flow.
Margin of safety – When establishing the loading capacity a portion may be reserved (i.e. not allocated to nonpointed or point sources of pollution) so that the allowed pollutant loading becomes conservative.
Mean (μ): Refers to the arithmetic mean:

$$\mu = \frac{1}{n} \cdot \sum x_i \cdot$$

Measured Daily Solar Radiation Load: The rate of heat energy transfer originating from the sun as determined by using a Solar Pathfinder©.
Median: A value in the data in which half the values are above and half are below.
Mitigation -- The act of alleviating or making less severe.
Monitor -- To systematically and repeatedly measure conditions in order to track changes.
Morphology -- The structure, form and appearance of an organism.

N

Near Stream Disturbance Zone – The distance between shade producing vegetation on opposite sides of a stream. This dimension is measured from digital orthophoto quads (DOQs) images at less than 1:5,000 scales. Where near stream vegetation is absent, the near stream boundary is used, as defined by armored streambanks or where near stream areas are unsuitable for vegetation growth due to external factors (i.e. roads, railroads, building, rock surfaces, etc.)
Nonpoint source pollution -- Pollution that does not originate from a clear or discrete source.

O

Objective -- A specific statement of planned results to be achieved by a predetermined date. Once achieved, the objectives represent measurable progress toward attainment of the broader goal.
Off-channel area -- Any relatively calm portion of a stream outside of the main flow.

Overstory -- Trees that provide the uppermost layer of foliage in a forest with more than one roughly horizontal layer of foliage.

P

Peak flow -- Refers to a specific period of time when the discharge of a stream or river is at its highest point.
Perennial Flow: Stream flow that persists throughout all seasons, yearlong.
Pluvial -- Of rain, formed by the action of rain, for example a body of water.
Point Source (PS) -- (1) A stationary or clearly identifiable source of a large individual water or air pollution emission, generally of an industrial nature. (2) Any discernible, confined, or discrete conveyance from which pollutants are or may be discharged, including (but not limited to) pipes, ditches, channels, tunnels, conduits, wells, containers, rolling stock, concentrated animal feeding operations, or vessels. Point source is also legally and more precisely defined in federal regulations. Contrast with Nonpoint Source (NPS) Pollution.
Point Source (PS) Pollution -- Pollutants discharged from any identifiable point, including pipes, ditches, channels, sewers, tunnels, and containers of various types. See Nonpoint Source (NPS) Pollution.
Pollutant -- (1) Something that pollutes, especially a waste material that contaminates air, soil, or water. (2) Any solute or cause of change in physical properties that renders water unfit for a given use.
Pool/riffle ratio -- The ratio of surface area or length of pools to the surface area or length of riffles in a given stream reach; frequently expressed as the relative percentage of each category. Used to describe fish habitat rearing quality.

Potential Daily Solar Radiation Load: For any particular location on earth, there is a potential load that could reach the stream if no vegetation were present At the latitude of Sucker Creek that value is 2440 BTU/ft^2/day
Primary Channel Length: Length of the primary channel located in the survey reach. Units are meters.
Primary Channel Width: Bankfull width of a stream reported in meters.

Q

R

Reach Averaged: An average that is based on the occurrence of a property weighted by the occurrence frequency over perennial stream length.
Recovery/restoration -- The reestablishment of a threatened or

endangered species to a self-sustaining level in its natural ecosystem (i.e., to the point where the protective measures of the Endangered Species Act are no longer necessary

Restoration -- The renewing or repairing of a natural system so that its functions and qualities are comparable to its original, unaltered state.

Riparian area -- An area of land and vegetation adjacent to a stream that has a direct effect on the stream. This includes woodlands, vegetation, and floodplains.

Riparian habitat -- The aquatic and terrestrial habitat adjacent to streams, lakes, estuaries, or other waterways.

Riparian vegetation -- The plants that grow rooted in the water table of a nearby wetland area such as a river, stream, reservoir, pond, spring, marsh, bog, meadow, etc.

River Channels -- Natural or artificial open conduits which continuously or periodically contain moving water, or which forms a connection between two bodies of water.

River miles (RM) -- Miles from the mouth of a river to a specific destination or, for upstream tributaries, from the confluence with the main river to a specific destination.

River Reach -- Any defined length of a river.

Riverine habitat -- The aquatic habitat within streams and rivers.

Run (in stream or river) -- A reach of stream characterized by fast flowing low turbulence water.

Runoff -- Water that flows over the ground and reaches a stream as a result of rainfall or snowmelt.

S

Salmonid -- Fish of the family Salmonidae, that includes salmon and steelhead.

Scenic Rivers -- Rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive, and shorelines largely undeveloped but accessible in places by roads.

Sediment -- The organic material that is transported and deposited by wind and water.

Seral Stage: Refers to the age and type of vegetation that develops from the stage of bare ground to the climax stage.
Seral Stage - Early: 0-39 years of age.
Seral Stage - Mid: 40-100 years of age
Seral Stage - Late: 100+ years of age

Sinuosity -- The amount of bending, winding and curving in a stream or river.

Site Potential: Physical and biological conditions that are at maximum potential, taking into account local natural environmental constraints and conditions.

Steelhead -- The anadromous form of the species Oncorhynchus mykiss. Anadromous fish spend their early life history in fresh water, then migrate to salt water, where they may spend up to several years before returning to fresh water to spawn. Rainbow trout is the nonanadromous form of Oncorhynchus mykiss.

Strategic plan -- A comprehensive long-term plan that identifies goals and objectives, and the problems in meeting them, together with strategies or actions needed to overcome the problems.

Stream -- A general term for a body of flowing water; natural water course containing water at least part of the year. In Hydrology, the term is generally applied to the water flowing in a natural channel as distinct from a canal. More generally, as in the term Stream Gaging, it is applied to the water flowing in any channel, natural or artificial.

Streamflow -- The rate at which water passes a given point in a stream or river,

usually expressed in cubic feet per second (cfs).
Surrogate Measures (Load Allocation): A term referenced in the Clean Water Act that refers to “other appropriate measures” that can be allocated to meet an established and accepted pollutant loading capacity.
Suspended sediment -- Sediment suspended in a fluid by the upward components of turbulent currents, moving ice, or wind.
System Potential: Physical and biological stream, vegetation, and channel conditions as that are at maximum potential (*Site Potential* at all sites). System Potential vegetation is defined as the vegetation and resulting percent effective shade that could be expected given mature native riparian vegetation in the absence of human impact. In the case of Sucker Creek it assumes that roads, bridges, and other manmade structures are not present. System Potential does not advocate the removal of such manmade structures, rather it is felt that in most cases such structures will have minimal impact on the overall average effective shade on the stream. Flow or water withdrawals are not included in the System Potential scenario.

T

Temperature Limited Waterbody: Refers to a stream or river that has been placed on the §303(d) list for violating water quality numeric criteria based on measured data.
Temperature Statistic: The seasonal seven (7) day moving average of the daily maximum stream tempertaures. Used to determine exceedance of temperature standard.
Threatened Species: Species that are likely to become endangered through their normal range within the foreseeable future.
Total Maximum Daily Load (TMDL): TMDLs are written plans and analyses established to ensure that the waterbody will attain and maintain water quality standards. The OAR definition is “The sum of the individual WLAs for point sources and LAs for nonpoint sources and background. If a receiving water has only one point source discharger, the TMDL is the sum of that point source WLA plus the LAs for any nonpoint sources of pollution and natural background sources, tributaries, or adjacent segments. TMDLs can be expressed in terms of either mass per time, toxicity, or other appropriate measure. If Best Management Practices (BMPs) or other nonpoint source pollution controls make more stringent load allocations practicable, then wasteload allocations can be made less stringent. Thus, the TMDL process provides for nonpoint source control tradeoffs” (340-04l-006(21))
Tributary -- A stream that flows into another stream, river, or lake.
Turbidity -- "The term ""turbid"" is applied to waters containing suspended matter that interferes with the passage of light through the water or in which visual depth is restricted."

U

Urban runoff -- Storm water from city streets and gutters that usually contains a great deal of litter and organic and bacterial wastes into the sewer systems and receiving waters.

V

Velocity -- In this concept, the speed of water flowing in a watercourse, such as a river.
Velocity barrier -- A physical structure, such as a barrier dam or floating weir,

built in the tailrace of a hydroelectric powerhouse, which blocks the tailrace from further adult salmon or steelhead migration to prevent physical injury or migration delay.

W

Wasteload Allocation (WLA): A term referenced in the Clean Water Act that refers to point source rates of pollutant delivery that can be specifically linked to an established and accepted pollutant loading capacity.
Water Pollution -- Generally, the presence in water of enough harmful or objectionable material to damage the water's quality.
Water quality -- A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.
Water Quality Limited: Can mean one of the following categories: (a) A receiving stream which does not meet in-stream water quality standards during the entire year or defined season even after the implementation of standard technology; (b) A receiving stream which achieves and is expected to continue to achieve in-stream water quality standard but utilizes higher than standard technology to protect beneficial uses; (c) A receiving stream for which there is insufficient information to determine if water quality standards are being met with higher than standard treatment technology or where through professional judgment the receiving stream would not be expected to meet water quality standards during the entire year or defined season without higher than standard technology. (OAR 340-04l-006(30))
Water Resources -- The supply of groundwater and surface water in a given area.
Water rights -- Claims to water. In western States, water rights are based on the principle ""first in time, first in right,"" meaning older claims take precedence over newer ones.
Water yield -- The quantity of water derived from a unit area of watershed.
Watershed: A drainage basin that contributes water, organic material, dissolved nutrients, and sediment to streams, rivers, and lakes.
Wetted Width – actual width of the water in the stream at the time the analysis was performed.
Width:Depth Ratio: The width of stream divided by the average depth in the survey reach of a stream.
Wild Rivers -- Rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
Wild stock -- A stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native).

Woody debris -- Referring to wood in streams.

X

Xeric -- Dry.

Y

Z

Zooplankton -- Small aquatic animals that are suspended or swimming in water.

ACRONYMS and ABBREVIATIONS

BLM – Bureau of Land Management

BOD - Biochemical Oxygen Demand

CFR - Code of Federal Regulations

cfs - cubic feet per second

CSRI - Coastal Salmon Restoration Initiative

CWA - Clean Water Act

DBH - Diameter at Breast Height

DEM - Digital Elevation Model

DEQ - Department of Environmental Quality (Oregon)

DOQ - Digital Orthophoto Quad

DOQQ - Digital Orthophoto Quarter Quad

EPA - (United States) Environmental Protection Agency

EQC - Environmental Quality Commission

FLIR - Forward Looking Infrared Radiometry

FPA - Forest Practices Act (Oregon)

GPS - Geographic Positioning System

HUC - Hydrologic Unit Code

LA - Load Allocation

LC - Loading Capacity

MOS - Margin of Safety

NPDES - National Pollutant Discharge Elimination System

NSDZ - Near-Stream Disturbance Zone

NTU - Nephelometric Turbidity Units

OAR - Oregon Administrative Rules

ODA - Oregon Department of Agriculture

ODF - Oregon Department of Forestry

ODFW - Oregon Department of Fish and Wildlife

ORS - Oregon Revised Statutes

OWRD - Oregon Water Resources Department

RM - River Mile

SE - Standard Error

SSCGIS - State Service Center for Geographic Information Systems

TMDL - Total Maximum Daily Load

TSS - Total Suspended Solids

USBR (US BOR) - United States Bureau of Reclamation

US COE - United States Army Corps of Engineers

USDA - United States Department of Agriculture

USFS - United States Forest Service

USGS - United States Geological Survey

W:D - Width to Depth (ratio)

WLA - Waste Load Allocation

WQMP - Water Quality Management Plan

WQS - Water Quality Standard

WWTP - Waste Water Treatment Plant