Potlatch River Subbasin Assessment and TMDLs

Department of Environmental Quality
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Abbreviations, Acronyms, and Symbols

§303(d) Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

§ Section (usually a section of federal or state rules or statutes)

ADB assessment database

AU assessment unit

AWS agricultural water supply

BAG Basin Advisory Group

BMP best management practice

Btu British thermal unit

BURP Beneficial Use Reconnaissance Program

C Celsius

CFR Code of Federal Regulations (refers to citations in the federal administrative rules)

cfs cubic feet per second

cm centimeters

CWA Clean Water Act

CWAL cold water aquatic life

DEQ Department of Environmental Quality

DO dissolved oxygen

DWS domestic water supply

EPA United States Environmental Protection Agency

HUC Hydrologic Unit Code

I.C. Idaho Code

IDAPA Refers to citations of Idaho administrative rules

IDFG Idaho Department of Fish and Game

IDL Idaho Department of Lands

km kilometer

km^2 square kilometer

LA load allocation

LC load capacity

m meter

m^3 cubic meter

mi mile

mi^2 square miles

MBI Macroinvertebrate Biotic Index

MGD million gallons per day

mg/L milligrams per liter

mm millimeter

MOS margin of safety

MWMT maximum weekly maximum temperature

NA not assessed

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NTU nephelometric turbidity unit

PCR primary contact recreation

ppm part(s) per million

QA quality assurance

QC quality control

SBA subbasin assessment

SCR secondary contact recreation

SS salmonid spawning

TDS total dissolved solids

TIN total inorganic nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

U.S.C. United States Code

USDA United States Department of Agriculture

WAG Watershed Advisory Group

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WLA wasteload allocation

WQLS water quality limited segment

WQS water quality standard

Executive Summary

The federal Clean Water Act requires that Idaho restore and maintain the chemical, physical, and biological integrity of state waters. Idaho, pursuant to Section 303 of the Clean Water Act, is to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 305 of the Clean Water Act requires Idaho to monitor water quality conditions of State waters. Idaho must identify, prioritize, and report water bodies that do not meet water quality standards. Idaho must develop a total maximum daily load plan for waters reported as not meeting water quality standards, to restore the water body to water quality standards. An integrated report is periodically published by Idaho to meet the integrated requirements of Section 303 and 305 of the Clean Water Act.

This Total Maximum Daily Load addresses the water bodies in the Potlatch River watershed that were listed as not meeting Idaho's water quality standards in Idaho's 2002 integrated report (DEQ 2002). The watershed assessment and total maximum daily load analysis have been developed to comply with Idaho law and the federal Clean Water Act. The total maximum daily load describes the water quality data used to develop estimated loads, and identifies estimates for existing loads, allowable loads, and load reductions needed to meet Idaho water quality standards.

Subbasin at a Glance

The Potlatch River watershed is a part of Hydrologic Unit 17060306, the Lower Clearwater River Subbasin. The watershed encompasses approximately 380,400 acres (594 square miles), draining into the Clearwater River between Myrtle and Spalding. The upper reaches of the Potlatch River are divided into two main tributaries, the East Fork and West Fork Potlatch Rivers. The East Fork originates in the northwest corner of Clearwater County and flows southwest to its confluence with the mainstem. The West Fork originates in the northeast corner of Latah County and flows southeast to its confluence with the Potlatch River. The Potlatch River drains the eastern two-thirds of Latah County, running from northeast to southwest.

Land uses in the upper watershed include: forestry, livestock, and agriculture. The river flows onto the Nez Perce Reservation approximately seven miles upstream from its confluence with the Clearwater River. Stream and river flows in the Potlatch River watershed reflect weather patterns. Most of the precipitation occurs during winter and early spring with very little precipitation occurring during the summer months. This pattern tends to cause high peak flows in early spring and extremely low flows in late summer.

The upper Potlatch River drains rolling hills and meadows of the eastern edge of the Columbia River basalt plateau and the adjacent Clearwater Mountains. Elevations range from approximately 2,500 feet on the plateau to near 5,000 feet on some of the mountains surrounding the watershed.

Key Findings

Multiple Assessment Units on the tributaries and mainstem of the Potlatch River were listed as not meeting state water quality standards in Section 5 of Idaho's 2002 integrated report (DEQ 2002) (Figure A). Section 303(d) of the Clean Water Act states that waters that do not meet water quality standards are required to have total maximum daily loads developed to bring them into compliance with water quality standards.

Figure A. Potlatch River TMDL Water Quality Limited Segments

Designated and existing cold water aquatic life beneficial uses for the Potlatch River include cold water aquatic life and salmonid spawning (Table A). Primary contact recreation and domestic water supply beneficial uses are also designated and existing. Water quality must be sufficiently maintained to meet the most sensitive use. The water bodies addressed by this TMDL are listed in Table B.

Table A. Beneficial uses of the Potlatch River watershed.

Stream Name	Listing	Assessment Unit	Designated Beneficial Uses	Existing Beneficial Uses
Potlatch River	Big Bear Cr. to Clearwater R.	ID17060306CL044_06	COLD, SS, PCR, DWS	
Potlatch River	Corral Cr. to Big Bear Cr.	ID17060306CL045_05	COLD, SS, PCR, DWS	
Potlatch River	Moose Cr. to Corral Cr.	ID17060306CL048_04 ID17060306CL048_05	COLD, SS, PCR, DWS	
Potlatch River	Headwaters to Moose Cr.	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	COLD, SS, PCR, DWS,SRW	
Big Bear Creek	WF Big Bear Cr. to Potlatch R.	ID17060306CL056_04 ID17060306CL056_05		COLD, SS, SCR
Boulder Creek	Pig Cr. to Potlatch R.	ID17060306CL047_03		COLD, SS, SCR
Cedar Creek	Leopold Cr. to Potlatch R.	ID17060306CL046_04		COLD, SS, SCR
Corral Creek	Headwaters to Potlatch R.	ID17060306CL054_02 ID17060306CL054_03		COLD, SS, SCR
Moose Creek	Headwaters to Potlatch R.	ID17060306CL053_02 ID17060306CL053_03		COLD, SS, PCR
Pine Creek	Headwaters to Potlatch R.	ID17060306CL055_02 ID17060306CL055_03		COLD, SS, SCR
Ruby Creek	Unnamed trib. 3.4 km upstream to E.F. Potlatch R.	ID17060306CL052_03		COLD, SS, SCR
East Fork Potlatch River	Ruby Cr. to Potlatch R.	ID17060306CL051_04		COLD, SS, SCR
West Fork Little Bear Creek	Headwaters to Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03		COLD,SS, SCR
Middle Potlatch Creek	Headwaters to Potlatch R.	ID17060306CL062_02 ID17060306CL062_03	COLD, SCR	SS

COLD= Cold Water Aquatic Life, SS = Salmonid Spawning, PCR = Primary Contact Recreation, SCR = Secondary Contact Recreation, DWS = Domestic Water Supply

Table B. 2002 Integrated Report Section 5 waters.

Stream Name	Listing	Assessment Unit	Pollutants
Potlatch River	Big Bear Cr. to Clearwater R.	ID17060306CL044_06	Bac, DO, NH3, Nut, O/G, Org, Pest, Sed, Temp
Potlatch River	Corral Cr. to Big Bear Cr.	ID17060306CL045_05	Bac, Nut, Sed, Temp
Potlatch River	Moose Cr. to Corral Cr.	ID17060306CL048_04 ID17060306CL048_05	Bac, Nut, Sed, Temp
Potlatch River	Headwaters to Moose Cr.	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Bac, Nut, Sed, Temp
Big Bear Creek	WF Big Bear Cr. to Potlatch R.	ID17060306CL056_04 ID17060306CL056_05	Temp
Boulder Creek	Pig Cr. to Potlatch R.	ID17060306CL047_03	Unknown*
Cedar Creek	Leopold Cr. to Potlatch R.	ID17060306CL046_04	Sed, Temp
Corral Creek	Headwaters to Potlatch R.	ID17060306CL054_02 ID17060306CL054_03	Sed
East Fork Potlatch River	Ruby Cr. to Potlatch R.	ID17060306CL051_04	Bac, Nut, Sed, Temp
Middle Potlatch Creek	Headwaters to Potlatch R.	ID17060306CL062_02 ID17060306CL062_03	Bac, Nut, Sed, Temp
Moose Creek	Headwaters to Potlatch R.	ID17060306CL053_02 ID17060306CL053_03	Bac, Nut, pH, Sed, Temp
Pine Creek	Headwaters to Potlatch R.	ID17060306CL055_02 ID17060306CL055_03	Bac, Nut, O/G, DO, Sed, Temp NH3
Ruby Creek	Unnamed tributary 3.4 km upstream to E.F. Potlatch River	ID17060306CL052_03	Bac, Nut, Sed, Temp

Bac = Bacteria, DO = Dissolved Oxygen, NH3 = Ammonia, Nut = Nutrients, O/G = Oil and Grease, Org = Organics, Pest = Pesticides, Sed = Sediment, Temp = Temperature
*Biological impairment, no pollutant identified

In 2002-2004, DEQ collected water quality data for the streams addressed in this TMDL. Water body monitoring locations are listed in Table C and their locations are illustrated in Figure B. Sites are located close to the mouths of the water bodies. An initial set of data was collected in 2002, with additional data collected in 2003 and 2004.

Most sites were monitored routinely every two weeks. Water quality parameters and pollutant concentrations measured during the 2002 season included instantaneous stream temperature and continuous stream temperature; *E. coli* bacteria and fecal coliform bacteria; dissolved oxygen, ammonia, total nitrogen and total phosphorus; turbidity and total suspended solids; pH; instantaneous stream flow; oil, grease and pesticides; and specific conductance.

Table C. Monitoring station locations.

Monitoring Station*	Stream Name	Location
PTR 1	Potlatch River	At the Mouth of the Potlatch River
PTR 3	Potlatch River	At the Kendrick Bridge
PTR 4	Middle Potlatch Creek	Highway Bridge at the Mouth of Middle Potlatch Creek
PTR 5	Middle Potlatch Creek	At the Spence Road Bridge
PTR 6	West Fork of Little Bear Creek	Down Stream of the City of Troy Discharge; 2006/2007 site downstream 200 yards
PTR 7	West Fork of Little Bear Creek	Up Stream of the City of Troy Discharge
PTR 8	Big Bear Creek	Bridge at the Mouth of Big Bear Creek
PTR 9	Big Bear Creek	Near Highway 8 down stream of Mount Deary Creek
PTR 9a	Big Bear Creek	Near Highway 8 up stream of Mount Deary Creek
PTR 10	Pine Creek	At the Bridge at the Mouth of Pine Creek
PTR 11	Cedar Creek	At the Mouth of Cedar Creek
PTR 12	Potlatch River	Near the Little Boulder Creek Campground
PTR 13	Corral Creek	Down Stream of the City of Helmer Discharge
PTR 14	Ruby Creek	Just above the Mouth of Ruby Creek
PTR 15	East Fork Potlatch River	At the Mouth of the East Fork Potlatch River
PTR 16	Potlatch River	Down Stream of the City of Bovill Discharge
PTR 17	Moose Creek	At the Mouth of Moose Creek
PTR 18	Moose Creek	Up Stream of Moose Creek Reservoir
PTR 19	Potlatch River	Highway Bridge Up Stream of the City of Bovill Discharge
PTR 20	Boulder Creek	At the Linden Road Crossing
PTR 21	West Fork Potlatch River	At the Mouth of the West Fork Potlatch River
PTR 22	Porcupine Creek	At the Mouth of Porcupine Creek
PTR 23	Sheep Creek	At the Mouth of Sheep Creek

*Shaded Monitoring Stations are established control points

Highway Stream ● Site ▲Town County Road

Figure B. Monitoring Station Locations

Based on the data collected at these locations, bacteria, nutrient, sediment, and temperature TMDLs have been developed for the Potlatch River watershed (Table D). The loads have been allocated to the existing sources currently in the watershed. A growth reserve is not included in the total maximum daily loads. Except for storm water construction permits, future sources will need to acquire a load allocation from existing allocations unless the load capacity is increased.

Bacteria TMDLs allocate a gross concentration to all sources of *E. coli* bacteria upstream of control points on each tributary and upstream of the control point on the mainstem Potlatch River. Bacteria TMDL(s) have been developed for:

- Boulder Creek, ID17060306CL047_03, with an allocation provided to a control point at PTR-20.
- Big Bear Creek, ID17060306CL056_05, with an allocation provided to a control point at PTR-8.
- Middle Potlatch Creek, ID17060306CL062_03, with an allocation provided to a control point at PTR-4.
- West Fork Little Bear Creek, ID17060306CL061_03, with an allocation provide to a control point at PTR-6.
- Potlatch River headwaters to Moose Creek segment, ID17060306CL049_04, with an allocation provided to a control point at PTR-12.
- Ruby Creek, ID17060306CL052_03, with an allocation provided to a control point at PTR-14.
- Moose Creek, ID17060306CL053_03, with an allocation provided to a control point at PTR-17.

E. coli bacteria wasteload allocations have been developed for five wastewater treatment facilities (Bovill, Deary, Juliaetta, Kendrick, and Troy) that discharge to the Potlatch River or associated tributaries and estuaries. The *E. coli* bacteria allocation applies to any 30-day period annually since secondary contact recreation may occur at any time of year. This allocation ensures water quality standards are attained for the protection of public health.

Table D. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Potlatch River, Big Bear Cr. to Mouth ID17060306CL044_06	Temp, Sed	Yes	Move to section 4a	TMDL completed
Potlatch River, Big Bear Cr. to Mouth ID17060306CL044_06	O/G, Nut, Pest, Bac, NH3,Org, DO	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Corral Cr. to Big Bear Cr. ID17060306CL045_05	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Corral Cr. to Big Bear Cr. ID17060306CL045_05	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Potlatch River, Moose Cr. to Corral Cr. ID17060306CL048_04 ID17060306CL048_05	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Moose Cr. to Corral Cr. ID17060306CL048_04 ID17060306CL048_05	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Headwaters to Moose Cr. ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Temp, Bac	Yes	Move to section 4a	TMDL completed
Potlatch River, Headwaters to Moose Cr. ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Big Bear Cr. ID17060306CL056_04 ID17060306CL056_05	Bac, Temp	Yes	Move to section 4a	TMDL completed
Boulder Cr. ID17060306CL047_03	Bac, Temp	Yes	Move to section 4a	TMDL completed
Cedar Cr. ID17060306CL046_04	Temp, Sed	Yes	Move to section 4a	TMDL completed
Corral Cr. ID17060306CL054_02 ID17060306CL054_03	Temp	Yes	Move to section 4a	TMDL completed
Corral Cr. ID17060306CL054_02 ID17060306CL054_03	Sed	No	Remove pollutants from list of impairments	SBA completed
Moose Cr. ID17060306CL053_02 ID17060306CL053_03	Temp, Bac	Yes	Move to section 4a	TMDL completed
Moose Cr. ID17060306CL053_02 ID17060306CL053_03	Nut, pH, Sed	No	Remove pollutants from list of impairments	SBA completed
Pine Cr. ID17060306CL055_02 ID17060306CL055_03	Temp, Nut, Sed	Yes	Move to section 4a	TMDL completed
Pine Cr. ID17060306CL055_02 ID17060306CL055_03	O/G, DO, Bac, NH3	No	Remove pollutants from list of impairments	SBA completed
Ruby Cr. ID17060306CL052_03	Temp, Bac	Yes	Move to section 4a	TMDL completed
Ruby Cr. ID17060306CL052_03	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
East Fork Potlatch River ID17060306CL051_04	Temp	Yes	Move to section 4a	TMDL completed

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
East Fork Potlatch River ID17060306CL051_04	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Middle Potlatch Cr. ID17060306CL062_02 ID17060306CL062_03	Temp, Bac, Sed	Yes	Move to section 4a	TMDL completed
West Fork Little Bear Cr.[a] ID17060306CL061_02 ID17060306CL061_03	Bac, Nut, Sed	Yes	Move to section 4a	TMDL Completed
Middle Potlatch Cr. ID17060306CL062_02 ID17060306CL062_03	Nut	No	Remove pollutants from list of impairments	SBA completed

[a]=West Fork Little Bear Creek was not on the 303 (d) list.

A nutrient TMDL that addresses the limiting nutrient, total phosphorus, was developed for Pine Creek, ID17060306CL055_03, with an allocation provided to a control point at PTR-10, from mid June through October. The TMDL allocates a daily load to all sources of total phosphorus upstream of the control point. The critical time period is based on measured dissolved oxygen violations. By controlling nutrient loading during this period, aquatic plant growth should be reduced and in-stream dissolved oxygen enhanced.

A nutrient TMDL that addresses total inorganic nitrogen (TIN) has been developed for the West Fork Little Bear Creek, ID17060306CL061_03, based on violations of Idaho's dissolved oxygen criterion of 6.0 mg/L, the limiting nutrient analysis discussed in Section 2.4, and the stream flows measured in West Fork Little Bear Creek. The TMDL allocates a daily waste load to the city of Troy for TIN at the control point.

Sediment TMDLs allocate a gross concentration to all sources of sediment upstream of control points on each tributary and upstream of the control point on the mainstem Potlatch River. Sediment TMDLs have been developed for:

- Potlatch River, ID17060306CL044_06, with an allocation provided to a control point at PTR-1.
- Middle Potlatch Creek, ID17060306CL062_03, with an allocation provided to a control point at PTR-4.
- West Fork Little Bear Creek, ID17060306CL061_03, with an allocation provided to a control point at PTR-6.
- Pine Creek, ID1706030CL6055_03, with an allocation provided to a control point at PTR-10.
- Cedar Creek, ID17060306CL046_04, with an allocation provided to a control point at PTR-11.

Waste load allocations were developed for Deary, Bovill, Kendrick, Juliaetta, and Troy WWTP facilities based on the estimated design flow times the maximum daily limit and the current allowable average monthly concentrations. Controlling sediment loads will assist in managing nutrient loads in the Potlatch River watershed since nutrients, particularly phosphorus, bind to soil particles delivered to the stream.

A temperature TMDL that calls for an increase in riparian shade in order to restore stream temperatures to background conditions has been developed for assessment units in all thirteen listed water bodies in the Potlatch River watershed. Streamside vegetation and channel morphology are factors influencing shade, which are most likely to have been changed by anthropogenic activities, and which can be most readily corrected and addressed by a TMDL.

Public Participation

This TMDL was finalized with the assistance of the Potlatch River Watershed Advisory Group (WAG). Members of the WAG were recommended by the Clearwater Basin Advisory Group, appointed by the DEQ Director, organized and having meetings by February 2007. Members of the WAG represent agriculture, local government, federal government, the Nez Perce Tribe, recreation, forestry, point source discharge, environmental, mining, livestock and residential interests. Over the course of nine meetings, the Potlatch WAG provided concurrence to complete this TMDL through their established operating procedures.

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act requires that Idaho restore and maintain the chemical, physical, and biological integrity of state waters. Idaho, pursuant to Section 303 of the Clean Water Act, is to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 305 of the Clean Water Act requires Idaho to monitor water quality conditions of State waters. Idaho must identify, prioritize, and report water bodies that do not meet water quality standards. Idaho must develop a Total Maximum Daily Load (TMDL) plan for waters reported as not meeting water quality standards, to restore them to water quality standards. An integrated report is periodically published by Idaho to meet the integrated requirements of Section 303 and 305 of the Clean Water Act.

This TMDL addresses the water bodies in the Potlatch River watershed that were listed as not meeting Idaho's water quality standards in Idaho's 2002 integrated report (DEQ 2002). The watershed assessment and TMDL analysis have been developed to comply with Idaho law and the federal Clean Water Act. The TMDL describes the water quality data used to develop estimated loads, and identifies estimates for existing loads, allowable loads, and load reductions needed to meet Idaho water quality standards.

1.1 Introduction

In 1972, Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The U.S. Environmental Protection Agency is responsible to ensure Idaho complies with the Clean Water Act. The Clean Water Act requires DEQ to adopt water quality standards and submit those standards to EPA for approval every three years. In addition, DEQ must monitor state waters to identify those not meeting state water quality standards; these impaired waters are included on what is called the 303(d) list. A TMDL must be completed for each water body not meeting water quality standards to restore the water body and comply with the standards.

Section 2 of this document includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Potlatch River watershed to date. This assessment is not a requirement of the total maximum daily load but is required by Idaho state law.

Idaho water quality standards address various beneficial uses designated or presumed for specific water bodies, defining the corresponding numeric and narrative physical and chemical limits, or criteria, needed to support the uses. These beneficial uses are identified in the Idaho water quality standards, IDAPA 58.01.02, and include the following:

- Aquatic life support–cold water, seasonal cold water, warm water, salmonid spawning, modified

- Contact recreation–primary, secondary
- Water supply–domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

The Idaho legislature designates uses for water bodies. Industrial water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state.

1.2 Physical and Biological Characteristics

The Potlatch River watershed (Figure 1) is a part of hydrologic unit 17060306, the Lower Clearwater River Subbasin. The watershed encompasses approximately 380,400 acres, draining into the Clearwater River between Myrtle and Spalding. The upper reaches of the Potlatch River are divided into two main tributaries, the East Fork and West Fork Potlatch Rivers. The East Fork originates in the northwest corner of Clearwater County and flows in a southwest to its confluence with the mainstem. The West Fork originates in the northeast corner of Latah County and flows south to its confluence with the Potlatch River. The Potlatch River drains the eastern two-thirds of Latah County, running from northeast to southwest. The river flows onto the Nez Perce Reservation approximately 7 miles upstream from its confluence with the Clearwater River. The location of water bodies in the watershed that are listed in the Idaho's 2002 integrated report (DEQ 2002) as not meeting state water quality standards and are illustrated in Figure 1. These water bodies are the subject of this TMDL.

Figure 1. Potlatch River TMDL Water Quality Limited Segments

Climate

Northern Idaho is dominated by Pacific maritime air masses and prevailing westerly winds. Over 85% of the annual precipitation occurs during late fall, winter, and spring months. Cyclonic storms consisting of a series of frontal systems moving east produce long duration, low-intensity precipitation during this period of the year. In winter and spring, this inland maritime regime is characterized by prolonged gentle rains, fog, cloudiness, and high humidity; with deep snow accumulations at higher elevations. Winter temperatures here are often 15 to 25 ^{o}F warmer than other continental locations of the same latitude. The climate during the summer months is influenced by stationary high-pressure systems over the northwest coast. These warm dry systems result in only 10-15% of the annual precipitation falling during the summer. Figure 2 shows the mean annual precipitation.

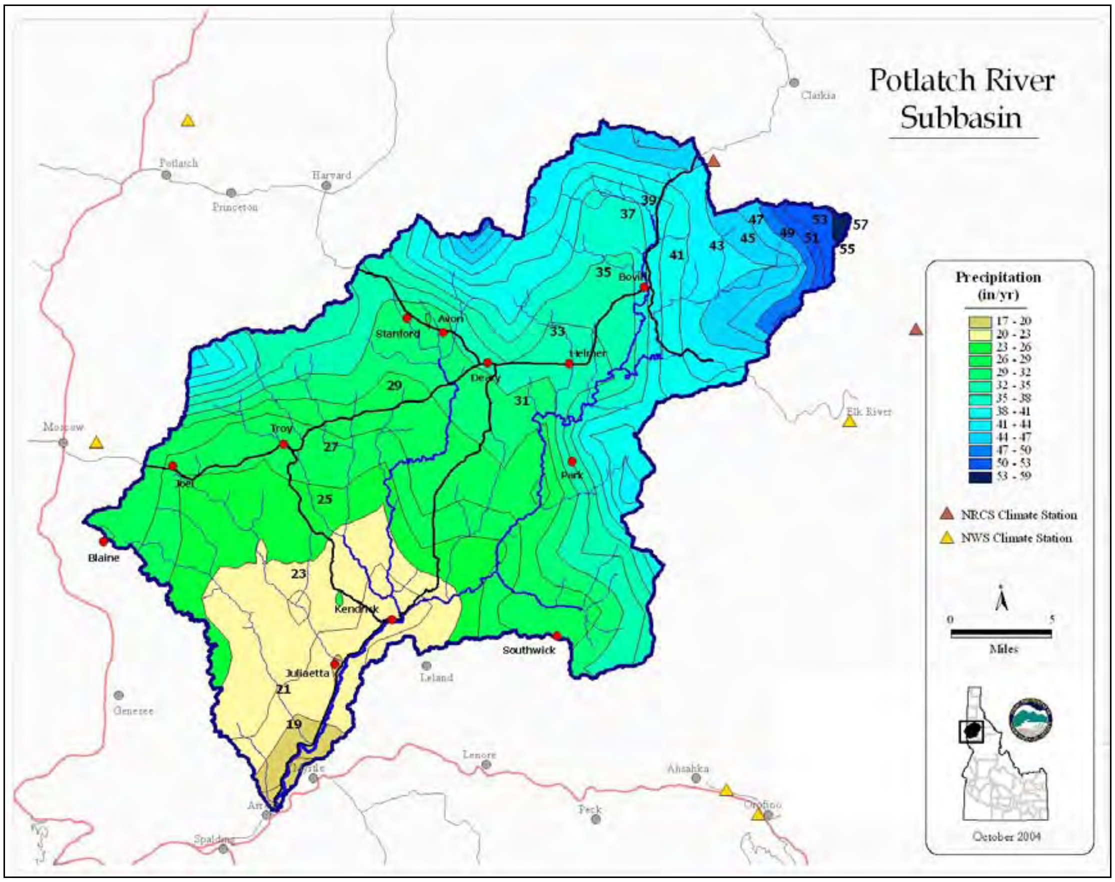

Figure 2. Mean Annual Precipitation of the Potlatch River Watershed

Hydrology

Flow (discharge) volume data from gage stations in and around the Potlatch River watershed included in Table 1 and plotted in Figure 3 illustrate the flow pattern typical of the low-lying watersheds draining to the Clearwater River. Stream and river flows in the Potlatch River watershed reflect the weather pattern. Most of the precipitation occurs during winter and early spring with very little precipitation occurring during the summer months. This pattern tends to cause high peak flows in early spring and extremely low flows in late summer (Figure 4 and Table 2).

Table 1. Long term flow, gage stations in and near the Potlatch River watershed.

Gage Station	Manager	Years of Record	Elevation (feet)	Drainage Area (mi^2)	Mean Annual Flow (cfs*)
Potlatch River at Kendrick	USGS	10/45-9/60	1,198	425	427
East Fork Potlatch River	USGS	9/59-10/71	2,800	42	62
Potlatch River at Little Boulder Cr.	CNF	10/94-09/05	2,610	126	184
Lapwai Creek	USGS	10/74-present	865	235	81
Palouse River	USGS	10/14-9/19 12/66-present	2,455	317	267

* cfs – cubic feet per second

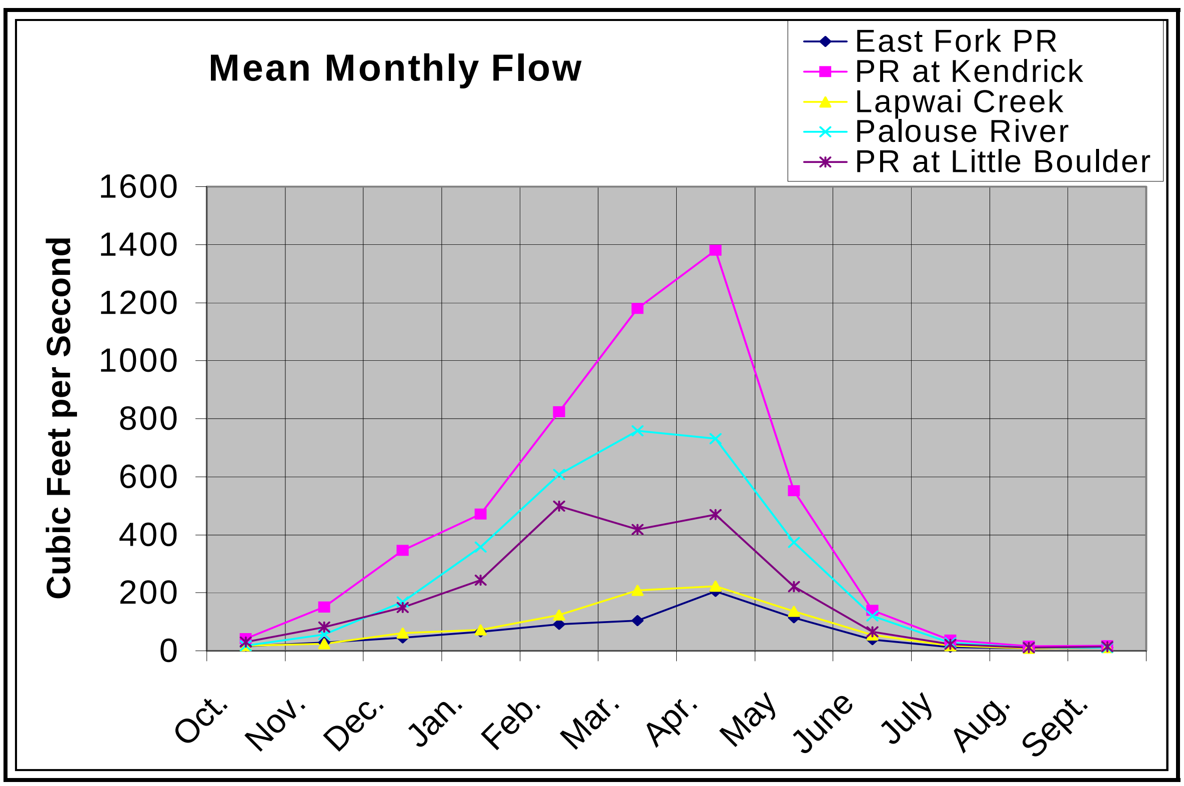

Figure 3. Mean Monthly Flow Pattern of Gage Stations in and near the Potlatch River watershed

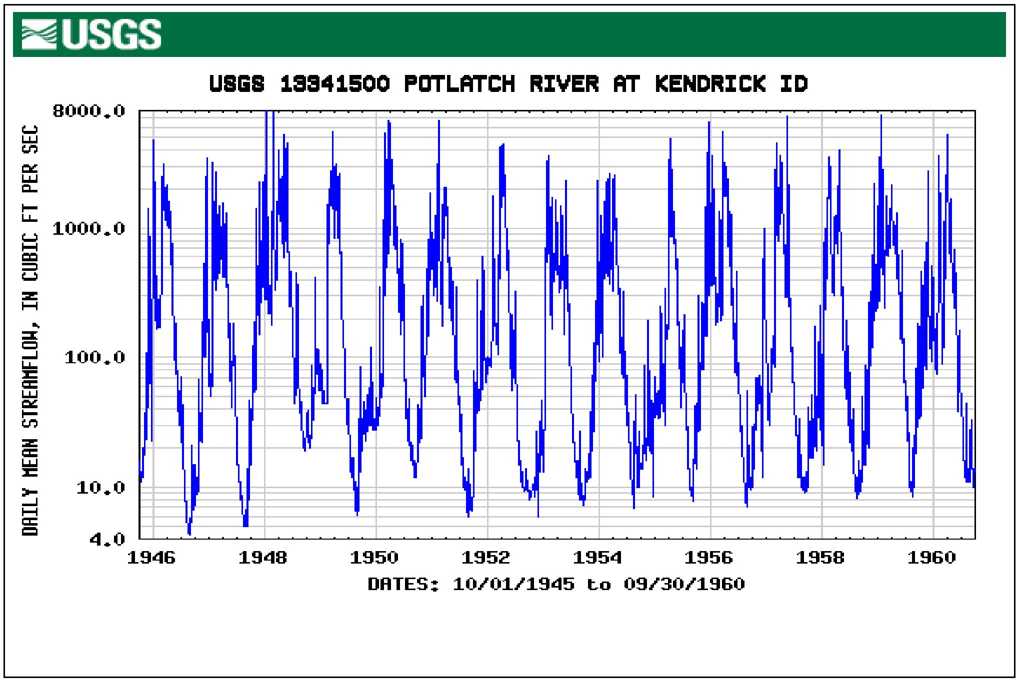

Figure 4. Average Daily Flow for the Potlatch River at Kendrick, October 1945 through September 1960

Table 2. Average monthly mean flow from August 2003 through September 2005, USGS gaging station Potlatch River below Little Potlatch Creek.

	Discharge (cfs*)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
2003									7.57	14.2	36.6	91.8
2004	291.4	894.3	1,104	379.2	567.5	165.0	17.9	17.6	25.6	46.2	128.9	258.5
2005	464.3	168.7	434.8	473.4	458.9	71.9	16.2	2.63	3.73			
Mean of monthly discharge	378	531	769	426	513	118	17	10	12	30	83	175

* cfs – cubic feet per second

Topography, Geology and Soils

The upper Potlatch River drains rolling hills and meadows of the eastern edge of the Columbia River basalt plateau and the adjacent Clearwater Mountains. Elevations range from approximately 5,000 feet on some of the mountains surrounding the basin and 2,500 feet on the plateau top to 1,000 feet at the confluence with the Clearwater River. In portions of the canyons of the river and its tributaries, Columbia River basalt flows and underlying granitic and metamorphic formations are exposed. Landslide deposits have occurred and exposed sediment interbeds along the valley sides. Wind-deposited silt loess forms the Palouse hills overlying the basalt on the plateau. The loess generally thins from west to east. Multiple floods from Lake Missoula deposited silt, sand, pebbles and cobbles in the lower elevations of the canyon reaches near the confluence with the Clearwater River.

Vegetation

The typical natural landscape for the area is grasslands, shrubs, and Ponderosa pine forests. Prairie grasslands were composed of Idaho fescue and blue bunch wheatgrass. Camas root typically grew in the valleys. Snowberry, serviceberry, wild rose, willows, red-osier dogwood, alder, Ponderosa pine, and black hawthorn grew in the foothills. Grand fir, western red cedar, western white pine, larch, and Douglas fir grew in the forested mountain areas.

The six major vegetation types in the area are cultivated fields, marshes, grasslands, brush lands, Ponderosa pine forests, and mountain forests. Dominant forest vegetation includes western white pine, larch, grand fir, Douglas fir, Ponderosa pine, and lodgepole pine. Shrub species include willows, alder, hawthorn, osiers, and Rocky Mountain maple. Grass species include Idaho fescue, bluebunch wheatgrass, and prairie junegrass.

Fisheries

An extensive fisheries survey carried out by Idaho Fish and Game (IDFG) on the Potlatch River and 21 of its tributaries found the following fish species (Schriever and Nelson).

Salmonids	Other Species
Rainbow trout	Largemouth Bass
Steelhead trout	Bluegill and Pumpkinseed sunfish
Coho salmon	Dace
Cutthroat trout	Sculpin
Brook trout	Redside shiner
Rainbow/cutthroat hybrid trout	Bullhead
	Sucker
	Chiselmouth chub
	Northern pike minnow

1.3 Cultural Characteristics

Members of the Nez Perce Tribe are historic inhabitants of the Potlatch River area. Lewis and Clark traveled past the mouth of the Potlatch River in the fall of 1805 and again in the spring of 1806. In 1860, gold was discovered near Orofino, which prompted the migration of miners to the area. Farms, settlements, and communities were established and in the 1880s timber companies were harvesting the white pine forests. The 1900s saw the extension of railroads into north central Idaho and marketing of crops and lumber from the area accelerated its modern settlement.

Population centers include the cities of Juliaetta, Kendrick, Bovill, Deary, and Troy (Table 3). Marketable exports are transported to markets through Lewiston or Spokane. Per capita annual income in the region has increased from approximately $9,000 in 1980 to approximately $23,500 in 1999.

Table 3. Population trends for cities in the Potlatch River area.

Town	1970	1980	1990	2000
Troy	541	820	699	798
Deary	411	539	529	552
Bovill	350	289	256	305
Juliaetta	423	522	488	609
Kendrick	426	395	325	369

Cultural Features and Land Use

Large tracts of the watershed's grass lands have been converted to dry land agriculture. Most agricultural activities are in the drier southwest end of the watershed. Forest lands are in the higher elevations in the northeast end of the watershed (Figure 5).

Over time, marginal farmland has been taken out of crop production and converted to non-cultivated crop uses, such as pasture or hay. Currently, most cultivated farmland is located in the lower reaches of the basin where conditions are best for agricultural production.

The forested parts of the watershed include private land owned by Potlatch Corporation and Bennett Lumber, state land managed by the Idaho Department of Lands, and federal land managed by the Clearwater National Forest.

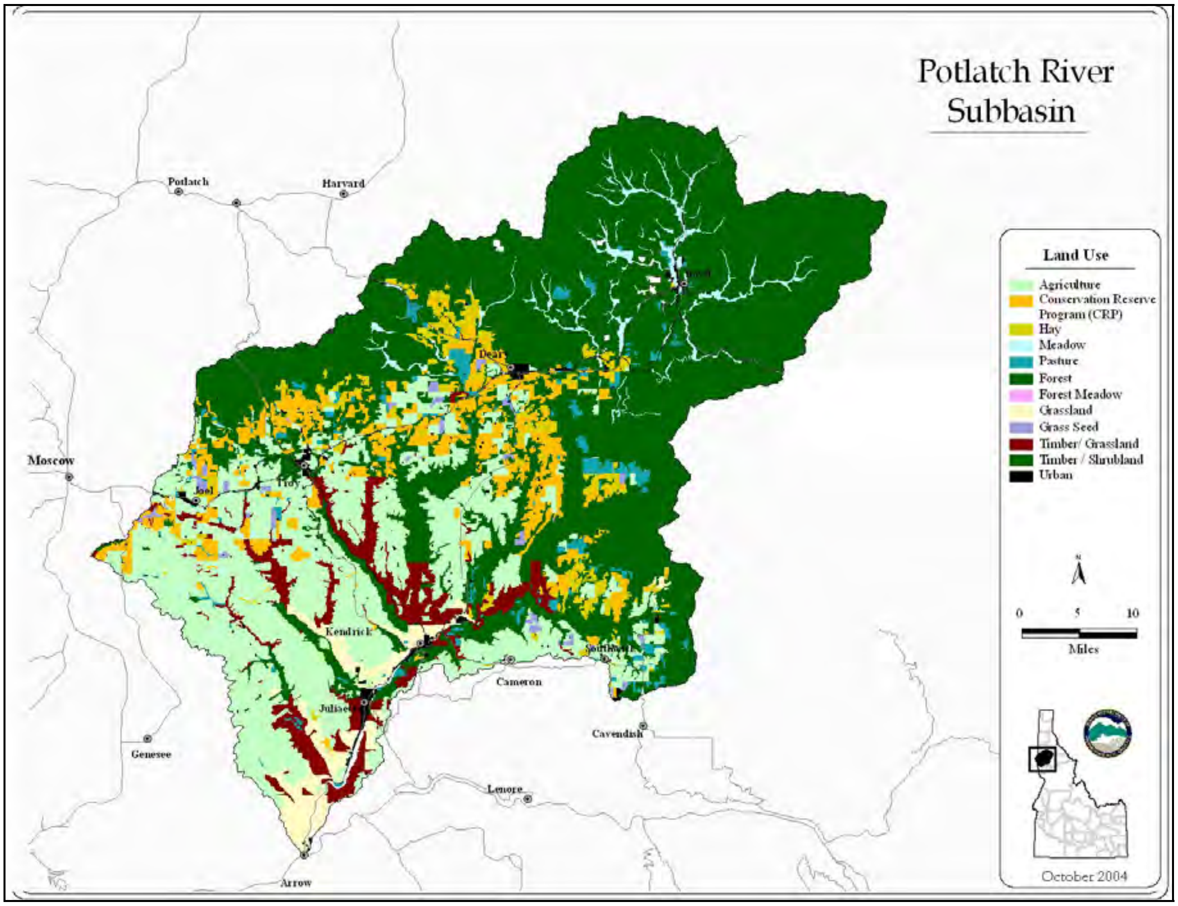

Figure 5. Land use in the Potlatch River Watershed

2. Subbasin Assessment – Water Quality Concerns and Status

This section identifies the applicable water quality standards (WQS) for the water quality limited water bodies in the Potlatch River watershed. The Potlatch River is in the Lower Clearwater River hydrologic unit code (HUC) 17060306.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the federal Clean Water Act requires establishment of a TMDL for waters in the state that are considered to be not meeting state WQS, to manage and regulate pollutants to bring the waters into compliance with state WQS. The state of Idaho collects reconnaissance level data for each of the streams through the Beneficial Use Reconnaissance Program (BURP). The data generated are evaluated for compliance with the State of Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02) following the Water Body Assessment Guidance, Second Edition (Grafe et al. 2002). Waters that fail the assessment process are then listed on the 303(d) list. Idaho code standardizes identification of Idaho's streams into water bodies for watershed management using the Idaho Water Body Identification (WBID) code. The Potlatch River water bodies listed in the Idaho's 2002 integrated report (DEQ 2002) are shown in Table 4.

The listed headwater streams are located on the West Fork of the Potlatch River above Moose Creek. These are typically low relief channels with numerous meanders and high sinuosity within broad silty alluvium meadows with established flood plains. When flooding occurs, water moves up out of the channels and spreads across the meadows. Little or no erosion occurs, and any sediment transported from the uplands settles in the meadows. The natural condition is that stream beds will be silty or sandy with limited salmonid spawning habitat (Clearwater BioStudies, Inc. 1994; Clearwater BioStudies, Inc. 1996).

Ruby Creek originates southeast of the town of Bovill, and runs northwest to its confluence with the East Fork Potlatch River. The East Fork then flows into the Potlatch River between Moose Creek and Corral Creek. Moose Creek drains the forested hills, meadows and grasslands north of Bovill. Corral Creek, from its headwaters to its mouth, drains the forested hills, meadows and grasslands surrounding the town of Helmer.

From Corral Creek to Big Bear Creek, the Potlatch River flows through a relatively inaccessible canyon to Cedar Creek, then opens up into a wider canyon. Boulder Creek, Cedar Creek, and Pine Creek flow into the Potlatch between Corral Creek and Big Bear Creek. Boulder Creek, from Pig Creek to its mouth, drains the forested hills east of the community of Park. Cedar Creek, from Leopold Creek to its mouth, drains the forested hills and grasslands north and east of the community of Southwick. Pine Creek drains the forested hills and agricultural lands just south of the town of Deary, flowing into a steep canyon and entering the Potlatch River above the town of Kendrick. At Kendrick, the Potlatch River flows into a constructed channel. The Army Corps of Engineers constructed dikes along the river channel to prevent flooding through Kendrick and Juliaetta.

Table 4. Waters listed in the 2002 Integrated Report, Section 5.

Stream Name	Listing	Assessment Unit	Pollutants
Potlatch River	Big Bear Cr. to Clearwater R.	ID17060306CL044_06	Bac, DO, NH3, Nut, O/G, Org, Pest, Sed, Temp
Potlatch River	Corral Cr. to Big Bear Cr.	ID17060306CL045_05	Bac, Nut, Sed, Temp
Potlatch River	Moose Cr. to Corral Cr.	ID17060306CL048_04 ID17060306CL048_05	Bac, Nut, Sed, Temp
Potlatch River	Headwaters to Moose Cr.	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Bac, Nut, Sed, Temp
Big Bear Creek	WF Big Bear Cr. to Potlatch R.	ID17060306CL056_04 ID17060306CL056_05	Temp
Boulder Creek	Pig Cr. to Potlatch R.	ID17060306CL047_03	Unknown*
Cedar Creek	Leopold Cr. to Potlatch R.	ID17060306CL046_04	Sed, Temp
Corral Creek	Headwaters to Potlatch R.	ID17060306CL054_02 ID17060306CL054_03	Sed
East Fork Potlatch River	Ruby Cr. to Potlatch R.	ID17060306CL051_04	Bac, Nut, Sed, Temp
Middle Potlatch Creek	Headwaters to Potlatch R.	ID17060306CL062_02 ID17060306CL062_03	Bac, Nut, Sed, Temp
Moose Creek	Headwaters to Potlatch R.	ID17060306CL053_02 ID17060306CL053_03	Bac, Nut, pH, Sed, Temp
Pine Creek	Headwaters to Potlatch R.	ID17060306CL055_02 ID17060306CL055_03	Bac, Nut, O/G, DO, Sed, Temp NH3
Ruby Creek	Unnamed tributary 3.4 km upstream to E.F. Potlatch River	ID17060306CL052_03	Bac, Nut, Sed, Temp

Bac = Bacteria, DO = Dissolved Oxygen, NH3 = Ammonia, Nut = Nutrients, O/G = Oil and Grease, Org = Organics, Pest = Pesticides, Sed = Sediment, Temp = Temperature
*Biological impairment, no pollutant identified

From Big Bear Creek to its mouth, the Potlatch River flows through a flat-bottomed canyon. Big Bear Creek from the West Fork of Big Bear Creek to the mouth drains the forested hills and grasslands west of the town of Deary, carving a steep canyon as it leaves the plateau on its way toward its confluence with Little Bear Creek. The canyon broadens as the stream approaches the Potlatch River.

Below Big Bear Creek, the Middle Potlatch Creek enters the Potlatch River. Its headwaters originate near the town of Joel in agricultural lands of the Palouse prairie. The creek carves a bedrock canyon as it leaves the plateau, widening as it descends toward the mouth, and enters the Potlatch River just above Juliaetta. At its lower end, the Potlatch River enters the Clearwater River as it travels through the Nez Perce Tribal Reservation.

About Assessment Units

Assessment units (AUs) now define all the waters of the state of Idaho. These units and the methodology used to describe them can be found in the Water Body Assessment Guidance, Second Edition (Grafe et al. 2002). AUs are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—even if ownership and land use change significantly, an AU remains the same.

Using AUs to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. Using AUs fulfills the fundamental requirement of the 305(b) report required by the Environmental Protection Agency (EPA), a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

The new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of 303(d) listed streams. Due to the nature of the court-ordered 1994 303(d) listings, and the subsequent 1998 303(d) list, all segments were added with boundaries from "headwater to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the watershed scale, so that all the waters in the drainage are and have been considered for TMDL purposes since 1994.

Beginning in 2002, the U.S. Environmental Protection Agency combined Section 303(d) and 305(b) reporting requirements into the requirement for an integrated report. The integrated report contains five sections that categorize water quality conditions relative to Sections 303(d) and 305(b) of the Clean Water Act.

Sections 1 and 2 of the integrated report list water bodies that are attaining, or comply with, all (1) or some (2) of Idaho water quality standards. Section 3 lists water bodies with insufficient data and information to determine if any standards are attained. Section 4 identifies water bodies that are impaired or threatened for one or more standards but do not need a TMDL. Section 4 waters either have a TMDL or are impaired by flow or habitat which are considered pollution rather than a pollutant and do not require a TMDL. Section 5 specifies waters that need a TMDL (303(d)).

The boundaries from the 1998 303(d)-listed segments have been transferred to the new AU framework, using an approach quite similar to how DEQ has been writing SBAs and TMDLs. All AUs contained in any listed segment were carried forward to the 2002 303(d) listings in Section 5 of the integrated report (DEQ 2002). AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the 303(d) list. This was necessary to maintain the integrity of the 1998 303(d) list and to maintain continuity with the TMDL program. These new AUs will lead to better assessment of the needs for water quality listing and de-listing.

2.2 Applicable Water Quality Standards

Idaho water quality standards address various beneficial uses designated or presumed for specific water bodies, defining the corresponding numeric and narrative physical and chemical limits or criteria, needed to support the uses. These beneficial uses are identified in the Idaho water quality standards, IDAPA 58.01.02, and include the following:

- Aquatic life support–cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation–primary, secondary
- Water supply–domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

Beneficial Uses

The Clean Water Act defines designated uses as “those uses specified in water quality standards for each water body or segment, whether or not they are being attained.” Idaho designations include aquatic life support, recreation, domestic water supply, and agricultural use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not preclude protection of an existing higher quality use. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho WQS.

The Clean Water Act defines existing uses as “those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards.” Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists.

Designated and existing cold water aquatic life beneficial uses for the Potlatch River include cold water aquatic life and salmonid spawning. Primary contact recreation and domestic water supply beneficial uses are also designated and existing. Water quality must be sufficiently maintained to meet the most sensitive use. The beneficial uses of water bodies addressed by this TMDL are listed in Table 5.

Criteria to Support Beneficial Uses

Beneficial uses are protected by applying narrative criteria for pollutants such as sediment and nutrients and numeric criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250). Table 6 lists applicable numeric criteria for cold water aquatic life and contact recreation.

Numeric water quality standards apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. Optimum flows are defined as >5.0 cubic foot per second (cfs) for recreation and water supply uses and >1.0 cfs for aquatic life uses. An intermittent stream is, "a stream which has a period of zero flow for at least one week during most years." Where flow records are available, a stream with a 7Q2 (7 day, 2 year low flow) hydrologic-based design flow of less than 0.1 (one-tenth) cfs is considered intermittent (IDAPA 58.01.02.070.06). Streams with perennial pools which create significant aquatic life uses are not intermittent (IDAPA 58.01.02.003.56).

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06: "Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses."

Figure 6 outlines the procedure to determine whether a water body fully supports designated and existing beneficial uses in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the Water Body Assessment Guidance, Second Edition (Grafe et al. 2002).

Table 5. Beneficial uses of the Potlatch River watershed.

Stream Name	Listing	Assessment Unit	Designated Beneficial Uses	Existing Beneficial Uses
Potlatch River	Big Bear Cr. to Clearwater R.	ID17060306CL044_06	COLD, SS, PCR, DWS	
Potlatch River	Corral Cr. to Big Bear Cr.	ID17060306CL045_05	COLD, SS, PCR, DWS	
Potlatch River	Moose Cr. to Corral Cr.	ID17060306CL048_04 ID17060306CL048_05	COLD, SS, PCR, DWS	
Potlatch River	Headwaters to Moose Cr.	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	COLD, SS, PCR, DWS,SRW	
Big Bear Creek	WF Big Bear Cr. to Potlatch R.	ID17060306CL056_04 ID17060306CL056_05		COLD, SS, SCR
Boulder Creek	Pig Cr. to Potlatch R.	ID17060306CL047_03		COLD, SS, SCR
Cedar Creek	Leopold Cr. to Potlatch R.	ID17060306CL046_04		COLD, SS, SCR
Corral Creek	Headwaters to Potlatch R.	ID17060306CL054_02 ID17060306CL054_03		COLD, SS, SCR
Moose Creek	Headwaters to Potlatch R.	ID17060306CL053_02 ID17060306CL053_03		COLD, SS, PCR
Pine Creek	Headwaters to Potlatch R.	ID17060306CL055_02 ID17060306CL055_03		COLD, SS, SCR
Ruby Creek	Unnamed trib. 3.4 km upstream to E.F. Potlatch R.	ID17060306CL052_03		COLD, SS, SCR
East Fork Potlatch River	Ruby Cr. to Potlatch R.	ID17060306CL051_04		COLD, SS, SCR
West Fork Little Bear Creek	Headwaters to Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03		COLD, SS, SCR
Middle Potlatch Creek	Headwaters to Potlatch R.	ID17060306CL062_02 ID17060306CL062_03	COLD, SCR	SS

COLD= Cold Water Aquatic Life, SS = Salmonid Spawning, PCR = Primary Contact Recreation, SCR = Secondary Contact Recreation, DWS = Domestic Water Supply

Table 6. Selected numeric criteria for designated beneficial uses in Idaho.

Designated and Existing Beneficial Uses				
Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation)**
Water Quality Standards: IDAPA 58.01.02.250				
Bacteria, pH, and Dissolved Oxygen	Less than 126 *E. coli*/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a one day minimum and exceeds 6.0 mg/L for a seven day average
Temperature[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in September and October
			Seasonal Cold Water: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	

Designated and Existing Beneficial Uses				
Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation)**
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.	
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature				7 day moving average of 10 °C or less maximum daily temperature for June – September

[a] *Escherichia coli* per 100 milliliters
[b] dissolved oxygen
[c] milligrams per liter
[d] Temperature exemption - exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
[e] Nephelometric turbidity units

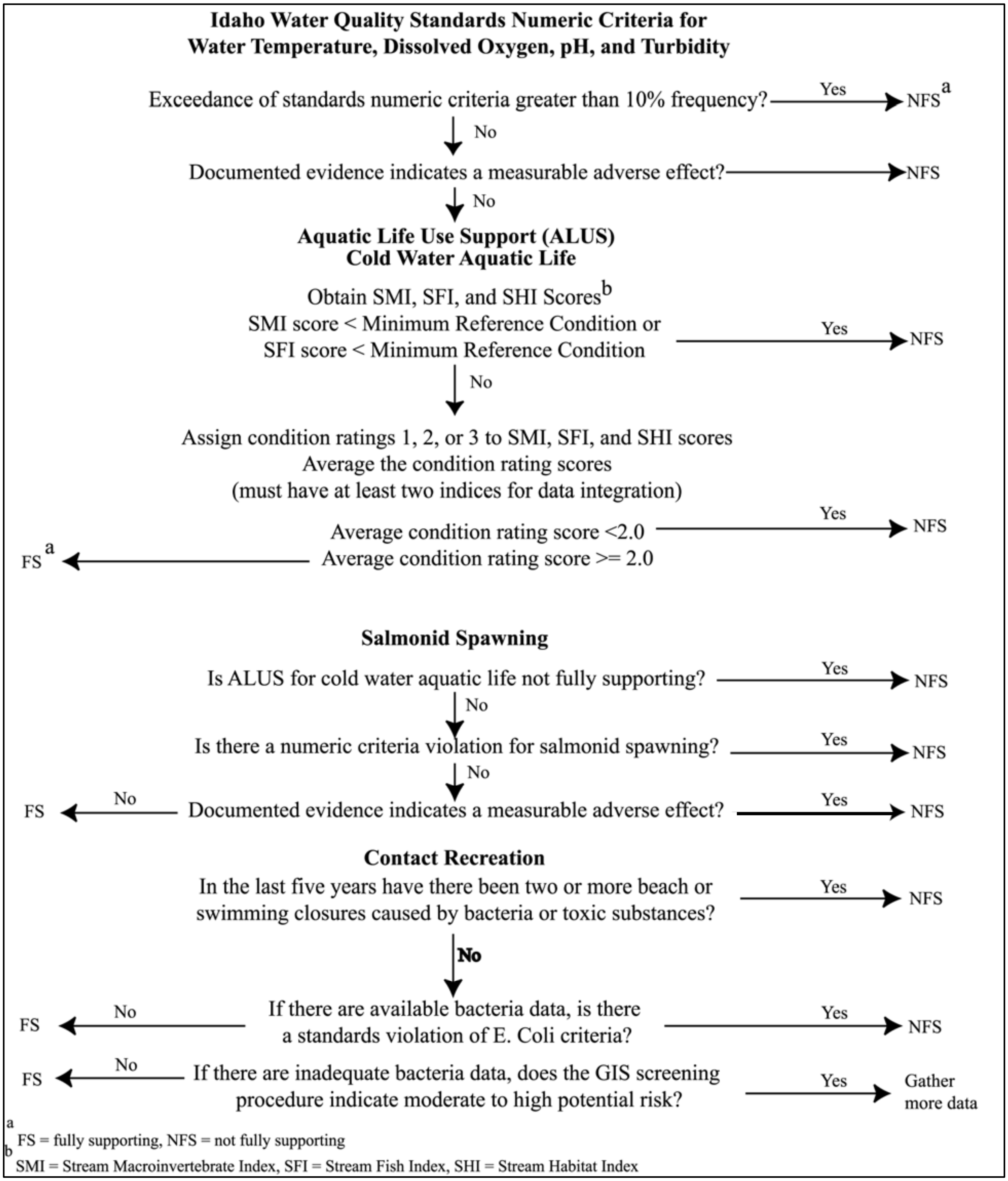

Figure 6. Steps and Criteria for Determining Support Status of Beneficial Uses

Most perennial streams in the watershed without a migration barrier have salmonid spawning as an existing use. In the upper watershed, spawning extends into many intermittent streams. Juvenile salmonids migrate downstream as flows decrease. In the lower portions of the watershed, most of the first order stream flow diminishes early in the season and offers little spawning opportunity. General periods of salmonid spawning and incubation are listed in Table 7 (Brindza, 2004).

Table 7. General spawning and incubation periods.

Estimated Spawning and Incubation Period												
Salmonid Species	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
A-run Steelhead Rainbow		✓	✓	✓	✓							
Westslope Cutthroat				✓	✓	✓						
Bull Trout									✓	✓	✓	✓
Brook Trout									✓	✓	✓	
Spring Chinook Salmon								✓	✓	✓	✓	✓
Fall Chinook Salmon										✓	✓	
Coho Salmon										✓	✓	✓

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in-streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally contain sediment, nutrients, etc., but when anthropogenic (human-made) sources cause these to reach unnatural levels, they are considered "pollutants" and can impair the beneficial uses of a stream.

Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human influenced factors include heated discharges, such as those from point sources: riparian alteration, channel alteration, and flow alteration.

Elevated stream temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower temperature value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of effects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

Dissolved Oxygen

Oxygen is necessary for the survival of most aquatic organisms and essential to stream purification. Dissolved oxygen (DO) is the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter (mg/L), parts per million, or percent of saturation. While air contains approximately 20.9% oxygen gas by volume, the proportion of oxygen dissolved in water is about 35%, because nitrogen (the remainder) is less soluble in water. Oxygen is considered to be moderately soluble in water. A complex set of physical conditions that include atmospheric and hydrostatic pressure, turbulence, temperature, and salinity affect the solubility.

Dissolved oxygen levels of 6 mg/L and above are considered optimal for aquatic life. When DO levels fall below 6 mg/L, organisms are stressed, and if levels fall below 3 mg/L for a prolonged period, these organisms may die; oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills. Dissolved oxygen levels below 1 mg/L are often referred to as hypoxic; anoxic conditions refer to those situations where there is no measurable DO.

Juvenile aquatic organisms are particularly susceptible to the effects of low DO due to their high metabolism and low mobility (they are unable to seek more oxygenated water). In addition, oxygen is necessary to help decompose organic matter in the water and bottom sediments. Dissolved oxygen reflects the health or the balance of the aquatic ecosystem.

Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. Oxygen enters water from photosynthesis and from the atmosphere. Where water is more turbulent (e.g., riffles, cascades), the oxygen exchange is greater due to the greater surface area of water coming into contact with air. The process of oxygen entering the water is called aeration.

Water bodies with significant aquatic plant communities can have significant DO fluctuations throughout the day. An oxygen sag will typically occur once photosynthesis stops at night and respiration/decomposition processes deplete DO concentrations in the water. Oxygen will start to increase again as photosynthesis resumes with the advent of daylight.

Temperature, flow, nutrient loading, and channel alteration all impact the amount of DO in the water. Colder waters hold more DO than warmer waters. As flows decrease, the amount of aeration typically decreases and the in-stream temperature increases, resulting in decreased DO. Channels that have been altered to increase the effectiveness of conveying water often have fewer riffles and less aeration. Thus, these systems may show depressed levels of DO in comparison to levels before the alteration. Nutrient enriched waters have a higher biochemical oxygen demand due to the amount of oxygen required for organic matter decomposition and other chemical reactions. This oxygen demand results in lower in-stream DO levels.

Sediment

Both suspended (floating in the water column) and bedload (moving along the stream bottom) sediment can have negative effects on aquatic life communities. Many fish species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental. Elevated suspended sediment levels can interfere with feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, and in extreme cases eventually lead to death.

Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on streams and estuaries. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at suspended sediment concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days. Similar effects are observed for other species, although the data sets are less reliable. Adverse effects on habitat, especially spawning and rearing habitat presumably from sediment deposition, were noted at similar concentrations of suspended sediment.

Organic suspended materials can also settle to the bottom and, due to their high carbon content, lead to low intergravel DO through decomposition.

In addition to these direct effects on the habitat and spawning success of fish, detrimental changes to food sources may also occur. Aquatic insects, which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is adapted to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community is diminished due to the reduction of coarse substrate habitat.

Settleable solids are defined as the volume (milliliters [ml]) or weight (mg) of material that settles out of a liter of water in one hour (Franson et al. 1998). Settleable solids may consist of large silt, sand, and organic matter. Total suspended solids (TSS) are defined as the material collected by filtration through a 0.45-µm (micrometer) filter (Standard Methods 1975, 1995). Settleable solids and TSS both contain nutrients that are essential for aquatic plant growth. Settleable solids are not as nutrient rich as the smaller TSS, but they do affect river depth and substrate nutrient availability for macrophytes. In low flow situations, settleable solids can accumulate on a stream bottom, thus decreasing water depth. This increases the area of substrate that is exposed to light, facilitating additional macrophyte growth.

Bacteria

Escherichia coli or E. coli, a species of fecal coliform bacteria, is used by the state of Idaho as the indicator for the presence of pathogenic microorganisms. Pathogens are a small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa), which, if taken into the body through contaminated water or food, can cause sickness or even death. Some pathogens are also able to cause illness by entering the body through the skin or mucous membranes. E. coli is often measured in colony forming units (cfu) per 100 ml.

Direct measurement of pathogen levels in surface water is difficult because pathogens usually occur in very low numbers and analysis methods are unreliable and expensive. Consequently, indicator bacteria which are often associated with pathogens, but which generally occur in higher concentrations and are thus more easily measured, are assessed.

Coliform bacteria are unicellular organisms found in feces of warm-blooded animals such as humans, domestic pets, livestock, and wildlife. Coliform bacteria are commonly monitored as part of point source discharge permits (National Pollution Discharge Elimination System [NPDES] permits), but may also be monitored in nonpoint source arenas. The human health effects from pathogenic coliform bacteria range from nausea, vomiting, and diarrhea to acute respiratory illness, meningitis, ulceration of the intestines, and even death. Coliform bacteria do not have a known effect on aquatic life.

Coliform bacteria from both point and nonpoint sources impact water bodies, although point sources are typically permitted and offer some level of bacteria-reducing treatment prior to discharge. Nonpoint sources of bacteria are diffuse and difficult to characterize. Unfortunately, nonpoint sources often have the greatest impact on bacteria concentrations in water bodies. This is particularly the case in urban storm water and agricultural areas.

Nutrients

While nutrients are a natural component of the aquatic ecosystem, natural cycles can be disrupted by increased nutrient inputs from anthropogenic activities. The excess nutrients result in accelerated plant growth and can result in a eutrophic or enriched system.

The first step in identifying a water body's response to nutrient flux is to define which of the critical nutrients is limiting. A limiting nutrient is one that normally is in short supply relative to biological needs. The relative quantity affects the rate of production of aquatic biomass. Either phosphorus or nitrogen may be the limiting factor for algal growth, although phosphorus is most commonly the limiting nutrient in Idaho waters. Ecologically speaking, a resource is considered limiting if the addition of that resource increases growth.

Total phosphorus (TP) is the measurement of all forms of phosphorus in a water sample, including all inorganic and organic particulate and soluble forms. In freshwater systems, typically more than 90% of the TP present occurs in organic forms as cellular constituents in the biota or adsorbed to particulate materials (Wetzel 1983). The remainder (10% or less of the total phosphorus) is mainly soluble orthophosphate, a more biologically available form of phosphorus than TP, which consequently leads to a more rapid growth of algae. In impaired systems, a larger percentage of the TP fraction is composed of orthophosphate. The relative amount of each form measured can provide information on the potential for algal growth within the system.

Nitrogen may be a limiting factor at certain times if there is substantial depletion of nitrogen in sediments due to uptake by rooted macrophyte beds. In systems dominated by blue-green algae, nitrogen is not a limiting nutrient due to the algal ability to fix nitrogen at the water/air interface.

Total nitrogen to TP ratios greater than 7.0 are indicative of a phosphorus-limited system while those ratios, when less than 7.0, are indicative of a nitrogen-limited system. Only biologically available forms of the nutrients are used in the ratios because these are the forms that are used by the immediate aquatic community (EPA 2000).

Nutrients primarily cycle between the water column and sediment through nutrient spiraling. Aquatic plants rapidly assimilate dissolved nutrients, particularly orthophosphate. If sufficient nutrients are available in either sediment or the water column, aquatic plants will store an abundance of such nutrients in excess of the plants' actual needs, a chemical phenomenon known as luxury consumption. When a plant dies, the tissue decays in the water column and the nutrients stored within the plant biomass are either restored to the water column or the detritus becomes incorporated into the river sediment. As a result of this process, nutrients (including orthophosphate) that are initially released into the water column in a dissolved form will eventually become incorporated into the river bottom sediment. Once these nutrients are incorporated into the river sediment, they are available once again for uptake by yet another life cycle of rooted aquatic macrophytes and other aquatic plants. This cycle is known as nutrient spiraling. Nutrient spiraling results in the availability of nutrients for later plant growth in higher concentrations downstream.

Sediment to Nutrient Relationship

The linkage between sediment and sediment-bound nutrients is important when dealing with nutrient enrichment problems in aquatic systems. Phosphorus is typically bound to particulate matter in aquatic systems and, thus, sediment can be a major source of phosphorus to rooted macrophytes and the water column. While most aquatic plants are able to absorb nutrients over the entire plant surface due to a thin cuticle (Denny 1980), bottom sediments serve as the primary nutrient source for most sub-stratum attached macrophytes. The USDA (1999) determined that other than harvesting and chemical treatment, the best and most efficient method of controlling growth is by reducing surface erosion and sedimentation.

Sediment acts as a nutrient sink under aerobic conditions. However, when conditions become anoxic sediments release phosphorus into the water column. Nitrogen can also be released, but the mechanism by which it happens is different. The exchange of nitrogen between sediment and the water column is for the most part a microbial process controlled by the amount of oxygen in the sediment. When conditions become anaerobic, the oxygenation of ammonia (nitrification) ceases and an abundance of ammonia is produced. This results in a reduction of nitrogen oxides (NO_x) being lost to the atmosphere.

Sediments can play an integral role in reducing the frequency and duration of phytoplankton blooms in standing waters and large rivers. In many cases there is an immediate response in phytoplankton biomass when external sources are reduced. In other cases, the response time is slower, often taking years. Nonetheless, the relationship is important and must be addressed in waters where phytoplankton is in excess.

Floating, Suspended, or Submerged Matter (Nuisance Algae)

Algae are an important part of the aquatic food chain. However, when elevated levels of algae have a negative impact on beneficial uses, the algae are considered a nuisance aquatic growth. The excess growth of phytoplankton, periphyton, and/or macrophytes can adversely affect both aquatic life and recreational water uses. Algal blooms occur where adequate nutrients (nitrogen and/or phosphorus) are available to support growth. In addition to nutrient availability, algae (and macrophyte) growth are affected by flow rates, velocities, water temperatures, and penetration of sunlight in the water column. Low velocity conditions allow algal concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algal growth. When the aforementioned conditions are appropriate and nutrient concentrations exceed the quantities needed to support normal algal growth, excessive blooms may develop.

Commonly, algae blooms appear as extensive layers or algal mats on the surface of the water. When present at excessive concentrations in the water column, blue-green algae often produce toxins that can result in skin irritation to swimmers and illness or even death in organisms ingesting the water. The toxic effect of blue-green algae is worse when an abundance of organisms die and accumulate in a central area.

Algal blooms also often create objectionable odors and coloration in water used for domestic drinking water and can produce intense coloration of both the water and shorelines as cells accumulate along the banks. In extreme cases, algal blooms can also result in impairment of agricultural water supplies due to toxicity. Water bodies with high nutrient concentrations that could potentially lead to a high level of algal growth are said to be eutrophic. The extent of the effect is dependent on both the type(s) of algae present and the size, extent, and timing of the bloom.

When algae die in low flow velocity areas, they sink slowly through the water column, eventually collecting on the bottom sediments. The biochemical processes that occur as the algae decompose remove oxygen from the surrounding water. Because most of the decomposition occurs within the lower levels of the water column, a large algal bloom can substantially deplete DO concentrations near the bottom. Low DO in these areas can lead to decreased fish habitat as fish will not frequent areas with low DO. Both living and dead (decomposing) algae can also affect the pH of the water due to the release of various acid and base compounds during respiration and photosynthesis. Additionally, low DO levels caused by decomposing organic matter can lead to changes in water chemistry and a release of sorbed phosphorus to the water column at the water/sediment interface.

Excess nutrient loading can be a water quality problem due to the direct relationship of high TP concentrations with excess algal growth within the water column, combined with the direct effect of the algal life cycle on DO and pH within aquatic systems. Therefore, the reduction of TP inputs to the system can act as a mechanism for water quality improvements, particularly in surface-water systems dominated by blue-green algae, which can acquire nitrogen directly from the atmosphere and the water column. Phosphorus management within these systems can potentially result in improvement in nutrients (phosphorus), nuisance algae, DO, and pH.

2.4 Summary and Analysis of Existing Water Quality Data

Table 8 displays the types and sources of available flow, biological, and water quality data. Available data sources include: Idaho Fish and Game Department, for fish distribution and spawning period data; DEQ and Nez Perce Tribe, for monitoring data; Clearwater National Forest, for flow and monitoring data; and US Geologic Survey and Soil Conservation Commission, for flow data.

Flow Characteristics

Stream and river flows reflect the weather pattern. Most precipitation occurs during winter and early spring with little occurring in the summer. The pattern tends to cause high peak flows in early spring and very low flows in late summer.

DEQ and the Nez Perce Tribe monitored flows at control points on the mainstem Potlatch River and its tributaries in 2001 and 2002 (Table 9). Over this monitoring period, middle and lower stream reaches experienced rising flows earlier in the year, beginning in January, while the upper reaches began rising in March and April. By July and August of 2002, monitored flows had diminished to less than 1 cfs on most of the tributaries, with Corral Creek going completely dry. Table 10 lists mean annual flows recorded at gage stations in or near the watershed. Figure 7 illustrates mean monthly flows recorded at these same stations.

Table 8. Sources of water quality data.

Description of Data	Source[a]
Salmonid Distribution	IDFG, DEQ, CNF,NPT
Salmonid Spawning Periods	IDFG, NPT
Stream Macroinvertebrates	DEQ
Stream Habitat	DEQ, CNF, NPT
Stream Chemical Data	DEQ, NPT
Stream Temperature Data	CNF, DEQ, NPT
Stream Sediment Data	CNF, DEQ, NPT
Stream Flow	USGS, CNF, SCC, DEQ, NPT

[a]CNF = Clearwater National Forest, DEQ = Department of Environmental Quality, USGS = U.S. Geological Survey, SCC = Soil Conservation Commission, NPT = Nez Perce Tribe, IDFG = Idaho Department of Fish and Game

Table 9. Monitored flows at control points.

Stream Segment	Monitoring Station	Max Flow (cfs)	Date Measured	Low Flow (cfs)	Date Measured
Potlatch R.	PTR-1	>549	5-14-02	8	7-29-02
Middle Potlatch Cr.	PTR-4	190	4-14-02	<1	7-23-02
Big Bear Cr.	PTR-8	148	3-18-02	<1	8-5-02
Pine Cr.	PTR-10	148	3-18-02	<1	7-23-02
Cedar Cr.	PTR-11	245	1-7-02	<1	7-23-02
Corral Cr.	PTR-13	174	4-16-02	DRY	7-23-02
Ruby Cr.	PTR-14	11	4-30-02	<1	7-24-02
EF Potlatch R.	PTR-15	270	1-8-02	5	12-27-01
Moose Cr.	PTR-17	>57	4-19-02	<1	7-24-02
West Fork Little Bear Cr.	PTR-6	>73	4-17-02	<1	summer
Boulder Cr.	PTR-20	15	4-29-02	<1	7-9-02

Table 10. Gage station flows.

Gaging Station	Manager	Years of Record	Elevation (feet)	Drainage Area (mi^2)	Mean Annual Flow (cfs)
Potlatch River at Kendrick	USGS	10/45-9/60	1,198	425	427
East Fork Potlatch River	USGS	9/59-10/71	2,800	42	62
Potlatch River at Little Boulder Creek	CNF	10/94-09/05	2,610	126	184
Lapwai Creek	USGS	10/74-present	865	235	81
Palouse River	USGS	10/14-9/19 12/66-present	2,455	317	267

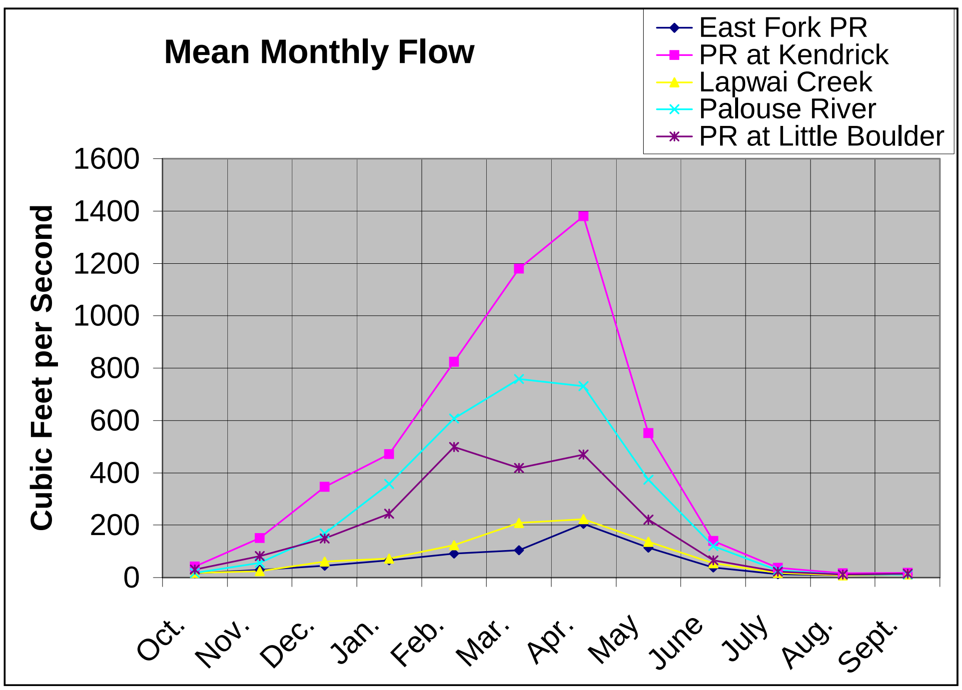

Figure 7. Mean Monthly Flow of Several Gaging Stations in and around the Potlatch River Watershed

The watershed lies in a transition zone for winter temperatures where winter precipitation may occur as either rain or snow. Extreme flows can occur when rain falls on an existing snow pack causing snowmelt and runoff of large amounts of water. These high runoff events have a return period of approximately 15 years with previous large events recorded in 1974, 1964, 1948, 1933, and 1919 (McClelland et al. 1997). For the period of record of the

Potlatch River near Kendrick, Figure 8 shows a USGS plot of daily flow and Figure 9 shows the annual high flows.

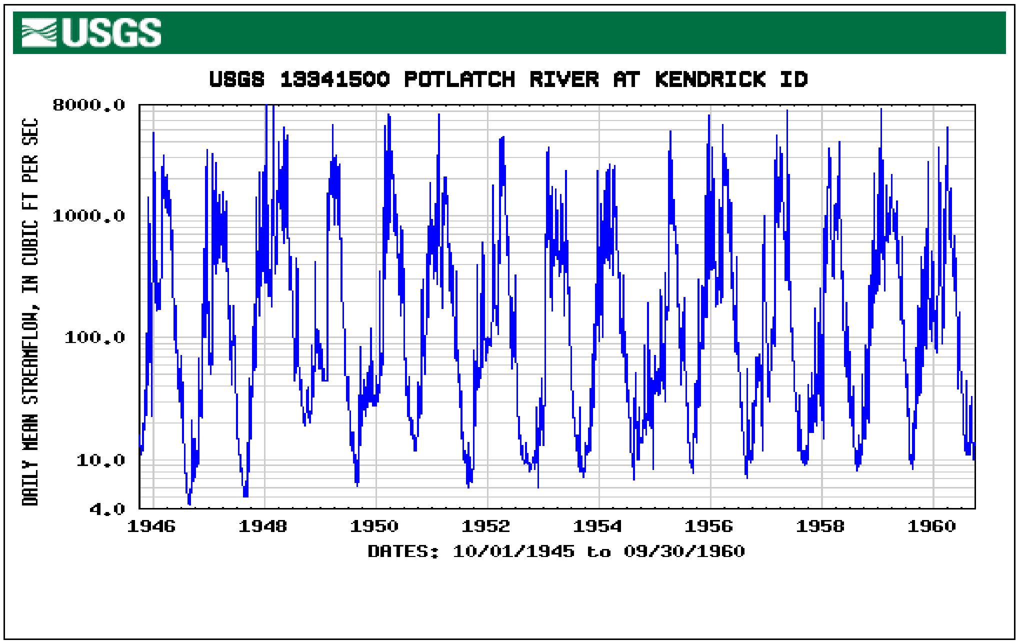

Figure 8. Average Daily Flow for the Potlatch River at Kendrick

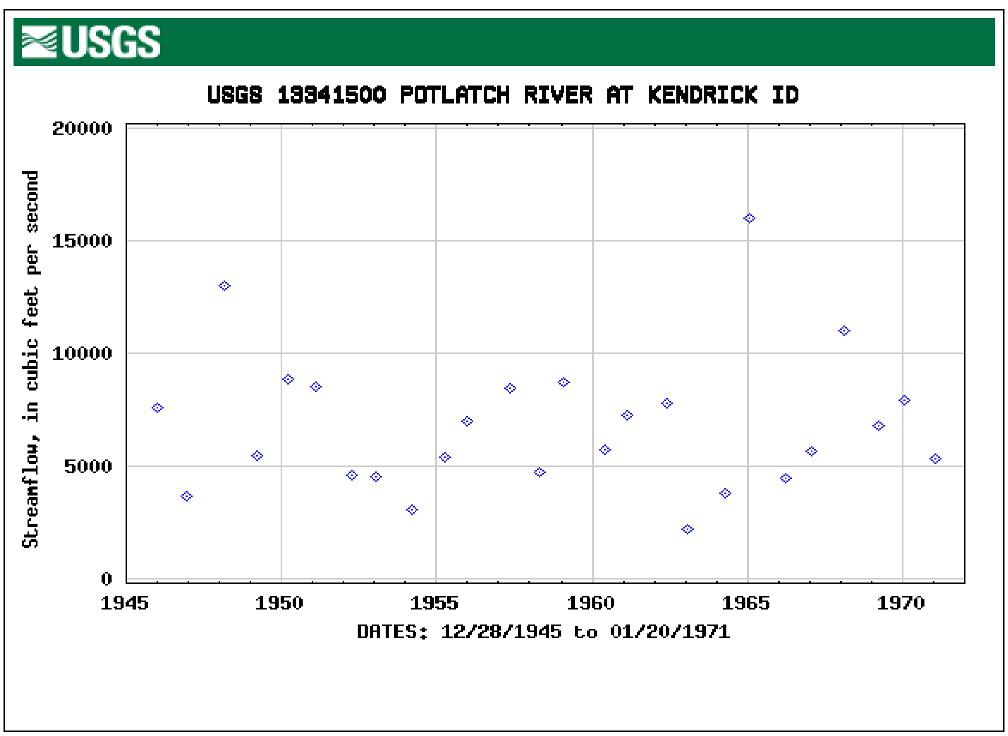

Figure 9. Annual High Flows for the Potlatch River at Kendrick

Water Column Data – Chemical, Physical and Bacteriological Monitoring Data

In 2002-2004, DEQ collected water quality data for the streams addressed in this TMDL. Water body monitoring locations are listed in Table 11 and their locations are illustrated in Figure 10. Sites located close to the mouths of the water bodies were used as established control points, or sites where monitoring efforts can be duplicated and WQS applied. An initial set of data was collected in 2002, with additional data collected in 2003 and 2004.

Established control points were monitored routinely every two weeks. Water quality parameters and pollutant concentrations measured during the 2002 season included instantaneous stream temperature and continuous stream temperature; *E. coli* bacteria; dissolved oxygen, ammonia, nitrite+nitrate as nitrogen (NO_2+NO_3-N), and total phosphorus; turbidity and total suspended solids; pH; instantaneous stream flow; oil, grease and pesticides; and specific conductance.

Table 11. Monitoring station locations.

Monitoring Station*	Stream Name	Location
PTR 1	Potlatch River	At the Mouth of the Potlatch River
PTR 3	Potlatch River	At the Kendrick Bridge
PTR 4	Middle Potlatch Creek	Highway Bridge at the Mouth of Middle Potlatch Creek
PTR 5	Middle Potlatch Creek	At the Spence Road Bridge
PTR 6	West Fork of Little Bear Creek	Down Stream of the City of Troy Discharge; 2006/2007 site downstream 200 yards
PTR 7	West Fork of Little Bear Creek	Up Stream of the City of Troy Discharge
PTR 8	Big Bear Creek	Bridge at the Mouth of Big Bear Creek
PTR 9	Big Bear Creek	Near Highway 8 down stream of Mount Deary Creek
PTR 9a	Big Bear Creek	Near Highway 8 up stream of Mount Deary Creek
PTR 10	Pine Creek	At the Bridge at the Mouth of Pine Creek
PTR 11	Cedar Creek	At the Mouth of Cedar Creek
PTR 12	Potlatch River	Near the Little Boulder Creek Campground
PTR 13	Corral Creek	Down Stream of the City of Helmer Discharge
PTR 14	Ruby Creek	Just above the Mouth of Ruby Creek
PTR 15	East Fork Potlatch River	At the Mouth of the East Fork Potlatch River
PTR 16	Potlatch River	Down Stream of the City of Bovill Discharge
PTR 17	Moose Creek	At the Mouth of Moose Creek
PTR 18	Moose Creek	Up Stream of Moose Creek Reservoir
PTR 19	Potlatch River	Highway Bridge Up Stream of the City of Bovill Discharge
PTR 20	Boulder Creek	At the Linden Road Crossing
PTR 21	West Fork Potlatch River	At the Mouth of the West Fork Potlatch River
PTR 22	Porcupine Creek	At the Mouth of Porcupine Creek
PTR 23	Sheep Creek	At the Mouth of Sheep Creek

*Shaded monitoring stations are established control points

Figure 10. Monitoring Locations

Temperature

Water temperature data collected using digital recording devices exists for numerous streams in the Potlatch River watershed. The Clearwater National Forest obtained continuous temperature data gathered from digital recording devices for the headwater streams that originate and flow through lands managed by the Clearwater National Forest. The Nez Perce Tribe obtained both instantaneous and continuous temperature data from their monitoring site at the mouth of the Potlatch River (PTR-1). Both data sets show temperature measurements comparable to those found in DEQ data sets. Assessments of temperature concerns and numeric criteria exceedances during critical time periods for salmonid spawning and cold water aquatic life are based on DEQ data gathered from continuous digital recording devices placed near the mouths of all streams listed for temperature within the watershed.

Table 12 lists water bodies where data shows numeric temperature criteria exceedances during the 2001-2002 monitoring season. These are the streams for which temperature TMDLs are needed. Data for these water bodies have been assessed using fish species distribution data from IDFG, presented in Table 7.

Table 12 outlines three beneficial use categories for temperature criteria in the Potlatch River watershed: salmonid spawning and incubation in the spring, salmonid spawning and incubation in the fall, and cold water aquatic life in the summer. Streams supporting spawning populations of steelhead, rainbow and/or cutthroat trout are protected during the spawning and incubation periods shown in Table 7. Streams supporting fall spawning salmonids, including spring chinook, fall chinook, coho, brook trout, and bull trout are protected during the spawning and incubation periods shown in Table 7. All streams are protected for cold water aquatic life temperature criteria during the critical time period from June 22 through September 21.

Table 12. Water body temperature data assessment summary.

Water Body Name/ID	AU No.	Temp Logger Location	Monitoring Station Represented	Dates Monitored	Salmonid Spawning Period	Spring SS[a] daily ave.	Fall SS daily ave.	CWAL[b] daily max.	CWAL daily ave.
						Criteria Exceeded			
Big Bear Cr. ID17060306CL056	05	Near mouth	PTR 8	5/14/02-11/12/02	Feb.-May	Y	N	Y	Y
	04	Below Hwy 9		5/17/02-11/13/02	Feb.-May	Y	N	Y	Y
Boulder Cr. ID17060306CL047	03	Linden Rd. crossing	PTR 20	5/14/02-11/11/02	Sept.-Nov.	N	Y	N	N
Cedar Cr. ID17060306CL046	04	At mouth	PTR 11	5/14/02-11/12/02	Feb.-May	Y	N	Y	Y
Corral Cr. ID17060306CL054	02	Below WWTP[c]	PTR 13	5/14/02-7/23/02	Feb.-May	Y	N	Y	Y
	03	CNF[d], near mouth		5/03/03-10/19/03	Feb.-May	Y	N	Y	N
E.F. Potlatch R. ID17060306CL051	04	At mouth	PTR 15	5/21/02-10/07-02	Feb.-May Aug.-Dec.	Y	Y	Y	Y
Mid. Potlatch Cr. ID17060306CL062	03	Near mouth	PTR 4	5/14/02-11/12/02	Feb.-May	Y	N	Y	Y
	02	At Spence Rd. crossing		5/17/02-7/29/02	Feb.-May	Y	N	N	N
Moose Cr. ID17060306CL053	02	Above reservoir	PTR 17	5/18/01-10/9/01	Feb.-May Sept.-Nov.	Y	Y	N	N
	02	Above reservoir		5/24/02-10/2/02	Feb.-May Sept.-Nov.	Y	Y	N	N
	02	Above reservoir		5/8/03-10/19/03	Feb.-May Sept.-Nov.	Y	Y	N	N

Water Body Name/ID	AU No.	Temp Logger Location	Monitoring Station Represented	Dates Monitored	Salmonid Spawning Period	Spring SS[a] daily ave.	Fall SS daily ave.	CWAL[b] daily max.	CWAL daily ave.
						Criteria Exceeded			
	03	Near mouth		5/8/03-10/19/03	Feb.-May Sept.-Nov.	Y	Y	Y	Y
	03	Near mouth	PTR 17	5/15/02-11/13/02	Feb.-May Sept.-Nov.	Y	Y	Y	Y
Pine Cr. ID17060306CL055	03	Near mouth	PTR 10	5/14/02-11/12/02	Feb.-May	Y	N	N	N
Potlatch River Headwaters ID17060306CL049	03	Near mouth West Fork Potlatch R.	PTR 19	5/11/01-10/9/01	Feb.-May Sept.-Dec.	Y	Y	N	Y
	03	Near mouth West Fork Potlatch R.		5/17/02-9/19/02	Feb.-May Sept.-Dec.	Y	Y	N	Y
	03	Near mouth West Fork Potlatch R.		5/1/03-10/19/03	Feb.-May Sept.-Dec.	Y	Y	N	N
	02	Lower Nat Brown Cr.		6/21/99-11/1/99	Feb.-May Sept.-Nov.	N	Y	N	N
	02	Lower Nat Brown Cr.		6/24/98-9/14/98	Feb.-May Sept.-Nov.	N	Y	Y	N
	02	Upper Nat Brown Cr.		6/21/99-11/1/99	Feb.-May Sept.-Nov.	N	Y	N	N
Potlatch R. Moose Cr. to Corral Cr. ID17060306CL048	04	Below Bovill WWTP	PTR 12	5/15/02-11/13/02	Feb.-Jun. Oct.-Dec.	Y	Y	Y	Y
	05	CNF gaging station		3/10/03-10/29/03	Feb.-Jun. Oct.-Dec.	Y	Y	Y	Y
	05	CNF gaging station		5/14/02-12/11/02	Feb.-Jun. Oct.-Dec.	Y	Y	Y	Y
	05	CNF gaging station		3/24/01-10/30/01	Feb.-Jun. Oct.-Dec.	Y	Y	Y	Y

Water Body Name/ID	AU No.	Temp Logger Location	Monitoring Station Represented	Dates Monitored	Salmonid Spawning Period	Spring SS[a] daily ave.	Fall SS daily ave.	CWAL[b] daily max.	CWAL daily ave.
						Criteria Exceeded			
Potlatch R. Corral Cr. to Big Bear Cr. ID17060306CL045	05	P1 Road bridge	PTR 3	7/8/00-10/4/00	Oct.-Nov.	N	N	Y	Y
	05	Above Cedar Cr.		7/12/00-10/4/00	Oct.-Nov.	N	N	Y	Y
Potlatch River Big Bear Cr. to Clearwater R. ID17060306CL044	06	Bridge at mouth	PTR 1	5/31/03-10/29/03	Oct.-Nov.	N	Y	Y	Y
	06	Bridge at Kendrick		3/14/02-11/11/02	Oct.-Nov.	N	Y	Y	Y
	06	Bridge at Kendrick		3/25/04-7/09/04	Oct.-Nov.	N	N	Y	Y
	06	Below Kendrick WWTP		3/25/04-7/09/04	Oct.-Nov.	N	N	Y	Y
	06	Below Kendrick WWTP		3/25/04-7/09/04	Oct.-Nov.	N	N	Y	Y
	06	Above Juliaetta WWTP		3/25/04-7/09/04	Oct.-Nov.	N	N	Y	Y
	06	Below Juliaetta WWTP		3/25/04-7/09/04	Oct.-Nov.	N	N	Y	Y
Ruby Cr. ID17060306CL052	03	Near mouth	PTR 14	5/15/02-11/13/02	Feb.-May Sept.-Nov.	Y	Y	N	N
	03	Headwaters, Hwy 8		7/8/00-10/4/00	Feb.-May Sept.-Nov.	N	Y	N	N

a. SS – salmonid spawning
b. CWAL – cold water aquatic life
c. WTP – wastewater treatment plant
d. CNF – Clearwater National Forest

E. coli Bacteria

The state of Idaho criteria for *E. coli* is that bacteria are not to exceed 126 colony forming units per 100 milliliters of solution (cfu/100 ml) as a 30-day geometric mean. Also, there are instantaneous limits of 406 cfu/100 ml for primary contact recreation uses and 576 cfu/100 ml for secondary contact uses. (IDAPA 58.01.02.251.01 & 02).

Primary contact use applies when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, swimming, water skiing, or skin diving. Secondary contact use applies for uses not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.

The 30-day geometric mean using 5 evenly spaced *E. coli* bacteria samples was conducted at selected sites in 2003 throughout the Potlatch River watershed (Appendix D). In 2004, streams thought to have potential for exceeding the *E. coli* bacteria standard were sampled every two weeks. If an instantaneous exceedance occurred, additional monitoring was conducted to assess compliance with the geometric mean criterion. Table 13 displays the water bodies with levels that exceeded the geometric mean criterion of 126 cfu/100 ml.

Table 13. Measured in-stream *E. coli* bacteria geometric mean concentrations.

WBID & AU #	Water Body Name	*E. coli* Concentration (cfu/100 ml)
ID17060306CL062_02 ID17060306CL062_03	Middle Potlatch Creek	798
ID17060306CL052_03	Ruby Creek	212
ID17060306CL053_02 ID17060306CL053_03	Moose Creek	554
ID17060306CL047_03	Boulder Creek	544
ID17060306CL056_04	Big Bear Creek	712
ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Potlatch River	289

As shown, six water bodies had *E. coli* that exceeded Idaho's water quality standard (geometric mean criterion). Based on these measured samples, a reduction in *E. coli* bacteria concentrations is needed throughout these water bodies to comply with Idaho's geometric mean criterion.

Dissolved Oxygen

Waters designated for cold water aquatic life must sustain dissolved oxygen concentrations of 6.0 milligrams per liter (mg/l) or greater at all times (IDAPA 58.01.02.250.02.a). The

Idaho state criterion for dissolved oxygen in the water column for the salmonid spawning beneficial use is a one-day minimum of not less than 6.0 mg/L or 90% (ninety percent) of saturation, whichever is greater (IDAPA 58.01.02.250.02.f.2.a). Low dissolved oxygen concentrations were measured in Pine Creek, West Fork Little Bear Creek, and Middle Potlatch Creek.

An instantaneous dissolved oxygen value of 5.5 mg/L was observed in Pine Creek during a sampling event on August 6, 2002 (Figure11). The magnitude of diurnal fluctuation in dissolved oxygen concentrations for Pine Creek is unknown. It is assumed that diurnal fluctuations including levels below the criterion are likely during the low summer flow period based on the instantaneous exceedance. The low dissolved oxygen measurement observed is most likely due to the effects of critical low flows, increased stream temperatures, and aquatic vegetation growth cycles.

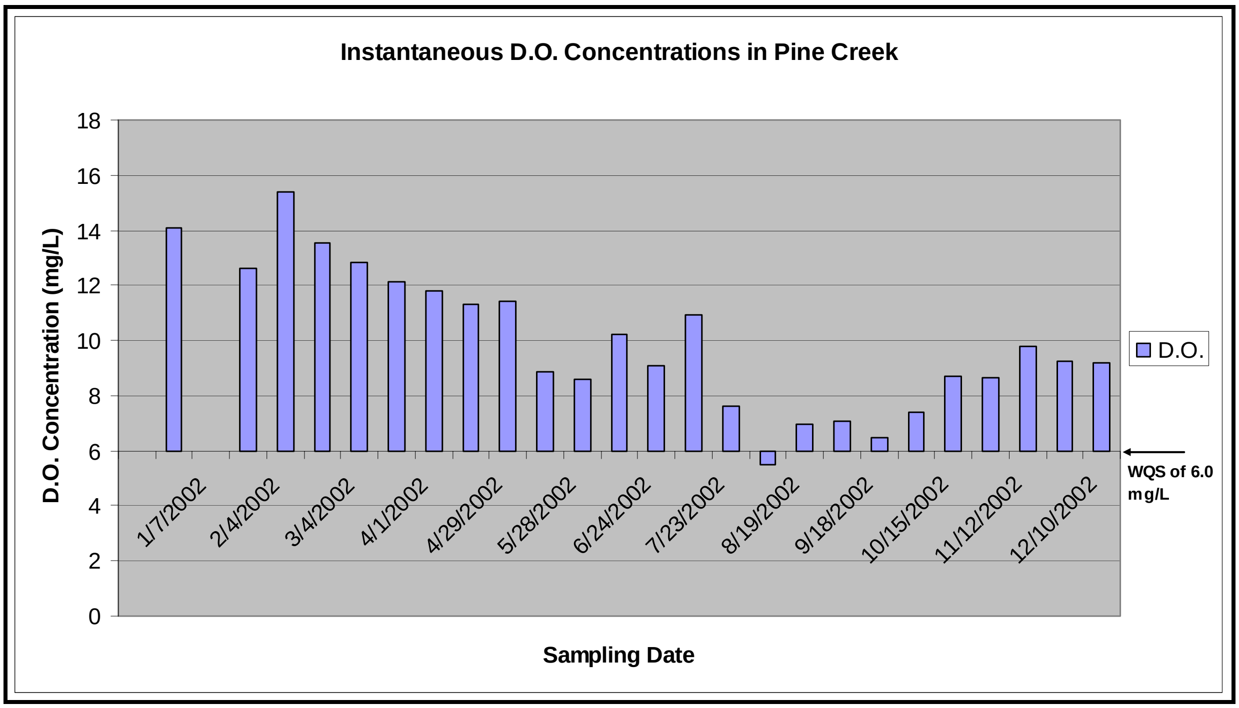

Figure 11. Pine Creek Dissolved Oxygen Concentrations

Instantaneous violations of the dissolved oxygen criterion were observed in the West Fork Little Bear Creek in 2002 at PTR-6 and two hundred yards downstream of PTR-6 in 2006 and 2007. The average instantaneous dissolved oxygen concentration from May through October 2006 and 2007 was 5.3 mg/L, while the percent saturation of dissolved oxygen in the water column was 55% (Table 14), (Figures 12-14).

Table 14. Dissolved oxygen and percent saturation values recorded in West Fork Little Bear Creek (2006-2007).

Date	Dissolved Oxygen (mg/L)	% Saturation
5/10/2006	9.32	89.5%
5/23/2006	8.13	86.3%
6/28/2006	5.69	65.8%
7/12/2006	4.48	48.8%
7/25/2006	3.64	41.4%
8/9/2006	3.62	39.3%
8/24/2006	3.37	35.2%
9/7/2006	2.72	28.1%
9/20/2006	3.9	36.7%
10/6/2006	3.84	34.3%
10/20/2006	4.9	42.6%
5/9/2007	7.98	84.9%
5/24/2007	8.82	88.7%
6/13/2007	7.37	72.2%
7/11/2007	3.11	36.4%
7/25/2007	2.32	26.0%
8/6/2007	5	54.5%
8/23/2007	6.46	68.4%
9/13/2007	6.98	70.1%
10/11/2007	4.71	42.7%
Average	**5.32**	**55%**

In-stream dissolved oxygen concentrations are significantly dependent on the volume and velocity of water in a stream during the summer months as the ability to assimilate pollutants decreases. Figure 15 shows that when West Fork Little Bear Creek stream flows are less than approximately 1.5 cfs, dissolved oxygen measurements were recorded below 6.0 mg/L. This relationship is used to identify the critical low flow period, (below approximately 1.5 cfs), occurring June through October in 2006 and 2007. This is the period when it is critical to reduce excessive total inorganic nitrogen loading identified from monitoring in order to maintain dissolved oxygen concentrations at desired levels.

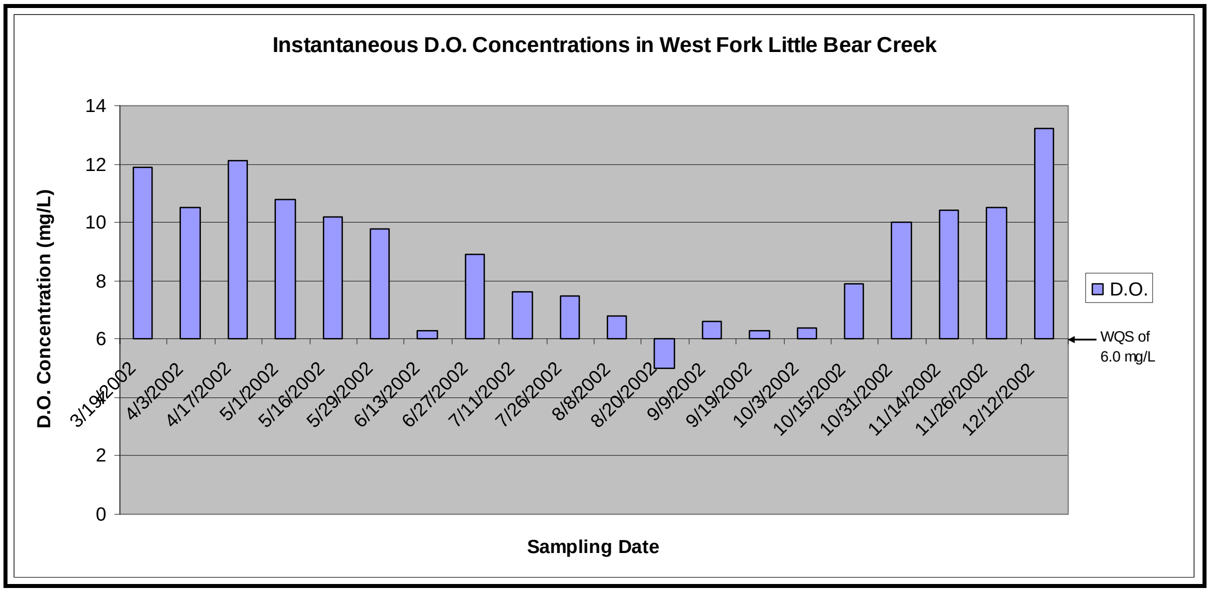

Figure 12. West Fork Little Bear Creek Dissolved Oxygen Concentrations at PTR-6 (2002)

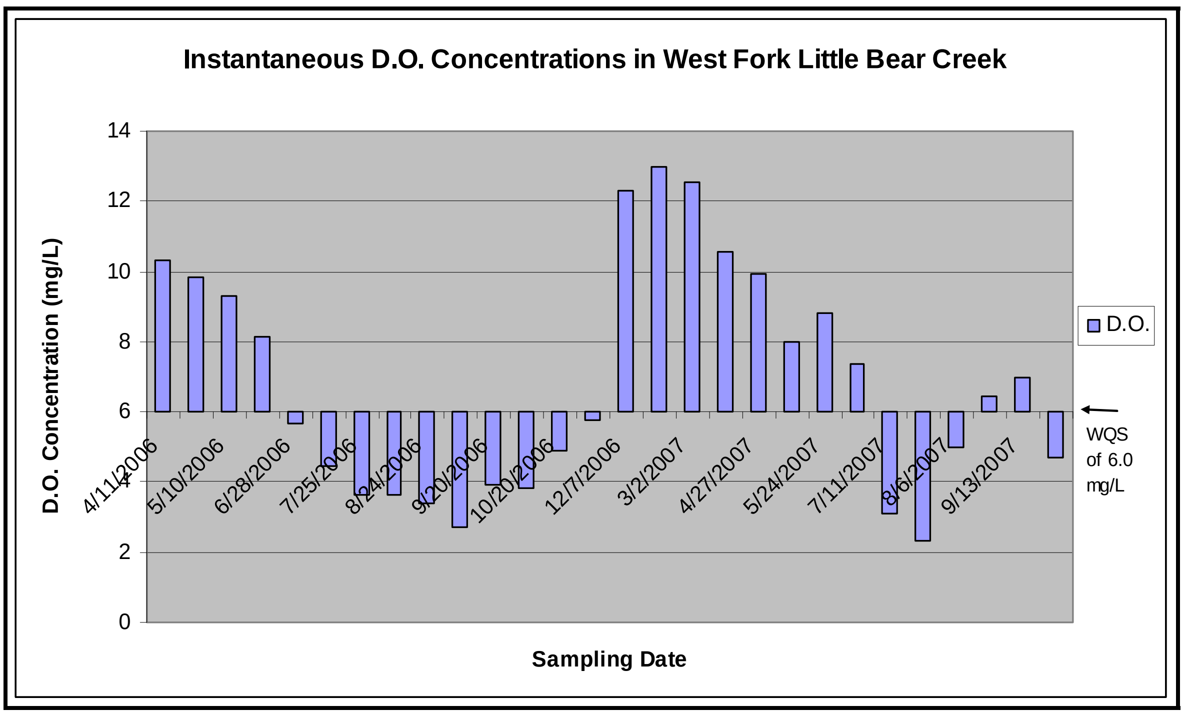

Figure 13. West Fork Little Bear Creek Dissolved Oxygen Concentrations Near PTR-6 (2006-2007)

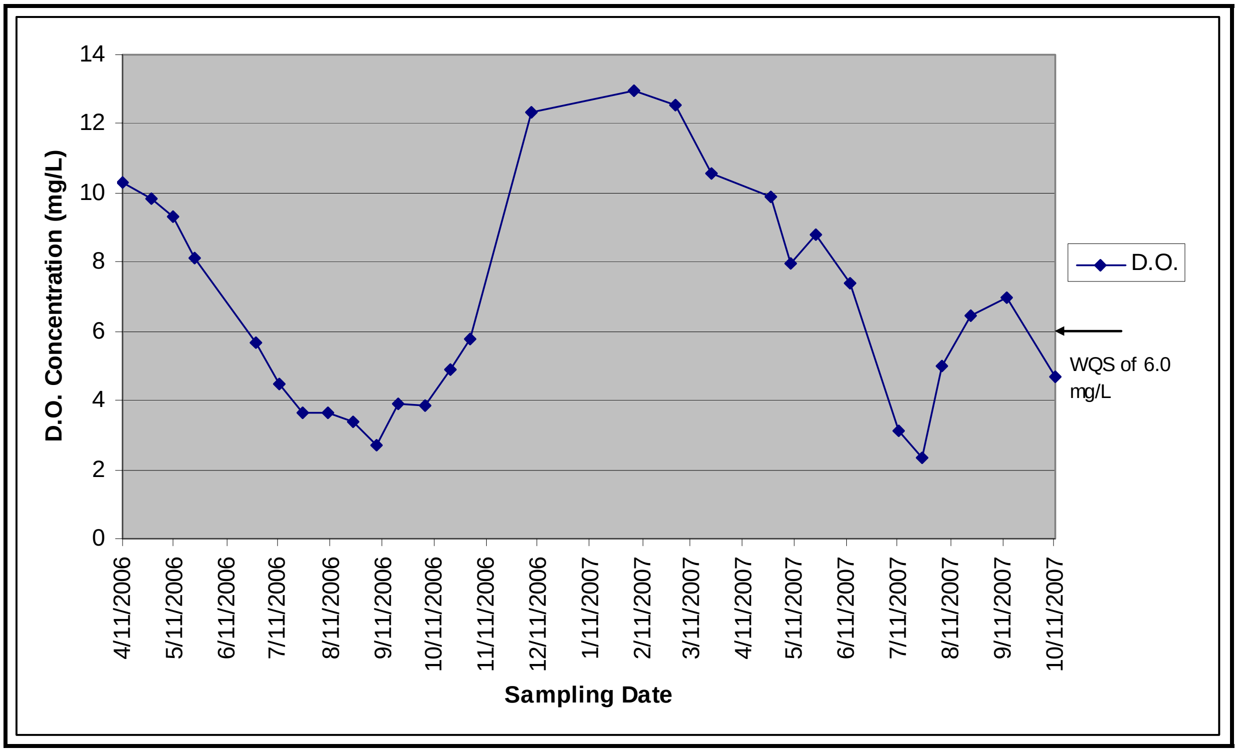

Figure 14. West Fork Little Bear Creek Dissolved Oxygen Concentrations near PTR-6 (2006-2007)

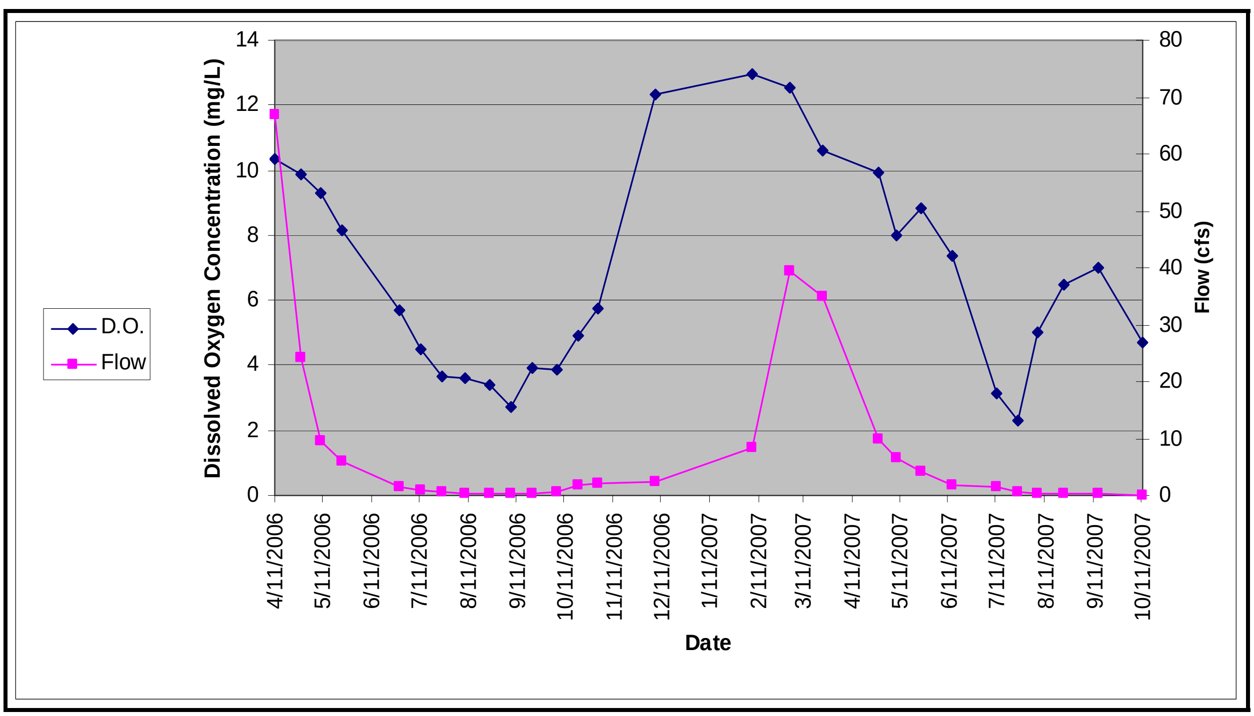

Figure 15. West Fork Little Bear Creek Flow and Dissolved Oxygen Concentrations near PTR-6 (2006-2007)

An instantaneous dissolved oxygen value of 5.8 mg/L was observed on an intermittent segment of Middle Potlatch Creek (PTR-5) during July 2002. No exceedances of the dissolved oxygen criterion were observed at the mouth (PTR-4). The measured flow during the July 25, 2002, sampling event when the low instantaneous dissolved oxygen value was observed was 0.02 cfs. In the upper reach of Middle Potlatch Creek, flows less than 0.1 cfs were measured beginning in the latter part of June and the creek was dry in August. The dissolved oxygen water quality standard does not apply to intermittent streams like this segment of Middle Potlatch Creek when flows are less than 1.0 cfs and therefore a nutrient TMDL is not necessary.

Nutrients

Idaho's narrative standard for nutrients states "surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses" (IDAPA 58.01.02.200.06). Excessive nutrients affect dissolved oxygen and impair aquatic life beneficial uses due to the growth and decomposition cycle of algae feeding on the nutrients and the biochemical oxygen demand as ammonia is transformed to nitrate-nitrogen. An in-stream dissolved oxygen concentration of 6.0 mg/L is required by Idaho's water quality standards for protection of aquatic life beneficial uses.

Nutrient loading needs to be controlled and managed to control and manage dissolved oxygen concentrations during the critical flow season when stream temperatures increase and flows decrease. Based on measured exceedances of the dissolved oxygen criterion in Pine Creek and the West Fork Little Bear Creek, nutrient TMDLs will be developed to enhance dissolved oxygen concentrations and restore full support of the cold water aquatic life beneficial use.

The annual mean ratio of total inorganic nitrogen (TIN) to orthophosphate (OP) in the West Fork of Little Bear is 6.6:1 (Table 15). TIN to OP ratios less than 7.0 are indicative of a nitrogen-limited system. The mean TIN:OP ratio during May-October was 6.8:1 (Table 16). This ratio indicates nutrient loading by nitrogen is more a concern than for phosphorus and this nutrient TMDL will focus on limiting nitrogen to enhance dissolved oxygen concentrations and protect the water quality in the West Fork of Little Bear.

A nutrient TMDL will not be developed for Middle Potlatch Creek. The low dissolved oxygen concentration was measured in the intermittent creek during flows less than optimum for aquatic life (1.0 cfs). Idaho's numeric standards for aquatic life do not apply to intermittent waters when flows are less than optimal and therefore no violation of the criterion occurred.

Table 15. Total inorganic nitrogen and orthophosphate summary for West Fork Little Bear Creek (2006-2007).

Date	NO_2+NO_3 (mg/L)	NH_3 (mg/L)	OP (mg/L)
4/11/2006	0.11	0.05	0.036
4/27/2006	0.05	0.05	0.06
5/10/2006	0.05	0.38	0.075
5/23/2006	0.19	0.49	0.14
6/28/2006	1.9	1.4	0.43
7/12/2006	7.2	3.1	1.2
7/25/2006	6.4	11	2.4
8/9/2006	15	4.6	2.4
8/24/2006	No Data	No Data	No Data
9/7/2006	7.5	14	3.6
9/20/2006	5.9	9.2	2.2
10/6/2006	6.8	11	1.9
10/20/2006	3.9	4.8	1.1
11/1/2006	3.8	7.6	1.5
12/7/2006	0.51	0.69	0.15
2/6/2007	0.36	0.34	0.089
3/2/2007	0.58	0.05	0.046
3/23/2007	0.11	0.05	0.05
4/27/2007	0.05	0.25	0.068
5/9/2007	0.2	0.59	0.14
5/24/2007	0.35	0.96	0.19
6/13/2007	0.97	1.4	0.31
7/11/2007	5.6	11	2.2
7/25/2007	19	3.9	2.5
8/6/2007	17	0.16	3
8/23/2007	14	0.05	2.9
9/13/2007	17	0.05	3.3
10/11/2007	13	2	2.5

Table 16. Total Inorganic Nitrogen summary for West Fork Little Bear Creek (2006-2007).

Date	DO (mg/L)	% Sat	NO_2+NO_3 (mg/L)*	NH_3 (mg/L)*	TIN (mg/L)	OP (mg/L)	Flow
5/10/2006	9.32	89.5%	0.05	0.38	0.43	0.08	9.486
5/23/2006	8.13	86.3%	0.19	0.49	0.68	0.14	5.88
6/28/2006	5.69	65.8%	1.9	1.4	3.3	0.43	1.372
7/12/2006	4.48	48.8%	7.2	3.1	10.3	1.2	0.897
7/25/2006	3.64	41.4%	6.4	11	17.4	2.4	0.468
8/9/2006	3.62	39.3%	15	4.6	19.6	2.4	0.298
8/24/2006	3.37	35.2%	No Data	No Data	No Data	No Data	0.246
9/7/2006	2.72	28.1%	7.5	14	21.5	3.6	0.242
9/20/2006	3.9	36.7%	5.9	9.2	15.1	2.2	0.435
10/6/2006	3.84	34.3%	6.8	11	17.8	1.9	0.552
10/20/2006	4.9	42.6%	3.9	4.8	8.7	1.1	1.772
5/9/2007	7.98	84.9%	0.2	0.59	0.79	0.14	6.505
5/24/2007	8.82	88.7%	0.35	0.96	1.31	0.19	4.131
6/13/2007	7.37	72.2%	0.97	1.4	2.37	0.31	1.863
7/11/2007	3.11	36.4%	5.6	11	16.6	2.2	1.378
7/25/2007	2.32	26.0%	19	3.9	22.9	2.5	0.522
8/6/2007	5	54.5%	17	0.16	17.16	3	0.301
8/23/2007	6.46	68.4%	14	0.05	14.05	2.9	0.276
9/13/2007	6.98	70.1%	17	0.05	17.05	3.3	0.233
10/11/2007	4.71	42.7%	13	2	15	2.5	0.134
Average	**5.32**	**55**	**7.47**	**4.21**	**11.69**	**1.71**	**1.85**

* Samples with results below the detection limit were given a value of 0.05 mg/L to compute the analysis

Nitrogen Compounds

Total nitrogen includes both inorganic and organic forms of nitrogen. NO_2+NO_3-N plus ammonia (NH_3-N), referred to as total inorganic nitrogen (TIN) for the remainder of the document, was used in the nutrient analysis of the West Fork Little Bear Creek, since these forms of nitrogen are available for plant uptake and can affect instream dissolved oxygen concentrations.

Ammonia nitrogen is more readily available for bacteria consumption, which results in the conversion of ammonia to nitrate–nitrogen (nitrification). The consumption and transformation of ammonia to nitrate-nitrogen by bacteria also consumes oxygen. An analysis of the ammonia data that was collected during the 2001-2002 and 2006-2007 monitoring seasons showed no violations of the acute or chronic criterion for ammonia included in Idaho's Water Quality Standards. Data suggest that nitrification is occurring in-stream and is affecting in-stream oxygen concentrations. Biochemical oxygen demand and plant uptake affected by nitrogen loading can both be managed by controlling the in-stream TIN load.

Figure 16 shows the relationships among flow, TIN, and dissolved oxygen. When flow decreases, TIN values increase and dissolved oxygen decreases to levels where violations are observed. A significant relationship between TIN and dissolved oxygen was observed in the West Fork Little Bear Creek during the critical low flow summer period. Figure 17 shows that approximately 73% of the variation in dissolved oxygen can be explained by TIN levels during the critical flow period. This relationship is much more significant than that of OP and dissolved oxygen during the same period (Figure 18), supporting the conclusion that, at this time, the oxygen demand required for nitrification of ammonia to nitrate nitrogen is having a greater influence on dissolved oxygen concentrations than the consumption of oxygen by aquatic vegetation life cycles cultivated by phosphorus concentrations.

As TIN values approximate 3 mg/L or more and flows approximate 1.5 cfs or less, dissolved oxygen violations are observed. We assume the biochemical oxygen demand required for nitrification of ammonia to occur on 8/23 and 9/13 was not significant because the available nitrogen was in the form of NO_2+NO_3-N.

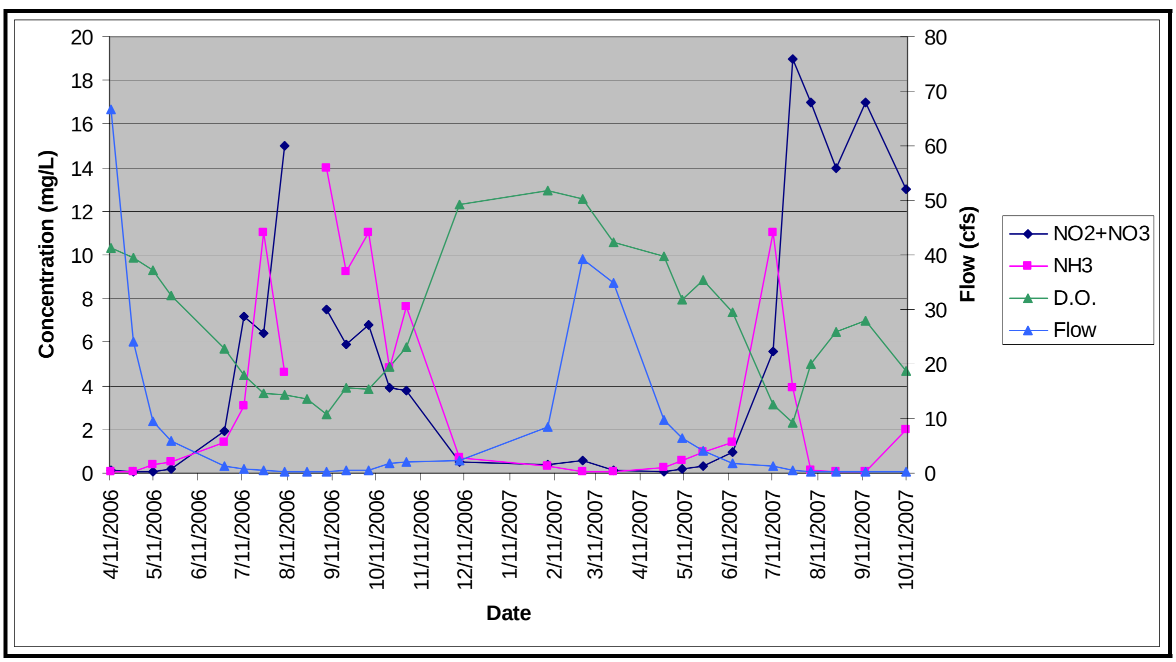

Figure 16. Flow, Dissolved Oxygen, and Total Inorganic Nitrogen (NO_2+NO_3-N and NH_3-N Combined), West Fork Little Bear Creek

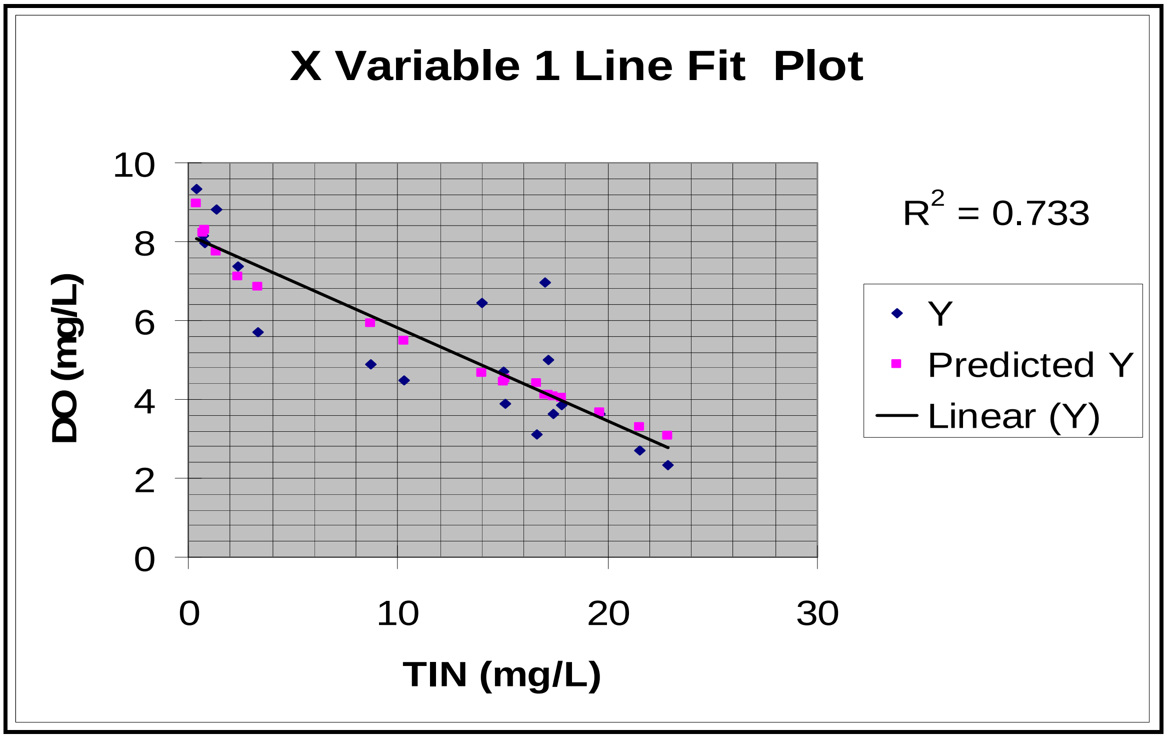

Figure 17. Total Inorganic Nitrogen (TIN) and Dissolved Oxygen (DO), West Fork Little Bear Creek

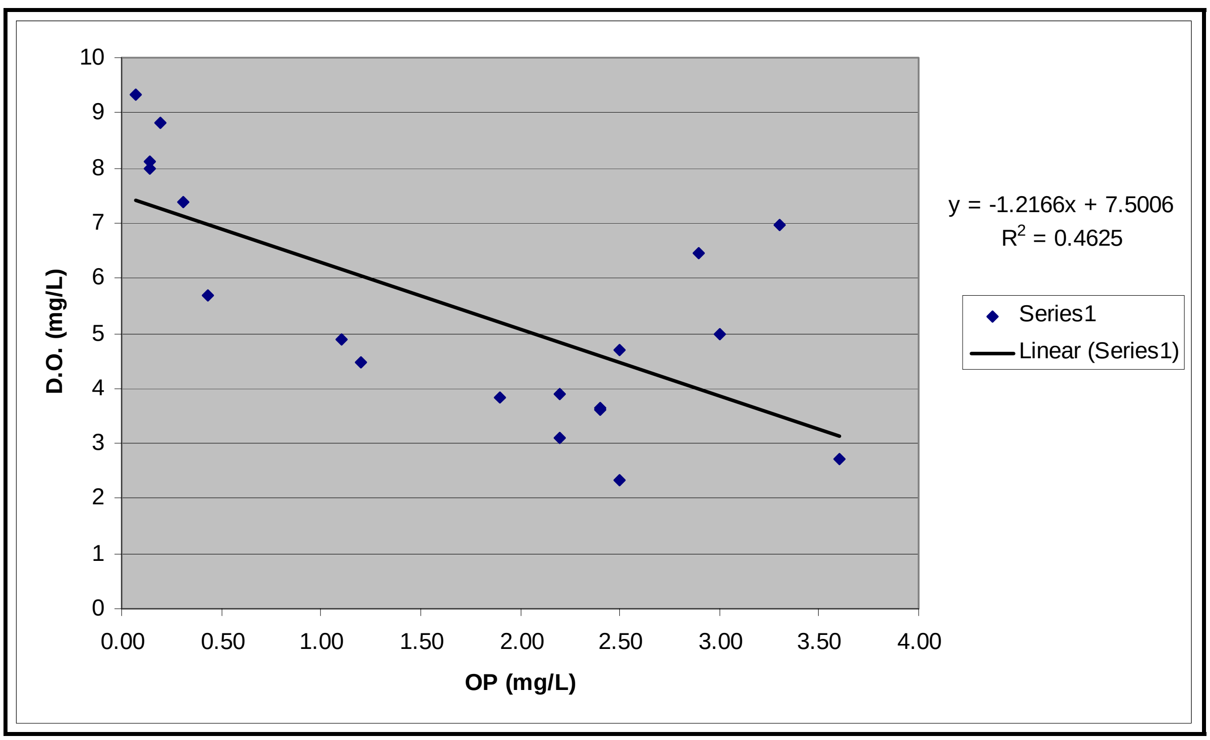

Figure 18. Orthophosphate (OP) and Dissolved Oxygen (DO), West Fork Little Bear Creek

Phosphorus Compounds

In order to prevent nuisance algae growth and to sustain optimal in-stream dissolved oxygen concentrations, the EPA recommended a national guideline for streams of 0.100 mg/L total phosphorus (EPA 1986). More recently, the EPA developed a nutrient criterion guidance for total phosphorus of 0.030 mg/L specific to Columbia Plateau subecoregion streams (EPA 2000). The recommended Columbia Plateau subecoregion criterion represents reference conditions for arid geographic areas of the Columbia Plateau. The Potlatch River watershed does not exhibit the same climate, soils, or vegetative features of the arid subecoregion 10 reference streams and is better represented by the national guideline of 0.100 mg/L.

The annual mean TIN:TP ratio is 14:1 for Pine Creek. Total nitrogen to total phosphorus ratios greater than 7.0 are indicative of a phosphorus-limited system. Table 17 displays the mean, maximum, and minimum total phosphorus concentrations observed in Pine Creek between December 26, 2001 and December 10, 2002. Figure 19 displays the total phosphorus measurements obtained during that period.

Table 17. Summary of total phosphorus concentrations in Pine Creek, December 26, 2001 – December 10, 2002.

mg/L	Pine Creek (PTR-10)
Mean	0.11
Maximum	0.21
Minimum	0.05

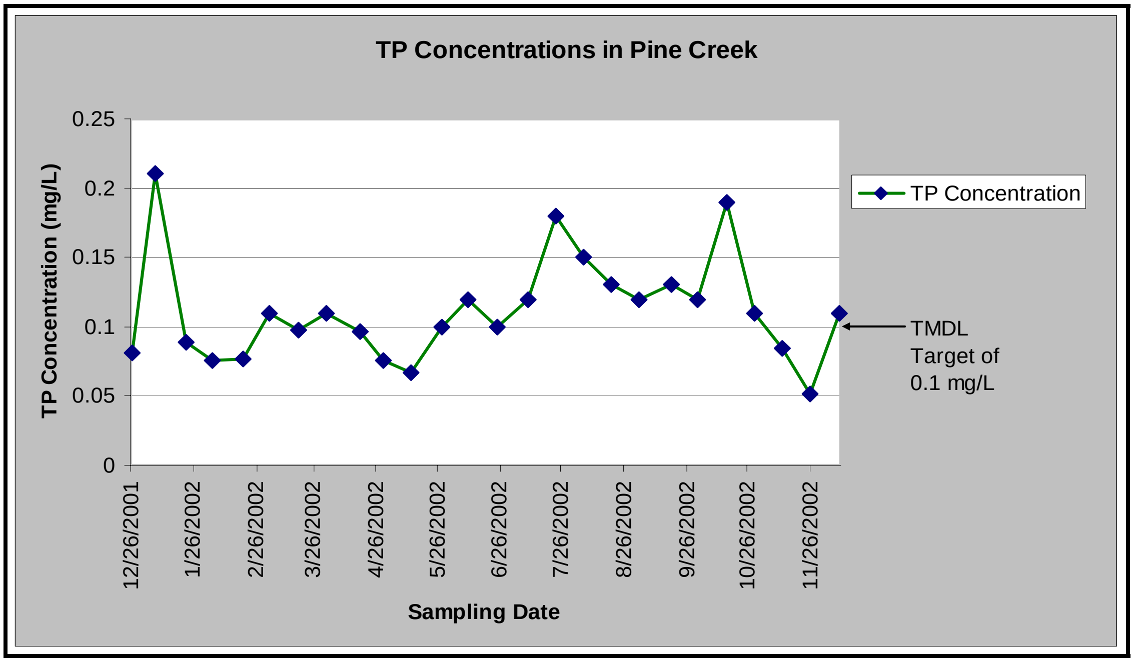

Figure 19. Pine Creek Total Phosphorus Concentrations, December 26, 2001 – December 10, 2002

Sediment

Sediment criteria found in Idaho Water Quality Standards (IDAPA 58.01.02) is narrative, meaning there is not a numeric value used to assess whether a water body is in compliance with standards. Instead, Idaho has a requirement that sediment shall be limited to a quantity that does not impair beneficial uses.

The most available water column sediment data for application in this TMDL are reported in terms of total suspended solids (TSS). A total suspended solids target for sediment has been taken from the *Guide to Selection of Sediment Targets for Use in Idaho TMDLs*, set at a level such that the Potlatch River and its tributaries will not exceed the estimated load capacity supportive of a good fishery (DEQ 2003).

The effects of sediment on the most sensitive designated beneficial use in the Potlatch River watershed, aquatic life, are dependent on concentration and duration of exposure (DEQ 2003). Guidance developed by DEQ for application of the narrative sediment criteria for protection of aquatic life beneficial uses suggests that a sediment target incorporate both concentration and duration of exposure, not only to properly protect aquatic life, but also to allow for episodic spikes that can occur naturally with spring runoff or heavy precipitation events.

The targets used to develop the loading calculations shown later (Section 5.3) are a monthly average of 50 mg/L total suspended solids (TSS) with a maximum daily limit of 80 mg/L to allow for natural variability. The average monthly target and the maximum daily limit are within the range identified by the European Inland Fisheries Advisory Commission and the

Committee on Water Quality Criteria from the Environmental Studies Board of the National Academy of Science and National Academy of Engineers as supporting a moderate fishery (DEQ 2003). These targets are consistent with targets applied in other sediment TMDLs addressing sediment in the Lower Clearwater Subbasin. Existing sediment loads in these water bodies are shown later (Section 5.3).

Sediment TMDLs were developed for control points where target concentrations greater than the load capacity were measured. Each of the sediment TMDLs allocates a gross concentration to all sources of sediment upstream of control points, which are on each tributary and the mainstem Potlatch River. Sediment TMDLs have been developed for the Potlatch River, ID17060306CL044_06, with an allocation provided to a control point at PTR-1; Middle Potlatch Creek, ID17060306CL062_03, with an allocation provided to a control point at PTR-4; West Fork Little Bear Creek, ID 17060306CL061_03, with an allocation provided to a control point at PTR-6; Pine Creek, ID17060306CL055_03, with an allocation provided to a control point at PTR-10; and Cedar Creek, ID17060306CL046_04, with an allocation provided to a control point at PTR-11. Waste load allocations were developed for Deary, Bovill, Kendrick, Juliaetta, and Troy, wastewater treatment plant (WWTP) facilities, based on the estimated design flow times the maximum daily limit and the current allowable average monthly concentrations.

Oil, Grease, and Pesticides

Pine Creek and the downstream segment of the Potlatch River are listed for pesticides and oil and grease. In the spring of 2003, DEQ collected both oil and grease and pesticide samples from the Potlatch River, downstream of the cities of Kendrick and Juliaetta, near PTR-1. These DEQ samples were taken on April 25, May 5, and May 12, 2003, coinciding with the first pesticide applications of the year in late April and early May.

Samples were analyzed for oil and grease using EPA method 1664, with a practical quantitation limit of 1.0 mg/L. All samples showed a no detect.

These samples were screened for pesticides using EPA method 8270MOD, utilizing a surrogate standard of Terphenyl-d14 with a recovery rate of 81.8%. All samples showed a no detect for all pesticides.

The Idaho Department of Agriculture, in conjunction with the Idaho Soil Conservation Commission and the Idaho Association of Soil Conservation Districts, sampled the Potlatch River for pesticides in 2004. The Department of Agriculture has the responsibility to ensure proper use of pesticides and the protection of the environment from pesticides In Idaho. Although pesticides were detected in the Potlatch River, the Idaho Department of Agriculture concluded that: "All pesticide concentrations detected during this study were below any chronic or acute levels that may cause ill effects for aquatic species" (Campbell 2004).

Biological and Other Data

Biological surveys were completed on water bodies in the Potlatch River watershed during the summer monitoring seasons of 1994, 1996, 2001, and 2002, at the locations shown in Figure 20.

The biological monitoring protocol includes three types of biological data: macroinvertebrates, fish, and habitat. A stream macroinvertebrate index is generated from seven different qualities of the macroinvertebrates found, including species diversity, richness of species diversity, species guilds, and pollutant tolerance. A stream fish index is developed based on species present, abundance of the different species, and the presence/absence of juveniles. A stream habitat index uses both quantitative and qualitative measures of stream habitat including substrate composition, channel structure, streamside vegetation, and stream bank condition. Sample indices are compared with statistical reference indices along with available physical and chemical data to determine whether an AU supports its beneficial uses.

The Idaho Water Body Assessment Guidance, Second Edition (WBAG-II) (Grafe *et al.* 2002) describes DEQ's method for evaluating biological data and determining beneficial use support of Idaho water bodies. Assessing a water body involves analyzing and integrating multiple types of data to determine the degree of beneficial use support and biological integrity. The WBAG considers data most relevant to support status determinations to be less than five years old.

Idaho's WBAG-II provides for use of a multimetric index score. A multimetric index score of 2.0 or greater indicates biological characteristics support beneficial uses, meaning the stream passes the assessment; a score of less than 2.0 indicates that biological characteristics do not support beneficial uses and the stream fails the assessment. Table 18 lists multimetric index score results for AUs in the Potlatch River watershed.

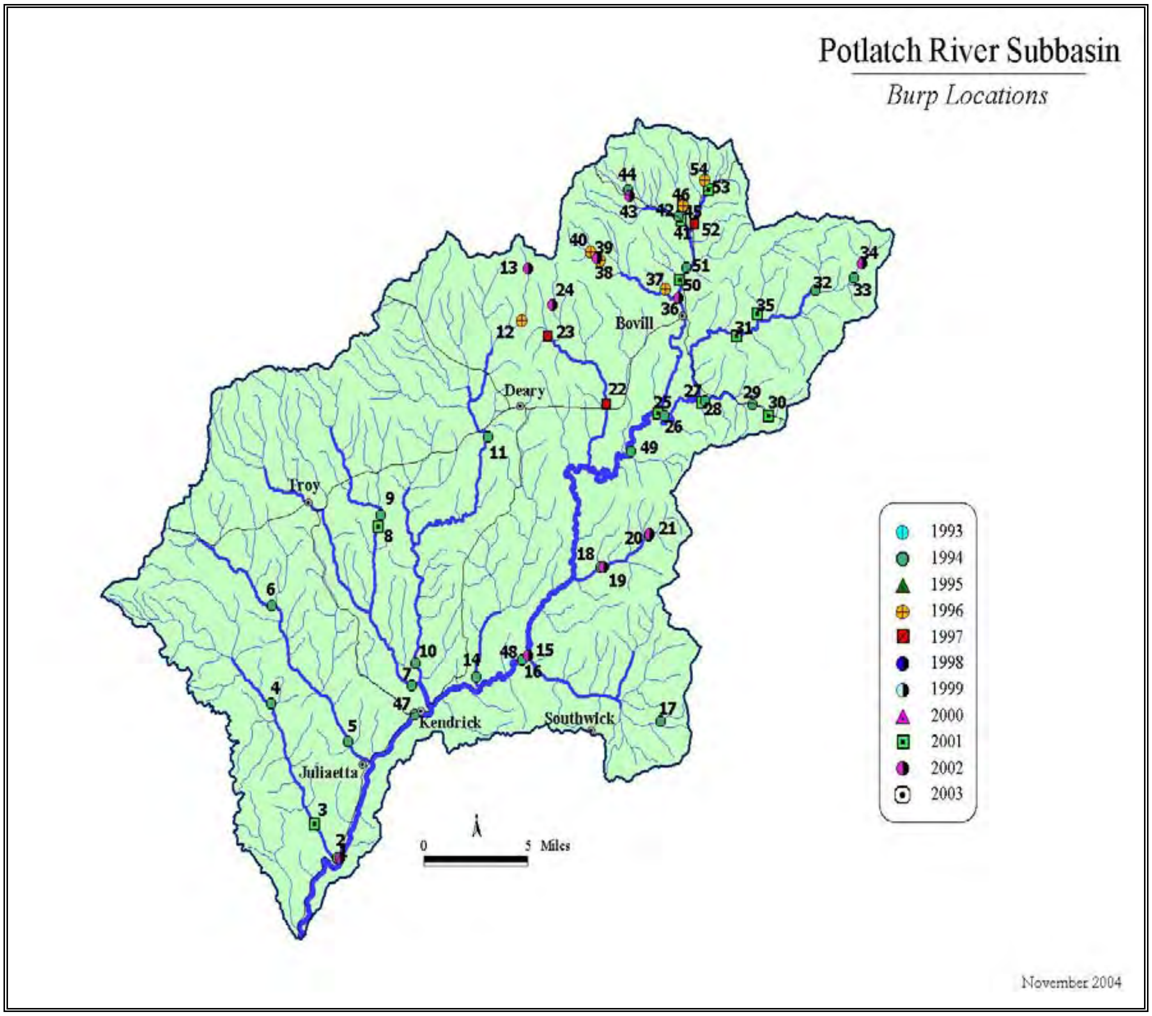

Figure 20. Survey Site Locations

Table 18. BURP multimetric index score results for assessment units in the Potlatch River watershed.

Assessment Unit	Stream Name	Year Sampled	Macro-invertebrate Index	Stream Fish Index	Stream Habitat Index	Macro-invertebrate Rating	Fish Rating	Habitat Rating	Condition Rating	Multi-metric Index Results
ID17060306CL044_06	Potlatch R. (Big Bear Cr. to mouth)	2002	55.88	46.17	61	3	1	3	2.33	Pass
ID17060306CL049_02	WF Potlatch River	2002	29.802	53.636	34	0	1	1	0.7	Fail
ID17060306CL049_02	WF Potlatch River	2001	50.892	74.561	50	1	2	1	1.3	Fail
ID17060306CL049_03	WF Potlatch River	2001	33.913	69.080	61	0	2	2	1.3	Fail
ID17060306CL049_02	Potlatch River Headwaters	2001	41.933	63.553	49	1	2	1	1.3	Fail
ID17060306CL049_04	Potlatch River Headwaters	2001	48.134	80.461	61	1	2	2	1.7	Fail
ID17060306CL047_02	Boulder Creek	2002	59.352	87.432	64	3	3	3	3.0	Pass
ID17060306CL047_03	Boulder Creek	2002	63.787	80.113	69	3	2	3	2.7	Pass
ID17060306CL046_04	Cedar Creek	2002	75.182	76.991	63	3	2	3	2.7	Pass
ID17060306CL054_02	Corral Creek	2002	21.955	---	37	0	---	1	0.0	Fail
ID17060306CL053_02	Moose Creek	2002	53.725	43.279	51	1	1	1	1.0	Fail
ID17060306CL053_03	Moose Creek (below reservoir)	2002	41.64	55.014	56	1	1	1	1.0	Fail
ID17060306CL052_02	Ruby Creek	2001	72.173	---	59	3	---	2	2.5	Pass
ID17060306CL052_03	Ruby Creek	2001	50.927	51.620	60	1	1	2	1.3	Fail
ID17060306CL057_02	EF Big Bear Creek	2002	51.164	59.304	69	1	1	3	1.7	Fail
ID17060306CL051_02	EF Potlatch River	2002	69.346	89.505	70	3	3	3	3.0	Pass
ID17060306CL051_02	EF Potlatch River	2001	54.173	94.377	45	1	3	1	1.7	Fail
ID17060306CL051_03	EF Potlatch River	2001	70.348	88.822	64	3	3	2	2.7	Pass
ID17060306CL051_04	EF Potlatch River	2001	56.794	59.194	67	1	1	3	1.7	Fail
ID17060306CL060_03	Little Bear Creek	2001	31.990	64.060	58	0	2	3	1.7	Fail
ID17060306CL064_03	Little Potlatch Creek	2002	55.876	46.168	61	3	1	3	2.3	Pass
ID17060306CL064_03	Little Potlatch Creek	2001	36.169	44.389	61	1	1	3	1.7	Fail

EF – East Fork, WF – West Fork

Status of Beneficial Uses

In addition to the BURP data and WBAG assessments, Tier 1 TMDL monitoring data is used in making support status determinations. Table 19 illustrates the most current support status determinations for the Potlatch River watershed listed water bodies, and the pollutants for which TMDLs will be written, based on all available data.

Table 19. Beneficial use support status and TMDL pollutants.

Stream Name	Extent	AU#	Aquatic Life Uses		Recreation Use	Pollutants
			SS	CWAL		
Potlatch River	Big Bear Cr to Clearwater R	ID17060306CL044_06	NFS	NFS	FS	Temp, Sed
Potlatch River	Corral C. to Big Bear Cr	ID17060306CL045_05	FS	NFS	FS	Temp
Potlatch River	Moose Cr to Corral Cr	ID17060306CL048_04 ID17060306CL048_05	NFS	NFS	NFS	Temp
Potlatch River	Headwaters to Moose Cr	ID17060306CL049_02, ID17060306CL049_03 ID17060306CL049_04	NFS	FS	NFS	Temp, Bac
Boulder Creek	Pig Cr to Potlatch R	ID17060306CL047_03	NFS	FS	NFS	Bac, Temp
Cedar Creek	Leopold Cr to Potlatch R	ID17060306CL046_04	NFS	NFS	FS	Temp, Sed
Corral Creek	Headwaters to Potlatch R	ID17060306CL054_02 ID17060306CL054_03	NFS	NFS	FS	Temp
Big Bear Creek	WF Big Bear Cr to Potlatch R	ID17060306CL056_04 ID17060306CL056_05	NFS	NFS	NFS	Bac, Temp
Moose Creek	Headwaters to Potlatch R	ID17060306CL053_02 ID17060306CL053_03	NFS	NFS	NFS	Temp, Bac
Pine Creek	Headwaters to Potlatch R	ID17060306CL055_02 ID17060306CL055_03	NFS	FS	FS	Temp, Nut, Sed
Ruby Creek	Unnamed trib. 3.4 km upstream to EF Potlatch R	ID17060306CL052_03	NFS	FS	NFS	Temp, Bac
EF Potlatch River	Ruby Cr to Potlatch R	ID17060306CL051_04	NFS	NFS	FS	Temp
West Fork Little Bear Creek	Headwaters to Little Bear Cr.	ID17060306CL061_02 ID17060306CL061_03	NFS	NFS	Unknown	Sed, Nut, Bac
Middle Potlatch Creek	Headwaters to Potlatch R	ID17060306CL062_02 ID17060306CL062_03	NFS	NFS	NFS	Temp, Bac, Sed

SS=salmonid spawning, CWB=cold water aquatic life , NFS=not fully supporting beneficial uses, FS=fully supporting beneficial uses, Bac=Bacteria, Nut=Nutrients, Sed=Sediment, Temp=Temperature

Conclusions

TMDLs will be written for the listed water bodies and assessment units shown in Table 19. Thirteen water bodies require a temperature TMDL. Boulder Creek, Big Bear Creek, Moose Creek, Middle Potlatch Creek, the Potlatch River headwaters to Moose Creek segment, and Ruby creek exceeded the geometric mean criterion for *E. coli*, and require bacteria TMDLs. An assessment of the *E. coli* bacteria geometric mean criterion is not available for the West Fork Little Bear Creek. Analysis of the samples obtained during the monitoring season (bi-weekly) indicate that the potential to exceed the state water quality standard existed during the 2001-2002 monitoring season. Since the state water quality standard for *E. coli* bacteria is a geometric mean concentration that is applicable year-round, a TMDL was developed.

Pine Creek requires a nutrient TMDL for total phosphorus. A nutrient TMDL that addresses total inorganic nitrogen has been developed for West Fork Little Bear Creek. Cedar Creek, Pine Creek, Middle Potlatch Creek, West Fork Little Bear Creek, and the Potlatch River from Big Bear Creek to the mouth require sediment TMDLs.

Preliminary reconnaissance data has been collected during the completion of the subbasin assessment. Where the data indicate violations of Idaho's water quality standards in streams currently not listed in Section 5 of Idaho's 2002 integrated report (DEQ 2002), this data will be incorporated into the next cycle of assessments and the streams included in the next version of Idaho's integrated report. Appropriate actions, such as completing more detailed monitoring, will be taken for analyses and assessment of in-stream conditions. Reconnaissance data indicate further monitoring, biological surveys, assessments, permits, and implementation projects should occur in West Fork Little Bear Creek, and the West Fork Potlatch River.

2.5 Data Gaps

This TMDL addresses water quality concerns in the Potlatch River watershed, based on available data. Additional data will become available over time (i.e. diurnal D.O. data). All available data generated in the future, where applicable, will be used to review and reevaluate the subbasin assessment and TMDLs.

3. Subbasin Assessment–Pollutant Source Inventory

This section identifies and discusses sources of pollutants affecting water quality in the Potlatch River watershed. Sources may occur as point sources, regulated by National Pollutant Discharge Elimination System (NPDES) permits, and as nonpoint sources which are not subject to any permitting program. Point sources convey pollutants directly into waters through a pipe, ditch or other identifiable point of discharge. Nonpoint sources have no exact point of discharge to receiving waters, conveying their associated pollutants over the landscape. The Potlatch River and its tributaries receive pollutants from both point sources and nonpoint sources which are discussed in more detail below.

3.1 Sources of Pollutants of Concern

All known point sources within the watershed are wastewater treatment facilities that operate under NPDES permits. Nonpoint sources within the watershed include agriculture, roads and highways, forestry, grazing, and septic systems.

Point Sources

Table 20 lists NPDES-permitted sources in the Potlatch River watershed. The table includes NPDES permit number, expiration date, location, discharge volume, and discharge season.

Table 20. NPDES permitted facilities.

City	NPDES #	Exp. Date	Location Lat./Long.[1]	Discharge Volume	Discharge Season
Deary	ID-002078-8	04/30/09	46 08’ 04” N 116 34’ 09” W	0.23mgd	Year-round
Bovill	ID-002286-1	03/31/10	46 51’ 20” N 116 23’ 53” W	0.05mgd[2]	November-April
Kendrick	ID-002455-4	03/31/10	46 36’ 31” N 116 39’ 55” W	0.08mgd	Year-round
Juliaetta	ID-002376-1	04/30/09	46 33’ 43” N 16 42’ 33” W	0.08mgd	Year-round
Troy	ID-002360-1	04/30/09	46 43’53” N 116 45’ 22” W	0.19mgd	Year-round

1. Lat./Long. – latitude and longitude
2. mgd – million gallons per day

Nonpoint Sources

Nonpoint sources within the Potlatch River watershed include agriculture, forestry, roads, and septic systems. Approximately 36% of the watershed is considered agricultural, which includes cropped fields, conservation reserve program (CRP) lands, pasture, and hay production areas. Approximately 42% of the watershed is considered forested. The major public roads in the watershed are: State Highways 3, 8, and 9. Numerous graveled county, forest, and Potlatch Corporation roads allow access to the more remote areas of the watershed.

Figure 21 is a land use map of the Potlatch River watershed, showing land uses from the forested headwaters to the meadows and pastures of the middle reaches, across the agricultural prairie and then down through the timbered shrub lands of the breaks.

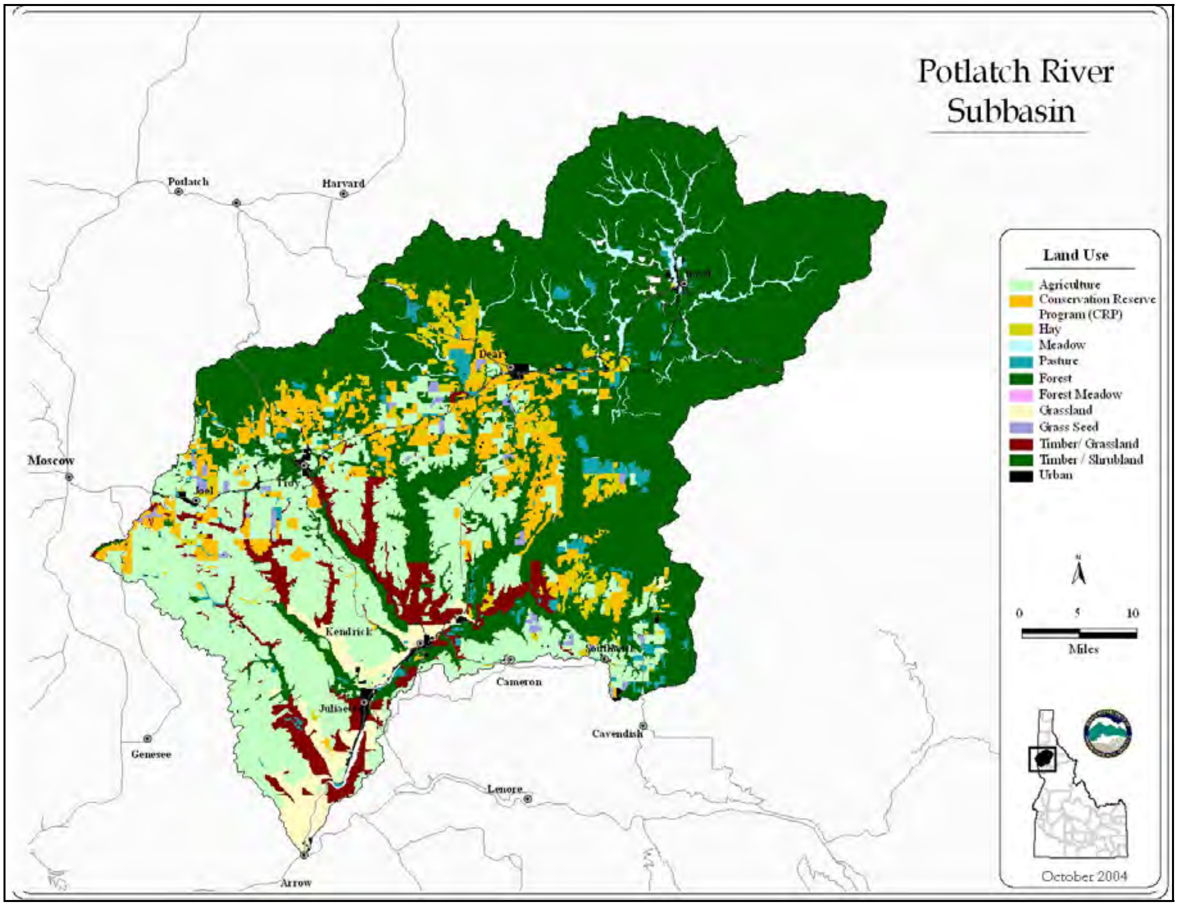

Figure 21. Land Use in the Potlatch River Watershed

Bacteria

Nonpoint sources of bacteria entering the Potlatch River watershed include livestock, wildlife, waterfowl, septic tank drain fields, and pets. Livestock manure from pastures, rangeland, and corrals are considered the most manageable sources of bacteria because manure can be collected and disposed of before it reaches surface water. Where livestock have direct access to the river and creeks, manure can be deposited directly into the stream. Septic system drain fields can also be a source of bacteria reaching surface waters if the drain field is placed too close to the stream. Bacteria typically do not travel as far underground as they do above ground, normally dying off before underground septic waste reaches the stream. However, if the drain field is not far enough away from the stream, bacteria can survive long enough to reach the stream.

E. coli bacteria data from the Potlatch River watershed indicate that six of the thirteen water bodies listed in Section 5 of Idaho's 2002 Integrated Report (DEQ 2002) require TMDLs aimed at reducing bacteria loads.

Nutrients

Potential nonpoint sources of nutrients (nitrogen and phosphorus) include agricultural and urban fertilizer, septic system drain fields, and livestock. Ground water is also affected by fertilizer application and can then deliver this excess nutrient load back to surface waters in the form of upwelling, or springs. Increased soil erosion from tillage practices may add both phosphorus and nitrogen directly to streams. Bank destruction, as well as soil compaction, contributes to increased run-off by creating a "hard pan" that water cannot infiltrate properly. Transport of nutrients (nitrogen and phosphorus) to water bodies takes place through rain events, subsequent runoff, groundwater, drainage networks, and industrial and waste effluents. Nutrients received by a water body can be taken up by aquatic vegetation (macrophytes), algae, and microorganisms; sorbed to organic and inorganic particles in the water and sediment; amassed or recycled in the sediment; or transformed into a gas and released from the water body (EPA 2000). Excess nutrient inputs taken up by macrophytes can lead to excess algae growth, which in turn can lead to oxygen depletion. High ammonia concentrations can also lead to low oxygen levels, as bacteria oxidize the ammonia to nitrate, through nitrification.

Nutrient data from the Potlatch River watershed indicate that one of the thirteen water bodies listed in Section 5 of Idaho's 2002 integrated report (DEQ 2002) requires a TMDL designed to reduce nutrient inputs.

Sediment

In-stream erosion is a major source of sediment; ephemeral overland flow and road runoff are others. Land uses such as silviculture and agriculture can expose soils, destabilize land formations, and increase and direct runoff, which in turn can contribute to higher erosion rates than those which would occur naturally in the watershed. Mass wasting within the watershed not directly attributed to the land uses listed above has also been observed along canyon walls within the watershed.

Sediment data collected from the Potlatch River watershed indicate that six of the thirteen water bodies listed in Section 5 of Idaho's 2002 integrated report (DEQ 2002) require TMDLs designed to reduce sediment loads.

Temperature

Heat from solar radiation is a source of temperature loading to streams in the Potlatch River watershed. Solar heat loads at levels greater than naturally occurring solar heat loads are usually a function of shade reduction and disturbances of natural stream morphology. Removal of shade or canopy cover from the riparian zones of streams and watershed forests can allow heat loading to streams and may accelerate melting of watershed snow packs, causing in the summer and fall flows that are lower-volume and warmer. Such disturbances also de-stabilize stream banks, leading to higher erosion rates and creating wider, shallower channels. The wider and more shallow the channel, the more solar heat load it can receive. The combination of low-volume summer flows and less shade can lead to temperature criteria exceedances.

Heat loading from solar radiation progresses downstream as the forested headwaters with 70 to 90 percent shade change into meadows and pasturelands with less shade, then into agricultural lands providing little to no shade and the canyon break lands receiving most of their shade from their canyon walls. Temperature data used in this report show that all thirteen stream segments listed in Idaho's 2002 integrated report (DEQ 2002) require TMDLs to reduce heat loading.

3.2 Data Gaps

The pollutant load data used in this assessment are in-stream pollutant loads and stream flows measured at selected sites within the watershed. Sites selected for measurement of in-stream loads and flow rates are used for points of compliance for monitoring of allowable in-stream loads. Authoritative water quality evaluations to discern in-stream load contributions from and between the various non point sources and point sources found within the watershed are not possible from this data. Instead, loads are attributed to those sources located within the watershed areas delineated by upstream and downstream monitoring sites and represented by the difference between the two. More specific identification of pollutant loads attributable to known non point sources located within the delineated watershed areas should be completed by the appropriate designated management agency to ensure effective and efficient load reductions are achieved if deemed necessary.

Point Sources

Pollutant loads used in this TMDL are developed through in-stream measurements collected at selected sites within the watershed. Pollutant loads are calculated at these sites based on the difference between the upstream site and the downstream site (see above). Loads, including point source loads, are attributed to all sources located within the watershed areas delineated by upstream and downstream monitoring sites. Loads used in this TMDL have been reported from each point source facility to DEQ, or estimated by DEQ staff based on data and known information available to them. Actual effluent measurements and pollutant load monitoring should be conducted by each facility to ensure the most accurate and up to date data is being used in determination of allowable and permitted pollutant loads.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

This chapter presents a brief summary of those efforts specifically implemented to control pollutants, enhance in-stream habitat, and improve water quality in the Potlatch River watershed. In some cases, federal agencies, the Nez Perce Tribe, state agencies, private landowners, and local communities mentioned here have coordinated efforts to restore habitat and control certain pollutants throughout the watershed. Other agencies and organizations mentioned will become involved in pollution control activities during the implementation phase of this TMDL. The type of restoration/pollutant control activities and the agencies and individuals undertaking these measures vary with land use and ownership.

4.1 Federal/Tribal Efforts

Clearwater Focus Program

The purpose of the Clearwater Focus Program is to coordinate staff and funding resources for projects to enhance and restore fish and wildlife habitats in the Clearwater River subbasin. The Idaho Soil Conservation Commission and the Nez Perce Tribal Watershed Division co-coordinate the program on behalf of the State of Idaho and the Nez Perce Tribe.

Projects have been conducted on private, state, federal, and tribal lands and partnerships have been developed for all projects. In addition to the commission and the Tribe, frequent project partners include the US Forest Service, Natural Resources Conservation Service, soil conservation districts, private landowners, Idaho Department of Fish and Game, and the Bureau of Land Management. Projects have focused on riparian fencing, plantings, road obliterations, revegetation, grassed waterways, culvert replacement, and agricultural ponds.

United States Natural Resources Conservation Service

The Natural Resources Conservation Service provides technical assistance to the Latah Soil and Water Conservation District and its landowners and administers cost-sharing programs on private lands. These programs are largely voluntary on the part of private landowners, and include:

- Environmental Quality Incentive Program
- Wildlife Habitat Incentive Program
- Wetland Reserve Program
- Conservation Reserve Program
- Continuous Conservation Reserve Program

US Forest Service, Clearwater National Forest

The Clearwater National Forest manages its lands within the watershed using guidelines and policies specified in the Clearwater National Forest Plan. The plan utilizes strategies designed to protect habitats and populations of fish. The Clearwater National Forest is currently revising their forest plan, with a new version anticipated by 2007. The plan contains a monitoring requirement designed to insure Idaho State Water Quality Standards are met on the forest. On-site monitoring will be conducted to establish a baseline, guide implementation, and track the effectiveness compliance of best management practices (BMPs). In-stream monitoring will be conducted to address the effect of land disturbance activities on water quality and fish habitat.

United States Fish and Wildlife Service

The United States Fish and Wildlife Service administers two grant programs: the Partners for Wildlife Program and the Private Stewardship Grant Program. The Partners for Wildlife Program provides cost-share opportunities for projects aimed at enhancing fish and wildlife habitat, with an emphasis on the restoration of riparian areas, wetlands, and native plant communities. The Private Stewardship Grant Program provides grants and assistance to groups engaged in private, voluntary conservation efforts targeted at benefitting endangered/threatened species.

Nez Perce Tribe

The Nez Perce Tribe manages a number of departments and divisions responsible for protecting, enhancing, and restoring tribal resources. The Tribe developed the 1998 Unified Watershed Assessment and Watershed Restoration Priorities plan, which identifies watersheds containing tribal fee and trust lands and tribal usual and accustomed fishing places. The plan sets out priorities for restoration. The Tribe Water Resources Division implements restoration work in watersheds within the Reservation upon completion of TMDLs that have been developed under a tri-party agreement with the Tribe, EPA, and DEQ. In addition, the 1996 Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs, and Yakima Tribes sets adult anadromous return targets for each subbasin in the Columbia Basin and makes recommendations for restoration activities and fish release and production programs.

4.2 State Agency Efforts

Idaho Department of Fish and Game

The Idaho Department of Fish and Game works to preserve, protect, perpetuate, and manage all wildlife. The agency has created several management plans and policies relevant to fish and wildlife and their habitat in the Clearwater subbasin. The staff assists in working with volunteer landowners to improve habitat through incentive programs. The Habitat Improvement Plan and Clearwater Pheasant Initiative have been implemented on several acres in the Potlatch River watershed, restoring habitat primarily for upland game birds, with a smaller percentage of the acreage being restored for waterfowl.

Idaho Conservation Data Center

The Idaho Conservation Data Center is the central repository for information related to the state's rare plant and animal populations. The staff is involved with rare plant and natural area surveys and the development of conservation strategies. These activities assist government agencies and private organizations to identify unique areas for protection against disturbance and development.

Idaho Soil Conservation Commission

The Idaho Soil Conservation Commission staff provide technical and administrative support to the 51 Conservation Districts in Idaho. The staff helps to provide funding with grants and loans through the Resource Conservation and Rangeland Development Program and financial incentives through the Water Quality Program for Agriculture. The programs are intended to improve rangeland and riparian areas and contribute to protection and enhancement of water quality. The commission also administers the Idaho Agricultural Pollution Abatement Plan, which is the implementing action for all nonpoint source agricultural sector activities in the state.

Idaho Department of Lands

The Idaho Department of Lands administers the following laws and acts: the Idaho Forestry Act Fire Hazard Reduction programs, the Idaho Forestry Practices Act, the Idaho Lake Protection Act, surface mining laws, placer mining laws, and navigable waters provisions. The Department also administers the state Stewardship Program, which provides cost-share dollars to perform forestry practices and assists private landowners in developing timber management plans with site-specific BMPs designed to protect riparian areas and water quality.

Idaho Department of Water Resources

The Department of Water Resources enforces the Stream Channel Protection Act, requiring permits for in-channel work or developments, and manages Idaho's water rights program, reserving the authority to establish minimum stream flows to protect a variety of in-stream uses. No minimum stream flows have been established for the Potlatch River watershed.

Idaho Department of Transportation

The Idaho Department of Transportation provides information on proposed highway construction and carries out conservation work affecting the highway right-of-way and adjacent agricultural lands. Department projects planned for implementation in the Potlatch River watershed within the next five years include paving Bear Ridge Grade, the Bovill pedestrian enhancement, and bank stabilization on State Highway 3 above Bear Creek.

Idaho Association of Soil Conservation Districts

Idaho Association of Soil Conservation Districts staff performs water quality monitoring throughout the Potlatch River watershed. Data collected is used by local, state, and federal entities to develop TMDLs.

University of Idaho

Faculty and students from the University of Idaho College of Agricultural and Life Sciences, College of Natural Resources, and College of Science have been directly involved in activities related to fish, wildlife, and water quality issues. The Cooperative Extension Service provides assistance in public outreach and education.

4.3 Local/Community Efforts

Latah Soil and Water Conservation District

The Latah Soil and Water Conservation District provides guidance and assistance to citizens with land use and natural resource needs. Their Resource Conservation Plan facilitates sustainable management of natural resources by outlining procedures and methods, prioritizing current needs, and identifying expectations. The district's goal is to ensure that the land, water, and wildlife resources under its care will remain viable and sustainable in the future.

Highway Districts

Both the North and South Latah County Highway Districts administer BMPs to control erosion and sediment transport from county road construction projects.

Idaho Trout Unlimited

The Three Rivers Chapter of Trout Unlimited has supported several erosion control projects aimed at protecting and enhancing cold water fisheries in the Potlatch River watershed.

US Environmental Protection Agency National Pollution Discharge Elimination System Program

The EPA National Pollution Discharge Elimination System program issues permits for wastewater discharges requiring the control and treatment of constituents in the effluent that impair water quality. Currently, the cities of Deary, Bovill, Kendrick, Juliaetta, and Troy operate wastewater treatment facilities under these permits (Table 20, page 55). Effluent limitations are based on best available technology controls and/or on water quality-based limits. The limits must be stringent enough to ensure that water quality standards are met and must be consistent with any available waste load allocation.

5. Total Maximum Daily Load(s)

A Total Maximum Daily Load (TMDL) calculates the allowable amount of a pollutant that can be in the water body according to state water quality standards. The allowable amount of the pollutant is called the pollutant load capacity. Once the load capacity is calculated, it is allocated among the sources of the pollutant in the watershed.

There are two kinds of pollutant sources: point sources and nonpoint sources. Point sources receive a waste load allocation; nonpoint sources receive a load allocation. Background is considered part of the load allocation, but it is not available for distribution.

A margin of safety is required to account for uncertainties used in the measurement, analysis, or calculation of the load capacity. The margin of safety may consist of conservative assumptions, or of a separate quantity of the pollutant included in the TMDL calculation.

The TMDL calculation can be written as an equation:

Load Capacity = Margin of Safety + Load Allocation + Waste Load Allocation

A TMDL is usually only required for water bodies that do not meet state water quality standards. Once the allowable loads are calculated, existing loads must also be calculated so load reduction requirements are recognized and completed by the sources.

The load capacity must be based on critical conditions, the conditions under which water quality standards are most likely to be violated. If protective under critical conditions, the load capacity will be protective under all conditions.

The load calculation is usually a product of pollutant concentration and flow volume, whether it is the allowable pollutant concentration according to Idaho water quality standards (to determine load capacity), or the existing pollutant concentration found in samples collected from the water body (to determine existing load). The critical condition for pollutants varies seasonally. Pollutant loads in these TMDLs are based on the most appropriate means available to ensure efficient implementation of control strategies.

Design conditions can vary from stream to stream for the various pollutants. One reason for such variability is the different land use practices that can occur within a subwatershed. Other factors can increase pollutant loadings at different times of the year. For example, total phosphorus and sediment may impair a beneficial use on a stream at different times of the year. Typically, sediment will impact a stream during the higher flows of spring runoff, while total phosphorus will impact a stream during the summer growing season when stream flows decrease. Therefore, the critical periods for each pollutant are discussed separately in the following sections.

Each TMDL provides a description of the pollutant target, design condition, load capacity, estimated existing load, load allocation and wasteload allocation if applicable, margin of safety, and a critical time period if appropriate, for the pollutant. Background has been included with the identified load allocations for all pollutants. An explicit growth reserve is not included; the load capacity has been allocated to the existing sources currently in the watershed. Except for storm water construction permits, future sources will need to acquire allocations from existing allocations unless the load capacity is increased.

The following sections describe the TMDLs that have been developed, by pollutant, for water bodies shown in Table 21.

5.1 *E. coli* Bacteria TMDL

E. coli bacteria data presented in Section 2.4 indicate the development of bacteria TMDLs are needed for the seven individual water bodies listed in Table 19. Wasteload allocations have been developed for five wastewater treatment facilities: Deary, Bovill, Kendrick, Juliaetta, and Troy, which discharge to the Potlatch River or associated tributaries and estuaries.

In-stream *E. coli* bacteria samples were collected at established monitoring sites throughout the Potlatch River watershed on a bi-weekly basis from December 26, 2001, through December 10, 2002. Additional *E. coli* samples were collected every three to five days over 30-day periods in 2003 and 2004 to evaluate compliance with the geometric mean criterion. This data has been used for calculating existing in-stream bacteria concentrations.

An assessment of the *E. coli* bacteria geometric mean criterion is not available for the West Fork Little Bear Creek. Analysis of the samples obtained during the monitoring season (bi-weekly) indicate that the potential to exceed the state water quality standard existed during the 2001-2002 monitoring season. Since the state water quality standard for *E. coli* bacteria is a geometric mean concentration that is applicable year-round, the load allocation for West Fork Little Bear Creek is based on a geometric mean of 126 cfu/100 ml. *E. coli* bacteria concentrations measured in-stream are highly variable and dependent on activities occurring within the watershed. Therefore, the existing load and the load reductions required by this TMDL will be based on actual measured concentrations found in the future. The loading analysis may be revised in the future when monitoring data is generated.

In-stream Water Quality Target

In water bodies designated for contact recreation, *E. coli* levels are not to exceed 126 colony forming units per 100 milliliters of solution (cfu/100 ml) as a 30-day geometric mean (IDAPA 58.01.02.251.01 and 02).

A single water sample exceeding either instantaneous criterion (406 cfu/100 ml for primary contact recreation and 576 cfu/100 ml for secondary) does not in itself constitute a violation of water quality standards; additional samples must be taken and the results compared against the 30-day geometric mean criterion (IDAPA 58.01.02.251.02).

The in-stream target used to calculate the load capacity, load allocations, and required load reductions for this bacteria TMDL is based on the Idaho geometric mean criterion of 126 cfu/100 ml as measured from samples taken every three to seven days over a 30-day/calendar month period. Waste load allocations are based on a maximum instantaneous limit of 406 cfu/100 ml and the 126 cfu/100 ml geometric mean concentration currently allowed by Idaho water quality standards.

Table 21. Water bodies and associated pollutants for which TMDLs have been developed.

Stream Name	Extent	WBID & AU#(s)	Control Point	Pollutants[1]
Potlatch River	Big Bear Cr. to Clearwater R	ID17060306CL044_06	PTR-1	Temp, Sed,
Potlatch River	Corral Cr. to Big Bear Cr	ID17060306CL045_05	PTR-3	Temp
Potlatch River	Moose Cr. to Corral Cr.	ID17060306CL048_04 ID17060306CL048_05	PTR-12	Temp
Potlatch River	Headwaters to Moose Cr.	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	PTR-19	Temp, Bac
Boulder Creek	Pig Cr. to Potlatch R.	ID17060306CL047_03	PTR-20	Bac, Temp
Cedar Creek	Leopold Cr. to Potlatch R.	ID17060306CL046_04	PTR-11	Temp, Sed
Corral Creek	Headwaters to Potlatch R.	ID17060306CL054_02 ID17060306CL054_03	PTR-13	Temp
Big Bear Creek	WF Big Bear Cr. to Potlatch R.	ID17060306CL056_04 ID17060306CL056_05	PTR-8	Bac, Temp,
Moose Creek	Headwaters. to Potlatch R.	ID17060306CL053_02 ID17060306CL053_03	PTR-17	Temp, Bac
Pine Creek	Headwaters to Potlatch R.	ID17060306CL055_02 ID17060306CL055_03	PTR-10	Temp, Nut, Sed
Ruby Creek	Unnamed trib. 3.4 km upstream to EF Potlatch R.	ID17060306CL052_03	PTR-14	Temp, Bac
EF Potlatch River	Ruby Cr. to Potlatch R.	ID17060306CL051_04	PTR-15	Temp
West Fork Little Bear Creek	Headwaters to Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03	PTR-6	Sed, Nut, Bac
Middle Potlatch Creek	Headwaters to Potlatch R.	ID17060306CL062_02 ID17060306CL062_03	PTR-4	Temp, Bac, Sed

[1]Temp=Temperature; Sed=Sediment; Bac=E. coli Bacteria; Nut=Nutrients

Design Conditions

All sources of *E. coli* bacteria upstream of monitoring sites where violations of the geometric mean criterion were observed will be provided an allocation based on the load capacity calculated at that site. Nonpoint source load allocations are based on the load capacities calculated for each water body segment between monitoring sites (i.e., Potlatch River-Headwaters to Moose Creek) or as a gross allocation to the whole subwatershed (i.e., Middle Potlatch Creek). Wasteload allocations are based on a maximum instantaneous limit and a 30-day geometric mean concentration currently allowed in Idaho state water quality standards. Load reductions that may be needed are based on the percent difference between the existing load and allocation.

Load Capacity

The load capacity is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a margin of safety to account for any uncertainty are calculated within the load capacity. The margin of safety accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The load capacity is based on existing uses within the watershed.

A required part of the loading analysis is that the load capacity be based on critical conditions– the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions.

The *E. coli* bacteria load capacity for the six water bodies where violations of the geometric mean criterion were observed are calculated using the geometric mean of 126 cfu/100 ml based on samples taken every three to five days over a 30-day period. The load capacity is expressed as a concentration (# cfu/100 ml) because it is more applicable for implementation.

A daily instantaneous maximum limit of 406 cfu/100 ml is applied to five permitted facilities in this TMDL, not to exceed 126 cfu/100 ml as a geometric mean, based on samples taken every three to five days over a 30-day period/calendar month period.

Estimates of Existing Pollutant Loads

Regulations allow that nonpoint source loads "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source.

Table 22 shows the existing geometric mean concentration (cfu/100 ml) by month from each NPDES facility based on discharge monitoring reports for the year 2005. Data pertaining to *E. coli* in discharge monitoring reports from the Bovill and Kendrick facilities for 2005 were not available. Table 23 shows the existing *E. coli* bacteria concentrations for various water bodies or river segments where violations of Idaho's geometric mean criterion were observed.

Table 22. Geometric mean E. coli bacteria concentrations for WWTP facilities.

Date	Deary (cfu/100 ml)[a]	Bovill	Kendrick	Juliaetta (cfu/100 ml)	Troy (cfu/100 ml)
January	4.1	NA[b]	NA	11	18.6
February	16.3	NA	NA	3.3	2
March	<1	NA	NA	3	18.4
April	16.7	NA	NA	2.9	9.6
May	1.5	NA	NA	NA	9.2
June	2.2	NA	NA	2.4	2
July	28	NA	NA	<2	3
August	No Discharge	NA	NA	NA	4.6
September	8.7	NA	NA	2	<3
October	67.2	NA	NA	4.6	<3
November	185.9	NA	NA	2.2	3
December	43.6	NA	NA	4	11.4

[a]cfu/100 ml = Colony forming units per 100 milliliters of solution based on a minimum of 5 samples over a 30-day period

[b]NA=Not Available

Table 23. Geometric mean *E. coli* bacteria concentrations measured in-stream.

WBID & AU #	Water Body Name	Existing Load (cfu/100 ml)[a]
ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Potlatch River	289
ID17060306CL047_03	Boulder Creek	544
ID17060306CL056_04	Big Bear Creek	712
ID17060306CL053_02 ID17060306CL053_03	Moose Creek	554
ID17060306CL052_03	Ruby Creek	212
ID17060306CL061_02 ID17060306CL061_03	West Fork Little Bear Creek	Not Available
ID17060306CL062_02 ID17060306CL062_03	Middle Potlatch Creek	798

[a]cfu/100 ml = Colony forming units per 100 milliliters of solution based on a minimum of 5 samples over a 30-day period

Load and Waste Load Allocations

E. coli bacteria are living organisms that have an associated die-off rate. The die-off rate fluctuates with varying water quality and atmospheric conditions (U.S.EPA 2001). Flow, stream temperature, and other environmental factors determine the actual number of bacteria in the water and complicate the load allocation process because of the continuous fluctuation of flow and temperature that occurs during any given time period. To account for such variability, in this TMDL, *E. coli* bacteria allocations are expressed in terms of the geometric mean criterion of 126 cfu/100 ml.

E. coli bacteria load and waste load allocations have been developed for specific tributaries, a mainstem river segment of the Potlatch River, and five municipal wastewater treatment plant facilities and applied to control points at the monitoring sites which provided the data used to develop the load and waste load allocations (Tables 24 and 25). In-stream load allocations apply to all sources of *E. coli* bacteria upstream of each control point. Waste load allocations apply as an instantaneous maximum limit and to any 30-day/calendar month period when effluent discharge occurs.

Bacteria load allocations have been developed for Boulder Creek, ID17060306CL047_03, with an allocation provided to a control point at PTR-20; West Fork Little Bear Creek, ID17060306CL061_03, with an allocation provided to a control point at site PTR-6; Big Bear Creek, ID17060306CL056_05, with an allocation provided to a control point at PTR-8; Middle Potlatch Creek, ID17060306CL062_03, with an allocation provided to a control point at PTR-4; the Potlatch River headwaters to Moose Creek segment, ID17060306CL049_04, with an allocation provided to a control point at PTR-12; and Ruby Creek, ID17060306CL052_03, with an allocation provided to a control point at PTR-14. Waste load allocations have been developed for five wastewater treatment facilities (Deary, Bovill, Kendrick, Juliaetta, and Troy) that discharge to the Potlatch River or associated tributaries and estuaries.

Margin of Safety

The establishment of a TMDL requires that a margin of safety (MOS) be identified to account for uncertainty. An MOS is expressed as either an implicit or explicit portion of a water body’s loading capacity that is reserved to allow for uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. The MOS is not allocated to any sources of a pollutant.

An implicit MOS has been incorporated into the bacteria TMDL by utilizing the state’s water quality criteria for contact recreation beneficial uses. Development of the load capacity and allocations is in accordance with Idaho Water Quality Standards, where the geometric mean target concentration for *E. coli* bacteria was used and allocated to any 30-day time period for nonpoint sources. Similarly, waste load allocations are in accordance with an allowable instantaneous maximum limit and a maximum 30-day concentration of *E. coli* bacteria in each facility’s effluent flow.

Table 24. Nonpoint Source *E. coli* bacteria allocations.

Water Body Name	WBID & AU#	Existing Load (cfu/100 ml)[a]	30-day Load Capacity (cfu/100 ml)	30-day Load Allocation (cfu/100 ml)	Load Reduction (%)
Potlatch River	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	289	126	126	56
Boulder Creek	ID17060306CL047_03	544	126	126	77
Big Bear Creek	ID17060306CL056_04	712	126	126	82
Moose Creek	ID17060306CL053_02 ID17060306CL053_03	554	126	126	77
Ruby Creek	ID17060306CL052_03	212	126	126	41
West Fork Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03	Not Available	126	126	Not Available
Middle Potlatch Creek	ID17060306CL062_02 ID17060306CL062_03	798	126	126	84

[a]cfu/100 ml = Colony forming units per 100 milliliters of solution based on a minimum of 5 samples over a 30-day period

Table 25. *E coli* bacteria wasteload allocations for NPDES permitted facilities.

WWTP Facility	Instantaneous Maximum Capacity (cfu/100 ml)	30-day Load Capacity (cfu/100 ml)	Instantaneous Maximum Load Allocation (cfu/100 ml)	30-day Load Allocation (cfu/100 ml)
Deary	406	126	406	126
Bovill	406	126	406	126
Kendrick	406	126	406	126
Juliaetta	406	126	406	126
Troy	406	126	406	126

Critical Time Period

The *E. coli* bacteria load allocation applies annually to any 30-day period since contact recreation may occur at any time of year. The wasteload allocations apply both instantaneously and to any 30-day period when discharges from the facilities occur. Table 26 shows the critical time period for bacteria.

Table 26. Critical time period for the *E. coli* bacteria TMDL.

Pollutant	Critical Period
E. coli Bacteria	**Year Round**

5.2 Nutrient TMDL

The Potlatch River and associated tributaries are designated by the state of Idaho for cold water aquatic life and contact recreation beneficial uses, or have cold water aquatic life and contact recreation as an existing beneficial use. Idaho's nutrient standard states that surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. Excessive nutrients affect dissolved oxygen and impair aquatic life beneficial uses due to the growth and decomposition cycle of algae feeding on the nutrients and the biochemical oxygen demand as ammonia is transformed to nitrate-nitrogen. An in-stream dissolved oxygen concentration of 6.0 mg/L is required by Idaho's water quality standards for protection of aquatic life beneficial uses.

A nutrient TMDL that addresses total phosphorus has been developed for Pine Creek based on violations of Idaho's dissolved oxygen criterion of no less than 6.0 mg/L, the limiting nutrient analysis discussed in Section 2.4, and the stream flows measured in Pine Creek during monitoring completed for the development of this TMDL.

The magnitude of diurnal fluctuation in dissolved oxygen concentrations for Pine Creek is unknown. It's assumed that diurnal fluctuations to levels below the criterion are likely during the low summer flow period as discussed in Section 2.4. The low dissolved oxygen concentration measured is most likely affected by low flows, elevated stream temperatures, and algal growth cycles.

A nutrient TMDL that addresses total inorganic nitrogen (TIN) has been developed for West Fork Little Bear Creek based on violations of Idaho's dissolved oxygen criterion of 6.0 mg/L, the limiting nutrient analysis discussed in Section 2.4, and the stream flows measured in West Fork Little Bear Creek.

Currently, the nutrient data shows the West Fork Little Bear Creek to be nitrogen-limited based on the 6.8:1 TIN:OP ratio. Future monitoring to track and evaluate the performance of nitrogen load reductions should include monitoring to determine whether the reduction in nitrogen causes the N:P ratio to shift.

In-Stream Water Quality Target

In order to prevent nuisance algae growth and dissolved oxygen problems, the Environmental Protection Agency developed a national guideline for streams of 0.100 mg/L total phosphorus (EPA 1986). More recently, the Environmental Protection Agency developed a nutrient criterion for total phosphorus of 0.030 mg/L specific to Columbia Plateau subecoregion 10 reference streams (EPA 2000). The recommended subecoregion 10 criterion represents reference conditions for arid geographic areas of the Columbia Plateau. The Pine Creek watershed does not exhibit the same climate, soils, or vegetative features of the arid subecoregion 10 reference streams.

The total phosphorus target of 0.100 mg/L has been applied in this TMDL. The target is within the range identified by EPA (1986) as supporting beneficial uses of free-flowing streams and rivers. Other regional nutrient TMDLs in the Palouse River and Clearwater River Watersheds addressing total phosphorus have applied this target for restoration and protection of designated beneficial uses. Reducing stream phosphorus concentration to below 0.100 mg/L should reduce aquatic plant growth while enhancing dissolved oxygen concentrations in Pine Creek.

The in-stream water quality target of 3.0 mg/L TIN developed in Section 2.4 has been applied to develop the nutrient TMDL for West Fork Little Bear Creek during the critical flow period when flows approximate 1.5 cfs or less. In 2006 and 2007, the critical flow period occurred from June through October.

Design Conditions

A critical low flow period for Pine Creek is considered to extend from June through September and coincides with water temperature increases. Nutrient loading, solar heat, and low flows impact the amount of dissolved oxygen in the stream during this period. As flows decrease, the amount of aeration decreases and reduces the amount of dissolved oxygen in the water. Oxygen is less soluble in water at higher temperatures. As water temperatures increase, the ability for oxygen to dissolve in water decreases. The solubility capacity of dissolved oxygen, or the quantity of molecular oxygen that can dissolve at 100 % saturation given a certain water temperature, increases as a result of cooler water temperatures. The temperature TMDL included in Section 5.4 will augment the nutrient TMDL for Pine Creek and enhance the solubility capacity of the creek during the critical low flow summer period.

In-stream total phosphorus samples were collected from the Potlatch River monitoring network on a bi-weekly basis from December 26, 2001, through December 10, 2002. A cumulative total phosphorus load by day has been assigned to assessment unit ID17060306CL055_03 for the months of June through September. Monitoring site PTR-10 will be used as a control point at the mouth of Pine Creek. This control point will be used for long term monitoring to determine compliance with this nutrient TMDL. The allocation will apply as a gross allowance to all sources upstream of the control point.

In-stream dissolved oxygen concentrations are significantly dependent on the volume of water in a stream during the summer months as the ability to assimilate pollutants decreases. Data collected by the Idaho Association of Soil Conservation Districts in 2006 near control point PTR-6 shows that when West Fork Little Bear Creek stream flows were less than approximately 1.5 cfs, dissolved oxygen measurements below 6.0 mg/L were recorded. This correlation is used to identify the critical low flow period, (below approximately 1.5 cfs), which occurred June through October in 2006 and 2007. This is the period when it is critical to reduce TIN loading in order to maintain dissolved oxygen concentrations at desired levels. A TIN allocation has been developed for assessment unit ID17060306CL061_03 at the control point approximately 200 yards downstream of PTR-6, based on TIN data collected from June through October 2006 and 2007. The allocation will apply as a gross allowance to all sources upstream of the control point.

Load Capacity

The total phosphorus load capacity for Pine Creek has been developed for the months of June through September using flow and total phosphorus data collected during June through September 2002. The load capacity was estimated using the target concentration multiplied by the average daily flow. Background loads are included as part of the loading capacity. To account for uncertainties used to develop the calculations, 10% margin of safety was subtracted from the load capacity to produce an available load capacity (Table 27).

The nitrogen (TIN) load capacity for the West Fork Little Bear Creek has been developed for the critical flow period, considered to be June through October based on its occurrence in the months of June through October 2006 and 2007, using flow and TIN data. The load capacity was estimated using the target concentration multiplied by the daily flow. Background loads were included as part of the load capacity. To account for uncertainties about the dynamic relationships between in-stream parameters, a 10% margin of safety was subtracted from the load capacity to produce an available load capacity.

Estimates of Existing Pollutant Load

For Pine Creek, the existing average daily load was estimated by multiplying the average concentration of total phosphorus by the average measured flow from June through September. Table 27 shows the estimated existing total phosphorus loads for Pine Creek. The equation below describes how the estimated existing load in kilograms per day (Kg/day) was generated.

For West Fork Little Bear Creek, the existing daily load was estimated by multiplying the concentration of TIN by the measured flow occurring during the 2006 and 2007 critical flow period of June through October in West Fork Little Bear Creek. Table 28 shows the existing TIN loads occurring in 2006 and 2007. The equation below describes how the existing load in kilograms per day (Kg/day) was generated.

Eq. 1 $$\text{Existing load (Kg/day)} = \frac{\text{daily concentration (mg/L)} * \text{daily flow (cfs)} * 5.39}{2.2}$$

Load Allocations

The total phosphorus load allocation for Pine Creek is presented in Table 27. The nonpoint source loading analyses were developed by calculating the average daily flow from June through late September by the average daily total phosphorus concentration for the same period. In-stream allocations were developed for the control point at monitoring site PTR-10, based on total phosphorus data collected from June through September 2002.

Table 27 lists the existing total phosphorus concentrations measured at site PTR-10, the load allocation, and the reduction in total phosphorus by day that must occur to meet the load allocation at the control point. The nutrient TMDL allocates 0.176 Kg/day to all nonpoint sources of total phosphorus upstream from the control point at monitoring site PTR-10. As such, sources extending upstream from this location must be managed to reduce the in-stream total phosphorus load from June through September by approximately 31%.

Table 27. Total Phosphorus load allocation for Pine Creek at PTR-10.

Stream Name	Average daily flow (cfs)[1]	Average Daily TP Concentration (mg/L)	Load Capacity (Kg/day)	Margin of Safety (Kg/day)	Load Allocation (Kg/day)	Existing load (Kg/day)	Required Load Reduction (%)
Pine Creek	0.8	0.131	0.196	0.020	0.176	0.257	31

[1]June through September

Nutrient Waste load Allocation for West Fork Little Bear Creek

The TIN waste load allocation (WLA) for West Fork Little Bear Creek is presented in Table 28. The source loading analyses for the critical flow periods occurring in 2006 and 2007 were developed by calculating the daily flow from June through October by the daily TIN concentration for the same period. In-stream allocations are developed for the control point approximately 200 yards downstream of PTR-6, based on TIN data collected from June through October 2006 and 2007.

Table 28 lists the existing TIN concentrations measured near site PTR-6, the allocation, and the reduction in TIN per day that must occur to meet the allocation at the control point. The nutrient TMDL allocates TIN in Kg/day to the city of Troy upstream from the control point near site PTR-6. Figure 22 illustrates the flow-based TIN allocation under various stream flow conditions in West Fork Little Bear Creek. A flow-based allocation should be used to determine the TIN allocation as stream flows fluctuate during critical flow periods.

Table 28. Total inorganic nitrogen waste load allocation for West Fork Little Bear Creek, near PTR-6.

Date	TIN (mg/L)	Flow (cfs)	Existing Load (Kg/day)	Load Capacity (Kg/day)	MOS (Kg/day)	WLA (Kg/day)	Required Reduction (Kg/day)
6/28/2006	3.3	1.372	11.09	10.08	1.01	9.08	2.02
7/12/2006	10.3	0.897	22.64	6.59	0.66	5.93	16.70
7/25/2006	17.4	0.468	19.95	3.44	0.34	3.10	16.86
8/9/2006	19.6	0.298	14.31	2.19	0.22	1.97	12.34
8/24/2006	NA[1]	0.246	NA	1.81	0.18	1.63	NA
9/7/2006	21.5	0.242	12.75	1.78	0.18	1.60	11.15
9/20/2006	15.1	0.435	16.09	3.20	0.32	2.88	13.22
10/6/2006	17.8	0.552	24.07	4.06	0.41	3.65	20.42
10/20/2006	8.7	1.772	37.77	13.02	1.30	11.72	26.05
6/13/2007	2.37	1.863	10.82	13.69	1.37	12.32	0.00
7/11/2007	16.6	1.378	56.04	10.13	1.01	9.12	46.93
7/25/2007	22.9	0.522	29.29	3.84	0.38	3.45	25.83
8/6/2007	17.16	0.301	12.65	2.21	0.22	1.99	10.66
8/23/2007	14.05	0.276	9.50	2.03	0.20	1.83	7.67
9/13/2007	17.05	0.233	9.73	1.71	0.17	1.54	8.19
10/11/2007	15	0.134	4.92	0.98	0.10	0.89	4.04

[1]NA=Not Available

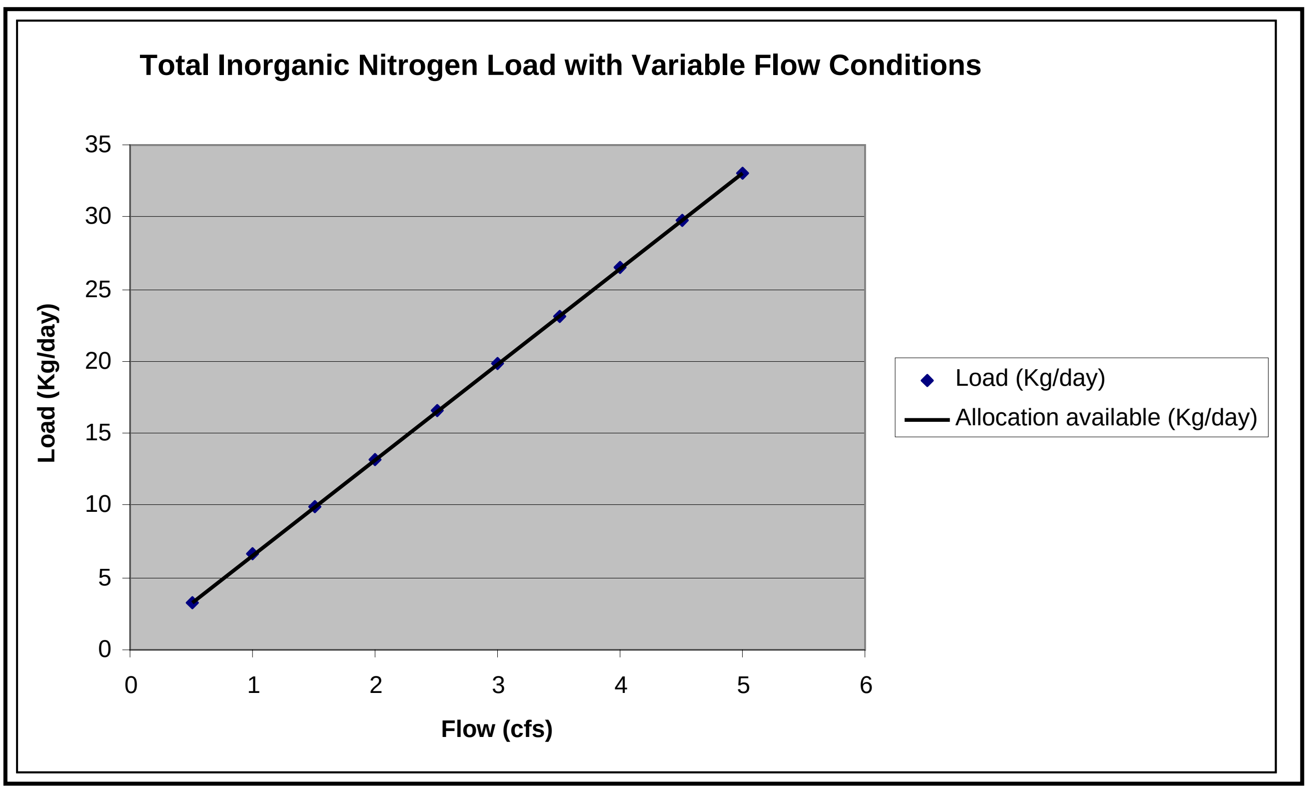

Figure 22. Total Inorganic Nitrogen Allocation under Various Stream Flows in West Fork Little Bear Creek

The West Fork Little Bear Creek is not currently listed as a 303(d) stream. The City of Troy operates a WWTP and discharges effluent to the West Fork of Little Bear Creek under the authority of an NPDES permit based on best available technology limits. Currently, the available water quality data and stream flow data is not adequate to develop separate load and waste load allocations. Additional data needs to be generated and considered in any future effluent discharge limitations included in future NPDES permits for the City of Troy's wastewater treatment facility's discharge.

As part of the watershed monitoring plan used to generate data for this TMDL, DEQ established two monitoring sites on West Fork Little Bear Creek in 2001, one above the WWTP and one just below the plant's effluent outfall pipe. The proximity of the lower monitoring site to the outfall pipe does not allow for complete mixing of the effluent with the receiving water and the data collected is more representative of the effluent and not considered to be representative of the receiving water. Data from this lower site may be valuable to the City of Troy as they continue to manage the WWTP, but is not appropriate for listing the stream, or for calculating a separate load and waste load allocation for the West Fork Little Bear Creek near site PTR-6. In 2006, the Idaho Association of Soil Conservation Districts and the Idaho Department of Agriculture located a second monitoring site approximately 200 yards further downstream to collect in-stream water samples that better represent in-stream receiving water quality conditions.

Dissolved oxygen data collected from West Fork Little Bear Creek during the period of April 11, 2006 through October 11, 2007 is significantly different than the data collected during the period of December 27, 2001, through December 12, 2002. A comparison between the results of samples collected during the 2006/2007 sampling period and results of samples collected during the 2001/2002 period, to determine if dissolved oxygen concentrations are consistent and continuous, is not possible since the sampling site was relocated in 2006/2007. A comparison between the two data sets does show significant differences in measured dissolved oxygen concentrations. Only one sample taken in the 2001/2002 period had a measured level below the critical level of 6.0 mg/l, while approximately 50% of the samples taken during the 2006/2007 period had measured levels below the critical level.

The interim TIN flow-based target included in this TMDL is calculated using flow data collected during the 2006/2007 sampling period when the Potlatch River and the West Fork of Little Bear Creek recorded severe drought conditions and are thought to have had stream flows below normal historic levels. NPDES-permitted effluent limitations are typically calculated using the lowest 7-day flow within a 10-year period (7Q10) for the receiving water. Flows recorded during the 2001/2002 and 2006/2007 are not considered to reflect normal in-stream flows and should not be used to determine a 7Q10 flow for West Fork Little Bear Creek.

The City of Troy is committed to protecting the beneficial uses of West Fork Little Bear Creek. The City of Troy has only recently been made aware of the water quality concerns in West Fork Little Bear Creek. The City will obtain additional stream flow, dissolved oxygen, and nutrient data that will be used to identify, develop, and implement an appropriate process strategy to ensure the City's effluent is adequately treated and does not adversely impair the beneficial uses of the West Fork of Little Bear. Water quality data will be collected on a continuous basis beginning with the next NPDES permit cycle scheduled for 2009. The data will be evaluated on a 5-year cycle concurrent with applicable NPDES permit cycles, allowable NPDES permit compliance schedules, and Idaho's required TMDL review cycles. The foremost objective of the monitoring is to develop a 7Q10 flow based on in-stream flow measurements for determination of effluent limitations included in any future NPDES permit issued to the City for discharges into the West Fork of Little Bear Creek. Since this is a water quality based effluent limitation, the NPDES permit issued subsequent to the 2009 permit will need to recognize an allowable 5-year compliance schedule. This schedule will allow the City of Troy and the NPDES permit program to collect water quality and flow data spanning a period of 10 years, or two 5-year permit cycles, which is considered to be minimally adequate to establish a 7Q10 flow for calculation of effluent limitations for nutrients.

Margin of Safety

An explicit margin of safety of 10% was deducted from the load capacity to determine the nutrient allocations for both water bodies. The allocations reflect a seasonally conservative estimate since the loading capacity is based on the summer period when stream flow volume decreases significantly. The explicit deduction accounts for uncertainties about the relationship between physical, chemical, and hydrological factors such as higher ambient air and water temperatures, length of day, and decreased stream flows during the summer growing season, which influence aquatic plant growth cycles, biochemical oxygen demand, and in-stream dissolved oxygen.

Critical Time/Flow Period

The critical time period for in-stream dissolved oxygen in Pine Creek coincides with the critical low flow summer period (June through September). No additional nutrient loading, and specifically a reduction in total phosphorus, should occur beginning in early June through late September. In-stream flows decrease and in-stream temperatures increase during this period, affecting aquatic vegetation growth, and subsequently, dissolved oxygen.

The critical flow period for in-stream dissolved oxygen in West Fork Little Bear Creek was observed to be approximately 1.5 cfs or less. During the 2006 and 2007 monitoring season, the critical flow period occurred during June through October. No additional nutrient loading, should occur, and specifically a reduction in TIN, should occur beginning at flows at or below 1.5 cfs.

5.3 Sediment (TSS) TMDL

Target

Sediment criteria found in Idaho Water Quality Standards (IDAPA 58.01.02) is narrative, meaning there is not a numeric value used to assess whether a water body is in compliance

with standards. Instead, the standard states sediment shall be limited to a quantity that does not impair beneficial uses.
The most available water column sediment data for application in this TMDL are reported in terms of total suspended solids (TSS). A total suspended solids target for sediment has been taken from the *Guide to Selection of Sediment Targets for Use in Idaho TMDLs* (DEQ 2003).

The effects of sediment on the most sensitive designated beneficial use in the Potlatch River watershed, aquatic life, are dependent on concentration and duration of exposure (DEQ 2003). Guidance developed by DEQ for application of the narrative sediment criteria for protection of aquatic life beneficial uses suggests that a sediment target incorporate both concentration and duration of exposure, not only to properly protect aquatic life, but also to allow for episodic spikes that can occur naturally with spring runoff or heavy precipitation events. The TSS (sediment) target is set at a level such that the Potlatch River and tributaries will not exceed the estimated load capacity supportive of a good fishery.

Sediment TMDLs were developed for control points where target concentrations were measured at levels above the load capacity. The targets used to develop the loading calculations are a monthly average of 50 mg/L TSS with a maximum daily limit of 80 mg/L to allow for natural variability. The average monthly target and the maximum daily limit are within the range identified by the European Inland Fisheries Advisory Commission and the Committee on Water Quality Criteria from the Environmental Studies Board of the National Academy of Science and National Academy of Engineers as supporting a moderate fishery (DEQ 2003). Additionally, these targets are consistent with targets applied in other sediment TMDLs addressing TSS in the Lower Clearwater Subbasin.

Load Capacity

The TSS load capacities are the product of the target concentration and flow. The load capacity for TSS is based on the in-stream load that would be present when the target concentration is met. For example, the maximum daily target for Middle Potlatch Creek is 80 mg/L TSS, not to exceed 50 mg/L as a monthly average. The load capacity is based on a maximum daily limit of 80 mg/L TSS throughout the stream multiplied by the daily flow, not to exceed a monthly average of 50 mg/L. Concentrations exceeding these target capacities require a load reduction. The equations below show how the maximum daily and average monthly load capacities were developed for the WWTP facilities.

Eq. 2 Load Capacity (lbs/day) = maximum daily limit (mg/L) * estimated design flow (mgd) * 8.34

Eq. 3 Load Capacity (lbs/day) = average monthly limit (mg/L) * estimated design flow (mgd) * 8.34

Where: mgd = million gallons per day
8.34 = conversion factor (converts results to pounds per day)

For Example:

Using *Eq.2* Load Capacity (lbs/day) = 80 mg/L * 0.05 mgd * 8.34 = 33.4 lbs/day

Using *Eq.3* Load Capacity (lbs/day) = 45 mg/L * 0.05 mgd * 8.34 = 18.8 lbs/day

Estimates of Existing Pollutant Loads

Current National Pollution Discharge Elimination System (NPDES) permits for the cities of Deary, Bovill, Kendrick, Juliaetta, and Troy allow for the discharge of TSS (http://yosemite.epa.gov/r10/water.nsf/2fb9887c3bbafaaf88256b5800609bf0/2978a2d617a53f36882568790059bd3c!OpenDocument). Effluent discharge of TSS as an average weekly and monthly limit based on permit allowances, and estimated design flows, are shown in Table 29. Monitoring requirements for TSS in the current NPDES permits require one grab sample per month; therefore, daily TSS concentrations in the effluent discharge from the five facilities are unknown. Estimates of existing loads are based on amounts of sediment measured during monitoring and recorded flows or averages of recorded flows.

Table 29. Allowable discharge limits of TSS for NPDES permitted facilities.[a]

WWTP Facility	Estimated Design Flow (mgd [b])	Average Monthly Limit (mg/L)	Average Weekly Limit (mg/L)
Deary	0.23	44	66
Bovill	0.05	45	65
Kendrick	0.08	45	65
Juliaetta	0.08	30	45
Troy	0.19	30	45

[a]Based on current NPDES permits for each facility
[b]mgd= million gallons per day

Load and Wasteload Allocations

Sediment TMDLs allocate a gross concentration to all sources of sediment upstream of control points on each tributary and upstream of the control point on the mainstem Potlatch River. Sediment TMDLs have been developed for the Potlatch River, ID17060306CL044_06, with an allocation provided to a control point at PTR-1; Middle Potlatch Creek, ID17060306CL062_03, with an allocation provided to a control point at PTR-4; West Fork Little Bear Creek, ID 17060306CL061_03, with an allocation provided to a control point at PTR-6; Pine Creek, ID17060306CL055_03, with an allocation provided to a control point at PTR-10; and Cedar Creek, ID17060306CL046_04, with an allocation provided to a control point at PTR-11 (Tables 30 through 39).

The load analysis for site PTR-1 utilized both measured flows and estimated flow values because of so many missing flow measurements (i.e. when in-stream flows are highest). Estimated flow values were obtained from the Palouse River USGS gage station because the USGS site below Little Potlatch was not yet established. An analysis looking at the relationship between in-stream flows at the Palouse River and Potlatch River USGS gage stations is shown in Figure 23.

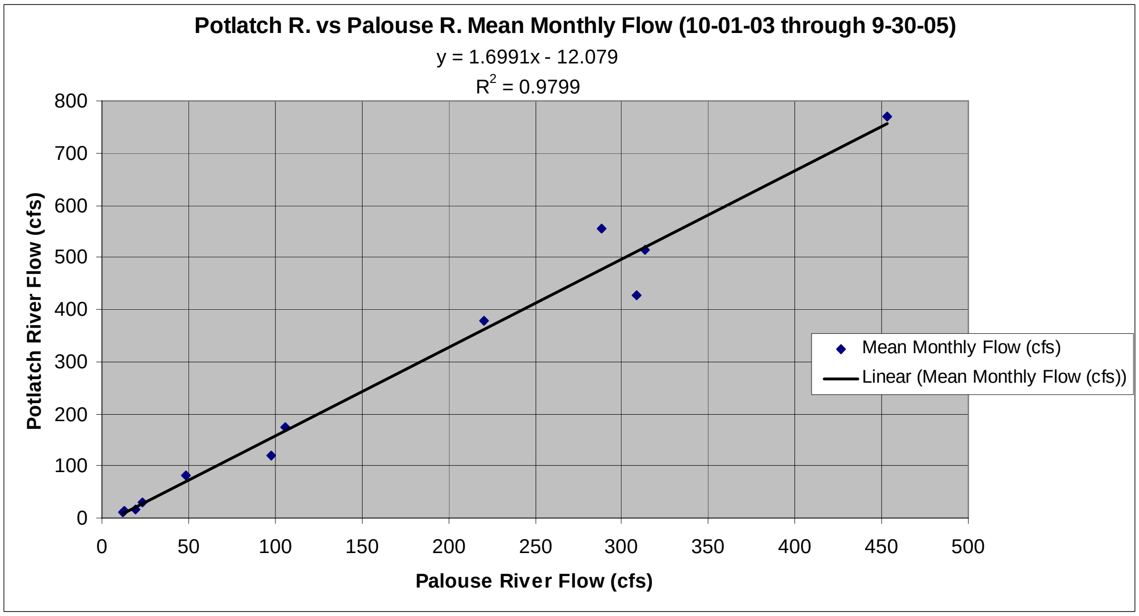

Figure 23. Potlatch River and Palouse River Mean Monthly Flows (10-01-03 through 9-30-05)

Waste load allocations were developed for Deary, Bovill, Kendrick, Juliaetta, and Troy WWTP facilities based on the estimated design flow times the maximum daily limit and current allowable average monthly concentrations (Table 40).

The cities of Kendrick and Juliaetta discharge to "estuaries" which enter the mainstem Potlatch River in assessment unit 44_06. A TMDL has been developed for this assessment unit. The city of Troy discharges to West Fork Little Bear Creek (61_03). A TMDL has been developed for this assessment unit. The city of Deary discharges to Mount Deary Creek (56_02), a tributary to Big Bear Creek. A TMDL was not developed for Big Bear Creek. A TMDL was not developed for assessment unit 48_04, which receives the city of Bovill's discharge, but waste load allocations are applied with the intent to ensure that the maximum daily limit and the average monthly load capacity is not exceeded. No load reduction is required for this river segment.

Specific nonpoint source loads of TSS were not monitored. It is assumed that the existing in-stream TSS loads are generated by the land uses or other combinations of activities occurring upstream from each monitoring point.

Table 30. Daily TSS load allocation for Potlatch River at the mouth (site PTR-1).

Date	TSS Concentration (mg/L)	Measured Flow (cfs)	Mean Flow (cfs)*	Flow (cfs) (Palouse R.)**	Existing Load (lbs/day)	Load Capacity (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/17/01	3	241.13	234	275	3,899.1	103,975.3	93,577.7	0
1/22/02	1	NA	598	140	754.6	60,368.0	54,331.2	0
1/30/02	2	NA	1,930	275	2,964.5	118,580.0	106,722.0	0
2/25/02	21	NA	831	1,460	165,257.4	629,552.0	566,596.8	0
3/6/02	3	467.5	436	348	7,559.5	201,586.0	181,427.4	0
3/12/02	606	NA	711	3,430	11,203,546.2	1,479,016.0	1,331,114.4	88.1
3/20/02	35	NA	593	1,050	198,082.5	452,760.0	407,484.0	0.0
4/8/02	11	NA	525	1,690	100,200.1	728,728.0	655,855.2	0.0
4/15/02	131	NA	363	4,660	3,290,379.4	2,009,392.0	1,808,452.8	45.0
5/14/02	4	548.9	282	559	11,834.3	236,685.7	213,017.1	0
5/29/02	4	380.6	954	444	8,205.7	164,114.7	147,703.2	0
6/10/02	3	159.9	132	159	2,585.6	68,948.9	62,054.0	0
6/24/02	1	77.1	48	65	415.6	33,245.5	29,921.0	0
7/2/02	1	60	34	46	323.4	25,872.0	23,284.8	0
7/29/02	1	7.7	6.6	12	41.5	3,320.2	2,988.2	0
8/6/02	1	11.9	4.1	12	64.1	5,131.3	4,618.2	0
9/9/02	1	12.2	8.4	7	65.8	5,260.6	4,734.6	0

*Mean daily flow for the Potlatch River gage station (USGS 13341570) below Little Potlatch Creek (10-01-03 through 9-30-05)

** Measured flow at the Palouse River gage station (USGS 13345000) near Potlatch, Idaho

Table 31. Monthly TSS load allocation for site Potlatch River at the mouth (site PTR-1).

Month	Existing Load (lbs/month)	Flow (cfs)*	Load Capacity (lbs/month)	Load Allocation (lbs/month)	Required Load Reduction (%)
January	91,683.9	378.0	4,889,808.0	4,400,827.2	0
February	1,883,255.2	554.6	7,174,305.6	6,456,875.0	0
March	26,731,193.0	768.9	9,946,490.4	8,951,841.4	67
April	4,894,222.4	426.3	5,514,616.8	4,963,155.1	0
May	3,818,028.1	513.3	6,640,048.8	5,976,043.9	0
June	38,290.6	118.4	1,531,622.4	1,378,460.2	0
July	2,765.1	17.1	221,205.6	199,085.0	0
August	1,633.2	10.1	130,653.6	117,588.2	0
September	2,360.8	14.6	188,865.6	169,979.0	0
October	NA	30.2	390,667.2	351,600.5	NA
November	NA	82.9	1,072,394.4	965,155.0	NA
December	84,989.5	175.2	2,266,387.2	2,039,748.5	0

*Mean monthly flow based on period from 10-01-03 through 9-30-05

Table 32. Daily TSS load allocation for Middle Potlatch Creek at the mouth (site PTR-4).

Date	TSS Concentration (mg/L)[1]	Flow (cfs)	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/26/2001	BDL (< 4.0)	4.672	75.5	2,014.6	201.5	1,813.1	0.0
1/7/2002	48	82.702	21,396.7	35,661.1	3,566.1	32,095.0	0.0
1/22/2002	4	22.272	480.2	9,603.7	960.4	8,643.3	0.0
2/4/2002	BDL (< 4.0)	18.014	291.3	7,767.6	776.8	6,990.9	0.0
2/19/2002	8	58.683	2,530.4	25,304.1	2,530.4	22,773.7	0.0
3/4/2002	BDL (< 4.0)	24.379	394.2	10,512.2	1,051.2	9,461.0	0.0
3/18/2002	BDL (< 4.0)	61.611	996.2	26,566.7	2,656.7	23,910.0	0.0
4/1/2002	9	55.044	2,670.2	23,735.0	2,373.5	21,361.5	0.0
4/14/2002	150	189.977	153,596.4	81,918.1	8,191.8	73,726.3	52.0
5/1/2002	BDL (< 4.0)	2.608	42.2	1,124.6	112.5	1,012.1	0.0
5/13/2002	BDL (< 4.0)	5.044	81.6	2,175.0	217.5	1,957.5	0.0
5/28/2002	4	3.486	75.2	1,503.2	150.3	1,352.8	0.0
6/10/2002	BDL (< 4.0)	2.411	39.0	1,039.6	104.0	935.7	0.0
6/24/2002	BDL (< 4.0)	1.656	26.8	714.1	71.4	642.7	0.0
7/8/2002	BDL (< 4.0)	1.266	20.5	545.9	54.6	491.3	0.0
7/23/2002	BDL (< 4.0)	0.926	15.0	399.3	39.9	359.4	0.0
8/5/2002	BDL (< 4.0)	0.52	8.4	224.2	22.4	201.8	0.0
8/19/2002	BDL (< 4.0)	0.382	6.2	164.7	16.5	148.2	0.0
9/2/2002	BDL (< 4.0)	0.421	6.8	181.5	18.2	163.4	0.0
9/18/2002	BDL (< 4.0)	0.521	8.4	224.7	22.5	202.2	0.0
10/1/2002	BDL (< 4.0)	0.692	11.2	298.4	29.8	268.6	0.0
10/15/2002	BDL (< 4.0)	0.8	12.9	345.0	34.5	310.5	0.0
10/29/2002	BDL (< 4.0)	1.509	24.4	650.7	65.1	585.6	0.0
11/12/2002	BDL (< 4.0)	1.656	26.8	714.1	71.4	642.7	0.0
11/25/2002	BDL (< 4.0)	1.962	31.7	846.0	84.6	761.4	0.0
12/10/2002	BDL (< 4.0)	2.141	34.6	923.2	92.3	830.9	0.0

[1]=A concentration of 3 mg/L TSS was used in place of BDL values to compute the loading analyses

Table 33. Monthly TSS load allocation for Middle Potlatch Creek at the mouth (site PTR-4).

Month	TSS Concentration (mg/L)	Flow	Existing Load (lbs/month)	Load Capacity (lbs/month)	MOS (lbs/month)	Load Allocation (lbs/month)	Required Load Reduction (%)
January	26.0	52.5	220,665.8	424,357.4	42,435.7	381,921.7	0.0
February	6.0	38.3	37,205.7	310,047.6	31,004.8	279,042.9	0.0
March	3.0	43.0	20,856.9	347,614.6	34,761.5	312,853.1	0.0
April	79.5	122.5	1,574,890.9	990,497.4	99,049.7	891,447.7	43.4
May	3.3	3.7	1,981.1	30,016.9	3,001.7	27,015.2	0.0
June	3.0	2.0	986.5	16,440.8	1,644.1	14,796.8	0.0
July	3.0	1.1	531.7	8,861.2	886.1	7,975.0	0.0
August	3.0	0.5	218.8	3,646.3	364.6	3,281.7	0.0
September	3.0	0.5	228.5	3,808.0	380.8	3,427.2	0.0
October	3.0	1.0	485.3	8,087.7	808.8	7,278.9	0.0
November	3.0	1.8	877.5	14,625.8	1,462.6	13,163.2	0.0
December	3.0	3.4	1,652.5	27,541.6	2,754.2	24,787.4	0.0

Table 34. Daily TSS load allocation for Pine Creek at the mouth (site PTR-10).

Date	TSS Concentration (mg/L)[1]	Flow (cfs)	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/26/2001	BDL (< 4.0)	9.753	157.7	4,205.5	420.5	3,784.9	0.0
1/7/2002	26	59.6	8,352.3	25,699.5	2,570.0	23,129.6	0.0
1/22/2002	BDL (< 4.0)	37	598.3	15,954.4	1,595.4	14,359.0	0.0
2/4/2002	BDL (< 4.0)	20.3	328.3	8,753.4	875.3	7,878.0	0.0
2/19/2002	BDL (< 4.0)	30.7	496.4	13,237.8	1,323.8	11,914.1	0.0
3/4/2002	BDL (< 4.0)	23	371.9	9,917.6	991.8	8,925.8	0.0
3/18/2002	BDL (< 4.0)	148.2	2,396.4	63,903.8	6,390.4	57,513.5	0.0
4/1/2002	BDL (< 4.0)	88.523	1,431.4	38,171.1	3,817.1	34,354.0	0.0
4/18/2002	BDL (< 4.0)	31.94	516.5	13,772.5	1,377.3	12,395.3	0.0
4/29/2002	BDL (< 4.0)	9.472	153.2	4,084.3	408.4	3,675.9	0.0
5/13/2002	BDL (< 4.0)	6.478	104.7	2,793.3	279.3	2,514.0	0.0
5/28/2002	BDL (< 4.0)	2.436	39.4	1,050.4	105.0	945.4	0.0
6/10/2002	BDL (< 4.0)	3.96	64.0	1,707.6	170.8	1,536.8	0.0
6/24/2002	BDL (< 4.0)	0.992	16.0	427.8	42.8	385.0	0.0
7/9/2002	BDL (< 4.0)	0.622	10.1	268.2	26.8	241.4	0.0
7/23/2002	BDL (< 4.0)	0.346	5.6	149.2	14.9	134.3	0.0
8/6/2002	4	0.156	3.4	67.3	6.7	60.5	0.0
8/19/2002	BDL (< 4.0)	0.023	0.4	9.9	1.0	8.9	0.0
9/2/2002	BDL (< 4.0)	0.143	2.3	61.7	6.2	55.5	0.0
9/18/2002	BDL (< 4.0)	0.162	2.6	69.9	7.0	62.9	0.0
10/1/2002	BDL (< 4.0)	0.089	1.4	38.4	3.8	34.5	0.0
10/15/2002	15	0.249	20.1	107.4	10.7	96.6	0.0
10/29/2002	BDL (< 4.0)	0.328	5.3	141.4	14.1	127.3	0.0
11/12/2002	BDL (< 4.0)	0.431	7.0	185.8	18.6	167.3	0.0
11/25/2002	BDL (< 4.0)	0.338	5.5	145.7	14.6	131.2	0.0
12/10/2002	5	0.642	17.3	276.8	27.7	249.1	0.0
12/2/2003	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
12/16/2003	BDL (< 4.0)	NA	NA	NA	NA	NA	NA

Date	TSS Concentration (mg/L)[1]	Flow (cfs)	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
1/7/2004	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
1/22/2004	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
2/3/2004	100	NA	NA	NA	NA	NA	20 mg/L[2]
2/17/2004	BDL (< 4.0)	NA	NA	NA	NA	NA	NA

[1]=A concentration of 3 mg/L TSS was used in place of BDL values to compute the loading analyses
[2]=Load Reduction is expressed as a concentration because of missing flow data

Table 35. Monthly TSS load allocation for Pine Creek at the mouth (site PTR-10).

Month	TSS Concentration (mg/L)	Flow (cfs)	Existing Load (lbs/month)	Load Capacity (lbs/month)	MOS (lbs/month)	Load Allocation (lbs/month)	Required Load Reduction (%)
January	8.8	48.3	2,291.0	390,505.5	39,050.6	351,455.0	0.0
February	27.3	25.5	3,752.2	206,167.5	20,616.8	185,550.8	0.0
March	3.0	85.6	1,384.2	692,076.0	69,207.6	622,868.4	0.0
April	3.0	43.3	700.3	350,174.8	35,017.5	315,157.3	0.0
May	3.0	4.5	72.1	36,034.8	3,603.5	32,431.4	0.0
June	3.0	2.5	40.0	20,018.5	2,001.8	18,016.6	0.0
July	3.0	0.5	7.8	3,913.1	391.3	3,521.8	0.0
August	3.5	0.1	1.7	723.6	72.4	651.2	0.0
September	3.0	0.2	2.5	1,233.0	123.3	1,109.7	0.0
October	9.0	0.2	10.8	1,794.9	179.5	1,615.4	0.0
November	3.0	0.4	6.2	3,108.7	310.9	2,797.8	0.0
December	3.0	5.2	84.0	42,021.8	4,202.2	37,819.6	0.0

Table 36. Daily TSS load allocation for Cedar Creek at the mouth (site PTR-11).

Date	TSS Concentration (mg/L)[1]	Flow (cfs)	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/26/2001	BDL (< 4.0)	8.161	132.0	3,519.0	351.9	3,167.1	0.0
1/7/2002	260	245	343,343.0	105,644.0	10,564.4	95,079.6	72.3
1/22/2002	BDL (< 4.0)	28.5	460.8	12,289.2	1,228.9	11,060.3	0.0
2/4/2002	BDL (< 4.0)	18	291.1	7,761.6	776.2	6,985.4	0.0
2/19/2002	5	50.2	1,352.9	21,646.2	2,164.6	19,481.6	0.0
3/4/2002	BDL (< 4.0)	60	970.2	25,872.0	2,587.2	23,284.8	0.0
3/18/2002	5	107	2,883.7	46,138.4	4,613.8	41,524.6	0.0
4/1/2002	16	103.871	8,957.8	44,789.2	4,478.9	40,310.3	0.0
4/18/2002	10	49.178	2,650.7	21,205.6	2,120.6	19,085.0	0.0
4/29/2002	BDL (< 4.0)	10.877	175.9	4,690.2	469.0	4,221.1	0.0
5/13/2002	BDL (< 4.0)	13.503	218.3	5,822.5	582.2	5,240.2	0.0
5/28/2002	BDL (< 4.0)	5.42	87.6	2,337.1	233.7	2,103.4	0.0
6/10/2002	4	6.572	141.7	2,833.8	283.4	2,550.5	0.0
6/24/2002	BDL (< 4.0)	1.523	24.6	656.7	65.7	591.0	0.0
7/8/2002	6	1.3	42.0	560.6	56.1	504.5	0.0
7/23/2002	BDL (< 4.0)	0.481	7.8	207.4	20.7	186.7	0.0
8/6/2002	BDL (< 4.0)	0.379	6.1	163.4	16.3	147.1	0.0
8/19/2002	BDL (< 4.0)	0.267	4.3	115.1	11.5	103.6	0.0
9/2/2002	6	0.248	8.0	106.9	10.7	96.2	0.0
9/18/2002	5	0.341	9.2	147.0	14.7	132.3	0.0
10/1/2002	6	0.182	5.9	78.5	7.8	70.6	0.0
10/15/2002	BDL (< 4.0)	0.421	6.8	181.5	18.2	163.4	0.0
10/29/2002	BDL (< 4.0)	0.398	6.4	171.6	17.2	154.5	0.0
11/13/2002	7	0.432	16.3	186.3	18.6	167.7	0.0
11/25/2002	BDL (< 4.0)	0.513	8.3	221.2	22.1	199.1	0.0

Date	TSS Concentration (mg/L)[1]	Flow (cfs)	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/10/2002	BDL (< 4.0)	0.982	15.9	423.4	42.3	381.1	0.0
12/2/2003	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
12/16/2003	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
1/22/2004	BDL (< 4.0)	NA	NA	NA	NA	NA	NA
2/3/2004	530	NA	NA	NA	NA	NA	450 mg/L[2]
2/17/2004	10	NA	NA	NA	NA	NA	NA

[1]=A concentration of 3 mg/L TSS was used in place of BDL values to compute the loading analyses

[2]=Load Reduction is expressed as a concentration because of missing flow data

Table 37. Monthly TSS load allocation for Cedar Creek at the mouth (site PTR-11).

Month	TSS Concentration (mg/L)	Flow (cfs)	Existing Load (lbs/month)	Load Capacity (lbs/month)	MOS (lbs/month)	Load Allocation (lbs/month)	Required Load Reduction (%)
January	89.0	136.8	1,968,010.3	1,842,706.3	184,270.6	1,658,435.6	15.7
February	137.0	34.1	755,413.9	275,698.5	27,569.9	248,128.7	67.2
March	4.0	83.5	54,007.8	1,125,162.5	112,516.3	1,012,646.3	0.0
April	10.0	54.6	88,356.1	441,780.6	44,178.1	397,602.5	0.0
May	3.0	9.5	4,589.8	127,493.7	12,749.4	114,744.3	0.0
June	3.5	4.0	2,290.7	32,724.0	3,272.4	29,451.6	0.0
July	4.5	0.9	648.0	11,999.5	1,199.9	10,799.5	0.0
August	3.0	0.3	156.7	2,611.5	261.1	2,350.3	0.0
September	5.5	0.3	261.9	3,968.4	396.8	3,571.5	0.0
October	4.0	0.3	215.8	2,697.7	269.8	2,427.9	0.0
November	5.0	0.5	382.0	6,366.9	636.7	5,730.2	0.0
December	3.0	4.6	2,217.6	36,960.6	3,696.1	33,264.5	0.0

Table 38. Daily TSS load allocation for West Fork Little Bear Creek (site PTR-6).

Date	TSS Concentration (mg/L)[1]	Flow (cfs)*	Existing Load (lbs/day)	Load Capacity (lbs/day)	MOS (lbs/day)	Load Allocation (lbs/day)	Required Load Reduction (%)
12/27/2001	3	5.155	83.4	2,222.8	222.3	2,000.6	0.0
1/8/2002	88	100	47,432.0	43,120.0	4,312.0	38,808.0	18.2
1/24/2002	3	24.085	389.5	10,385.5	1,038.5	9,346.9	0.0
2/5/2002	5	16.703	450.1	7,202.3	720.2	6,482.1	0.0
2/20/2002	10	25.176	1,357.0	10,855.9	1,085.6	9,770.3	0.0
3/6/2002	24	25.321	3,275.5	10,918.4	1,091.8	9,826.6	0.0
3/19/2002	14	50.741	3,828.9	21,879.5	2,188.0	19,691.6	0.0
4/2/2002	31	100	16,709.0	43,120.0	4,312.0	38,808.0	0.0
4/17/2002	25	73	9,836.8	31,477.6	3,147.8	28,329.8	0.0
5/1/2002	8	50.486	2,177.0	21,769.6	2,177.0	19,592.6	0.0
5/16/2002	5	25.316	682.3	10,916.3	1,091.6	9,824.6	0.0
5/29/2002	5	22.698	611.7	9,787.4	978.7	8,808.6	0.0
6/14/2002	4	7.52	162.1	3,242.6	324.3	2,918.4	0.0
6/26/2002	5	2.908	78.4	1,253.9	125.4	1,128.5	0.0
7/11/2002	3	0.845	13.7	364.4	36.4	327.9	0.0
7/25/2002	13	0.069	4.8	29.8	3.0	26.8	0.0
8/8/2002	6	0.188	6.1	81.1	8.1	73.0	0.0
8/20/2002	13	0.072	5.0	31.0	3.1	27.9	0.0
9/4/2002	40	0.061	13.2	26.3	2.6	23.7	0.0
9/20/2002	43	0.064	14.8	27.6	2.8	24.8	0.0
10/3/2002	35	0.036	6.8	15.5	1.6	14.0	0.0
10/14/2002	19	0.032	3.3	13.8	1.4	12.4	0.0
10/30/2002	14	0.111	8.4	47.9	4.8	43.1	0.0
11/14/2002	140	0.124	93.6	53.5	5.3	48.1	48.6
11/26/2002	10	0.464	25.0	200.1	20.0	180.1	0.0
12/12/2002	8	1.001	43.2	431.6	43.2	388.5	0.0

[1]=A concentration of 3.0 mg/L was used in place of BDL values to compute the loading analyses
*=Flow measurements were estimated for 1/8, 4/2, and 4/17 because of missing data

Table 39. Monthly TSS load allocation for West Fork Little Bear Creek (site PTR-6).

Date	TSS Concentration	Flow (cfs)	Existing Load (lbs/month)	Load Capacity (lbs/month)	MOS (lbs/month)	Load Allocation (lbs/month)	Required Load Reduction (%)
Jan	45.5	62.0	456,468.4	501,613.6	50,161.4	451,452.3	1.1
Feb	7.5	20.9	25,394.4	169,295.9	16,929.6	152,366.3	0.0
Mar	19.0	38.0	116,842.6	307,480.6	30,748.1	276,732.6	0.0
Apr	28.0	86.5	391,637.4	699,352.5	69,935.3	629,417.3	0.0
May	6.0	32.8	31,854.9	265,457.5	26,545.8	238,911.8	0.0
Jun	4.5	5.2	3,794.0	42,155.2	4,215.5	37,939.7	0.0
Jul	8.0	0.5	591.2	3,694.8	369.5	3,325.4	0.0
Aug	9.5	0.1	199.7	1,051.1	105.1	945.9	0.0
Sep	41.5	0.1	419.4	505.3	50.5	454.8	0.0
Oct	22.7	0.1	218.7	482.4	48.2	434.2	0.0
Nov	75.0	0.3	3,565.5	2,377.0	237.7	2,139.3	40.0
Dec	5.5	3.1	2,737.4	24,885.6	2,488.6	22,397.1	0.0

Table 40. TSS waste load allocations for NPDES permitted facilities in the Potlatch River watershed.

WWTP Facility	Assessment Unit	Maximum Daily Capacity (lbs/day)	Monthly Average Load Capacity (lbs/day)	Maximum Daily Allocation (lbs/day)	Monthly Average Allocation (lbs/day)
Deary	56_02	153.5	84.4	138.1	76.0
Bovill	48_04	33.4	18.8	30.1	16.9
Kendrick	44_06	53.4	30.0	48.1	27.0
Juliaetta	44_06	53.4	20.0	48.1	18.0
Troy	61_03	126.8	47.5	114.1	42.8

Margin of Safety

An explicit margin of safety of 10% of the target load was deducted from the load and waste load allocations to account for uncertainties about the relationship between in-stream dynamics and TSS concentrations.

Critical Time Period

The critical time period for TSS in the Potlatch River watershed occurs between January and April when TSS concentrations become elevated as the result of increasing stream flow and overland runoff. However, increased sediment loading can occur outside of this critical time period as the result of activities occurring within the sub-watersheds.

5.4 Temperature TMDL

In-stream Water Quality Target

The potential natural vegetation (PNV) method has been used to create the Potlatch River watershed temperature TMDL. Idaho Water Quality Standards, IDAPA 58.01.02.200.09, states: "When natural background conditions exceed any applicable water quality criteria set forth …., the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increased above natural background conditions when allowed under Section 401." In these situations, natural conditions are the water quality standard, and the natural level of shade and channel width are the TMDL target. The in-stream temperature which results from these conditions is consistent with the water quality standard, even though it may exceed numeric temperature criteria (DEQ 2004).

Potential Natural Vegetation for Temperature TMDLs

Ground water temperature, air temperature, and direct solar radiation are important contributors to stream temperature (Poole and Berman 2001). Shade and stream morphology affect or control the amount of solar radiation reaching a stream. They are the natural stream conditions most likely to be impaired by anthropogenic activities, and the two that can be readily corrected. The amount of solar radiation reaching the stream may be reduced by restoring the stream bank, vegetation, and channel to more natural conditions.

Vegetation outside the riparian corridor can provide shade if there is enough relief in the surrounding watershed; however, riparian vegetation provides the most substantial amount of shade. Effective shade is shade that exists as the sun makes its way across the sky. Effective shade is measured using optical equipment, similar to a fish eye lens on a camera, called a Solar Pathfinder. Effective shade can be modeled using detailed information about riparian plant communities, topography, and the stream's aspect. Riparian canopy cover is the vegetation that hangs over a stream and is measured using a densiometer or is estimated on site or on aerial photographs.

Potential natural vegetation (PNV) along a stream is the mature riparian plant community that would exist if it had not been disturbed or reduced—in some cases, it still does exist; in other cases, estimates must be made of what would have existed. The PNV is used as a temperature TMDL target because it provides a natural level of solar loading to the stream. A riparian plant community composed of less than PNV results in the stream heating up from excess solar radiation.

Existing shade was estimated for the Potlatch River watershed from aerial photos. The estimates were field-verified by measuring shade with a solar pathfinder at selected points in the watershed. PNV targets were determined from an analysis of probable vegetation in the watershed and comparison with shade curves developed for similar vegetation communities in other IDEQ TMDLs. A shade curve shows the relationship between effective shade and stream width. Shade decreases with width as the vegetation is less able to shade the center of a wide stream. Taller riparian vegetation allows shade to reach further across a stream channel.

Pathfinder Methodology

The solar pathfinder is a device used, at some point in a stream, to trace an outline of objects producing shade on the stream onto a specialized chart called the solar path chart. The percentage of the sun's path covered by these objects is the effective shade on the stream at the point where the tracing is made. In order to adequately characterize the effective shade on a reach of stream, 10 traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the solar pathfinder is placed in the middle of the stream at bankfull water level height and oriented to true south. Starting from a unique location, traces are then taken at fixed intervals proceeding upstream.

Aerial Photo Interpretation

Canopy coverage estimates are based on observation about the kind of vegetation present, its density, and the width of the stream. The typical vegetation type shows the kind of landscape a particular cover class usually falls into for a stream 5m wide or less.

Cover class	Typical vegetation type on 5m wide stream
0 = 0 – 9% cover	agricultural land, denuded areas
10 = 10 –19%	agricultural land, meadows, open areas, clearcuts
20 = 20 – 29%	agricultural land, meadows, open areas, clearcuts
30 = 30 – 39%	agricultural land, meadows, open areas, clearcuts
40 = 40 – 49%	shrublands/meadows
50 = 50 – 59%	shrublands/meadows, open forests
60 = 60 – 69%	shrublands/meadows, open forests
70 = 70 – 79%	forested
80 = 80 – 89%	forested
90 = 90 –100%	forested

The visual estimates of shade in this TMDL were field-verified with a solar pathfinder. The pathfinder measures effective shade and takes into consideration physical features other than vegetation that block the sun from hitting the stream surface (e.g., hillsides and canyon walls). The estimate of shade made visually from an aerial photo does not always take into account topography or any shading that may occur from physical features other than vegetation.

Stream Morphology

Measures of current bankfull width or near stream disturbance zone width may not reflect widths present under PNV. Width-to-depth ratios tend to increase and streams become wider and shallow as streams and riparian areas are disturbed. Channel width was not developed from the aerial photo work presented above. Bankfull width is estimated based on drainage area of the Clearwater River curve from Figure 24. Existing width is evaluated from available data. If the stream's existing width is wider than that predicted by the Clearwater River curve in Figure 24, then the Figure 24 estimate of bankfull width is used in the loading analysis. If existing width is smaller, then existing width is used in the loading analysis. On most of the smaller tributaries, existing widths are used. The larger, third and fourth order tributaries show the effects of upstream disturbances, with width to depth ratios that have increased and existing widths that are wider than those taken from the Clearwater River bankfull curve.

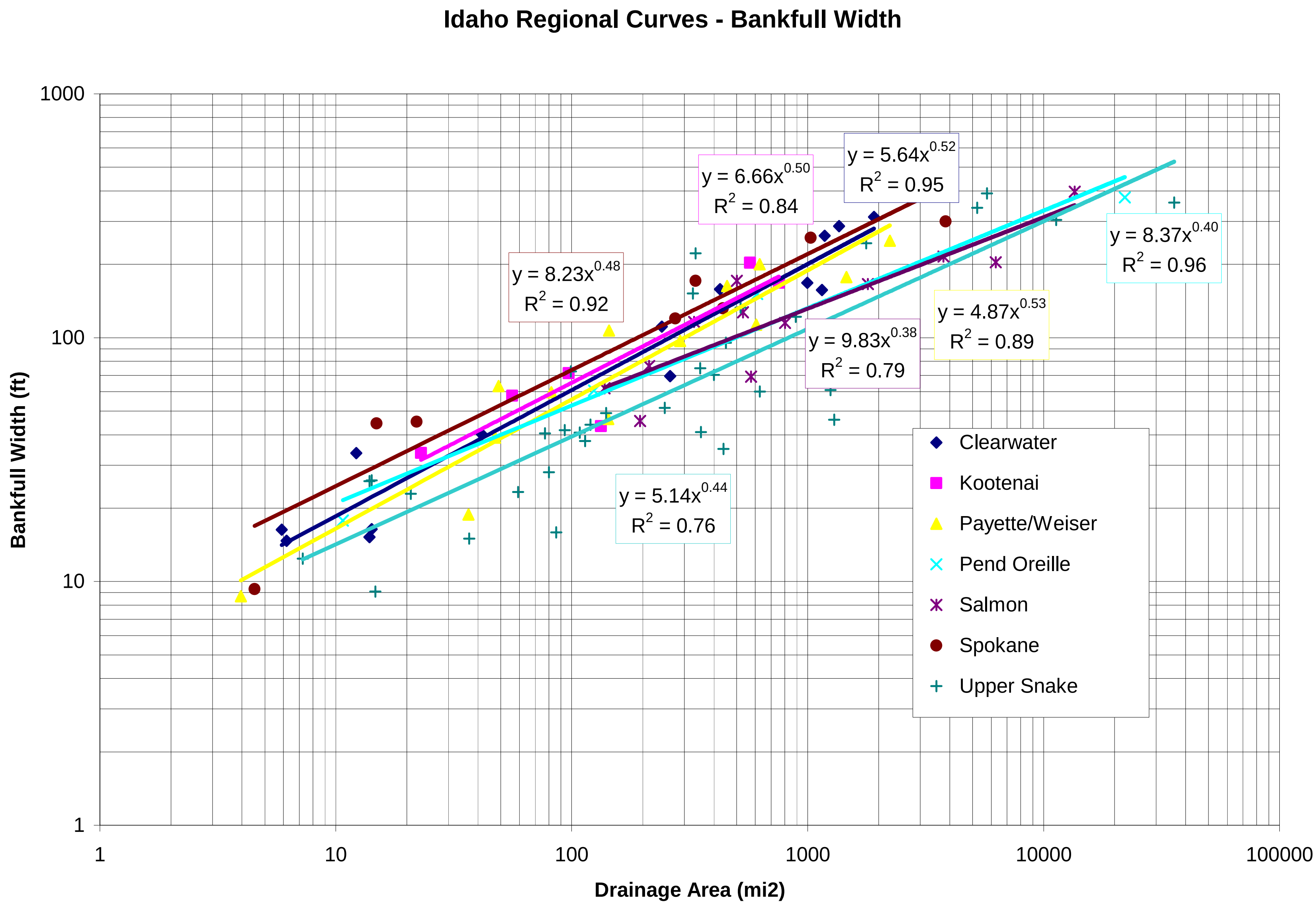

Figure 24. Bankfull Width as a Function of Drainage Area

Design Conditions

The natural vegetation of the upper Potlatch River region in Latah and Clearwater Counties, Idaho, can best be described as bunchgrass-dominated steppe of the Palouse Prairie where it meets the conifer forest. In 1846, Charles Geyer, an early botanist and explorer of the region, described the higher elevation grasslands of the Palouse region as bunchgrass prairie bordered by “spacious, open, grassy woods” of large widely-spaced Ponderosa pine in “elegant parks” dotted with seasonally wet “spongy meadows” or “gamass” (camas) (Weddell 2000). Later, I.I. Stevens, from performing railroad surveys for the Army in 1853-1855, wrote in 1860 that the Palouse region was “very fertile rolling country,” “a most beautiful prairie country, the whole of it adapted to agriculture,” “rolling table-land,” “comparable to that of the prairie of Illinois” (Weddell 2000). Stevens indicated that the bottomland of the Palouse “has great resources,” “it is heavily timbered with pine, but with very little underbrush” (Weddell 2000). Both of these explorers captured two very important images of the Palouse River region: the prairie steppe was extensively dominated by bunchgrasses, and valley bottoms and stream corridors may have been in open timber.

Rexford Daubenmire, one of the West’s best known plant ecologists, explained forest types for this region. His forest classification for northern Idaho and adjacent Washington (Daubenmire 1952) showed fescue grassland meeting forest in western Latah County. Weaver (1917), on the other hand, showed the entire Palouse River region east of the Idaho-Washington border as coniferous woodland (see Figure 1 of Weaver 1917). An Idaho fescue (*Festuca idahoensis*) /snowberry (*Symphoricarpus albus*) association (Franklin and Dryness 1973) probably dominated western Latah County near the Idaho border. How far north and east this vegetation type existed on the Palouse is perhaps debatable. Most authors suggest it occurred as far as Potlatch or even beyond, according to maps in Black et al. (1998).

Daubenmire (1952) described forest habitat types that vary with elevation and other factors such as soil type, moisture and aspect. He described several predominant zones of vegetation that roughly follow a moisture/elevation gradient. The Ponderosa pine zone occupies the lowest and driest zone, then, continuing up the elevational/moisture gradient, there is the Douglas fir (*Psuedotsuga menziesii*) zone, followed by the western redcedar (*Thuja plicata*)/ western hemlock (*Tsuga heterophylla*) zone, and finally the Engelmann spruce (*Picea engelmanni*)/subalpine fir (*Abies lasiocarpa*) zone. Franklin and Dryness (1973), in describing the forest zones of eastern Oregon and Washington, list seven forest zones with increasing elevation and moisture. Their list begins with western juniper forests not found in Idaho’s Latah County, then includes a Ponderosa pine zone, a lodgepole pine (*Pinus contorta*) zone, a Douglas fir zone, a grand fir (*Abies grandis*) zone, a western hemlock zone (with western redcedar), and finally a subalpine fir zone at the top. Black et al. (1998) described forest communities of the Palouse region on higher elevation mountain and ridges with warmer sites occupied by Ponderosa pine and Douglas fir with a rich understory of oceanspray (*Holodiscus discolor*), ninebark (*Physocarpus malvaceus*), serviceberry (*Amelanchier alnifolia*), snowberry, and rose (*Rosa sp.*) shrubs. On cooler northwest-facing canyons, western redcedar, grand fir, and western larch (*Larix occidentalis*) are supported.

In eastern Washington and presumably adjacent western Idaho, Ponderosa pine stands first appear within the matrix of steppe vegetation and increase in extent in wetter areas until steppe or shrub-steppe vegetation is reduced to mere islands in a matrix of Ponderosa pine forest (Franklin and Dryness 1973). Also, groves of aspen occur on riparian and poorly drained wet areas throughout the Ponderosa pine zone and adjacent forest/steppe zones as well (Franklin and Dryness 1973).

While much has been written about forest types in this region (Daubenmire 1952, Franklin and Dryness 1973), and about the historic steppe and shrub-steppe vegetation of the Palouse Prairie (Black et al. 1998, Weddell 2000, and Weddell 2001), little has been written to describe the vegetation in riparian areas of this region.

Weaver (1917) included wet meadow and floodplain forest types in his “hydrosere” classification system. He described dense thickets of trees and shrubs along streams. Larger streams that cut canyons into the basalt had narrow riparian forests while smaller streams that were intermittent did not cut canyons and thus were exposed to the wind, resulting in no woody vegetation in the riparian area. Weaver described small groves of poplars where aspens or even black cottonwoods were dominant. But by far the major riparian community type was one containing a mixture of alders, hawthorns, willows, serviceberry, and chokecherry. In some cases, alders were the dominant vegetation; in others, dense thickets of pure hawthorn and serviceberry became dominant. Weaver (1917) described wet meadows in both the mountains and the prairie. He listed a variety of wet meadow “types” including tufted hairgrass meadows, sometimes as pure stands, and others such as camas- and cow parsnip-dominated meadows.

Within the fescue/snowberry zone, moist draws were dominated by black hawthorn (*Crataegus douglasii*) (Black et al. 1998, Franklin and Dryness 1973, Weaver 1917). In fact, Franklin and Dryness (1973) describe two plant associations in these wet draws: a hawthorn/snowberry association and a hawthorn/cow-parsnip (*Heracleum lanatum*) association. These draws are dominated by 5- to 7-meter tall hawthorn and may include other shrubs such as shiny-leaf spirea (*Spiraea betulifolia*), Columbia hawthorn (*Crataegus columbiana*), chokecherry (*Prunus virginiana*), and serviceberry (*Amelanchier alnifolia*). Aspens (*Populus tremuloides*) occurred in phases in these hawthorn associations. Because aspen is short-lived, aspen suckers would grow up through the hawthorns, dominate for several years, and then die back, allowing hawthorns to predominate (Franklin and Dryness 1973).

There were two related riparian types briefly described by Daubenmire. They included a black cottonwood (*Populus trichocarpa*)/water-hemlock (*Cicuta douglasii*) association, which replaces hawthorn/cow-parsnip in drier portions of the steppe, and a white alder (*Alnus rhombifolia*) forest occurring in some riparian habitats, sometimes in association with black cottonwood (Franklin and Dryness 1973). Black et al. (1998) indicated that true riparian communities were largely limited to the Palouse and Potlatch Rivers. These communities were comprised of narrow gallery forests of plains cottonwood (*Populus deltoides*), aspens, mountain maple (*Acer glabrum*), and red alder (*Alnus rubra*).

There may have been some confusion on exact species over the years; however, the information clearly demonstrates that riparian areas, whether they were merely moist draws or river gallery forest, were dominated by tall shrubs and trees: hawthorns, aspens, cottonwoods, and alders. Remnants of these species can still be found in the riparian areas of the Potlatch River watershed. In terms of vegetation height, hawthorns and aspens are relatively small trees (4-20m), alders are of intermediate heights (10-25m), and cottonwoods can be very tall (25-30m). Vegetative cover over a small stream(less than 5 meters wide) typically vary from about 40-50% for mature hawthorn-dominated communities, to about 80-100% cover for mature alder-, aspen- and cottonwood-dominated communities.

The Potlatch River watershed, from headwaters to the mouth, was divided into four general riparian vegetation types:

1) *Conifer*—mixed conifer vegetation type at the headwaters where denser stands of Douglas fir, grand fir and cedar occur.
2) *Mountain Alder*— alders, hawthorns, red osier dogwoods, willows, and other mixed shrubs found in the upland meadows.
3) *Ponderosa Pine*—park-like stands of tall Ponderosa with an understory of ninebark, chokecherry and rose, found on the south facing break lands of the watershed.
4) *Black Cottonwood*—tall cottonwoods dominating an understory of deciduous shrubs, found in the bottomlands of the watershed.

Target Selection

Effective shade curves from existing temperature IDEQ TMDLs were used to determine potential natural vegetation (PNV) shade targets for the watershed. These TMDLs used vegetation community modeling to produce these shade curves. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Potlatch River watershed, curves for the vegetation types most similar to those identified above were selected for shade target determinations. Tables 41 through 44 contain the shade curves used for each of the four vegetation types. For each curve, the tables specify the shade percentages at various stream widths.

The effective shade calculations are based on a six month period from April through September. This time period coincides with the critical time period when temperatures affect beneficial uses such as spring and fall salmonids spawning, and when cold water aquatic life criteria may be exceeded during summer months. Late July and early August typically represent the period of highest stream temperatures. Solar gains can begin early in the spring and affect not only the highest temperatures reached later on in the summer, but also affect salmonid spawning temperatures in spring and fall. Thus, solar loading in these streams is evaluated from spring (April) to early fall (September).

Table 41. Shade curve values[a] for the Conifer vegetation type at various stream widths .

Conifer	Stream Width				
	1m	5m	10m	20m	30m
Douglas fir (DEQ 2003)	91	83	74	56	38

a. Curve values are percentages.

Table 42. Shade curve values[a] for the Ponderosa Pine vegetation type at various stream widths.

Ponderosa Pine	Stream Width				
	1m	5m	10m	20m	30m
Ponderosa pine (DEQ 2003)	92	74	60	38	11

a. Curve values are percentages.

Table 43. Shade curve values[a] for the Mountain Alder vegetation type at various stream widths.

Mountain Alder	Stream Width				
	1m	3m	5m	10m	15m
Mountain alder (DEQ 2008)	95	88	64	37	26

a. Curve values are percentages.

Table 44. Shade curve values[a] for the Black Cottonwood vegetation type at various stream widths.

Black Cottonwood	Stream Width					
	6m	17m-24m		26m-40m		42m-75m	
Black Cottonwood (DEQ 2008)	97	69	54	51	35	34	19

a. Curve values are percentages.

Load Capacity

A stream's load capacity based on PNV is the solar load allowed by the shade targets specified for the stream. The load is the solar load measured by a flat plate collector under full sun conditions for a given period of time multiplied by the fraction of the solar radiation that is not blocked by shade in a particular location during that same period of time. In other words, the solar load hitting the collector under full sun is considered to be 100%, so if a shade target is 60%, then the solar load hitting the stream under conditions meeting that target would be 40%.

Solar load data from a flat plate collector at the National Renewable Energy Laboratory weather station in Spokane were used for this TMDL. The solar loads used to calculate the shade target are spring and summer averages occurring between April and September. This period coincides with the time of year when stream temperatures are increasing and vegetation is growing. Tables in Appendix C show the PNV shade targets (Target or Potential Shade) and their corresponding potential summer loads (in kWh/m^2/day and kWh/day) that serve as the load capacities. Target shade is also visually illustrated, indicating the potential (target) percent shade for each stream segment on an aerial photo, in Figure 25.

Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the land use and area, but may be aggregated. Background loads should be distinguished from human-caused increases in nonpoint loads to the extent possible.

Existing loads in this temperature TMDL are estimates, derived from estimates of existing shade determined through aerial photo interpretations (Figure 26). Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat plate collector at the Spokane weather station. Existing shade estimates are presented in Appendix C. Like load capacities (potential loads), existing loads in Appendix C are presented both on an area basis (kWh/m^2/day) and as total loads (kWh/day).

Total load amounts are highly variable depending on the size of the stream. Large rivers that are wide have less shade than smaller, narrow streams. Thus, total potential loads on rivers are expected to be quite large. A large river may have a very large existing load, but require only a small increase in shade because its total load is expected to be much greater. Conversely, a small stream may have a small existing load in relation to larger streams, but its necessary increase in shade could be high because it has a small potential load to begin with.

Existing and potential/target/total loads in kWh/day can be summed for the entire stream or portion of stream examined in a single loading table. These total loads are shown at the bottom of their respective columns in each table in Appendix C. The difference between potential load and existing load is also summed for the entire table. If existing load exceeds potential load, this difference becomes the excess load to be discussed next in the load allocation section.

The excess load can also be expressed as the lack of shade. To calculate the lack of shade, the potential shade fraction is subtracted from the existing shade fraction for the individual stream segments or reaches. The lack of shade for individual reaches is summed and then divided by the number of segments to produce the average lack of shade for the entire stream (Table 45). If the average lack of shade shown is a negative number, this means that the shade averaged over the entire water body is less than the target. If the number is positive, this means that the shade averaged over the entire water body meets or exceeds the target. It is important to note that even if the average lack of shade calculated for a given water body is a positive number, it is still likely that individual reaches in that water body do not meet their individual shade targets and should still receive restoration treatment during the implementation phase of this TMDL.

In the loading tables, each vegetation type is highlighted in its own color to distinguish when and where the dominant vegetation type changes. Each of the four vegetation types have their own specific shade targets for each specific stream width, therefore the changes in highlighted color also help visually explain the changes in potential shade.

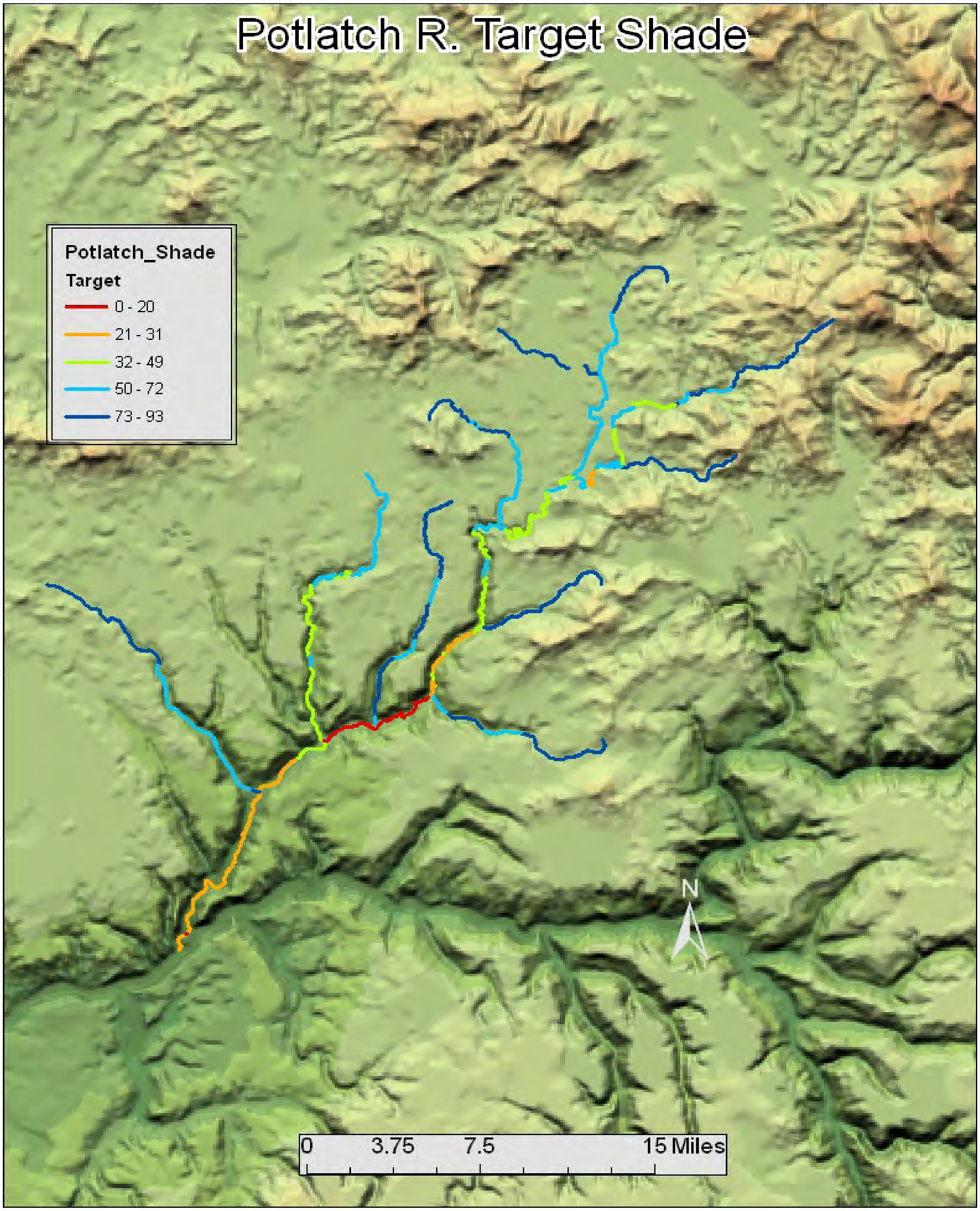

Figure 25. Percent Target Shade for Stream Segments in the Potlatch River Watershed Based on Regional Shade Curves

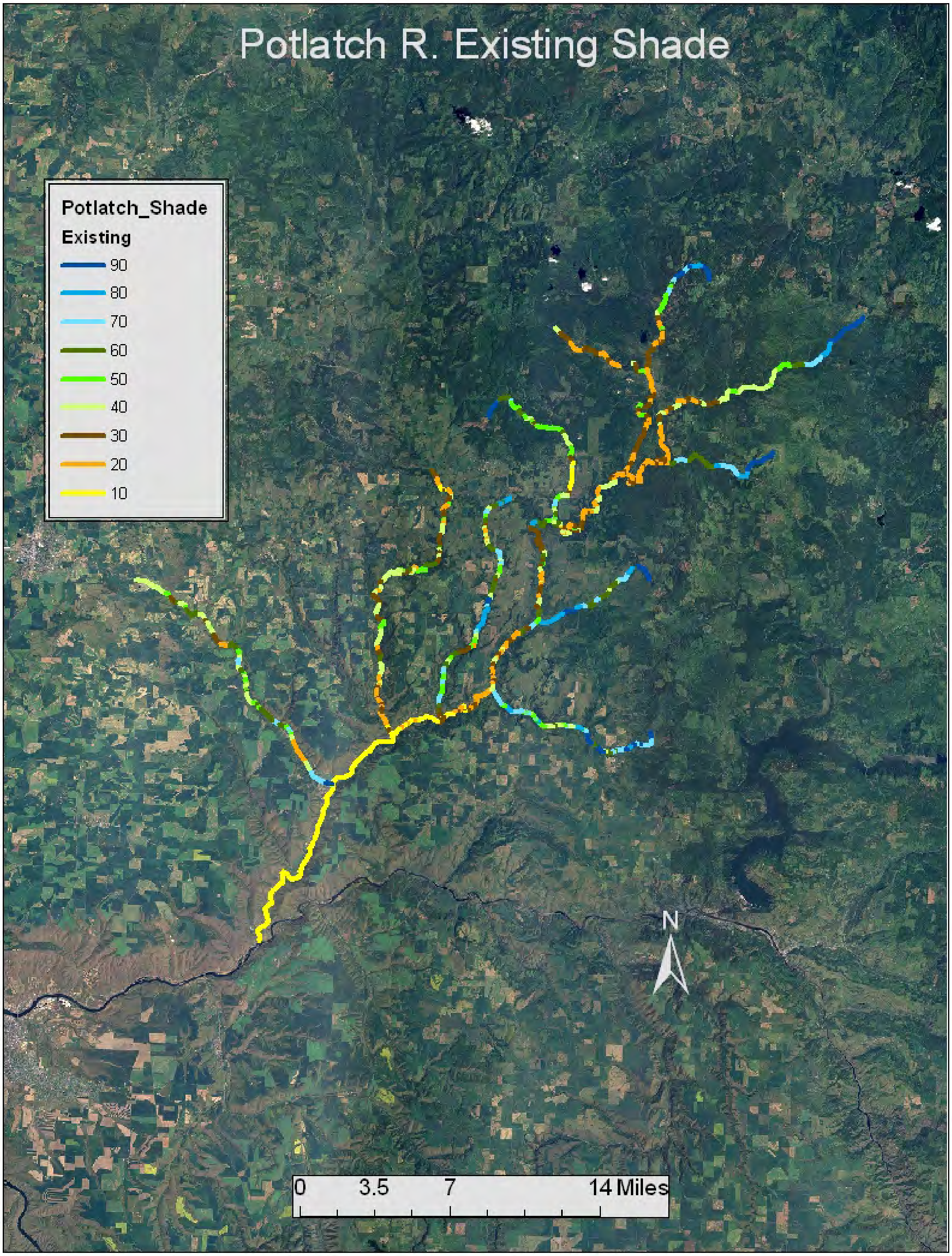

Figure 26. Percent Existing Shade for Stream Segments in the Potlatch River Watershed Based on Aerial Photo Interpretation

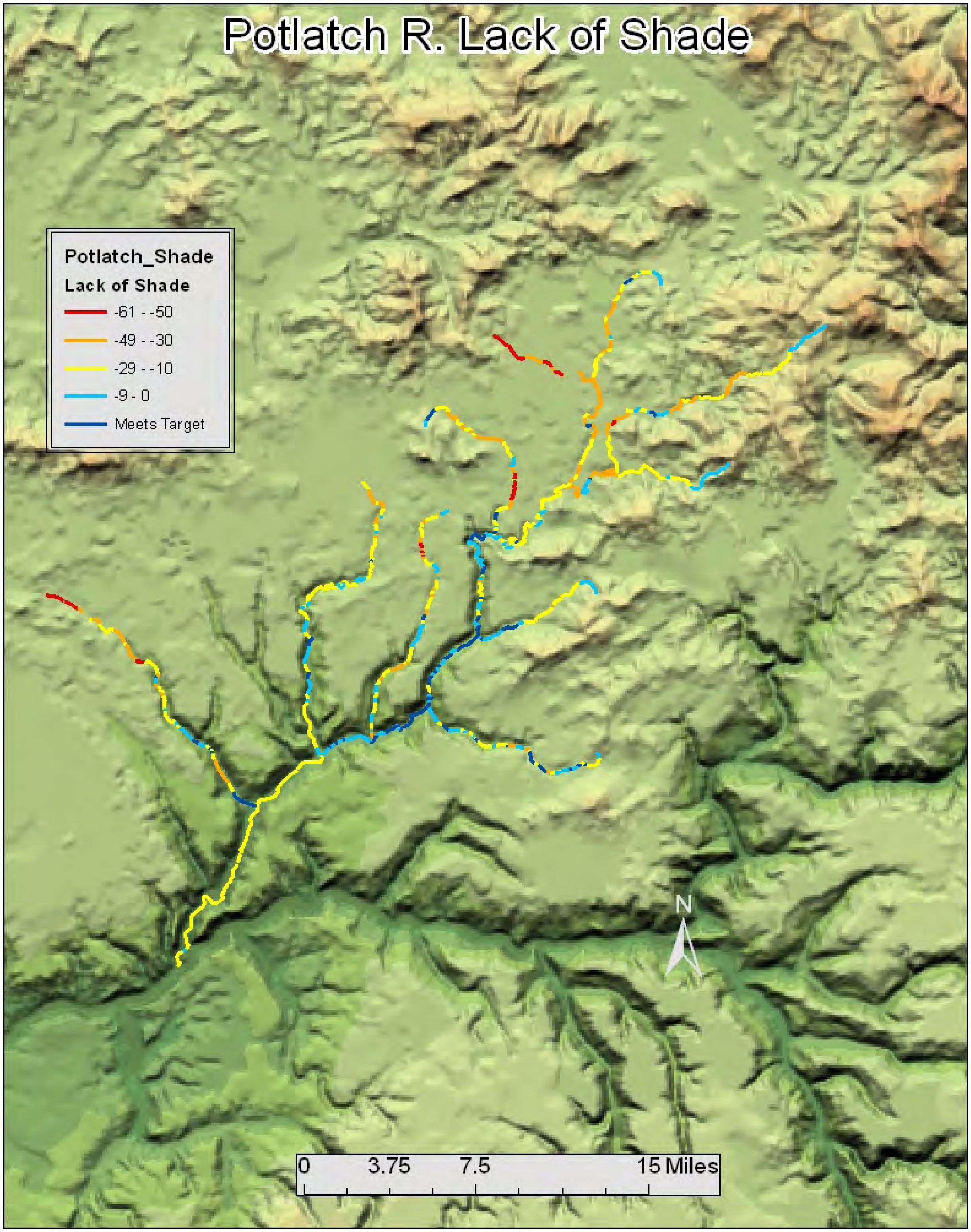

Figure 27. Percent Shade Change Required to meet Target for Stream Segments in the Potlatch River Watershed Based on Target Shade minus Existing Shade

Load Allocation

This TMDL is based on potential natural vegetation, which is equivalent to natural background loading. Although water bodies not listed for temperature in Idaho's 2002 integrated report (DEQ 2002) are not included in this analysis, it is necessary for all water bodies in the watershed to achieve PNV in order for natural background loading to occur. Compliance with the load allocation is achieved when natural background conditions are established. Load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade. Load allocations are therefore stream reach specific and are dependent upon the target load for a given reach.

The difference between existing shade and target shade (the Delta) is visually illustrated for each reach in Figure 27. Where the percentage in Figure 27 is expressed as a negative, this indicates the lack of shade or the deviation from the target for that reach. Similarly, where the percentage is expressed as a positive this indicates that the reach meets or exceeds the target.

The loading tables in Appendix C show the potential shade and load capacity of the stream that is necessary to achieve natural background conditions, in addition to the load reduction needed for each stream segment, listed in descending order. The potential shade has been converted to a summer load by multiplying the inverse fraction (1.0 minus the shade fraction) by the average loading to a flat plate collector for the months of April through September. There is no opportunity to allocate shade removal to an activity.

Table 45 shows the total excess heat load (kWh/day) experienced by each water body examined and the average lack of shade for all segments in that water body. The lack of shade percentage shown in Table 45 represents the average deviation from the target for all the reaches in that water body. Where the percentage in Table 45 is expressed as a negative, this represents the average lack of shade or the average deviation from the target for that water body. Similarly, where the percentage is expressed as a positive this indicates that the average shade for all the reaches in that water body meets or exceeds the target. It is important to note that even if the average lack of shade calculated for a given water body is a positive number, it is still likely that individual reaches in that water body do not meet their individual shade targets and should still receive restoration treatment during the implementation phase of this TMDL. Entities wishing to estimate load reductions for specific implementation projects should use the reach-specific values shown in the loading tables in Appendix C, which represent the load reductions necessary over the length of each specific reach.

Margin of Safety

The margin of safety in this TMDL is considered implicit in the design. Because the target is essentially background conditions, there are no loads allocated to specific sources or activities. Although the loading analysis used in this TMDL involves gross estimations that are likely to have large variances, there are no load allocations that may benefit or suffer from that variance. Figure 26 visually illustrates those stream segments that fall within the margin of safety.

Seasonal Variation

This TMDL is based on average summer loads, calculated to be inclusive of the 6-month period from April through September. This time period was chosen because it represents the time period when the combination of increasing air and water temperatures coincides with increasing solar inputs and increasing vegetative shade. The critical time periods are June when spring salmonid spawning is occurring, July and August when maximum temperatures exceed cold water aquatic life criteria, and September during fall salmonid spawning. Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angle.

Table 45. Excess solar loads and average lack of shade for the Potlatch River watershed.

Water Body	Excess Load (kWh/day)	Average Lack of Shade
Potlatch R. Big Bear Cr. to Mouth	-2,341,614	-19.5%
Potlatch R. Corral Cr. to Big Bear Cr.	-446,284	1.6%
Potlatch R. Moose Cr. to Corral Cr.	-521,397	-22%
Potlatch R. Headwaters to Moose Cr.	-38,834	-18%
Big Bear Creek	-573,048	-15.6%
Boulder Creek	-17,750	-16%
Cedar Creek	-67,295	-12.5%
Corral Creek	-162,990	-22.5%
Moose Creek	-139,811	-49%
Pine Creek	-211,187	-24%
Ruby Creek	-30,683	-16%
EF Potlatch River	-113,989	-19%
Middle Potlatch Creek	-225,298	-22%

Point Sources of Temperature

Those facilities with the potential to increase stream temperature by discharging during the critical time period may increase stream temperatures downstream from the point of discharge by 0.3 degree Celsius (°C) if they meet the requirements addressed in IDAPA 58.01.02.401.03.a.v, which states:

> If temperature criteria for the designated aquatic life use are exceeded in the receiving waters upstream of the discharge due to natural background conditions, then . . . wastewater must not raise the receiving water temperatures by more than three tenths (0.3) degrees C.

Individual waste load allocations, if needed, can be determined through application of the following equation. The equation will yield the allowable effluent temperature that would not increase the in-stream temperature by 0.3 ^{o}C with a mixing zone of 25% volume of stream flow (IDAPA 58.01.02.060).

Eq. 4 $T_E = \{[Q_E + (0.25 \text{ x } Q_S)] \text{ x } [\ T_u + 0.3C] - [\ (0.25 \text{ x } Q_S) \text{ x } Tu\ ]\} \div Q_E$

Where:
T_E = Effluent temperature (^{o}C)
Q_E = Effluent flow (cfs)
Q_S = stream flow (cfs)
T_u = upstream temperature (^{o}C)
0.25= 25% by volume mixing zone (unit-less)

NPDES-permitted point sources discharging to Section 5-listed assessment units include the waste treatment facilities operated by the City of Bovill, the City of Juliaetta, and the City of Kendrick. However, the current NPDES permit for the city of Bovill does not allow discharge to occur during the critical time period for temperature (May 15 through September 30). In-stream water temperature and flow data upstream and downstream of these facilities is limited. Monthly facility effluent flow and effluent temperatures are available through NPDES discharge monitoring reports. Monthly data is considered insufficient.

If individual waste load allocations are necessary for these facilities, a compliance schedule should be included in future NPDES permits to provide for data collection and determination of individual waste load allocations for each facility. This compliance schedule is explained in IDAPA 58.01.02.400.03, which states:

> Discharge permits for point sources may incorporate compliance schedules which allow a discharger to phase in, over time, compliance with water quality-based effluent limitations when new limitations are in the permit for the first time.

A compliance schedule should be included in future NPDES permits for these facilities to provide for collection of sufficient and appropriate data needed to calculate the allowable effluent flow and seasonality of discharge for each facility requiring an individual temperature waste load allocation. Facility waste load allocations should be applied in accordance within the period of time when numeric criteria for Salmonid Spawning and Cold Water Aquatic Life are exceed as shown in Figure 28. Permits should be reissued in accordance with EPA's 5-year permit schedule to reflect upstream temperatures changes which will occur in response to implementation of the PNV TMDL.

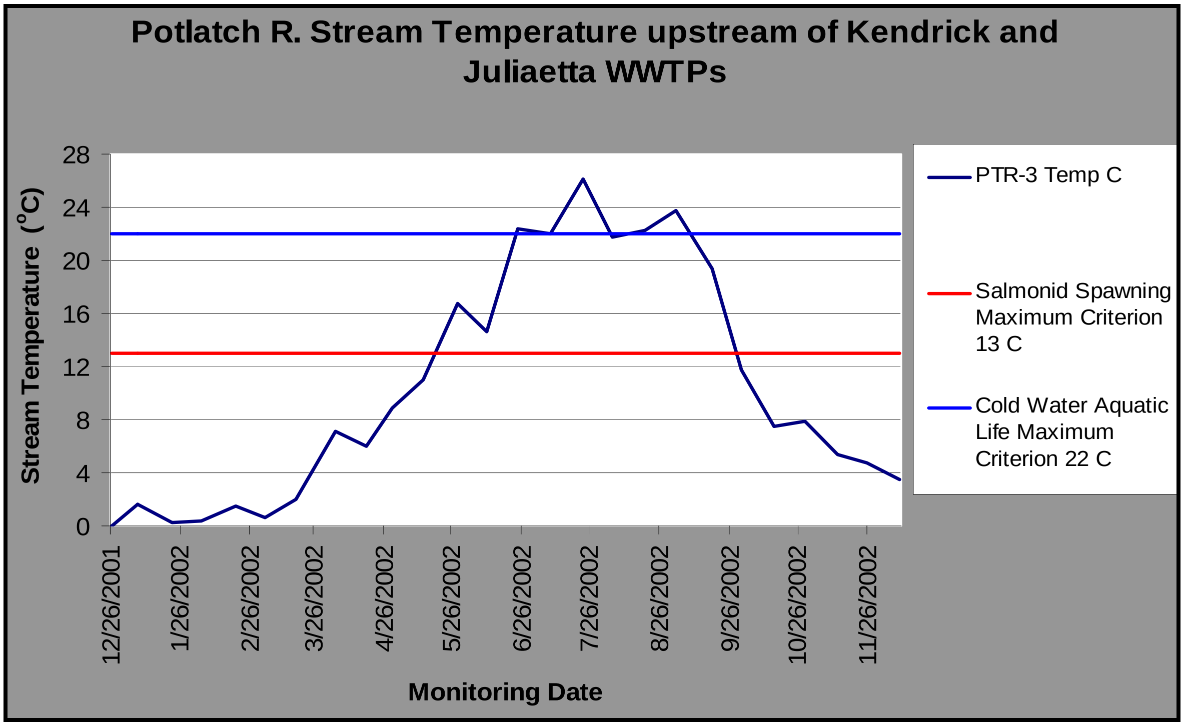

Figure 28. Critical Time Period for Salmonid Spawning and Cold Water Aquatic Life Temperature Criteria in the Potlatch River Upstream of Kendrick and Juliaetta WWTPs

Waste Load Allocation

The cities of Kendrick and Juliaetta discharge to a Section 5 listed assessment unit (44_06) of the Potlatch River during the critical time period when in-stream temperatures exceed the numeric criteria for Salmonid Spawning and Cold Water Aquatic Life beneficial uses. To evaluate the heat contribution from these facilities, a mass balance approach using the equation shown above was used to calculate and identify when effluent temperatures would increase the receiving water by more than 0.3 ^{o}C. Table 46 is intended to illustrate allowable effluent discharge temperatures that would not exceed the upstream receiving water by more than 0.3 ^{o}C using average monthly flow and temperature conditions of the Potlatch River at site PTR-3, based on temperature and flow data collected in 2002.

The allowable effluent temperature discharged by these facilities should be based on current temperature and flow conditions in the receiving water. An accurate 7Q10 value for each month is not currently available for this segment of the Potlatch River since the gaging station wasn't established until 2003. Additionally, the 7Q10 value identified in the Juliaetta NPDES permit is not accurate and therefore should not be a basis for developing a temperature allocation. It is recommended that additional stream flow and temperature data be collected by these facilities and that this data is used in the next permitting cycle. It is assumed that by 2013, an accurate 7Q10 value could be computed using the established USGS gage site.

As shown in Table 46, Kendrick and Juliaetta's WWTP facilities would need to limit the effluent temperatures to 34.3 ^{o}C in July, 26.1 ^{o}C in August, 28.7 ^{o}C in September and 23.7 ^{o}C in October to ensure that the receiving water was not increased by more than 0.3 ^{o}C, based on the values shown in Table 46.

Table 46. Allowable effluent temperatures for Kendrick and Juliaetta WWTPs.

Mean Monthly		Effluent Flow, Qe (cfs)		
Month	**Mean Stream Flow (cfs)**	**0.1**	**0.124***	**0.2**
August	6	27.1	26.1	24.7
September	11	30.3	28.7	26.1
July	17	36.7	34.3	30.5
October	24	27.1	23.7	18.2
November	114	91.2	74.6	48.3
June	122	110.6	92.8	64.7
December	311	237.1	192.0	120.5
May	390	306.9	250.2	160.5
April	580	442.8	358.6	225.2
January	612	460.4	371.5	230.8
February	789	593.2	478.7	297.2
March	965	725.6	585.5	363.6

*Note: WWTP (Kendrick and Juliaetta) design flow = 0.124 cfs (0.08 million gallons per day)
Criterion temp change: less than 0.3°C

5.5 Construction Storm Water and TMDL Waste Load Allocations

Construction Storm Water

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge storm water to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for storm water discharges from construction sites. In the past, storm water was treated as a nonpoint source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires a National Pollution Discharge Elimination System Permit (NPDES).

The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land, or is part of a larger common development that will disturb more than one acre of land, the operator is required to apply for permit coverage from EPA after developing a site specific Storm Water Pollution Prevention Plan.

Storm Water Pollution Prevention Plan (SWPPP)

In order to obtain the Construction General Permit, operators must develop a site specific Storm Water Pollution Prevention Plan. The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the best management practices through the life of the project.

Requirements

When a stream has a TMDL developed, DEQ may incorporate a gross waste load allocation for anticipated construction storm water activities where one can be quantified. TMDLs developed in the past that did not have a waste load allocation for construction storm water activities and current TMDLs unable to accurately quantify a waste load allocation for construction storm water will also be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate best management practices.

Typically, there are specific requirements that must be followed to be consistent with any local pollution allocations. Many communities throughout Idaho are currently developing rules for post-construction storm water management. Sediment is usually the main pollutant of concern in storm water from construction sites. The application of specific best management practices from *Idaho's Catalog of Storm Water Best Management Practices for Idaho Cities and Counties* is generally sufficient to meet the standards and requirements of the General Construction Permit, unless local ordinances have more stringent and site specific standards that are applicable.

5.6 Implementation Strategies

Idaho Code 39-3611 and 39-3612 provide guidance on the development and implementation of total maximum daily loads in Idaho. The guidance contained in code relies on participation and assistance of watershed advisory groups and designated management agencies.

Reasonable Assurance

Nonpoint sources will be managed by applying the combination of authorities the state has included in the Idaho Nonpoint Source Management Plan (DEQ 1999). Section 319 of the Federal Clean Water Act requires each state to submit to EPA a management plan for controlling pollution from nonpoint sources within the state. Idaho's authority for implementing the Idaho Nonpoint Source Management Plan has been certified by the Idaho Attorney General. The plan has been submitted to and approved by EPA as complying with Section 319 of the Clean Water Act.

Nonpoint source pollutant controls or best management practices determined to be ineffective in achieving the desired load reductions are subject to the feedback loop process or adaptive management to ensure load reductions are achieved, IDAPA 58.01.02.350. The feedback loop provides for water quality improvements and maintenance through best management practice installation, evaluation and modification. Implementing the feedback loop to modify best management practices until water quality standards are met results in compliance with the water quality standards.

Time Frame

A schedule for implementation of best management practices, pollution control strategies, assessment reporting dates, and evaluation of progress will be developed with appropriate designated management agencies and the Potlatch River Watershed Advisory Group and included in the Potlatch River TMDL Implementation Plan. Based on such assessments and evaluations, implementation strategies for TMDLs may need to be modified if monitoring shows that the water quality standards are not being met.

Approach

This TMDL focuses on implementation of load allocations for *E. coli* bacteria, nutrients, sediment, and stream temperature. Both the biological and numeric water quality data analyzed for this project suggests the poor habitat conditions and exceedances of numeric standards are impairing the designated beneficial uses in the Potlatch River and its tributaries. Nonpoint source best management practices for activities with the potential to contribute bacteria, nutrients, and sediment will be evaluated for application within the watershed by the designated management agencies responsible for such activities. Point source discharges will be managed by EPA's National Pollution Discharge Elimination System through load allocations provided by this TMDL.

The Potlatch River Watershed Advisory Group recommends the implementation plan to be developed for this TMDL include a survey to identify property-owners willing to participate in restoration and remediation of the Potlatch River watershed to address the TMDL pollutants.

Responsible Parties

Idaho Code 39-3612 states designated management agencies are to use TMDL processes for achieving water quality standards. The Department of Environmental Quality will rely on the designated management agencies to implement pollution control measures or best management practices for pollutant sources they identify as priority.

The Department of Environmental Quality also recognizes the authorities and responsibilities of local city and county governments as well as applicable state and federal agencies and will enlist their involvement and authorities for protecting water quality through implementation of Idaho Administrative Procedures Act 58.01.02 and Clean Water Act Section 401.

The designated state agencies listed below are responsible for assisting and providing technical support for the development of specific implementation plans and other appropriate support to water quality projects. General responsibilities for Idaho designated management agencies are:

- Idaho Soil Conservation Commission: Grazing and Agriculture.
- Idaho Department of Agriculture: Aquaculture and Animal Feeding Operations.
- Idaho Department of Transportation: Public Roads.
- Idaho Department of Lands: Timber Harvest, Oil and Gas Exploration, and Mining.
- Idaho Department of Water Resources: Stream Channel Alteration activities.
- Idaho Department of Environmental Quality: All other activities.

Monitoring Strategy

Idaho Code 39-3611 requires the Department of Environmental Quality to review and evaluate each Idaho TMDL, supporting assessment, implementation plan and all available data periodically at intervals no greater than five years. Such reviews are to be conducted using the Beneficial Use Reconnaissance Program protocol and the Water Body Assessment Guidance methodology to determine beneficial use attainability and status and whether state water quality standards are being achieved.

Permanent control points for water quality monitoring should be established at the mouths of the tributaries and at the assessment unit boundaries along the mainstem Potlatch River. These will be used for long term monitoring to assess trends in cumulative pollutant loading identified by this TMDL. Beneficial use support status monitoring and assessment will be conducted within each assessment unit of the watershed and evaluated using the Water Body Assessment Guidance for compliance with Idaho state water quality standards.

Idaho Code 39-3621 requires designated agencies, in cooperation with the appropriate land management agency, to ensure best management practices are monitored for their effect on water quality. The monitoring results should be presented to the Department of Environmental Quality on a schedule agreed to between the designated agency and the Department. The designated management agency should report the effectiveness of the measures or practices implemented to the Department in the form of load reductions applicable to the TMDL.

Pollutant load reductions gained by the application of pollutant controls and best management practices will be monitored by the Department of Environmental Quality through reports provided by Designated Management Agencies. Information reported will be compiled and tracked over time to provide measurable pollutant load reductions relative to the total maximum daily load allocations.

5.7 Conclusions

Bacteria, nutrient, sediment, and temperature TMDLs have been developed for the Potlatch River watershed (Table 47). With the exception of storm water construction permits, loads have been allocated to the existing sources currently in the watershed. A growth reserve is not included in the total maximum daily loads. Future sources will need to acquire a load allocation from existing allocations unless the load capacity is increased.

Table 47. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Potlatch River, Big Bear Cr. to Mouth ID17060306CL044_06	Temp, Sed	Yes	Move to section 4a	TMDL completed
Potlatch River, Big Bear Cr. to Mouth ID17060306CL044_06	O/G, Nut, Pest, Bac, NH3,Org, DO	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Corral Cr. to Big Bear Cr. ID17060306CL045_05	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Corral Cr. to Big Bear Cr. ID17060306CL045_05	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Moose Cr. to Corral Cr. ID17060306CL048_04 ID17060306CL048_05	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Moose Cr. to Corral Cr. ID17060306CL048_04 ID17060306CL048_05	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Headwaters to Moose Cr. ID17060306CL0049_02 ID17060306CL0049_03 ID17060306CL0049_04	Temp, Bac	Yes	Move to section 4a	TMDL completed
Potlatch River, Headwaters to Moose Cr. ID17060306CL0049_02 ID17060306CL0049_03 ID17060306CL0049_04	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Big Bear Cr. ID17060306CL056_04 ID17060306CL056_05	Bac, Temp	Yes	Move to section 4a	TMDL completed
Boulder Cr. ID17060306CL047_03	Bac, Temp	Yes	Move to section 4a	TMDL completed
Cedar Cr. ID17060306CL046_04	Temp, Sed	Yes	Move to section 4a	TMDL completed

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Corral Cr. ID17060306CL054_02 ID17060306CL054_03	Temp	Yes	Move to section 4a	TMDL completed
Corral Cr. ID17060306CL054_02 ID17060306CL054_03	Sed	No	Remove pollutants from list of impairments	SBA completed
Moose Cr. ID17060306CL053_02 ID17060306CL053_03	Temp, Bac	Yes	Move to section 4a	TMDL completed
Moose Cr. ID17060306CL053_02 ID17060306CL053_03	Nut, pH, Sed	No	Remove pollutants from list of impairments	SBA completed
Pine Cr. ID17060306CL055_02 ID17060306CL055_03	Temp, Nut, Sed	Yes	Move to section 4a	TMDL completed
Pine Cr. ID17060306CL055_02 ID17060306CL055_03	O/G, DO, Bac, NH3	No	Remove pollutants from list of impairments	SBA completed
Ruby Cr. ID17060306CL052_03	Temp, Bac	Yes	Move to section 4a	TMDL completed
Ruby Cr. ID17060306CL052_03	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
East Fork Potlatch River ID17060306CL051_04	Temp	Yes	Move to section 4a	TMDL completed
East Fork Potlatch River ID17060306CL051_04	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Middle Potlatch Cr. ID17060306CL062_02 ID17060306CL062_03	Temp, Bac, Sed	Yes	Move to section 4a	TMDL completed
Middle Potlatch Cr. ID17060306CL062_02 ID17060306CL062_03	Nut	No	Remove pollutants from list of impairments	SBA completed
West Fork Little Bear Cr.[a] ID17060306CL061_02 ID17060306CL061_03	Sed, Nut, Bac	Yes	Move to section 4a	TMDL Completed

[a]=West Fork Little Bear was not on the 303 (d) list.

Bacteria TMDLs allocate a gross concentration to all sources of *E. coli* bacteria upstream from the control points on each tributary, and upstream of the control point on the mainstem Potlatch River. Bacteria TMDLs have been developed for Boulder Creek, ID17060306CL047_03 with an allocation provided to a control point at PTR-20; West Fork Little Bear Creek, ID17060306CL061_03 with an allocation provided to a control point at site PTR-6; Big Bear Creek, ID17060306CL056_05 with an allocation provided to a control point at PTR-8; Middle Potlatch Creek, ID17060306CL062_03 with an allocation provided to a control point at PTR-4; the Potlatch River headwaters to Moose Creek segment, ID17060306CL049_04 with an allocation provided to a control point at PTR-12; and Ruby Creek, ID17060306CL052_03 with an allocation provided to a control point at PTR-14. Waste load allocations have been developed for five wastewater treatment facilities (Deary, Bovill, Juliaetta, Kendrick, and Troy) that discharge to the Potlatch River or associated tributaries and estuaries. The *E. coli* bacteria allocation applies to any 30-day period annually since secondary contact recreation may occur at any time of year. This allocation ensures water quality standards are attained for the protection of public health.

A nutrient TMDL that addresses the limiting nutrient, total phosphorus, was developed for Pine Creek, ID17060306CL055_03 with an allocation provided to a control point at PTR-10, from mid-June through October. The critical time period is based on measured dissolved oxygen violations. By controlling nutrient loading during this period, aquatic plant growth should be reduced and in-stream dissolved oxygen enhanced.

A nutrient TMDL that addresses total inorganic nitrogen (TIN) has been developed for West Fork Little Bear Creek based on violations of Idaho's dissolved oxygen criterion of 6.0 mg/L, the limiting nutrient analysis discussed in Section 2.4, and the stream flows measured in West Fork Little Bear Creek.

Sediment TMDLs allocate daily and monthly loads to all sources of sediment upstream of control points on each tributary and upstream of the control point on the mainstem Potlatch River. Sediment TMDLs have been developed for the Potlatch River, ID17060306CL044_06 with an allocation provided to a control point at PTR-1; Middle Potlatch Creek, ID17060306CL062_03 with an allocation provided to a control point at PTR-4; West Fork Little Bear Creek, ID17060306CL061_03 with an allocation provided to a control point at site PTR-6; Pine Creek, ID17060306CL055_03 with an allocation provided to a control point at PTR-10; and Cedar Creek, ID17060306CL046_04 with an allocation provided to a control point at PTR-11. Waste load allocations were developed for Deary, Bovill, Kendrick, Juliaetta, and Troy WWTP facilities based on the estimated design flow times the maximum daily limit and the current allowable average monthly concentrations. Controlling sediment loads will assist in managing nutrient loads in the Potlatch River watershed since nutrients, particularly phosphorus, bind to soil particles delivered to the stream.

A temperature TMDL that address riparian shading has been developed for the assessment units included in thirteen listed water bodies in the Potlatch River watershed. Streamside vegetation and channel morphology are the factors influencing shade that are most likely to have been changed by anthropogenic activities, and which can be most readily corrected and addressed by a TMDL.

Preliminary reconnaissance data has been collected during the completion of the subbasin assessment. Where the data indicate violations of Idaho's water quality standards in streams currently not listed in Section 5 of Idaho's 2002 integrated report (DEQ 2002), this data will be incorporated into the next cycle of assessments and the streams included in the next version of Idaho's integrated report. Appropriate actions, such as completing more detailed monitoring, will be taken for analyses and assessments of in-stream conditions.

Reconnaissance data indicate further work may need to occur in the West Fork Little Bear Creek and the West Fork Potlatch River.

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GIS Coverage

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. The term "305(b)" generally describes a report of each state's water quality and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
§303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Adsorption	The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules
Aeration	A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
Adfluvial	Describes fish whose life history involves seasonal migration from lakes to streams for spawning.
Adjunct	In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin	A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment (Armantrout 1998). In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations or specific disturbances such as a wastewater outfall (EPA 1996).
Anadromous	Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the saltwater but return to fresh water to spawn.
Anaerobic	Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.
Anoxia	The condition of oxygen absence or deficiency.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.61).

Aquatic

Occurring, growing, or living in water.

Aquifer

An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.

Assemblage (aquatic)

An association of interacting populations of organisms in a given water body; for example, a fish assemblage or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).

Assessment Database (ADB)

The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Assessment Unit (AU)

A segment of a water body that is treated as a homogenous unit, meaning that any designated uses, the rating of these uses, and any associated causes and sources must be applied to the entirety of the unit.

Assimilative Capacity

The ability to process or dissipate pollutants without ill effect to beneficial uses.

Autotrophic

An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis.

Batholith

A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.

Bedload

Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.

Beneficial Use

Any of the various uses of water, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers

Benthic

Pertaining to or living on or in the bottom sediments of a water body

Benthic Organic Matter.

The organic matter on the bottom of a water body.

Benthos

Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms.

Best Management Practices (BMPs)

Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.

Best Professional Judgment

A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information.

Biochemical Oxygen Demand (BOD)

The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

Biological Integrity

1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).

Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria, *E. Coli*, and Pathogens).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (µ) mhos/centimeter at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. The U.S. Environmental Protection Agency develops criteria guidance; states establish criteria.

Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Cultural Eutrophication	The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication).
Culturally Induced Erosion	Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion).
Debris Torrent	The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains.
Decomposition	The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.
Depth Fines	Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 centimeters).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans, but their presence in water is often indicative of fecal contamination. *E. coli* are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.

Eocene
An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Eolian
Windblown, referring to the process of erosion, transport, and deposition of material by the wind.

Ephemeral Stream
A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table (American Geological Institute 1962).

Erosion
The wearing away of areas of the earth's surface by water, wind, ice, and other forces.

Eutrophic
From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.

Eutrophication
1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.

Exceedance
A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Existing Beneficial Use or Existing Use
A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Exotic Species
A species that is not native (indigenous) to a region.

Extrapolation
Estimation of unknown values by extending or projecting from known values.

Fauna
Animal life, especially the animals characteristic of a region, period, or special environment.

Fecal Coliform Bacteria
Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria, *E. coli*, and Pathogens).

Fecal Streptococci
A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals.

Feedback Loop
In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress.

Fixed-Location Monitoring
Sampling or measuring environmental conditions continuously or repeatedly at the same location.

Flow
See *Discharge*.

Fluvial
In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.

Focal
Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.

Fully Supporting
In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Fully Supporting Cold Water
Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions.

Fully Supporting but Threatened
An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.

Geographical Information Systems (GIS)
A georeferenced database.

Geometric Mean

A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.

Grab Sample

A single sample collected at a particular time and place. It may represent the composition of the water in that water column.

Gradient

The slope of the land, water, or streambed surface.

Ground Water

Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.

Growth Rate

A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Basin

The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Cycle

The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit

One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC)

The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology

The science dealing with the properties, distribution, and circulation of water.

Impervious

Describes a surface, such as pavement, that water cannot penetrate.

Influent

A tributary stream.

Inorganic

Materials not derived from biological sources.

Instantaneous

A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen

The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

Intermittent Stream

1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.

Interstate Waters

Waters that flow across or form part of state or international boundaries, including boundaries with Native American nations.

Irrigation Return Flow

Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.

Key Watershed

A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical

	to the long-term persistence of regionally important trout populations.
Knickpoint	Any interruption or break of slope.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Limnology	The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load(ing) Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Lotic	An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth.

Luxury Consumption

A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs.

Macroinvertebrate

An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.

Macrophytes

Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting

A general term for the down slope movement of soil and rock material under the direct influence of gravity.

Mean

Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median

The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; 6 is the median of 1, 2, 5, 7, 9, 11.

Metric

1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/L)

A unit of measure for concentration. In water, it is essentially equivalent to parts per million (ppm).

Million Gallons per Day (MGD)

A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene

Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

Monitoring

A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth

The location where flowing water enters into a larger water body.

National Pollution Discharge Elimination System (NPDES)

A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

Nitrogen

An element essential to plant growth, and thus is considered a nutrient.

Nodal

Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.

Nonpoint Source

A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

Not Attainable

A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Not Fully Supporting Cold Water

At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

Nuisance

Anything that is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.

Nutrient

Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.

Nutrient Cycling

The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).

Oligotrophic

The Greek term for "poorly nourished." This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity.

Organic Matter

Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate

A form of soluble inorganic phosphorus most readily used for algal growth.

Oxygen-Demanding Materials

Those materials, mainly organic matter, in a water body that consume oxygen during decomposition.

Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Partitioning	The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment.
Pathogens	A small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa) that can cause sickness or death. Direct measurement of pathogen levels in surface water is difficult. Consequently, indicator bacteria that are often associated with pathogens are assessed. *E. coli*, a type of fecal coliform bacteria, are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Physiochemical	In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the term "physical/chemical."
Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Pretreatment	The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

Primary Productivity	The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training (Rand 1995). The goal of QA is to assure the data provided are of the quality needed and claimed (EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples (Rand 1995). QC is implemented at the field or bench level (EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known and thus is used to calibrate or standardize instruments.
Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).

Reference Site

A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.

Representative Sample

A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.

Resident

A term that describes fish that do not migrate.

Respiration

A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.

Riffle

A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

Riparian

Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.

Riparian Habitat Conservation Area (RHCA)

A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:
300 feet from perennial fish-bearing streams
150 feet from perennial non-fish-bearing streams
100 feet from intermittent streams, wetlands, and ponds in priority watersheds.

River

A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.

Runoff

The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediments

Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a water body.
Stenothermal	Unable to tolerate a wide temperature range.
Stratification	A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata).
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4^{th} field hydrologic units (also see Hydrologic Unit).

Subbasin Assessment (SBA)
A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.

Subwatershed
A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.

Surface Fines
Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 millimeters depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff
Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.

Surface Water
All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Suspended Sediments
Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Taxon
Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).

Tertiary
An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

Thalweg

The center of a stream's current, where most of the water flows.

Threatened Species

Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Total Maximum Daily Load (TMDL)

A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + waste load allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)

The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Franson et al. 1998) call for using a filter of 2.0 microns or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants

Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary

A stream feeding into a larger stream or lake.

Trophic State

The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

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Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

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Turbidity

A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.

Vadose Zone

The unsaturated region from the soil surface to the ground water table.

Waste load Allocation (WLA)

The portion of receiving water’s loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Column

Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.

Water Pollution

Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality

A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.

Water Quality Limited

A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.

Water Quality Limited Segment (WQLS)

Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."

Water Quality Management Plan

A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water Quality Modeling

The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.

Water Quality Standards

State-adopted and U.S. Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Water Table

The upper surface of ground water; below this point, the soil is saturated with water.

Watershed

1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)

A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

Wetland

An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

Young of the Year

Young fish born the year captured, evidence of spawning activity.

Appendix A. Unit Conversion Chart

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Table A-1. Metric - English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (gal) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 gal = 3.78 L 1 L= 0.26 gal 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 gal = 11.35 L 3 L = 0.79 gal 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (cfs)[a]	Cubic Meters per Second (m^3/sec)	1 cfs = 0.03 m^3/sec 1 m^3/sec = 35.31cfs	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[b]	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 lb
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

[a] 1 cfs = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 cfs.

[b] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix B. Potlatch River Subbasin Monitoring Data

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Table B-1. Monitoring parameters, protocols, and reporting units.

Monitoring Parameter	Monitoring Protocol	Reporting Units
Dissolved Oxygen (DO)	Hydro-lab Mini-Sonde	Milligrams/Liter (mg/L)
Escherichia Coli (*E. coli*)	SM 9223 B (MPN)	Colony Forming Units/100 ml
Ammonia (NH_3)	EPA 353.2 & EPA 350.1	mg/L
Nitrogen (NO3+NO2)	EPA 353.2 & EPA 350.1	mg/L
Total Phosphorus	EPA 365.4	mg/L
Instantaneous Temperature	Lab Grade Thermometer	^{o}C
Turbidity	EPA 180.1	Nephelometric Units (NTU)
Total Suspended Solids (TSS)	EPA 160.2 - TSS	mg/L
Conductance	Hydro-lab Mini-Sonde	micromhos
pH	Standard Buffer (4, 7, 10)	pH
Instantaneous Discharge	March-McBirney Model 2000 or Price Current Meter	Cubic Feet/Second (cfs)

Table PTR-1. Potlatch River, at the mouth of the Potlatch River.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Tempera ture	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
07/05/00	9.0	4	0.02	0.02	0.08	20.9	1	1	9.0	39.32
08/02/00	nd	2	< 0.01	0.06	0.07	nd	2	< 1	nd	nd
09/06/00	12.4	< 2	0.01	0.08	0.07	19.5	1	2	8.4	20.84
10/10/00	13.5	10	0.05	nd	0.02	10.9	2	2	8.2	27.82
12/05/00	14.7	2	0.06	nd	0.02	3.7	4	nd	8.7	49.86
01/17/01	nd	<2	<.01	0.20	0.03	1.0	3	2	8.6	46.61
06/12/01	15.5	14	0.01	0.02	0.03	15.4	2	3	8.4	nd
07/09/01	12.7	160	0.02	<.01	0.05	23.4	1	2	8.5	14.57
08/29/01	17.0	12	0.01	0.03	0.08	27.7	2	10	9.1	nd
10/23/01	12.7	32	<.01	<.01	0.04	9.5	1	<1	7.7	nd
10/30/01	10.8	28	<.01	<.01	0.04	10.9	1	2	7.7	nd
11/14/01	14.0	62	<.01	<.01	0.03	9.0	<1	<1	8.6	33.72
11/15/01	nd	nd	nd	nd	nd	nd	nd	nd	nd	34.36
12/05/01	17.4	12	<.01	0.95	0.05	4.1	3	<1	8.1	89.86
12/17/01	13.4	nd	<.01	1.87	0.08	3.4	11	3	7.7	101.94
01/22/02	14.4	6	<.01	1.83	0.07	1.7	7	1	6.8	241.13
01/30/02	12.8	12	<.01	2.02	0.09	3.0	13	2	7.3	nd
02/25/02	15.6	nd	0.01	2.38	0.14	1.7	32	21	7.2	nd
03/06/02	14.0	24	<.01	2.95	0.09	3.6	13	3	7.4	467.53
03/12/02	13.7	248	nd	2.35	nd	1.8	250	606	7.2	nd
03/20/02	13.3	90	0.01	2.67	0.15	3.4	36	35	7.4	nd

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Tempera ture	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
04/08/02	13.5	<4	<.01	0.25	0.07	6.0	14	11	7.1	nd
04/15/02	12.3	26	<.01	0.21	0.22	4.9	49	131	7.0	nd
05/14/02	11.8	14	<.01	0.02	0.05	11.5	4	4	8.0	548.89
05/29/02	10.4	24	0.02	0.03	0.05	16.7	3	4	7.5	380.60
06/10/02	9.7	74	0.02	0.05	0.04	12.9	2	3	7.6	159.88
06/24/02	8.3	24	0.02	0.03	0.05	20.3	<1	<1	7.7	77.13
07/02/02	10.9	18	0.01	0.02	0.06	19.6	1	1	7.9	59.96
07/29/02	16.0	24	0.01	0.02	0.02	27.8	<1	<1	9.0	7.74
08/06/02	12.3	2	0.03	0.03	0.04	22.5	<1	1	9.4	11.90
09/09/02	19.3	4	0.02	0.04	0.06	21.2	1	<1	8.9	12.21
4/21/2003		31								
4/24/2003		16								
4/28/2003		44								
5/1/2003		11								
5/6/2003		13								
2/3/2004								15		
5/27/2004								130		1300

Table PTR-2. Potlatch River (not monitored)

Station PTR-2 was discontinued at onset monitoring of the project. Data was not collected.

Table PTR-3. Potlatch River, at the Kendrick Bridge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/26/01	14.1	0	BDL	1.40	0.05	-0.2	5.3	BDL	7.5	72.74
1/7/02	nd	1,000	BDL	3.50	0.29	1.6	89.8	90	7.8	too deep
1/22/02	14.0	16	BDL	1.10	0.05	0.3	8.4	BDL	7.4	271.08
2/4/02	nd	11	BDL	1.30	0.05	0.4	9.3	BDL	8.4	100.31
2/19/02	13.5	50	BDL	1.90	0.06	1.5	3.1	6	7.8	too deep
3/4/02	12.7	13	BDL	1.10	0.07	0.6	12.9	BDL	7.6	315.67
3/18/02	nd	17	BDL	1.10	0.07	2.0	13.9	BDL	7.5	too deep
4/4/02	12.8	5	BDL	0.17	0.06	7.1	11.8	7	7.8	nd
4/18/02	nd	15	BDL	0.10	0.05	6.0	12.9	8	7.6	nd
4/29/02	10.5	4	BDL	1.50	0.12	8.9	6.9	BDL	7.6	nd
5/13/02	9.4	11	BDL	BDL	0.03	11.0	3.7	BDL	7.5	419.24
5/28/02	9.9	33	BDL	BDL	0.04	16.7	4.3	BDL	7.7	337.23
6/10/02	11.6	37	BDL	BDL	0.04	14.6	4.4	BDL	7.9	187.46
6/24/02	10.0	13	BDL	BDL	0.05	22.4	4.0	BDL	8.2	71.30
7/8/02	12.6	59	BDL	BDL	0.03	22.0	1.3	BDL	8.4	38.38
7/23/02	10.1	47	BDL	BDL	0.05	26.1	1.3	BDL	8.8	15.39

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
8/5/02	9.7	33	BDL	BDL	0.04	21.7	1.4	BDL	8.2	15.98
8/19/02	9.1	10	BDL	BDL	0.03	22.2	0.9	BDL	8.9	6.95
9/2/02	10.1	250	BDL	BDL	0.04	23.8	1.1	BDL	8.4	6.87
9/18/02	9.3	nd	BDL	BDL	0.03	19.4	3.2	BDL	8.9	8.31
10/1/02	9.9	3	BDL	BDL	0.02	11.7	2.5	BDL	8.2	10.39
10/15/02	11.1	5	BDL	BDL	0.02	7.5	1.0	BDL	8.4	9.52
10/29/02	9.9	65	BDL	BDL	0.03	7.9	2.0	BDL	8.4	14.07
11/12/02	11.0	27	BDL	BDL	0.02	5.4	2.0	BDL	8.2	16.34
11/25/02	11.9	1	BDL	BDL	BDL	4.8	3.3	BDL	8.5	15.01
12/10/02	10.8	1	BDL	BDL	0.10	3.5	1.7	BDL	8.6	18.65

Table PTR-4. Middle Potlatch Creek, highway bridge at mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/26/01	13.9	0	BDL	3.70	0.13	0.6	1.2	BDL	7.7	4.67
1/7/02	nd	390	BDL	5.70	0.24	2.2	43.5	48	6.8	82.70
1/22/02	13.7	20	BDL	5.90	0.13	0.9	6.4	4	7.2	22.27
2/4/02	15.0	10	BDL	6.50	0.12	0.3	6.7	BDL	7.3	18.01
2/19/02	13.5	39	BDL	6.70	0.15	0.7	6.3	8	7.8	58.68
3/4/02	12.1	12	BDL	6.50	0.15	0.6	16.1	BDL	6.4	24.38
3/18/02	nd	16	BDL	6.30	0.17	2.0	23.4	BDL	7.6	61.61
4/1/02	11.9	16	BDL	3.70	0.18	6.8	18.3	9	7.7	55.04
4/14/02	9.0	26	0.11	2.00	0.56	10.5	178.0	150	7.7	189.98
5/1/02	11.6	2	BDL	BDL	0.04	10.1	20.8	BDL	8.7	2.61
5/13/02	10.9	< 1	BDL	0.90	0.10	9.7	3.2	BDL	8.5	5.04
5/28/02	9.3	60	BDL	1.00	0.16	14.3	2.3	4	8.4	3.49
6/10/02	10.8	980	BDL	0.94	0.17	13.5	4.1	BDL	8.4	2.41
6/24/02	15.3	160	BDL	0.64	0.15	18.7	6.4	BDL	8.8	1.66
7/8/02	9.1	210	BDL	0.41	0.13	19.1	2.3	BDL	8.0	1.27
7/23/02	8.9	330	BDL	0.24	0.16	22.1	2.6	BDL	8.0	0.93
8/5/02	8.8	580	BDL	0.19	0.14	18.1	2.8	BDL	7.9	0.52
8/19/02	8.9	180	BDL	0.17	0.13	17.4	2.5	BDL	8.1	0.38
9/2/02	9.3	50	BDL	0.15	0.15	19.8	2.4	BDL	8.6	0.42
9/18/02	8.7	34	BDL	0.16	0.13	17.4	3.5	BDL	8.4	0.52

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
10/1/02	10.0	69	BDL	0.30	0.13	10.4	5.2	BDL	7.8	0.69
10/15/02	10.7	17	BDL	0.40	0.13	7.0	2.7	BDL	8.4	0.80
10/29/02	9.3	390	BDL	0.24	0.12	8.2	2.9	BDL	7.8	1.51
11/12/02	9.9	13	BDL	1.10	0.12	8.2	5.8	BDL	8.4	1.66
11/25/02	11.2	4	BDL	1.40	0.10	7.0	3.9	BDL	8.2	1.96
12/10/02	10.3	11	BDL	0.88	0.15	6.5	4.8	BDL	8.3	2.14
4/21/2003		5								
4/24/2003		2								
4/28/2003		120								
5/1/2003		3								
5/6/2003		5								
6/8/2004		86								
6/21/2004		103.6								
7/6/2004		1,203.3								
7/19/2004		648.8								
7/22/2004		240								
7/26/2004		1,732.9								
7/29/2004		770.1								
8/2/2004		1,553.1								

Table PTR-5. Middle Potlatch Creek, at Spence Road Bridge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	nd	0	BDL	2.30	0.07	0.6	1.8	BDL	7.0	3.09
1/8/02	nd	370	0.16	8.10	0.44	0.9	97.9	120	7.5	too deep
1/24/02	nd	17	BDL	4.90	0.12	0.9	10.1	BDL	7.2	24.95
2/5/02	12.3	26	BDL	5.60	0.10	0.1	11.1	BDL	7.6	14.16
2/20/02	12.2	17	BDL	5.40	0.16	2.9	7.6	7	7.5	32.02
3/6/02	nd	42	BDL	5.20	0.17	1.3	33.1	16	7.8	25.42
3/20/02	11.8	130	BDL	5.40	0.36	3.0	143.0	160	7.4	too deep
4/2/02	10.2	3	BDL	1.70	0.17	8.3	27.1	12	7.8	29.61
4/17/02	10.8	33	BDL	0.99	0.14	9.6	21.9	10	7.8	16.64
4/29/02	11.1	1	BDL	0.36	0.10	13.0	6.5	5	9.2	11.24
5/14/02	11.1	2	BDL	0.10	0.07	14.6	5.3	BDL	8.2	0.79
5/29/02	8.7	31	BDL	BDL	BDL	14.3	4.1	BDL	7.8	0.59
6/14/02	7.1	220	BDL	BDL	0.08	17.9	7.9	11	7.7	0.22
6/26/02	8.6	74	BDL	BDL	0.09	19.6	6.0	8	7.6	0.05
7/11/02	6.3	21	BDL	BDL	0.07	21.0	4.0	6	7.6	0.02
7/25/02	5.8	340	BDL	BDL	0.06	20.0	4.7	BDL	7.4	0.02
8/8/02	Stream is dry									

Table PTR-6. West Fork Little Bear Creek, downstream of the City of Troy discharge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper -ature	Turbi dity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	13.8	nd	0.42	0.58	0.14	0.3	6.6	BDL	6.8	5.16
1/8/02	nd	290	0.11	2.40	0.30	0.2	59.9	88	7.7	too deep
1/24/02	nd	25	0.30	1.30	0.13	0.6	11.8	BDL	6.7	24.09
2/5/02	12.4	32	0.20	1.40	0.12	0.1	13.8	5	7.4	16.70
2/20/02	12.5	13	BDL	1.20	0.13	2.2	3.1	10	7.6	25.18
3/6/02	nd	55	BDL	1.10	0.18	1.8	50.1	24	7.6	25.32
3/19/02	11.9	50	BDL	1.30	0.15	2.1	34.3	14	7.4	50.74
4/3/02	10.5	23	BDL	0.36	0.13	5.2	23.5	31	7.4	too deep
4/17/02	12.1	nd	BDL	0.15	0.10	5.1	21.0	25	7.3	nd
5/1/02	10.8	5	0.12	BDL	0.07	7.8	8.9	8	7.6	50.49
5/16/02	10.2	3	0.17	BDL	0.07	11.1	6.7	5	7.4	25.32
5/29/02	9.8	41	BDL	BDL	0.07	11.6	6.1	5	7.6	22.70
6/13/02	6.3	70	BDL	BDL	0.08	16.4	6.6	4	8.1	7.52
6/27/02	8.9	140	1.20	0.20	0.27	22.3	8.0	5	7.6	2.91
7/11/02	7.6	51	BDL	BDL	0.08	22.8	4.9	BDL	7.4	0.85
7/26/02	7.5	84	BDL	0.13	0.30	21.0	5.7	13	7.6	0.07
8/8/02	6.8	20	0.20	7.60	1.20	20.0	6.1	6	7.6	0.19
8/20/02	5.0	70	2.20	14.00	2.90	19.2	11.3	13	7.1	0.07
9/9/02	6.6	2,000	BDL	19.00	3.80	18.5	7.4	40	7.5	0.06
9/19/02	6.3	1,600	BDL	17.00	3.60	16.5	29.3	43	7.5	0.06

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper -ature	Turbi dity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/3/02	6.4	2,400	BDL	17.00	3.10	12.5	29.5	35	7.1	0.04
10/15/02	7.9	220	BDL	13.00	2.20	10.8	13.6	19	7.4	0.03
10/31/02	10.0	28	3.80	3.40	0.94	1.9	8.3	14	7.6	0.11
11/14/02	10.4	730	1.00	0.97	0.53	5.5	27.4	140	7.5	0.12
11/26/02	10.5	1	3.20	0.66	0.57	2.4	203.0	10	7.6	0.46
12/12/02	13.2	11	2.00	0.30	0.39	3.4	18.7	8	7.6	1.00

Table PTR-7. West Fork Little Bear Creek, upstream of the City of Troy discharge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temperature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
12/27/01	13.2	0	BDL	0.52	0.05	0.2	6.2	BDL	6.4	5.33
1/8/02	nd	100	BDL	2.10	0.26	0.7	54.0	50	7.6	too deep
1/24/02	nd	25	BDL	1.20	0.08	0.5	10.3	BDL	6.5	22.83
2/5/02	13.0	46	BDL	1.30	0.08	0.1	12.7	BDL	7.4	13.28
2/20/02	12.6	25	BDL	1.20	0.10	2.2	1.7	5	7.6	27.89
3/6/02	nd	42	BDL	1.10	0.14	1.6	34.3	15	7.8	26.97
3/19/02	11.9	70	BDL	1.30	0.14	2.0	35.4	20	7.4	51.23
4/2/02	10.4	10	BDL	0.35	0.10	5.2	18.6	22	7.4	too deep
4/17/02	11.9	11	BDL	0.13	0.09	4.9	19.7	22	7.4	72.70
5/1/02	10.5	9	BDL	BDL	0.05	6.9	7.8	7	7.7	49.17
5/16/02	10.4	2	BDL	BDL	0.05	10.4	6.5	5	7.4	28.16
5/29/02	10.2	26	BDL	BDL	0.05	10.6	6.4	4	7.6	19.81
6/14/02	7.2	20	BDL	BDL	0.07	15.4	5.9	5	8.1	6.95
6/26/02	8.3	88	BDL	BDL	0.08	22.2	6.0	5	7.8	3.98
7/11/02	8.3	37	BDL	1.90	0.31	22.1	4.6	BDL	8.0	1.43
7/25/02	8.3	190	BDL	BDL	0.08	22.3	4.2	BDL	7.7	0.23
8/8/02	7.9	29	BDL	BDL	0.07	19.4	2.7	BDL	7.6	0.22
8/20/02	8.5	120	BDL	BDL	0.08	17.4	3.3	BDL	7.6	0.09
9/4/02	Dry									Dry
9/20/02	Dry									Dry

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbit-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
10/3/02	9.4	13	BDL	BDL	0.06	10.0	2.8	BDL	7.5	0.16
10/14/02	10.1	2	BDL	BDL	0.11	9.0	10.5	21	7.6	0.02
10/30/02	11.1	83	BDL	BDL	0.06	1.5	4.4	BDL	7.6	0.07
11/14/02	10.6	600	0.20	0.76	0.39	5.3	16.3	140	7.5	0.12
11/26/02	11.4	<1	BDL	0.13	0.04	2.1	226.0	BDL	7.8	0.42
12/12/02	13.0	160	BDL	0.20	0.07	2.9	23.3	9	7.8	1.01

Table PTR-8. Big Bear Creek, bridge at mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
12/26/01	nd		BDL	1.90	0.05	-0.2	2.8	BDL	7.1	24.08
1/7/02	nd	220	BDL	4.40	0.23	1.5	40.7	50	7.8	96.3
1/22/02	13.9	29	BDL	2.00	0.08	0.9	8.3	BDL	7.4	24.2
2/4/02	15.5	9	BDL	2.10	0.07	0.6	8.9	BDL	7.6	41.6
2/19/02	13.3	31	BDL	2.40	0.07	1.6	1.9	BDL	7.8	58.2
3/4/02	13.6	44	BDL	1.70	0.11	0.8	14.3	BDL	7.6	108.4
3/18/02	nd	19	BDL	1.30	0.10	2.0	17.8	4	7.6	148.3
4/4/02	11.9	12	BDL	0.32	0.09	7.4	15.6	9	7.6	260
4/18/02	11.7	35	BDL	0.21	0.09	8.3	16.0	7	7.4	156
4/29/02	10.8	6	BDL	BDL	0.07	11.0	10.8	BDL	7.8	132.37
5/13/02	9.6	6	BDL	BDL	0.05	11.0	6.2	BDL	7.8	60.77
5/28/02	9.7	37	BDL	BDL	0.07	17.0	6.0	BDL	7.8	46.40
6/10/02	11.3	480	BDL	BDL	0.09	14.1	6.7	BDL	8.0	26.99
6/24/02	10.9	66	BDL	BDL	0.07	21.4	6.7	BDL	8.9	13.99
7/9/02	13.0	35	BDL	BDL	0.06	20.4	2.5	BDL	8.4	4.84
7/23/02	11.0	21	BDL	BDL	0.09	24.0	3.1	BDL	8.6	1.54
8/5/02	10.9	150	BDL	BDL	0.08	21.2	3.1	BDL	8.4	0.82
8/19/02	9.5	580	BDL	BDL	0.07	21.4	2.4	BDL	8.5	0.64
9/2/02	10.5	25	BDL	BDL	0.08	21.6	3.1	BDL	8.6	0.64
9/18/02	8.6	13	BDL	BDL	0.06	19.5	2.7	BDL	8.5	0.83

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100 ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
10/1/02	9.4	36	BDL	BDL	0.05	15.9	4.0	BDL	8.4	1.06
10/15/02	10.4	16	BDL	BDL	0.05	12.3	1.9	BDL	8.5	0.70
10/29/02	9.3	39	BDL	BDL	0.06	10.7	2.1	BDL	8.2	1.55
11/12/02	9.8	4	BDL	BDL	0.04	9.9	2.9	BDL	8.0	1.64
11/25/02	11.7	<1	BDL	BDL	0.02	8.2	2.9	BDL	8.4	1.45
12/10/02	10.2	<1	BDL	BDL	0.04	6.9	2.6	BDL	8.2	3.46
4/21/2003		3								
4/24/2003		2								
4/28/2003		93								
5/1/2003		3								
5/6/2003		4								
7/28/03		310								
7/31/03		550								
8/4/03		1600								
8/7/03		770								
8/11/03		870								

Table PTR-9. Big Bear Creek, near Highway 8 downstream of Mount Deary Creek.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/26/01	nd	0	BDL	0.78	0.07	0.1	10.9	BDL	6.2	7.39
1/8/02	nd	370	BDL	1.20	0.20	0.4	38.1	45	7.5	too deep
1/22/02	13.0	26	BDL	0.42	0.09	0.1	13.1	BDL	6.4	29.62
2/5/02	12.7	16	BDL	0.50	0.09	0.1	13.8	BDL	7.1	28.94
2/20/02	12.6	17	BDL	0.38	0.10	0.5	5.0	9	7.4	59.34
3/5/02	nd	29	BDL	0.28	0.09	0.4	18.8	5	7.2	51.66
3/19/02	12.2	28	BDL	0.33	0.09	1.1	17.0	5	7.1	116.14
4/2/02	11.0	22	BDL	0.14	0.10	3.4	18.3	17	7.1	too deep
4/17/02	12.3	70	BDL	BDL	0.08	4.3	19.6	17	7.4	too deep
5/1/02	10.5	120	BDL	BDL	0.05	8.8	12.2	8	7.6	67.30
5/16/02	10.1	24	BDL	BDL	0.03	9.9	8.3	BDL	7.5	20.30
5/29/02	9.0	490	BDL	BDL	0.05	14.6	11.4	4	7.8	14.10
6/12/02	9.5	230	BDL	BDL	0.06	17.8	5.7	BDL	7.9	5.68
6/26/02	9.3	300	BDL	BDL	0.05	24.9	4.7	BDL	7.8	1.80
7/11/02	7.7	45	BDL	BDL	0.06	22.8	3.3	BDL	7.6	0.94
7/25/02	6.9	260	BDL	BDL	0.07	23.5	3.2	BDL	7.4	0.23
8/6/02	9.2	340	BDL	BDL	0.06	19.1	2.9	BDL	7.3	0.52
8/20/02	8.0	73	BDL	BDL	0.06	18.1	3.9	6	7.8	0.34
9/4/02	8.5	120	BDL	BDL	0.10	14.5	3.2	BDL	7.8	0.41
9/20/02	10.1	1,000	BDL	BDL	0.15	14.1	3.0	6	8.0	0.31

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/3/02	9.2	120	BDL	BDL	0.05	8.1	3.7	BDL	7.5	0.35
10/16/02	9.6	37	BDL	BDL	0.05	6.1	2.7	BDL	7.9	0.29
10/29/02	10.9	220	BDL	BDL	0.08	4.6	2.5	BDL	7.7	0.71
11/14/02	10.8	88	BDL	0.15	0.08	5.4	3.2	BDL	7.6	0.82
11/26/02	11.2	140	BDL	BDL	0.02	3.0	6.1	BDL	7.6	0.78
12/12/02	12.4	26	BDL	0.46	0.07	3.1	6.0	BDL	7.6	1.13

Table PTR-10. Pine Creek, bridge at mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbit-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
12/26/01	14.1	0	BDL	3.40	0.08	0.2	6.9	BDL	7.2	9.75
1/7/02	nd	180	BDL	4.30	0.21	0.2	46.6	26	7.7	59.6
1/22/02	12.6	15	BDL	2.20	0.09	1.6	10.0	BDL	7.3	37
2/4/02	nd	5	BDL	2.30	0.08	0.8	9.8	BDL	7.4	20.3
2/19/02	13.5	11	BDL	2.50	0.08	2.3	2.9	BDL	7.9	30.7
3/4/02	12.9	13	BDL	2.10	0.11	1.4	13.3	BDL	7.6	23
3/18/02	12.1	15	BDL	2.00	0.10	2.8	15.0	BDL	7.5	148.2
4/1/02	11.8	12	BDL	1.00	0.11	5.5	13.4	BDL	7.4	88.52
4/18/02	11.3	7	BDL	0.43	0.10	9.0	13.7	BDL	7.5	31.94
4/29/02	11.4	5	BDL	0.14	0.08	11.4	6.5	BDL	8.9	9.47
5/13/02	8.9	2	BDL	BDL	0.07	11.9	3.0	BDL	7.9	6.48
5/28/02	8.6	120	BDL	0.36	0.10	16.7	4.7	BDL	7.0	2.44
6/10/02	10.2	190	BDL	0.14	0.12	13.7	4.6	BDL	7.8	3.96
6/24/02	9.1	16	BDL	BDL	0.10	19.3	3.4	BDL	7.6	0.99
7/9/02	10.9	42	BDL	BDL	0.12	20.0	2.8	BDL	7.6	0.62
7/23/02	7.6	870	BDL	BDL	0.18	21.0	2.6	BDL	7.1	0.35
8/6/02	5.5	35	BDL	0.12	0.15	20.3	2.4	4	7.4	0.16
8/19/02	6.9	11	BDL	BDL	0.13	20.1	2.5	BDL	7.2	0.02
9/2/02	7.1	18	BDL	BDL	0.12	19.4	2.6	BDL	7.4	0.14
9/18/02	6.5	99	BDL	0.22	0.13	17.2	3.1	BDL	7.4	0.16
10/1/02	7.4	130	BDL	0.10	0.12	15.8	3.0	BDL	7.2	0.09

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbit-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/15/02	8.7	9	BDL	BDL	0.19	12.5	7.9	15	8.0	0.25
10/29/02	8.6	280	BDL	0.60	0.11	10.9	3.7	BDL	8.0	0.33
11/12/02	9.8	9	BDL	BDL	0.08	7.8	3.5	BDL	8.1	0.43
11/25/02	9.2	11	BDL	BDL	0.05	7.9	2.2	BDL	8.1	0.34
12/10/02	9.2	67	BDL	BDL	0.11	6.3	4.0	5	7.8	0.64
4/21/2003		17								
4/24/2003		9								
4/28/2003		27								
5/1/2003		5								
5/6/2003		12								
12/2/2003								BDL		
12/16/2003								BDL		
1/7/2004								BDL		
1/22/2004								BDL		
2/3/2004								100		
2/17/2004								BDL		
6/8/2004		116.9								
6/21/2004		31.3								
7/6/2004		42.6								
7/27/2004		105.4								
8/23/2004		547.5								

Table PTR-11. Cedar Creek at the mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
12/26/01	14.6	0	BDL	2.50	0.07	0.2	6.6	BDL	7.5	8.16
1/7/02	nd	1,100	BDL	4.30	0.57	2.2	69.2	260	7.5	245.0
1/22/02	13.2	35	BDL	1.60	0.07	0.9	10.0	BDL	7.6	28.5
2/4/02	15.1	50	BDL	2.10	0.06	0.5	11.8	BDL	7.4	18
2/19/02	12.5	79	BDL	2.10	0.08	2.2	4.7	5	7.8	50.2
3/4/02	13.3	29	BDL	1.80	0.10	1.1	16.7	BDL	7.4	60
3/18/02	12.8	19	BDL	2.00	0.09	2.1	17.8	5	7.6	107
4/1/02	12.9	38	BDL	0.42	0.09	4.6	19.6	16	7.5	103.87
4/18/02	11.7	28	BDL	0.28	0.08	7.3	17.0	10	7.5	49.18
4/29/02	11.3	4	BDL	0.21	0.06	9.5	10.2	BDL	8.3	10.88
5/13/02	9.6	9	BDL	BDL	0.04	11.6	7.3	BDL	8.5	13.50
5/28/02	9.7	44	BDL	BDL	0.06	17.3	4.5	BDL	8.6	5.42
6/10/02	11.8	72	BDL	BDL	0.11	12.5	8.0	4	8.2	6.57
6/24/02	9.8	3	BDL	BDL	0.08	21.5	8.3	BDL	7.4	1.52
7/8/02	11.4	120	BDL	BDL	0.08	21.5	3.6	6	8.9	1.30
7/23/02	10.0	76	BDL	BDL	0.09	23.8	2.9	BDL	8.6	0.48
8/6/02	10.0	24	BDL	BDL	0.07	18.9	2.2	BDL	8.4	0.38
8/19/02	9.4	96	BDL	BDL	0.07	18.5	2.9	BDL	8.6	0.27
9/2/02	10.3	4	BDL	BDL	0.08	19.1	2.5	6	8.7	0.25
9/18/02	8.8	61	BDL	BDL	0.09	16.1	3.0	5	8.5	0.34

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/1/02	10.1	34	BDL	BDL	0.07	10.4	3.2	6	8.2	0.18
10/15/02	11.0	7	BDL	BDL	0.06	4.9	1.7	BDL	8.2	0.42
10/29/02	10.9	38	BDL	BDL	0.06	4.8	1.5	BDL	8.2	0.40
11/13/02	10.6	32	BDL	0.48	0.07	7.0	3.1	7	8.2	0.43
11/25/02	11.8	2	BDL	BDL	0.03	4.1	5.2	BDL	8.2	0.51
12/10/02	11.1	8	BDL	BDL	0.04	2.3	1.8	BDL	8.1	0.98
4/21/2003		6								
4/24/2003		5								
4/28/2003		59								
5/1/2003		3								
5/6/2003		7								
12/2/2003								BDL (< 4.0)		
12/16/2003								BDL (< 4.0)		
1/22/2004								BDL (< 4.0)		
2/3/2004								530		
2/17/2004								10		

Table PTR-12. Potlatch River, near Little Boulder Creek Campground.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
12/26/01	nd		BDL	BDL	0.03	0	5.0	BDL	7.4	41.87
1/8/02	12.8	110	BDL	0.10	0.08	0.1	24.9	25	7.7	too deep
1/23/02	nd	21	BDL	BDL	0.03	0.1	5.1	5	7.0	118.95
2/5/02	12.9	12	BDL	BDL	0.02	0.0	6.0	BDL	7.6	USFS gage
2/20/02	12.9	15	BDL	BDL	0.03	0.0	2.7	7	7.6	USFS gage
3/5/02	nd	11	BDL	BDL	0.03	0.0	7.6	BDL	7.6	USFS gage
3/19/02	12.8	27	BDL	BDL	0.03	0.5	7.9	4	7.3	USFS gage
4/2/02	11.6	11	BDL	BDL	0.04	1.5	8.3	7	7.6	USFS gage
4/14/02	12.3	12	BDL	BDL	0.04	2.7	13.2	15	7.2	USFS gage
4/29/02	11.3	3	BDL	BDL	0.03	8.0	9.3	24	7.6	USFS gage
5/13/02	8.9	6	BDL	BDL	0.02	10.6	5.4	4	7.2	USFS gage
5/28/02	9.3	93	BDL	BDL	0.03	14.2	5.6	BDL	7.6	USFS gage
6/12/02	7.5	12	BDL	BDL	0.03	15.9	3.3	BDL	7.8	USFS gage
6/25/02	8.5	17	BDL	BDL	0.03	23.7	2.0	BDL	8.4	USFS gage
7/9/02	8.7	32	BDL	BDL	0.02	20.8	1.7	BDL	8.5	USFS gage
7/23/02	10.5	14	BDL	BDL	0.03	24.8	1.8	BDL	8.9	USFS gage
8/6/02	9.1	120	BDL	BDL	0.02	18.7	1.7	BDL	8.5	USFS gage
8/20/02	11.9	46	BDL	BDL	0.02	19.1	1.3	BDL	7.4	USFS gage
9/17/02	9.5	2,400	BDL	BDL	0.06	16.0	2.6	BDL	8.7	USFS gage

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/1/02	10.0	32	BDL	BDL	0.01	9.1	1.6	BDL	8.0	USFS gage
10/15/02	10.5	36	BDL	BDL	0.02	5.0	1.2	BDL	8.0	USFS gage
10/29/02	12.2	33	BDL	BDL	0.02	3.8	2.3	BDL	7.9	USFS gage
11/13/02	11.3	61	BDL	BDL	0.03	1.9	3.7	4	7.8	USFS gage
11/25/02	11.7	5	BDL	BDL	BDL	3.1	3.8	BDL	7.9	USFS gage

Table PTR-13. Corral Creek, downstream of the City of Helmer discharge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/26/01	13.1	0	BDL	BDL	0.06	-0.2	17.2	BDL	7.1	3.38
1/7/02	nd	96	BDL	0.16	0.10	0.5	54.3	BDL	7.4	16.70
1/22/02	13.0	58	BDL	BDL	0.04	0.1	13.7	BDL	6.4	17.01
2/4/02	12.0	80	BDL	BDL	0.05	0.1	14.8	BDL	7.2	7.73
2/19/02	12.6	99	BDL	BDL	0.05	0.9	2.4	BDL	7.1	8.65
3/5/02	nd	70	BDL	BDL	0.06	0.1	15.8	BDL	7.4	17.55
3/20/02	12.2	55	BDL	BDL	0.04	0.9	15.0	BDL	7.1	37.08
4/1/02	10.0	11	BDL	BDL	0.06	4.1	12.7	13	7.1	115.24
4/16/02	12.5	20	BDL	BDL	0.05	3.9	14.6	13	6.9	173.74
4/29/02	11.3	11	BDL	BDL	0.04	8.9	11.4	6	7.2	59.04
5/13/02	7.8	6	BDL	BDL	0.03	14.5	10.7	4	7.2	17.08
5/29/02	8.6	40	BDL	BDL	0.06	18.0	8.8	4	7.6	8.62
6/12/02	8.0	250	BDL	BDL	0.05	23.1	8.4	BDL	7.7	2.86
6/26/02	7.7	210	BDL	BDL	0.03	31.3	5.6	BDL	7.6	0.35
7/9/02	6.4	870	BDL	BDL	0.03	28.2	3.9	BDL	7.5	No Flow
7/23/02	Totally Dry									

Table PTR-14. Ruby Creek, just above the mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Tempera-ture	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
4/30/02	11.0	9	BDL	BDL	0.04	5.1	7.0	19	7.6	11.00
5/14/02	11.4	12	BDL	BDL	0.08	6.1	20.1	30	7.6	4.89
5/30/02	10.0	17	BDL	BDL	0.03	9.7	5.7	8	7.6	2.59
6/11/02	9.1	19	BDL	BDL	0.05	7.9	6.9	6	7.8	2.45
6/25/02	10.0	26	BDL	BDL	0.05	12.3	3.5	BDL	7.4	1.38
7/10/02	9.5	17	BDL	BDL	0.04	12.2	3.5	4	7.8	1.00
7/24/02	7.8	1,400	BDL	BDL	0.05	15.4	2.8	4	7.4	0.67
8/7/02	9.1	170	BDL	BDL	0.03	10.8	1.6	BDL	7.2	0.63
8/21/02	10.6	84	BDL	BDL	0.04	12.1	3.0	7	7.6	0.53
9/3/02	9.2	100	BDL	BDL	0.03	12.3	4.2	BDL	7.6	0.64
9/19/02	9.1	21	BDL	BDL	0.03	9.7	0.8	BDL	7.9	0.74
10/2/02	9.8	7	BDL	BDL	0.04	6.0	5.2	10	7.5	0.40
10/14/02	11.1	10	BDL	BDL	0.05	4.5	4.9	9	7.5	0.37
10/30/02	11.9	3	BDL	BDL	0.03	1.5	4.1	BDL	8.1	0.39
11/14/02	11.1	88	BDL	BDL	0.07	5.2	5.1	11	7.7	0.41
11/25/02	11.3	3	BDL	BDL	BDL	2.1	11.8	BDL	7.6	0.50
12/11/02	12.9	19	BDL	BDL	0.02	3.0	7.1	BDL	7.4	0.61
4/21/2003		10								
4/24/2003		38								
4/28/2003		4								

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Tempera-ture	Turbidity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
5/1/2003		7								
5/6/2003		10								
6/8/2004		7.3								
6/21/2004		4.1								
7/6/2004		12.2								
7/27/2004		16								
8/5/2004		980.4								
8/16/2004		410.6								
8/19/2004		344.1								
8/23/2004		920.8								
8/26/2004		95.9								
8/30/2004		33.6								

Table PTR-15. East Fork Potlatch River at the mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	nd	nd	BDL	BDL	0.02	0.1	3.8	BDL	6.6	4.75
1/8/02	nd	55	BDL	BDL	0.09	0.1	25.8	29	7.3	270
1/23/02	13.2	12	BDL	BDL	0.02	0.1	10.2	BDL	6.7	70
2/4/02	12.0	4	BDL	BDL	0.02	0.0	5.3	BDL	7.4	144
2/19/02	13.2	5	BDL	BDL	0.03	0.1	2.2	BDL	7.5	79
3/4/02	nd	6	BDL	BDL	0.03	0.0	7.4	5	7.4	88
3/19/02	12.7	47	BDL	BDL	0.02	0.6	7.4	BDL	7.3	98
4/1/02	10.9	4	BDL	BDL	0.04	4.3	8.9	9	7.1	234
4/19/02	12.1	nd	BDL	BDL	0.03	4.1	9.8	5	7.1	269
4/30/02	11.1	4	BDL	BDL	0.02	7.2	3.9	5	7.4	233
5/16/02	10.5	12	BDL	BDL	0.01	6.6	4.0	BDL	7.6	189.27
5/30/02	10.3	3	BDL	BDL	0.02	11.2	2.9	BDL	7.4	137.84
6/12/02	7.8	24	BDL	BDL	0.03	13.0	3.0	BDL	7.8	58.68
6/26/02	8.9	110	BDL	BDL	0.02	20.9	2.7	BDL	8.0	27.87
7/11/02	8.6	120	BDL	BDL	0.02	20.2	3.0	BDL	7.8	15.97
7/25/02	7.9	34	BDL	BDL	0.03	22.8	2.5	BDL	8.2	8.66
8/8/02	9.4	180	BDL	BDL	0.02	19.0	1.4	BDL	7.8	12.17
8/20/02	11.3	77	BDL	BDL	0.02	19.1	1.7	BDL	8.4	10.64
9/4/02	9.8	34	BDL	BDL	0.03	14.5	1.4	BDL	7.8	10.42
9/20/02	9.5	59	BDL	BDL	0.06	15.4	1.4	BDL	7.4	9.90

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
10/3/02	9.7	53	BDL	BDL	0.02	8.5	2.8	BDL	7.6	5.64
10/16/02	10.3	17	BDL	BDL	0.02	4.2	1.8	BDL	8.0	6.41
10/30/02	11.7	23	BDL	BDL	0.03	1.4	1.5	BDL	7.6	9.40
11/13/02	11.6	65	BDL	BDL	0.04	2.3	2.1	BDL	7.8	8.96
11/26/02	11.4	10	BDL	BDL	BDL	1.6	3.3	BDL	7.2	8.31
12/12/02	13.6	31	BDL	BDL	0.01	1.6	5.3	20	7.8	8.94

Table PTR-16. Potlatch River, downstream of the City of Bovill discharge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	nd	nd	BDL	BDL	0.04	0.1	5.8	BDL	6.8	19.57
1/8/02	nd	150	BDL	0.15	0.08	0.2	15.7	14	7.6	too deep
1/23/02	13.0	37	BDL	BDL	0.03	0.1	6.0	BDL	6.8	74.40
2/4/02	12.8	17	BDL	BDL	0.03	0.0	6.3	BDL	7.3	32.71
2/19/02	13.5	8	BDL	BDL	0.03	0.3	2.3	BDL	7.5	34.18
3/4/02	nd	46	BDL	BDL	0.04	0.2	7.6	5	7.1	57.71
3/18/02	10.4	53	BDL	BDL	0.04	0.4	7.4	5	6.9	too deep
4/1/02	11.2	27	BDL	BDL	0.03	2.0	6.6	9	6.9	too deep
4/19/02	11.2	nd	BDL	BDL	0.03	4.6	7.9	6	6.9	too deep
4/30/02	10.2	4	BDL	BDL	0.02	7.8	3.8	BDL	7.3	too deep
5/16/02	9.3	6	BDL	BDL	0.02	9.7	3.8	4	7.7	too deep
5/30/02	9.5	310	BDL	BDL	0.02	14.4	3.7	BDL	7.2	81.31
6/11/02	8.9	72	BDL	BDL	0.04	12.9	2.7	BDL	7.6	51.10
6/26/02	8.8	580	BDL	BDL	0.03	19.5	3.5	BDL	7.6	13.33
7/10/02	8.2	120	BDL	BDL	0.03	21.5	3.0	5	7.6	7.43
7/24/02	8.0	310	BDL	BDL	0.05	25.8	2.8	BDL	7.3	2.33
8/7/02	8.2	390	BDL	BDL	0.03	18.0	2.6	BDL	7.3	3.42
8/21/02	8.4	240	BDL	BDL	0.03	18.4	3.9	4	7.5	2.61
9/3/02	8.5	140	BDL	BDL	0.03	19.1	2.7	BDL	7.4	2.81
9/20/02	7.2	370	0.19	BDL	0.04	13.5	1.6	4	7.7	2.54

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/2/02	9.5	190	BDL	BDL	0.02	9.9	5.6	BDL	7.6	1.86
10/14/02	9.8	110	BDL	BDL	0.03	7.2	3.4	BDL	7.6	1.42
10/30/02	11.7	120	BDL	BDL	0.03	2.5	3.0	8	8.0	3.39
11/14/02	11.6	340	BDL	BDL	0.04	3.3	3.6	6	7.9	4.10
11/25/02	11.2	2	0.16	BDL	0.06	2.2	9.5	BDL	7.7	5.00
12/11/02	12.8	4	0.96	BDL	0.06	2.0	3.7	BDL	7.5	8.24

Table PTR-17. Moose Creek at the mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	14.0	nd	0.12	BDL	0.03	0.1	7.0	BDL	6.2	4.31
1/8/02	nd	9	BDL	BDL	0.03	1.0	10.0	BDL	7.7	7.03
1/22/02	13.4	16	BDL	BDL	0.03	0.2	5.9	BDL	7.2	7.02
2/4/02	14.1	13	BDL	BDL	0.02	0.3	6.7	BDL	7.1	10.88
2/19/02	11.5	6	BDL	BDL	0.03	0.5	1.2	BDL	7.6	7.17
3/4/02	nd	22	BDL	BDL	0.03	0.7	6.4	BDL	6.9	23.61
3/18/02	10.4	18	BDL	BDL	0.03	0.5	6.6	BDL	6.7	22.91
4/1/02	11.7	6	BDL	BDL	0.03	1.5	4.2	BDL	7.1	56.65
4/19/02	10.9		BDL	BDL	0.03	5.4	5.7	BDL	7.1	too deep
4/30/02	9.8	5	BDL	BDL	0.02	10.4	3.5	BDL	7.4	too deep
5/13/02	8.3	6	BDL	BDL	0.01	12.0	3.5	BDL	6.8	40.15
5/29/02	8.4	40	BDL	BDL	0.03	17.3	2.7	BDL	7.4	21.13
6/12/02	7.8	7	BDL	BDL	0.03	16.0	2.9	BDL	7.5	6.01
6/25/02	8.3	33	BDL	BDL	0.03	23.5	1.9	BDL	7.4	2.00
7/10/02	7.2	38	BDL	BDL	0.03	23.5	2.7	5	7.4	1.40
7/24/02	7.1	690	BDL	BDL	0.06	24.5	2.8	5	7.4	0.22
8/8/02	8.4	61	BDL	BDL	0.02	17.4	2.0	BDL	7.3	0.18
8/21/02	10.2	610	BDL	BDL	0.04	16.9	2.0	BDL	7.6	0.14
9/4/02	8.3	1,600	BDL	BDL	0.29	13.2	2.1	5	7.6	0.12
9/19/02	8.2	56	BDL	BDL	0.09	12.2	1.7	BDL	7.6	0.13
10/3/02	8.5	1,000	BDL	BDL	0.03	9.9	6.8	5	7.6	1.22

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/16/02	10.0	96	BDL	BDL	0.02	3.5	2.4	BDL	8.4	0.03
10/30/02	11.7	82	BDL	BDL	0.02	2.1	1.6	BDL	7.6	1.04
11/14/02	10.8	16	BDL	BDL	0.02	5.7	3.0	BDL	7.6	1.65
11/25/02	10.6	3	BDL	BDL	BDL	2.8	3.4	BDL	7.6	1.84
12/11/02	12.8	7	BDL	BDL	0.01	3.4	2.9	BDL	7.5	2.12
4/21/2003		1								
4/24/2003		2								
4/28/2003		2								
5/1/2003		<1								
5/6/2003		1								
6/8/2004		4.1								
6/21/2004		14.6								
7/6/2004		40.8								
7/27/2004		249.5								
8/5/2004		228.2								
8/12/2004		2419								
8/16/2004		218.7								
8/19/2004		214.3								
8/23/2004		727								
8/26/2004		204.6								
8/30/2004		1721.5								

Table PTR-18. Moose Creek, upstream of Moose Creek Reservoir.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid -ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^{o}C)	(NTU)	(mg/L)		(cfs)
12/27/01	14.3	0	BDL	BDL	0.04	0.2	6.3	BDL	6.0	2.34
1/8/02	nd	28	BDL	BDL	0.03	0.2	7.8	BDL	7.3	9.10
1/22/02	11.4	24	BDL	BDL	0.02	0.1	6.3	BDL	7.1	5.66
2/4/02	11.0	29	BDL	BDL	0.02	0.2	5.3	BDL	7.1	5.03
2/19/02	9.0	29	BDL	BDL	0.03	0.0	1.4	BDL	7.6	too deep
3/4/02	13.4	30	BDL	BDL	0.03	0.0	4.9	BDL	6.8	too much ice
3/18/02	8.7	35	BDL	BDL	0.03	0.1	5.7	BDL	6.7	too much ice
4/1/02	11.2	11	BDL	BDL	0.02	1.2	3.9	BDL	7.4	too deep
4/14/02	11.7	30	BDL	BDL	0.02	2.0	7.2	7	7.1	too deep
4/30/02	10.8	14	BDL	BDL	0.01	7.0	3.5	BDL	7.6	too deep
5/13/02	9.0	25	BDL	BDL	0.01	11.4	3.2	BDL	7.2	too deep
5/30/02	9.8	29	BDL	BDL	0.03	12.9	2.8	BDL	7.3	10.11
6/11/02	9.4	150	BDL	BDL	0.03	13.9	3.7	BDL	7.6	7.00
6/25/02	9.6	1300	BDL	BDL	0.04	20.0	5.7	6	7.2	1.56
7/10/02	8.3	160	BDL	BDL	0.05	19.5	8.3	16	7.4	0.92
7/24/02	6.8	730	BDL	BDL	0.08	22.1	7.1	17	7.1	0.13
8/7/02	7.8	520	BDL	BDL	0.04	16.9	5.7	8	7.2	0.33
8/21/02	9.2	490	BDL	BDL	0.05	17.0	5.7	6	7.4	0.23
9/4/02	8.1	440	BDL	BDL	0.05	19.5	5.4	6	7.6	0.24
9/19/02	9.1	400	0.16	BDL	0.05	15.0	5.1	5	7.6	0.15

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/3/02	8.7	1,600	BDL	BDL	0.04	8.5	14.0	8	7.6	0.08
10/15/02	10.5	650	0.17	BDL	0.04	6.9	7.8	8	7.8	0.16
10/30/02	11.1	51	BDL	BDL	0.04	2.8	8.3	14	7.7	0.32
11/14/02	11.4	130	BDL	BDL	0.04	2.9	9.1	BDL	7.6	0.37
11/26/02	10.6	12	0.15	BDL	0.02	2.1	8.3	BDL	7.6	0.41
12/11/02	Frozen Over									

Table PTR-19. Potlatch River, upstream of the City of Bovill discharge.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
12/27/01	13.9	0	BDL	BDL	0.03	0.3	5.4	BDL	7.3	20.65
1/8/02	nd	46	BDL	BDL	0.04	0.3	9.4	6	7.3	68.22
1/23/02	12.0	15	BDL	BDL	0.03	0.1	6.0	BDL	5.9	40.63
2/4/02	10.9	9	BDL	BDL	0.02	0.1	5.7	BDL	7.1	32.99
2/19/02	11.8	4	BDL	BDL	0.03	0.3	1.4	BDL	6.9	29.20
3/4/02	nd	13	BDL	BDL	0.02	0.2	6.5	BDL	6.8	44.49
3/19/02	10.7	13	BDL	BDL	0.03	0.2	6.9	4	6.9	87.64
4/1/02	11.0	5	BDL	BDL	0.03	1.9	6.4	BDL	6.9	too deep
4/19/02	11.2		BDL	BDL	0.02	4.5	6.8	BDL	7.2	too deep
4/30/02	10.1	8	BDL	BDL	0.02	7.9	4.0	BDL	7.1	too deep
5/14/02	9.6	46	BDL	BDL	0.02	9.6	4.6	5	7.4	too deep
5/30/02	9.4	5	BDL	BDL	0.03	14.6	3.1	BDL	7.1	88.71
6/11/02	8.2	50	BDL	BDL	0.03	13.2	2.4	BDL	7.6	45.86
6/26/02	7.7	2,400	BDL	BDL	0.06	19.9	14.0	21	7.5	13.59
7/11/02	6.9	190	BDL	BDL	0.04	19.5	4.3	8	7.6	7.61
7/24/02	8.1	770	BDL	BDL	0.05	24.8	3.3	5	7.3	2.01
8/7/02	8.0	400	BDL	BDL	0.03	17.3	1.9	BDL	7.3	3.46
8/21/02	8.2	1,600	BDL	BDL	0.04	nd	nd	5	nd	nd
9/3/02	7.9	200	BDL	BDL	0.03	19.0	2.1	BDL	7.5	3.36
9/20/02	8.6	520	0.14	BDL	0.03	15.0	2.2	BDL	7.6	2.99

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
10/2/02	9.5	180	BDL	BDL	0.02	9.8	5.4	BDL	7.6	1.54
10/14/02	10.0	28	BDL	BDL	0.02	6.8	3.4	BDL	7.5	1.32
10/30/02	11.5	50	BDL	BDL	0.03	2.7	2.6	BDL	7.8	3.16
11/14/02	11.4	110	BDL	BDL	0.04	3.4	5.6	7	7.6	4.65
11/25/02	10.8	4	BDL	BDL	0.02	2.3	9.5	BDL	7.6	5.02
12/11/02	12.8	5	BDL	BDL	0.02	1.9	2.7	BDL	7.5	8.61
4/21/2003		3								
4/24/2003		1								
4/28/2003		9								
5/1/2003		17								
5/6/2003		25								
6/21/2004		90.9								
7/19/2004		135.4								
7/22/2004		248.9								
7/26/2004		248.1								
7/26/2004		410.6								
7/29/2004		1732.9								
8/2/2004		98.7								

Table PTR-20. Boulder Creek at Linden Road crossing.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
4/29/02	11.1	10	BDL	BDL	0.03	8.0	8.7	5	7.5	15.40
5/13/02	9.3	10	BDL	BDL	0.03	9.5	7.2	4	7.4	7.46
5/28/02	9.6	1,400	BDL	BDL	0.05	13.3	12.6	8	7.5	6.22
6/12/02	7.6	210	BDL	BDL	0.04	11.8	5.7	BDL	7.8	3.08
6/24/02	8.9	160	BDL	BDL	0.04	17.3	4.5	BDL	8.1	1.63
7/9/02	9.3	160	BDL	BDL	0.04	15.3	5.6	BDL	8.2	0.76
7/23/02	9.2	89	BDL	BDL	0.05	20.1	6.1	6	7.8	0.12
8/6/02	9.2	870	BDL	BDL	0.04	14.4	5.7	6	7.6	0.60
8/19/02	9.1	19	BDL	BDL	0.04	16.9	4.7	BDL	7.9	0.09
9/2/02	10.2	110	BDL	BDL	0.05	16.5	5.3	BDL	8.0	0.10
9/17/02	9.5	77	BDL	BDL	nd	13.2	3.0	BDL	8.2	0.12
10/2/02	10.5	57	BDL	BDL	0.05	4.3	4.8	BDL	7.9	0.41
10/15/02	11.0	41	BDL	BDL	0.03	4.0	1.9	BDL	8.0	0.12
10/29/02	10.5	86	BDL	BDL	0.04	2.5	3.1	BDL	7.9	0.72
11/13/02	10.8	44	BDL	BDL	0.04	4.3	3.0	BDL	8.0	0.84
11/25/02	11.4	4	BDL	BDL	BDL	2.7	4.0	BDL	8.3	0.72
12/10/02	14.9	11	BDL	BDL	0.02	1.5	2.4	BDL	7.9	1.02
4/21/2003		20								
4/24/2003		22								
4/28/2003		400								

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
5/1/2003		64								
5/6/2003		65								
6/8/2004		148.3								
6/21/2004		218.7								
7/6/2004		461.1								
7/19/2004		2419.2								
7/22/2004		307.6								
7/26/2004		307.6								
7/26/2004		365.4								
7/29/2004		816.4								
8/2/2004		378.4								

Table PTR-21. West Fork Potlatch River at mouth.

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid-ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(°C)	(NTU)	(mg/L)		(cfs)
4/30/02	10.6	20	BDL	BDL	0.01	3.5	3.6	BDL	7.4	too deep
5/13/02	10.8	110	BDL	BDL	0.02	7.1	2.8	BDL	7.4	too deep
5/28/02	8.3	44	BDL	BDL	0.03	15.5	2.4	BDL	7.1	35.51
6/11/02	9.4	42	BDL	BDL	0.04	10.2	2.7	BDL	7.6	13.08
6/25/02	9.3	100	BDL	BDL	0.03	16.8	2.4	BDL	7.1	4.45
7/10/02	8.2	120	BDL	BDL	0.04	16.0	2.4	BDL	7.6	2.27
7/24/02	6.3	140	BDL	BDL	0.05	20.0	2.5	BDL	7.2	1.10
8/7/02	7.7	580	BDL	BDL	0.03	14.4	2.5	BDL	7.0	1.43
8/21/02	8.4	19	BDL	BDL	0.03	15.5	2.8	BDL	7.4	1.24
9/3/02	7.0	33	BDL	BDL	0.04	15.6	2.5	6	7.5	1.36
9/19/02	8.4	55	0.19	BDL	0.04	11.1	1.6	BDL	7.8	0.94
10/2/02	8.9	140	BDL	BDL	0.04	6.4	5.4	8	7.6	0.54
10/14/02	9.3	26	BDL	BDL	0.03	4.6	1.8	BDL	7.1	0.60
10/30/02	11.0	54	BDL	BDL	0.03	1.5	3.0	BDL	8.2	0.90
11/14/02	11.9	170	BDL	BDL	0.05	1.6	3.9	BDL	7.6	1.01
11/25/02	11.8	<1	BDL	BDL	0.02	1.6	4.4	BDL	8.2	1.14
12/11/02	12.8	<1	BDL	BDL	0.02	1.7	2.7	BDL	7.4	1.26
4/21/2003		1								
4/24/2003		3								
4/28/2003		<1								

Sample Date	Dissolved Oxygen	*E. Coli*	NH_3	NO_2+NO_3	TP	Temper-ature	Turbid -ity	TSS	pH	Flow
	(mg/L)	(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)	(^oC)	(NTU)	(mg/L)		(cfs)
5/1/2003		4								
5/6/2003		1								
6/21/2004		8.6								
7/6/2004		67.6								
7/27/2004		38.9								
8/5/2004		210.5								
8/16/2004		1299.7								
8/23/2004		613.1								
8/26/2004		1119.9								
8/30/2004		64.5								

Table PTR-22. Porcupine and Sheep Creeks, at the mouths.

Sample Location	Sample Date	*E. Coli*	NH_3	NO_2+NO_3	TP
		(cfu/100ml)	(mg/L)	(mg/L)	(mg/L)
Porcupine Cr.	4/30/02	<1	0.25	BDL	BDL
Porcupine Cr.	5/13/02	< 1	BDL	BDL	BDL
Porcupine Cr.	5/28/02	3	BDL	BDL	0.01
Porcupine Cr.	6/11/02	3	BDL	BDL	0.03
Porcupine Cr.	6/25/02	4	BDL	BDL	0.03
Porcupine Cr.	7/10/02	260	BDL	BDL	0.03
Porcupine Cr.	7/24/02	22	BDL	BDL	0.04
Porcupine Cr.	8/7/02	93	BDL	BDL	0.03
Porcupine Cr.	8/21/02	54	BDL	BDL	0.07
Porcupine Cr.	9/4/02	11	nd	BDL	0.12
Porcupine Cr.	9/20/02	4	BDL	BDL	0.04
Porcupine Cr.	10/3/02	10	BDL	BDL	0.03
Sheep Cr.	10/15/02	650	BDL	BDL	0.17
Sheep Cr.	10/30/02	99	BDL	BDL	0.04
Sheep Cr.	11/15/02	Frozen Solid			

Appendix C. Percent Natural Vegetation Loading Tables

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Table C-1. Existing and potential solar loads for Potlatch River, Big Bear Creek to Mouth.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
1552	0.1	5.13	0.34	3.762	-1.368	53	42	82256	421973.28	65184	245222.208	-176751.072	-24	Blk Cottonwood
1112	0.1	5.13	0.34	3.762	-1.368	55	42	61160	313750.8	46704	175700.448	-138050.352	-24	Blk Cottonwood
1290	0.1	5.13	0.34	3.762	-1.368	55	42	70950	363973.5	54180	203825.16	-160148.34	-24	Blk Cottonwood
854	0.1	5.13	0.34	3.762	-1.368	62	42	52948	271623.24	35868	134935.416	-136687.824	-24	Blk Cottonwood
1142	0.1	5.13	0.34	3.762	-1.368	61	42	69662	357366.06	47964	180440.568	-176925.492	-24	Blk Cottonwood
784	0.1	5.13	0.34	3.762	-1.368	52	42	40768	209139.84	32928	123875.136	-85264.704	-24	Blk Cottonwood
849	0.1	5.13	0.3	3.99	-1.14	56	48	47544	243900.72	40752	162600.48	-81300.24	-20	Blk Cottonwood
951	0.1	5.13	0.3	3.99	-1.14	63	48	59913	307353.69	45648	182135.52	-125218.17	-20	Blk Cottonwood
960	0.1	5.13	0.3	3.99	-1.14	59	48	56640	290563.2	46080	183859.2	-106704	-20	Blk Cottonwood
788	0.1	5.13	0.3	3.99	-1.14	60	48	47280	242546.4	37824	150917.76	-91628.64	-20	Blk Cottonwood
941	0.1	5.13	0.3	3.99	-1.14	67	48	63047	323431.11	45168	180220.32	-143210.79	-20	Blk Cottonwood
841	0.1	5.13	0.3	3.99	-1.14	65	48	54665	280431.45	40368	161068.32	-119363.13	-20	Blk Cottonwood
996	0.1	5.13	0.3	3.99	-1.14	62	48	61752	316787.76	47808	190753.92	-126033.84	-20	Blk Cottonwood
384	0.1	5.13	0.3	3.99	-1.14	68	48	26112	133954.56	18432	73543.68	-60410.88	-20	Blk Cottonwood
280	0.1	5.13	0.27	4.161	-0.969	62	52	17360	89056.8	14560	60584.16	-28472.64	-17	Blk Cottonwood
300	0.1	5.13	0.27	4.161	-0.969	53	52	15900	81567	15600	64911.6	-16655.4	-17	Blk Cottonwood
1321	0.1	5.13	0.27	4.161	-0.969	63	52	83223	426933.99	68692	285827.412	-141106.578	-17	Blk Cottonwood
902	0.1	5.13	0.27	4.161	-0.969	54	52	48708	249872.04	46904	195167.544	-54704.496	-17	Blk Cottonwood
1106	0.1	5.13	0.27	4.161	-0.969	53	52	58618	300710.34	57512	239307.432	-61402.908	-17	Blk Cottonwood
937	0.1	5.13	0.27	4.161	-0.969	55	52	51535	264374.55	48724	202740.564	-61633.986	-17	Blk Cottonwood
931	0.1	5.13	0.28	4.104	-1.026	51	51	47481	243577.53	47481	194862.024	-48715.506	-18	Blk Cottonwood
822	0.1	5.13	0.27	4.161	-0.969	63	52	51786	265662.18	42744	177857.784	-87804.396	-17	Blk Cottonwood
184	0.1	5.13	0.27	4.161	-0.969	64	52	11776	60410.88	9568	39812.448	-20598.432	-17	Blk Cottonwood
750	0.1	5.13	0.25	4.275	-0.855	54	54	40500	207765	40500	173137.5	-34627.5	-15	Blk Cottonwood
709	0.1	5.13	0.25	4.275	-0.855	61	54	43249	221867.37	38286	163672.65	-58194.72	-15	Blk Cottonwood
							Total	**1264833**	**6488593.29**	**1035479**	**4146979**	**-2341614**	**-19.52**	

Table C-2. Existing and potential solar loads for Potlatch River, Corral Creek to Big Bear Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
645	0.5	2.85	0.56	2.508	-0.342	20	20	12900	36765	12900	32353.2	-4411.8	-6	Conifer
1135	0.6	2.28	0.57	2.451	0.171	19	19	21565	49168.2	21565	52855.815	3687.615	3	Conifer
617	0.8	1.14	0.58	2.394	1.254	18	18	11106	12660.84	11106	26587.764	13926.924	22	Conifer
2976	0.3	3.99	0.34	3.762	-0.228	23	21	68448	273107.52	62496	235109.952	-37997.568	-4	Ponderosa
256	0.4	3.42	0.38	3.534	0.114	20	20	5120	17510.4	5120	18094.08	583.68	2	Ponderosa
366	0.6	2.28	0.56	2.508	0.228	20	20	7320	16689.6	7320	18358.56	1668.96	4	Conifer
226	0.3	3.99	0.54	2.622	-1.368	21	21	4746	18936.54	4746	12444.012	-6492.528	-24	Conifer
214	0.5	2.85	0.54	2.622	-0.228	21	21	4494	12807.9	4494	11783.268	-1024.632	-4	Conifer
204	0.6	2.28	0.61	2.223	-0.057	17	17	3468	7907.04	3468	7709.364	-197.676	-1	Conifer
173	0.3	3.99	0.61	2.223	-1.767	17	17	2941	11734.59	2941	6537.843	-5196.747	-31	Conifer
377	0.4	3.42	0.61	2.223	-1.197	17	17	6409	21918.78	6409	14247.207	-7671.573	-21	Conifer
904	0.2	4.56	0.34	3.762	-0.798	21	21	18984	86567.04	18984	71417.808	-15149.232	-14	Ponderosa
130	0.4	3.42	0.34	3.762	0.342	21	21	2730	9336.6	2730	10270.26	933.66	6	Ponderosa
168	0.2	4.56	0.34	3.762	-0.798	21	21	3528	16087.68	3528	13272.336	-2815.344	-14	Ponderosa
821	0.3	3.99	0.34	3.762	-0.228	26	21	21346	85170.54	17241	64860.642	-20309.898	-4	Ponderosa
344	0.2	4.56	0.34	3.762	-0.798	23	21	7912	36078.72	7224	27176.688	-8902.032	-14	Ponderosa
553	0.4	3.42	0.34	3.762	0.342	26	21	14378	49172.76	11613	43688.106	-5484.654	6	Ponderosa
483	0.3	3.99	0.34	3.762	-0.228	26	21	12558	50106.42	10143	38157.966	-11948.454	-4	Ponderosa
659	0.6	2.28	0.42	3.306	1.026	18	18	11862	27045.36	11862	39215.772	12170.412	18	Ponderosa
596	0.5	2.85	0.38	3.534	0.684	20	20	11920	33972	11920	42125.28	8153.28	12	Ponderosa
490	0.7	1.71	0.42	3.306	1.596	18	18	8820	15082.2	8820	29158.92	14076.72	28	Ponderosa
475	0.3	3.99	0.27	4.161	0.171	26	24	12350	49276.5	11400	47435.4	-1841.1	3	Ponderosa
416	0.6	2.28	0.27	4.161	1.881	24	24	9984	22763.52	9984	41543.424	18779.904	33	Ponderosa
614	0.2	4.56	0.27	4.161	-0.399	30	24	18420	83995.2	14736	61316.496	-22678.704	-7	Ponderosa
663	0.3	3.99	0.27	4.161	0.171	24	24	15912	63488.88	15912	66209.832	2720.952	3	Ponderosa
631	0.2	4.56	0.27	4.161	-0.399	30	24	18930	86320.8	15144	63014.184	-23306.616	-7	Ponderosa
114	0.4	3.42	0.38	3.534	0.114	20	20	2280	7797.6	2280	8057.52	259.92	2	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load ($kWh/m^2/day$)	Potential Shade (fraction)	Potential Summer Load ($kWh/m^2/day$)	Potential Load minus Existing load ($kWh/m^2/day$)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
324	0.2	4.56	0.27	4.161	-0.399	26	24	8424	38413.44	7776	32355.936	-6057.504	-7	Ponderosa
265	0.3	3.99	0.27	4.161	0.171	27	24	7155	28548.45	6360	26463.96	-2084.49	3	Ponderosa
203	0.2	4.56	0.27	4.161	-0.399	25	24	5075	23142	4872	20272.392	-2869.608	-7	Ponderosa
383	0.2	4.56	0.27	4.161	-0.399	25	24	9575	43662	9192	38247.912	-5414.088	-7	Ponderosa
423	0.3	3.99	0.27	4.161	0.171	25	24	10575	42194.25	10152	42242.472	48.222	3	Ponderosa
648	0.2	4.56	0.38	3.534	-1.026	20	20	12960	59097.6	12960	45800.64	-13296.96	-18	Ponderosa
133	0.3	3.99	0.27	4.161	0.171	30	24	3990	15920.1	3192	13281.912	-2638.188	3	Ponderosa
304	0.2	4.56	0.27	4.161	-0.399	30	24	9120	41587.2	7296	30358.656	-11228.544	-7	Ponderosa
370	0.3	3.99	0.27	4.161	0.171	30	24	11100	44289	8880	36949.68	-7339.32	3	Ponderosa
240	0.2	4.56	0.27	4.161	-0.399	30	24	7200	32832	5760	23967.36	-8864.64	-7	Ponderosa
337	0.4	3.42	0.23	4.389	0.969	25	25	8425	28813.5	8425	36977.325	8163.825	17	Ponderosa
2118	0.2	4.56	0.16	4.788	0.228	30	28	63540	289742.4	59304	283947.552	-5794.848	4	Ponderosa
327	0.3	3.99	0.16	4.788	0.798	30	28	9810	39141.9	9156	43838.928	4697.028	14	Ponderosa
313	0.2	4.56	0.16	4.788	0.228	33	28	10329	47100.24	8764	41962.032	-5138.208	4	Ponderosa
245	0.3	3.99	0.16	4.788	0.798	33	28	8085	32259.15	6860	32845.68	586.53	14	Ponderosa
238	0.1	5.13	0.16	4.788	-0.342	33	28	7854	40291.02	6664	31907.232	-8383.788	-6	Ponderosa
144	0.3	3.99	0.11	5.073	1.083	30	30	4320	17236.8	4320	21915.36	4678.56	19	Ponderosa
164	0.1	5.13	0.11	5.073	-0.057	30	30	4920	25239.6	4920	24959.16	-280.44	-1	Ponderosa
414	0.2	4.56	0.11	5.073	0.513	30	30	12420	56635.2	12420	63006.66	6371.46	9	Ponderosa
207	0.3	3.99	0.11	5.073	1.083	30	30	6210	24777.9	6210	31503.33	6725.43	19	Ponderosa
311	0.2	4.56	0.11	5.073	0.513	33	30	10263	46799.28	9330	47331.09	531.81	9	Ponderosa
854	0.1	5.13	0.11	5.073	-0.057	40	30	34160	175240.8	25620	129970.26	-45270.54	-1	Ponderosa
648	0.3	3.99	0.11	5.073	1.083	36	30	23328	93078.72	19440	98619.12	5540.4	19	Ponderosa
1997	0.1	5.13	0.11	5.073	-0.057	45	30	89865	461007.45	59910	303923.43	-157084.02	-1	Ponderosa
311	0.2	4.56	0.11	5.073	0.513	36	30	11196	51053.76	9330	47331.09	-3722.67	9	Ponderosa
312	0.1	5.13	0.11	5.073	-0.057	45	30	14040	72025.2	9360	47483.28	-24541.92	-1	Ponderosa
222	0.2	4.56	0.11	5.073	0.513	40	30	8880	40492.8	6660	33786.18	-6706.62	9	Ponderosa
320	0.1	5.13	0.11	5.073	-0.057	32	30	10240	52531.2	9600	48700.8	-3830.4	-1	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
233	0.2	4.56	0.11	5.073	0.513	32	30	7456	33999.36	6990	35460.27	1460.91	9	Ponderosa
840	0.1	5.13	0.11	5.073	-0.057	45	30	37800	193914	25200	127839.6	-66074.4	-1	Ponderosa
							Total	**808746**	**3392534.55**	**701009**	**2946251**	**-446283.55**	**1.561404**	

Table C-3. Existing and potential solar loads for Potlatch River, Moose Creek to Corral Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
1017	0.2	4.56	0.69	1.767	-2.793	7	7	7119	32462.64	7119	12579.273	-19883.367	-49	Ponderosa
955	0.2	4.56	0.69	1.767	-2.793	7	7	6685	30483.6	6685	11812.395	-18671.205	-49	Ponderosa
715	0.3	3.99	0.61	2.223	-1.767	9	9	6435	25675.65	6435	14305.005	-11370.645	-31	Ponderosa
218	0.2	4.56	0.61	2.223	-2.337	9	9	1962	8946.72	1962	4361.526	-4585.194	-41	Ponderosa
835	0.3	3.99	0.61	2.223	-1.767	9	9	7515	29984.85	7515	16705.845	-13279.005	-31	Ponderosa
358	0.5	2.85	0.61	2.223	-0.627	9	9	3222	9182.7	3222	7162.506	-2020.194	-11	Ponderosa
390	0.3	3.99	0.61	2.223	-1.767	9	9	3510	14004.9	3510	7802.73	-6202.17	-31	Ponderosa
181	0.2	4.56	0.58	2.394	-2.166	11	11	1991	9078.96	1991	4766.454	-4312.506	-38	Ponderosa
395	0.5	2.85	0.6	2.28	-0.57	10	10	3950	11257.5	3950	9006	-2251.5	-10	Ponderosa
520	0.3	3.99	0.6	2.28	-1.71	10	10	5200	20748	5200	11856	-8892	-30	Ponderosa
425	0.2	4.56	0.55	2.565	-1.995	12	12	5100	23256	5100	13081.5	-10174.5	-35	Ponderosa
234	0.3	3.99	0.55	2.565	-1.425	12	12	2808	11203.92	2808	7202.52	-4001.4	-25	Ponderosa
436	0.2	4.56	0.55	2.565	-1.995	12	12	5232	23857.92	5232	13420.08	-10437.84	-35	Ponderosa
1101	0.3	3.99	0.55	2.565	-1.425	13	12	14313	57108.87	13212	33888.78	-23220.09	-25	Ponderosa
1005	0.3	3.99	0.55	2.565	-1.425	14	12	14070	56139.3	12060	30933.9	-25205.4	-25	Ponderosa
771	0.2	4.56	0.55	2.565	-1.995	12	12	9252	42189.12	9252	23731.38	-18457.74	-35	Ponderosa
430	0.3	3.99	0.55	2.565	-1.425	12	12	5160	20588.4	5160	13235.4	-7353	-25	Ponderosa
397	0.2	4.56	0.55	2.565	-1.995	12	12	4764	21723.84	4764	12219.66	-9504.18	-35	Ponderosa
184	0.3	3.99	0.55	2.565	-1.425	12	12	2208	8809.92	2208	5663.52	-3146.4	-25	Ponderosa
898	0.2	4.56	0.48	2.964	-1.596	15	15	13470	61423.2	13470	39925.08	-21498.12	-28	Ponderosa
497	0.3	3.99	0.45	3.135	-0.855	17	17	8449	33711.51	8449	26487.615	-7223.895	-15	Ponderosa
297	0.2	4.56	0.45	3.135	-1.425	17	17	5049	23023.44	5049	15828.615	-7194.825	-25	Ponderosa
1440	0.4	3.42	0.61	2.223	-1.197	17	17	24480	83721.6	24480	54419.04	-29302.56	-21	Conifer
777	0.2	4.56	0.45	3.135	-1.425	20	17	15540	70862.4	13209	41410.215	-29452.185	-25	Ponderosa
535	0.4	3.42	0.45	3.135	-0.285	20	17	10700	36594	9095	28512.825	-8081.175	-5	Ponderosa
595	0.2	4.56	0.45	3.135	-1.425	20	17	11900	54264	10115	31710.525	-22553.475	-25	Ponderosa
636	0.4	3.42	0.45	3.135	-0.285	21	17	13356	45677.52	10812	33895.62	-11781.9	-5	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
309	0.2	4.56	0.45	3.135	-1.425	21	17	6489	29589.84	5253	16468.155	-13121.685	-25	Ponderosa
183	0.3	3.99	0.45	3.135	-0.855	21	17	3843	15333.57	3111	9752.985	-5580.585	-15	Ponderosa
1155	0.2	4.56	0.45	3.135	-1.425	22	17	25410	115869.6	19635	61555.725	-54313.875	-25	Ponderosa
849	0.3	3.99	0.45	3.135	-0.855	17	17	14433	57587.67	14433	45247.455	-12340.215	-15	Ponderosa
181	0.4	3.42	0.45	3.135	-0.285	17	17	3077	10523.34	3077	9646.395	-876.945	-5	Ponderosa
405	0.3	3.99	0.45	3.135	-0.855	22	17	8910	35550.9	6885	21584.475	-13966.425	-15	Ponderosa
230	0.5	2.85	0.45	3.135	0.285	17	17	3910	11143.5	3910	12257.85	1114.35	5	Ponderosa
342	0.3	3.99	0.45	3.135	-0.855	17	17	5814	23197.86	5814	18226.89	-4970.97	-15	Ponderosa
640	0.2	4.56	0.45	3.135	-1.425	23	17	14720	67123.2	10880	34108.8	-33014.4	-25	Ponderosa
176	0.3	3.99	0.45	3.135	-0.855	16	17	2816	11235.84	2992	9379.92	-1855.92	-15	Ponderosa
506	0.4	3.42	0.45	3.135	-0.285	18	17	9108	31149.36	8602	26967.27	-4182.09	-5	Ponderosa
160	0.2	4.56	0.45	3.135	-1.425	18	17	2880	13132.8	2720	8527.2	-4605.6	-25	Ponderosa
298	0.4	3.42	0.45	3.135	-0.285	18	17	5364	18344.88	5066	15881.91	-2462.97	-5	Ponderosa
117	0.2	4.56	0.45	3.135	-1.425	26	17	3042	13871.52	1989	6235.515	-7636.005	-25	Ponderosa
241	0.3	3.99	0.45	3.135	-0.855	26	17	6266	25001.34	4097	12844.095	-12157.245	-15	Ponderosa
120	0.2	4.56	0.45	3.135	-1.425	21	17	2520	11491.2	2040	6395.4	-5095.8	-25	Ponderosa
181	0.4	3.42	0.45	3.135	-0.285	20	17	3620	12380.4	3077	9646.395	-2734.005	-5	Ponderosa
100	0.4	3.42	0.61	2.223	-1.197	17	17	1700	5814	1700	3779.1	-2034.9	-21	Conifer
550	0.6	2.28	0.63	2.109	-0.171	16	16	8800	20064	8800	18559.2	-1504.8	-3	Conifer
							Total	**346162**	**1394385.3**	**316145**	**872988.744**	**-521396.556**	**-22.0435**	

Table C-4. Existing and potential solar loads for Potlatch River, Headwaters to Moose Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetative Community
825	0.9	0.57	0.91	0.513	-0.057	1	1	825	470.25	825	423.225	-47.025	-1	Conifer
485	0.9	0.57	0.91	0.513	-0.057	1	1	485	276.45	485	248.805	-27.645	-1	Conifer
840	0.8	1.14	0.91	0.513	-0.627	1	1	840	957.6	840	430.92	-526.68	-11	Conifer
168	0.9	0.57	0.91	0.513	-0.057	1	1	168	95.76	168	86.184	-9.576	-1	Conifer
593	0.7	1.71	0.89	0.627	-1.083	2	2	1186	2028.06	1186	743.622	-1284.438	-19	Conifer
640	0.9	0.57	0.89	0.627	0.057	2	2	1280	729.6	1280	802.56	72.96	1	Conifer
166	0.9	0.57	0.89	0.627	0.057	2	2	332	189.24	332	208.164	18.924	1	Conifer
370	0.7	1.71	0.86	0.798	-0.912	3	3	1110	1898.1	1110	885.78	-1012.32	-16	Conifer
243	0.6	2.28	0.86	0.798	-1.482	3	3	729	1662.12	729	581.742	-1080.378	-26	Conifer
332	0.5	2.85	0.85	0.855	-1.995	4	4	1328	3784.8	1328	1135.44	-2649.36	-35	Conifer
446	0.7	1.71	0.85	0.855	-0.855	4	4	1784	3050.64	1784	1525.32	-1525.32	-15	Conifer
1084	0.5	2.85	0.85	0.855	-1.995	4	4	4336	12357.6	4336	3707.28	-8650.32	-35	Conifer
280	0.5	2.85	0.85	0.855	-1.995	4	4	1120	3192	1120	957.6	-2234.4	-35	Conifer
330	0.4	3.42	0.64	2.052	-1.368	5	5	1650	5643	1650	3385.8	-2257.2	-24	Mtn. Alder
895	0.3	3.99	0.64	2.052	-1.938	5	5	4475	17855.25	4475	9182.7	-8672.55	-34	Mtn. Alder
616	0.2	4.56	0.57	2.451	-2.109	6	6	3696	16853.76	3696	9058.896	-7794.864	-37	Mtn. Alder
216	0.5	2.85	0.57	2.451	-0.399	6	6	1296	3693.6	1296	3176.496	-517.104	-7	Mtn. Alder
156	0.3	3.99	0.57	2.451	-1.539	6	6	936	3734.64	936	2294.136	-1440.504	-27	Mtn. Alder
653	0.2	4.56	0.57	2.451	-2.109	6	6	3918	17866.08	3918	9603.018	-8263.062	-37	Mtn. Alder
370	0.3	3.99	0.57	2.451	-1.539	6	6	2220	8857.8	2220	5441.22	-3416.58	-27	Mtn. Alder
512	0.2	4.56	0.5	2.85	-1.71	7	7	3584	16343.04	3584	10214.4	-6128.64	-30	Mtn. Alder
1345	0.3	3.99	0.57	2.451	-1.539	6	6	8070	32199.3	8070	19779.57	-12419.73	-27	Mtn. Alder
1130	0.3	3.99	0.57	2.451	-1.539	6	6	6780	27052.2	6780	16617.78	-10434.42	-27	Mtn. Alder
273	0.2	4.56	0.57	2.451	-2.109	6	6	1638	7469.28	1638	4014.738	-3454.542	-37	Mtn. Alder
							Total	**27576**	**78472.47**	**27576**	**38834.67**	**-39637.8**	**-17.8889**	

Table C-5. Existing and potential solar loads for Big Bear Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
1109	0.3	3.99	0.55	2.565	-1.425	12	12	13308	53098.92	13308	34135.02	-18963.9	-25	Ponderosa
746	0.2	4.56	0.55	2.565	-1.995	13	12	9698	44222.88	8952	22961.88	-21261	-35	Ponderosa
450	0.1	5.13	0.55	2.565	-2.565	18	12	8100	41553	5400	13851	-27702	-45	Ponderosa
218	0.3	3.99	0.55	2.565	-1.425	12	12	2616	10437.84	2616	6710.04	-3727.8	-25	Ponderosa
129	0.1	5.13	0.55	2.565	-2.565	12	12	1548	7941.24	1548	3970.62	-3970.62	-45	Ponderosa
559	0.2	4.56	0.55	2.565	-1.995	12	12	6708	30588.48	6708	17206.02	-13382.46	-35	Ponderosa
147	0.4	3.42	0.55	2.565	-0.855	12	12	1764	6032.88	1764	4524.66	-1508.22	-15	Ponderosa
531	0.3	3.99	0.55	2.565	-1.425	12	12	6372	25424.28	6372	16344.18	-9080.1	-25	Ponderosa
176	0.5	2.85	0.55	2.565	-0.285	13	12	2288	6520.8	2112	5417.28	-1103.52	-5	Ponderosa
601	0.2	4.56	0.53	2.679	-1.881	14	13	8414	38367.84	7813	20931.027	-17436.813	-33	Ponderosa
520	0.3	3.99	0.53	2.679	-1.311	14	13	7280	29047.2	6760	18110.04	-10937.16	-23	Ponderosa
215	0.5	2.85	0.53	2.679	-0.171	14	13	3010	8578.5	2795	7487.805	-1090.695	-3	Ponderosa
295	0.2	4.56	0.53	2.679	-1.881	14	13	4130	18832.8	3835	10273.965	-8558.835	-33	Ponderosa
713	0.4	3.42	0.51	2.793	-0.627	15	14	10695	36576.9	9982	27879.726	-8697.174	-11	Ponderosa
1020	0.3	3.99	0.51	2.793	-1.197	15	14	15300	61047	14280	39884.04	-21162.96	-21	Ponderosa
161	0.6	2.28	0.51	2.793	0.513	16	14	2576	5873.28	2254	6295.422	422.142	9	Ponderosa
285	0.4	3.42	0.51	2.793	-0.627	16	14	4560	15595.2	3990	11144.07	-4451.13	-11	Ponderosa
234	0.3	3.99	0.5	2.85	-1.14	17	15	3978	15872.22	3510	10003.5	-5868.72	-20	Ponderosa
235	0.4	3.42	0.5	2.85	-0.57	17	15	3995	13662.9	3525	10046.25	-3616.65	-10	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
551	0.3	3.99	0.5	2.85	-1.14	17	15	9367	37374.33	8265	23555.25	-13819.08	-20	Ponderosa
1161	0.6	2.28	0.66	1.938	-0.342	16	15	18576	42353.28	17415	33750.27	-8603.01	-6	Conifer
983	0.5	2.85	0.63	2.109	-0.741	17	16	16711	47626.35	15728	33170.352	-14455.998	-13	Conifer
378	0.2	4.56	0.48	2.964	-1.596	18	16	6804	31026.24	6048	17926.272	-13099.968	-28	Ponderosa
414	0.4	3.42	0.48	2.964	-0.456	18	16	7452	25485.84	6624	19633.536	-5852.304	-8	Ponderosa
247	0.2	4.56	0.48	2.964	-1.596	17	16	4199	19147.44	3952	11713.728	-7433.712	-28	Ponderosa
322	0.6	2.28	0.61	2.223	-0.057	17	17	5474	12480.72	5474	12168.702	-312.018	-1	Conifer
429	0.3	3.99	0.45	3.135	-0.855	18	17	7722	30810.78	7293	22863.555	-7947.225	-15	Ponderosa
225	0.5	2.85	0.61	2.223	-0.627	18	17	4050	11542.5	3825	8502.975	-3039.525	-11	Conifer
2470	0.4	3.42	0.61	2.223	-1.197	18	17	44460	152053.2	41990	93343.77	-58709.43	-21	Conifer
481	0.3	3.99	0.45	3.135	-0.855	18	17	8658	34545.42	8177	25634.895	-8910.525	-15	Ponderosa
412	0.4	3.42	0.45	3.135	-0.285	18	17	7416	25362.72	7004	21957.54	-3405.18	-5	Ponderosa
248	0.2	4.56	0.42	3.306	-1.254	19	18	4712	21486.72	4464	14757.984	-6728.736	-22	Ponderosa
335	0.4	3.42	0.42	3.306	-0.114	18	18	6030	20622.6	6030	19935.18	-687.42	-2	Ponderosa
992	0.3	3.99	0.42	3.306	-0.684	18	18	17856	71245.44	17856	59031.936	-12213.504	-12	Ponderosa
1001	0.4	3.42	0.42	3.306	-0.114	18	18	18018	61621.56	18018	59567.508	-2054.052	-2	Ponderosa
685	0.3	3.99	0.42	3.306	-0.684	20	18	13700	54663	12330	40762.98	-13900.02	-12	Ponderosa
852	0.5	2.85	0.42	3.306	0.456	19	18	16188	46135.8	15336	50700.816	4565.016	8	Ponderosa
1414	0.4	3.42	0.4	3.42	0	21	19	29694	101553.48	26866	91881.72	-9671.76	0	Ponderosa
354	0.2	4.56	0.4	3.42	-1.14	22	19	7788	35513.28	6726	23002.92	-12510.36	-20	Ponderosa
436	0.3	3.99	0.57	2.451	-1.539	21	19	9156	36532.44	8284	20304.084	-16228.356	-27	Conifer
585	0.6	2.28	0.57	2.451	0.171	20	19	11700	26676	11115	27242.865	566.865	3	Conifer
1156	0.4	3.42	0.4	3.42	0	20	19	23120	79070.4	21964	75116.88	-3953.52	0	Ponderosa
395	0.2	4.56	0.4	3.42	-1.14	22	19	8690	39626.4	7505	25667.1	-13959.3	-20	Ponderosa
205	0.4	3.42	0.4	3.42	0	22	19	4510	15424.2	3895	13320.9	-2103.3	0	Ponderosa
212	0.2	4.56	0.4	3.42	-1.14	23	19	4876	22234.56	4028	13775.76	-8458.8	-20	Ponderosa
170	0.3	3.99	0.4	3.42	-0.57	20	19	3400	13566	3230	11046.6	-2519.4	-10	Ponderosa
674	0.2	4.56	0.4	3.42	-1.14	26	19	17524	79909.44	12806	43796.52	-36112.92	-20	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
156	0.3	3.99	0.4	3.42	-0.57	24	19	3744	14938.56	2964	10136.88	-4801.68	-10	Ponderosa
465	0.2	4.56	0.4	3.42	-1.14	20	19	9300	42408	8835	30215.7	-12192.3	-20	Ponderosa
165	0.3	3.99	0.4	3.42	-0.57	20	19	3300	13167	3135	10721.7	-2445.3	-10	Ponderosa
152	0.2	4.56	0.4	3.42	-1.14	22	19	3344	15248.64	2888	9876.96	-5371.68	-20	Ponderosa
276	0.3	3.99	0.4	3.42	-0.57	19	19	5244	20923.56	5244	17934.48	-2989.08	-10	Ponderosa
1318	0.2	4.56	0.4	3.42	-1.14	25	19	32950	150252	25042	85643.64	-64608.36	-20	Ponderosa
165	0.1	5.13	0.38	3.534	-1.596	25	20	4125	21161.25	3300	11662.2	-9499.05	-28	Ponderosa
517	0.3	3.99	0.32	3.876	-0.114	25	22	12925	51570.75	11374	44085.624	-7485.126	-2	Ponderosa
							Total	**529123**	**1994634.1**	**482554**	**1421586.3**	**-573047.73**	**-15.6**	

Table C-6. Existing and potential solar loads for Boulder Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
905	0.9	0.57	0.91	0.513	-0.057	1	1	905	515.85	905	464.265	-51.585	-1	Conifer
835	0.9	0.57	0.91	0.513	-0.057	1	1	835	475.95	835	428.355	-47.595	-1	Conifer
150	0.6	2.28	0.91	0.513	-1.767	1	1	150	342	150	76.95	-265.05	-31	Conifer
462	0.8	1.14	0.89	0.627	-0.513	2	2	924	1053.36	924	579.348	-474.012	-9	Conifer
682	0.7	1.71	0.89	0.627	-1.083	2	2	1364	2332.44	1364	855.228	-1477.212	-19	Conifer
527	0.7	1.71	0.89	0.627	-1.083	2	2	1054	1802.34	1054	660.858	-1141.482	-19	Conifer
102	0.4	3.42	0.89	0.627	-2.793	2	2	204	697.68	204	127.908	-569.772	-49	Conifer
770	0.6	2.28	0.89	0.627	-1.653	2	2	1540	3511.2	1540	965.58	-2545.62	-29	Conifer
214	0.4	3.42	0.86	0.798	-2.622	3	3	642	2195.64	642	512.316	-1683.324	-46	Conifer
855	0.6	2.28	0.86	0.798	-1.482	3	3	2565	5848.2	2565	2046.87	-3801.33	-26	Conifer
254	0.7	1.71	0.85	0.855	-0.855	4	4	1016	1737.36	1016	868.68	-868.68	-15	Conifer
983	0.6	2.28	0.83	0.969	-1.311	5	5	4915	11206.2	4915	4762.635	-6443.565	-23	Conifer
397	0.7	1.71	0.83	0.969	-0.741	5	5	1985	3394.35	1985	1923.465	-1470.885	-13	Conifer
338	0.8	1.14	0.82	1.026	-0.114	6	6	2028	2311.92	2028	2080.728	-231.192	-2	Conifer
1214	0.9	0.57	0.82	1.026	0.456	6	6	7284	4151.88	7284	7473.384	3321.504	8	Conifer
920	0.8	1.14	0.8	1.14	0	7	7	6440	7341.6	6440	7341.6	0	0	Conifer
1023	0.8	1.14	0.8	1.14	0	7	7	7161	8163.54	7161	8163.54	0	0	Conifer
263	0.8	1.14	0.79	1.197	0.057	8	8	2104	2398.56	2104	2518.488	119.928	1	Conifer
							Total	**41012**	**57081.51**	**41012**	**39331.71**	**-17749.8**	**-16.1765**	

Table C-7. Existing and potential solar loads for Cedar Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load ($kWh/m^2/day$)	Potential Shade (fraction)	Potential Summer Load ($kWh/m^2/day$)	Potential Load minus Existing load ($kWh/m^2/day$)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
505	0.9	0.57	0.91	0.513	-0.057	1	1	505	287.85	505	259.065	-28.785	-1	Conifer
1179	0.7	1.71	0.91	0.513	-1.197	1	1	1179	2016.09	1179	604.827	-1411.263	-21	Conifer
264	0.9	0.57	0.89	0.627	0.057	2	2	528	300.96	528	331.056	30.096	1	Conifer
216	0.7	1.71	0.89	0.627	-1.083	2	2	432	738.72	432	270.864	-467.856	-19	Conifer
318	0.9	0.57	0.89	0.627	0.057	2	2	636	362.52	636	398.772	36.252	1	Conifer
300	0.8	1.14	0.89	0.627	-0.513	2	2	600	684	600	376.2	-307.8	-9	Conifer
200	0.9	0.57	0.89	0.627	0.057	2	2	400	228	400	250.8	22.8	1	Conifer
675	0.7	1.71	0.76	1.368	-0.342	3	3	2025	3462.75	2025	2770.2	-692.55	-6	Ponderosa
143	0.6	2.28	0.76	1.368	-0.912	3	3	429	978.12	429	586.872	-391.248	-16	Ponderosa
273	0.7	1.71	0.76	1.368	-0.342	3	3	819	1400.49	819	1120.392	-280.098	-6	Ponderosa
369	0.6	2.28	0.76	1.368	-0.912	3	3	1107	2523.96	1107	1514.376	-1009.584	-16	Ponderosa
214	0.4	3.42	0.76	1.368	-2.052	3	3	642	2195.64	642	878.256	-1317.384	-36	Ponderosa
765	0.9	0.57	0.86	0.798	0.228	3	3	2295	1308.15	2295	1831.41	523.26	4	Conifer
346	0.6	2.28	0.85	0.855	-1.425	4	4	1384	3155.52	1384	1183.32	-1972.2	-25	Conifer
1245	0.9	0.57	0.85	0.855	0.285	4	4	4980	2838.6	4980	4257.9	1419.3	5	Conifer
121	0.7	1.71	0.83	0.969	-0.741	5	5	605	1034.55	605	586.245	-448.305	-13	Conifer
296	0.5	2.85	0.83	0.969	-1.881	5	5	1480	4218	1480	1434.12	-2783.88	-33	Conifer
642	0.8	1.14	0.82	1.026	-0.114	7	6	4494	5123.16	3852	3952.152	-1171.008	-2	Conifer
525	0.4	3.42	0.7	1.71	-1.71	8	6	4200	14364	3150	5386.5	-8977.5	-30	Ponderosa
149	0.7	1.71	0.69	1.767	0.057	8	7	1192	2038.32	1043	1842.981	-195.339	1	Ponderosa
239	0.5	2.85	0.69	1.767	-1.083	7	7	1673	4768.05	1673	2956.191	-1811.859	-19	Ponderosa
474	0.4	3.42	0.65	1.995	-1.425	9	8	4266	14589.72	3792	7565.04	-7024.68	-25	Ponderosa
223	0.6	2.28	0.65	1.995	-0.285	9	8	2007	4575.96	1784	3559.08	-1016.88	-5	Ponderosa
624	0.4	3.42	0.65	1.995	-1.425	9	8	5616	19206.72	4992	9959.04	-9247.68	-25	Ponderosa
589	0.5	2.85	0.65	1.995	-0.855	9	8	5301	15107.85	4712	9400.44	-5707.41	-15	Ponderosa
268	0.8	1.14	0.79	1.197	0.057	9	8	2412	2749.68	2144	2566.368	-183.312	1	Conifer
161	0.5	2.85	0.76	1.368	-1.482	9	9	1449	4129.65	1449	1982.232	-2147.418	-26	Conifer
150	0.7	1.71	0.76	1.368	-0.342	9	9	1350	2308.5	1350	1846.8	-461.7	-6	Conifer

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
379	0.5	2.85	0.76	1.368	-1.482	10	9	3790	10801.5	3411	4666.248	-6135.252	-26	Conifer
134	0.4	3.42	0.76	1.368	-2.052	10	9	1340	4582.8	1206	1649.808	-2932.992	-36	Conifer
308	0.7	1.71	0.76	1.368	-0.342	10	9	3080	5266.8	2772	3792.096	-1474.704	-6	Conifer
240	0.5	2.85	0.74	1.482	-1.368	12	10	2880	8208	2400	3556.8	-4651.2	-24	Conifer
881	0.7	1.71	0.74	1.482	-0.228	10	10	8810	15065.1	8810	13056.42	-2008.68	-4	Conifer
618	0.8	1.14	0.73	1.539	0.399	11	11	6798	7749.72	6798	10462.122	2712.402	7	Conifer
338	0.5	2.85	0.71	1.653	-1.197	12	12	4056	11559.6	4056	6704.568	-4855.032	-21	Conifer
1353	0.7	1.71	0.71	1.653	-0.057	12	12	16236	27763.56	16236	26838.108	-925.452	-1	Conifer
							Total	**100996**	**207692.61**	**95676**	**140397.669**	**-67294.941**	**-12.5278**	

Table C-8. Existing and potential solar loads for Corral Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
757	0.9	0.57	0.91	0.513	-0.057	1	1	757	431.49	757	388.341	-43.149	-1	Conifer
862	0.9	0.57	0.89	0.627	0.057	2	2	1724	982.68	1724	1080.948	98.268	1	Conifer
994	0.6	2.28	0.88	0.684	-1.596	3	3	2982	6798.96	2982	2039.688	-4759.272	-28	Mtn. Alder
228	0.7	1.71	0.86	0.798	-0.912	3	3	684	1169.64	684	545.832	-623.808	-16	Conifer
946	0.5	2.85	0.85	0.855	-1.995	4	4	3784	10784.4	3784	3235.32	-7549.08	-35	Conifer
685	0.6	2.28	0.85	0.855	-1.425	4	4	2740	6247.2	2740	2342.7	-3904.5	-25	Conifer
279	0.5	2.85	0.83	0.969	-1.881	5	5	1395	3975.75	1395	1351.755	-2623.995	-33	Conifer
514	0.4	3.42	0.64	2.052	-1.368	5	5	2570	8789.4	2570	5273.64	-3515.76	-24	Mtn. Alder
277	0.5	2.85	0.83	0.969	-1.881	5	5	1385	3947.25	1385	1342.065	-2605.185	-33	Conifer
223	0.3	3.99	0.57	2.451	-1.539	6	6	1338	5338.62	1338	3279.438	-2059.182	-27	Mtn. Alder
1035	0.5	2.85	0.83	0.969	-1.881	5	5	5175	14748.75	5175	5014.575	-9734.175	-33	Conifer
858	0.5	2.85	0.83	0.969	-1.881	5	5	4290	12226.5	4290	4157.01	-8069.49	-33	Conifer
340	0.5	2.85	0.82	1.026	-1.824	6	6	2040	5814	2040	2093.04	-3720.96	-32	Conifer
295	0.6	2.28	0.82	1.026	-1.254	6	6	1770	4035.6	1770	1816.02	-2219.58	-22	Conifer
915	0.4	3.42	0.5	2.85	-0.57	7	7	6405	21905.1	6405	18254.25	-3650.85	-10	Mtn. Alder
190	0.4	3.42	0.5	2.85	-0.57	7	7	1330	4548.6	1330	3790.5	-758.1	-10	Mtn. Alder
749	0.5	2.85	0.5	2.85	0	7	7	5243	14942.55	5243	14942.55	0	0	Mtn. Alder
512	0.3	3.99	0.69	1.767	-2.223	7	7	3584	14300.16	3584	6332.928	-7967.232	-39	Ponderosa
376	0.1	5.13	0.69	1.767	-3.363	9	7	3384	17359.92	2632	4650.744	-12709.176	-59	Ponderosa
177	0.4	3.42	0.69	1.767	-1.653	9	7	1593	5448.06	1239	2189.313	-3258.747	-29	Ponderosa
742	0.1	5.13	0.65	1.995	-3.135	10	8	7420	38064.6	5936	11842.32	-26222.28	-55	Ponderosa
603	0.1	5.13	0.65	1.995	-3.135	10	8	6030	30933.9	4824	9623.88	-21310.02	-55	Ponderosa
508	0.3	3.99	0.65	1.995	-1.995	10	8	5080	20269.2	4064	8107.68	-12161.52	-35	Ponderosa
500	0.4	3.42	0.65	1.995	-1.425	10	8	5000	17100	4000	7980	-9120	-25	Ponderosa
581	0.5	2.85	0.65	1.995	-0.855	9	8	5229	14902.65	4648	9272.76	-5629.89	-15	Ponderosa
580	0.7	1.71	0.61	2.223	0.513	11	9	6380	10909.8	5220	11604.06	694.26	9	Ponderosa
165	0.5	2.85	0.61	2.223	-0.627	11	9	1815	5172.75	1485	3301.155	-1871.595	-11	Ponderosa
279	0.4	3.42	0.61	2.223	-1.197	11	9	3069	10495.98	2511	5581.953	-4914.027	-21	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
132	0.6	2.28	0.61	2.223	-0.057	11	9	1452	3310.56	1188	2640.924	-669.636	-1	Ponderosa
216	0.5	2.85	0.61	2.223	-0.627	11	9	2376	6771.6	1944	4321.512	-2450.088	-11	Ponderosa
283	0.7	1.71	0.61	2.223	0.513	11	9	3113	5323.23	2547	5661.981	338.751	9	Ponderosa
							Total	**101137**	**327048.9**	**91434**	**164058.882**	**-162990.02**	**-22.548387**	

Table C-9. Existing and Potential solar loads for Moose Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
615	0.4	3.42	0.91	0.513	-2.907	1	1	615	2103.3	615	315.495	-1787.805	-51	Conifer
1138	0.3	3.99	0.89	0.627	-3.363	3	2	3414	13621.86	2276	1427.052	-12194.808	-59	Conifer
1440	0.2	4.56	0.75	1.425	-3.135	4	4	5760	26265.6	5760	8208	-18057.6	-55	Mtn. Alder
1707	0.3	3.99	0.75	1.425	-2.565	6	4	10242	40865.58	6828	9729.9	-31135.68	-45	Mtn. Alder
934	0.2	4.56	0.75	1.425	-3.135	6	4	5604	25554.24	3736	5323.8	-20230.44	-55	Mtn. Alder
368	0.3	3.99	0.75	1.425	-2.565	6	4	2208	8809.92	1472	2097.6	-6712.32	-45	Mtn. Alder
646	0.2	4.56	0.75	1.425	-3.135	6	4	3876	17674.56	2584	3682.2	-13992.36	-55	Mtn. Alder
997	0.2	4.56	0.75	1.425	-3.135	5	4	4985	22731.6	3988	5682.9	-17048.7	-55	Mtn. Alder
147	0.4	3.42	0.75	1.425	-1.995	5	4	735	2513.7	588	837.9	-1675.8	-35	Mtn. Alder
853	0.3	3.99	0.75	1.425	-2.565	5	4	4265	17017.35	3412	4862.1	-12155.25	-45	Mtn. Alder
604	0.5	2.85	0.85	0.855	-1.995	4	4	2416	6885.6	2416	2065.68	-4819.92	-35	Conifer
							Total	**44120**	**184043.31**	**33675**	**44232.627**	**-139810.68**	**-48.6364**	

Table C-10. Existing and potential solar loads for Pine Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load ($kWh/m^2/day$)	Potential Shade (fraction)	Potential Summer Load ($kWh/m^2/day$)	Potential Load minus Existing load ($kWh/m^2/day$)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
659	0.9	0.57	0.92	0.456	-0.114	1	1	659	375.63	659	300.504	-75.126	-2	Ponderosa
188	0.6	2.28	0.92	0.456	-1.824	1	1	188	428.64	188	85.728	-342.912	-32	Ponderosa
336	0.8	1.14	0.92	0.456	-0.684	1	1	336	383.04	336	153.216	-229.824	-12	Ponderosa
644	0.6	2.28	0.81	1.083	-1.197	2	2	1288	2936.64	1288	1394.904	-1541.736	-21	Ponderosa
256	0.4	3.42	0.81	1.083	-2.337	2	2	512	1751.04	512	554.496	-1196.544	-41	Ponderosa
354	0.7	1.71	0.81	1.083	-0.627	2	2	708	1210.68	708	766.764	-443.916	-11	Ponderosa
272	0.5	2.85	0.76	1.368	-1.482	3	3	816	2325.6	816	1116.288	-1209.312	-26	Ponderosa
481	0.6	2.28	0.75	1.425	-0.855	4	4	1924	4386.72	1924	2741.7	-1645.02	-15	Ponderosa
137	0.3	3.99	0.75	1.425	-2.565	4	4	548	2186.52	548	780.9	-1405.62	-45	Ponderosa
166	0.4	3.42	0.75	1.425	-1.995	4	4	664	2270.88	664	946.2	-1324.68	-35	Ponderosa
433	0.2	4.56	0.75	1.425	-3.135	4	4	1732	7897.92	1732	2468.1	-5429.82	-55	Ponderosa
219	0.4	3.42	0.75	1.425	-1.995	4	4	876	2995.92	876	1248.3	-1747.62	-35	Ponderosa
190	0.2	4.56	0.75	1.425	-3.135	4	4	760	3465.6	760	1083	-2382.6	-55	Ponderosa
160	0.4	3.42	0.75	1.425	-1.995	4	4	640	2188.8	640	912	-1276.8	-35	Ponderosa
100	0.2	4.56	0.75	1.425	-3.135	4	4	400	1824	400	570	-1254	-55	Ponderosa
210	0.4	3.42	0.75	1.425	-1.995	4	4	840	2872.8	840	1197	-1675.8	-35	Ponderosa
790	0.6	2.28	0.75	1.425	-0.855	4	4	3160	7204.8	3160	4503	-2701.8	-15	Ponderosa
837	0.7	1.71	0.75	1.425	-0.285	4	4	3348	5725.08	3348	4770.9	-954.18	-5	Ponderosa
192	0.4	3.42	0.74	1.482	-1.938	5	5	960	3283.2	960	1422.72	-1860.48	-34	Ponderosa
247	0.7	1.71	0.74	1.482	-0.228	5	5	1235	2111.85	1235	1830.27	-281.58	-4	Ponderosa
101	0.4	3.42	0.74	1.482	-1.938	5	5	505	1727.1	505	748.41	-978.69	-34	Ponderosa
649	0.5	2.85	0.74	1.482	-1.368	7	5	4543	12947.55	3245	4809.09	-8138.46	-24	Ponderosa
178	0.4	3.42	0.7	1.71	-1.71	6	6	1068	3652.56	1068	1826.28	-1826.28	-30	Ponderosa
309	0.6	2.28	0.7	1.71	-0.57	6	6	1854	4227.12	1854	3170.34	-1056.78	-10	Ponderosa
185	0.3	3.99	0.7	1.71	-2.28	6	6	1110	4428.9	1110	1898.1	-2530.8	-40	Ponderosa
1022	0.6	2.28	0.7	1.71	-0.57	6	6	6132	13980.96	6132	10485.72	-3495.24	-10	Ponderosa
392	0.4	3.42	0.7	1.71	-1.71	6	6	2352	8043.84	2352	4021.92	-4021.92	-30	Ponderosa
436	0.9	0.57	0.82	1.026	0.456	6	6	2616	1491.12	2616	2684.016	1192.896	8	Conifer

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
232	0.7	1.71	0.82	1.026	-0.684	6	6	1392	2380.32	1392	1428.192	-952.128	-12	Conifer
2246	0.8	1.14	0.8	1.14	0	7	7	15722	17923.08	15722	17923.08	0	0	Conifer
259	0.7	1.71	0.8	1.14	-0.57	7	7	1813	3100.23	1813	2066.82	-1033.41	-10	Conifer
373	0.4	3.42	0.69	1.767	-1.653	7	7	2611	8929.62	2611	4613.637	-4315.983	-29	Ponderosa
484	0.5	2.85	0.69	1.767	-1.083	9	7	4356	12414.6	3388	5986.596	-6428.004	-19	Ponderosa
162	0.2	4.56	0.69	1.767	-2.793	11	7	1782	8125.92	1134	2003.778	-6122.142	-49	Ponderosa
250	0.5	2.85	0.69	1.767	-1.083	11	7	2750	7837.5	1750	3092.25	-4745.25	-19	Ponderosa
1079	0.3	3.99	0.69	1.767	-2.223	12	8	12948	51662.52	8632	15252.744	-36409.776	-39	Ponderosa
508	0.6	2.28	0.79	1.197	-1.083	11	8	5588	12740.64	4064	4864.608	-7876.032	-19	Conifer
381	0.5	2.85	0.79	1.197	-1.653	11	8	4191	11944.35	3048	3648.456	-8295.894	-29	Conifer
241	0.4	3.42	0.79	1.197	-2.223	11	8	2651	9066.42	1928	2307.816	-6758.604	-39	Conifer
428	0.6	2.28	0.79	1.197	-1.083	11	8	4708	10734.24	3424	4098.528	-6635.712	-19	Conifer
539	0.7	1.71	0.79	1.197	-0.513	11	8	5929	10138.59	4312	5161.464	-4977.126	-9	Conifer
442	0.5	2.85	0.76	1.368	-1.482	12	9	5304	15116.4	3978	5441.904	-9674.496	-26	Conifer
357	0.7	1.71	0.76	1.368	-0.342	12	9	4284	7325.64	3213	4395.384	-2930.256	-6	Conifer
744	0.5	2.85	0.76	1.368	-1.482	13	9	9672	27565.2	6696	9160.128	-18405.072	-26	Conifer
785	0.7	1.71	0.76	1.368	-0.342	13	9	10205	17450.55	7065	9664.92	-7785.63	-6	Conifer
376	0.6	2.28	0.74	1.482	-0.798	13	10	4888	11144.64	3760	5572.32	-5572.32	-14	Conifer
157	0.3	3.99	0.6	2.28	-1.71	13	10	2041	8143.59	1570	3579.6	-4563.99	-30	Ponderosa
136	0.6	2.28	0.6	2.28	0	13	10	1768	4031.04	1360	3100.8	-930.24	0	Ponderosa
391	0.3	3.99	0.6	2.28	-1.71	13	10	5083	20281.17	3910	8914.8	-11366.37	-30	Ponderosa
127	0.1	5.13	0.6	2.28	-2.85	13	10	1651	8469.63	1270	2895.6	-5574.03	-50	Ponderosa
							Total	**153111**	**394850.4**	**126516**	**183663.291**	**-211187.11**	**-24.36**	

Table C-11. Existing and potential solar loads for Ruby Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
1082	0.9	0.57	0.91	0.513	-0.057	1	1	1082	616.74	1082	555.066	-61.674	-1	Conifer
1106	0.9	0.57	0.91	0.513	-0.057	1	1	1106	630.42	1106	567.378	-63.042	-1	Conifer
564	0.9	0.57	0.91	0.513	-0.057	1	1	564	321.48	564	289.332	-32.148	-1	Conifer
1101	0.8	1.14	0.89	0.627	-0.513	2	2	2202	2510.28	2202	1380.654	-1129.626	-9	Conifer
1180	0.7	1.71	0.89	0.627	-1.083	2	2	2360	4035.6	2360	1479.72	-2555.88	-19	Conifer
509	0.7	1.71	0.89	0.627	-1.083	2	2	1018	1740.78	1018	638.286	-1102.494	-19	Conifer
262	0.8	1.14	0.89	0.627	-0.513	2	2	524	597.36	524	328.548	-268.812	-9	Conifer
1115	0.6	2.28	0.86	0.798	-1.482	3	3	3345	7626.6	3345	2669.31	-4957.29	-26	Conifer
1127	0.6	2.28	0.85	0.855	-1.425	4	4	4508	10278.24	4508	3854.34	-6423.9	-25	Conifer
679	0.6	2.28	0.85	0.855	-1.425	4	4	2716	6192.48	2716	2322.18	-3870.3	-25	Conifer
925	0.7	1.71	0.82	1.026	-0.684	6	6	5550	9490.5	5550	5694.3	-3796.2	-12	Conifer
382	0.6	2.28	0.82	1.026	-1.254	6	6	2292	5225.76	2292	2351.592	-2874.168	-22	Conifer
247	0.4	3.42	0.82	1.026	-2.394	6	6	1482	5068.44	1482	1520.532	-3547.908	-42	Conifer
							Total	**28749**	**54334.68**	**28749**	**23651.238**	**-30683.442**	**-16.23077**	

Table C-12. Existing and potential solar loads for EF Potlatch River.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
1864	0.9	0.57	0.91	0.513	-0.057	1	1	1864	1062.48	1864	956.232	-106.248	-1	Conifer
1600	0.9	0.57	0.91	0.513	-0.057	1	1	1600	912	1600	820.8	-91.2	-1	Conifer
1250	0.8	1.14	0.91	0.513	-0.627	1	1	1250	1425	1250	641.25	-783.75	-11	Conifer
980	0.7	1.71	0.89	0.627	-1.083	2	2	1960	3351.6	1960	1228.92	-2122.68	-19	Conifer
496	0.7	1.71	0.86	0.798	-0.912	3	3	1488	2544.48	1488	1187.424	-1357.056	-16	Conifer
1192	0.6	2.28	0.85	0.855	-1.425	4	4	4768	10871.04	4768	4076.64	-6794.4	-25	Conifer
1277	0.5	2.85	0.83	0.969	-1.881	5	5	6385	18197.25	6385	6187.065	-12010.185	-33	Conifer
1322	0.4	3.42	0.82	1.026	-2.394	6	6	7932	27127.44	7932	8138.232	-18989.208	-42	Conifer
127	0.5	2.85	0.82	1.026	-1.824	6	6	762	2171.7	762	781.812	-1389.888	-32	Conifer
2325	0.4	3.42	0.5	2.85	-0.57	7	7	16275	55660.5	16275	46383.75	-9276.75	-10	Mtn. Alder
815	0.4	3.42	0.79	1.197	-2.223	8	8	6520	22298.4	6520	7804.44	-14493.96	-39	Conifer
613	0.5	2.85	0.79	1.197	-1.653	8	8	4904	13976.4	4904	5870.088	-8106.312	-29	Conifer
1180	0.4	3.42	0.71	1.653	-1.767	12	12	14160	48427.2	14160	23406.48	-25020.72	-31	Conifer
320	0.4	3.42	0.74	1.482	-1.938	10	10	3200	10944	3200	4742.4	-6201.6	-34	Conifer
1064	0.3	3.99	0.32	3.876	-0.114	12	12	12768	50944.32	12768	49488.768	-1455.552	-2	Mtn. Alder
550	0.4	3.42	0.37	3.591	0.171	10	10	5500	18810	5500	19750.5	940.5	3	Mtn. Alder
255	0.3	3.99	0.37	3.591	-0.399	10	10	2550	10174.5	2550	9157.05	-1017.45	-7	Mtn. Alder
696	0.2	4.56	0.32	3.876	-0.684	12	12	8352	38085.12	8352	32372.352	-5712.768	-12	Mtn. Alder
497	0.3	3.99	0.37	3.591	-0.399	10	10	4970	19830.3	4970	17847.27	-1983.03	-7	Mtn. Alder
968	0.2	4.56	0.32	3.876	-0.684	13	12	12584	57383.04	11616	45023.616	-12359.424	-12	Mtn. Alder
680	0.4	3.42	0.71	1.653	-1.767	13	12	8840	30232.8	8160	13488.48	-16744.32	-31	Conifer
507	0.3	3.99	0.71	1.653	-2.337	12	12	6084	24275.16	6084	10056.852	-14218.308	-41	Conifer
311	0.2	4.56	0.71	1.653	-2.907	14	12	4354	19854.24	3732	6168.996	-13685.244	-51	Conifer
441	0.4	3.42	0.71	1.653	-1.767	13	12	5733	19606.86	5292	8747.676	-10859.184	-31	Conifer
685	0.3	3.99	0.71	1.653	-2.337	13	12	8905	35530.95	8220	13587.66	-21943.29	-41	Conifer
253	0.4	3.42	0.71	1.653	-1.767	14	12	3542	12113.64	3036	5018.508	-7095.132	-31	Conifer
351	0.2	4.56	0.32	3.876	-0.684	14	12	4914	22407.84	4212	16325.712	-6082.128	-12	Mtn.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
														Alder
797	0.2	4.56	0.32	3.876	-0.684	13	12	10361	47246.16	9564	37070.064	-10176.096	-12	Mtn. Alder
970	0.2	4.56	0.32	3.876	-0.684	15	12	14550	66348	11640	45116.64	-21231.36	-12	Mtn. Alder
784	0.2	4.56	0.32	3.876	-0.684	16	12	12544	57200.64	9408	36465.408	-20735.232	-12	Mtn. Alder
444	0.2	4.56	0.32	3.876	-0.684	16	12	7104	32394.24	5328	20651.328	-11742.912	-12	Mtn. Alder
230	0.2	4.56	0.66	1.938	-2.622	16	15	3680	16780.8	3450	6686.1	-10094.7	-46	Conifer
875	0.3	3.99	0.68	1.824	-2.166	14	14	12250	48877.5	12250	22344	-26533.5	-38	Conifer
385	0.2	4.56	0.66	1.938	-2.622	15	15	5775	26334	5775	11191.95	-15142.05	-46	Conifer
304	0.3	3.99	0.66	1.938	-2.052	15	15	4560	18194.4	4560	8837.28	-9357.12	-36	Conifer
152	0.2	4.56	0.66	1.938	-2.622	15	15	2280	10396.8	2280	4418.64	-5978.16	-46	Conifer
442	0.3	3.99	0.66	1.938	-2.052	15	15	6630	26453.7	6630	12848.94	-13604.76	-36	Conifer
1027	0.2	4.56	0.66	1.938	-2.622	16	15	16432	74929.92	15405	29854.89	-45075.03	-46	Conifer
128	0.3	3.99	0.26	4.218	0.228	16	15	2048	8171.52	1920	8098.56	-72.96	4	Mtn. Alder
843	0.2	4.56	0.26	4.218	-0.342	17	15	14331	65349.36	12645	53336.61	-12012.75	-6	Mtn. Alder
1140	0.2	4.56	0.26	4.218	-0.342	17	15	19380	88372.8	17100	72127.8	-16245	-6	Mtn. Alder
381	0.3	3.99	0.66	1.938	-2.052	17	15	6477	25843.23	5715	11075.67	-14767.56	-36	Conifer
273	0.2	4.56	0.66	1.938	-2.622	18	15	4914	22407.84	4095	7936.11	-14471.73	-46	Conifer
400	0.3	3.99	0.66	1.938	-2.052	18	15	7200	28728	6000	11628	-17100	-36	Conifer
1061	0.2	4.56	0.66	1.938	-2.622	18	15	19098	87086.88	15915	30843.27	-56243.61	-46	Conifer
							Total	**102238**	**336983.43**	**102238**	**222994.203**	**-113989.23**	**-18.9444**	

Table C-13. Existing and potential soar loads for Middle Potlatch Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
3016	0.4	3.42	0.92	0.456	-3	1	1	3016	10314.72	3016	1375.296	-8939.424	-52	Ponderosa
405	0.5	2.85	0.92	0.456	-2.394	3	1	1215	3462.75	405	184.68	-3278.07	-42	Ponderosa
735	0.3	3.99	0.92	0.456	-3.534	2	1	1470	5865.3	735	335.16	-5530.14	-62	Ponderosa
227	0.6	2.28	0.81	1.083	-1.197	2	2	454	1035.12	454	491.682	-543.438	-21	Ponderosa
514	0.4	3.42	0.81	1.083	-2.337	2	2	1028	3515.76	1028	1113.324	-2402.436	-41	Ponderosa
167	0.5	2.85	0.81	1.083	-1.767	2	2	334	951.9	334	361.722	-590.178	-31	Ponderosa
1396	0.6	2.28	0.81	1.083	-1.197	3	2	4188	9548.64	2792	3023.736	-6524.904	-21	Ponderosa
647	0.4	3.42	0.76	1.368	-2.052	4	3	2588	8850.96	1941	2655.288	-6195.672	-36	Ponderosa
307	0.3	3.99	0.76	1.368	-2.622	4	3	1228	4899.72	921	1259.928	-3639.792	-46	Ponderosa
340	0.4	3.42	0.76	1.368	-2.052	4	3	1360	4651.2	1020	1395.36	-3255.84	-36	Ponderosa
273	0.5	2.85	0.75	1.425	-1.425	4	4	1092	3112.2	1092	1556.1	-1556.1	-25	Ponderosa
506	0.4	3.42	0.75	1.425	-1.995	5	4	2530	8652.6	2024	2884.2	-5768.4	-35	Ponderosa
901	0.3	3.99	0.75	1.425	-2.565	5	4	4505	17974.95	3604	5135.7	-12839.25	-45	Ponderosa
675	0.2	4.56	0.74	1.482	-3.078	6	5	4050	18468	3375	5001.75	-13466.25	-54	Ponderosa
1020	0.6	2.28	0.74	1.482	-0.798	6	5	6120	13953.6	5100	7558.2	-6395.4	-14	Ponderosa
567	0.5	2.85	0.74	1.482	-1.368	6	5	3402	9695.7	2835	4201.47	-5494.23	-24	Ponderosa
243	0.4	3.42	0.74	1.482	-1.938	6	5	1458	4986.36	1215	1800.63	-3185.73	-34	Ponderosa
545	0.7	1.71	0.7	1.71	0	6	6	3270	5591.7	3270	5591.7	0	0	Ponderosa
349	0.4	3.42	0.7	1.71	-1.71	6	6	2094	7161.48	2094	3580.74	-3580.74	-30	Ponderosa
182	0.6	2.28	0.7	1.71	-0.57	6	6	1092	2489.76	1092	1867.32	-622.44	-10	Ponderosa
381	0.5	2.85	0.7	1.71	-1.14	7	6	2667	7600.95	2286	3909.06	-3691.89	-20	Ponderosa
258	0.4	3.42	0.7	1.71	-1.71	7	6	1806	6176.52	1548	2647.08	-3529.44	-30	Ponderosa
523	0.5	2.85	0.69	1.767	-1.083	7	7	3661	10433.85	3661	6468.987	-3964.863	-19	Ponderosa
372	0.4	3.42	0.69	1.767	-1.653	9	7	3348	11450.16	2604	4601.268	-6848.892	-29	Ponderosa
153	0.5	2.85	0.69	1.767	-1.083	8	7	1224	3488.4	1071	1892.457	-1595.943	-19	Ponderosa
155	0.6	2.28	0.69	1.767	-0.513	8	7	1240	2827.2	1085	1917.195	-910.005	-9	Ponderosa
995	0.4	3.42	0.65	1.995	-1.425	8	8	7960	27223.2	7960	15880.2	-11343	-25	Ponderosa

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Dominant Vegetation Community
326	0.5	2.85	0.65	1.995	-0.855	8	8	2608	7432.8	2608	5202.96	-2229.84	-15	Ponderosa
240	0.6	2.28	0.65	1.995	-0.285	8	8	1920	4377.6	1920	3830.4	-547.2	-5	Ponderosa
216	0.5	2.85	0.65	1.995	-0.855	8	8	1728	4924.8	1728	3447.36	-1477.44	-15	Ponderosa
1280	0.6	2.28	0.65	1.995	-0.285	9	8	11520	26265.6	10240	20428.8	-5836.8	-5	Ponderosa
572	0.7	1.71	0.65	1.995	0.285	9	8	5148	8803.08	4576	9129.12	326.04	5	Ponderosa
564	0.6	2.28	0.65	1.995	-0.285	8	8	4512	10287.36	4512	9001.44	-1285.92	-5	Ponderosa
188	0.5	2.85	0.65	1.995	-0.855	8	8	1504	4286.4	1504	3000.48	-1285.92	-15	Ponderosa
260	0.7	1.71	0.65	1.995	0.285	8	8	2080	3556.8	2080	4149.6	592.8	5	Ponderosa
108	0.5	2.85	0.61	2.223	-0.627	9	9	972	2770.2	972	2160.756	-609.444	-11	Ponderosa
147	0.7	1.71	0.61	2.223	0.513	9	9	1323	2262.33	1323	2941.029	678.699	9	Ponderosa
172	0.5	2.85	0.61	2.223	-0.627	9	9	1548	4411.8	1548	3441.204	-970.596	-11	Ponderosa
347	0.4	3.42	0.61	2.223	-1.197	10	9	3470	11867.4	3123	6942.429	-4924.971	-21	Ponderosa
2054	0.2	4.56	0.6	2.28	-2.28	13	10	26702	121761.12	20540	46831.2	-74929.92	-40	Ponderosa
826	0.4	3.42	0.6	2.28	-1.14	13	10	10738	36723.96	8260	18832.8	-17891.16	-20	Ponderosa
1467	0.7	1.71	0.58	2.394	0.684	12	11	17604	30102.84	16137	38631.978	8529.138	12	Ponderosa
550	0.9	0.57	0.84	0.912	0.342	12	12	6600	3762	6600	6019.2	2257.2	6	Blk. Cottonwood
							Total	**168377**	**497978.79**	**146233**	**272680.989**	**-225297.8**	**-21.76744**	

Appendix D. Public Comment

The Potlatch River Watershed Advisory Group voted to provide a 30-day public comment period for the June 2008 Draft of the *Potlatch River Subbasin Assessment and TMDLs* at the February 25, 2008 meeting. The document was made available for review at DEQ's Lewiston Regional Office, the Latah County and Lewiston Tsceminicum Libraries, the Latah Soil and Water Conservation District office, the Palouse Clearwater Environmental Institute, and in PDF format on DEQ's Web site.

Written comments were received from:

William Stewart, Environmental Protection Specialist, US Environmental Protection Agency, Region 10, Idaho Operations Office, 1435 N. Orchard St., Boise, Idaho.

Andrea Masom. Resident in the watershed.

<u>Comments received are summarized and addressed below.</u>

Comment: On page 24 of the document in the section titled "Nutrients" there is a statement in the forth paragraph that states "Only biologically available forms of nutrients are used in the ratios (N:P) because these are the forms used by the immediate aquatic community." What is the citation for this method?

Response: A citation has been added to the document.

Comment: On page 42 of the document in the forth paragraph you describe using the N:P ratio with the values which appear to be total inorganic nitrogen to total phosphorus in the ratio. Since the readily available form of phosphorus for uptake by plants is inorganic orthophosphorus, this appears to be inconsistent with the statement on page 24.

Response: The discussion on page 42 has been revised and now includes inorganic orthophosphorus data.

Comment: While it is clear from the data on page 159 that nitrates+nitrites and ammonia are elevated in the West Fork Little Bear Creek at site PTR-6, below the city of Troy, total phosphorus is also elevated in concentration. It is more likely that the high phosphorus concentrations rather than nitrogen are driving down the dissolved oxygen concentrations.

Response: The evaluation and discussion of the available nutrient data presented on pages 42 through 46 of the document has been enhanced and now includes comparisons of nitrogen and phosphorus nutrient concentration correlations with dissolved oxygen concentrations. These correlations support the conclusion that, at this time, nitrification of ammonia to nitrate nitrogen is a greater influence on dissolved oxygen concentrations than the consumption of oxygen by aquatic vegetation life cycles cultivated by phosphorus concentrations.

Comment: It is not clear why the city of Troy was given wasteload allocations (WLA) for E. coli bacteria and total suspended solids but was not given any nutrient WLA even though there is clear evidence of impairment of beneficial uses due to low dissolved oxygen in the stream.

Response: Wasteload allocations for E. coli bacteria and total suspended solids were provided to be consistent with the effluent limitations in the City's current NPDES permit. A nutrient TMDL for total inorganic nitrogen was developed for the West Fork Little Bear Creek. The nutrient allocation is for all sources upstream of the control point including the City's waste water discharge. For the purposes of an NPDES permit, a wasteload allocation is usually based on a 7Q10 flow, which is not available at this time. On page 75, the TMDL provides a compliance schedule for collection of 7Q10 stream flow and other data beginning with the reissuance of their NPDES permit in 2009. In the interim, a waste load allocation can be derived as the product of the facility's design flow and the in-stream target value during the critical flow time period if necessary.

Comment: In reviewing the data on page 156 for Middle Potlatch Creek (PTR-4), it appears that 23 samples of a total of 26 samples exceed the States target of 0.100 mg/l of total phosphorus. Yet no TMDL was developed for the stream. Only 7 of 26 sample dates had flows of less than 1.0 cfs.

Response: No violations of Idaho's dissolved oxygen criterion of 6.0 mg/L were observed in Middle Potlatch Creek during routine water quality monitoring. Low concentrations or dissolved oxygen sags are considered a symptom of nutrient impairment. Since available data indicate the dissolved oxygen criterion is not being violated, nutrients are currently not considered to be impairing Middle Potlatch Creek.

Comment: Most of the sample results for this TMDL show dissolved oxygen well above the Idaho water quality standard of 6.0 mg/l. It is common for waters impaired by nutrients to have dissolved oxygen at saturation or even super-saturation during the daylight hours during the growing season. It is important to monitor dissolved oxygen for the entire 24 hour time period to determine if there are diurnal fluctuations in concentration. Aquatic life may be affected if oxygen levels drop at night when there is no photosynthesis happening.

Response: We agree. Future dissolved oxygen monitoring within the Potlatch River Watershed should gather diurnal data rather than instantaneous data. This is discussed in section 2.5 Data Gaps.

Comment: The 1986 EPA guidance which gives the concentration of 0.100 mg/l total phosphorus as a level to prevent nuisance algae growth and prevent dissolved oxygen problems is no longer in use. The 1986 guidance was replaced by the Ambient Water Quality Criteria Recommendations in December of 2000.

Response: The data collected and used to develop the December 2000 criterion was collected primarily from a more arid geographic area to the west of the Potlatch River Subbasin; an area with different climate, soils, and vegetative features than those found in the

Potlatch River Subbasin. As is supported by various other TMDLs applicable to north central Idaho, background phosphorus levels found in the region tend to be more similar to the levels included in the 1986 guidance. Justification for application of the 1986 EPA guidance concentration and the rational for not applying the December 2000 criteria has been included in Section 5.2 on page 71 of the TMDL.

Comment: There seems to be more than adequate data for listing the West Fork of Little Bear Creek for impairment due to nutrients and low dissolved oxygen. Since it appears that you have chosen to not give the city of Troy a WLA for nutrients in the Potlatch River TMDL, it is strongly recommended that you include the West Fork Little Bear Creek on the next integrated list followed by a separate TMDL for dissolved oxygen and nutrients (TP).

Response: As a result of this TMDL, the West Fork of Little Bear will be listed in Section 4a as being impaired by nutrients, sediment, and bacteria and having TMDLs for total inorganic nitrogen, e-coli bacteria, and total suspended sediment.

Comment: Keep the cows out of the river! As a local resident of Kendrick, and President of the Kendrick Urban Forestry Board, I am unhappy about the lack of regulation on ranchers in this area. Cows defecate directly into the river where our children swim.

Response: Section 5.6 of the TMDL outlines implementation strategies, lists responsible parties, and describes monitoring to be completed to ensure success. The implementation plan will include strategies for livestock operators to implement best management practices aimed toward improving water quality.

Comment: The local fertilizer plant also issues forth all kinds of chemical directly into the river. Adding insult to injury, the employees shoot skeets behind the plant over the river.

Response: Section 2.4 on page 49 of the TMDL describes the pesticide sampling program completed by the Idaho Department of Agriculture in conjunction with the Idaho Association of Soil Conservation Districts in 2004. The study concluded that all pesticide concentrations detected during the study were below any chronic or acute levels that may cause ill effects for aquatic species.

Comment: Many people shoot their guns at a site north of the high school into the Little Bear, littering the entire area with refuse.

Response: The North Central District Health Department has responsibility and authority to manage solid waste including refuse. This comment has been referred to the North Central District Health Solid Waste Program. In response to this complaint, two water samples were collected in the main stem Potlatch River by DEQ staff below the confluence with Big Bear Creek on August 25, 2008. Lead was not detected in the laboratory analysis of the samples.

Appendix E. Distribution List

Department of Environmental Quality – Lewiston Regional Office, 1118 F Street, Lewiston, Idaho 83501

Department of Environmental Quality – State Office, 1410 North Hilton, Boise, Idaho 83706

US Environmental Protection Agency – Idaho Operations Office, 1435 North Orchard, Boise, Idaho 83706

Clearwater Basin Advisory Group Members

Potlatch River Watershed Advisory Group Members

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