Potlatch River Subbasin

Total Maximum Daily Load

Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality
Prepared by the Idaho Soil Conservation Commission
In Cooperation with the Latah Soil and Water Conservation District

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INTRODUCTION

Within the Potlatch River Subbasin (HUC #17060306), TMDLs were developed for eleven waterbodies; these streams are assessed in the Potlatch River Subbasin Assessment and TMDLs (IDEQ, 2008). The waterbodies are: Potlatch River, East Fork Potlatch River, Big Bear Creek, Boulder Creek, Cedar Creek, Corral Creek, Moose Creek, Pine Creek, Ruby Creek, Middle Potlatch Creek, West Fork Little Bear Creek. This agricultural implementation plan addresses water quality concerns associated with agricultural lands that are located within the watersheds of the §303(d) listed streams.

The Potlatch River watershed, part of the Lower Clearwater River Subbasin, drains into the Clearwater River between Myrtle and Spalding. The Potlatch drainage is about 594 square miles (381,000 acres) in size with primary landuses of forestry, agriculture and grazing; several small communities are located within the watershed. 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 to its confluence with the Clearwater River (IDEQ, 2008).

The upper Potlatch River drains rolling hills and meadows of the eastern edge of the Columbia River basalt plateau and the adjacent Clearwater Mountains. Watershed elevations range from 800 feet at the confluence with the Clearwater River, about 2,500 feet on the plateau, to nearly 5,000 feet on some of the mountains bordering the watershed. Major land uses in the watershed include forestry, livestock, and agriculture. The Potlatch River flows onto the Nez Perce Reservation approximately seven miles upstream from its mouth (IDEQ, 2008).

The listed water quality parameters of concern include: sediment, temperature, nutrients, and bacteria. For waterbodies identified on the list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards (IDEQ, 2008). The Potlatch River Subbasin Assessment and TMDLs was submitted by IDEQ and approved by EPA in February 2009.

The Potlatch River Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for the Potlatch River Subbasin TMDL. The plan will specify projects and controls designed to improve water quality and meet the load allocations presented in the TMDL document. Implementation of best management practices (BMPs) within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis (IDEQ, 2008). This "Implementation Plan for Agriculture" will be a component of the overall Potlatch River Subbasin TMDL Implementation Plan.

As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may be revisited. In the event that new data or information shows that changes are warranted, TMDL revisions will be made with the assistance of the Potlatch River WAG. The Agricultural Implementation Plan will be modified as necessary. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved (IDEQ, 2008).

The Idaho Soil Conservation Commission (ISCC) works with the Latah, Nez Perce, and Clearwater Soil and Water Conservation Districts (SWCDs), the Idaho Association of Soil Conservation Districts (IASCD), and the USDA Natural Resource Conservation Service (NRCS) in a partnership to reach common goals and successfully deliver conservation programs within the Potlatch River Subbasin, which is located primarily in Latah County but also straddles Clearwater and Nez Perce counties (Figure 1). ISCC is the designated state agency in Idaho for managing agricultural nonpoint source pollution (Idaho Code § 39-3601).

Purpose

The agricultural component of the Potlatch River Subbasin Total Maximum Daily Load (TMDL) Implementation Plan outlines an adaptive management approach for application of Best Management Practices (BMPs) to meet the requirements of the TMDL. The purpose of this plan is to assist and/or complement other watershed stakeholders in restoring and protecting beneficial uses for the §303(d) listed stream segments (IDEQ, 2008).

Table A. Streams and pollutants for which TMDLs were developed.

Waterbody	Assessment Units	Listing	Pollutants
Potlatch River	ID17060306CL044_06 ID17060306CL045_05 ID17060306CL048_04 ID17060306CL048_05	Big Bear Creek to Clearwater Corral Creek to Big Bear Moose Creek to Corral Creek	Bacteria, Nutrients, Sediment, Temperature
East Fork Potlatch River	ID17060306CL051_04	Ruby Creek to Potlatch River	Bacteria, Nutrients, Sediment, Temperature
Big Bear Creek	ID17060306CL056_04 ID17060306CL056_05	West Fork Big Bear Creek to Potlatch River	Temperature
Boulder Creek	ID17060306CL047_03	Pig Creek to Potlatch River	No pollutant identified
Cedar Creek	ID17060306CL046_04	Leopold Cr. to Potlatch River	Sediment, Temperature
Pine Creek	ID17060306CL055_02 ID17060306CL055_03	Headwaters to Potlatch River	Bacteria, Nutrients, DO, Sediment, Temperature
Ruby Creek	ID17060306CL052_03	Unnamed Tributary 3.4 km upstream to East Fork Potlatch	Bacteria, Nutrients, Sediment, Temperature
Middle Potlatch Creek	ID17060306CL062_02 ID17060306CL062_03	Headwaters to Potlatch River	Bacteria, Nutrients, Sediment, Temperature
West Fork Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03	Headwaters to Little Bear Cr. [previously not on 303(d) list]	Bacteria, Nutrients, Sediment, Temperature
Corral Creek	ID17060306CL054_02 ID17060306CL054_03	Headwaters to Potlatch River	Sediment
Moose Creek	ID17060306CL053_02 ID17060306CL053_03	Headwaters to Potlatch River	Bacteria, Nutrients, pH, Sediment, Temperature

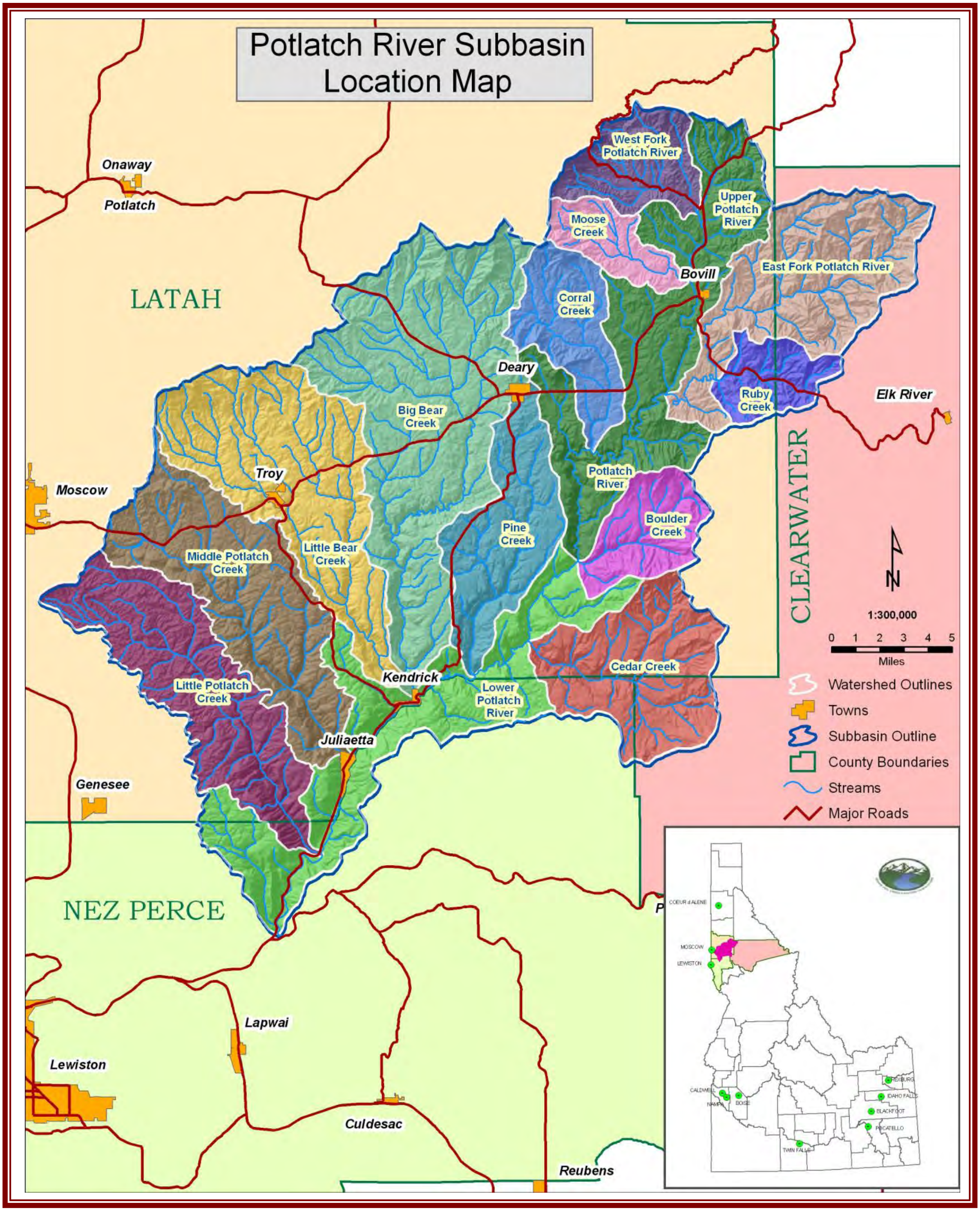

Figure 1. Potlatch River Subbasin Location Map

Goals and Objectives

This component implementation plan is intended to assist and document ongoing efforts of the Latah Soil and Water Conservation District and agricultural producers in the Potlatch River Subbasin to identify critical agricultural acres and suggest BMPs necessary to meet the requirements of the Potlatch River Subbasin TMDL. This work has already begun due to the efforts of the Latah Conservation District and individual farm operators within the watershed combined with funding assistance from the Bonneville Power Administration (BPA), Idaho Department of Environmental Quality (IDEQ), Natural Resources Conservation Service (NRCS) and the Idaho Soil Conservation Commission (ISCC). Whether the TMDL targets are attainable remains to be seen. The main goal of this plan will be to identify critical agricultural acres and to outline practices to reduce the amount of pollutants entering these waterbodies from agricultural sources, where economically feasible.

Agricultural pollutant reductions will be achieved through the application of BMPs developed and implemented on-site with willing individual agricultural landowners and operators. Many county roads intersect agricultural lands; although some road related BMPs may be suggested, it is the responsibility of the county roads district to determine the optimum BMPs to use and their subsequent implementation.

A long range objective of this plan will be to provide BMP effectiveness evaluation and monitoring to determine pollutant load reductions and the cumulative impact on the designated beneficial uses of the listed stream segments. Emphasis will also be placed on the continuance of an on-going water quality outreach program initiated by the Latah Conservation District to encourage landowner participation in water quality remediation efforts within the watershed.

Background

The Potlatch River TMDL document was submitted by the Idaho Department of Environmental Quality (IDEQ) and approved by the US Environmental Protection Agency (EPA) in February 2009. Permitted point sources of pollutants are the Deary, Bovill, Kendrick, Juliaetta, and Troy wastewater treatment facilities. The primary nonpoint sources (NPS) of pollutants in the Potlatch River Subbasin are timber harvest, non-irrigated croplands, grazing lands, land development (construction activities), urban runoff, and roads (IDEQ, 2008).

In 2002, the Idaho State Waterbody Identification Assessment Units shown in Table A were listed as water quality limited under §303(d) of the Clean Water Act (CWA). Pollutants of concern included sediment, temperature, bacteria and nutrients.

Section §303(d) of the Clean Water Act requires states to devise a TMDL management plan for waterbodies determined to be water quality limited. A waterbody is determined to be water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a waterbody can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. TMDLs are the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and allowance for natural background conditions (IDEQ, 2008).

Project setting

The Potlatch River is the largest tributary to the lower Clearwater River, and drains a subwatershed of the Columbia River Basin. The Potlatch River watershed, comprised of approximately 381,000 acres (594 square miles), is characterized by steep basaltic canyons rimmed by rolling cropland in the lower reaches, and by timbered hills and high meadow terrain in the upper reaches (Schriever and Nelson, 1999). The Potlatch River originates north of Bovill (Figure 1). The basin ranges in elevation from almost 5,000 feet on Beals Butte to 800 feet at the confluence with the Clearwater River. The Clearwater joins the Snake River, and then the Columbia River. The communities of Bovill, Helmer, Deary, Troy, Juliaetta, and Kendrick are the principal towns within the watershed. The upper reaches of the Potlatch River basin contains the largest contiguous area of forested land cover in the Lower Clearwater River Basin. The Potlatch River enters the Clearwater River several miles southwest of Juliaetta. The Potlatch River is approximately 56 miles long and traverses the southern and eastern portions of Latah County in a southwesterly direction with roughly 1,900 miles of tributary streams (RPU, 2007).

Fisheries

There are anadromous fish populations within the Potlatch River system. The Potlatch River drainage suffers from the historic effects of some of the most intensive industrial use among drainages supporting steelhead in the state of Idaho. Most of the drainage has been altered by mining, forestry, grazing, farming, or residential development. In spite of these conditions, the Potlatch River watershed provides spawning and rearing habitat for steelhead trout and is considered one of the primary producing drainages for A-run steelhead within the Clearwater River System (LSWCD, 2004).

Historically, the Potlatch River provided spawning and rearing habitat for steelhead trout and Chinook salmon, in addition to resident fish species. An estimated 97 miles of potential spawning habitat was present within the subbasin. The upper two-thirds of the watershed probably provided the major spawning habitat for chinook. Steelhead likely spawned throughout the system, particularly in the tributaries and upper mainstem. A survey of the upper Potlatch River watershed conducted from 1959-1960 documented the principal steelhead spawning streams as Cedar, Boulder, Ruby, Fry, Bob’s, Bloom, and Mallory creeks and the East Fork Potlatch River (Buechler 1982).

The Nez Perce Tribe (NPT) has conducted a coho reintroduction program that includes the Potlatch River and various tributaries (Ecovista 2003). In 1999, the NPT captured six adult and 12 jack fall chinook salmon at a Potlatch River weir near Juliaetta; eight redds were reported downstream of the same town in the mainstem Potlatch River (RPU, 2007).

A fisheries inventory conducted by Idaho Fish and Game during 2003 and 2004 reported that rainbow/steelhead trout were present in 14 of 17 streams sampled. Greatest densities of these fish were found in the canyon stream sections lower in the Potlatch River system. The West Fork Little Bear Creek had the highest reported rainbow/steelhead densities, followed by Little Bear Creek, Cedar Creek and Little Boulder Creek. The ten remaining streams had much lower rainbow/steelhead numbers. No rainbow or steelhead trout were observed in Boulder Creek, Cougar Creek or Feather Creek; brook trout and/or sculpin appear to be dominant in these streams. Both rainbow/steelhead and brook trout are present within the tributaries of the East Fork Potlatch River. Rainbow/steelhead trout are present above the East Fork confluence but comprise a smaller portion of overall fish inventoried when compared to streams below the East Fork mouth. A natural barrier six miles above the mouth of Big Bear Creek severely inhibits rainbow/steelhead migration within that drainage (Bowersox et.al, 2006). Other natural migration barriers occur on Boulder Creek, Middle Potlatch Creek, and Little Potlatch Creek (Johnson, 1985).

Fish species reported by the 2003-2004 survey are:

Rainbow/steelhead trout	Hatchery Rainbow trout	Brook trout
Yellow perch	Largemouth bass	Pumpkinseed
Speckled dace	Longnose Dace	Redside shiner
Northern pikeminnow	Bridgelip sucker	Largescale sucker
Sculpin		

Common Resource Areas

Common Resource Areas (CRAs) are defined as geographical areas where resource concerns, problems, or treatment needs are similar. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area . Six CRAs occur within the Potlatch River Subbasin. CRA boundaries are illustrated in Figure 2 and described below (http://soils.usda.gov/survey/geography/cra.html).

43A.1 **Northern Rocky Mountains - Grassy Potlatch Ridges** The Grassy Potlatch Ridges ecoregion is underlain by volcanics and mantled by loess and volcanic ash. Idaho fescue, bluebunch wheatgrass, bluegrass, snowberry, and, on cooler, moister sites, scattered ponderosa pine occur and contrast with the forests of the Northern Idaho Hills and the forests and savannas of the Lower Clearwater Canyons. Today, small grain farming, hay operations, and livestock grazing are extensive.

43A.3 **Northern Rocky Mountains - Lower Clearwater Canyons** The deep, narrow Lower Clearwater Canyons are lower, drier, warmer, and have been more developed than the Lochsa-Selway-Clearwater Canyons. Savanna, Douglas-fir-ponderosa pine forest, and, in riparian areas, western red cedar-western white pine-grand fir forest occur. Forests are more widespread on canyon bottoms than on slopes.

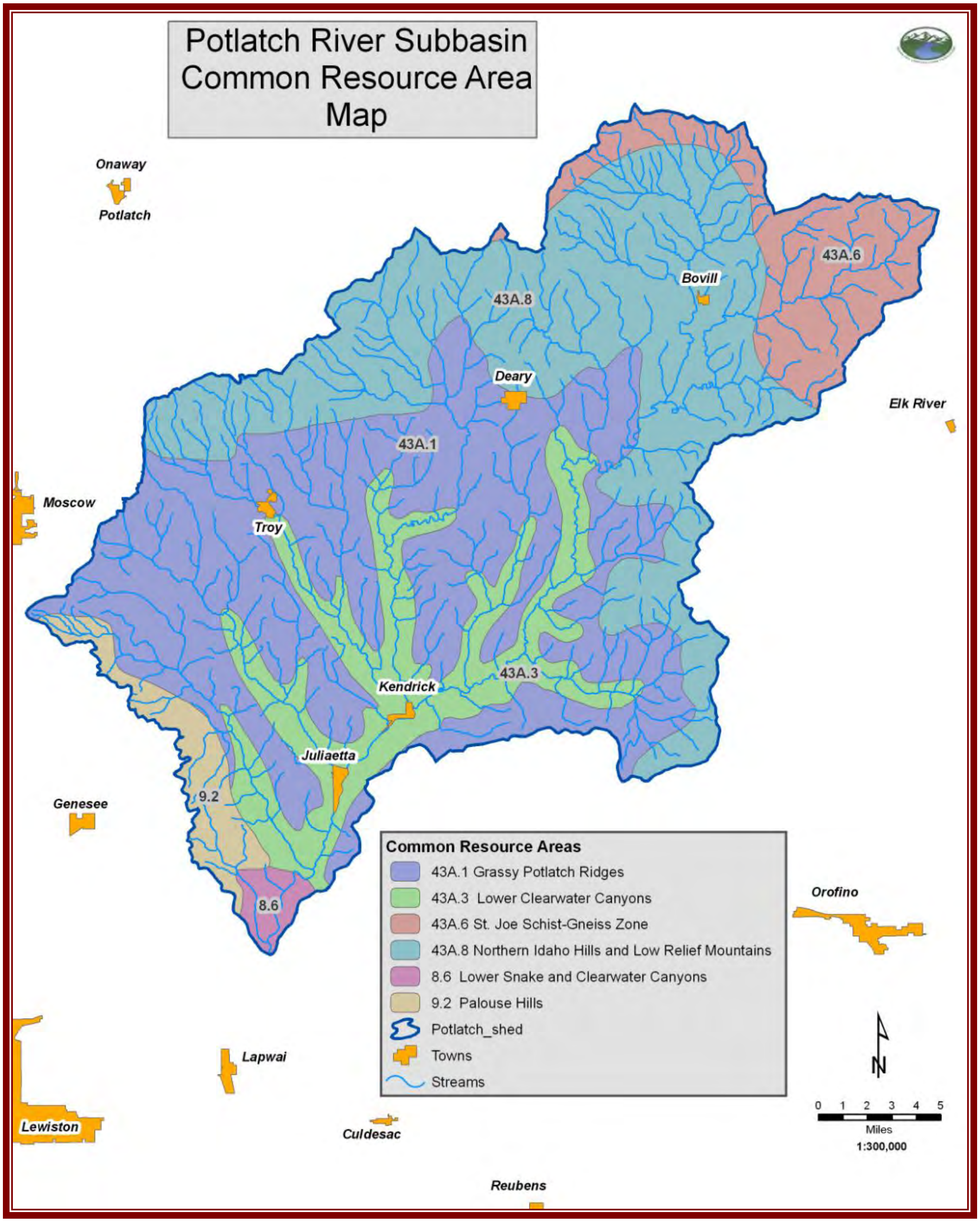

Figure 2. Potlatch River Subbasin Common Resource Areas

<u>43A.6 **Northern Rocky Mountains - St. Joe Schist-Gneiss Zone**</u> The St. Joe Schist-Gneiss Zone is mountainous, mantled by volcanic ash, and prone to landslides. High gradient streams dissect the region and receive episodic sedimentation from slides. Streams were used to transport logs to mills; log drives greatly altered aquatic ecosystems and stream morphology. Pacific influence is greater than to the south. Potential natural vegetation is mapped as cedar-hemlock-

pine but hemlock is absent in the south. Near tree line, mountain hemlock, subalpine fir, Engelmann spruce, and whitebark pine occur.

43A.8 **Northern Rocky Mountains - Northern Idaho Hills and Low Relief Mountains** The Northern Idaho Hills and Low Relief Mountains ecoregion is mantled by volcanic ash and loess and has rich, forest-type soils that are unlike the grassland-type soils of the Columbia Plateau. Grand fir, western red cedar, Douglas fir, and ponderosa pine are common. Its productive forests are widely logged; logging is easier and cheaper than in more rugged terrain.

8.6 **Columbia Plateau - Lower Snake and Clearwater Canyons** This unit consists of deeply dissected canyons cut through the basalt layers of the Columbia Plateau. It has isolated plateau fragments of the Dissected Loess Uplands CRA. The depth of the canyons, up to 2,000 feet, create drier conditions and Mean annual precipitation decreases to about 10 inches at the bottom of these canyons. Outside of human population centers and transportation corridors, canyons provide wildlife habitat for bighorn sheep and game birds. Grass-covered areas furnish grazing, recreation, and wildlife habitat.

9.2 **Palouse and Nez Perce Prairies - Palouse Hills** This unit is the western foothills of the Northern Rocky Mountains. This unit is characterized by a non-forested, loess-covered area with greater than 15 inches of precipitation. The highly productive soil has high organic matter and clay content. Original plant cover has been almost entirely supplanted by wheat farms. Water erosion is the major management issue. Perennial streams originate from the mountains to the east. Smaller, loess-bottomed streams rise within the CRA and are intermittent. Many of these intermittent streams are plowed and tiled. Extensive farming includes small grains, peas, lentils, hay and pastureland.

Climate

Over 50 inches of mean annual precipitation occurs in the higher elevation forest headwaters near the northeastern watershed boundary, and as little as 17 inches in canyon valleys near the mouth of the Potlatch River. Annual precipitation decreases with declining elevation as the stream travels in a southwesterly direction. Precipitation ranges for the Potlatch River Subbasin are shown on Figure 3.

Precipitation is reported (Teasdale and Barber, 2005) to have apparently increased over the last century within the late winter and spring period (December through March). Increases ranging from 21% to 32% were observed with late winter precipitation increase more than early winter. Snowfall reported for December has increased 89% (from 1900 to 2000), while February and March snowfall decreased by 6% and 7% (RPU, 2007).

Air temperature rises with elevation, as does precipitation. In the summer months, the average temperatures are about 10˚F warmer at the lower elevations than at mid-level locations. Summer temperatures at the middle to lower elevations in the Potlatch River Subbasin often exceed 100˚F; winter temperatures below 0˚F are common (RPU, 2007). The average growing season varies from 110 to 130 days in the northern portion of the watershed and from 120 to 140 days in the southern portion (USDA SCS, 1994).

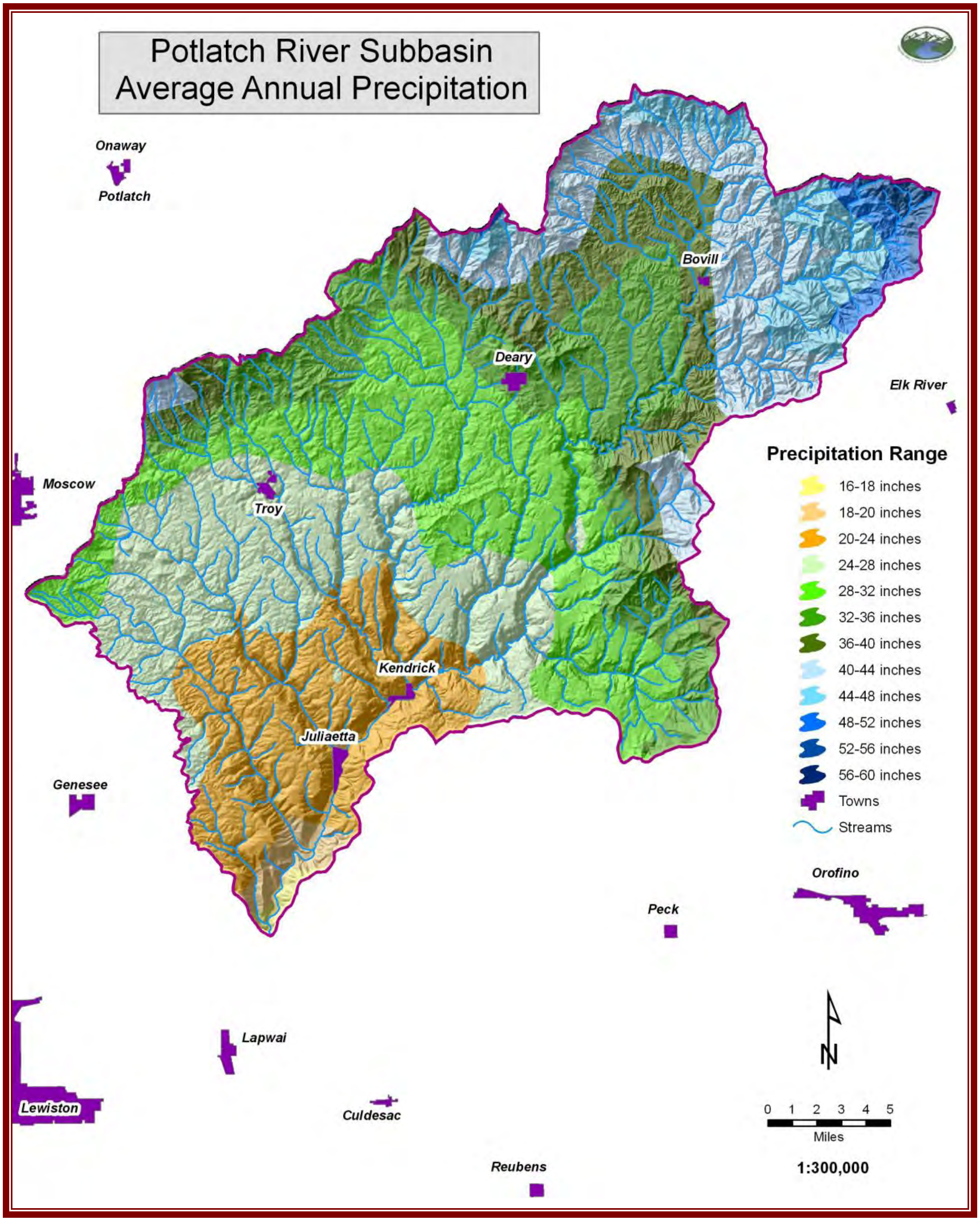

Figure 3. Potlatch River Subbasin Precipitation Ranges

Soil Formation

From the source of the Potlatch River to the mouth of the East Fork Potlatch River, the soil is composed of soft granitic materials which decompose rapidly to form suitable spawning gravels for salmonids (Johnson, 1985). Downstream from the East Fork Potlatch River, the soils are basaltic in origin and the streambed is mostly bedrock and boulders (Buechler, 1982). Landslide deposits formed and exposed sediment interbeds along the valley walls. Wind-deposited silt (Palouse Loess) forms hills overlying the basalt on the plateau. The loess generally thins from west to east (IDEQ, 2008).

Headwater areas are comprised of metasedimentary rocks of the Belt Series. Granitic rocks are exposed where the older sediments have eroded away. The Potato Hill Volcanics form Potato Hill and Cherry Butte near Deary. The younger basaltic plateau is present beneath the Palouse Loess and extends upriver to the Bovill area. Along the upper edge of the basaltic plateau, lake deposits formed when basalt flows dammed existing valleys. The valley bottoms along the Potlatch River and its main tributaries are blanketed by coarse textured alluvium. (RPU, 2007).

The soils derived from metasedimentary rocks generally weather to finer textured soils with varying amounts of coarse fragments. Granitics weather rapidly to *grus*; this is sandy and excessively well-drained in composition. Basalt rock has a tendency to weather into large cobble-size material. The Palouse Loess erodes fine silt that is relatively easily transported into waterways and makes up much of the sediment load in streams of the Potlatch River Subbasin.

Soils within the Potlatch Subbasin area belong to two general soils groups. Deep silty soils on plateaus underlie most cropland. Shallow to deep stony soils underlie forest and grasslands in canyon areas; similar soils that contain volcanic ash at the surface are found in mountainous forest areas. (USDA SCS, 1994).

Erosion History

Soil erosion had become a significant problem in the area by the early 1890s, as prairie was converted to cropland. When crawler tractors replaced the horse, some areas previously used for pasture were converted to grain. Greater power moved equipment faster, worked the soil more, and caused more downslope movement of the soil. Farmers were able to go up and down hills instead of working on the contours, as in the days of horse-drawn equipment. Fewer pastures were needed for horses; fences and fence rows were removed along with early timber plantings. Habitat for wildlife gradually disappeared. During World War II grasslands were plowed out and planted to grain or peas as part of the “Food for Freedom” program (Gilmore, 2004).

Introduction of field peas to areas of high precipitation made annual cropping possible; this reduced the need for summer fallow, which lessened the erosion hazard. The newer horse-drawn combine created the problem of excess straw after harvest. A commonly used crop residue management tool for the farmer was to set fire to stubble after harvest.

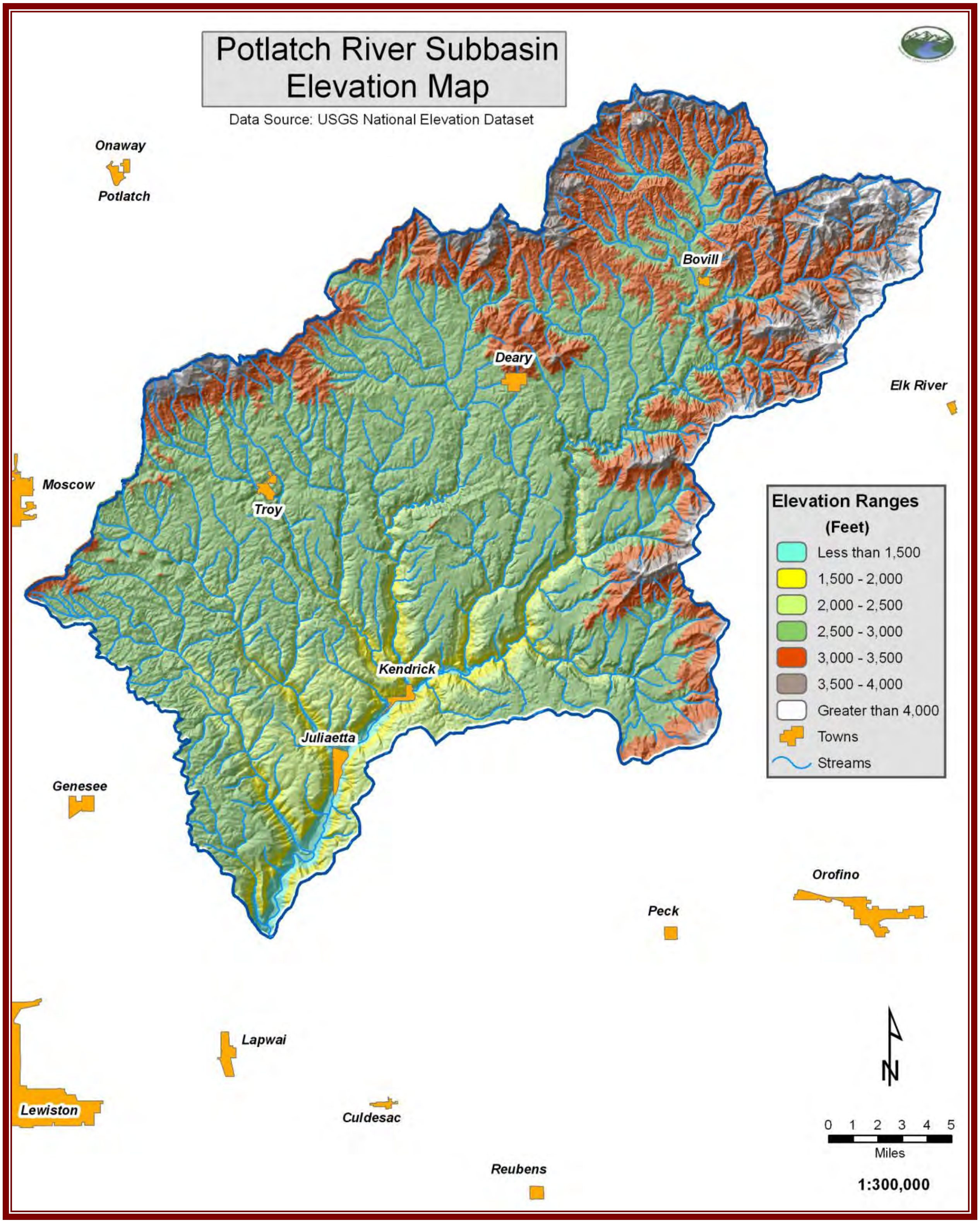

Figure 4. Elevation Map

Nearly all the residue went up in smoke and nothing was returned to the soil as organic matter or retained to protect the soil surface from water-induced erosion (Gilmore, 2004).

Sheet, rill, and ephemeral gully erosion are considered a moderate to severe problem associated with dry cropland. Channel erosion occurs throughout the watershed where past channelization, road building, and poor grazing management has altered the natural drainage sytem hydrology. USDA estimated annual erosion rates for the Lower Clearwater Subbasin, which includes the Potlatch River Watershed, have decreased noticeably since 1982. Rates have decreased from about 10.5 tons per acre year in 1982 to approximately 5.5 tons per acre per year in 1997. Modeling, based on RUSLE, conducted by Dansart (2004) estimated Potlatch River watershed cropland erosion rates ranging from 14 tons/acre under conventional tillage scenarios reduced to a low of 3 tons/acres utilizing direct seeding.

Drainage description (Hydrology)

Most of the following description is excerpted from the *Potlatch River Watershed Management Plan* (RPU, 2007).

Stream and river flows in the Potlatch River subbasin 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. Roughly 1,900 miles of tributary streams feed the Potlatch River, which is approximately 56 miles long (IDEQ, 2008).

Approximately 95 percent of the annual stream flow occurs from December through June (USDA SCS, 1994). On average, the February through May period accounts for 75% of annual stream flow; March and April are the peak discharge months. Rain-on-snow events are a common occurrence in the winter and early spring; this often results in high volume rapid runoff when snow pack is significant. Snow covers parts of the watershed from November through March, providing additional runoff during rain events. The highest number of maximum daily precipitation events for each year occurs in November, December, or January and range from 1 to 2 inches. Precipitation events that exceed an inch a day in the watershed are not unusual during winter months. Localized high intensity rainfall leading to rapid large volume runoff may occur at any time of the year (RPU, 2007).

Flow regimes were estimated for each of the streams evaluated in the *Potlatch River Subbasin Assessment and TMDLs* (IDEQ 2008). The February 1996 rain-on-snow event that caused widespread flooding in the lower Clearwater River Basin is noted in the report. The report concludes that high-runoff, rain-on-snow events, have a return rate of approximately 15 years noting that large events were recorded in 1919, 1933, 1948, 1964, and 1974 (RPU, 2007).

The Potlatch River hydrograph has been altered by timber management practices, agriculture practices, mining activities and urbanization; results are changes to

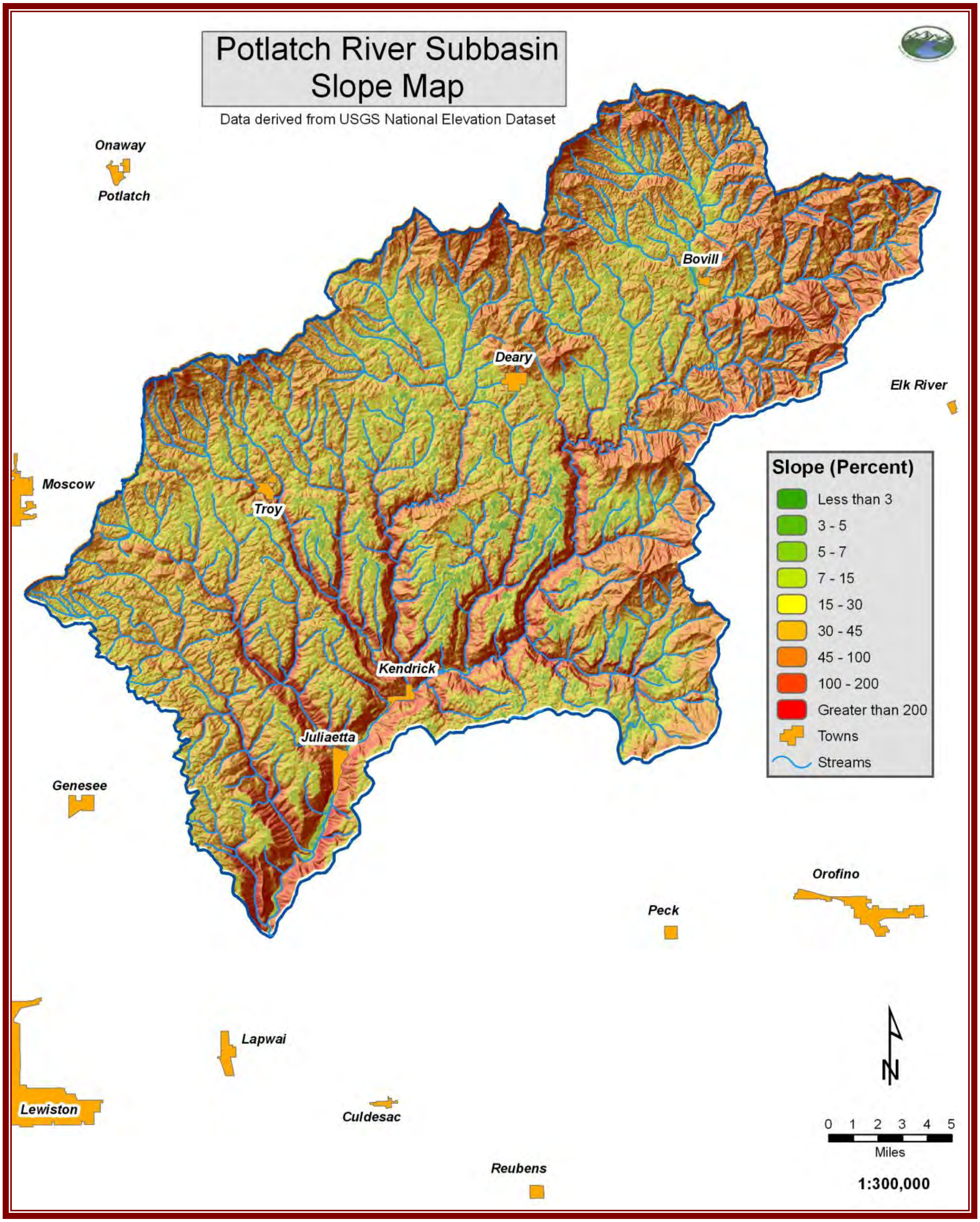

Figure 5. Slope Map

vegetative cover, soil compaction, storage capacity and channel shape (USDI BLM, 2000). The current hydrograph reflects a flashy system where runoff occurs quickly. Instantaneous discharges of 8,000 cubic feet per second (cfs) in winter and early spring followed by late summer flows less than 10 cfs are not uncommon. Discharge modeled for a five year 24-hour storm was estimated at 850 cfs (USDA SCS, 1994) under pre-settlement ground cover and canopy conditions. The same storm event under present land cover conditions has an estimated peak of 2,980 cfs. Total discharge for this peak was calculated at 1,265 acre-feet for the historic conditions and 3,720 acre-feet for present conditions (RPU, 2007).

The upland streams within the agricultural area of Potlatch River watershed are characterized by low gradients, incised channels, limited riparian vegetation, small substrate composition, and flashy hydrographs. Canyon streams are characterized by high gradients, large substrate size composition, riffle/pocketwater habitat types, and a flashy hydrograph. Forestland streams are characterized by low gradients, dense canopy cover, meadow connectivity, stable banks, and small substrate composition. Most streams throughout the watershed are currently dominated by Rosgen B and C channel types (Bowersox et al. 2006). Some forestland streams such as Purdue, Feather and Cougar Creeks are predominantly E channel types (RPU, 2007).

Land Ownership (Management)

Most (78%) of the Idaho portion of the Potlatch River Subbasin are private lands, split largely between cropland, hayland, pasture and forest lands. The Clearwater National Forest (CNF) administers federal forest lands (14%). The State of Idaho manages seven percent of mostly forested subbasin lands. Tribal lands total about 1,000 acres (<0.5%); Bureau of Land Management (BLM) lands comprise roughly the same percentage. Most (85%) of the subbasin is located in Latah County. The southeastern edge of the subbasin (8%) is located in Clearwater County and the southwestern edge of the watershed (7%) is located in Nez Perce County. Towns located within the subbasin are Troy, Deary, Bovill, Juliaetta, Kendrick and Helmer; less than 1,000 people reside in each town. The towns support a sometimes thriving timber industry in addition to the agricultural community and local residents.

Distribution of land management is shown in Figure 6.

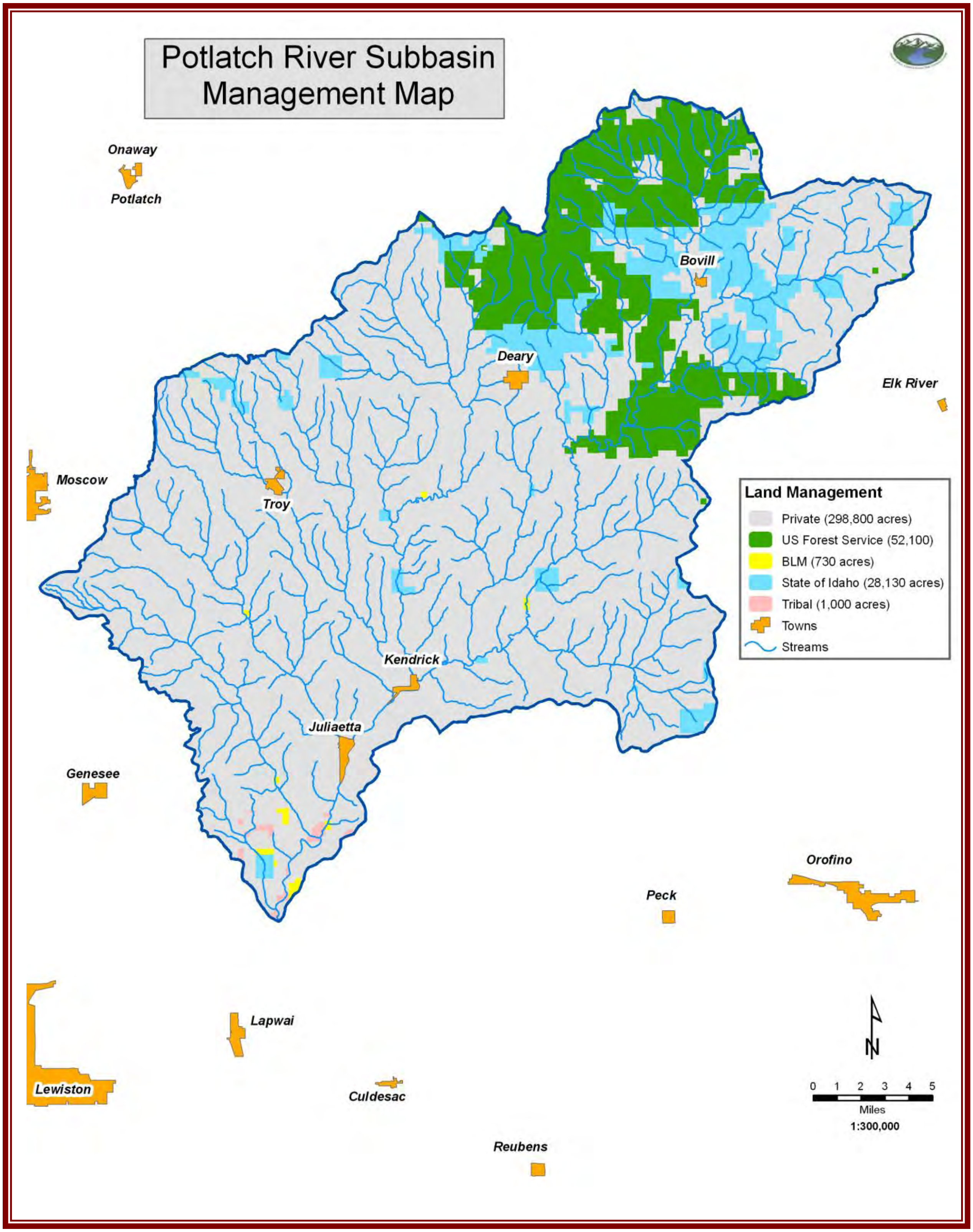

Figure 6. Potlatch River Subbasin Management Map

Land Uses

The main land uses (Figure 7) in the Potlatch River Subbasin are forestry and agriculture (farming and grazing). There is also a very limited amount of mining activity; increased industrial mineral production is expected in the near future. Outdoor recreation is popular throughout the area, particularly on public lands and commercial timber holdings. Watershed outlines are shown on Figure 8.

Fertile soils and favorable climate make a large portion of the Potlatch subbasin, a very productive agricultural area. In the 1870s, settlers discovered the Palouse region soil's fertility and planted grain on dry meadows and gentler hillsides.

The opening of the railroad just after the turn of the twentieth century had a major impact on the Palouse as agricultural goods, equipment, and supplies were easily transported into the area. Wheat and other cereals were planted and adapted well to the soils and climate of the Potlatch watershed. These crops were shipped to other markets. Machinery began to change farming, and by 1930, wheat was harvested using combines. Federal programs encouraged farmers to drain seasonal wet areas. In less than 100 years, small family farms had mostly disappeared as technology allowed farmers to more efficiently cultivate more acres of land (IDEQ, 2005).

Cereal crop (wheat and barley) and legume crop (pea and lentil) production dominate agricultural landuse within the Potlatch Subbasin. Dryland farming is practiced as irrigation is unnecessary. Hay is produced to feed livestock.

Some highly erodible croplands have been removed from production through both the Federal Conservation Reserve Program (CRP) and State Habitat Improvement Program (HIP).

Small fenced pastures are present in all of the §303(d) watersheds. Some of these fields receive heavy use. In addition, several animal feeding operations (AFOs) exist. These AFOs are used primarily for winter feeding and calving of livestock that graze in other areas during the remainder of the year. Idaho Department of Lands (IDL), Potlatch Corporation, and the Clearwater National Forest (CNF) have a cooperative agreement regarding grazing allotments on their lands (IDEQ, 2005).

Although greatly reduced compared to the early to middle 1900's, logging is still important to the economy of the Palouse area. Bennett Lumber Products Inc. and Potlatch Corporation Inc. still manage large land parcels in the Potlatch watershed for timber harvest. The US Forest Service and the Idaho Department of Lands (IDL) also manage thousands of acres in the Potlatch subbasin for silviculture and recreational activities (IDEQ, 2008).

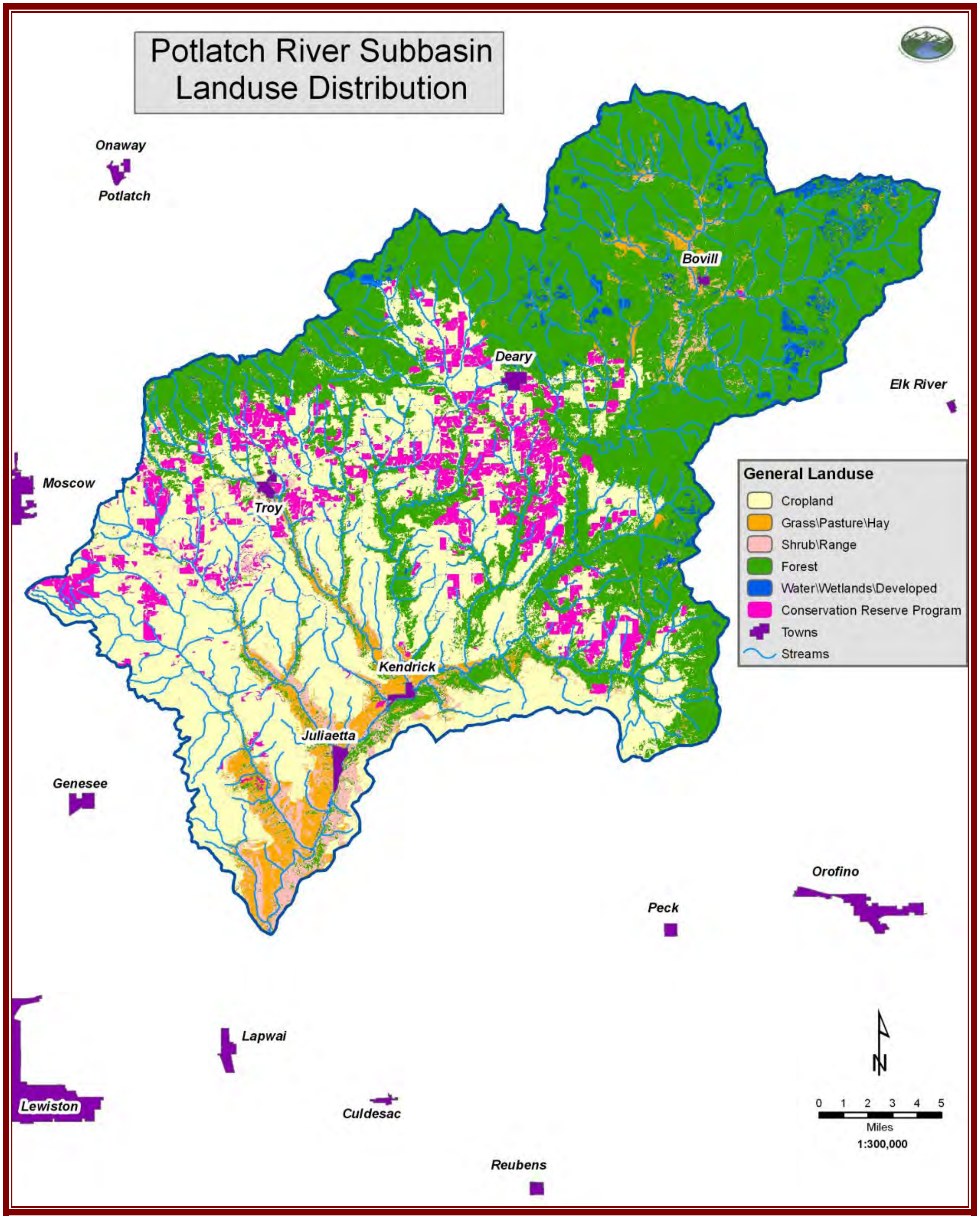

Figure 7. Potlatch River Subbasin General Landuse Distribution

A more detailed description of land uses for the TMDL watersheds is provided in the *TMDL Watersheds Descriptions* section. Land uses are summarized in Table B below.

Table B. Land Uses by TMDL watershed

Cedar Creek

Land Use Category	Acres	% of Watershed
Cropland	5,950	23%
CRP	1,930	8%
Grass\Crop	230	1%
Hay	810	3%
Pasture	90	0.3%
Grass	750	3%
Shrub\Grass	1,580	6%
Tree\Shrub\Grass	9,580	39%
Tree\Shrub (Forest)	4,430	17%
Urban	20	0.1%
TOTAL:	25,415	100%

East Fork Potlatch

Land Use Category	Acres	% of Watershed
CRP	60	0.2%
Pasture	150	0.4%
Tree Farm	10	<0.1%
Meadow	730	2%
Active Clearcut	110	0.3%
Shrub\Grass	150	0.4%
Tree\Shrub\Grass	4,120	10%
Tree\Shrub (Forest)	34,330	87%
Rock Pit	1	<0.1%
TOTAL:	39,656	100%

Pine Creek

Land Use Category	Acres	% of Watershed
Cropland	4,040	20%
CRP	5,510	27%
Hay	1,480	7%
Pasture	240	1%
Tree Farm	104	0.5%
Grass	670	3%
Shrub\Grass	1,140	6%
Tree\Shrub\Grass	5,700	28%
Tree\Shrub (Forest)	1,240	6%
Urban	70	0.4%
Rock Pit	14	<0.1%
Cemetary	2	<0.1%
TOTAL:	20,258	100%

Corral Creek

Land Use Category	Acres	% of Watershed
Cropland	280	2%
CRP	510	4%
Hay	200	1%
Pasture	80	1.4%
Grass	560	4%
Shrub\Grass	320	2%
Tree\Shrub\Grass	2,650	18%
Tree\Shrub (Forest)	9,700	68%
Urban	25	0.1%
Wastewater Treatment Plant	10	<0.1%
Rock Pit	6	<0.1%
TOTAL:	14,347	100%

Boulder Creek

Land Use Category	Acres	% of Watershed
Cropland	30	0.3%
CRP	470	4%
Hay	810	7%
Pasture	80	0.7%
Grass	360	3%
Shrub\Grass	610	5%
Tree\Shrub\Grass	4,620	40%
Tree\Shrub (Forest)	4,540	39%
Rock Pit	3	<0.1%
TOTAL:	11,514	100%

Ruby Creek (Tributary of East Fork Potlatch)

Land Use Category	Acres	% of Watershed
Pasture	7	<0.1%
Meadow	60	0.7%
Tree\Shrub\Grass	1,930	24%
Tree\Shrub (Forest)	6,140	75%
TOTAL:	8,140	100%

Moose Creek

Land Use Category	Acres	% of Watershed
Tree\Shrub (Forest)	6,190	81%
Tree\Shrub\Grass	715	9%
Meadow	610	8%
Impounded Water	41	0.5%
Mine Area	50	0.7%
TOTAL:	7,605	100%

West Fork Little Bear

Land Use Category	Acres	% of Watershed
Cropland	1,860	9%
CRP	2,867	15%
Grass\Crop	110	0.6%
Hay	760	4%
Pasture	390	2%
Orchard	50	0.2%
Grass	180	1%
Meadow	60	0.3%
Shrub\Grass	730	4%
Tree\Shrub\Grass	7,950	40%
Tree\Shrub (Forest)	4,590	23%
Urban	220	1%
WWTP	2	<0.1%
Industrial	30	0.2%
Rock Pit	10	<0.1%
Cemetary	6	<0.1%
TOTAL:	19,764	100%

Big Bear Creek

Land Use Category	Acres	% of Watershed
Cropland	7,370	12%
CRP	5,910	10%
Grass\Crop	130	0.2%
Hay	4,600	8%
Pasture	1,080	2%
Feedlot	2	<0.1%
Grass	630	1%
Shrub\Grass	3,770	6%
Tree\Shrub\Grass	16,100	27%
Tree\Shrub (Forest)	20,740	34%
Urban	190	0.3%
WWTP	14	<0.1%
Rock Pit	35	<0.1%
Cemetary	13	<0.1%
TOTAL:	60,742	100%

Upper Potlatch River (Above Moose Creek; includes West Fork Potlatch)

Land Use Category	Acres	% of Watershed
Crop	13	<0.1%
CRP	17	<0.1%
Pasture	130	0.5%
Shrub\Grass	1,240	5%
Industrial	21	<0.1%
Tree\Shrub\Grass	2.920	11%
Tree\Shrub (Forest)	21,900	83%
TOTAL:	26,250	100%

Potlatch River (Moose Creek to Corral Creek)

Land Use Category	Acres	% of Watershed
Crop	126	0.7%
CRP	92	0.5%
Hay	47	0.2%
Grass\Crop	10	<0.1%
Pasture	346	2%
Meadow	620	3%
Shrub\Grass	330	2%
Tree\Shrub (Forest)	12,663	68%
Tree\Shrub\Grass	3,546	19%
Clay Pit	94	0.5%
Rock Pit	17	<0.1%
Industrial	12	<0.1%
WWTP	8	<0.1%
Park	12	<0.1%
Urban	87	0.5%
TOTAL:	18,522	100%

Potlatch River (Corral Creek to Big Bear)

Land Use Category	Acres	% of Watershed
Cropland	5,580	21%
CRP	1,900	7%
Grass\Crop	340	1.3%
Hay	550	2%
Pasture	1,035	4%
Tree Farm	46	0.2%
Grass	92	0.4%
Shrub\Grass	1,890	7%
Tree\Shrub\Grass	8,985	34%
Tree\Shrub (Forest)	5,990	23%
Urban	22	0.1%
Industrial	5	<0.1%
TOTAL:	26,470	100%

Potlatch River (Big Bear Creek to Clearwater River)

Land Use Category	Acres	% of Watershed
Cropland	10,000	44%
CRP	72	0.3%
Grass\Crop	125	0.5%
Hay	74	0.3%
Pasture	942	4%
Vineyard	40	0.2%
Feedlot	11	<0.1%
Grass	425	2%
Shrub\Grass	7,730	34%
Tree\Shrub\Grass	2,520	11%
Tree\Shrub (Forest)	600	3%
Urban	213	0.9%
WWTP	7	<0.1%
Rock Pit	1	<0.1%
Cemetary	2	<0.1%
Industrial	44	0.2%
Junkyard	5	<0.1%
Airstrip	4	<0.1%
TOTAL:	22,810	100%

Middle Potlatch Creek

Land Use Category	Acres	% of Watershed
Cropland	19,820	55%
CRP	3,600	10%
Grass\Crop	290	0.8%
Hay	810	2%
Pasture	850	2%
Feedlot	11	<0.1%
Grass	620	2%
Shrub\Grass	3,840	10%
Tree\Shrub\Grass	5,350	15%
Tree\Shrub (Forest)	500	1%
Urban	70	0.2%
WWTP	2	<0.1%
Rock Pit	43	0.1%
Cemetary	2	<0.1%
Industrial	55	0.2%
Junkyard	11	<0.1%
TOTAL:	35,860	100%

TMDL Watersheds Descriptions

TMDL watersheds are shown in Figure 8. Watershed descriptions that include land uses, management, and listing criteria are included in narratives largely derived from the TMDL document (IDEQ, 2008).

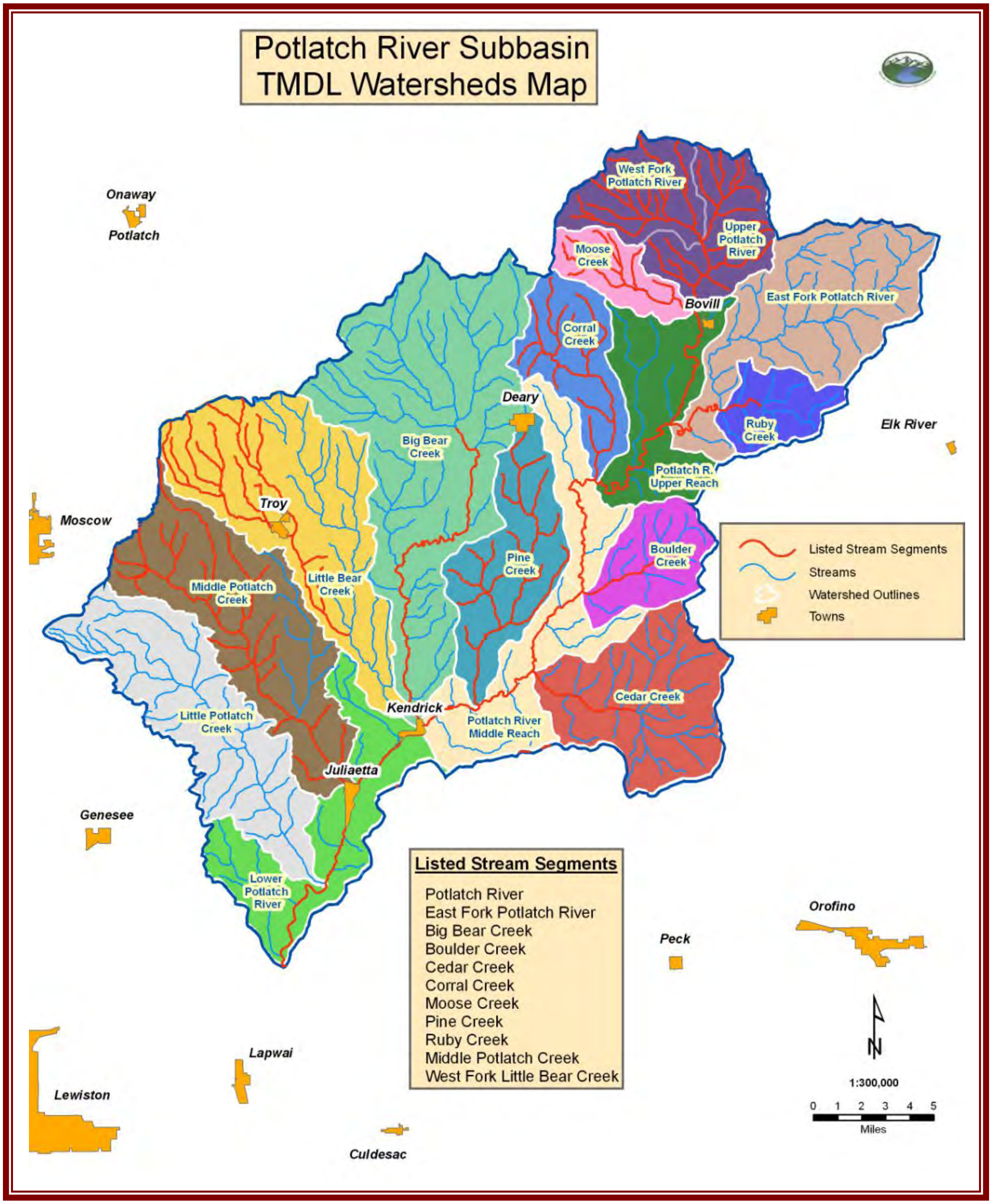

Figure 8. Potlatch River Subbasin TMDL Watersheds Map

Upper Potlatch River (above Moose Creek)

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 crossing broad silty alluvium meadows with established flood plains. When flooding occurs, water moves 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. 1996).

The West Fork of the Potlatch is a third order stream at its confluence with the Potlatch River; headwaters originate off the east side of Gold Hill and Prospect Peak. The Upper Potlatch River watershed (above Bovill) is primarily forest lands and about 26,250 acres in size. Most of the land (17,680 acres) drained by the Upper Potlatch River is managed by the Clearwater National Forest. Private forest lands (4,500 acres) are scattered throughout the watershed. State of Idaho lands (4,500 acres) mixed with private lands make up the southernmost quarter of the watershed area. Location of the Upper Potlatch River area relative to other TMDL watersheds is shown on Figure 8.

Only 13 acres of cropland were noted for the watershed area, along with 17 acres of CRP lands. The primary land uses in the watershed are forestry, grazing, and recreational activities. In addition to scattered grazing on forestlands, some of the most concentrated cattle grazing observed within the Potlatch River subbasin was noted in forest meadows along the West Fork Potlatch River drainage system. An old lumber mill location and a roads maintenance shop are present adjacent to the Potlatch River just north of the town of Bovill. Land use distribution is shown in Figure 9.

The West Fork Potlatch flows from due west to due south. Watershed elevations range from about 4,600 feet along the western divide to 2,850 feet just north of Bovill. The geology of the watershed consists of highly weathered metasediments of the Wallace Formation at higher elevations along the northern watershed divide and in the southeast quadrant; these rocks are intruded by areas of weathered granitics that dominate the rest of the watershed. The valley bottoms of the Upper Potlatch River and its tributaries are underlain by alluvium (IGS, 2009).

The Upper Potlatch River (including the West Fork) is §303(d) listed for sediment, nutrients, temperature, and bacteria; the boundaries are defined as headwaters to Moose Creek. The designated beneficial uses for this assessment unit include salmonid spawning, cold water aquatic life, primary contact recreation, and domestic water supply. The West Fork Potlatch River had the highest fish densities of all subbasin streams inventoried by IDFG during 2003 and 2004. More than 4,600 fish were observed by snorkeling. Redside shiner and dace were the predominant fish species comprising more than 80% of the total numbers observed. Rainbow/steelhead trout comprised about 3% of the total numbers recorded; brook trout and sculpin were also present (Bowersox et.al., 2006). Based on monitoring data, IDEQ developed TMDLs for bacteria and temperature;

it recommended that this headwaters portion of the Potlatch River be de-listed for sediment and nutrients.

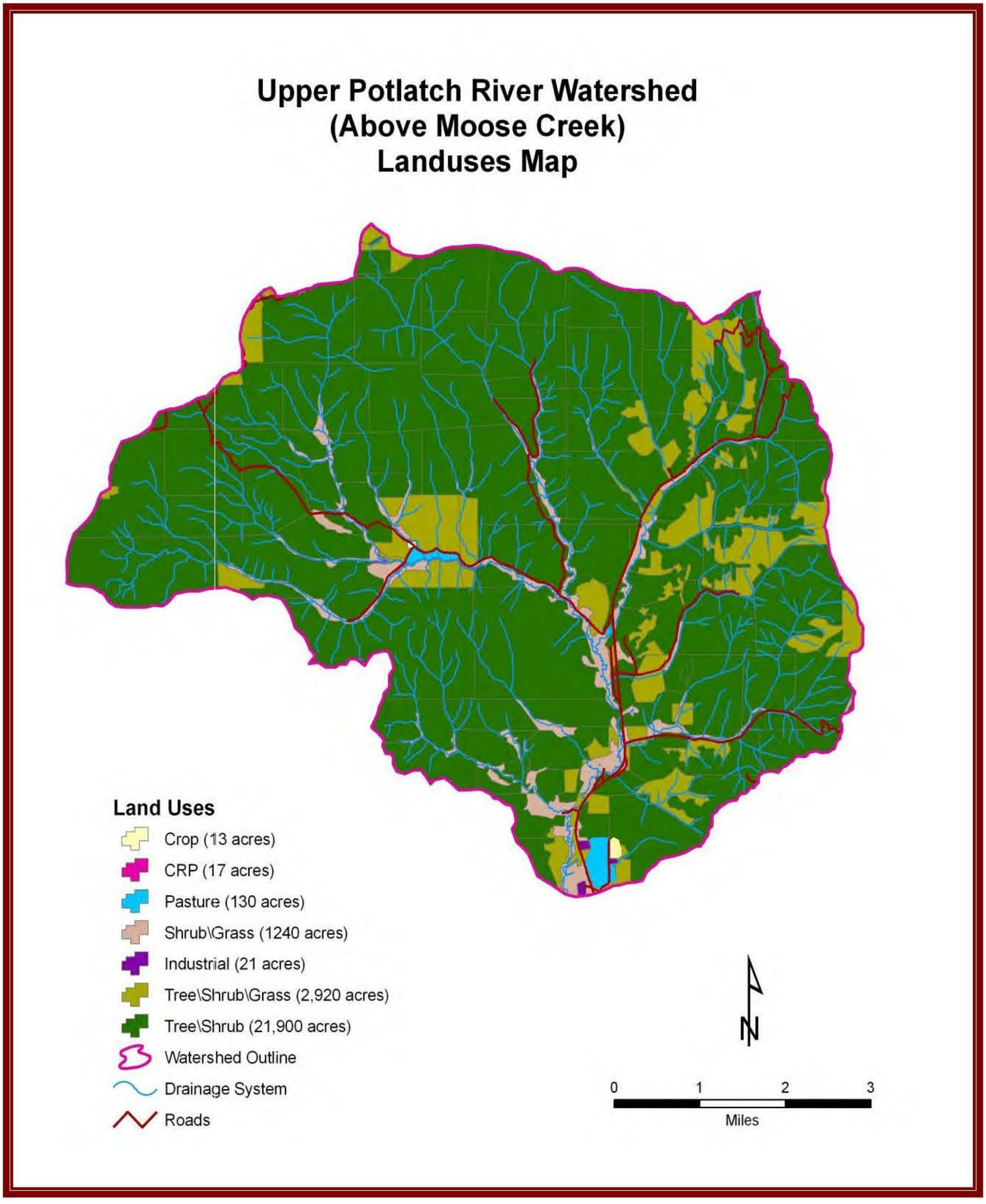

Figure 9. Upper Potlatch River Landuse Map

Moose Creek

The IDEQ (2008) reports three water bodies, Moose Creek, West Fork Potlatch, and the Potlatch River headwaters fail to show support of their beneficial uses, yet exhibit no data or indication of significant sediment loading above background. The three adjacent water bodies in the upper northwest corner of the Potlatch River watershed, are reportedly dominated by low relief, silty-loess soils, significant swampy meadows, and E type stream channels. With their low gradient E type channels (Rosgen classification), flood waters simply move out of the channels and across the meadows, carrying virtually no sediment so long as cattle have not destabilized the stream banks (IDEQ, 2008). However, these types of channels and meadow vegetation reportedly do not provide much spawning habitat for fish, or much substrate for macroinvertebrates (RPU, 2007). Johnston (1993) reports clay mining in the early 1950s by miners resulted in damage to the fisheries resource.

From the headwaters to the Potlatch River, Moose Creek is listed for bacteria, nutrients, pH, sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning and primary contact recreation. Current support status indicated none of the beneficial uses are fully supported. TMDLs were written for temperature and bacteria. IDEQ recommended that nutrients, pH and sediment be removed from the list of impairments. Location of Moose Creek relative to other TMDL watersheds is shown on Figure 8.

Moose Creek generally flows from the northwest to the southeast. Elevations range from 2,850 feet to 4,300 feet. The mouth of Moose Creek is located approximately 1 mile north of the town of Bovill. The geology of the watershed consists of highly weathered metasediments of the Wallace Formation at higher elevations along the western headwater divide and in the southeast quadrant; these rocks are intruded by areas of weathered granitics that dominate the majority of the watershed. The valley bottoms of Moose Creek and its tributaries are underlain by alluvium (IGS, 2009). Underlying and adjacent to the alluvial deposits, primarily in the southeast quarter of the watershed, are sediments of the Latah Formation. This formation has been mined historically for its clay deposits; it will be mined for both clay and feldspar in the immediate future.

Most of the upper half of the watershed is managed by the Clearwater National Forest (CNF). The lower half of the watershed consists of state lands interspersed with private ownership. The CNF controls about 3,800 acres; the state of Idaho manages 2,900 acres and about 800 acres are in private ownership.

Of 23 Potlatch subbasin streams inventoried by IDFG in 2003 and 2004, Moose Creek was ranked as fifth in protection priority needs and fifteenth in restoration priority. According to Bowersox et al. (2006), fish species composition in the forestland streams was dominated by brook trout and sculpin. Results of the 2003-2004 surveys indicated a strong correlation between trout abundance and large organic debris in forestland streams.

Almost the entire watershed is forested lands with about 600 acres of meadow lands adjacent to tributaries. Moose Creek Reservoir, a state recreational park, is located approximately 1 mile above the mouth of Moose Creek. Development of a commercial industrial minerals (feldspar/clay) operation is currently in the permitting stage on lands primarily leased from the state of Idaho. There is no cropland, hayland, pasture, or CRP lands but scattered livestock grazing occurs within the watershed. Land use distribution is shown in Figure 10.

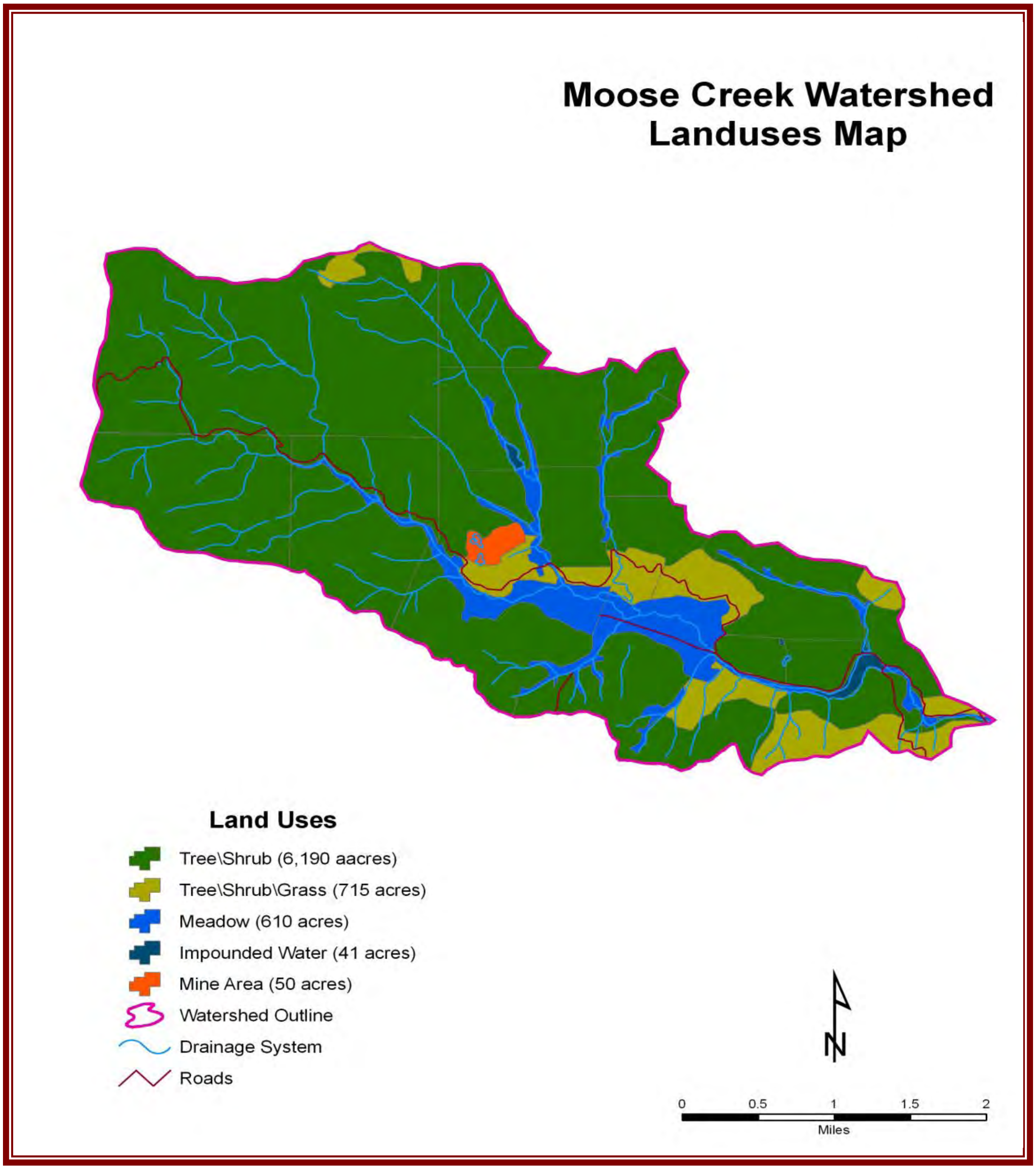

Figure 10. Moose Creek Landuse Map

Ruby Creek

Ruby Creek originates southeast of the town of Bovill, and runs northwest to its confluence with the East Fork Potlatch River. Ruby Creek is a west-facing watershed found in the upper portion of the Potlatch River and major tributary to the East Fork Potlatch River. The Ruby Creek drainage is 8,100 acres in size, representing approximately 2% of the overall watershed. Location of Ruby Creek relative to other TMDL watersheds is shown on Figure 8.

The subwatershed is comprised of forest lands with meadow areas along some stream drainages. There are a few acres of pasture and scattered livestock graze the meadows. Timber harvest is the primary land use. Land use distribution is shown in Figure 11.

Management of the forested lands is divided between private (3,700 ac), state (2,130 ac), an US Forest Service (2,300 ac). Watershed elevations range from 2,770 feet where Ruby Creek empties into the East Fork Potlatch to almost 4,700 feet on Jackson Mountain. The entire watershed is underlain by metamorphic rocks intruded by granite and rhyolitic dike rocks. Latah Formation sediments overlay the basement rocks near the western divide (IGS, 2009). Valley bottoms are underlain by alluvium.

According to IDEQ (2008), Ruby Creek is 303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses listed for Ruby Creek are cold water aquatic life, salmonid spawning, and secondary contact recreation. Ruby Creek shows full support of cold water aquatic life but not salmonid spawning or recreation. Salmonid spawning is an existing use in Ruby Creek and the creek is identified as having steelhead and rainbow trout, with a spawning and incubation period of January through May. TMDLs were developed for temperature and bacteria. It was recommended that nutrients and sediment be removed from the list of impairments.

Ruby Creek is listed as the 14th highest priority highest priority out of 23 streams for restoration by IDFG (Bowersox et al., 2006). In streams prioritized in terms of protection, Ruby Creek is ranked 6th highest out of 23 streams inventoried during 2003-2004.

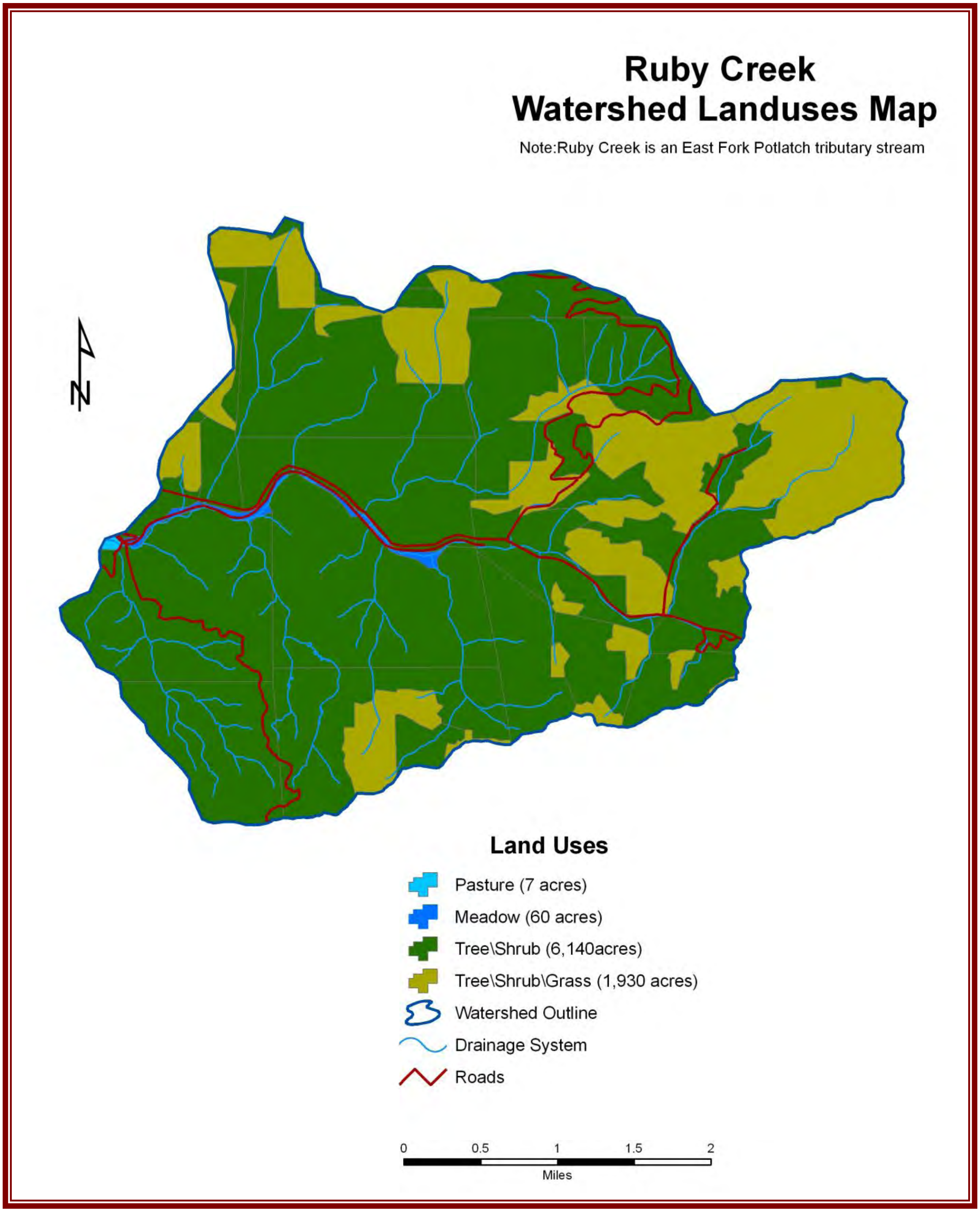

Figure 11. Ruby Creek Landuse Map

East Fork Potlatch River

The East Fork Potlatch River originates in the northwest corner of Clearwater County and flows southwest to its confluence with the mainstem between Moose Creek and Corral Creek. Mean annual flow is estimated at about 62 cfs (IDEQ, 2008). Ruby Creek, previously described, is tributary to the East Fork Potlatch River. Location relative to other TMDL watersheds is shown on Figure 8.

Watershed elevations range from 2,670 feet where the East Fork joins the Potlatch River to almost 5,000 feet along the northern divide. The watershed is primarily underlain by gneiss, schist, and quartzite of the Wallace and St. Regis formations intruded by granite and rhyolitic dike rocks. Latah Formation sediments overlay the basement rocks near the western divide (IGS, 2009). Valley bottoms are underlain by alluvium.

The East Fork Potlatch River has a forested watershed, almost 40,000 acres in size, when Ruby Creek is included. Most lands are private timberland (25,600 ac); the state of Idaho (8,800 ac) and US Forest Service (4,800 ac) manage the remaining acres. No cropland or hayland is present in the watershed, but approximately 60 acres are in CRP. About 150 acres of pasture was noted, mostly in meadow lands just east of Bovill; a few acres of pasture were observed near the East Fork mouth. Active timber harvest is occurring within the watershed; some areas appear to be clearcut. A state tree farm is also present. Land use distribution is shown in Figure 12.

The East Fork Potlatch River was §303(d) listed only from Ruby Creek downstream for sediment, nutrients, temperature and bacteria. Designated beneficial uses are salmonid spawning, coldwater aquatic life, and recreation. IDEQ (2008) determined temperature to be problematic and developed a TMDL. It was recommended that the remaining pollutants be removed from the list of impairments.

The East Fork is listed as the 19th highest priority highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006). Its tributaries Bobs Creek and Pivash Creek are prioritized 23rd and 18th , respectively. In streams prioritized in terms of protection, the East Fork is ranked 2nd highest, with Bobs Creek 1st and Pivash Creek 4th , out of the 23 streams inventoried during 2003-2004. Ruby Creek is prioritized as 14th for restoration, and 6th for protection.

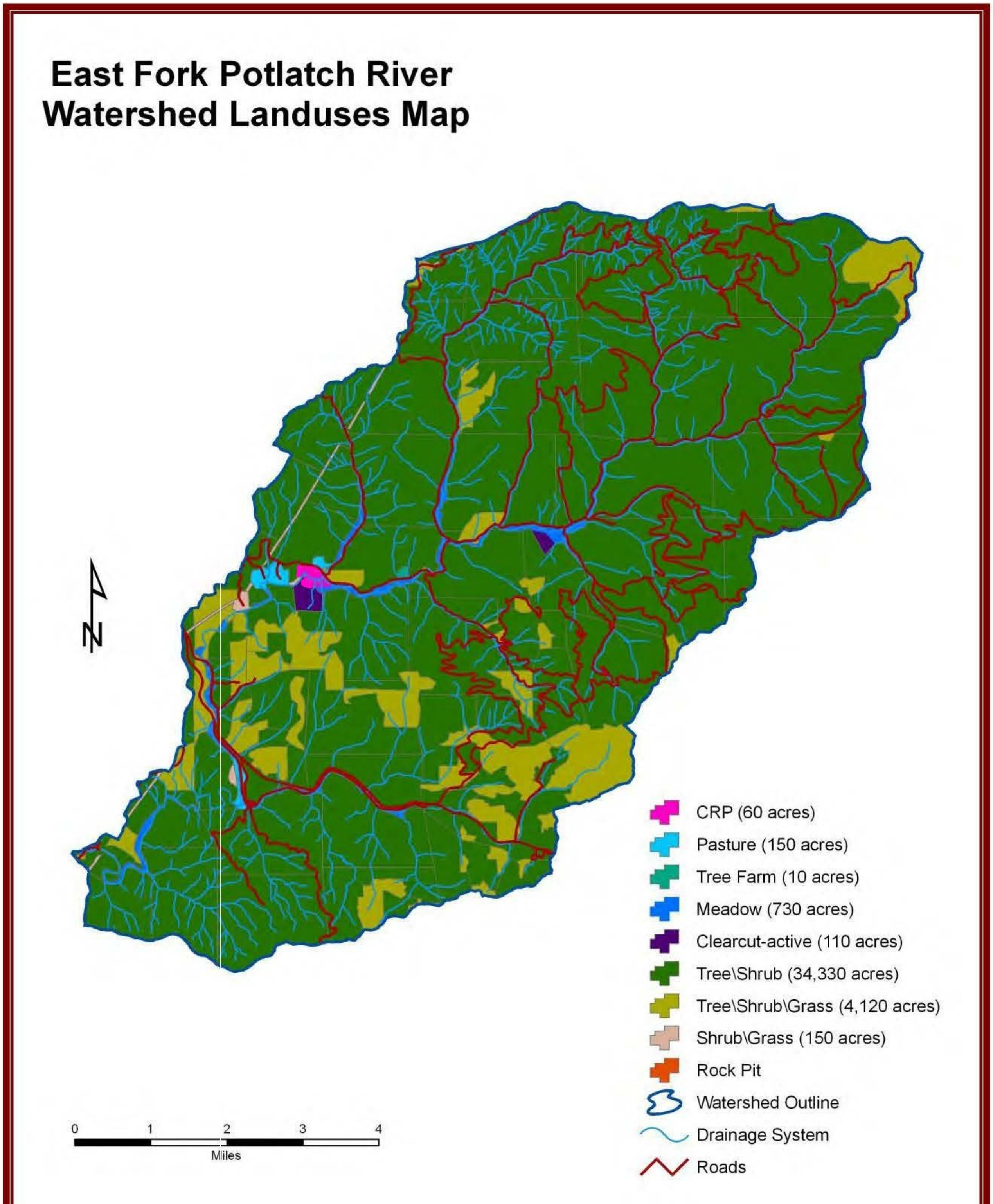

Figure 12. East Fork Potlatch River Landuse Map

Boulder Creek

The Boulder Creek Watershed is roughly 11,500 acres in size. The watershed is entirely privately owned with the exception of about 40 acres managed by the Clearwater National Forest. Location of Boulder Creek relative to other TMDL watersheds is shown on Figure 8.

Boulder Creek is a west facing watershed. Boulder Creek generally flows from northeast to southwest. Elevations range from approximately 4,200 feet on Tamarack Ridge, the southern watershed divide, to 1,850 feet at the stream mouth. Metamorphic rocks (schists and gneiss) comprise bedrock in the higher elevation watershed areas. In the lower elevation portions of the watershed, where all agricultural lands are located, sediments of the Latah formation blanket underlying basalt flows. In the valley bottoms along much of Boulder Creek, coarse textured alluvium is present (IGS, 2009).

Forestland makes up about 80 percent of the watershed.. Agricultural lands consist primarily of hayland, CRP, pasture and a few acres of cropland. Most agricultural lands are located near the community of Park, in the west-central portion of the watershed; a smaller pod of agriculture is located in the extreme southwestern corner of the drainage area. Landuse distribution is shown in Figure 13.

Boulder Creek, from Pig Creek to its mouth is §303(d) listed for unknown pollutants; it drains the forested hills east of the community of Park. Boulder Creek was determined as not fully supporting salmonid spawning or contact recreation beneficial uses. As a result, TMDLs were developed for temperature and bacteria. The stream was determined to be supporting its beneficial use of cold water aquatic life (IDEQ 2008).

Boulder Creek has a falls at stream mile 1.2 that probably acts as a migration barrier to anadromous and resident fish (Schriever and Nelson 1999). No rainbow/steelhead trout were found in Boulder Creek during a 2003-2004 IDFG survey. According to survey results, Boulder Creek is listed as the 16th highest priority for restoration by IDFG. In streams prioritized in terms of protection, Boulder Creek ranked 8th highest out of 23 streams (Bowersox et al. 2006).

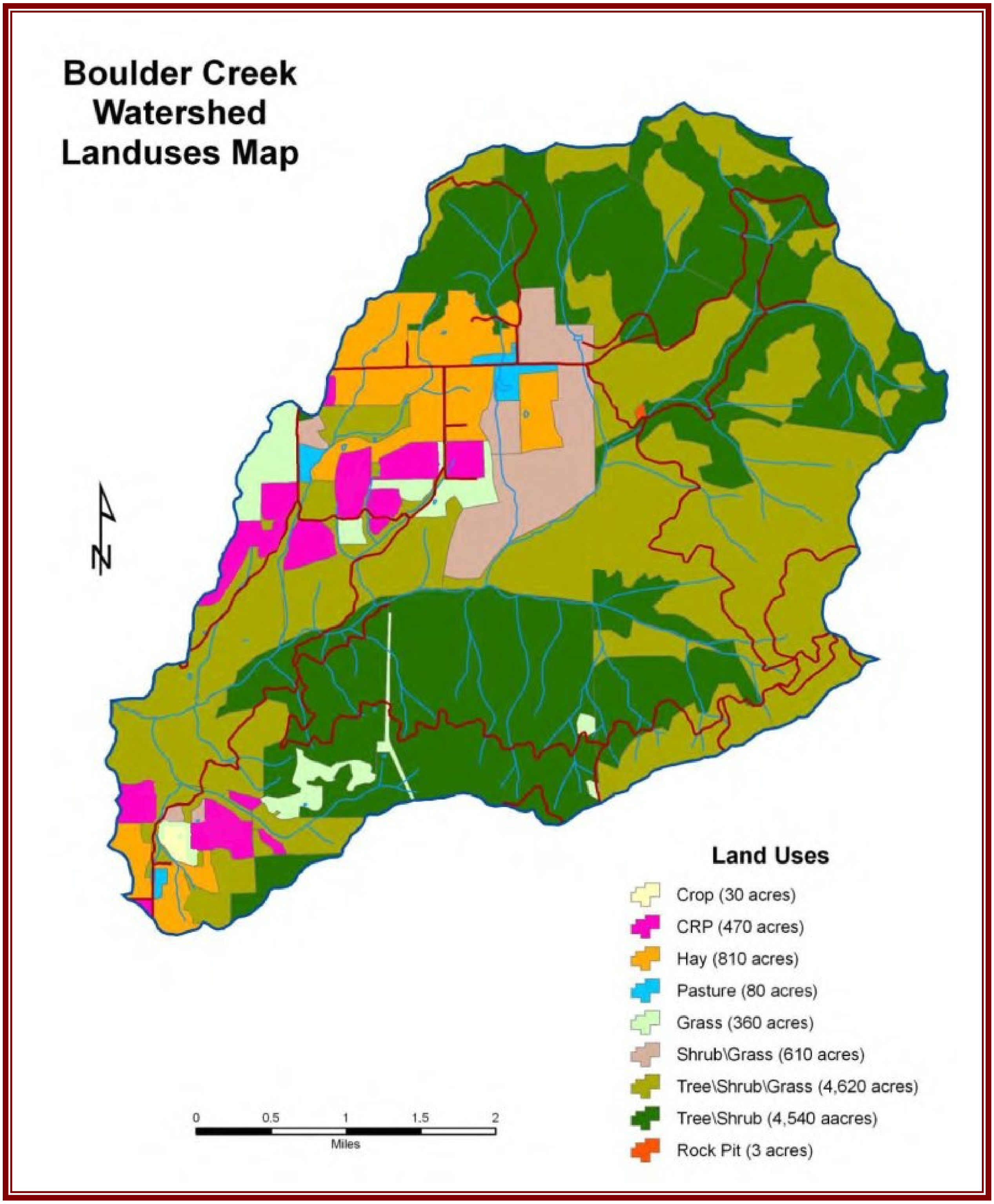

Figure 13. Boulder Creek Landuse Map

Pine Creek

The Pine Creek Watershed is about 20,260 acres in size. Most of the land in the Pine Creek watershed is under private ownership, with 90 acres of forest land managed by the state. Location of Pine Creek relative to other TMDL watersheds is shown on Figure 8.

Pine Creek is a third order stream at its confluence with the Potlatch River. The headwaters originate just east of the town of Deary. Pine Creek generally flows from the north to the south with a dendritic drainage pattern. Elevations range from 3,400 feet at Deary to 1,350 feet at the mouth . The uppermost tip of the watershed is underlain by rhyolitic volcanic rocks, referred to as the Potato Hill Volcanics. Basalt forms bedrock in the rest of the watershed, with the exception of a small window of metamorphic rock just south of Deary and along the west-central watershed divide. Sediments of the Latah formation are wedged along the contact of this metamorphic rock group, where it overlies and is interbedded with Columbia River Basalt. Latah sediment interbeds and landslide deposits are present in the canyons formed by Pine Creek, in addition to more commonly encountered alluvial deposits. The canyons of Pine Creek steepen significantly below 2,000 feet in elevation.

Upland use is primarily agricultural. There is more CRP ground (5,500 ac) than cropland (4,000 ac). About 1,500 acres are hayland with a few hundred acres of pastures adjacent to stream channels. A livestock winter feeding area with adjacent pastureland is present at Pine Creek's mouth. Most canyon areas are forested rangelands with scattered livestock grazing. A tree farm is located along the eastern watershed divide. Open forested lands are scattered throughout the watershed with more heavily forested areas occurring adjacent to stream drainages within the southern half of the watershed. Several rock pits are present and a portion of the town of Deary. State Highway 3 transects the western watershed edge. Landuse distribution is illustrated in Figure 14.

Pine Creek was §303(d) listed from headwaters to the Potlatch River for sediment, temperature, nutrients, bacteria, dissolved oxygen, oil/gas and ammonia. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that aquatic life and recreation beneficial uses were fully supported but salmonid spawning was not; this was due temperature, nutrient, and sediment impairments. TMDLs were completed for the three impairments and IDEQ recommended removing oil/gas, dissolved oxygen, bacteria, and ammonia as listed pollutants.

Salmonid spawning is an existing use in Pine Creek and the stream is identified as supporting steelhead and rainbow trout, with a spawning and incubation period of January through May. Water quality standards for sediment are exceeded, as are temperature standards for spring salmonid spawning. Based on a 2003-2004 survey conducted by IDFG, upper Pine Creek is listed as the 2nd highest priority out of 23 streams for restoration, while the remainder of Pine Creek is ranked 3rd (Bowersox et al. 2006). Prioritized in terms of protection, Pine Creek is ranked 17th highest out of 23 streams, while Upper Pine Creek is ranked 21st (RPU, 2007).

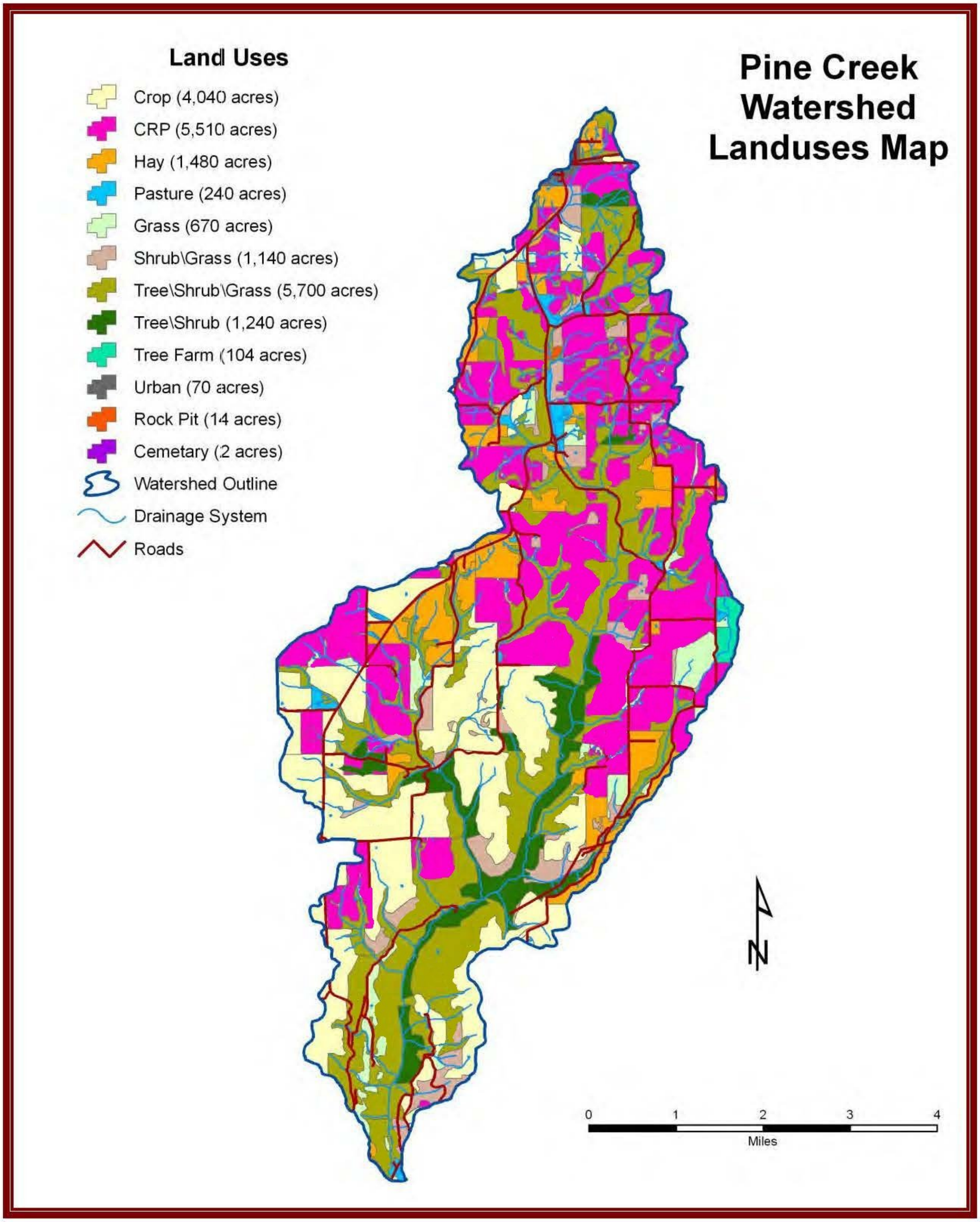

Figure 14. Pine Creek Landuse Map

Cedar Creek

The Cedar Creek watershed is about 25,400 acres in size. Most of the land in the Cedar Creek drainage is under private ownership, with approximately 1,100 acres of forest land managed by the state; most is located along the easternmost divide. Location of Cedar Creek relative to other TMDL watersheds is shown on Figure 8.

Cedar Creek is a third order stream at its confluence with the Potlatch River. The headwaters originate to the north and east of the town of Southwick. Cedar Creek generally flows from the east to west with a dendritic drainage pattern. Elevations range from about 4,100 feet at Teakean Butte in the southeast corner of the watershed to 1,520 feet at the stream's mouth. Basalts makeup the bedrock geology in the southern and western portions of the Cedar Creek watershed; the volcanic flows lap up against metamorphic rocks (schist, gneiss, and quartzite) that underlie the remaining higher elevation areas. The metamorphic rocks are intruded by several small tonalitic rock bodies in the southeastern quadrant. Sediments of the Latah formation occur along the contact area between the metamorphic rock group and basalt flows, where it overlies and is interbedded with Columbia River Basalt. Latah sediment interbeds and landslide deposits are present in the canyons formed by Cedar Creek, in addition to more commonly encountered alluvial deposits along stream channels. The canyons of Cedar Creek steepen and narrow significantly from 2,000 feet in elevation to the drainage outlet at the Potlatch River.

Forested lands comprise approximately 60% of the watershed; most forested areas within the heart of the watershed are relatively open with more heavily forested tracts located near the northern and eastern divide and steeper canyon localities. About 6,000 acres of uplands are cropped with an additional 1,900 acres set aside in CRP. Approximately 800 acres are hayland and about 90 acres of pasture adjacent to stream channels. Most canyon areas are forested rangelands with scattered livestock grazing. The community of Southwick is located near the lower center watershed boundary. County Highway 3 transects the western watershed edge. The county boundaries of Latah, Nez Perce, and Clearwater counties intersect close to the pour points of Leopold Creek and Kauder Creek; these are the two major tributaries to Cedar Creek. Landuse distribution is illustrated in Figure 15.

Cedar Creek was §303(d) listed from Leopold Creek to the Potlatch River for sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that recreation beneficial use was fully supported but salmonid spawning and cold water aquatic life uses were not; this was due to temperature and sediment impairments. TMDLs were completed for the two pollutants.

Cedar Creek showed one of the highest rainbow/steelhead trout densities according to the fish survey conducted by IDFG (Bowersox et. al., 2006). The study also listed this creek as 7th highest restoration priority and 14th highest protection priority of 23 streams in the Potlatch River subbasin surveyed.

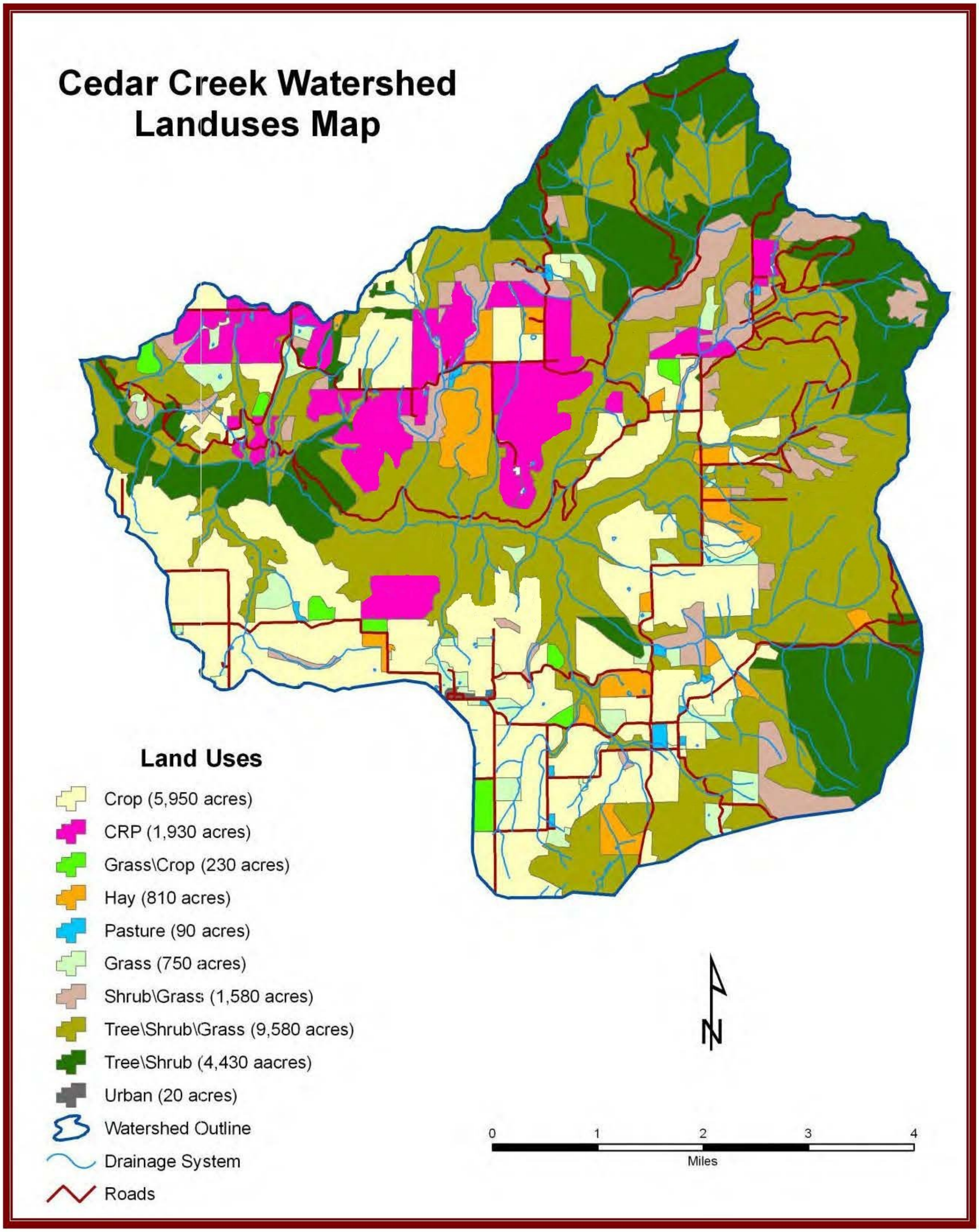

Figure 15. Cedar Creek Landuse Map

Corral Creek

Corral Creek is a south facing watershed of about 14,350 acres in size. Most of the land in the Corral Creek drainage is managed by the Clearwater National Forest (7,400 ac), with an additional 3,000 acres of forest land managed by the state; remaining forest is privately owned. Most federal and state lands are located north of State Highway 3 with USFS lands located primarily in the upper third of the watershed. Most private lands are in the lower half of the drainage. Location of Corral Creek relative to other TMDL watersheds is shown on Figure 8.

Corral Creek is a third order stream at its confluence with the Potlatch River. The headwaters originate about 8 miles to the north and east of the community of Helmer. Corral Creek generally flows from the north to south. Elevations range from just over 4,000 feet on the northernmost edge of the watershed to 2,370 feet at the stream's canyon mouth. The northernmost watershed has granitic bedrock; while the western central portion is comprised of rhyolitic and dacitic volcanic rocks. Basalts makeup the bedrock geology in the southern and eastern portions of the Corral Creek watershed; the volcanic flows lap up against granitic and older volcanic rocks that make up the higher elevation areas. Sediments of the Latah formation overlie and are interbedded with Columbia River Basalt. Latah sediment interbeds and landslide deposits are present in the canyons formed by Corral Creek, in addition to more commonly encountered alluvial deposits along stream channels. The canyons of Corral Creek steepen and narrow significantly from 2,600 feet in elevation to the drainage outlet at the Potlatch River.

Forested lands comprise more than 80% of the watershed; most forested areas within the southern portion of the watershed are relatively open with more heavily forested tracts located north of the old railroad grade above the town of Helmer and in steeper canyon localities . Less than 300 acres of uplands are cropped with an additional 500 acres set aside in CRP; these agricultural lands are located within the southern one-third of the drainage area. Approximately 200 acres are hayland and about 80 acres are pasture. Grass meadows and grassy shrubland is located adjacent to stream channels on forest lands. Scattered livestock grazing occurs throughout the watershed; meadow areas are generally the most heavily grazed. The community of Helmer is located in the southeastern portion of the watershed along State Highway 3 which transects the southern third of the drainage area. Landuse distribution is illustrated in Figure 16.

Corral Creek was §303(d) listed from its headwaters to the Potlatch River for sediment. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that recreation beneficial use was fully supported but salmonid spawning and cold water aquatic life uses were not; this was due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that sediment be removed from the list of impairments.

The fish study conducted by IDFG (Bowersox, et. al., 2006) listed this creek as 8th highest restoration priority and 16th highest protection priority of 23 streams in the Potlatch River subbasin surveyed. Rainbow/steelhead were observed in Corral Creek. A fish migration barrier was identified where Corral Creek flows through a box culvert under the old railroad grade north of Helmer. This barrier has been removed.

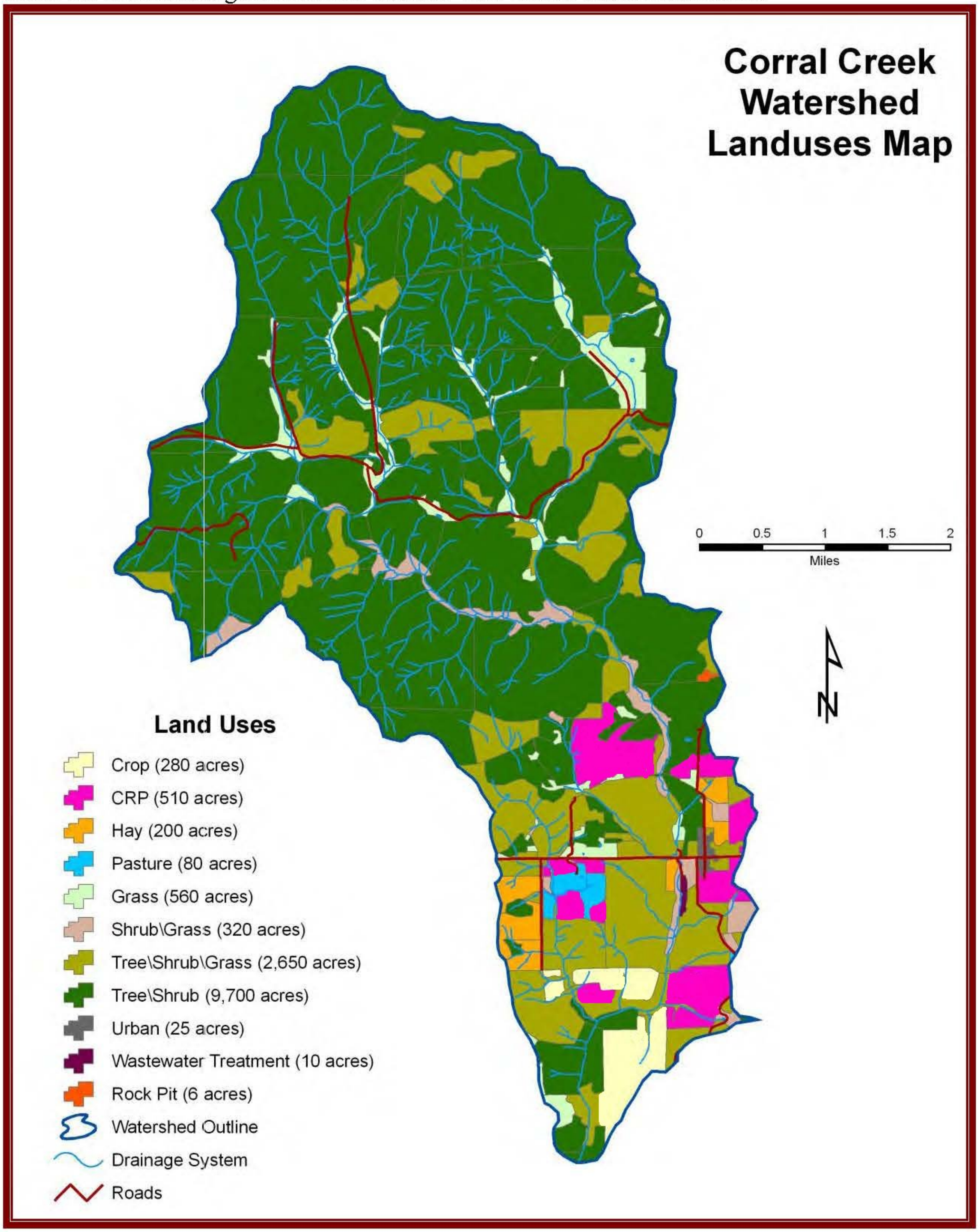

Figure 16. Corral Creek Landuse Map

Big Bear Creek

Big Bear Creek is a south-facing watershed of approximately 61,000 acres. The drainage area includes 51,500 acres of private lands. State lands (3,400 acres) are distributed in several areas near the watershed divide. Clearwater National Forest lands (5,800 acres) are located in the northwest corner of the watershed. Forty acres of BLM land is located just south of Dry Creek Road, in the lower central portion of the watershed. Headwaters originate six miles northwest of the town of Deary; the creek flows north to south for about 22 miles before reaching its outlet immediately southwest of the Kendrick High School. Location relative to other TMDL watersheds is shown on Figure 8.

Big Bear Creek from the West Fork 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. Little Bear Creek, the main tributary, joins Big Bear Creek about 1 mile upstream of its' mouth. Little Bear Creek watershed is not included in this description. Elevations range from over 4,800 feet at Mica Mountain to 1,235 feet at the confluence with the Potlatch River. The canyons of Big Bear Creek steepen and narrow significantly from 2,300 feet in elevation just above Dry Creek to about 1,350 feet just above the mouth of Little Bear; the canyon widens significantly for the next mile to the drainage outlet at the Potlatch River. The headwaters bedrock consists of metamorphic rocks of the Wallace Formation intruded by granitic rocks in the upper northeast corner adjacent to younger rhyolitic and dacitic volcanic rocks. Metamorphic rocks are also exposed at several additional localities along both the eastern and western watershed boundaries. Much of the remaining watershed is underlain by Columbia River Basalt flows which are overlain by, or include interbeds of Latah formation sediments. Alluvial deposits are found along stream channels with more extensive occurrences in upland areas.

Cropland makes up only about 12% (7,370 acres) of the Big Bear Creek watershed. About 5,900 acres of agricultural lands are set aside in the Conservation Reserve Program. Approximately 4,600 acres are planted to hay and about 130 acres is cropped grass. Pasture lands comprise 1,080 acres, much of it near State Highway 9 which links Deary to Harvard. Concentrated grazing by cattle occurs at several riparian sites; a winter feed area has been relocated outside the riparian zone. The most heavily forested lands (20,740 acres) are located in the northern third of the watershed. Open forest and shrublands (16,100 acres) cover much of the remaining watershed and are grazed by livestock. Wastewater treatment facilities are located within the watershed adjacent to the communities of Deary and Kendrick. Landuse distribution is shown in Figure 17.

According to IDEQ, Big Bear Creek is not supporting its beneficial uses, and is listed for temperature and bacteria in Section 5 of the 2008 Integrated Report (IDEQ, 2008). The highest overall fish densities present in electrofishing sites in 2003-2004 IDFG surveys were found in large canyon streams such as Big Bear Creek (Bowersox et al. 2006). Dace and rainbow/steelhead trout constituted the majority of fish sampled. A natural barrier in Big Bear Creek exists about 5.6 miles above the mouth. Although desribed as impassible for adult steelhead in several studies (Johnson 1985 and Shriever and Nelson, 1999), at least one rainbow/steelhead was observed above the barrier by Bowersox, et. al (2006). Upper Big Bear Creek is listed as the highest priority for restoration by IDFG (Bowersox et.al., 2006).

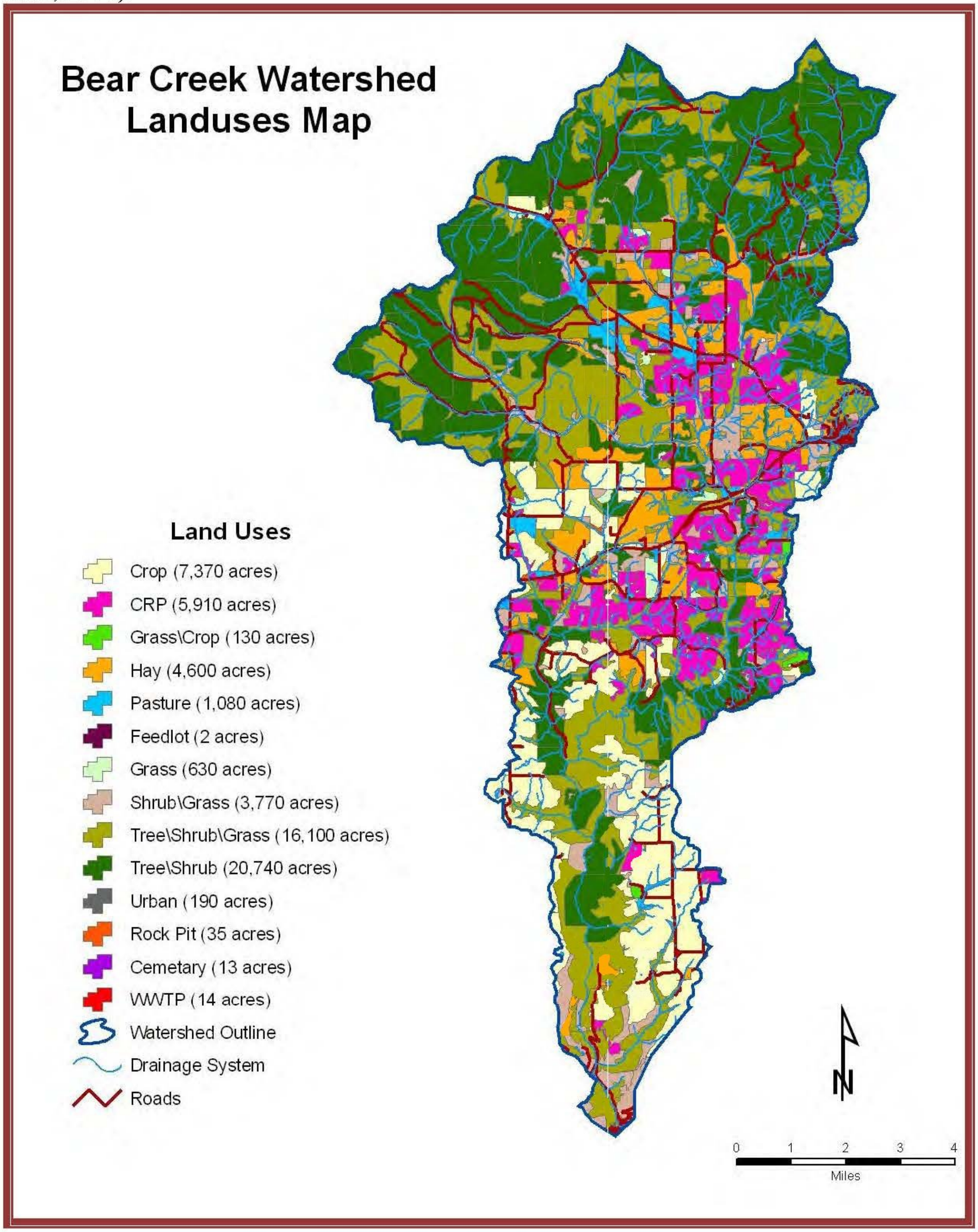

Figure 17. Big Bear Creek Landuse Map

West Fork Little Bear Creek

The West Fork of Little Bear Creek drains approximately 19,800 acres. The watershed is entirely private lands with the exception of 924 acres of state land located within headwater areas of the Felton Creek and Big Meadow Creek tributaries. The West Fork Little Bear Creek is approximately 12 miles long, originating roughly five miles northwest of Troy, Idaho. The stream flows southeast, through the town of Troy and down a narrow canyon, before entering Little Bear Creek. Location relative to other TMDL watersheds is shown on Figure 8.

Elevations range from about 4,900 feet on Moscow Mountain to 1,900 feet where the West Fork outlets at Little Bear Creek. The upper third of the watershed has granitic bedrock. With the exception of a small exposure of metasedimentary rock along the western boundary, the remainder of the watershed is underlain by basalt interbedded and overlain by Latah formation sediment. Alluvial deposits are found along stream channels; Onaway Basalt is exposed adjacent to stream channels above the canyon section.

Landuse distribution is shown in Figure 18. There is little active cropland (1,860 acres) but 2,870 acres are set aside in the Conservation Reserve Program. Another 900 acres are planted to grass or hay. Pasture lands cover almost 400 acres. The most heavily forested areas are located above Highway 8. The rest of the watershed is primarily open forest or shrublands.

Although the West Fork of Little Bear Creek is not currently shown on the 303(d) list as being water quality impaired, the IDEQ concluded from their monitoring efforts in 2002 that the stream is in fact water quality limited due to high levels of nitrate measured below the City of Troy WWTP. When West Fork flows were less than 1.5 cfs, dissolved oxygen measurements were below 6.0 mg/L. A TMDL was developed by IDEQ for total inorganic nitrogen (TIN) in this stream. Data collected in 2008 affirmed that water quality standards for nutrients, temperature and bacteria are being exceeded in the West Fork of Little Bear (IASCD, 2010). The fish study conducted by IDFG (Bowersox et al, 2006) concluded the West Fork of Little Bear Creek had the highest rainbow/steelhead trout density of all sampled streams in the Potlatch River watershed, with a mean density of 13.2 fish/100 m^2.

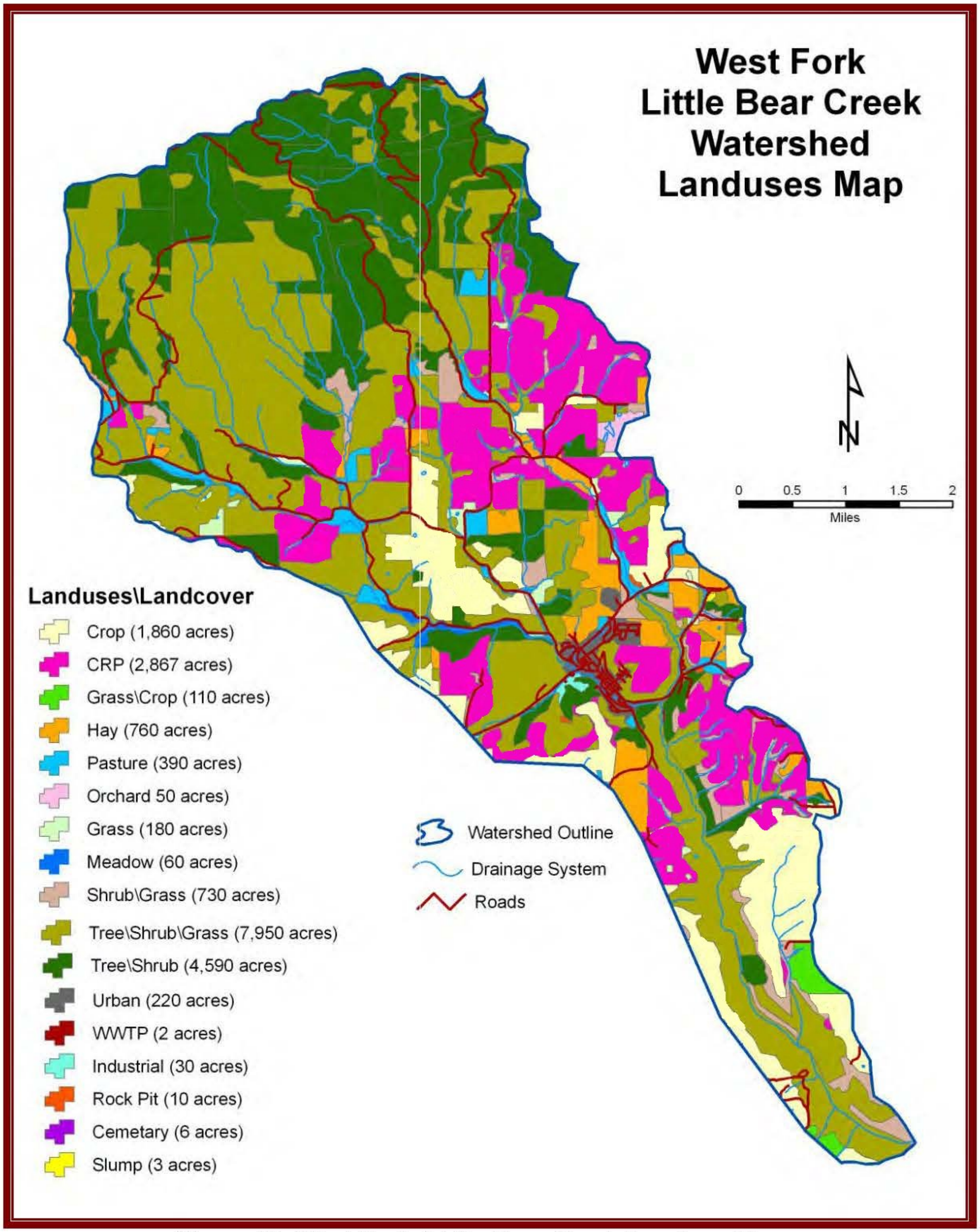

Figure 18. West Fork Little Bear Creek Landuse Map

Middle Potlatch Creek

Middle Potlatch Creek is a southeast facing watershed of about 36,000 acres in size. The drainage area is entirely private lands with the exception of 40 acres of BLM property along the drainage approximately 7 miles above the mouth. Location of Middle Potlatch Creek relative to other TMDL watersheds is shown on Figure 8.

Middle Potlatch Creek is a third order stream at its confluence with the Potlatch River. The headwaters originate several miles to the north of the stretch of Highway 8 between Moscow and Troy. The watershed outlet is just northeast of the town of Juliaetta. Middle Potlatch Creek generally flows from the northwest to southeast. Elevations range from just 3,466 feet at Tomer Butte on the northwest edge of the watershed to 1,084 feet at the stream's mouth. The headwaters have granitic bedrock along with metamorphic rocks of the Wallace Formation; the northwestern watershed edge is comprised of schist, gneiss and quartzite of the Syringa sequence. Basalts make up the bedrock geology in much of the rest of the watershed; the volcanic flows lap up against granitic, metamorphic and older volcanic rocks that comprise the higher elevation areas. Orthogneiss outcrops in the upper portion of the main drainage canyon, while landslide deposits are numerous along the lower reaches. Sediments of the Latah formation are interbedded with Columbia River Basalt flows. Alluvial deposits are found along stream channels; more extensive occurrences are located in upland areas. The canyons of Middle Potlatch Creek steepen and narrow significantly from 2,300 feet in elevation to about 1,600 feet at the mouth of Bethel Canyon; the canyon widens significantly for the next four miles to the drainage outlet at the Potlatch River.

Cropland makes up more than half the watershed area; about 3,600 acres are set aside in CRP. Approximately 800 acres are planted to hay and about 300 acres is cropped grass. Pasture lands comprise about 850 acres. Several livestock winter feeding areas are present, notably along Cook's Canyon several miles upstream of the drainage outlet. Heavily forested lands (500 ac) are relatively rare, but open forest and shrubland blanket canyon areas and are grazed by livestock; these rangeland areas comprise approximately 25% of the watershed. Landuse distribution is illustrated in Figure 19.

Middle Potlatch Creek was §303(d) listed from its headwaters to the Potlatch River for sediment, nutrients, temperature, and bacteria. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that no beneficial uses were fully supported due to temperature, bacteria, and sediment impairments. IDEQ recommended that nutrients be removed from the list of impairments.

A preliminary water quality investigation was completed by SCS (1993) on Middle Potlatch Creek. This report concluded fish habitat was poor in the upper watershed; little or no flow in the summer is a severe limitation. The mid portion of Middle Potlatch Creek habitat was rated good, but the lower section of the creek had a poor habitat rating. Adjacent land use was severely limiting due to streamside location of animal holding facilities, lack of riparian and range management practices and forest harvest activities (USDA SCS, 1993). Middle Potlatch Creek has a fish migration barrier (falls) at stream mile 8. The creek is identified as having steelhead and rainbow trout, with a spawning and incubation period of January through May. The fish study conducted by IDFG (Bowersox, et. al., 2006) listed this creek as 17th highest restoration priority and 10th highest protection priority of 23 streams in the Potlatch River subbasin surveyed.

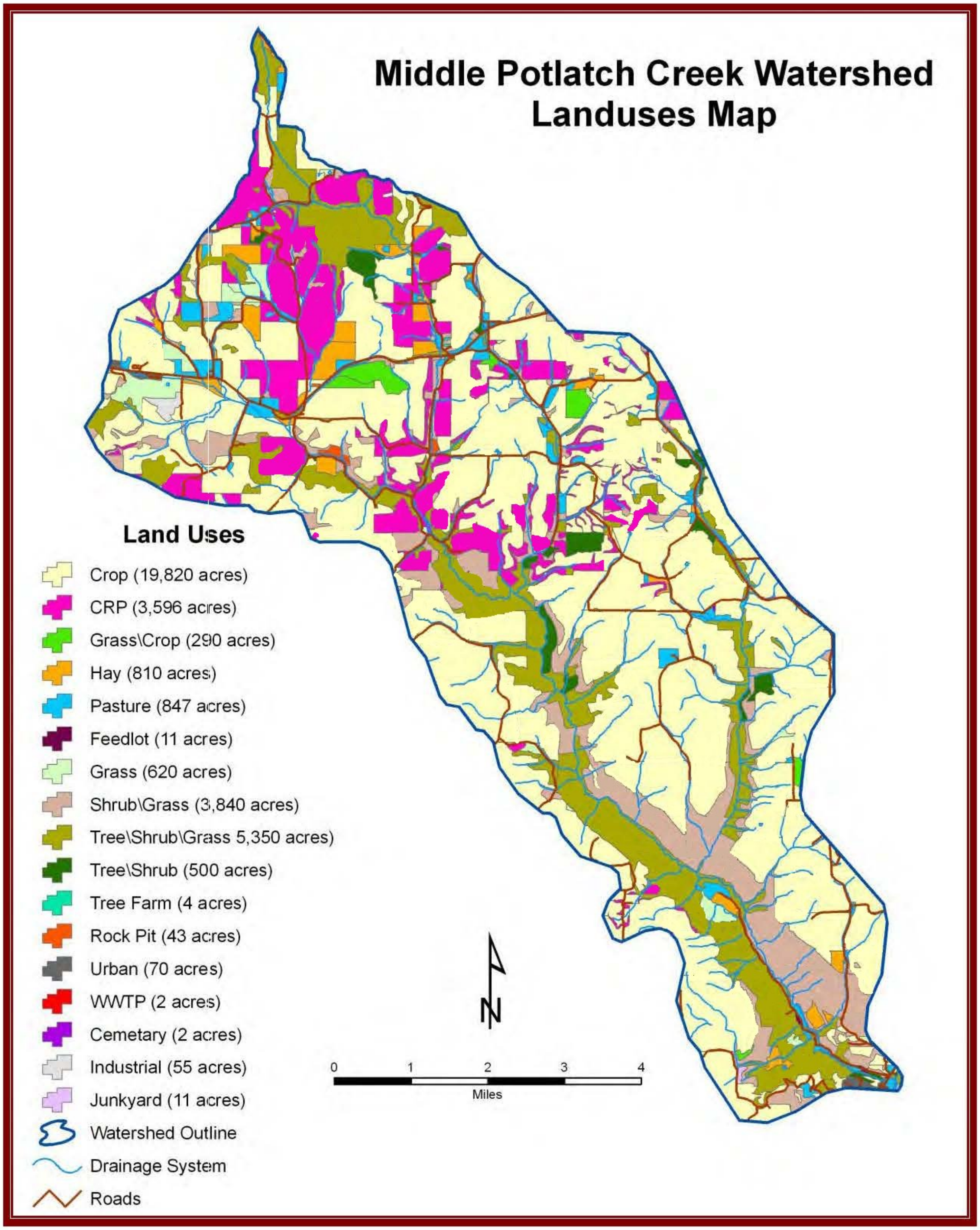

Figure 19. Middle Potlatch Creek Landuse Map

Potlatch River (Moose Creek to Corral Creek)

The drainage area described for this reach of the Potlatch River is approximately 18,500 acres in size. Most of the land is managed by the Clearwater National Forest (12,082 ac). Private lands (4,960 ac) are distributed throughout the area, with 1,480 acres of state lands located mostly in the northeastern corner. The town of Bovill is also located in the northeastern corner and is sited near the intersection of State Highway 3 and State Highway 8. The community of Helmer is located adjacent to, but outside the west-central edge of the watershed along Highway 3. Location relative to other TMDL watersheds is shown on Figure 8.

The Potlatch River generally flows from the north to south in this stretch. In addition to face watersheds along this stretch of river, the drainage area for Hog Meadow Creek and Little Boulder Creek tributaries is included in the described area. Elevations range from about 4,200 feet on the southernmost edge of the watershed to 2,370 feet at the Corral Creek canyon mouth. Below an elevation of approximately 2,600 feet and about a half mile below the Little Boulder Creek Campground, the Potlatch River flows through a very steep canyon. Canyon walls with slopes greater than 200% are common. Schists, phyllites and quartzites of the Wallace Formation are exposed in the northeastern corner of the drainage area; another group of metamorphic rocks comprise the bedrock of the southernmost watershed. Basalts underlie much of the rest of the drainage area and are most commonly exposed adjacent to the river canyons. Rhyolitic and dacitic volcanic rocks and several granitic plugs occur in several localites in the northern part of the watershed. Sediments of the Latah formation overlie and are interbedded with Columbia River Basalt. Alluvial deposits are commonly encountered along drainage channels.

Forested lands comprise more than 80% of the watershed; heavily forested areas dominate with more open forest areas in localities where recent timber harvest has occurred or adjacent to forest meadows along the Potlatch River and its tributaries. Agricultural lands are mostly located close to the towns of Bovill or Helmer, with cropland acres located near the end of Old Park Road at the southwest edge of the drainage area. About 126 acres are cropped with an additional 92 acres set aside in CRP; these agricultural lands are located within the southern one-third of the drainage area. Approximately 50 acres are hayland and about 350 acres are pasture. Livestock grazing occurs throughout the watershed; meadow areas are generally the most heavily grazed with the Hog Meadow Creek drainage showing heavy concentrations of cattle. Horses are pastured on several small tracts near the intersection of Forks Road and Highway 3. Grass meadows and grassy shrubland is located adjacent to stream channels on forest lands. Several old revegetated clay pits are located a few miles west of Bovill. Landuse distribution is illustrated in Figure 20.

The Potlatch River from the mouth of Moose Creek to Corral Creek was §303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ (2008) determined that beneficial uses were not fully supported due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that the other reported impairments be removed from the list. The Upper Mainstem Potlatch River is listed as the 13th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 7th for protection.

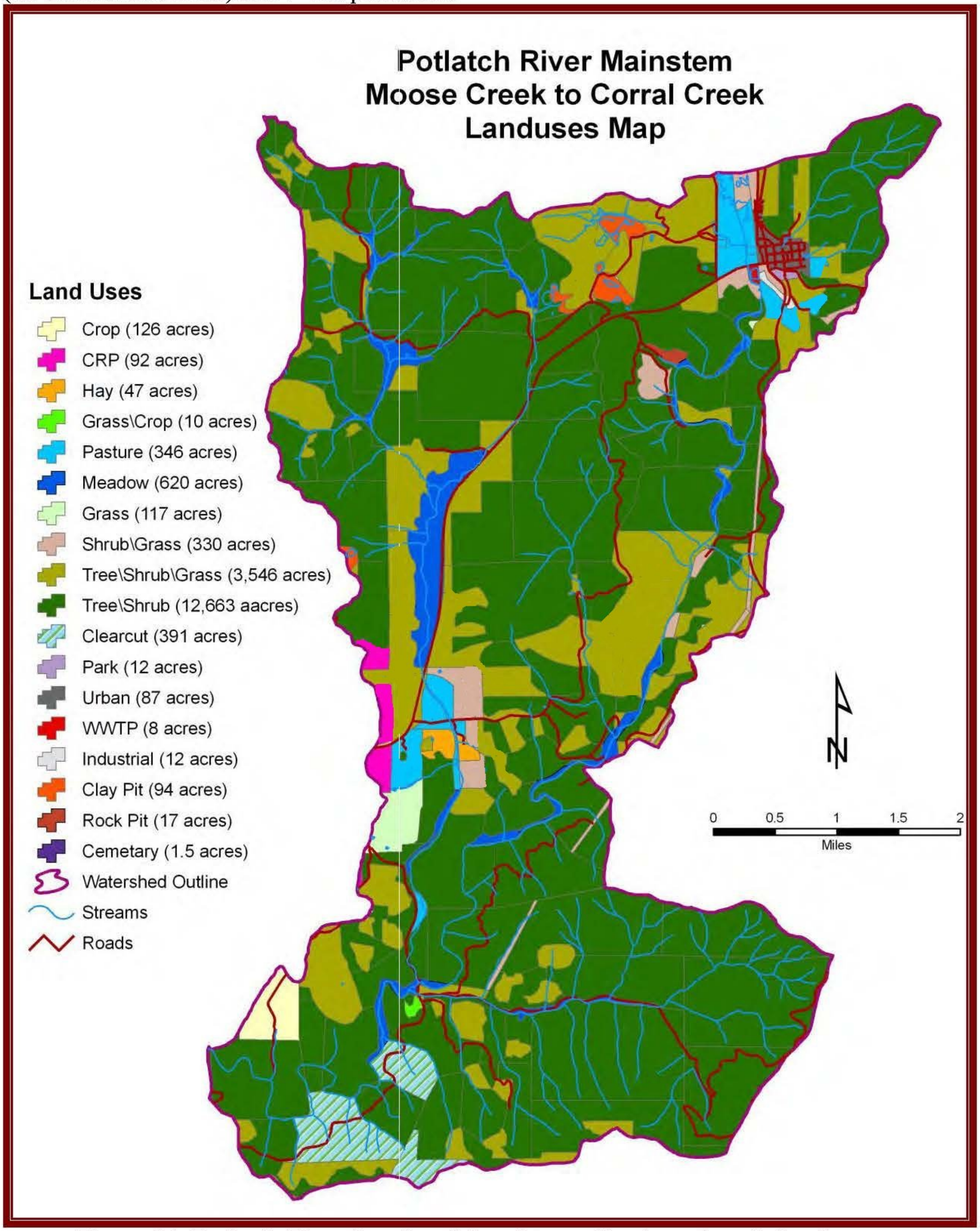

Figure 20. Potlatch River Landuse Map. Moose Creek to Corral Creek

Potlatch River (Corral Creek to Big Bear Creek)

The drainage area described for this reach of the Potlatch River is approximately 26,470 acres in size. Almost 90% of the land is privately managed (23,600 ac). Some USFS lands (315 ac) lie just below the Corral Creek mouth, with state lands (2,310 ac) located mostly in the northern tip of the Brush Creek watershed and at the mouth of Rock Creek. About 80 acres of BLM ground is located along the river below Rock Creek. The community of Deary is located adjacent, but outside the northwest edge of the area along State Highway 3. The town of Kendrick is located just southwest of the bottom of the river reach. Location relative to other TMDL watersheds is shown on Figure 8.

The Potlatch River generally flows from the north to the southwest in this stretch. In addition to face watersheds along this stretch of river; the drainage area for Brush Creek and Rock Creek tributaries is included in the described area. The highest point (4,017 ft) in the watershed is Potato Hill, just north of Deary; the lowest elevation (1,235 ft) is near the mouth of Bear Creek on the east edge of Kendrick. From the top of reach, at the mouth of Corral Creek to about one half mile above the mouth of Pine Creek, the Potlatch River flows through a very steep canyon. Canyon walls with slopes greater than 200% are common. Schist and gneiss outcrop in several places along the eastern drainage divide; the Potato Hill volcanics form the uplands north of Deary. Basalts underlie most of the rest of the drainage area and are interbedded and blanketed by sediments of the Latah formation in some locations. Alluvial deposits are common along drainage channels; landslide deposits occur frequently within the river canyon.

Forested lands are located in upland areas within and adjacent to the river canyons and comprise about half of the watershed; the more heavily forested areas generally occur in the northern third of the drainage area. Cropland is found primarily on uplands adjacent to the lower third of the river reach. About 5,900 acres are cropped with an additional 1,900 acres set aside in CRP. Approximately 550 acres are hayland and about 1,030 acres are pasture. Livestock grazing occurs throughout the watershed but free ranging cattle appear to be less abundant than in adjacent watershed areas. A tree farm is located along the central part of the western drainage divide. Grassy shrubland is located adjacent to stream channels on forested lands and on upland areas adjacent to the river canyon. State Highway 3 roughly parallels the watershed to the west from Kendrick to Deary, where it merges with Highway 8, turns west, and splits the Brush Creek drainage. Landuse distribution is illustrated in Figure 21.

The Potlatch River from the mouth of Corral Creek to Big Bear Creek was §303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ (2008) determined that beneficial uses were not fully supported due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that the other reported impairments be removed from the list.

The Lower Mainstem Potlatch River is described as the 11th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 20th for protection. The

Upper Mainstem Potlatch River is listed as the 13th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 7th for protection.

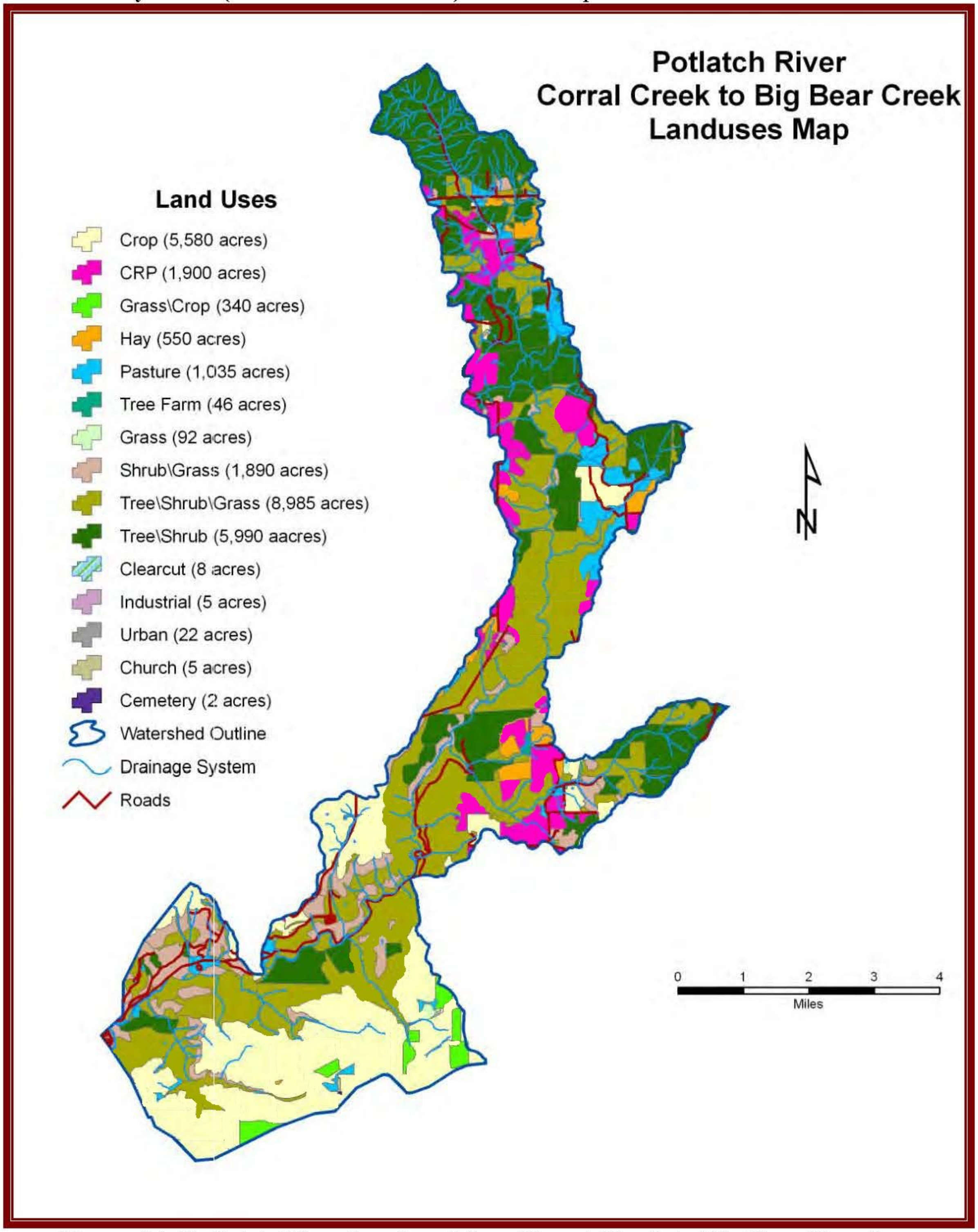

Figure 21. Potlatch River Landuse Map, Corral Creek to Big Bear Creeek

Potlatch River (Big Bear Creek to Clearwater River)

The drainage area described for this reach of the Potlatch River is approximately 22,800 acres in size. Over 90% of the land is privately managed (20,860 ac). A few tracts of tribal property (900 ac) are distributed throughout the southern half of the drainage area, in addition to state (480 ac) and BLM (330 ac) lands. The town of Kendrick is located at the top of the river reach; Juliaetta is midreach, with US Highway 12 at the Potlatch River outlet along the Clearwater River. Location relative to other TMDL watersheds is shown on Figure 8.

The Potlatch River generally flows from the northeast to the southwest in this stretch. In addition to face watersheds along this stretch of river; the drainage area for the Howard Gulch tributary is included in the described area. The highest elevation (2,900 ft) in the watershed is at the head of the Howard Gulch drainage; the lowest elevation (800 ft) is at the mouth of the Potlatch River. The Potlatch River flows through a canyon with walls more than 1,000 feet higher than the river valley; the river valley is generally less than one quarter mile wide along this reach. Canyon walls with slopes greater than 200% are common; slope values usually are between 100% and 200%. Basalts underlie the entire drainage area; an extensive stratigraphic basalt flow sequence is exposed in the canyon walls. Alluvial deposits blanket most of the river valley; landslide deposits are common along the upper third of the Potlatch River reach.

Forested lands are usually fairly open and comprise about 14% of the drainage area. Tree covered areas are generally located on the canyon walls or along the valley bottom. Most (34%) of these areas are covered with grass or shrubs and is classified as rangeland. Livestock grazing occurs in rangeland areas and several livestock winter feeding operations are located along the Potlatch River. Upland areas are commonly cropland (44% or 10,000 ac); very little farmland (72 ac) is set aside in CRP. Pasture areas (940 ac) are generally adjacent to the river channel. A vineyard is located along the east side of the Potlatch River about 1.5 miles above the mouth. State Highway 3 runs along the river over the entire reach. Landuse distribution is illustrated in Figure 22.

The Potlatch River from the mouth of Big Bear Creek to the Clearwater River was §303(d) listed for bacteria, nutrients, sediment, temperature, DO, ammonia, oil/gas, organics and pesticides. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ (2008) determined that beneficial uses were not fully supported due to temperature and sediment impairments. TMDLs were completed for temperature and sediment, but IDEQ recommended that the other reported impairments be removed from the list. The Lower Mainstem Potlatch River is listed as the 11th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 20th for protection.

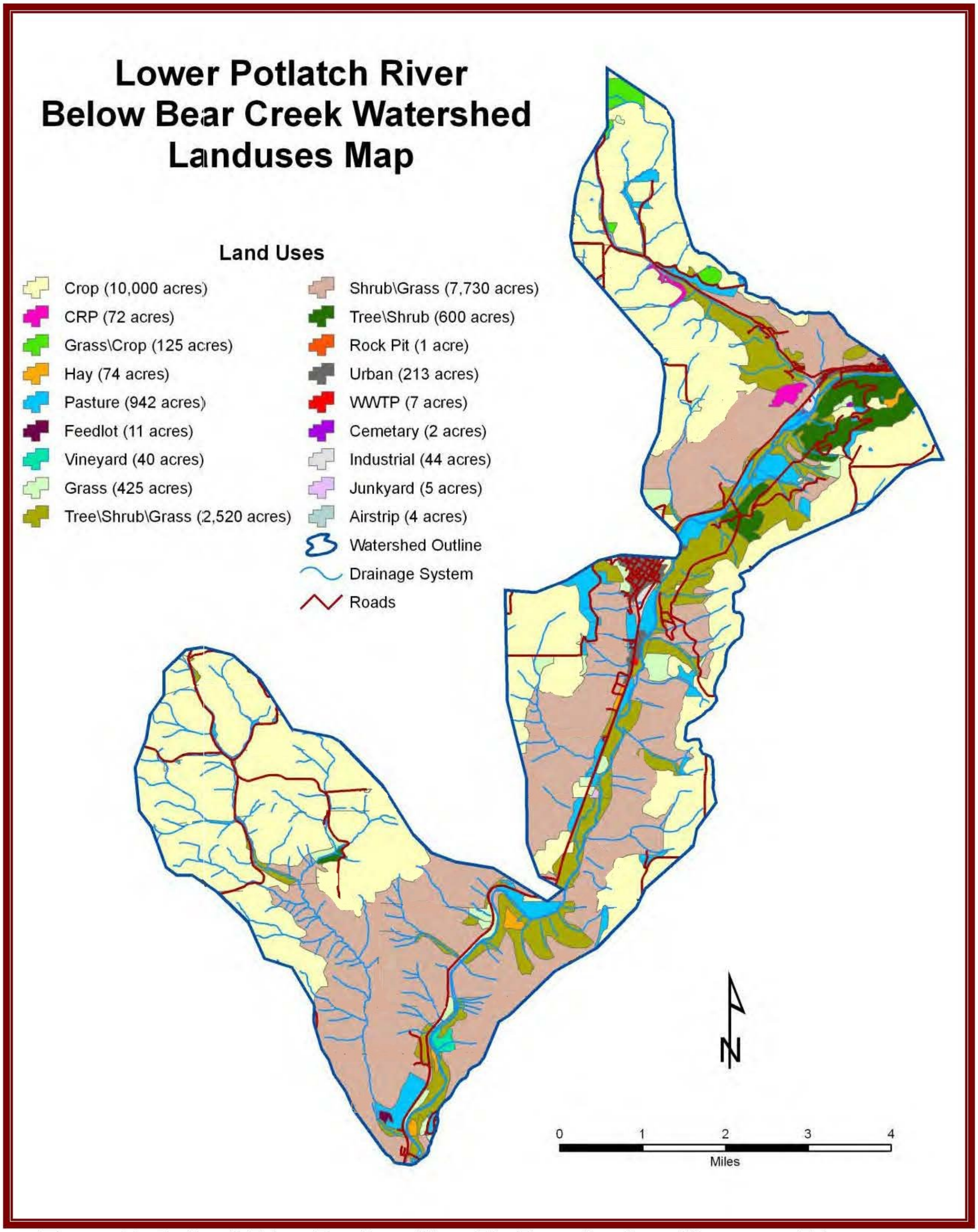

Figure 22. Potlatch River Landuse Map, Big Bear Creek to Clearwater River

Past Agricultural Conservation Efforts

According to ISCC's survey (Dansart, 2009) of land uses within the watersheds of the 303(d) listed waterbodies, an estimated 55,000 acres are in cropland, about 23,000 acres are set aside in CRP, approximately 9,500 acres are hayland and 3,000 acres pasture. Thousands of additional acres of grassland, rangeland, and forestland are grazed by livestock, with some areas, such as forest meadows, receiving fairly heavy use. Agricultural lands within the 303(d) listed watersheds represents approximately one half of the total agricultural acres located within the Potlatch River Subbasin. More than 80% of the total subbasin acreage set aside in the Conservation Reserve Program is within these TMDL watersheds.

The Soil Conservation Service (SCS) became active in the Potlatch River Subbasin in 1935, five years before the first conservation districts in the area were organized. Major SCS activities included technical assistance to individual farmers and farmer groups planning and applying conservation on the land through Soil and Water Conservation Districts (SWCDs). The SCS (now NRCS) has worked in the Potlatch River Subbasin through the Latah SWCD and Nez Perce SWCD to assist with conservation planning and assistance. The Latah Soil Survey, which encompasses most of the watershed, was published in 1981; a new soil survey for the area is in progress and should be completed within the next few years.

The Agricultural Research Service (ARS) has conducted investigations to provide new agronomic alternatives for farmers in the Palouse and develop data to revise the Universal Soil Loss Equation (USLE). The Agricultural Stabilization and Conservation Service which later became the Farm Service Agency (FSA) has cost-shared, through various farm programs, implementation of selected conservation practices with landowners and operators in the watershed.

USDA Farm Services Administration (FSA) and the Natural Resources Conservation Service (NRCS) administer and implement the federal Conservation Reserve Program (CRP) and Continuous Conservation Reserve Program (CCRP). Agricultural lands with a previous cropping history are enrolled into CRP to remove highly erodable land from production. The land is planted to herbaceous or woody vegetation to reduce soil and water erosion. CRP contracts are for a minimum of 10 years. Practices that occur under CRP include planting vegetative cover, such as introduced or native grasses, wildlife cover plantings, conifers, filter strips, grassed waterways, riparian forest buffers, and field windbreaks (Gilmore, 2004). Within the Potlatch River 303(d) listed watersheds, approximately 23,000 acres have been removed from production and placed into permanent vegetative cover under the Conservation Reserve Program (CRP).

The Continuous Conservation Reserve Program (CCRP) focuses on the improvement of water quality and riparian areas. Practices include shallow water areas, riparian forest buffers, filter strips, grassed waterways and field windbreaks. Enrollment for these practices is not limited to highly erosive land, as is required for the CRP, and carries a longer contract period (10-15 years), higher BMP installation reimbursement rate, and higher annual annuity rate (Gilmore, 2004). Total CCRP acres within the Potlatch River Subbasin are unknown at this time but are assumed to be fairly low.

The NRCS both administers and implements the Environmental Quality Incentives Program (EQIP). The program provides technical, educational, and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers to comply with federal, state, and tribal environmental laws, and encourages environmental enhancement. The purposes of the program are achieved through the implementation of a conservation plan that includes structural, vegetative, and land management practices on eligible land. Five- to ten-year contracts are made with eligible producers. Cost-share payments may be made to implement one or more eligible structural or vegetative practices, such as animal waste management facilities, terraces, filter strips, tree planting, and permanent wildlife habitat (Gilmore, 2004). Several EQUIP projects are active in the watershed.

The Wildlife Habitat Incentives Program (WHIP) is administered and implemented by NRCS. WHIP provides financial incentives to develop wildlife habitat on private lands. Participants agree to implement a wildlife habitat development plan and NRCS agrees to provide cost-share assistance for the initial implementation of habitat enhancement practices for wildlife. This agreement generally lasts a minimum of 10 years from the date that the contract is signed (RPU, 2007).

The Wetlands Reserve Program (WRP) is a voluntary program administered and implemented by NRCS and is designed to restore wetlands. Participating landowners can establish conservation easements of permanent or 10- to 30-year duration, or can enter into restoration cost-share agreements where no easement is involved. Easements and restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the easement or agreement (RPU, 2007).

The Idaho Soil Conservation Commission (ISCC) staff provides technical and administrative support to Conservation Districts in Idaho. ISCC has provided financial incentives under the Water Quality Program for Agriculture (WQPA) to supplement EPA 319 funds on agricultural lands. The intent of WQPA is to contribute to protection and enhancement of the quality and value of Idaho's waters by controlling and abating water pollution from agricultural lands. The program provides financial assistance to Soil Conservation Districts who conduct water quality planning studies and implement water quality projects.

The Idaho Association of Soil Conservation Districts (IASCD) has performed water quality monitoring within the TMDL watersheds, from 2006 to 2008, to collect baseline data prior to subsequent BMP implementation efforts on agricultural lands.

The Habitat Improvement Program (HIP) is a program administered by IDFG to create and improve habitat for upland game and waterfowl on public and private land. Initiated in 1987, the program is designed primarily to financially help private landowners to use their property to the benefit of upland game birds and waterfowl. From 1987-2003, it is estimated that 3,600 acres of habitat improvement was implemented in the Potlatch River watershed. From 2002-2005, It is estimated that 2,822 acres were enrolled in HIP. The IDFG also administers the Clearwater Pheasant Initiative (CPI) that provides funding for pheasant habitat projects in the Clearwater Region. These funds complement current HIP funds, but are focused on improving woody cover, planting food plots, and managing crop residue (RPU, 2007).

The Latah Soil Water Conservation District (LSWCD) serves as the lead in administering the Section 319/WQPA funded AFO project which identifies problem areas and implements best management practices related to confined animal feeding operations. The project was initiated in 2001 and continues to present; it involves five Conservation Districts in north-central Idaho. Currently, seven projects have been implemented within the Potlatch River Subbasin.

The LSWCD sponsored the Potlatch River Watershed Management Plan which was partially funded by BPA; the plan was completed by Resource Planning Unlimited in 2007. The stated purpose of the plan is to provide guidelines to facilitate the collaborative coordination of steelhead habitat restoration efforts throughout the Potlatch River watershed. The plan defines priority restoration and protection for individual watersheds and land types and is a tool to direct voluntary steelhead restoration efforts on both private and public lands within each subwatershed.

The LSWCD applied for and was awarded a CWA §319 grant, in 2004, through IDEQ to fund the Potlatch River Water Quality Improvement Project (PoRWQIP), with non-federal match provided by landowner PoRWQIP participants and WQPA. The project focus is promoting the implementation of best management practices on croplands such as conservation tillage practices and crop rotations that minimize erosion and pollutant delivery to the watershed drainage system. In 2009, LSWCD was awarded a CWA §319 grant to implement a multi-year project entitled "Potlatch River Watershed Management Plan – Phase One".

Beginning in 2003, the LSWCD began coordination of what was to become a multi-agency effort to remove a passage barrier to steelhead migration on Corral Creek. A fish survey conducted by IDFG recognized that steelhead were abundant below a major culvert crossing an abandoned railroad line, but absent above. A partnership between Federal and State agencies developed to open up 18 miles of previously inaccessible fish habitat (NRCS, 2009). In 2007, the 200 foot-long culvert was removed and an artificial channel was created to restore the stream. Subsequent wetland creation and riparian planting to promote a healthy riparian zone occurred and is currently ongoing. Project participants include NOAA Fisheries, NRCS, Idaho Office of Species Conservation, IDL, BPA, USFS, ITD, and IDFG.

WATER QUALITY PROBLEMS

Table C lists all the §303(d) water bodies addressed in the Potlatch River Subbasin TMDL (IDEQ, 2008) along with boundaries, listing basis, pollutants and segment IDs.

Table C. §303(d) segments in the Potlatch River Subbasin. (IDEQ, 2008)

Waterbody	Assessment Unit-ID	2002 §303 (d)[1] Listing	Pollutants[2]
Potlatch River	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Headwaters to Moose Creek	Sed, Nut, Temp, Bac
Potlatch River	ID17060306CL048_04 ID17060306CL048_05	Moose Creek to Corral Creek	Sed, Nut, Temp, Bac
Potlatch River	ID17060306CL045_05	Corral Creek to Big Bear Creek	Sed, Nut, Temp, Bac
Potlatch River	ID17060306CL044_06	Big Bear Creek to Clearwater River	Bac, DO, NH_3, Nut, O/G,Org, Pest, Sed, Temp
Big Bear Creek	ID17060306CL056_04 ID17060306CL056_05	West Fork Big Bear Creek to Potlatch River	Temp
Boulder Creek	ID17060306CL047_03	Pig Creek to Potlatch River	Unknown*
Cedar Creek	ID17060306CL046_04	Leopold Creek to Potlatch River	Sed, Temp
Corral Creek	ID17060306CL054_02 ID17060306CL054_03	Headwaters to Potlatch River	Sed
East Fork Potlatch River	ID17060306CL051_04	Ruby Creek to Potlatch River	Sed, Nut, Temp, Bac
Middle Potlatch Creek	ID17060306CL062_02 ID17060306CL062_03	Headwaters to Potlatch River	Sed, Nut, Temp, Bac
Moose Creek	ID17060306CL053_02 ID17060306CL053_03	Headwaters to Potlatch River	Bac, Nut, pH, Sed, Temp
Pine Creek	ID17060306CL055_02 ID17060306CL055_03	Headwaters to Potlatch River	Bac, Nut, O/G, DO, Sed, Temp NH_3
Ruby Creek	ID17060306CL052_03	Unnamed tributary 3.4 km upstream to East Fork Potlatch	Sed, Nut, Temp, Bac
West Fork Little Bear Creek[a]	ID17060306CL061_02 ID17060306CL061_03	Headwaters to Little Bear Creek	Sed, Nut, Bac

1 Refers to a list created in 2002 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.
2 Bac = Bacteria; DO=Dissolved Oxygen; NH_3=Ammonia; Nut = Nutrients, O/G=Oil/Gas; Org=Organics; Pest=Pesticides; Sed = Sediment, Temp = Temperature
a The West Fork of Little Bear Creek was not on the 2002 §303(d) list but was recommended for listing by the TMDL document (IDEQ, 2008)

Beneficial uses/status

The beneficial uses of cold water aquatic life and salmonid spawning are designated or existing for all of the §303(d) listed waterbodies. Primary contact recreation and drinking water supply are designated uses listed for the Potlatch River; primary contact recreation is an existing use in Moose Creek. Secondary contact recreation is an existing or designated beneficial use for the remaining waterbodies on the list (IDEQ, 2008).

Water quality must be adequately maintained to meet the most sensitive use. Table D lists beneficial uses for each waterbody.

Table D. Beneficial uses for §303(d) listed stream segments (IDEQ, 2008)

Waterbody	Assessment Unit-ID	2002 §303 (d)[1] Listing	Designated Uses	Existing Uses
Potlatch River	ID17060306CL049_02 ID17060306CL049_03 ID17060306CL049_04	Headwaters to Moose Creek	CWAL, SS, PCR, DWS,	
Potlatch River	ID17060306CL048_04 ID17060306CL048_05	Moose Creek to Corral Creek	CWAL, SS, PCR, DWS	
Potlatch River	ID17060306CL045_05	Corral Creek to Big Bear Creek	CWAL, SS, PCR, DWS	
Potlatch River	ID17060306CL044_06	Big Bear Creek to Clearwater River	CWAL, SS, PCR, DWS	
Big Bear Creek	ID17060306CL056_04 ID17060306CL056_05	West Fork Big Bear Creek to Potlatch River		CWAL, SS, SCR
Boulder Creek	ID17060306CL047_03	Pig Creek to Potlatch River		CWAL, SS, SCR
Cedar Creek	ID17060306CL046_04	Leopold Creek to Potlatch River		CWAL, SS, SCR
Corral Creek	ID17060306CL054_02 ID17060306CL054_03	Headwaters to Potlatch River		CWAL, SS, SCR
East Fork Potlatch River	ID17060306CL051_04	Ruby Creek to Potlatch River		CWAL, SS, SCR
Middle Potlatch Creek	ID17060306CL062_02 ID17060306CL062_03	Headwaters to Potlatch River		CWAL, SS, SCR
Moose Creek	ID17060306CL053_02 ID17060306CL053_03	Headwaters to Potlatch River		CWAL, SS, PCR
Pine Creek	ID17060306CL055_02 ID17060306CL055_03	Headwaters to Potlatch River		CWAL, SS, SCR
Ruby Creek	ID17060306CL052_03	Unnamed tributary 3.4 km upstream to East Fork Potlatch		CWAL, SS, SCR
West Fork Little Bear Creek	ID17060306CL061_02 ID17060306CL061_03	Headwaters to Little Bear Creek		CWAL, SS, SCR

1 Refers to a list created in 2002 of water bodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.
CWAL= Cold Water Aquatic Life; SS = Salmonid Spawning; PCR = Primary Contact Recreation;
SCR =Secondary Contact Recreation; DWS = Domestic Water Supply

Pollutants

Pollutants listed for the §303(d) listed water bodies are shown in Table C. Changes to the §303(d) list recommended in the TMDL document included removing specific pollutants from the list of impairments for the listed Potlatch River reaches, Corral Creek, Pine Creek, Ruby Creek, East Fork Potlatch River and Middle Potlatch Creek. These recommended changes are shown in Table E. TMDLs were completed for other pollutants on the listed stream segments.

Potential sources of sediment, excluding natural background in the basin, include in-stream erosion, roads, agriculture, logging, and grazing activities. The source for temperature is solar radiation, i.e., the sun. Possible sources for nutrients include natural background, fertilizers, grazing sources, septic systems, and storm runoff. Potential

Table E. Summary of assessment outcomes. From IDEQ (2008)

Waterbody	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Potlatch River, Big Bear Creek .to Mouth	Temp, Sed	Yes	Move to section 4a	TMDL completed
Potlatch River, Big Bear Creek .to Mouth	O/G, Nut, Pest, Bac, NH3,Org, DO	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Corral Creek. to Big Bear Creek	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Corral Creek to Big Bear Creek	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Moose Creek. to Corral Creek	Temp	Yes	Move to section 4a	TMDL completed
Potlatch River, Moose Creek to Corral Creek	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Potlatch River, Headwaters to Moose Creek	Temp, Bac	Yes	Move to section 4a	TMDL completed
Potlatch River, Headwaters to Moose Creek	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Big Bear Creek	Bac, Temp	Yes	Move to section 4a	TMDL completed
Boulder Creek	Bac, Temp	Yes	Move to section 4a	TMDL completed
Cedar Creek	Temp, Sed	Yes	Move to section 4a	TMDL completed
Corral Creek	Temp	Yes	Move to section 4a	TMDL completed
Corral Creek	Sed	No	Remove pollutants from list of impairments	SBA completed
Moose Creek	Temp, Bac	Yes	Move to section 4a	TMDL completed
Moose Creek	Nut, pH, Sed	No	Remove pollutants from list of impairments	SBA completed
Pine Creek	Temp, Nut, Sed	Yes	Move to section 4a	TMDL completed
Pine Creek	O/G, DO, Bac, NH3	No	Remove pollutants from list of impairments	SBA completed
Ruby Creek	Temp, Bac	Yes	Move to section 4a	TMDL completed
Ruby Creek	Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
East Fork Potlatch River	Temp	Yes	Move to section 4a	TMDL completed
East Fork Potlatch River	Bac, Nut, Sed	No	Remove pollutants from list of impairments	SBA completed
Middle Potlatch Creek	Temp, Bac, Sed	Yes	Move to section 4a	TMDL completed
Middle Potlatch Creek	Nut	No	Remove pollutants from list of impairments	SBA completed
West Fork Little Bear Creek	Sed, Nut, Bac	Yes	Move to section 4a	TMDL completed

sources of bacteria include grazing activities, septic systems, wildlife, and humans (IDEQ, 2005). These sources of pollutants will be discussed in more detail in the following section. Although habitat alteration is not a pollutant requiring a TMDL load allocation, improvements to water quality related to nutrient, temperature and sediment load reductions will improve habitat conditions within the watersheds.

Point Sources

Waste load allocations were developed for the Deary, Bovill, Kendrick, Juliaetta, and Troy wastewater treatment facilities based on the estimated design flow, the maximum daily limit, and the current allowable average monthly concentrations.

Sediment

Eleven of thirteen §303(d) listed waterbodies addressed in the Potlatch River Subbasin Assessment and TMDLs have sediment listed as a pollutant. Sediment data collected from the Potlatch River watershed indicate that four of the thirteen water bodies listed in Section 5 of Idaho's 2002 integrated report (IDEQ 2002) required TMDLs designed to reduce sediment loads. An additional waterbody, the West Fork Little Bear Creek, was recommended for listing.

Nonpoint sources of sediment in the Potlatch River Subbasin include forest management practices, agricultural activities, grazing, landslides, instream erosion, fires, and air deposition. The precise amount of pollutant contribution from each of these nonpoint sources to the subbasin is unknown, as it is nearly impossible to determine the exact amount from each source (IDEQ, 2008).

Temperature (Heat Sources)

Eleven waterbodies in the Potlatch River Subbasin were §303(d) listed for temperature; temperature data collected indicated that thirteen stream segments require TMDLs to reduce heat loading. The heat source is solar radiation; this is a natural condition that can be affected by changes in landuse. Additional heat absorbed by a waterbody, above background conditions, is usually a function of shade reduction. The stream segments that are listed for temperature have been altered by landuse changes that decreased stream shading (IDEQ, 2008).

Some evidence exists that canopy removal over broad sections of a watershed may increase flows in the early part of the season and result in lower flows later in the season when air temperatures are highest. Conflicting evidence exists that in watersheds with deep, permeable vadose zones and vegetative covers with large evapotranspiration potentials, that canopy removal may result in increased flows throughout the year. If flows are lower in the summer following the removal of the watershed canopy, higher stream temperatures could be the one of the results (IDEQ, 2005).

IDEQ used the Potential Natural Vegetation (PNV) model for the temperature TMDLs. This methodology uses the narrative natural condition state standard as a temperature target instead numeric criteria (IDEQ, 2008).

Nutrients

Nine waterbodies were §303(d) listed for nutrients. Nutrient data from the Potlatch River watershed indicate that one (Pine Creek) of the thirteen waterbodies listed in Section 5 of Idaho's 2002 integrated report (IDEQ 2002) required a TMDL designed to reduce nutrient inputs. An additional waterbody, the West Fork Little Bear Creek, was recommended for listing.

Nutrients are delivered predominantly from agriculture, grazing activities, residential sources and natural sources. The Idaho general surface water quality standard states: "Surface waters must be free of excess nutrients that cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses." A numeric standard for dissolved oxygen (DO) of 6.0 mg/L applies as well. A growing season (June-October) nutrient target of 0.1mg/L and DO levels above the 6.0 mg/L was established in the TMDL (IDEQ, 2008).

<u>Bacteria</u>

Nine TMDL waterbodies were §303(d) listed for bacteria. *E. coli* data collected from the Potlatch River watershed indicate that six of the thirteen waterbodies listed in Section 5 of Idaho's 2002 Integrated Report (IDEQ 2002) required TMDLs aimed at reducing bacteria loads. . An additional waterbody, the West Fork Little Bear Creek, was recommended for listing. Sources of bacteria include livestock, wildlife (especially waterfowl), humans, pets or septic system drain fields; livestock appears to be the most likely as well as the most manageable source (IDEQ, 2008).

TMDLs

Section §303(d) of the Clean Water Act (CWA) requires states to develop a TMDL management plan for waterbodies determined to be water quality limited. A waterbody is determined as water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a waterbody can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. TMDLs are the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and natural background conditions (IDEQ, 2008).

Water quality standards for the State of Idaho are intended to provide protection of designated beneficial uses. TMDL targets are based on these water quality standards. Numeric water quality criteria are used where they exist. Narrative water quality criteria have numerical interpretations that are applied to waterbodies for nutrients. Load capacities reflect these water quality targets based on available and estimated instream flow data. Load allocations distribute the existing pollutant loading between point and nonpoint sources within the watershed based on the available load capacity of the subwatersheds (IDEQ, 2008).

TMDL calculations are gross estimates based on very limited field data collection. Loads determined were based primarily on water quality data collected for one monitoring year (2002); additional *E. coli* sampling occurred, for some waterbodies, during 2003 and 2004. Load targets, although they appear static in the TMDL, should be fluid and vary with changes in annual flow. Better targets are based on instream pollutant concentrations rather than loads, to help ensure beneficial uses are supported regardless of annual flow regime. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved (IDEQ, 2008).

Sediment TMDLs

Sediment TMDLs were developed for four of the thirteen §303(d) listed streams: Potlatch River, Middle Potlatch Creek, Pine Creek, and Cedar Creek. A TMDL was also completed for an unlisted stream, the West Fork Little Bear Creek. 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 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 (IDEQ, 2008). Monthly TSS allocations resulting from the sediment load analyses are shown in Table F. A 10% margin of safety is applied to each load allocation.

Table F. Estimated monthly TSS load reductions required (IDEQ, 2008).

Compliance Sites At Mouth Waterbodies	**Month**	**Est. Flow (cfs)**	**Est. Existing Load (lbs/mo)**	**Est. Load Capacity (lbs/mo)**	**Est. Load Allocation (lbs/mo)**	**Required Reduction**
Potlatch River	March	769	26,731,000	9,946,000	8,952,000	67%
Middle Potlatch Creek	April	122	1,575,000	990,500	891,500	43%
Cedar Creek	Jan	137	1,968,000	1,842,700	1,658,400	16%
Cedar Creek	Feb	34	755,400	275,700	248,100	67%
West Fork Little Bear	Jan	62	456,500	501,600	451,500	1.1%
West Fork Little Bear	Nov	0.3	3,565	2,377	2,139	40%

Temperature TMDLs

IDEQ completed temperature TMDLs for thirteen §303(d) listed waterbodies. The load capacities determined for temperature TMDLs are based on potential natural vegetation (PNV) cover over the streams. The potential cover as a percentage represents the heat loading permitted to achieve water quality standards and maximum possible heat reduction.

Table G shows the total excess heat load (kWh/day) experienced by each waterbody examined and the average lack of shade for all segments in that water body. Where the percentage in Table G is expressed as a negative, this represents the average lack of shade or deviation from the target for that waterbody. Where the percentage is expressed as a positive number, indications are that the average shade for all the reaches in that water body meets or exceeds the target (IDEQ, 2008).

Table G. Excess solar loads and average lack of shade for waterbodies (IDEQ, 2008)

Waterbody	Excess Load (kWh/day)	Average Lack of Shade
Potlatch River, Big Bear Creek to Mouth	-2,341,614	-19.5%
Potlatch River, Corral Creek to Big Bear Creek	-446,284	1.6%
Potlatch River, Moose Creek to Corral Creek	-521,397	-22%
Potlatch River, Headwaters to Moose Creek	-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%
East Fork Potlatch River	-113,989	-19%
Middle Potlatch Creek	-225,298	-22%

Nutrient TMDLs

Nutrient TMDLs were developed only for Pine Creek and the West Fork of Little Bear Creek. The nutrient target is based on a numeric state standard for dissolved oxygen (DO) requiring concentration to be greater than 6.0 mg/L at all times, and a narrative target stating that "surface waters shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses". A critical limiting factor for cold water biota is low levels (<6 mg/l) of DO. The nutrient rich stream system stimulates algal and macrophyte populations. The respiration cycles of these populations can cause seasonal DO depletion during summer low flow periods.

Phosphorus was determined to be the limiting nutrient for Pine Creek. The nutrient load capacities and existing loads established by the TMDL were estimated, in kilograms (Kg) per day. In addition to the total phosphorus (TP) target, the DO readings within Pine Creek will need to stay above 6.0 mg/L. The nutrient TMDL only applies during the growing season, June through September, of each year (IDEQ, 2008).

Table H. Total Phosphorus load allocation for Pine Creek at PTR-10 (IDEQ, 2008).

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

The West Fork Little Bear Creek was determined to be nitrogen-limited based on the 6.8:1 TIN:OP ratio. A nutrient TMDL that addresses total inorganic nitrogen (TIN) was developed based on violations of the 6.0 mg/L DO criterion. The critical flows are less than 1.5 cfs and usually occur from June through October. A reduction in TIN should occur when flows are at or below 1.5 cfs (IDEQ, 2008).

The West Fork Little Bear Creek was not 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. Currently, available water quality data and stream flow data is not adequate to develop separate load and waste load allocations. More data needs to be generated and considered for any future effluent limitations included in future NPDES permits for the City of Troy's wastewater treatment plant discharge (IDEQ, 2008).

Bacteria TMDLs

Bacteria TMDLs were developed for six of the thirteen §303(d) listed streams. A TMDL was also completed for an unlisted stream, the West Fork Little Bear Creek. *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 I and J). 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 (IDEQ, 2008).

Table I. *E. coli* bacteria nonpoint source load allocations (IDEQ, 2008)

Waterbody	Reach WBID & AU#	Existing Load (cfu/100 ml)*	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	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%

Table J. *E. coli* bacteria wasteload allocations for WWTPs (IDEQ, 2008).

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

Water Quality Monitoring

DEQ Monitoring

From 2002 to 2004, the Idaho Department of Environmental Quality (IDEQ) collected water quality data for the streams addressed in the TMDL document. The monitoring project was initiated to provide background data on the State of Idaho's §303 (d) listed tributaries of the Potlatch River to aid in TMDL development.

Analyses performed on collected water samples were: total phosphorus (TP), nitrate and nitrite (NO_2/NO_3), ammonia (NH_4), total suspended solids (TSS), and fecal and total coliform counts. Other parameters collected in the field included flow, pH, specific conductivity, turbidity, dissolved oxygen (DO), and air and water temperatures.

Monitoring site locations, listed in Table K below, are displayed in Figure 20.

Table K. DEQ Monitoring Sites for the Potlatch River Subbasin (IDEQ, 2008)

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 Little Bear Creek	Down Stream of the City of Troy Discharge
PTR-7	West Fork 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-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 Upstream 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

*Shaded monitoring stations are established as control points

Sample collection began in December of 2001 and continued for a full calendar year, with IASCD, LSWCD, and IDEQ staff sampling the sites every two weeks. Sites located close to stream mouths were established as control points where future monitoring efforts could be duplicated and water quality standards applied. At times during the year, some sites were not sampled: in the winter and spring, snow and large runoff events made accessibility and sampling impossible, and in the summer some sites were dry (IDEQ, 2008). Additional sampling for bacteria was conducted at selected locations, at times, during 2003 and 2004.

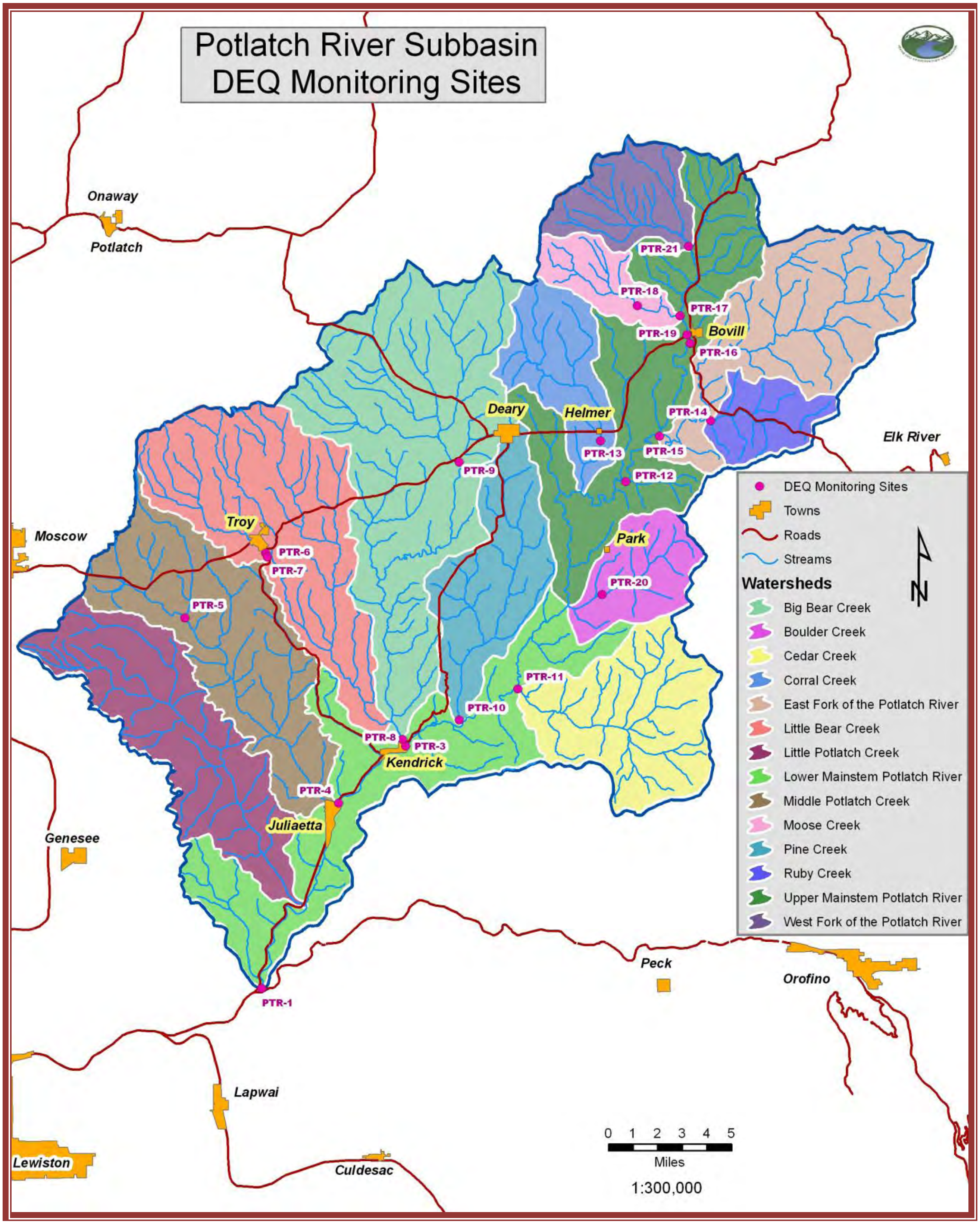

Figure 23. Water Quality Monitoring Site Locations

Low dissolved oxygen concentrations were measured in Pine Creek, West Fork Little Bear Creek, and Middle Potlatch Creek. An instantaneous D.O. value of 5.5 mg/L was recorded for Pine Creek on 8/6/2002; it was likely due to low flow (0.16 cfs) conditions. A D.O. value of 5.8 mg/L, with associated flow of 0.02 cfs was recorded for an intermittent segment of Middle Potlatch Creek; the water quality standard doesn't apply to intermittent streams. Numerous low dissolved oxygen values were recorded when flows fell to 1.5 cfs or less in the West Fork Little Bear Creek, below the Troy WWTP discharge (IDEQ, 2008).

Nutrient TMDLs were developed for both Pine Creek and the West Fork Little Bear Creek. A nutrient TMDL was not developed for Middle Potlatch Creek because no violation of the water quality criteria occurred due to intermittent flows.

Six waterbodies had *E. coli* levels that exceeded Idaho's 30-day geometric mean criterion of 126 colony forming units per 100 milliliters (cfu/100 ml). The stream segments are listed below in Table L.

Table L. In-stream *E. coli* bacteria geometric mean concentrations (IDEQ, 2008).

Waterbody ID_Assessment Unit	**Waterbody Name**	**E. coli Concentration (cfu/100ml)**
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

Monitoring determined exceedances of the 50 mg/L monthly average total suspended sediment (TSS) target for compliance points on six waterbodies: Potlatch River, Middle Potlatch Creek, West Fork Little Bear Creek, Pine Creek and Cedar Creek.

Although Pine Creek and the downstream section of the Potlatch River were listed for oil, grease and pesticides, monitoring by both IDEQ and IDA showed concentrations not detectable or below deleterious levels.

Water temperatures collected by digital recorders indicated exceedances of the temperature criterion for salmonid spawning at Ruby Creek, the Potlatch River above Corral Creek, Pine Creek, Moose Creek, Middle Potlatch Creek, East Fork Potlatch River, Corral Creek, Cedar Creek and Big Bear Creek. The cold water aquatic life criterion was exceeded in Big Bear Creek, Cedar Creek, Corral Creek, East Fork Potlatch River, Middle Potlatch Creek, and along the entire Potlatch River reach.

IASCD Monitoring

Additional water quality monitoring was conducted by IASCD April of 2006 through March of 2008. Low dissolved oxygen (DO) values were recorded, at times, for the West Fork Potlatch River, the Potlatch River at Bovill, Big Bear Creek above Highway 9, and the West Fork Little Bear Creek below the Troy WWTP. No DO violations were recorded for Pine Creek or Middle Potlatch Creek; this indicates improved condition relative to the 2001 monitoring for these two drainages. Although several streams exhibit somewhat elevated TP values, only The West Fork of Little Bear Creek below Troy exhibits a corresponding DO problem.

High *E-coli* values were noted at several Potlatch River monitoring sites: the West Fork Potlatch River, Cedar Creek, Boulder Creek, upper Corral Creek, upper Big Bear Creek, and the West Fork Little Bear Creek below Troy. A significant decrease of 98% in median *E. Coli* levels was noted at the mouth of Middle Potlatch Creek, from 2002 to 2008. Bacteria is presumed to be largely related to livestock presence within riparian areas with the exception of Little Boulder Creek Campground. The Potlatch River monitoring site at the campground may reflect human pollution.

According to the 2006 to 2008 monitoring, sediment does not appear to be a significant problem in most of the Potlatch watersheds, however one major rain event occurred in May, 2006 that caused extreme increases in sediment levels in Cedar Creek, and the Potlatch River below Cedar Creek. A similar event occurred the following year in February in the Cedar Creek watershed, and once again caused sediment levels to dramatically increase. In both cases, a large plume of extremely turbid water flowed from Cedar Creek into the Potlatch River and noticeably increased turbidity and SSC levels in the Potlatch River, from the Cedar Creek confluence to the mouth (IASCD, 2010).

Temperatures remain a concern within the Potlatch River, from the Bovill area downstream, during summer low flows. Big Bear Creek had temperature standard violations at all monitoring sites. Cedar Creek exhibited elevated temperatures, at times, near its mouth.

District Monitoring

During the summers of 2004 to 2006, crews of the Latah Soil and Water Conservation District surveyed approximately 44 miles of perennial and intermittent streams. A modified version of the NRCS Stream Visual Assessment Protocol (SVAP) was used to document findings in the surveyed areas. SVAP was expanded to include detailed information about channel type, erosion, macroinvertebrates, and vegetation. The Pine Creek drainage was examined during 2004. Big Bear Creek, Corral Creek, Hog Meadow Creek, and Spring Valley Creek were surveyed during 2005. Corral Creek, Little Potlatch Creek, Spring Valley Creek and the West Fork of Little Bear Creek (including Randall Flat Creek) were assessed during 2006. A summary of the number of stream feet and miles of SVAP surveys completed in the target watersheds is presented in Table M.

SVAP survey reaches with condition ratings are described in the treatment sections for the applicable watersheds.

Little Bear Creek was selected as a focus area for the 2006 work season because data from the 2003-2004 fisheries surveys (Bowersox et. al., 2006) in the Potlatch River Basin showed high densities of steelhead trout in this watershed. The Little Bear Creek watershed was surveyed to determine whether there was any need for riparian and wetland restoration projects to further improve habitat. The Corral Creek, Little Potlatch Creek, and Spring Valley Creek survey sites focused on areas where landowners are planning to improve fish habitat by doing exclusion fencing, riparian planting, and wetland restoration (Latah SWCD, 2007).

Table M. Potlatch River Subbasin SVAP Surveys Summary

Drainage	2004 SVAP Surveys		2004 SVAP Surveys		2004 SVAP Surveys		Totals	
	Feet	Miles	Feet	Miles	Feet	Miles	Feet	Miles
Big Bear Creek			13,236	2.5			13,236	2.5
Corral Creek			44,069	8.3	1,840	0.4	45,909	8.7
Dry Creek tributary (Big Bear Creek)			4,645	0.9			4,645	0.9
Hog Meadow Creek			5,300	1			5,300	1
Little Potlatch Creek					7,242	1.4	7,242	1.4
Pine Creek	73,995	14.2	5,720	1.1			79,715	15.3
Spring Valley Creek			16,239	3.1	4,045	0.8	20,284	3.9
West Fork Little Bear Creek					52,142	10	52,142	10
Total	**73,995**	**14.2**	**89,209**	**16.9**	**65,269**	**12.5**	**228,473**	**43.6**

<u>SCC Monitoring</u>

During November of 2000, water level (WL) recorders were installed at the mouths of the East Fork Potlatch River, Cedar Creek, and Pine Creek; another water level recorder was installed approximately one mile above the mouth of Big Bear Creek, just above the confluence with Little Bear Creek. Monitoring continued through March of 2006.

The purpose for installation of the recorders was to estimate discharge patterns for subwatersheds selected based on steelhead habitat potential for BMP implementation on private lands within the Potlatch River Basin. An additional selected subwatershed (Little Bear Creek) did not have a suitable accessible site near the mouth for placement of a water level recorder.

Global pressure transducers/recorders were installed at three of the sites. An ISCO ultrasonic water level recorder was installed at the mouth of the East Fork; the ISCO recorder proved unreliable, particularly at higher flows, and was replaced with a Global recorder on October 16, 2001.

Problems with the recorders were common. Data was lost because of battery failures, vandalism, and damage during flood events. Recorders at all sites needed to be replaced or reinstalled at least once. There are significant gaps in the data record for two sites

(East Fork of the Potlatch River and Pine Creek). Stage/Discharge relationships were determined and annual discharge patterns recorded.

For the East Fork Potlatch River, lowest discharges were estimated to occur during late August of 2005 (>1 cfs); the highest discharge was estimated as 925 cfs on April 14, 2002. Low flows, generally less than 20 cfs occur from July through August. Annual peak flows were generally observed from late January to early April, when rain-on-snow events are most likely to occur. Runoff can be quickly delivered; the East Fork Potlatch water level rose 4 feet and receeded the same amount during a 48 hour period (4/14 to 4/15) in 2002.

For Cedar Creek, continuous flow monitoring was conducted from late October of 2000 thru February of 2004. Lowest flows occurred from July through October; discharge recorded manually was less than 0.05 cfs on Sept. 10, 2001 and was below the recorder's transducer level from August through September most of the time. Peak flows occurred from February to April, with an estimated high flow of 563 cfs calculated for February 1, 2003.

For Pine Creek, continuous flow monitoring was conducted from late November of 2000 thru October of 2003. Lowest flows occurred from July through September; discharge recorded manually was less than 0.1 cfs on Sept. 10, 2001 and was below the recorder's transducer level from August through September of that year. Peak flows occurred during February or March, with high flows of more than 400 cfs estimated for March 12, 2002 and January 31, 2003. The March 12, 2002 event toppled the cottonwood tree that the recording device was attached to and sent the recording apparatus downstream to the Potlatch River.

For Big Bear Creek, continuous flow monitoring was conducted from late December of 2000 thru March of 2006. Lowest flows occurred from July through October; flow went subsurface in remanent 1996 flood event cobbles/gravels during 2001, 2002, and 2003. Peak flows occurred during January to March, with high flows of more than 2,700 cfs estimated for January 11, 2006. Although this date corresponds to record flows on the Potlatch River, this dramatic increase in discharge relative to previous peak flows was likely due to removal of existing cobbles\gravel deepening and widening the channel cross-section, in addition to increased runoff from the watershed.

Continuous temperature data was collected at 16 sites throughout the Potlatch River subbasin from June until early October, from 2000 to 2005; some additional data was collected from July to October 2007. A summary of exceedances relative to the Cold Water Aquatic Life Standard (Daily Average) is presented below. Of the sites monitored, the East Fork Potlatch River, Cedar Creek, Bear Creek and Little Bear Creek consistently showed exceedances of the temperature standard. The Potlatch tributaries Bob's Creek and Purdue Creek showed no violations; Corral Creek showed no exceedances at its mouth. Upper Cedar Creek, upper Pine Creek and upper East Fork Potlatch River showed very few temperature exceedances. Violations of the salmonid spawning temperature criteria was commonly noted for most waterbodies with the exception of the upper East Fork Potlatch River, upper Bob's Creek, and Purdue Creek.

Table N. Summary of Cold Water Aquatic Life temperature standard exceedances

Monitoring Site	Temperature Exceedences – Cold Water Aquatic Life Daily Average						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2007**
East Fork Potlatch River (Upper)	0	0	0	0	0	0	0
East Fork Potlatch River (Middle)	*NA*	6	1	8	3	0	*NA*
East Fork Potlatch River (Mouth)	13	0	25	*Bad Data*	50	40	33
Bob's Creek (Upper)	0	0	0	0	0	0	0
Bob's Creek (Mouth)	0	0	0	0	0	0	0
Purdue Creek (Upper)	0	0	0	0	0	0	
Purdue Creek (Mouth)	0	0	0	0	0	0	
Corral Creek (Upper)	0	5	9	0	11	0	*NA*
Corral Creek (Mouth)	0	0	0	0	0	0	*NA*
Cedar Creek (Upper)	0	0	0	0	0	0	1
Cedar Creek (Mouth)	0	13	26	24	*Logger Disappeared*	7	30
Pine Creek (Upper)	0	1	0	0	3	0	
Pine Creek (Mouth)	0	12	10	0	13	1	
Bear Creek (Upper)	0	36	27	30	40	20	*NA*
Bear Creek (Lower)	0	51	33	42	*28 thru 8/10*	37	26
Little Bear Creek (Upper)	0	3	3	20	4	0	17
	13	127	133	124	152	105	

Modeling

From the Palouse TMDL document (IDEQ, 2005): "All models inherently have some range of error associated with them, some even around 50% or more. The exact output or end result of a model are not necessarily the most important feature, but observing trends over a unspecified period of time are perhaps more important. For water quality, streams must meet beneficial uses regardless of the output or percent reduction the model(s) predicted. It could be possible to meet the beneficial uses and not meet the exact percent reduction within a model, and conversely the reverse is true".

Sediment TMDLs were developed for four of the thirteen §303(d) listed streams: Potlatch River, Middle Potlatch Creek, Pine Creek, and Cedar Creek. A TMDL was also completed for an unlisted stream, the West Fork Little Bear Creek. 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. 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 (IDEQ, 2008). Monthly TSS allocations resulting from the sediment load analyses are shown in Table O.

Table O. Estimated monthly TSS load reductions required (IDEQ, 2008).

Compliance Sites At Mouth Waterbodies	Month	Est. Flow (cfs)	Est. Existing Load (lbs/mo)	Est. Load Capacity (lbs/mo)	Est. Load Allocation (lbs/mo)	Required Reduction
Potlatch River	March	769	26,731,000	9,946,000	8,952,000	67%
Middle Potlatch Creek	April	122	1,575,000	990,500	891,500	43%
Cedar Creek	Jan	137	1,968,000	1,842,700	1,658,400	16%
Cedar Creek	Feb	34	755,400	275,700	248,100	67%
West Fork Little Bear	Jan	62	456,500	501,600	451,500	1.1%
West Fork Little Bear	Nov	0.3	3,565	2,377	2,139	40%

Land-use maps were created by IDEQ for each §303(d) watershed by taking printed maps of aerial photos and driving to hilltops to determine landuse during the 2002 calendar year.

Utilizing IDEQs (2003) landuse map; Dansart (2004) modeled potential for cropland sediment delivery reduction due to tillage conversion, for several TMDL watersheds. Following methodology outlined in Boll, J., E. Brooks, and D. Traeumer (2002), a GIS processed model incorporating USDA's RUSLE equation and watershed-specific sediment delivery ratios was utilized. Under a conventional tillage to direct seeding conversion scenario, estimated average sediment delivery reductions to stream drainage by cropland acre were:

Pine Creek – 3.0 tons/acre
Cedar Creek – 1.8 tons/acre
Corral Creek – 4.1 tons/acre
Middle Potlatch Creek – 3.0 ton/acre
Boulder Creek – No cropland erosion
Potlatch River – 2.0 tons/acre

Subsequent to the 2002 monitoring (IASCD, 2003) that the TMDL document was based on, significant cropland acres have been converted to some form of conservation tillage (mulch till or direct seed). Some cropland has been enrolled in CRP since 2002. Additional water quality monitoring was performed by IASCD from 2006 to 2008. Regularly scheduled monitoring to determine how distant instream water quality targets are from being met is likely a good use of funds to track results of past BMP performance and to guide future implementation efforts.

Threatened And Endangered Species

Steelhead are anadromous fish that occur within the Potlatch River Subbasin (Bowersox et. al., 2006). According to the Conservation Data Center (IDFG, 2009), other listed fish species that could potentially exist within the subbasin are chinook and sockeye salmon, in addition to bull trout. Lynx, listed as threatened for Latah County, is likely to be found in boreal and subalpine fir habitats that harbor snowshoe hares; these rabbits are a major component of the cat's diet (Holt, 2008). There have been occasional gray wolf sightings in recent years, but it is unknown if any resident wolf packs exist. The yellow-billed cuckoo is a bird species candidate for listing. Water Howellia, a threatened aquatic plant, is known to exist in wetland areas within the subbasin while Spalding's silene, a threatened plant, has potential to exist within the watersheds (IDFG, 2009).

Agricultural Water Quality Inventory and Evaluation

Within the entire Potlatch River Subbasin, an estimated 129,500 acres are cropland, 27,500 acres are enrolled in the Conservation Reserve Program, and 16,250 acres are hayland or pasture. At the present time, approximately 95,200 acres of agricultural lands, not including rangelands, are located within the watersheds of the thirteen §303(d) listed tributary streams. Distribution of agricultural lands within those watersheds are shown below.

Table P. Agricultural lands distribution within TMDL subwatersheds.
(Rangelands and grazed forests are not included in acreage totals)

	Crop Land	***CRP***	***Grass Crop***	***Hay***	***Pasture***	***Tree Farm***	***Vineyard***	***Ag Land Totals***
Cedar Creek	5,950	1,930	230	810	90			**9,010**
East Fork Potlatch	60				150	10		**220**
Pine Creek	4,040	5,510		1,480	240	104		**11,374**
Corral Creek	280	510		200	80			**1,070**
Boulder Creek	30	470		810				**1,310**
West Fork Little Bear Creek	1,860	2,867	110	760	390	50		**6,037**
Big Bear Creek	7,370	5,910	130	4,600	1,080			**19,090**
Middle Potlatch Creek	19,820	3,600	290	810	850			**25,370**
Upper Potlatch River	13	17			130			**160**
Potlatch River (Moose Creek to Corral Creek)	126	92	10	47	346			**621**
Potlatch River (Corral Creek to Big Bear)	5,580	1,900	340	550	1,035	46		**9,451**
Potlatch River (Big Bear Creek to Clearwater River)	10,000	72	125	74	942		40	**11,463**
	55,129	**22,878**	**1,235**	**10,141**	**5,333**	**210**	**40**	**95,176**

Agricultural activities are potentially the largest nonpoint sources of pollutants within several of the TMDL watersheds. Crop production requires inputs of nutrients that can reach stream channels by surface runoff or through tile drains. Some tillage operations increase soil erosion; this results in sediment delivery, with attached phosphorus and nitrogen, to the stream drainage. Livestock grazing along creeks contribute bacteria, nutrients and sediment directly from runoff or indirectly by streambed deterioration. Streambed deterioration includes streambank destruction and soil compaction. Lawn fertilizers and septic systems may also be nonpoint sources in the watershed (IDEQ, 2005).

Agricultural lands within the Potlatch River Subbasin are primarily located in the Grassy Potlatch Ridges Common Resource Area (Figure 2). Much of the rangeland is located in the Lower Clearwater Canyons Common Resource Area. The Grassy Potlatch Ridges ecoregion is underlain by volcanics mantled by loess and volcanic ash. Idaho fescue, bluebunch wheatgrass, bluegrass, snowberry, and, on cooler, moister sites, scattered ponderosa pine occur and contrast with the forests of the Northern Idaho Hills and the forests and savannas of the Lower Clearwater Canyons (USDA, 2008).

Soils underlying agricultural lands within the Potlatch River Subbasin belong to three major soils groups. Along the major drainages, often in canyon areas, Klickson-Bluesprin soils are most common; these deep and well drained silt to cobbly loam soil types are formed in loess over material derived from weathered basalts. Most cropland, hayland, and pasture areas are underlain by soils of the Palouse-Naff or Southwick-Larkin associations. Cropland is the most common agricultural landuse of the historic grasslands underlain by the Palouse-Naff soils. Cropland, hayland, and pastures are hosted by Southwick-Larkin association soils in areas that hosted conifer forests prior to cultivation by settlers.

Within the TMDL watersheds, it is believed that most cropland landowners/operators are participating in USDA programs. It is estimated that 23,000 acres or close to one quarter of the agricultural lands within the watersheds are contracted under the Conservation Reserve Program (CRP). Table P lists estimated acreage totals for each landuse by TMDL watershed.

<u>*Dry Cropland*</u>

Dansart (2004) estimated annual erosion rates of 8 to 15 tons/acre/year for Potlatch River Subbasin cropland using traditional tillage scenarios. Utilizing continuous direct seeding practices, estimated erosion rates drop to a range of 2 to 4 tons/acre annually. Conversion to this higher level of conservation tillage practices may result in 1.8 to 3 tons/acre/year decrease in sediment delivered to drainage channels.

Sheet and rill erosion is variable, depending primarily on slope gradient; it may exceed 10 tons per acre in the steepest areas, with little cropland erosion evident on the floodplains. Typical annual erosion cycles include winter rains on semi-frozen ground and spring cloud bursts. Research has shown that maximizing residues from the previously harvested crop reduces erosion potential on the farm fields. Some concentration (gully) erosion occurs in places due to the steepness of the slopes, even where high residue levels are maintained on the fields (LSWCD, 2004).

Most cropland is under an Idaho Coordinated Conservation agreement (Knecht, 2008), with requirements regarding tillage practices (contour farming), residue management and crop rotations. Tillage practices used varies among operators; conventional tillage, mulch-till, and direct-seeding practices are all utilized to different extents within the watersheds. Typical crop rotation consists of 3 year rotations of winter wheat, spring cereal (barley or wheat), and a legume (peas or lentils) or canola.

It is estimated that 55,130 acres are currently cropped under some type of grain/legume rotation within the TMDL watersheds with an additional 1,230 acres of cropped grass. Over half the cropland acres are located in two TMDL watersheds, Middle Potlatch Creek (19,820) and the drainage area for the Potlatch River unit below Bear Creek (10,000). It is believed that most of the 22,880 acres contracted under the Conservation Reserve Program (CRP) was previously cropland. CRP acres for Big Bear Creek (5,910) and Pine Creek (5,510) comprise half the subbasin total. CRP lands make up half the agricultural lands (11,374) documented within the Pine Creek watershed; this is the highest percentage within the Potlatch River Subbasin.

Pasture/hayland/shrubland

Pasture and hayland within the TMDL watersheds totals about 15,500 acres. Hay is cut on approximately 10,140 acres. The Big Bear Creek watershed has the most acres of pasture (1,080) and hayland (4,600). The Upper Potlatch River and East Fork Potlatch River watersheds have no hayland and about 150 acres of pasture each.

Ungrazed hayfields and grass fields are not generally a large contributor of sediment and bacteria. Although much of the hayland and some grassland is likely grazed after cutting, it is probable most of the sediment and bacteria delivered to the drainage system originates from the concentrated presence of a limited number of livestock in pastures that abut stream channels.

Much of the pastureland occurs in lowland areas adjacent to drainages. Most pastures are grazed by cattle or horses; a few goats, sheep, and llamas also pasture in the watersheds. There appears to be some concentrated winter feeding of cattle that occurs in several locations along reaches of Big Bear Creek, Pine Creek, Middle Potlatch Creek and the Potlatch River below Bear Creek. Monitoring results (IASCD, 2010) showed the Potlatch River mainstem from Bovill upstream and from Bear Creek downstream, West Fork of the Potlatch River, and Middle Potlatch Creek exhibited violations of the bacteria standard for secondary contact recreation, most likely due to livestock presence in the riparian zone.

Pasture/hayland species are made up mostly of smooth brome, orchard grass, timothy, and intermediate wheatgrass. On upland fields that are in somewhat of a deteriorated condition, Kentucky bluegrass is an invader species. Meadow foxtail invades wetter fields. Erosion potential is based primarily on steepness of slope and vegetative cover.

Some idle areas of herbaceous cover associated with edges of cropland fields and adjacent to access roads are typically less than 1 acre in size and not utilized except by wildlife. Approximately 90% of the fields have good vegetative cover; the erosion potential is slight if that good vegetative cover is maintained.

Native grass and shrubland occur throughout the watershed, primarily in canyon areas that drain to the lower mainstem Potlatch River from Cedar Creek down river. Most are located on steep slopes inaccessible to farming operations; some are often comprised of remnant islands of grass and shrub mixtures with occasional pine or cottonwood that separate cultivated fields. These isolated patches offer zones of stable vegetation that intercept overland flow from cropped fields and filter sediment from upslope farming operations. They also act as small refuges, containing food and cover for wildlife. Scattered cattle grazing occurs on these lower elevation rangelands throughout the watershed in addition to grazing in open forest and meadows in higher elevation areas.

Riparian areas

Erosion is occurring along many streambank reaches adjacent to cropland fields and pastures due to the lack of woody vegetation and rhizomatus herbaceous species. Livestock activity often promotes streambank deterioration, as well as the removal of vegetation. This lack of root mass promotes bank sloughing which can contribute significant amounts of sediment into stream channels. Many stream stretches were historically straightened or had woody vegetation removed when cropland fields were established. Herbicide spray and tillage operations, as well as grazing activities, have prevented the re-establishment of woody species. While there are some remnant areas, much of the historically diverse and multi-layered vegetation along the stream is missing. In grazed forested areas, channel erosion is much less evident but can be significant in places where concentrated grazing is allowed to occur.

Water Quality Concerns Related to Agricultural Land Use

Agricultural activities in TMDL watersheds contribute to sediment, bacteria, nutrient and temperature problems identified in the TMDL document. Nutrients don't appear to be a major problem. IDEQ (2008) recommended that the Potlatch River, Moose Creek, Ruby Creek, East Fork Potlatch River, and Middle Potlatch Creek be de-listed for nutrients. Although a nutrient TMDL was developed for the West Fork Little Bear Creek, the problem indicated is associated with the Troy WWTP point source. Evidence for nutrient problems in Pine Creek is inconclusive; the dissolved oxygen problems attributed to nutrients are likely to be due to extremely low stream flows ($\leq$ 0.2 cfs) and stagnant conditions at the time monitoring occurred; no DO violations were recorded in the most recent IASCD monitoring (2006-2008).

Sediment contributions are associated with sheet and rill, concentrated flow, and streambank soil erosion processes. Sediment TMDLs were developed for the Potlatch River, Middle Potlatch Creek, Cedar Creek, and the West Fork Little Bear. According to the 2006 to 2008 monitoring (IASCD, 2010), sediment does not appear to be a significant problem in most of the Potlatch watershed. Two major rain events occurred in May, 2006 and February, 2007 that caused extreme increases in sediment levels in Cedar Creek, and the Potlatch River below Cedar Creek. West Fork Little Bear Creek sediment problems appear to be more associated with the Troy WWTP point source rather than agricultural activities.

Bacteria violations are generally a symptom of livestock access to riparian areas; livestock presence was noted at, or adjacent to, several water quality monitoring sites (IASCD, 2010). Bacteria TMDLs were developed for six of the thirteen §303(d) listed streams. A TMDL was also completed for an unlisted stream, the West Fork Little Bear Creek; the bacteria problem for this tributary seems tied to the Troy WWTP. Additional TMDLs were developed for the Potlatch River, Boulder Creek, Big Bear Creek, Moose Creek, Ruby Creek, and Middle Potlatch Creek. The 2006 to 2008 IASCD monitoring showed a 98% decrease in *E.Coli* levels at the mouth of Middle Potlatch Creek. Human pollution, rather than livestock, appears to be the bacteria source at Little Boulder Creek Campground on the Potlatch River.

The occasionally high stream temperatures recorded are a function of both an inadequate vegetative canopy and low flows along some stream reaches. Violations of the salmonid spawning temperature criteria was commonly noted for most waterbodies with the exception of the upper East Fork Potlatch River, upper Bob's Creek, and Purdue Creek. Temperatures remain a concern within the Potlatch River, from the Bovill area downstream, during summer low flows. Big Bear Creek had temperature standard violations at all monitoring sites. Cedar Creek exhibited elevated temperatures, at times, near its mouth. The East Fork Potlatch River mouth showed temperature exceedances that were largely due to the location of the temperature recorder. The most effective management practices will be the ones that increase base flow during the summer in addition to those that emphasize shading.

Because data gaps exist about specific pollutant sources for §303(d) listed streams, load allocations are applied broadly, not specifically. Improvements in the TMDL watersheds, wherever they occur, that cumulatively result in lower pollutant loadings are assumed to be beneficial (IDEQ, 2005).

IMPLEMENTATION PRIORITY

The TMDL implementation planning process includes assessing impacts to water quality from agricultural lands and recommending priorities for installing BMPs to meet water quality objectives stated in the TMDL document (IDEQ, 2008). Data from water quality monitoring, field inventory and evaluations were used to identify critical agricultural areas affecting water quality and set priorities for treatment.

Critical Areas

Agricultural lands that contribute excessive pollutants to waterbodies are defined as critical areas for BMP implementation. Critical areas are prioritized for treatment based on proximity to a waterbody of concern and potential for pollutant transport and delivery to the receiving waterbody. Critical areas are those areas in which treatment is considered necessary to address resource concerns affecting water quality.

Recommended Priorities for BMP implementation

A priority for BMP implementation is the adoption of conservation tillage practices to minimize cropland sheet and rill erosion and decrease sediment delivery to the Potlatch River drainage network. Reduction of ephemeral gully erosion is also a priority. On-site retention of nutrient-laden sediment should reduce phosphorus and nitrogen loads during the critical flow periods identified in the TMDL. Although nutrients don't appear to be a major problem, adoption of nutrient management plans to promote nutrient level reductions in cropland soils is an important associated practice. This will help ensure that violations of the Idaho Water Quality Standard for dissolved oxygen (DO) continue to occur only during periods of extremely low flow, when waters are stagnant. Livestock should be excluded from riparian areas by fencing or removal, wherever possible, to minimize the presence of bacteria; offstream watering sites should be developed. Vegetative plantings should be implemented in riparian zones to both mitigate streambank erosion and to establish future stream canopy cover to help reduce stream temperatures.

Priority for treatment (with rationale), by TMDL watershed, is as follows:

1) Cedar Creek - fourth highest cropland acreage, second highest sediment load, several bacteria violations, highest sediment load reduction target of the mainstem Potlatch tributaries. Recent IASCD monitoring confirms continuing sediment concerns during major rain events in addition to bacteria, nutrient and temperature exceedances.
2) Potlatch River, Big Bear Creek to mouth – contains second highest cropland acreage and third most total agricultural lands, significant pastureland acreage in addition to several winter feed areas; several bacteria violations, highest sediment load reduction target of 303(d) listed segments. Temperature exceedances and one of the higher shade targets.
3) Middle Potlatch Creek – contains highest agricultural acreage and the most cropland, significant hayland and pastureland acreage in addition to several winter feed areas; several bacteria violations, second highest sediment load reduction target of the mainstem Potlatch tributaries. Temperature exceedances and one of the higher shade targets.
4) Pine Creek – fourth highest agricultural lands acreage. Several nutrient target exceedances. Temperature exceedances and one of the higher shade targets. Winter feed area at mouth.
5) Big Bear Creek - has second highest cropland acreage and total agricultural lands acreage. Significant pasture and hayland. Concentrated livestock grazing in riparian area; winter feed area. Recent bacteria, DO and temperature exceedances.
6) Corral Creek – significant livestock grazing. Recent bacteria and temperature exceedances. Second highest shade target. Complements existing project work.
7) West Fork Little Bear Creek – although pollutant problems appear to be primarily related to Troy WWTP point source, the watershed contains 6,040 acres of agricultural lands that potentially contribute to the total pollutant load. Recent bacteria, DO, nutrient, and temperature exceedances.

8) Upper Potlatch River, above Moose Creek - recent bacteria, DO and temperature exceedances. Significant livestock grazing occurs along this stretch in pastures and meadowlands particularly along the West Fork Potlatch River.
9) Potlatch River, Moose Creek to Corral Creek – recent DO and temperature exceedances. Significant livestock grazing, particularly close to the town of Bovill.
10) Potlatch River, Corral Creek to Big Bear – recent temperature exceedances. Significant agricultural lands (9,450 acres) that potentially contribute to pollutant load.
11) Boulder Creek – Some temperature exceedances, little cropland (30 acres) or pasture. Generally very good water quality according to most recent monitoring.
12) East Fork Potlatch (includes Ruby Creek) – recent temperature exceedances, little agricultural lands but livestock grazing is common. Moderate shade target.
13) Moose Creek – no agricultural lands. Little livestock grazing observed. Highest shade target.

TREATMENT

Treatment Units (TU)

Three agricultural treatment units are established for inventory and evaluation purposes. A treatment unit is defined as a unit of land with similar soil and water conservation problems requiring similar combinations of conservation treatment. Treatment units developed for agricultural lands within the TMDL watersheds are: cropland, pasture and hayland. Cropland treatment units span both riparian and upland areas; most of the pasture and hayland requiring treatment is located within the riparian zone. A fourth treatment unit (road corridors) intersects agricultural lands throughout the watershed; it falls under the authority of the designated County Highway Districts along with the responsibility for roads BMPs installation.

<u>Cropland</u>

The Palouse has been called one of the most erosive areas in the United States. The USDA estimated that from 1939 through 1977, the average annual rate of soil erosion in the Palouse was 14 tons/acre on cultivated cropland (Ebbert and Rowe, 1998). Sediment delivery to the drainage system was likely in range of 3 to 4 tons/acre annually (USDA, 1978). The Palouse estimates roughly correspond to the modeled estimates for Potlatch River Subbasin cropland calculated by Dansart (2004). Potlatch River Subbasin average annual cropland erosion was estimated to be 14 tons/acre; annual sediment delivery averaged 3 tons/acre, with a range from 2 to 4 tons.

Upland Cropland Resource Issues

Soil

Sheet/rill erosion

> *Problem:* Erosion rates exceed the soil loss tolerance (T)
>
> *Treatment:* Reduce soil erosion through implementation of reduced tillage systems. Conversion to reduced tillage systems is estimated to result in a 6 to 11 tons/acre drop in soil erosion depending on cropland location, current tillage system in use and new tillage system chosen (Dansart, 2004).

Ephemeral gully erosion

> *Problem:* Small channels formed by concentrated surface water flow tend to increase in depth over time. On cropland, the gullies can be obscured by heavy annual tillage.
>
> *Treatment:* Reduce or eliminate gully erosion by installing water and sediment control structures.

Water

Surface water – excessive nutrients and organics

> *Problem:* Water quality monitoring indicates TP exceeds 0.10 mg/L TMDL target criteria in some watersheds.
>
> *Treatment:* Apply nutrients at a time and rate that maximizes plant uptake, to achieve reduced nutrient loading; reduce sediment attached phosphorus delivery by conservation tillage system.
>
> Reduce or eliminate gully erosion by installing water and sediment control structures and minimize transport of phosphorus bound to soil particles.

Surface water – excessive suspended sediment and turbidity

> *Problem:* Suspended sediment is a concern for downstream and onsite water quality and stream-dwelling organisms. Inversion tillage is a primary source within the watershed.
>
> *Treatment:* Reduce soil erosion through implementation of a reduced tillage system. Conversion to such a system may result in a reduction of soil loss by an average of 11 tons/acre and a 2 ton/acre average reduction in sediment delivered to drainage channels.
>
> *Treatment:* Reduce or eliminate ephemeral gully erosion (concentrated source of soil erosion) by installing water and sediment control structures.

<u>Riparian Zone</u>

Channel erosion is a significant source of sedimentation in the TMDL watersheds. A cursory examination of the watersheds revealed that some streambanks are unstable. In cropland areas, the stream channels are comprised mostly of silt and clay sized material; downcutting by the stream occurs during spring runoff until the stream channel encounters a compacted clay layer or other more resilient substrate, then the stream's energy is re-directed to bank erosion. In addition to sediment loading due to channel erosion, bacteria loads originating from livestock presence is a problem within the riparian zone on pastureland. Much smaller levels of bacteria may be delivered from hayland to stream channels from grazing after the last hay cutting of the season. The removal of natural riparian vegetative canopy has contributed to temperature exceedances observed, at times, in some locations.

<u>*Riparian Zone Cropland Resource Issues*</u>

Erosion from adjacent cropland

Problem: Suspended sediment is a concern for downstream water quality and the habitat of stream-dwelling organisms. Cropland is cultivated close to stream edge, sometimes overtopping banks and delivering sediment directly into adjacent channels or road ditches.

Treatment: Install vegetative buffers to filter sediment from adjacent fields and preclude cultivation to channel edge.

Channel Erosion

Problem: Channel bank erosion

Treatment: Slope banks to natural angle of repose; install vegetative cover on banks.

Elevated seasonal water temperatures

Problem: Historic removal of stream channel vegetative canopy has resulted in occasional violations of instream temperature standards.

Treatment: Install BMPs that restore vegetative canopy and encourage increases in base flow at critical times.

<u>*Pasture*</u>

Field observations conclude that grazing activities contribute to riparian area denudation and to the overall sediment and bacteria loads within the Potlatch River Subbasin. In addition to grazing conducted on private agricultural lands, the Clearwater National Forest, Potlatch Corporation, and Idaho Department of Lands issue grazing leases or allotments on forested lands throughout the Potlatch River Subbasin. Most of the §303(d) listed water bodies have some grazing impacts to their riparian areas.

Pasture lands (>5,300 acres) are generally adjacent to stream channels where livestock can access water. Concentrated winter feeding occurs along some §303(d) drainages; notably Big Bear Creek, Middle Potlatch Creek, Pine Creek and the Lower Potlatch River.

Problem: Channel bank erosion due to livestock traffic contributes sediment with attached nutrients. Nutrient/bacteria enrichment from direct manure deposition or manure-laden runoff. Removal of riparian vegetation due to grazing activity.

Treatment: Limit livestock access to stream by fencing and off-site water development. Develop waste storage facilities where concentrated feeding occurs. Promote channel bank stabilization and establishment of riparian vegetation to help filter pollutants and promote stream canopy restoration in previously denuded areas.

Hayland

Hayland generally provides continuous ground cover and therefore supplies relatively little pollutant load when compared to cropland and pastureland. Although some of the haylands (>10,000 acres) in the TMDL watersheds are likely grazed after cutting, it is more likely bacteria and sediment contributions to the drainage system originate from the concentrated presence of a limited number of livestock in areas that abut stream channels.

> *Problem:* Channel bank erosion due to seasonal livestock traffic that contributes suspended sediment with attached nutrients and bacteria enrichment from direct manure deposition or manure-laden runoff.
> *Treatment**:*** Limit grazing on hay fields to times when runoff is unlikely and exclude cattle from the riparian zone. Promote channel bank stabilization and establishment of riparian vegetation to help filter pollutants and promote stream canopy restoration in previously denuded areas.

Conservation Treatments

Best management practices (or BMPs) are defined as a practice or combination of component practices determined to be the most effective, workable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Nonpoint source loads are largely driven by climatic conditions and the effects of some best management practices (forest buffer strips, bank stabilization, etc.) may take years to be fully realized. The agricultural implementation plan should be viewed as a dynamic document, subject to change as current conditions dictate. Tables Q thru Ca summarize the recommended BMPs and provide estimated implementation costs for the TMDL watersheds.

Agricultural resource management planning to address water quality typically involves the application of BMPs to address particular resource concerns. For the TMDL watersheds, there are three groups of practices that are applicable: agronomic, structural, and riparian. It is difficult to accurately predict the effectiveness of any BMP; ultimately, the impact any conservation activity has on a resource concern is a function of a wide assortment of variables. The goal of any implementation project is to provide the most practical, cost-effective solution to correct the resource concern.

For the Potlatch River TMDL watersheds, the most cost-effective and practical implementation strategy involves a phased or incremental approach. Practices with the best cost/benefit ratio should be implemented initially. If monitoring shows that additional practices are needed, the next cost/benefit tier of practices will be used; this process will continue until the resource concerns are addressed.

Agronomic Practices

Keeping the land under some form of surface cover is the single most important factor in preventing soil erosion. Surface cover absorbs the explosive power of rain, which can detach soil particles from the soil mass, setting up transport by runoff water. Cover also slows the flow of water across the soil surface, further reducing the threat of erosion.

Conservation Cropping Sequence / Conservation Tillage / Residue Management

Conservation tillage in all its various forms (such as shank and seed, minimum tillage and no-till direct seeding), leaves residue on the soil surface, generally from the previously harvested crop. If adequate residue remains on the surface upon entering the critical erosion period, the BMP is effective at reducing soil erosion.

Locally, extended research efforts at the Palouse Conservation Field Station from 1978 through 1985 showed that with a 50% surface residue cover, a 92% reduction in soil loss was achieved (McCool, *et al*., 1993) when comparing conservation tillage to more conventional tillage (Gilmore, 1995). Conservation tillage is proposed for use on cropland acres within the Potlatch River TMDL watersheds. Direct seeding practices undertaken on cropland in the Paradise Creek watershed, several miles north and west of the Potlatch River TMDL watersheds, reduced sediment delivery by an average of 2.3 tons/acre/year (Dansart, 2002).

EPA (2002) reported that reduced tillage systems could decrease sediment by 75%, total phosphorus by 45% and total nitrogen by 55% over conventional tillage practices. A one-ton reduction in sediment can reduce orthophosphate (H_2PO_4) loads by 14,000 mg and total nitrogen loads by 4,500 mg (Gardner, 2003). In addition to nutrient-rich sediment reductions, additional nutrient reductions can occur through the implementation of comprehensive nutrient management plans developed with collaborative individual growers. Nutrient management plans seek to reduce excess nutrient applications to agricultural fields that may eventually leave the fields and enter local surface and ground waters. Nutrient management planning is a recommended BMP for controlling nitrogen pollution in ground and surface waters (Mahler, Tindall & Mahler 2002). EPA (2002) has summarized research that indicates a resulting 8% to 32% decrease in median nitrate concentrations in ground water samples following decreases of 39% to 67% in nitrogen application rates under implemented nutrient management plans.

Continuous Direct Seeding High Residue Management Systems

Development of crop sequences and equipment requirements for continuous direct seeding have not been fully realized in the TMDL watersheds. Recent research has shown that continuous direct seeding can be profitable, but to succeed it requires careful management of all components of the production and marketing system. Profitable continuous direct seeding requires more than high crop yield, it requires careful control of costs at each stage of the production process.

As in other areas of farming, the economic performance of direct seeding varies considerably from grower to grower. These differences appear to be associated with site factors, management, and luck (Young, 1999). Research has shown that there is a transition of 3 to 6 years for the soil/weeds/microorganisms to reach equilibrium and for operators to make sound management decisions based on good and bad experiences, research, and technical assistance. Some problems which need to be worked out during this transition period are: 1) dealing with excess residue without burning stubble; 2) dealing with increased weed problems during the first 2 to 3 years; 3) instituting longer crop rotations to reduce the potential for soil-borne diseases; 4) handling problems with continuous direct seeding specifically prevalent in high rainfall areas that occur in parts of the Potlatch River Subbasin; and 5) bearing new equipment costs.

Continuous direct seeding systems provide the most effective cropland erosion protection, other than establishing grass and trees. Continuous direct seeding reduces soil disturbance, increases organic matter content, improves soil structure, buffers soil temperature and allows soil to catch and hold more melt water (Clapperton, 1999). After a transition period, the practice of continuous direct seed high residue management improves soil biological health. Continuous direct seeding retains residue on the surface and minimizes spring soil compaction, thus reducing the potential for runoff and soil erosion and improving water infiltration (Veseth, 1999). The Revised Universal Soil Loss Equation (RUSLE) predicted erosion on continuous direct seeded fields would decrease by rates ranging from 6 to 11 tons/acre, when compared to conventional seeding (Dansart, 2004). Without financial incentive to try continuous direct seeding, some landowners/operators cannot and will not risk the chance of failure in today's financial climate and will continue to use conventional tillage.

Once fully adopted, direct seeding systems make significant contributions to the reduction in sediment and nutrient delivery to local waterbodies through the minimization of sheet and rill erosion. Under a conventional tillage to direct seeding conversion scenario (Dansart, 2004), estimated average sediment delivery reductions to TMDL stream drainages, by cropland acre, were as follows:

Pine Creek – 3.0 tons/acre
Cedar Creek – 1.8 tons/acre
Corral Creek – 4.1 tons/acre
Middle Potlatch Creek – 3.0 ton/acre
Boulder Creek – NA, no cropland erosion
Potlatch River (subbasin average) – 2.0 tons/acre

An additional benefit of continuous direct seeding systems is carbon sequestration. Local area growers that have incorporated direct seeding systems have entered into 10-year carbon sequestration leases with a Louisiana-based energy generation and holding company for the "production" of carbon credits that can be traded on the open market. This is the first carbon sequestration contract for direct seeding in the country (PNDSA, 2002).

Contour Farming / Strip-cropping

Performing farming operations across slopes and following the shape of the land has proven to be an effective practice for reducing erosion compared to farming up and downhill, particularly on gentle slopes. On steeper slopes it is less effective, unless combined with strip-cropping or buffer strips. The use of strip-cropping and contour buffer strips on the steeper slopes characteristic of much of the Potlatch River Subbasin will always be encouraged.

Structural Practices

Erosion associated with concentrated flow is best addressed with structural practices. Structural practices that address concentrated flow erosion work in two ways; structures trap sediment that has been eroded by concentrated water flow, or impede the eroding action of the water (either by armoring the soil or by slowing the water down to reduce the eroding energy). When properly designed, installed, and maintained, the right combination of structural practices can virtually eliminate erosion associated with concentrated flow. The practices most applicable to the Potlatch River TMDL watersheds are grade stabilization structures and water and sediment control structures (gully plugs).

In the nearby Paradise Creek watershed, the reduction in sediment delivery from individual water and sediment control structures averaged 55 tons/year, ranging from 10 to 288 tons/year per structure. Since there are strong similarities between the Paradise Creek watershed and some Potlatch River TMDL watersheds, it is anticipated each proposed structure within the TMDL watersheds should reduce sediment delivery within the range mentioned.

When direct seeding and erosion control structures are coordinated within a watershed, significant reduction in erosion and sedimentation can occur. Direct seeding (1,300 acres) in combination with 24 erosion control structures reduced sediment delivery to Paradise Creek by approximately 4,000 tons/year (Dansart, 2004). Due to common watershed characteristics, substantial reductions are expected within the Potlatch River TMDL watersheds through the implementation of the suggested cropland BMPs.

Riparian Buffer Strips

Riparian buffer strips, also known as filter strips, have been shown to be effective in reducing suspended sediments from overland flows by reducing the velocity of runoff. Analysis of vegetative filter strips (VFS) has shown that a 30-foot wide grassed buffer will trap from 70 to 98% of the sediment in water filtering through the strip (Gilmore, 1995). EPA (2002) has reported that riparian filter strips, alone, have been shown to reduce sediment by 70%, total phosphorus by 70% and total nitrogen by 65% as compared to those areas with no riparian filters.

Sheet and rill erosion are the types of erosion most likely to be mitigated by a VFS. Erosion associated with concentrated flow cannot be addressed by VFS implementation. With respect to temperature, VFS on the agricultural lands may slightly improve base flow conditions for the TMDL tributaries. However, given the predicted size of the strips, this effect is likely to be negligible.

Channel erosion is a significant source of sedimentation in the Potlatch River TMDL watersheds. A cursory examination of the watershed revealed that some streambanks are unstable. Fields are sometimes cultivated to channel bank edges and deliver sediment directly to adjoining streams or road ditches. Adjacent to agricultural lands, most stream channels are comprised of silt and clay sized material. During high flow periods, downcutting by the stream occurs until the stream channel encounters a compacted clay layer or other more resistive substrate, the stream's energy is then re-directed to bank erosion. Aggradation (deposition) of sediment occurs at some locations along the stream course. The annual effects of these natural stream processes to achieve hydraulic equilibrium vary depending on the unique characteristics of the annual runoff regime. Permanent vegetative buffers could eventually reduce streambank erosion substantially once stream channel stability and hydraulic equilibrium are restored.

In addition to filter strips, woody vegetative buffers would be highly desirable, but may be economically impractical for working farm operators; problems include stand establishment due to weeds and rodents, loss of productive cropland and associated income, future large woody debris causing obstruction and flood problems. Installation should be encouraged, particularly on idle cropland, hayland or pastureland. Besides filtering sediment and helping stabilize streambanks through additional rootmass, buffer strips would help maintain base flow to the creek by decreasing upland runoff, encourage infiltration, and increase interception and depression storage of precipitation. Rather than runoff from the land surface to the creek, more water would be stored beneath the floodplains and slowly released to the stream channel. As woody vegetation matured, canopy cover to the stream would increase, likely resulting in some water temperature decrease as well as blocking a portion of the sunlight necessary for algal growth. Fish habitat would be improved over time with recruitment of large woody debris and development of undercut banks; wildlife habitat would be enhanced for both game and nongame species.

Wide vegetated buffers would allow stream segments, particularly those historically straightened sections, to meander and establish equilibrium over time without the need to perform channel re-alignment using heavy equipment. Increased stream length will result in decreased flood intensity through increased channel storage capacity and decreased flow velocity. This will result in a reduction in sediment load and bank erosion.

For eligible landowners, the USDA Conservation Reserve Program (CRP) is viewed as the program most attractive for installation of filter strips and riparian forest buffers. By enrolling in CRP, landowners and operators will receive assistance with installation costs for approved practices, and will additionally receive annual rental payments.

Riparian Area Pasture and Hayland BMPs

Some haylands (>10,000 acres) in the TMDL watersheds are grazed after the last cutting. Livestock presence is scattered and seasonal; impact to water quality is likely minimal due to general lack of runoff during the fall. Because ungrazed hayfields are not generally a large contributor of sediment or bacteria, no specific BMPs that address nutrients, sediment or bacteria are recommended for hayland other than to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone. Only BMPs that address temperature concerns (like riparian forest buffers) are recommended unless specific problem areas that need additional treatment are identified.

Pastureland, about 5,300 acres, grazed by livestock is scattered throughout the watersheds. Cattle are present in all watersheds, with numbers observed ranging from 4 to 320 head per watershed; cattle numbers within the watersheds can increase dramatically when concentrated winter feeding occurs. Horses were observed in lower quantity (up to 104 head) per watershed. Smaller numbers of sheep, goats and llamas occur in some watersheds. It is assumed many additional livestock were not visible during examination of the watershed areas. In addition, winter feeding areas exist in several watersheds; hundreds of additional cattle are present in concentrated areas during the winter months. Riparian livestock impact is spotty but severe in several areas where concentrated winter feeding occurs adjacent to creek channels.

It is likely some of the sediment and much of the bacteria contributions to the drainage system are due to the concentrated presence of a limited number of livestock in pasture areas that abut streams. Bacteria originates from livestock or wildlife manure in the riparian area or from manure-laden runoff. Another possible contributor is failed septic systems that drain to the riparian area. Trampling of channel banks by livestock is likely to be a significant sediment contributor. In addition, stretches of riparian area have been denuded of vegetation due to overgrazing.

BMPs implemented to limit livestock access to the riparian area, establish stream canopy, and help stabilize channel banks should be given the highest priority. Off stream watering sites should be established where livestock are concentrated, such as winter feeding areas. This will limit the need for livestock to access the riparian area. Other BMPs considered should be removal of livestock from riparian areas or exclusion by fencing. Channel bank stabilization and establishment of overhanging canopy cover should also be a priority, particularly along stream segments where temperature exceedances have been reported.

Livestock exclusion practices should also be considered in rangeland and forest areas where riparian damage observed indicates concentrated grazing by livestock at unacceptable levels.

Recommended BMPs And Estimated Costs

A summary of water quality concerns and BMP recommendations were developed for the thirteen TMDL watersheds that encompass the 303 (d) listed stream segments within the Potlatch River subbasin. The summary information, list of BMPs, and estimated costs organized by TMDL watershed are presented below.

Cedar Creek

Forested lands comprise approximately 60% of the watershed. About 1,100 acres within the watershed are managed by the State of Idaho; remaining lands are privately owned. The community of Southwick is located near the lower center watershed boundary. Cedar Creek is a moderately sized (25,415 acres) watershed with about 9,000 acres of agricultural lands. About 6,000 acres of uplands are cropped with an additional 1,900 acres set aside in CRP. Most canyon areas are forested rangelands with scattered livestock grazing. Watershed location within the Potlatch River Subbasin is shown in Figure 8 of the *TMDL Watersheds Descriptions* section.

Landuse distribution is shown in Figure 15 of the *TMDL Watersheds Descriptions* section. Estimated agricultural landuse acres in the Cedar Creek Watershed are:

Cropland	5,950 acres
CRP	1,930 acres
Grass Crop	230 acres
Hay	810 acres
Pasture	90 acres

Agricultural Activities

About 34% of the watershed acres are agricultural lands. Approximately 21% of agricultural lands are enrolled in CRP, or about 8% of the entire watershed. Some CRP fields may have been retired or grass stands re-established due to weed problems. Approximately 1,000 non-CRP acres are in some sort of grass cover; about 25% of those acres appear to be cropped grass.

Relatively little pastureland (90 acres) was noted in the watershed. Approximately 25 horses and 22 cattle were observed on a drive through the watershed; several llamas were also present. Dispersed cattle forage on forest lands and shrublands.

Water Quality Concerns

Cedar Creek is the highest priority for implementation of BMPs. Of the TMDL watersheds, Cedar Creek has the fourth highest cropland acreage, second highest sediment load, several bacteria violations, and the highest sediment load reduction target of the mainstem Potlatch tributaries. Recent IASCD monitoring confirms continuing sediment concerns during major rain events in addition to bacteria, nutrient and temperature exceedances.

Cedar Creek was §303(d) listed from Leopold Creek to the Potlatch River for sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that recreation beneficial use was fully supported but salmonid spawning and cold water aquatic life uses were not; this was due temperature and sediment impairments. TMDLs were completed for the two pollutants.

Cedar Creek showed one of the highest rainbow/steelhead trout densities according to the fish survey conducted by IDFG (Bowersox, et. al., 2006). The study also listed this creek as 7th highest restoration priority and 14th highest protection priority of 23 streams in the Potlatch River subbasin surveyed.

The largest portion of the sediment pollutant load probably originates from cropland; cultivated fields abut drainages that receive sheet, rill, and gully runoff. A smaller, but still significant, share of the load may be due to livestock activity. Hayland and permanent grass stands provide surface ground cover throughout the year and are relatively minor pollutant contributors. Another, perhaps very significant, sediment source could be mass wasting (landslides) within the forested canyons that are eroded during storm events. Aside from these localized events, turbidity and sediment levels were typically very low in Cedar Creek, and were well within an optimal range for aquatic life (IASCD, 2010).

Temperature exceedances probably result from a lack of stream canopy cover associated with a lack of riparian canopy on agricultural acres within the uplands and partially due to natural conditions at the monitoring sites. IDEQ (2008) estimates that a 12.5% increase in canopy is needed to reach potential natural vegetation levels.

Recommended Treatments

The summary report (IASCD, 2010) of the 2006 to 2008 water quality monitoring states: "Although suspended sediment levels were generally quite low in the Potlatch River watershed, erosion is evident in many areas, both in-stream and in adjacent farmland, and treatment should be applied to areas undergoing the most severe erosion. In particular, priority should be given to the Cedar Creek subwatershed, where the lack of substantial riparian vegetation in the upper portion of the catchment results in heavy seasonal sediment loads being delivered to the stream channel annually, and subsequently flushed down into the Potlatch River."

There are approximately 6,000 acres of cropland currently being farmed in the watershed. About 113,500 feet of stream channel intersects cropland acres. An additional 1,930 acres are enrolled in the Conservation Reserve Program (CRP). Cropland is not a source of bacteria; it is likely to be a significant source of sediment and nutrient delivery to the drainage system. There is minimal streamside vegetation on cropland throughout much of the watershed. Recommended BMPs include additional land conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices installation where gully erosion is present and filter strips where cropland abuts drainage channels. BMPs that effect water temperature include those that help establish riparian vegetation. Implementation of cropland BMPs are a high priority in this watershed. Dansart (2004) estimated conversion from conventional tillage to direct seeding may result in a reduction of 2 tons/acre annually in sediment delivery to Cedar Creek drainage channels. How this translates to changes in pollutant concentration in the stream at the compliance point remains to be determined.

Hay is cut on approximately 810 acres; grass covers an additional 2,800 acres. About 85,000 feet of stream channel intersects hayland or grassland acres. Much of the hayland is likely grazed after cutting. Because ungrazed hayfields and grass fields are not generally a large contributor of sediment or bacteria, no specific BMPs that address nutrients, sediment or bacteria are recommended for hayland or grassland other than to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone. Only BMPs that address temperature concerns are recommended. Few (90) acres of pasture were identified within the watershed; livestock should be excluded from access to live water whenever possible.

Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover in open riparian areas; this includes hayland, pasture, and cropland in addition to open grass covered areas. To enhance the survival of riparian vegetation to help meet the shade target, these areas should be fenced to exclude livestock and wildlife where needed.

Table Q. Cedar Creek recommended BMPs with cost estimates.

Future Level of Treatment for Dry Cropland				
Dry Cropland	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Dry Cropland	Ac.	6,000		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	1,500	$ 135,000	$ 22,500
Residue Mgmt. Mulch Till (345)	Ac.	1,500	$ 67,500	$ 22,500
Wtr.& Sediment Control Basin(638)	No.	20	$ 80,000	$ 2,400
Filter Strip (393)	Ac.	72	$ 7,200	$ 150
Riparian Forest Buffer (391)	Ac.	22	$ 33,000	$ 330
Riparian Herbaceous Cover (390)	Ac.	22	$ 6,600	$ 66
Tree/Shrub Establishment (612)	Ac.	22	$ 10,230	$ 102
Total RMS Costs			$ 339,530	$ 48,048

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	3,600		
Channel Bank Vegetation (322)	Ac.	2	$ 10,350	$ 210
Channel Stabilization (584)	Ft.	1,000	$ 20,000	$ 100
Fence (382)	Ft.	12,500	$ 25,000	$ 500
Riparian Forest Buffer (391)	Ac.	17	$ 25,500	$ 250
Riparian Herbaceous Cover (390)	Ac.	17	$ 5,100	$ 50
Tree/Shrub Establishment (612)	Ac.	17	$ 7,900	$ 80
Total RMS Costs			$ 93,850	$ 1,190

Potlatch River (Big Bear Creek to Clearwater River)

The drainage area described for this reach of the Potlatch River is approximately 22,800 acres in size. Over 90% of the land is privately managed (20,860 ac). A few tracts of tribal property (900 ac) are distributed throughout the southern half of the drainage area, in addition to state (480 ac) and BLM (330 ac) lands. The town of Kendrick is located at the head of this river reach; Juliaetta is midreach and US Highway 12 at the Potlatch River outlet along the Clearwater River. Location relative to other TMDL watersheds is shown on Figure 8.

Forested lands are usually fairly open and comprise about 14% of the drainage area. Tree covered areas are generally located on the canyon walls or along the valley bottom. Most (34%) of these areas are covered with grass or shrubs and is classified as rangeland. A vineyard is located along the east side of the Potlatch River about 1.5 miles above the mouth. State Highway 3 runs along the river over the entire reach.

Landuse distribution is illustrated in Figure 22. Estimated agricultural landuse for the drainage area of the Potlatch River below Bear Creek is:

Cropland	10,000 acres
Grass Crop	125 acres
CRP	72 acres
Hay	74 acres
Pasture	942 acres
Grass	425 acres
Vineyard	40 acres

An additional 8000+ acres could potentially be grazed at times by livestock.

Agricultural Activities

Most cropland occurs in upland areas; and makes up 44% of the watershed. Relatively little of the watershed area is used for hay production or is set aside in CRP; these two landuses combined account for less than 1% of the drainage.

Pasture areas are generally adjacent to the river channel. Livestock grazing occurs in rangeland areas; several livestock winter feeding operations are located along the Potlatch River. Approximately 24 horses, 16 cattle, 5 sheep and 8 goats were observed on a September drive through the watershed but the number of cattle will increase significantly when winter feeding occurs. Dispersed cattle likely forage on open forest lands and shrublands.

Water Quality Concerns

The Potlatch River from the mouth of Big Bear Creek to the Clearwater River was §303(d) listed for bacteria, nutrients, sediment, temperature, DO, ammonia, oil/gas, organics and pesticides. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ (2008) determined that beneficial uses were not fully supported due to temperature and sediment impairments. TMDLs were completed for temperature and sediment, but IDEQ recommended that the other reported impairments be removed from the list. The Lower Mainstem Potlatch River is listed as the 11th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 20th for protection.

The largest portion of the sediment pollutant load probably originates from cropland; cultivated fields abut drainages that receive sheet, rill, and gully runoff. A small but still significant, share of the load is due to livestock activity. Hayland and permanent grass stands provide surface ground cover throughout the year and are relatively minor pollutant contributors. Turbidity and sediment were generally very low at this site, with the exception of a week-long even in late May of 2006, when heavy rains near Southwick resulted in a massive load of sediment being deposited from Cedar Creek into the Potlatch River. This one event accounts for the maximum values for turbidity, SSC and TP. Although several TP exceedances were noted, there were no violations of the DO standard at the monitoring site. Two exceedances of the 406 organisms/100mL *E. coli* standard for primary contact recreation were observed. Temperature levels exceeded state criteria about half the time (IASCD, 2010).

Recommended Treatments

The drainage area for the Potlatch River below Bear Creek is the second highest priority for implementation of BMPs. It contains the second highest cropland acreage and the fourth largest agricultural lands total. It contains significant pasture lands and several winter feeding areas. This lowest stretch of the Potlatch River has the highest sediment load reduction target (67%) and one of the higher shade targets (20%). Recent monitoring has shown sediment, bacteria, and temperature exceedances.

Although suspended sediment levels were generally quite low in the lowest stretch there was one event driven exceedance. Nutrient levels were slightly elevated above target levels; these pollutants often originate from the same sources. BMPs are recommended that mitigate erosion on agricultural lands; these include modifications in tillage practices and installation of structural BMPs. The re-vegetation of stream banks along in tributary drainage channesl would help to reduce sediment transport, as healthy riparian vegetation is effective in reducing bank erosion. Riparian vegetation will also filter sediment being transported in surface water runoff. (IASCD, 2010). Dansart (2004) estimated conversion from conventional tillage to direct seeding may result in a reduction of 2 tons/acre annually in sediment delivery to the Potlatch River drainage. How this translates to changes in pollutant concentration in the river at the compliance point remains to be determined.

Temperature exceedances are partially due to a lack of stream canopy cover on agricultural acres within the uplands that drain to the Potlatch River and mostly due to natural conditions above the monitoring sites on the Potlatch River mainstem. The Potlatch River, for this reach, flows through canyon landscapes with natural canopy cover that cannot shade the existing channel width from solar radiation. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover in open riparian areas; this includes hayland, pasture, and cropland in addition to open grass covered areas. To enhance the survival of riparian vegetation to help meet the shade target, these areas should be fenced to exclude livestock and wildlife where needed. Whether the desired temperature decrease could be accomplished by this BMP installation is another question; it may not be achievable due to overriding natural conditions.

Table R. Potlatch River (Below Bear Creek) Recommended BMPs

Future Level of Treatment for Dry Cropland				
Dry Cropland	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Dry Cropland	Ac.	10,000		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	2,500	$ 225,000	$ 37,500
Residue Mgmt. Mulch Till (345)	Ac.	2,500	$ 112,500	$ 37,500
Wtr.& Sediment Control Basin(638)	No.	31	$ 124,000	$ 3,720
Filter Strip (393)	Ac.	316	$ 31,600	$ 6,320
Riparian Forest Buffer (391)	Ac.	79	$ 118,500	$ 1,185
Riparian Herbaceous Cover (390)	Ac.	79	$ 23,700	$ 237
Tree/Shrub Establishment (612)	Ac.	79	$ 36,735	$ 367
Total RMS Costs			**$ 672,035**	**$ 86,829**

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	1,513		
Channel Bank Vegetation (322)	Ac.	1	$ 5,175	$ 104
Channel Stabilization (584)	Ft.	2,284	$ 45,680	$ 228
Fence (382)	Ft.	116,600	$ 233,200	$ 4,664
Riparian Forest Buffer (391)	Ac.	23	$ 34,500	$ 345
Riparian Herbaceous Cover (390)	Ac.	23	$ 6,900	$ 69
Tree/Shrub Establishment (612)	Ac.	23	$ 10,695	$ 107
Watering Facility (614)	No.	10	$ 10,500	$ 105
Total RMS Costs			$ 346,650	$ 5,622

Middle Potlatch Creek

Middle Potlatch Creek is a southeast facing watershed of about 36,000 acres in size. The drainage area is entirely private lands with the exception of 40 acres of BLM property along the drainage approximately 7 miles above the mouth. Location of Middle Potlatch Creek relative to other TMDL watersheds is shown on Figure 8.

Heavily forested lands (500 ac) are relatively rare, but open forest and shrubland blanket canyon areas and are grazed by livestock; these rangeland areas comprise approximately 25% of the watershed. The town of Juliaetta is located at the southern end of the watershed. Upland use is primarily agricultural. Landuse distribution is illustrated in Figure 19.

Estimated agricultural landuse acres in the Middle Potlatch Creek Watershed are:

Cropland	19,820 acres
CRP	3,600 acres
Grass Crop	290 acres
Hay	810 acres
Pasture	850 acres

An additional 4,500 acres of privately owned grassed lands could potentially be grazed by livestock. Open mixed forest and shrubland may be grazed as well.

Agricultural Activities

Cropland makes up more than half the watershed area; about 3,600 acres are set aside in CRP. These two landuses comprise about 65% the watershed area. Almost all CRP lands are located in the northern half of the watershed. Hay and pasture are scattered throughout the watershed. Approximately 800 acres are planted to hay and about 300 acres is cropped grass.

Approximately 100 horses, 20 cattle, several goats and llamas were observed on a September drive through the watershed; the number of cattle will increase significantly when winter feeding occurs. Pasture lands comprise about 850 acres. Several livestock winter feeding areas are present, notably along Cook's Canyon several miles upstream of the stream outlet. Dispersed cattle likely forage on forest lands and shrublands.

Water Quality Concerns

Middle Potlatch Creek was §303(d) listed from its headwaters to the Potlatch River for sediment, nutrients, temperature, and bacteria. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that no beneficial uses were fully supported due to temperature, bacteria, and sediment impairments. IDEQ recommended that nutrients be removed from the list of impairments.

A preliminary water quality investigation was completed by SCS (1993) on Middle Potlatch Creek. This report concluded fish habitat was poor in the upper watershed with little or no flow in the summer a severe limitation. The mid portion of the watershed habitat was rated good, and the lower section of the creek had a poor habitat rating. Adjacent land use was severely limiting due to streamside location of animal holding facilities, lack of riparian and range management practices and forest harvest activities (USDA SCS 1993).

Middle Potlatch Creek has a fish migration barrier (falls) at stream mile 8. The creek is identified as having steelhead and rainbow trout, with a spawning and incubation period of January through May. The fish study conducted by IDFG (Bowersox et. al., 2006) listed this creek as 17th highest restoration priority and 10th highest protection priority of 23 streams in the Potlatch River subbasin surveyed.

The largest portion of the sediment pollutant load probably originates from cropland; cultivated fields abut drainages that receive sheet, rill, and gully runoff. A small but still significant, share of the load is due to livestock activity. Hayland and permanent grass stands provide surface ground cover throughout the year and are relatively minor pollutant contributors. Another sediment source could be mass wasting (landslides) within the forested canyons that are eroded during storm events. Recent (2006-2008) monitoring showed turbidity and sediment levels were typically very low in Middle Potlatch Creek, and were well within an optimal range for aquatic life (IASCD, 2010). A very significant decrease in *E.coli* exceedances was noted as well. DO levels always met state criterion.

Recommended Treatments

Middle Potlatch Creek is the third highest priority for implementation of BMPs. It contains the highest agricultural lands acreage total of the TMDL watersheds. It has the most cropland, significant pasture and hayland, in addition to several winter feeding areas. Middle Potlatch Creek has the third highest sediment reduction target (43%) and fourth highest (22%) shade target. Recent (2006-2008) monitoring showed several nutrient and temperature exceedances. Elevated bacteria levels were also observed at the lower monitoring site but were much reduced relative to the 2002 monitoring (IDEQ, 2008). Although several TP exceedances were noted, there were no violations of the DO standard at the monitoring sites; the correlation to a resulting problem was not evident.

Dansart (2004) estimated conversion from conventional tillage to direct seeding may result in a reduction of 3 tons/acre annually in sediment delivery to Middle Potlatch Creek drainage channels. How this translates to changes in pollutant concentration in the stream at the compliance point remains to be determined. Since the 2002 monitoring, on which the TMDL was based, much cropland has been converted to some form of conservation tillage (mulch till or direct seed). Some additional acreage has been enrolled in CRP since 2002. Monitoring to determine how distant water quality targets are from being met, currently, is likely a good use of funds prior to future major implementation efforts. The most recent monitoring (2006-2008) did not show a sediment problem; it did indicate that nutrient target exceedances continue.

There is almost 20,000 acres of cropland currently being farmed in the watershed. About 295,000 feet of stream channel intersects cropland acres. There are about 3,600 CRP acres. Cropland is not a source of bacteria; it is likely to be a significant source of sediment and nutrient delivery to the drainage system. There is minimal streamside vegetation on cropland throughout much of the watershed. Recommended BMPs include additional land conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices installation where gully erosion is present and filter strips where cropland abuts drainage channels. BMPs that effect water temperature include those that help establish riparian vegetation. Implementation of cropland BMPs are a high priority in this watershed.

About 208,000 feet of stream channel intersects hayland or grassland acres. Much of the hayland and some grassland is likely grazed after cutting. Because ungrazed hayfields and grass fields are not generally a large contributor of sediment or bacteria, no specific BMPs that address nutrients, sediment or bacteria are recommended for hayland or grassland other than to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone. Only BMPs that address temperature concerns are recommended.

It is probable some of the sediment and bacteria contributions to the drainage system originate from the concentrated presence of a limited number (300-400) of livestock in pastures (850 acres) that abut stream channels. Pastures adjoin an estimated 42,000 feet of stream channel. BMPs implemented to limit livestock access to the riparian area, establish stream canopy, and help stabilize channel banks should be given high priority. BMPs recommended are removal of livestock from these areas, development of offsite watering sites, or riparian use exclusion by fencing. Runoff diversion from concentrated winter feed areas would be beneficial to water quality. Spot channel bank stabilization and establishment of overhanging canopy cover should be implemented as site conditions indicate.

Best Management Practices recommendations for the Middle Potlatch Creek watershed, with associated cost estimates are listed in Table S.

Table S. Middle Potlatch Creek Recommended BMPs

Future Level of Treatment for Dry Cropland				
Dry Cropland	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Dry Cropland	Ac.	19,820		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	5,000	$ 450,000	$ 75,000
Residue Mgmt. Mulch Till (345)	Ac.	5,000	$ 225,000	$ 75,000
Wtr.& Sediment Control Basin(638)	No.	62	$ 250,000	$ 7,500
Filter Strip (393)	Ac.	328	$ 32,800	$ 656
Riparian Forest Buffer (391)	Ac.	93	$ 139,500	$ 140
Riparian Herbaceous Cover (390)	Ac.	93	$ 27,900	$ 279
Tree/Shrub Establishment (612)	Ac.	9	$ 43,245	$ 432
Total RMS Costs			$1,168,445	$ 159,007

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	5,880		
Channel Bank Vegetation (322)	Ac.	3	$ 15,525	$ 310
Channel Stabilization (584)	Ft.	6,240	$ 124,800	$ 6,240
Fence (382)	Ft.	83,500	$ 167,000	$ 3,340
Riparian Forest Buffer (391)	Ac.	67	$ 100,500	$ 1,005
Riparian Herbaceous Cover (390)	Ac.	67	$ 20,100	$ 201
Tree/Shrub Establishment (612)	Ac.	67	$ 31,155	$ 312
Watering Facility (614)	No.	10	$ 10,500	$ 105
Total RMS Costs			$ 469,580	$ 11,513

Pine Creek

The Pine Creek Watershed is about 20,260 acres in size. Most of the land in the Pine Creek watershed is under private ownership, with 90 acres of forest land managed by the state. Location of Pine Creek relative to other TMDL watersheds is shown on Figure 8.

Open forested lands are scattered throughout the watershed with more heavily forested areas occurring adjacent to stream drainages within the southern half of the watershed. Upland use is primarily agricultural. Most canyon areas are forested rangelands with scattered livestock grazing. A tree farm is located along the eastern watershed divide. Several rock pits are present and the northern tip of the watershed contains part of the town of Deary. State Highway 3 transects the western watershed edge.

Landuse distribution is shown in Figure 14 of the *TMDL Watersheds Descriptions* section. Estimated agricultural landuse acres in the Big Creek Watershed are:

Cropland	4,040 acres
CRP	5,510 acres
Hay	1,480 acres
Pasture	240 acres
Tree Farm	104 acres

An additional 1,800 acres of privately owned grassed lands could potentially be grazed by livestock.

Agricultural Activities

There is more CRP ground (5,500 ac) than cropland (4,000 ac). These two landuses comprise almost half the watershed area. About 1,500 acres are hayland with a few hundred acres of pastures adjacent to stream channels. A livestock winter feeding area with adjacent pastureland is present at Pine Creek's mouth.

Relatively little pastureland (240 acres) was noted in the watershed. Approximately 46 horses, 10 sheep and 4 cattle were observed on a September drive through the watershed. The number of cattle will increase significantly when winter feeding occurs. Dispersed cattle likely forage on forest lands and shrublands.

Water Quality Concerns

Pine Creek was §303(d) listed from headwaters to the Potlatch River for sediment, temperature, nutrients, bacteria, dissolved oxygen, oil/gas and ammonia. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that aquatic life and recreation beneficial uses were fully supported but salmonid spawning was not; this was due to temperature, nutrient, and sediment impairments. TMDLs were completed for the three impairments and IDEQ recommended removing oil/gas, dissolved oxygen, bacteria, and ammonia as listed pollutants.

Salmonid spawning is an existing use in Pine Creek and the stream is identified as supporting steelhead and rainbow trout, with a spawning and incubation period of January through May. Water quality standards for sediment are exceeded, as are temperature standards for spring salmonid spawning. Based on a 2003-2004 survey conducted by IDFG, upper Pine Creek is listed as the 2nd highest priority highest priority out of 23 streams for restoration, while the remainder of Pine Creek is ranked 3rd (Bowersox et al. 2006). Prioritized in terms of protection, Pine Creek is ranked 17th highest out of 23 streams, while Upper Pine Creek is ranked 21st (RPU, 2007).

The largest portion of the sediment pollutant load probably originates from cropland; cultivated fields abut drainages that receive sheet, rill, and gully runoff. A small, but still significant, share of the load is due to livestock activity. Hayland and permanent grass stands provide surface ground cover throughout the year and are relatively minor pollutant contributors. Another sediment source could be mass wasting (landslides) within the forested canyons that are eroded during storm events.

Recent (2006-2008) monitoring showed several nutrient and temperature exceedances, but no elevated sediment or bacteria levels. Although several TP exceedances were noted, there were no violations of the DO standard at the monitoring site; the correlation to a resulting problem was not evident (IASCD, 2010).

Recommended Treatments

Pine Creek is the fourth highest priority for implementation of BMPs. It has the third highest agricultural lands acreage total of the TMDL watersheds. Pine Creek has the second highest (24%) shade target. Although suspended sediment levels were generally quite low in the Pine Creek watershed, nutrient levels were slightly elevated above target levels; these pollutants often originate from the same sources.

BMPs are recommended that mitigate erosion on agricultural lands; these include modifications in tillage practices and installation of structural BMPs. The re-vegetation of stream banks along Pine Creek would help to reduce sediment transport, as healthy riparian vegetation is effective in reducing bank erosion. Riparian vegetation will also filter sediment being transported in surface water runoff. (IASCD, 2010). Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover, in places, to help meet the shade target as vegetation matures.

Dansart (2004) estimated conversion from conventional tillage to direct seeding may result in a reduction of 3 tons/acre annually in sediment delivery to Pine Creek drainage channels. How this translates to changes in pollutant concentration in the stream at the compliance point remains to be determined. Since the 2002 monitoring, on which the TMDL was based, much cropland has been converted to some form of conservation tillage (mulch till or direct seed). Some additional acreage has been enrolled in CRP since 2002. Monitoring to determine how distant water quality targets are from being met, currently, is likely a good use of funds prior to future major implementation efforts. The most recent monitoring (2006-2008) did not show a sediment problem; it did indicate that nutrient target exceedances continue.

There is approximately 4,000 acres of cropland currently being farmed in the watershed. About 57,000 feet of stream channel intersects cropland acres. There are about 5,100 CRP acres. Cropland is not a source of bacteria; it is likely to be a significant source of sediment and nutrient delivery to the drainage system. There is minimal streamside vegetation on cropland throughout much of the watershed. Recommended BMPs include additional land conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices installation where gully erosion is present and filter strips where cropland abuts drainage channels. BMPs that effect water temperature include those that help establish riparian vegetation. Implementation of cropland BMPs are a high priority in this watershed.

Hay is cut on approximately 1,500 acres; grass covers additional 1,800 acres. About 115,000 feet of stream channel intersects hayland or grassland acres. Much of the hayland and some grassland is likely grazed after cutting. Because ungrazed hayfields and grass fields are not generally a large contributor of sediment or bacteria, no specific BMPs that address nutrients, sediment or bacteria are recommended for hayland or grassland other than to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone. Only BMPs that address temperature concerns are recommended.

It is probable some of the sediment and bacteria contributions to the drainage system originate from the concentrated presence of a limited number (200-300) of livestock in pastures (240 acres) that abut stream channels. Pastures abut an estimated 20,000 feet of stream channel. BMPs implemented to limit livestock access to the riparian area, increase stream canopy, and help stabilize channel banks should be given high priority. BMPs recommended are removal of livestock from these areas, development of offsite watering sites, or riparian use exclusion by fencing. Runoff diversion from concentrated winter feed areas would be beneficial to water quality. Spot channel bank stabilization should be implemented as site conditions indicate.

Best Management Practices recommendations for the Pine Creek watershed, with associated cost estimates are listed in Table T.

Table T. Pine Creek Recommended BMPs

Future Level of Treatment for Dry Cropland				
Dry Cropland	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Dry Cropland	Ac.	4,040		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	1,000	$ 90,000	$ 15,000
Residue Mgmt. Mulch Till (345)	Ac.	1,000	$ 45,000	$ 15,000
Wtr.& Sediment Control Basin(638)	No.	25	$ 100,000	$ 3,000
Filter Strip (393)	Ac.	27	$ 2,700	$ 54
Riparian Forest Buffer (391)	Ac.	9	$ 13,500	$ 135
Riparian Herbaceous Cover (390)	Ac.	9	$ 2,700	$ 27
Tree/Shrub Establishment (612)	Ac.	9	$ 4,185	$ 42
Total RMS Costs			**$ 258,085**	**$ 33,258**

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	3,530		
Channel Bank Vegetation (322)	Ac.	4	$ 20,700	$ 414
Channel Stabilization (584)	Ft.	7,220	$ 144,400	$ 7,220
Fence (382)	Ft.	40,000	$ 80,000	$ 1,600
Riparian Forest Buffer (391)	Ac.	88	$ 132,000	$ 1,320
Riparian Herbaceous Cover (390)	Ac.	88	$ 26,400	$ 264
Tree/Shrub Establishment (612)	Ac.	88	$ 40,920	$ 409
Watering Facility (614)	No.	10	$ 10,500	$ 105
Total RMS Costs			$ 454,920	$ 11,332

Big Bear Creek

Big Bear Creek is a south-facing watershed of approximately 61,000 acres. The drainage area includes 51,500 acres of private lands. State lands (3,400 acres) are distributed in several areas near the watershed divide. Clearwater National Forest lands (5,800 acres) are located in the northwest corner of the watershed. Forty acres of BLM land is located just south of Dry Creek Road, in the lower central portion of the watershed. Headwaters originate six miles northwest of the town of Deary; the creek flows north to south for about 22 miles before reaching its outlet immediately southwest of the Kendrick High School. Location relative to other TMDL watersheds is shown on Figure 8.

The most heavily forested lands (20,740 acres) are located in the northern third of the watershed. Open forest and shrublands (16,100 acres) cover much of the remaining watershed and are grazed by livestock. Wastewater treatment facilities are located within the watershed adjacent to the communities of Deary and Kendrick. Figure 17 of the *TMDL Watersheds Descriptions* section shows landuse distribution.

Estimated agricultural acres in the Big Bear Creek watershed are:

Crop	7,360 acres
CRP	5,910 acres
Grass Crop	130 acres
Hay	4,600 acres
Pasture	1,080 acres

An additional 4,400 acres of privately managed grass and grassy shrubland is located within the watershed on which livestock may potentially graze.

Agricultural Activities

The drainage contains about 19,090 acres of agricultural lands; this is the second highest total of the TMDL watersheds. Cropland makes up only about 12% (7,370 acres) of the Big Bear Creek watershed; but this is the third highest cropland total for the TMDL watersheds. About 5,900 acres of agricultural lands are set aside in the Conservation Reserve Program. Approximately 4,600 acres are planted to hay and about 130 acres of cropped grass.

Pasture lands comprise 1,080 acres, much of it near State Highway 9 which links Deary to Harvard. Concentrated grazing by cattle occurs at several riparian sites; a winter feed area has been relocated outside the riparian zone. Approximately 104 horses and 143 cattle were observed on a drive through the watershed; several llamas, goats, and sheep were also present. Dispersed cattle forage on forest lands and shrublands.

Water Quality Concerns

According to IDEQ, Big Bear Creek is not supporting its beneficial uses, and is listed for temperature and bacteria in Section 5 of the 2008 Integrated Report (IDEQ, 2008). TMDL analyses were completed for the two pollutants. Beneficial uses are listed as Cold Water Aquatic Life, Salmonid Spawning and Secondary Contact Recreation.

Big Bear Creek is 5th of 13 TMDL watersheds in priority for BMP installation; it has 84% private lands. TMDLs showed a 16% lack of shade, the third lowest of the TMDL watersheds in the Potlatch Subbasin. The Big Bear Creek drainage has the third highest cropland and second highest agricultural land acreage totals. There is significant hayland and pasture. Concentrated livestock grazing occurs in the riparian area; there is at least one winter feeding operation. Recent monitoring (2006-2008) showed both DO and temperature exceedances, but not bacteria exceedances.

The highest overall fish densities present in electrofishing sites in 2003-2004 IDFG surveys were found in large canyon streams such as Big Bear Creek (Bowersox et al. 2006). Dace and rainbow/steelhead trout constituted the majority of fish sampled. A natural barrier in Big Bear Creek exists about 5.6 miles above the mouth. Although characterized as impassible for adult steelhead in several studies (Johnson 1985 and Shriever and Nelson, 1999) at least one rainbow/steelhead was observed above the barrier by Bowersox, et. al (2006). Upper Big Bear Creek is listed as the highest priority for restoration by IDFG (Bowersox et. al, 2006).

Temperature exceedances probably result from a lack of stream canopy cover associated with upland agricultural acres and open grassy riparian areas; they are also partially due to natural conditions at the monitoring sites.

Recommended Treatments

Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover, in places, to help meet the the shade target as vegetation matures. Where establishment of vegetation is endangered by livestock presence, the riparian corridor should be fenced off to exclude grazing.

Table U. Big Bear Creek Recommended BMPs.

Future Level of Treatment for Dry Cropland				
Dry Cropland	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Dry Cropland	Ac.	7,360		
Riparian Forest Buffer (391)	Ac.	30	$ 45,000	$ 450
Riparian Herbaceous Cover (390)	Ac.	30	$ 9,000	$ 90
Tree/Shrub Establishment (612)	Ac.	30	$ 13,950	$ 418
Total RMS Costs			**$ 67,950**	**$ 958**

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	6,310		
Fence (382)	Ft.	122,000	$ 244,000	$ 4,880
Riparian Forest Buffer (391)	Ac.	92	$ 138,000	$ 1,380
Riparian Herbaceous Cover (390)	Ac.	92	$ 27,600	$ 276
Tree/Shrub Establishment (612)	Ac.	92	$ 42,780	$ 428
Use Exclusion (472)	Ac.	92	$ 3,220	$ 97
Total RMS Costs			**$ 455,600**	**$ 7,061**

Corral Creek

Corral Creek is a south facing watershed of about 14,350 acres in size. Most of the land in the Corral Creek drainage is managed by the Clearwater National Forest (7,400 ac), with an additional 3,000 acres of forest land managed by the state; remaining forest is privately owned. The community of Helmer is located in the southeastern portion of the watershed along State Highway 3 which transects the southern third of the drainage area. Most federal and state lands are located north of State Highway 3 with USFS lands located primarily in the upper third of the watershed. Most private lands are in the lower half of the drainage. Location of Corral Creek relative to other TMDL watersheds is shown on Figure 8.

Forested lands comprise more than 85% of the watershed. Most forested areas within the southern portion of the watershed are relatively open; more heavily forested tracts are located north of the old railroad grade above the town of Helmer and in steeper canyon localities. Meadows and grassy shrubland are located adjacent to stream channels on forest lands. Figure 16 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural acres in the Corral Creek watershed are:

Crop	280 acres
CRP	510 acres
Pasture	80 acres
Hay	200 acres

There are an additional 900 acres of privately managed grass and grassy shrubland located within the watershed on which livestock may graze.

Agricultural Activities

The watershed contains about 1,070 acres of agricultural lands. Less than 300 acres of uplands are cropped with an additional 500 acres set aside in CRP; these agricultural lands are located within the southern one-third of the drainage area. Approximately 200 acres are hayland and about 80 acres are pasture. Scattered livestock grazing occurs throughout the watershed; grass stands, open shrubland, and forest meadow areas are generally the most heavily grazed.

Water Quality Concerns

Corral Creek was §303(d) listed from its headwaters to the Potlatch River for sediment. Beneficial uses are cold water aquatic life, salmonid spawning and secondary contact recreation. IDEQ (2008) determined that recreation beneficial use was fully supported but salmonid spawning and cold water aquatic life uses were not; this was due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that sediment be removed from the list of impairments.

Corral Creek is 6th of 13 TMDL watersheds in priority for BMP installation. TMDLs showed a 23% lack of shade for Corral Creek, the third highest of the TMDL watersheds in the Potlatch Subbasin. There is significant livestock grazing in the watershed. Recent monitoring (2006-2008) showed both bacteria and temperature exceedances.

The fish study conducted by IDFG (Bowersox, et. al., 2006) listed this creek as 8th highest restoration priority and 16th highest protection priority of 23 streams in the Potlatch River subbasin surveyed. Rainbow/steelhead were observed in Corral Creek. A fish migration barrier was identified under the old railroad grade north of Helmer.

Extensive stream restoration is currently being implemented in this watershed. An entire section of the railroad grade where Corral Creek flows through a box culvert was identified as a migration barrier for steelhead. It has already been removed and riparian vegetation is being established. Recontouring of the stream channel and riparian planting further upstream is also underway.

Recommended Treatments

Cropland only makes up 2% of the watershed; sediment and nutrients are not considered pollutant problems requiring BMP treatment at this time. Hay is cut on approximately 200 acres; grass covers an additional 900 acres. About 89,000 feet of stream channel intersects hayland or grassland acres. Much of the hayland and some grassland is likely grazed after cutting. Because ungrazed hayfields and grass fields are not generally a large contributor of sediment or bacteria, no specific BMPs that address nutrients, sediment or bacteria are recommended for hayland or grassland other than to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone. Only BMPs that address temperature concerns are recommended.

Temperature is the identified pollutant of concern, but several bacteria exceedances were noted in the most recent monitoring. Several BMPs are recommended to complement existing restoration work currently being performed within the watershed. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover to help meet the shade target. Recommendations include exclusion of the stream corridor by fencing where livestock might access the channel; water gaps may be an acceptable alternative to offsite watering if monitoring determines bacteria exceedances are not caused by livestock.

Table V. Corral Creek Recommended BMPs.

Future Level of Treatment for Private Agricultural Lands Riparian				
Private Riparian Ag Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Ag Lands	Ac.	1,070		
Fence (382)	Ft.	63,200	$ 126,400	$ 1264
Riparian Forest Buffer (391)	Ac.	47	$ 70,500	$ 705
Riparian Herbaceous Cover (390)	Ac.	47	$ 14,100	$ 141
Tree/Shrub Establishment (612)	Ac.	47	$ 21,855	$ 219
Use Exclusion (472)	Ac.	47	$ 1,645	$ 49
Watering Facility (614)	Each	6	$ 6,300	$ 63
Total Costs			**$ 240,800**	**$ 2,441**

West Fork Little Bear Creek

The West Fork of Little Bear Creek drains approximately 19,800 acres. The watershed is entirely private lands with the exception of 924 acres of state land located within headwater areas of the Felton Creek and Big Meadow Creek tributaries. The West Fork Little Bear Creek is approximately 12 miles long, originating roughly five miles northwest of Troy, Idaho. The stream flows southeast, through the town of Troy and down a narrow canyon, before entering Little Bear Creek.

Landuse distribution is shown in Figure 18. The most heavily forested areas are located above Highway 8. Much of the drainage is open forest or shrublands. Estimated agricultural landuse acres in the West Fork Little Bear watershed are:

Cropland	1,860 acres
CRP	2,867 acres
Grass Crop	110 acres
Hay	760 acres
Pasture	390 acres
Tree Farm	50 acres

Agricultural Activities

The watershed contains about 6,040 acres of agricultural lands that potentially contribute to the pollutant load. There is little active cropland (1,860 acres) but an additional 2,870 acres are set aside in the Conservation Reserve Program. Another 900 acres are planted to grass or hay. Pasture lands cover almost 400 acres.

Water Quality Concerns

Of the TMDL watersheds, the West Fork Little Bear Creek is the seventh highest priority for BMP implementation. It has the seventh highest cropland acreage and seventh most agricultural lands acres. Water quality problems appear to be related primarily to a point source (Troy WWTP) rather than nonpoint sources. Although there may be some temperature concerns throughout the rest of the watershed, no shade target was established in the TMDL document. The potential of nutrient contribution to the pollutant load from cropland is somewhat limited; few cropped fields abut drainages above the WWTP.

Although the West Fork of Little Bear Creek is not currently listed on the 303(d) list as water quality impaired, the IDEQ concluded from their monitoring efforts in 2002 that the stream is, in fact, water quality limited due to high levels of nitrate measured below the City of Troy WWTP. When West Fork flows were less than 1.5 cfs, dissolved oxygen measurements were below 6.0 mg/L. A TMDL was developed by IDEQ for total inorganic nitrogen (TIN) in this stream. Data collected in 2008 affirmed that water quality standards for nutrients, temperature and bacteria are being exceeded in the West Fork of Little Bear (IASCD, 2010).

The fish study conducted by IDFG (Bowersox et. al, 2006) concluded the West Fork of Little Bear Creek had the highest rainbow/steelhead trout density of all sampled streams in the Potlatch River watershed, with a mean density of 13.2 fish/100 m^2.

Recommended Treatments

No application of BMPs is deemed necessary at the present time. Temperature appears to be a concern on private lands, but no shade target was set by IDEQ. Additional monitoring, to justify expending funds, prior to BMP implementation is advisable until the point vs. nonpoint pollutant source problem is fully sorted out.

A BMP list is provided for future deliberation, if subsequent monitoring confirms a nonpoint related water temperature problem exists. Recommendations include exclusion of the stream corridor by fencing; water gaps may be an acceptable alternative to offsite watering if monitoring determines bacteria exceedances are not caused by livestock. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover.

Table W. West Fork Little Potlatch Creek Potential Recommended BMPs.

Future Level of Treatment for Private Agricultural Lands Riparian				
Private Riparian Ag Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Ag Lands	Ac.	9,450		
Fence (382)	Ft.	68,000	$ 136,000	$ 1,360
Riparian Forest Buffer (391)	Ac.	31	$ 46,500	$ 465
Riparian Herbaceous Cover (390)	Ac.	31	$ 9,300	$ 93
Tree/Shrub Establishment (612)	Ac.	31	$ 14,415	$ 144
Use Exclusion (472)	Ac.	31	$ 1,085	$ 33
Watering Facility (614)	Each	3	$ 3,150	$ 32
Total Costs			**$ 210,450**	**$ 2,127**

Upper Potlatch River (above Moose Creek)

The Upper Potlatch River watershed (above Bovill) is primarily forest lands and about 26,250 acres in size. Most (17,680 acres) of the land drained by the Upper Potlatch River is managed by the Clearwater National Forest. Private forest lands (4,500 acres) are scattered throughout the watershed. The lower portion is privately owned. State of Idaho lands (4,500 acres) mixed with private lands make up the southernmost quarter of the watershed area. Location of the Upper Potlatch River area relative to other TMDL watersheds is shown on Figure 8.

Figure 9 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres in the Upper Potlatch watershed are:

Crop	13 acres
CRP	17 acres
Pasture	130 acres

Grass\Shrub 640 acres (non-public lands)

Agricultural Activities

Only 13 acres of cropland were noted for the watershed area, along with 17 acres of CRP lands. The primary land uses in the watershed are forestry, grazing, and recreational activities. In addition to scattered grazing on forestlands, some of the most concentrated cattle grazing observed within the Potlatch River subbasin was noted in forest meadows along the West Fork Potlatch River drainage system.

Pastureland, forest meadows and open grassed shrubland grazed by livestock abuts drainages throughout the watershed. Private lands in this category total about 770 acres. Dispersed cattle forage on other forest lands. Approximately 155 cattle and 8 horses were observed during September during a quick drive-by survey.

Water Quality Concerns

The Upper Potlatch River (or West Fork) is §303(d) listed for sediment, nutrients, temperature, and bacteria; the boundaries are defined as headwaters to Moose Creek. The designated beneficial uses for this assessment unit include salmonid spawning, cold water aquatic life, primary contact recreation, and domestic water supply. Little or no erosion occurs, and any sediment transported from the uplands settles in the meadows. Based on monitoring data, IDEQ developed TMDLs for bacteria and temperature and recommends that this headwaters portion of the Potlatch River be de-listed for sediment and nutrients.

Much of the pollutant load is likely attributable to livestock presence. Bacteria concentration increases may be due to livestock grazing and watering along the creek; four bacteria exceedances were recorded during the 2002 monitoring. Livestock activity in the riparian area also tends to break down streambanks and contribute to channel erosion. More recent monitioring by IASCD (2006–2008) showed two bacteria exceedances and two DO violations; the presence of a beaver pond immediately upstream of the monitoring site clouds the connection of violations to livestock presence. More monitoring is needed.

Any existing temperature problems relative to agricultural acitvities would be located in the pasture\meadow areas. IDEQ (2008) set the shade target at 18%. Temperature levels exceeded state criteria in about one/third of measurements (IASCD, 2010). Exceedances may result from a lack of stream canopy cover associated with several large meadows within the watershed. Temperature exceedances could also be due to a beaver pond immediately above the monitoring site serving as a heat sink. Shade target deficiencies are likely due lack of riparian canopy on the few pastureland acres along the lower channel stretch as well as riparian areas denuded of canopy within open grassy shrublands and meadows further upstream in the watershed.

The West Fork Potlatch River had the highest fish densities of all subbasin streams inventoried by IDFG during 2003 and 2004. More than 4,600 fish were observed by snorkeling. Redside shiner and dace were the predominant fish species comprising more than 80% of the total numbers observed. Rainbow/steelhead trout comprised about 3% of the total numbers recorded; brook trout and sculpin were also present (Bowersox et.al., 2006).

Recommended Treatments

There are relatively few (160) acres of agricultural lands within the Upper Potlatch River watershed. Many other riparian areas such as forest meadows and open grassy shrublands are grazed by livestock. It is probable much of the sediment and bacteria contributions to the drainage system originates from the concentrated presence of a limited number of livestock in pastures and open forest areas that abut stream channels. Private grasslands likely to be grazed abut 44,000 feet of stream channel. BMPs implemented to limit livestock access to the riparian area, help stabilize channel banks, and restore riparian canopy should be given priority.

Additional monitoring, to justify expending funds, prior to BMP implementation is advisable. A BMP list is provided for future deliberation, if subsequent monitoring confirms a water quality problem exists. Recommendations include exclusion of the stream corridor by fencing; water gaps may be an acceptable alternative to offsite watering if monitoring determines bacteria exceedances are not caused by livestock. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover. BMP recommendations, with associated cost estimates are listed in Table X.

Table X. Upper Potlatch River Recommended BMPs.

Future Level of Treatment for Private Grass\Pasture Areas				
Private Grass\Pasture Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Grass\Pasture	Ac.	790		
Fence (382)	Ft.	89,000	$ 178,000	$ 3,560
Riparian Forest Buffer (391)	Ac.	54	$ 81,000	$ 810
Riparian Herbaceous Cover (390)	Ac.	54	$ 16,200	$ 162
Tree/Shrub Establishment (612)	Ac.	54	$ 25,110	$ 251
Use Exclusion (472)	Ac.	54	$ 1,890	$ 57
Watering Facility (614)	Each	4	$ 4,200	$ 42
Total Costs			**$ 306,400**	**$ 4,882**

Potlatch River (Moose Creek to Corral Creek)

The drainage area described for this reach of the Potlatch River is approximately 18,500 acres in size. Most of the land is managed by the Clearwater National Forest (12,082 ac). Private lands (4,960 ac) are distributed throughout the area, with 1,480 acres of state lands located mostly in the northeastern corner. The town of Bovill is also located in the northeastern corner and is sited near the intersection of State Highway 3 and State Highway 8. The community of Helmer is located adjacent, but outside, the west-central edge of the watershed along Highway 3. Location relative to other TMDL watersheds is shown on Figure 8.

In addition to Potlatch River face watersheds along this stretch of river; the drainage area for Hog Meadow Creek and Little Boulder Creek tributaries is included in the described area. Forested lands comprise more than 80% of the watershed. Heavily forested areas dominate with more open forest areas in localities where recent timber harvest has occurred or adjacent to forest meadows along the Potlatch River and its tributaries. Several old revegetated clay pits are located a few miles west of Bovill. The watershed has about 620 acres of agricultural lands. Additional acres of privately owned forest meadow are grazed by livestock.

Figure 20 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres in the Moose to Corral Creek drainage area:

Crop	126 acres
CRP	92 acres
Hay	47 acres
Pasture	346 acres
Meadow\Grass	620 acres (non-public lands)

Agricultural Activities

Agricultural lands are mostly located close to the towns of Bovill or Helmer, with cropland acres located near the end of Old Park Road at the southwest edge of the drainage area. About 126 acres are cropped with an additional 92 acres set aside in CRP. Approximately 50 acres are hayland and about 350 acres are pasture. Livestock grazing occurs throughout the watershed; meadow areas are generally the most heavily grazed with the Hog Meadow Creek drainage showing heavy concentrations of cattle. Horses are pastured on several small tracts near the intersection of Forks Road and Highway 3. Grass meadows and grassy shrubland is located adjacent to stream channels on forest lands.

Water Quality Concerns

The Potlatch River from the mouth of Moose Creek to Corral Creek was §303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ

(2008) determined that beneficial uses were not fully supported due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that the other reported impairments be removed from the list. More recent monitoring by IASCD (2006–2008) showed seven bacteria exceedances and two DO violations at the upper monitoring site near Bovill. Seasonal cattle grazing occurred directly upstream from this monitoring station and could have contributed to the increased levels of *E. coli* that were observed. An additional two bacteria violations were noted at the Little Boulder Creek Campground site, but likely are not livestock related.

Any existing temperature problems relative to agricultural acitvities would be located in the pasture\meadow areas. IDEQ (2008) set the shade target at 22%. Temperature levels exceeded state criteria in about one-half of measurements taken during the more recent monitoring effort (IASCD, 2010). In addition to open agricultural lands, temperature exceedances may result from a lack of stream canopy cover associated with several large meadows within the watershed.

The Upper Potlatch River is listed as the 13th highest priority out of 23streams for restoration and 7th for protection by IDFG (Bowersox et al. 2006).

Recommended Treatments

There are relatively few (612) acres of agricultural lands within the Moose Creek to Corral Creek Potlatch River reach drainage area. Riparian areas located in forest meadows and open grassy shrublands are grazed by livestock; private lands of this type total about 620 acres. It is probable much of the pollutant contributions to the drainage system originates from the concentrated presence of a limited number of livestock in pastures and open forest areas that abut stream channels. Private grassed lands likely to be grazed abut 52,500 feet of stream channel. BMPs implemented to limit livestock access to the riparian area, help stabilize channel banks, and restore riparian canopy should be given the highest priority.

Additional monitoring, to justify expending funds, prior to BMP implementation is advisable. A BMP list is provided for future deliberation, if subsequent monitoring confirms a water quality problem exists. Recommendations include exclusion of the stream corridor by fencing; water gaps may be an acceptable alternative to offsite watering if monitoring determines bacteria exceedances are not being caused by livestock. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover. BMP recommendations, with associated cost estimates are listed in Table Y.

Table Y. Potlatch River (Moose Creek to Corral Creek) Recommended BMPs.

Future Level of Treatment for Private Riparian Areas				
Private Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Ag Lands	Ac.	1,250		
Fence (382)	Ft.	52,500	$ 105,000	$ 1,050
Riparian Forest Buffer (391)	Ac.	17	$ 25,500	$ 255
Riparian Herbaceous Cover (390)	Ac.	17	$ 5,100	$ 51
Tree/Shrub Establishment (612)	Ac.	17	$ 7,905	$ 79
Use Exclusion (472)	Ac.	17	$ 1,890	$ 57
Watering Facility (614)	Each	4	$ 595	$ 18
Total Costs			**$ 145,990**	**$ 1,510**

Potlatch River, (Corral Creek to Big Bear Creek)

The drainage area described for this reach of the Potlatch River is approximately 26,470 acres in size. Almost 90% of the land is privately managed (23,600 ac). Some USFS lands (315 ac) lie just below the Corral Creek mouth, with state lands (2,310 ac) located mostly in the northern tip of the Brush Creek watershed and at the mouth of Rock Creek. About 80 acres of BLM ground is located along the river below Rock Creek. The town of Deary is located adjacent but outside the northwest edge of the area along State Highway 3. The community of Kendrick is located just southwest of the bottom of the river reach. Location relative to other TMDL watersheds is shown on Figure 8.

Forested lands are located in upland areas within and adjacent to the river canyons and comprise about half of the watershed; the more heavily forested areas generally occur in the northern third of the drainage area. Grassy shrubland is located adjacent to stream channels on forested lands and on upland areas adjacent to the river canyon. State Highway 3 roughly parallels the watershed to the west from Kendrick to Deary, where it merges with Highway 8, turns west, and splits the Brush Creek drainage. Landuse distribution is illustrated in Figure 21.

Cropland is found primarily on uplands adjacent to the lower third of the river reach. About 5,600 acres are cropped with an additional 1,900 acres set aside in CRP. Approximately 550 acres are hayland and about 1,030 acres are pasture. Livestock grazing occurs throughout the watershed but free ranging cattle appear to be less abundant than in adjacent watershed areas. A tree farm is located along the central part of the western drainage divide.

Estimated agricultural landuse acres in the watershed are:

Cropland	5,580 acres
CRP	1,900 acres
Grass Crop	340 acres
Hay	550 acres
Pasture	1,035 acres
Tree Farm	46 acres

Agricultural Activities

About 36% of the watershed, or 9,450 acres are agricultural lands. Approximately 20% of agricultural lands are enrolled in CRP, or about 7% of the entire watershed. Some CRP fields may have been retired or grass stands re-established due to weed problems. Approximately 2,000 non-CRP acres are in some sort of grass cover; about 17% of those acres appear to be cropped grass. Hay is grown in several localities scattered throughout the drainage area. Significant pastureland (1,035 acres) was noted in the watershed. Approximately 320 cattle and 43 horses were observed on a drive through the watershed; dispersed cattle forage on forest lands and shrublands.

Water Quality Concerns

The Potlatch River from the mouth of Corral Creek to Big Bear Creek was §303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses are cold water aquatic life, salmonid spawning, primary contact recreation and drinking water supply. IDEQ (2008) determined that beneficial uses were not fully supported due to temperature impairments. A TMDL was completed for temperature, but IDEQ recommended that the other reported impairments be removed from the list.

The Corral Creek to Big Bear Creek stretch of the Potlatch River drainage area is the 10th highest priority for implementation of BMPs. Of the TMDL watersheds, the watershed draining to the Corral Creek to Bear Creek Potlatch river reach has the fourth highest cropland acreage, fifth highest agricultural lands total, second highest sediment load, several bacteria violations, and the lowest shade target. Recent monitoring confirms temperatures continue to be a concern.

The Lower Mainstem Potlatch River is listed as the 11th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 20th for protection. The Upper Mainstem Potlatch River is listed as the 13th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006) and 7th for protection. The Potlatch River stretch from Corral Creek to Bear Creek incorporates portions of both reaches.

Temperature exceedances are partially due to a lack of stream canopy cover on agricultural acres within the uplands that drain to the Potlatch River and mostly due to natural conditions above the monitoring sites on the Potlatch River. The Potlatch River, for much of this reach, flows through canyon landscapes with natural canopy cover that cannot shade the existing channel width from solar radiation. The temperature TMDL indicates that existing shade meets natural vegetative conditions with an average excess shade of 1.6%.

Recommended Treatments

Temperature is the only TMDL water quality concern for this reach. The TMDL indicates that this reach of the Potlatch River meets the natural vegetative target. No BMP installation is recommended until an investigation is conducted to determine the best implementation sites and an evaluation of the likelihood of achieving the desired results. Since application of additional shade is unlikely to have any effect if implemented along the Potlatch River channel, BMP implementation should occur in unshaded upland areas, if it occurs at all.

If the desired result is to meet the TMDL shade target, this target has already been met. If additional reductions in water temperature are deemed desirable, stream canopy beyond estimated natural conditions would need to be established.

Woody vegetation within a 30 foot buffer could be established to enhance stream canopy cover in open riparian areas; this includes hayland, pasture, and cropland in addition to open grass covered areas. To enhance the survival of riparian vegetation to help meet the shade target, these areas should be fenced to exclude livestock and wildlife. BMP recommendations, with associated cost estimates are listed in Table Z.

Table Z. Potlatch River (Corral Creek to Big Bear Creek) Recommended BMPs.

Future Level of Treatment for Private Agricultural Lands Riparian				
Private Riparian Ag Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Ag Lands	Ac.	9,450		
Fence (382)	Ft.	22,000	$ 44,000	$ 440
Riparian Forest Buffer (391)	Ac.	17	$ 25,500	$ 256
Riparian Herbaceous Cover (390)	Ac.	17	$ 5,100	$ 51
Tree/Shrub Establishment (612)	Ac.	17	$ 7,905	$ 79
Use Exclusion (472)	Ac.	17	$ 595	$ 18
Watering Facility (614)	Each	3	$ 3,150	$ 32
Total Costs			**$ 86,250**	**$ 876**

Boulder Creek

The Boulder Creek Watershed is roughly 11,500 acres in size. The watershed is entirely privately owned with the exception of about 40 acres managed by the Clearwater National Forest. Location of Boulder Creek relative to other TMDL watersheds is shown on Figure 8. It is the third lowest priority for implementation of BMPs. Watershed location within the Potlatch Subbasin is shown in Figure 8 of the *TMDL Watersheds Descriptions* section.

Forestland makes up about 80 percent of the watershed. Boulder Creek watershed has about 1,400 acres that could be classified as agricultural. Landuse distribution is shown in Figure 13.

Estimated agricultural landuse acres in the Boulder Creek Watershed are:

Hay	810 acres
CRP	470 acres
Pasture	80 acres
Cropland	30 acres

Agricultural Activities

Agricultural lands consist primarily of hayland, CRP, pasture and a few acres of cropland. Most agricultural lands are located near the community of Park, in the west-central portion of the watershed; a smaller pod of agriculture is located in the extreme southwestern corner of the drainage area.

Cattle likely graze in the more open private forest lands throughout the watershed. In a September roadside survey of landuses, some goats (20) and a few head of cattle were observed in a pasture area in the southwest corner of the watershed; about 35 cattle and 23 horses were seen on the same day near the community of Park.

Water Quality Concerns

Boulder Creek, from Pig Creek to its mouth is §303(d) listed for unknown pollutants; it drains the forested hills east of the community of Park. Boulder Creek was determined as not fully supporting salmonid spawning or contact recreation beneficial uses. As a result, TMDLs were developed for temperature and bacteria. The stream was determined to be supporting its beneficial use of cold water aquatic life (IDEQ 2008). TMDLs showed a 16% lack of shade for Boulder Creek. A bacteria load reduction was recommended by IDEQ.

Temperature exceedances probably result from a lack of stream canopy cover; this is most prevalent within the agricultural lands and open forest areas. Two exceedances of the bacteria standard for secondary contact recreation were reported by the more recent (2006-2008) monitoring effort (IASCD, 2010). Bacteria concentration increases may be due to livestock grazing and watering along the creek; since no livestock were observed in the monitoring site vicinity, the pollutant might be wildlife related.

Boulder Creek has a falls at stream mile 1.2 that probably acts as a migration barrier to anadromous and resident fluvial fish (Schriever and Nelson 1999). No rainbow/steelhead trout were found in Boulder Creek during a 2003-2004 IDFG survey. According to survey results, Boulder Creek is listed as the 16th highest priority for restoration by

IDFG. In streams prioritized in terms of protection, Boulder Creek ranked 8th highest out of 23 streams (Bowersox et al. 2006).

Recommended Treatments

There are few (30) acres of cropland within the Boulder Creek watershed. More CRP acres (470 acres) exist in the watershed than cropland. Cropland is not a source of bacteria; it is also unlikely to be a major source of sediment delivery to the drainage system. Implementation of cropland BMPs are a low priority in this watershed.

Some of the hayland (800+ acres) is grazed after cutting. Livestock presence is scattered and seasonal; impact to water quality is likely minimal due to general lack of runoff during the fall. Because ungrazed hayfields are not generally a large contributor of sediment or bacteria, no specific BMPs are recommended except to limit grazing on these lands to times when runoff is unlikely and exclude cattle from the riparian zone.

It is probable much of the bacteria contributions to the drainage system originates from the concentrated presence of a limited number of livestock in pastures (80 acres) that abut stream channels. Pastures border an estimated 3,000 feet of stream channel. BMPs implemented to limit livestock access to the riparian area should be given the highest priority. BMPs considered should be removal of livestock from these areas, development of offsite watering sites, or riparian use exclusion by fencing.

Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover in open riparian areas; this includes hayland, pasture and cropland in addition to open grass covered areas. To enhance the survival of riparian vegetation to help meet the shade target, these areas should be fenced to exclude livestock and wildlife. BMP recommendations, with associated cost estimates are listed in Table Aa.

Table Aa. Boulder Creek Recommended BMPs

Future Level of Treatment for Private Grass\Pasture\Hay Lands				
Private Riparian GPH	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Riparian GPH	Ac.	2,330		
Fence (382)	Ft.	18,000	$ 36,000	$ 360
Riparian Forest Buffer (391)	Ac.	15	$ 22,500	$ 225
Riparian Herbaceous Cover (390)	Ac.	15	$ 4,500	$ 45
Tree/Shrub Establishment (612)	Ac.	15	$ 6,975	$ 70
Use Exclusion (472)	Ac.	15	$ 525	$ 16
Watering Facility (614)	Each	3	$ 3,150	$ 32
Total Costs			$ 73,650	$ 748

East Fork Potlatch River

The East Fork Potlatch River originates in the northwest corner of Clearwater County and flows southwest to its confluence with the mainstem between Moose Creek and Corral Creek. Mean annual flow is estimated at about 62 cfs (IDEQ, 2008). Ruby Creek is a tributary to the East Fork Potlatch River. Location relative to other TMDL watersheds is shown on Figure 8.

The East Fork Potlatch River has a forested watershed, almost 40,000 acres in size, when Ruby Creek is included. Most lands are private timberland (25,600 ac); the state of Idaho (8,800 ac) and US Forest Service (4,800 ac) manage the remaining acres. No cropland or hayland is present in the watershed, but approximately 60 acres are in CRP.

Approximately 150 acres of pasture was noted, mostly in meadow lands just east of Bovill; a few acres of pasture were observed near the East Fork mouth and along the Ruby Creek drainage. Livestock graze an additional 700 acres of forest meadow and other open forest lands. Active timber harvest is occurring within the watershed; some appears to be clearcut. A state tree farm was also noted. Land use distribution is shown in Figure 12.

Estimated agricultural landuse acres in the East Fork Potlatch Watershed are:

Pasture	150 acres
CRP	100 acres
Tree Farm	10 acres
Grazed Meadow	730 acres

Agricultural Activities

Agricultural activities are practiced in only a small portion (3%) of the watershed, primarily grazing a few miles east of Bovill. Little cumulative water quality impact can be attributed to agriculture in this forested watershed. About 100 head of cattle and 20 horses were observed in September. Most livestock were dispersed in meadow areas adjacent to tributary channels.

Water Quality Concerns

Of the TMDL watersheds, the East Fork Potlatch River is the second lowest priority for BMP implementation. It has no cropland acreage and less than 300 acres of agricultural lands; some additional grasslands are grazed by livestock. With the exception of bacteria exceedances at the mouth of Ruby Creek, the water quality concern is temperature only. The shade target is moderate (19%). There has been no water quality monitoring, for parameters other than temperature, conducted in the last few years; hence, there is no confirmation of additional pollutant concerns.

The East Fork Potlatch River was §303(d) listed only from Ruby Creek downstream for sediment, nutrients, temperature and bacteria. Designated beneficial uses are salmonid spawning, coldwater aquatic life, and recreation. IDEQ (2008) determined temperature to be problematic and developed a TMDL. No obvious sediment or nutrient problems related to agricultural activities were observed. Minor bank trampling occurs where cattle graze. It was recommended that the remaining pollutants be removed from the list of impairments.

According to IDEQ (2008), Ruby Creek is 303(d) listed for bacteria, nutrients, sediment and temperature. Beneficial uses are the same as the East Fork. TMDLs were developed for temperature and bacteria. It was recommended that nutrients and sediment be removed from the list of impairments.

The East Fork is listed as the 19th highest priority out of 23 streams for restoration by IDFG (Bowersox et al. 2006). Its tributaries Bobs Creek and Pivash Creek are prioritized 23rd and 18th, respectively. Of streams prioritized in terms of protection, the East Fork is ranked 2nd highest, with Bobs Creek 1st and Pivash Creek 4th , out of the 23 streams inventoried during 2003-2004. Ruby Creek is prioritized as 14th for restoration, and 6th for protection.

Any existing temperature problems relative to agricultural acitvities would be located in the pasture\meadow areas. IDEQ (2008) set the shade target at 19%. Numerous standard exceedances were recorded during the summers of 2004 to 2007 at the mouth of the East Fork (Dansart, 2008). Exceedances probably result from a lack of stream canopy cover associated with several large meadows within the watershed as well as lack of riparian canopy on the few agricultural acres along the lower channel. This is, to a large extent, a natural condition. The monitoring site is located at the end of a long stretch of east to west flowing stream; this channel stretch provides maximum exposure to solar radiation during most daylight hours. Elevated bacteria concentrations reported for Ruby Creek were likely due to a pasture located at the mouth, adjacent to the monitoring site.

Recommended Treatments

With the exception of the potential bacteria source near the mouth of Ruby Creek, the water quality problem identified is elevated stream temperatures. Due to the lack of agricultural lands, limited application of BMPs is deemed necessary at the present time. BMPs should focus on providing additional stream canopy cover in meadow areas; a BMP list is provided for future deliberation. Additional monitoring, to prioritize expending limited funds, prior to BMP implementation is advisable. In the future, consideration should be given to working with the livestock owner(s) that graze livestock along the East Fork Potlatch to encourage removal or exclusion of animals from the riparian zone; this would promote natural canopy regeneration and protect vegetative BMPs that may be installed.

Recommendations include exclusion of meadow stream corridors by fencing; water gaps would be acceptable if no future sediment or bacteria problem are identified. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover. Potential future BMPs to consider, with cost estimates, are listed in Table Ba.

Table Ba. East Fork Potlatch River Recommended BMPs (potential future work).

Future Level of Treatment for Pasture/Grass Lands				
Pasture/Meadows	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture Lands	Ac.	950		
Fence (382)	Ft.	150,000	$ 300,000	$ 6,000
Riparian Forest Buffer (391)	Ac.	26	$ 39,000	$ 390
Riparian Herbaceous Cover (390)	Ac.	26	$ 7,800	$ 78
Tree/Shrub Establishment (612)	Ac.	26	$ 12,090	$ 121
Use Exclusion (472)	Ac.	26	$ 910	$ 27
Total Costs			$ 359,800	$ 6,616

Moose Creek

Moose Creek has a small (7,605 acres) watershed with no agricultural lands. It is the lowest priority for implementation of BMPs. Watershed location within the Potlatch Subbasin is shown in Figure 8 of the *TMDL Watersheds Descriptions* section. Almost the entire watershed is forested lands with about 600 acres of meadow lands adjacent to tributaries. Moose Creek Reservoir, a state recreational park, is located approximately 1 mile above the mouth of Moose Creek. Development of a commercial industrial minerals (feldspar/clay) operation is currently in the permitting stage on lands primarily leased from the state of Idaho. There is no cropland, hayland, pasture, or CRP lands; scattered livestock grazing occurs within the watershed.

Most of the upper half of the watershed is managed by the Clearwater National Forest (CNF). The lower half of the watershed consists of state lands interspersed with private ownership. The CNF controls about 3,800 acres; the state of Idaho manages 2,900 acres with about 800 acres in private ownership. Dispersed cattle graze on forest lands throughout the watershed on allotments with the Clearwater National Forest (CNF) and commercial timber companies. Visible riparian impact due to forest land grazing is minimal, but is heaviest in forest meadow areas. Landuse distribution is shown in Figure 10 of the *TMDL Watersheds Descriptions* section.

Agricultural Activities

Forest meadows immediately upstream and downstream of Moose Creek Reservoir appear to be grazed; most appear to be private lands. Dispersed cattle graze on other forest lands throughout the watershed. Only 10 head of cattle were observed in September on a roadside survey of landuses in the watershed. No other agriculture related activities were noted.

Water Quality Concerns

TMDLs for temperature and bacteria were completed for Moose Creek. Nutrients, pH and sediment were removed from the list of impairments. TMDLs showed a 49% lack of shade for Moose Creek, the highest of any TMDL watershed in the Potlatch Subbasin. A bacteria load reduction was recommended by DEQ. Bacteria sources could be human or animal; the compliance point lies below Moose Creek Reservoir, a popular recreation site with multiple waste disposal facilities. No obvious sediment or nutrient problems related to agricultural activities were observed. Minor bank trampling occurs where cattle graze.

Of 23 Potlatch subbasin streams inventoried by IDFG in 2003 to 2004, Moose Creek was ranked as fifth in protection priority needs and fifteenth in restoration priority. According to Bowersox et al. (2006), fish species composition in forestland streams was dominated by brook trout and sculpin.

Any existing temperature problem would be isolated to forest meadow areas within the watershed. Exceedances probably result from a lack of stream canopy cover; this is, to a large extent, a natural condition. Consideration should be given to future temperature monitoring just above and below Moose Creek Reservoir prior to BMP implementation. It would not be at all surprising if the reservoir serves as a large heat sink; temperatures in the stream segments above it could be acceptable.

Recommended Treatments

No application of BMPs is deemed necessary at the present time. Additional monitoring, to justify expending funds, prior to BMP implementation is advisable. A BMP list is provided for future deliberation, if subsequent monitoring confirms a water quality problem exists.

In the future, consideration should be given to working with livestock owner(s) that graze/feed livestock in the meadows above Moose Creek Reservoir. Recommendations include exclusion of the stream corridor by fencing; water gaps may be an acceptable alternative to offsite watering if monitoring determines bacteria exceedances are not caused by livestock. Woody vegetation within a 30 foot buffer should be established to enhance stream canopy cover.

Recommendations for future BMP implementation to be considered are listed in Table Ca below.

Table Ca. Moose Creek Recommended BMPs (potential future work).

Future Level of Treatment for Private Forest Meadow Areas				
Forest Meadow Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Private Meadow	Ac.	600		
Fence (382)	Ft.	62,500	$ 125,000	$ 2,500
Riparian Forest Buffer (391)	Ac.	22	$ 33,000	$ 330
Riparian Herbaceous Cover (390)	Ac.	22	$ 6,600	$ 66
Tree/Shrub Establishment (612)	Ac.	22	$ 10,230	$ 102
Use Exclusion (472)	Ac.	22	$ 770	$ 23
Watering Facility (614)	Each	2	$ 2,100	$ 21
Total Costs			**$ 177,700**	**$ 3,042**

Current BMP Status

Restoration activities have been on-going in the Potlatch River Subbasin. The TMDL was based on 2002 water quality monitoring results.

Table Da is a summary of BMPs applied since 2002 in Latah County as reported by the NRCS. The District Conservationist estimated approximately 70% of these practices have been implemented in the Potlatch River Subbasin (Evans, 2009).

Table Da: BMPs implemented since 2003 in Latah County
(≈70% applied within the Potlatch Subbasin)

NRCS PRS DATA								
Conservation Treatment Applied	**FY03**	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**Total**
Comprehensive Nutrient Mgt. Plans (no)	21			1				22
Conservation Buffers (ac)	180							180
Conservation Cover (ac)		2,552	18,999	5,382	5,603	11,034	7,367	50,937
Conservation Crop Rotation (ac)		594	2,960	2,704	844	3,343	4,910	15,355
Contour Farming (ac)		645	2,530	2,452	926		1,855	8,408
Critical Area Planting (ac)				3	15	41		59
Fence (ft)			10,801	31,852	1,344	4,325	9,430	57,752
Field Border (ft)					6,123			6,123
Filter Strip (ac)				43		17	17	77
Firebreak (ft)			9,464	87,379	513,088	10,300	1,038	621,269
Grade Stabilization Structure (no)			14	3		1	9	27
Nutrient Management (ac)	5,159	645	1,478	2,539	973		3,056	13,850
Pasture and Hay Planting (ac)			70			12		82
Pest Management (ac)	4,355	850	1,105	3,215	3,490	21,826	3,128	37,429
Prescribed Grazing (ac)	122					483		605
Residue Management (ac) Direct Seed			526	1,076	291			1,893
Residue Management (ac) Mulch Till	10,073		1,526	2,622	734		1,574	16,529
Residue Management (ac) No Till		598	763		777	3,624	3,337	9,099
Restoration and Management of Declining Habitats (643) (ac)					2	1	25	28
Riparian Forest Buffer (ac)				41		20		61
Riparian Herbaceous Cover (ac)				37	11		23	71
Spring Development				1		1		2
Streambank and Shoreline Protection (ft)		445		797		2,000	11,960	15,202
Terrace							627	627
Tree/Shrub Establishment (ac)	183	347	526	74	57	2,334	37	3,558
Underground Outlet (ft)			1,024	731			260	2,015
Upland Wildlife Habitat Management (ac)		1,865	13,491	6,818	4,515	14,312	9,301	50,302
Use Exclusion (ac)		1,975	8,650	1,918	2,691	10,901		26,135
Water and Sediment Control Basin (no)				1	1		1	3
Watering Facility (no)			3	4		1	5	13
Wetland Practices (ac)	15			6		51	4	76
Wildlife Habitat Management (644) (ac)	6,210	6	30	309	3	51	23	6,632
Wildlife Watering Facility (no)			7	13				20

Agricultural lands with a previous cropping history are enrolled into CRP to remove highly erodible land from production. The land is converted into herbaceous or woody vegetation to reduce soil and water erosion. CRP contracts are for a minimum of 10 years. Practices that occur under CRP include planting vegetative cover, such as introduced or native grasses, wildlife cover plantings, conifers, filter strips, grassed waterways, riparian forest buffers, and field windbreaks (Gilmore, 2004). Within the Potlatch River TMDL watersheds, approximately 23,000 acres have been removed from production and placed into permanent vegetative cover under the Conservation Reserve Program (CRP).

Although the Potlatch River Subbasin Assessment and TMDL's was not approved by EPA until 2009, TMDL implementation efforts were initiated by the Latah Soil Water Conservation District (LSWCD) in 2001 with the administration of the Division II AFO (Animal Feeding Operation) project. The Latah SWCD serves as the lead in administering the Section 319 funded AFO project which identifies problem areas and implements best management practices for animal feeding operations (AFOs). The project involves five north-central Idaho Conservation Districts. The Latah SWCD applied for and was awarded a 319 grant through IDEQ with non-federal matching funds provided by ISCC and landowner participants. Seven AFO sites located within the Potlatch River subbasin were treated as part of the regional project. BMPs installed included feeding area relocation, off-stream water developments, livestock exclusion fencing, hardened stream crossings, streambank restoration and riparian plantings. More than 2,000 head of livestock were removed from the riparian zone with approximately 14,000 feet of stream receiving riparian zone protection. Approximately $146,000 of cost-share funds have been expended (Latah SWCD, 2009).

The Latah SWCD applied for and was awarded a CWA §319 grant, in 2004, through IDEQ to fund the Potlatch River Water Quality Improvement Project (PoRWQIP), with non-federal match provided by landowner PoRWQIP participants and the ISCC WQPA. The project focus is implementation of best management practices on croplands by promoting conservation tillage practices and crop rotations that minimize erosion and pollutant delivery to the watershed drainage system. Approximately 3,700 acres have been obligated under the PoRWQIP by 12 farm operations; cost-share totals about $224,000 with an additional $371,000 from participant match. These totals do not include BMPs installed on additional acres not enrolled in the cost-share program by farm operators throughout the subbasin. In 2009, LSWCD was awarded a CWA §319 grant to implement a multi-year project entitled "Potlatch River Watershed Management Plan – Phase One".

Beginning in 2003, the Latah SWCD began coordination of what was to become a multi-agency effort to remove a passage barrier to steelhead migration on Corral Creek. A fish survey conducted by IDFG recognized that steelhead were abundant below a major culvert beneath the abandoned railroad line, but absent above. A partnership between Federal and state agencies developed to open up 18 miles of previously inaccessible fish habitat (NRCS, 2009). In 2007, the 200 foot long culvert was removed and an artificial

channel was created to restore the stream. Project participants include NOAA Fisheries, NRCS, Idaho Office of Species Conservation, IDL, ITD, and IDFG.
During 2008, about one-half mile of Corral Creek was moved from an existing ditch back to its historic channel. Livestock exclusion fencing and hardened crossings were installed Subsequent wetland creation and riparian planting to promote a healthy riparian zone has occurred and is currently ongoing. Approximately 60 acres of riparian pasture has been recently excluded and 200 acres of floodplain restored to wet meadow. A similar project has been proposed by the Latah SWCD upstream that includes the lower reach of the East Fork of Corral Creek and adjacent meadow areas (Latah SWCD, 2009). Implementation costs of the Corral Creek projects are currently exceed $1.3 million.

Riparian restoration, by the Latah SWCD, consisting of streambank stabilization structures, planting native riparian vegetation, and native seeding has been ongoing since 2006 and continues currently (Latah SWCD, 2009). To date, 54,420 plants have been placed at 35 sites throughout the Potlatch River subbasin. Road rocking of unsurfaced rural roads has also been completed in several areas.

Regularly scheduled (ex. two consecutive years of monitoring spaced at 5 year intervals) water quality monitoring should be utilized to track the effects of previous BMPs as well as guide future implementation priorities. Limited funding could then be directed to higher priority watersheds to build upon the previous work of the Potlach River Water Quality Improvement Project (PoRWQIP), AFO Project, and other State or Federal BMP implementation efforts as monitoring results indicate.

FUNDING

To adequately address the TMDL concerns within the Potlatch River TMDL watersheds will require a significant collaborative effort for technical and financial assistance. Lands enrolled in the Conservation Reserve Program make up significant acreages within the TMDL watersheds. Numerous BMPs have been implemented within the last five years through NRCS administered programs. In 2001, the Latah Soil and Water Conservation District received funding through Northwest Power and Conservation Council's Fish and Wildlife Program to develop the Potlatch River Watershed Management Plan to help facilitate the coordination of steelhead habitat restoration throughout the Potlatch River Subbasin. In 2004, additional funding was awarded to the Latah SWCD from the Pacific Coastal Salmon Recovery Fund to begin implementation actions; IDFG was funded by the same source to conduct additional fisheries monitoring. Also in 2004, funding was awarded to the Latah SWCD thru Idaho Department of Environmental Quality (IDEQ) §319 program monies and from the ISCC through the Water Quality Program for Agriculture. The funding was targeted at addressing water quality issues associated with listed streams in Section 5 of the 2002 Integrated Report (IDEQ 2002). . In 2009, LSWCD was awarded a CWA §319 grant to implement a multi-year project entitled "Potlatch River Watershed Management Plan – Phase One". Depending on project results, additional funding may be pursued in the future. These sources are (but are not limited to):

CWA §319 –These are Environmental Protection Agency funds allocated to the Nez Perce Tribe and the State of Idaho. The Idaho Department of Environmental Quality (IDEQ) administers the Clean Water Act §319 Non-point Source Management Program for areas outside the Nez Perce Reservation. Funds focus on projects to improve water quality and are usually related to the TMDL process. The Nez Perce tribe has CWA 319 funds available for projects on Tribal lands on a competitive basis. Source: IDEQ http://www.deq.idaho.gov/water/prog_issues/surface_water/nonpoint.cfm#management

Water Quality Program for Agriculture (WQPA) –The WQPA is administered by the Idaho Soil Conservation Commission (ISCC). This program is also coordinated with the TMDL process. Source: ISCC http://www.scc.state.id.us/programs.htm

Resource Conservation and Rangeland Development Program (RCRDP) –The RCRDP is a loan program administered by the ISCC for implementation of agricultural and rangeland best management practices or loans to purchase equipment to increase conservation. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Improvement Grants – These grants are administered by the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Reserve Program (CRP) –The CRP is a land retirement program for blocks of land or strips of land that protect the soil and water resources, such as buffers and grassed waterways. Source: NRCS http://www.nrcs.usda.gov/programs/crp/

Environmental Quality Incentives Program (EQIP): EQIP offers cost-share and incentive payments and technical help to assist eligible participants in installing or implementing structural and management practices on eligible agricultural land. Source: NRCS http://www.nrcs.usda.gov/programs/eqip/

Wetlands Reserve Program (WRP) –The WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. Easements and restoration payments are offered as part of the program. Source: NRCS http://www.nrcs.usda.gov/programs/wrp/

Wildlife Habitat Incentives Program (WHIP) –WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Cost-share payments for construction or re-establishment of wetlands may be included. Source: NRCS http://www.nrcs.usda.gov/programs/whip/

State Revolving Loan Funds (**SRF) –**These funds are administered through the ISCC. Source: ISCC http://www.scc.state.id.us/programs.htm

Conservation Security Program (**CSP) –**CSP is a voluntary program that rewards the Nation's premier farm and ranch land conservationists who meet the highest standards of conservation environmental management. Source: NRCS http://www.nrcs.usda.gov

Habitat Incentive Program (HIP) – This is an Idaho Department of Fish and Game program to provide technical and financial assistance to private landowners and public land managers who want to enhance upland game bird and waterfowl habitat. Funds are available for cost sharing on habitat projects in partnership with private landowners, non-profit organizations, and state and federal agencies. Source: IDFG http://fishandgame.idaho.gov/cms/wildlife/hip/default.cfm

Partners for Fish and Wildlife Program in Idaho – This is a U.S. Fish and Wildlife program providing funds for the restoration of degraded riparian areas along streams, and shallow wetland restoration. Source: USFWS http://www.fws.gov/partners/pdfs/ID-needs.pdf

Forestland Enhancement Program - The Forest Land Enhancement Program (FLEP) was part of Title VIII of the 2002 Farm Bill. FLEP replaces the Stewardship Incentives Program (SIP) and the Forestry Incentives Program (FIP). FLEP is optional in each State and is a voluntary program for non-industrial private forest (NIPF) landowners. It provides for technical, educational, and cost-share assistance to promote sustainability of the NIPF forests. http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml

Office of Species Conservation (**OSC)**

Bonneville Power Administration (**BPA)**

OUTREACH

The Latah Soil and Water Conservation District has undertaken formal outreach efforts to inform residents within the Potlatch River watersheds of the status of Potlatch River Water Quality Improvement Project (PoRWQIP) and the applicability of these practices to other areas in the region. The program has been formally announced using district newsletters and through the Potlatch River Watershed Advisory Group. Information to the agricultural community, conservation agencies and organizations, and the general public will be relayed through public presentations, district newsletters and announcements to various agencies and local news media. Field tours are/will be conducted to educate operators and landowners about benefits and costs of implementing BMPs. Additionally, conservation district newsletters will periodically update local landowners on project progress and status.

MONITORING AND EVALUATION

Monitoring is an important component of the implementation plan and will be used to measure the success of both individual activities and the overall effort. Due to the phased structure of the Potlatch River TMDL, an on-going, long-term monitoring effort is required to determine beneficial use status. The results of this monitoring effort will be used to evaluate the changing condition of the watershed and may lead to adjustments in pollutant targets throughout the implementation phase of the TMDL. The monitoring plan will utilize several approaches to obtain water quality data from the Potlatch River Subbasin.

Field Level

Prior to riparian area BMP implementation, Stream Visual Assessment Protocol (SVAP) and NRCS channel erosion procedures should be conducted to establish a baseline for future comparison. This has already occurred in some watersheds within the Potlatch River Subbasin.

At the field level, annual status reviews will be conducted to insure that landowner contracts meet schedules and that BMPs are being installed according to standards and specifications. BMP effectiveness monitoring will be conducted on installed projects to determine installation adequacy, operation consistency and maintenance, and the relative usefulness of implemented BMPs in reducing water quality impacts. These BMP effectiveness evaluations will be conducted according to the protocols outlined in the Agriculture Pollution Abatement Plan and the ISCC Field Guide for Evaluating BMP Effectiveness.
Digital photographs will be used to document before and after conditions of individual project sites. This documentation should prove useful for reviewing qualitative changes in resource conditions.

Gully erosion sites needing treatment will be identified; gully measurements will be collected. Subsequent gully measurements will be taken during the spring(s) of the year(s) following structural practice installation to determine effectiveness of the BMP.

RUSLE (Revised Universal Soil Loss Equation) will be used to calculate reduction in erosion for cropland acres that transition to high residue conservation tillage systems.

Watershed Level

At the watershed level, there are many governmental and private groups involved with water quality monitoring. The Idaho Department of Environmental Quality uses the Beneficial Use Reconnaissance Protocol (BURP) to collect and measure key water quality variables that aid in determining the beneficial use support status of Idaho's waterbodies. The determination will tell if a waterbody is in compliance with water quality standards and criteria. In addition, IDEQ will be conducting five-year TMDL reviews.

Annual reviews for funded projects will be conducted to insure the project is kept on schedule. With many projects being implemented across the state, ISCC developed a software program to track the costs and other details of each BMP installed. This program can show what has been installed by project, by watershed level, by subbasin level, and by state level. These project and program reviews will insure that TMDL implementation remains on schedule and on target. Monitoring BMPs and projects will be the key to a successful application of the adaptive watershed planning and implementation process.

Since the the 2002 water quality monitoring effort used to establish baseline conditions for watershed assessment in the TMDL document, significant cropland has been converted to some form of conservation tillage (mulch till or direct seed). Additional acreage has been enrolled in the Conservation Reserve Program (CRP). Monitoring to determine how distant water quality targets are from being achieved, currently, is likely a good use of funds prior to major future BMP implementation.

The Latah Conservation District, IASCD and the Potlatch River WAG should coordinate the development of a long-term monitoring program for the watershed similar to the Paradise Creek monitoring plan adopted by the Paradise Creek WAG. The Paradise Creek WAG, in cooperation with IASCD and LSWCD, approved a monitoring plan whereby IASCD will return in five years to monitor throughout the watershed to determine watershed changes and effects of implemented BMPs.

RUSLE (Revised Universal Soil Loss Equation) in combination with a flow routing model processed using GIS (Boll, J., E. Brooks, and D. Traeumer. 2002) was used by Dansart (2004) to calculate erosion from cropland acres under different tillage scenarios on a watershed scale. It may be used in the future to document trends resulting from tillage conversion implemented since TMDL adoption.

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APPENDIX A

Acronyms/Abbreviations

BMP -	Best Management Practice
BURP -	Beneficial Use Reconnaissance Project
CFR -	Code of Federal Regulations
cfs -	cubic feet per second
CNF -	Clearwater National Forest
CRP -	Conservation Reserve Program
CWA -	Federal Clean Water Act
DO -	dissolved oxygen
EPA -	U.S. Environmental Protection Agency
FPA -	Idaho State Forest Practices Act
FSA -	USDA Farm Service Agency
HEL -	Highly Erodible Land
IASCD-	Idaho Association of Soil Conservation Districts
IDEQ -	Idaho Department of Environmental Quality
IDL -	Idaho State Department of Lands
ISCC -	Idaho State Soil Conservation Commission
ISDA-	Idaho State Department of Agriculture
kg/d -	kilograms per day
LA -	Load Allocation
LSWCD -	Latah Soil and Water Conservation District
MCL -	maximum contaminant level
mg/l -	milligrams per liter
NPDES -	National Pollution Discharge Elimination System
NPS -	Nonpoint Source Pollution
NRCS -	USDA Natural Resource Conservation Service
NWPCC -	Northwest Power and Conservation Council.
PNDSA -	Pacific Northwest Direct Seed Association
PoRWQIP -	Potlatch River Water Quality Improvement Project
RUSLE -	Revised Universal Soil Loss Equation
SSC-	Suspended Sediment Concentration
TMDL -	Total Maximum Daily Load
TP -	total phosphorus
USDA -	United States Department of Agriculture
USGS -	United States Geologic Service
VFS -	Vegetative Filter Strip
WAG -	Watershed Advisory Group
WLA -	Waste Load Allocation
WQPA -	Water Quality Program for Agriculture (ISCC)

APPENDIX B

List of Figures

APPENDIX C

List of Tables