Palouse River Tributaries

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 Palouse River Subbasin (HUC #17060108), there were eight waterbodies on the 1998 §303 (d) list; six of the waterbodies are assessed in the "Palouse River Tributaries Subbasin Assessment and TMDLs" (IDEQ, 2005). The six waterbodies flow into the mainstem Palouse River (sometimes referred to as the North Fork Palouse) within the state of Idaho. They are: Big Creek, Deep Creek, Flannigan Creek, Gold Creek, Hatter Creek and Rock Creek. This agricultural implementation plan addresses water quality concerns associated with agricultural lands that are located within the watersheds of the six waterbodies. **Only the Idaho portion of the Palouse Subbasin that drains to the mainstem Palouse River is described in this report.** Those Idaho portions of the Palouse Subbasin that are part of the South Fork Palouse River watershed are not examined; three of these tributary waterbodies (Paradise Creek, Cow Creek and South Fork Palouse) have been examined by Idaho Department of Environmental Quality (IDEQ) in other TMDL documents submitted to EPA and have separate implementation plans for each associated watershed.

The headwaters of the Palouse River originate in the Hoodoo Mountains of the St. Joe National Forest. The Palouse River (Figure 1) and most of its tributaries originate in forested mountainous terrain and flow downstream into the lower gradient rolling hills of the Palouse, which are dominated by agriculture. The Palouse River flows into the State of Washington about six miles west of the town of Potlatch. Bordering the Palouse River Subbasin to the north and northeast is the St. Maries River drainage; to the east and southeast is the Potlatch River drainage; and to the south is the South Fork Palouse River tributary drainages. The Idaho portion of the Palouse River Subbasin is approximately 363 square miles (232,500 acres) and is located primarily in Latah County. There are no anadromous fish in the Palouse River; Palouse River Falls, located in the State of Washington, blocks fish migration (IDEQ, 2005).

The listed water quality parameters of concern include: sediment, temperature, nutrients, and bacteria (Table A). 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, 2005). The Palouse River Tributaries TMDL was submitted in 2005 by IDEQ and approved by EPA.

The Palouse River Tributaries Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for the Palouse River Tributaries 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 within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis (IDEQ, 2005). This "Implementation Plan for Agriculture" will be a component of the overall Palouse River Tributaries 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 Palouse River Tributaries 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, 2005).

The Idaho Soil Conservation Commission (ISCC) works with the Latah Soil and Water Conservation District (Latah SWCD), 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 this portion of the Palouse River subbasin, which straddles Latah and Benewah 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 Palouse River Tributaries Total Maximum Daily Load (TMDL) Implementation Plan outlines an adaptive management approach for implementation 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.

Table A. Streams and pollutants for which TMDLs were developed. (IDEQ, 2005)

Waterbody)	Assessment Units	1998 §303(d) Boundaries	Pollutants
Big Creek	ID1706108CL027a_02 ID1706108CL027b_02	Headwaters to Palouse River	Temperature
Deep Creek	ID1706108CL032a_02 ID1706108CL032a_03 ID1706108CL032b_02 ID1706108CL032b_03	Headwaters to Palouse River	Sediment, Temperature, Bacteria
Flannigan Creek	ID1706108CL011a_02 ID1706108CL011a_03 ID1706108CL011b_02 ID1706108CL011b_03	Headwaters to Palouse River	Sediment, Temperature, Bacteria, Nutrients
Gold Creek	ID1706108CL029_02 ID1706108CL029_03 ID1706108CL030_02 ID1706108CL031a_02 ID1706108CL031b_02	Waterhole Creek to Palouse River	Sediment, Temperature, Bacteria
Hatter Creek-upper	ID1706108CL015a_02	Headwaters to Palouse River	Sediment, Temperature, Bacteria
Hatter Creek-lower	ID1706108CL015b_02 ID1706108CL015b_03	Headwaters to Palouse River	Sediment, Temperature, Bacteria, Nutrients
Rock Creek	ID1706108CL012_03 ID1706108CL013a_02 ID1706108CL013b_03 ID1706108CL014a_02 ID1706108CL014b_02	Headwaters to Palouse River (West Fork Rock Creek)	Sediment, Bacteria

Figure 1. Palouse River Subbasin (Idaho portion) 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 Palouse Subbasin to identify critical agricultural acres and suggest BMPs necessary to meet the requirements of the Palouse River Tributaries 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 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 SWCD and IASCD to encourage landowner participation in water quality remediation efforts within the watershed.

Background

The Palouse River Tributaries TMDL was submitted by the Idaho Department of Environmental Quality (IDEQ) and approved by the US Environmental Protection Agency (EPA) in March, 2005. The are no permitted point sources of pollution along any of the §303(d) listed waterbodies. The primary nonpoint sources (NPS) of pollutants in the Palouse River Subbasin are timber harvest, non-irrigated croplands, grazing lands, land development (construction activities), urban runoff, and roads (IDEQ, 2005).

In 1998, 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 natural background conditions (IDEQ, 2005).

Project setting

The headwaters of the Palouse River originate in the Hoodoo Mountains of the St. Joe National Forest; the watershed is bounded by the Palouse Mountain Range to the south. The Palouse River and most of its tributaries originate in forested, mountainous terrain and flow downstream the through undulating hilly terrain of northwestern Latah County, which is dominated by agricultural. The Palouse River flows into the State of Washington about six miles west of the town of Potlatch. The Palouse River then winds through the rolling farm country of Whitman County before it enters the Snake River at the Franklin County boundary.

The Palouse River Subbasin is located within the Columbia Plateau Province. The Idaho portion of the subbasin addressed by the TMDL examines only those tributary watersheds that drain to the mainstem (North Fork) Palouse River. There are no anadromous fish in the Palouse River as Palouse River Falls, located in the State of Washington, blocks fish migration. Elevations range from 2,453 ft at the state line to 5,334 ft on Bald Mountain in the Hoodoo Mountain range. Most of the mid- to lower elevation topography in the basin is blanketed by Palouse Loess. The north and east slopes are short and steep, while the south and west facing slopes are more gently sloping (IDEQ, 2005).

Climate

As much as 53 inches of mean annual precipitation occurs in the forestlands near the eastern boundary, and as little as 22 inches near the Idaho/Washington border. Snow normally comprises 60-70% of the total annual precipitation at higher elevations and 40% of the annual precipitation at the lower forestland elevations in the headwaters and middle reaches of the watershed. Annual precipitation decreases with decreasing elevation as the stream travels in a westerly direction (Gilmore, 2004). Precipitation ranges for the Palouse River Subbasin are shown on Figure 2.

Prolonged gentle rains and deep snow accumulations at higher elevations with fog, cloudiness, and high humidity characterize the basin in the fall, winter, and spring months. A seasonal snow pack generally covers elevations above 4,000 feet from December to May. The climate during the summer months is influenced by high-pressure stationary systems that may produce high-intensity electrical storms, which cause frequent wildfires, (IDEQ, 2005).

In the summer months, the average temperatures are about 10-15˚F warmer at the lower elevations than at summit locations. Hot summer temperatures are common at the middle to lower elevations in the Palouse River Subbasin exceeding 90˚F much of the time in July and August (IDEQ, 2005).

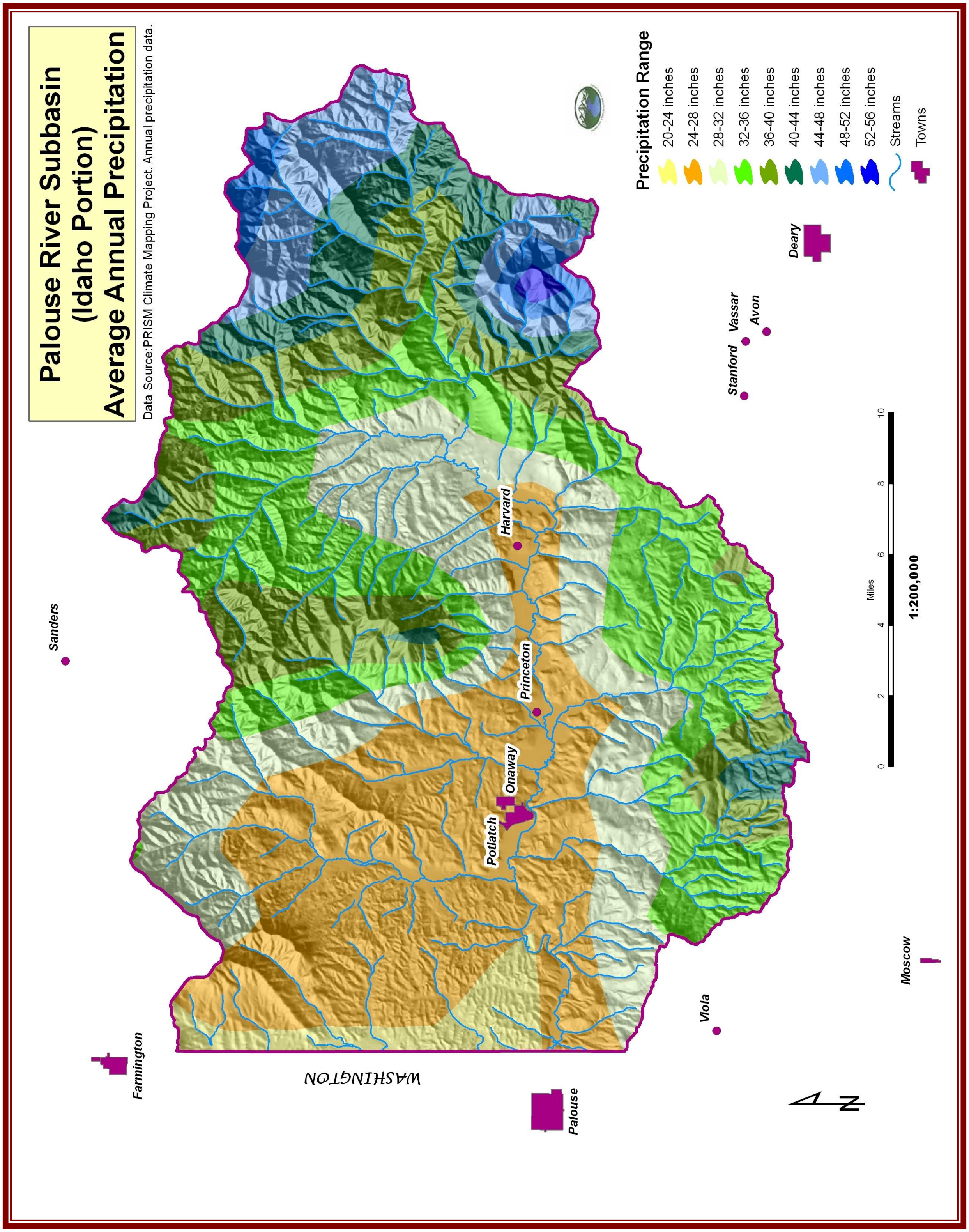

Figure 2. Palouse River Subbasin Precipitation Ranges

Soil Formation

Several landforms compromise the topography of the Palouse River Subbasin. Most the Palouse River Subbasin is covered by rolling hills (Palouse Loess), which were created by wind deposition. The hills are anywhere from 100- to 300-feet thick and form some of the most agriculturally productive soils in the world. These rich, silty-loam soils are the main reason the Palouse area was settled and the land converted from prairie grasslands into dryland agriculture (IDEQ, 2005).

High elevations in the middle portions of the Palouse River Subbasin have weathered granitic features like Moscow Mountain and Gold Hill. The highest elevations to the north and east, like the Hoodoo Mountain range and Bald Mountain, are comprised of metasedimentary rocks of the Belt Series. Basalt outcroppings appear underneath the Palouse Loess in the western potions of the watershed. In the valley bottoms along the Palouse River and the main tributaries, coarse textured alluvium sediment deposition is present (IDEQ, 2005).

The soils derived from metasedimentary rocks generally weather to finer textured soils with varying amounts of coarse fragments. Granitics weather rapidly to *grus*, which is sandy and excessively well-drained in composition. Basalt rock has a tendency to weather into large cobble-size material. The Palouse Loess erodes as fine silt, which is relatively easily transported into waterways and makes up much of the sediment load in streams of the Palouse River Subbasin (IDEQ, 2005).

Soils underlying agricultural lands within the Palouse Subbasin area in Idaho belong to three major soils groups. Near the Idaho-Washington border are very deep to moderately deep soils formed in loess and rock fragments on scattered buttes at elevations greater than 2,500 feet; these are typically soils of the Palouse-Thatuna-Naff association. Farther east, deep soils formed in loess on upland hills less than 3,000 feet high are represented by the Larkin-Southwick association and the Freeman-Joel-Taney association. Transecting these deep soils are very deep valley soils formed in loess known as the Palouse-Athena association (USDA, 1978).

Erosion History

Soil erosion had become a significant problem on the Palouse 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 annual grain crop production. 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. 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).

USDA estimated annual erosion rates for Palouse River Basin cropland, in areas where precipitation was greater than 18 inches annually, averaged from 6 to 10 tons/acre/year, depending on soil type. The Palouse-Thatuna-Naff and the Freeman-Joel-Taney soil association croplands averaged 12 tons/acre/year soil loss rates; the Larkin-Southwick soils had 7 tons/acre annual erosion rates reported (USDA, 1978). Sediment delivery has decreased noticeably over the last 50 years; suspended sediment levels in the Palouse River show a decreasing trend (Ebbert and Roe, 1998).

Drainage description

The Palouse River flows freely with no man-made impoundments existing between the headwaters and its confluence with the Snake River six miles below Palouse Falls.
A USGS gaging station, 1 mile downstream from Potlatch, indicates the North Fork Palouse River flow usually peaks during the month of March with an average annual discharge of 740 cubic feet per second (cfs). The gaging station monitors flow from a 317 square mile drainage area. Flows average less than 15 cfs from August through October. Most precipitation occurs from December through June; rain-on-snow events cause large swings in stream discharge. Recorded extremes in flow recorded during the last 40 years are a high of 14,600 cfs (2/9/96) and low of 0.09 cfs (9/24/73) (Gilmore, 2004).

Over the past century it is likely that the hydrology of the Palouse River has changed due to changes in landuse. For example, Deep Creek, once named for its deep perennial pools, is now classified as an intermittent stream. A USGS quadrangle map dated 1955 displays Deep Creek as a perennial stream while the current USGS map displays Deep Creek as intermittent. Many intermittent streams in the Palouse probably have a similar hydrologic history. Of the §303 (d) listed streams, the most current USGS maps classify Deep and Rock Creeks as intermittent streams, and Big, Flannigan, Gold and Hatter Creeks as perennial streams (IDEQ, 2005).

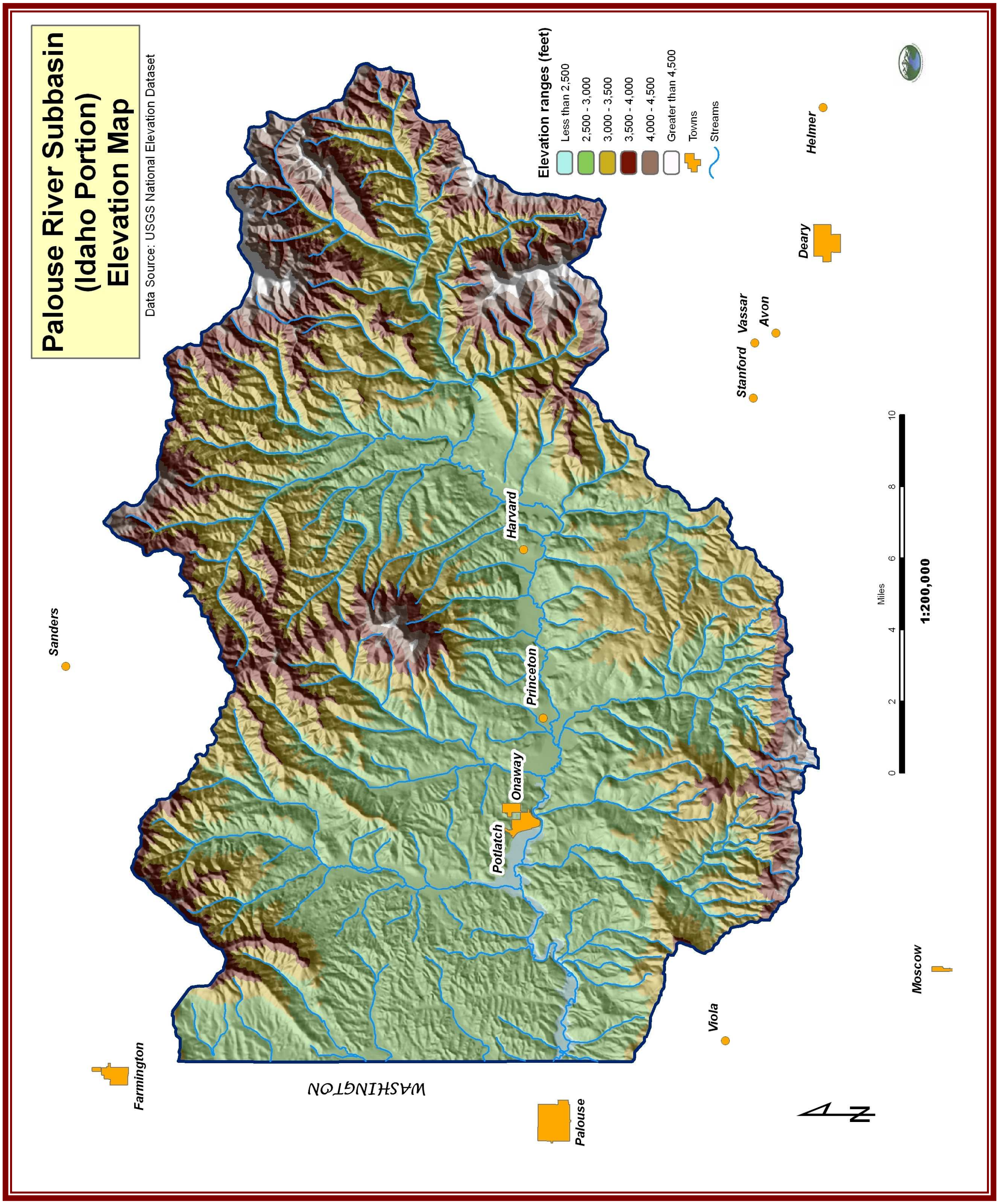

Figure 3. Elevation Map

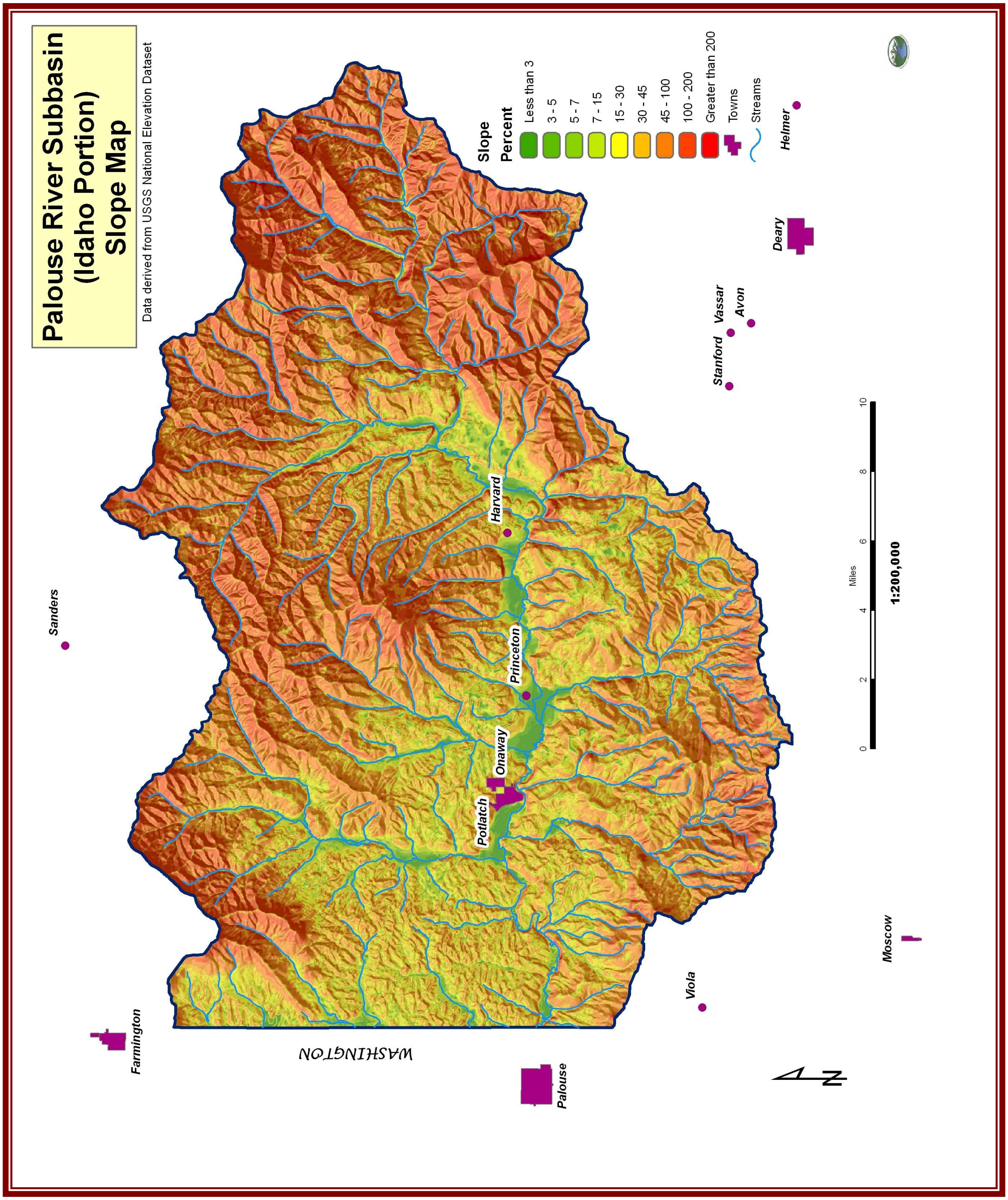

Figure 4. Slope Map

Land Ownership (Management)

Most (72%) of the Idaho portion of the mainstem Palouse River Subbasin are private lands, split largely between cropland, hayland, pasture and forest lands. The Clearwater National Forest (CNF) administers federal forest lands (23%). The State of Idaho manages 5% of subbasin lands, including Idaho Department of Lands (IDL) forest lands and McCroskey State Park. Nearly all (94%) of the subbasin is located in Latah County; the northernmost edge of the subbasin is located in Benewah County. Potlatch is the largest town within the subbasin and once supported a thriving timber industry; it now chiefly supports the agricultural community and local residents. Smaller towns are Onaway, Princeton, and Harvard.

Distribution of land management is shown in Figure 5.

Land Uses

The main land uses (Figure 6) in the Palouse River Subbasin are agriculture (farming and grazing), followed closely by forestry. There is also a very limited amount of mining activity. Outdoor recreation is popular throughout the area, particularly on public lands and commercial timber holdings.

Fertile soils and favorable climate make the Palouse prairie one of the most productive agricultural areas in the world. In the 1860s, the first European settlers discovered the 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 hillsides and climate of the Palouse. These crops were shipped to other markets. Horse and mule teams worked the land in the early 1900's. Machinery soon began to change farming, and by 1930, 90% of the Palouse wheat was harvested using combines. Fertilizers were introduced after World War II and increased crop production 200% to 400% (Black et al., 1998). Federal agricultural programs encouraged farmers to drain seasonal wet areas; beginning in 1936, USDA provided cost-sharing for wetland drainage, a practice that continued into the late 1970's (USDA, 1998). 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 Palouse Subbasin. Dryland farming is practiced as irrigation is unnecessary and not practical. Hay is produced to feed livestock.

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

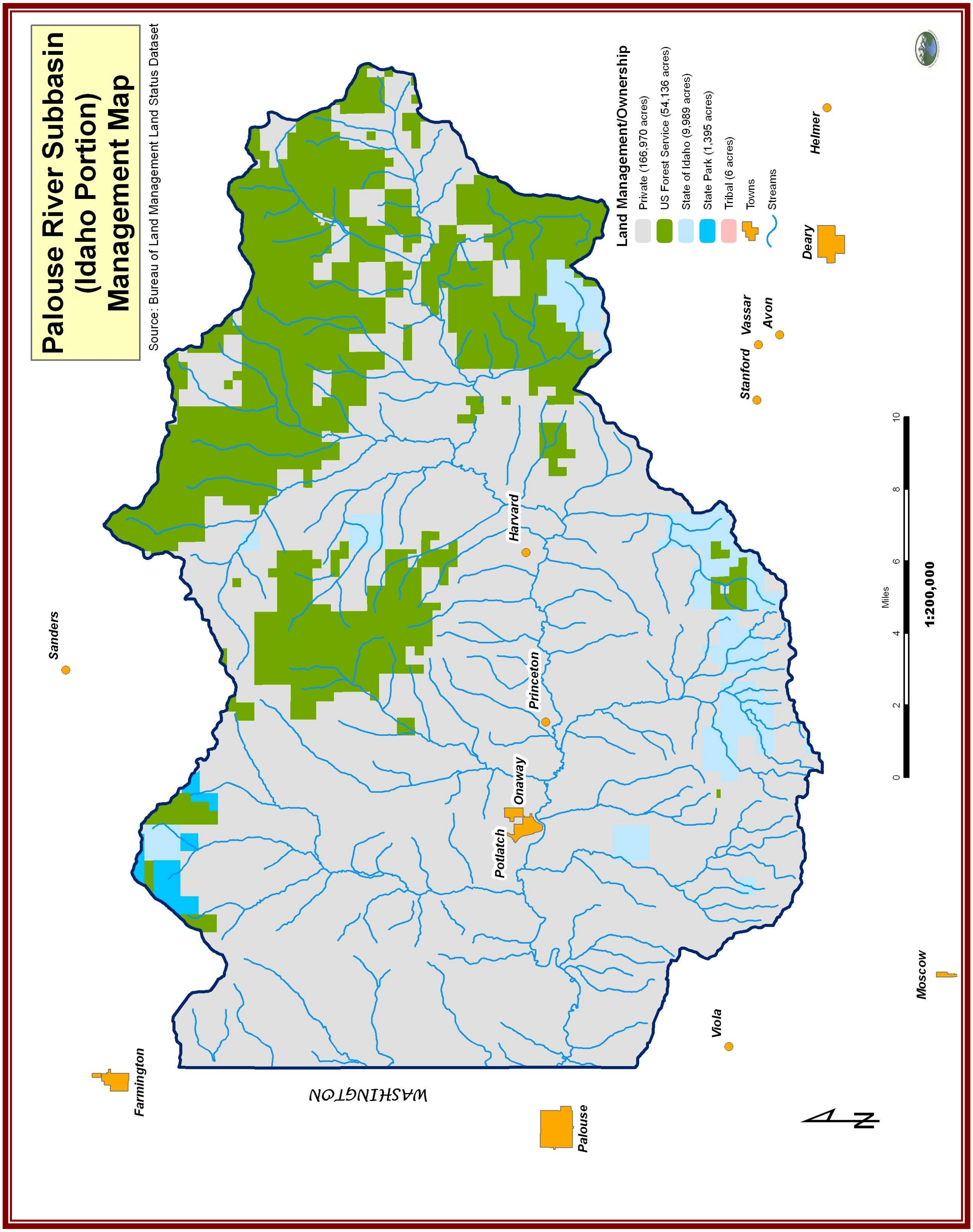

Figure 5. Palouse River Subbasin Management Map

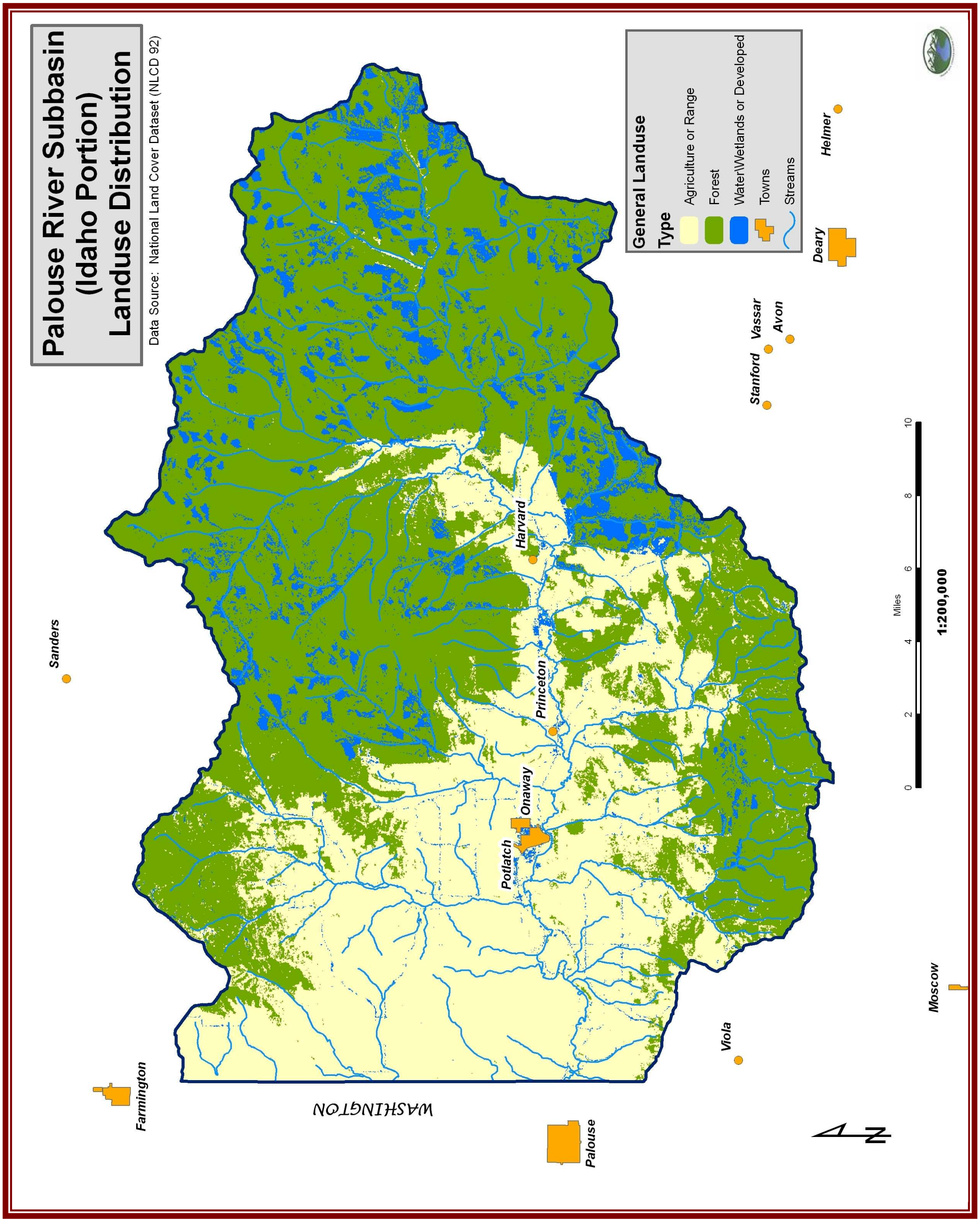

Figure 6. Palouse River Subbasin General Landuse Distribution

Small fenced pastures are present in all of the §303(d) watersheds, although Flannigan Creek, Hatter Creek, and Deep Creek have the most livestock activity. 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. Bennett Lumber Products Inc. and Potlatch Corporation Inc. still manage large land parcels in the Palouse for timber harvest. The US Forest Service and the Idaho Department of Lands (IDL) also manage thousands of acres in the Palouse for silviculture and recreational activities (IDEQ, 2005).

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

Big Creek

Land Use Category	Acres	% of Watershed
Hay	160	1.5%
CRP	100	1%
Pasture	20	0.2%
Grazed Meadow	25	0.2%
Forest	10,000	97%
TOTAL:	10,256	100%

Deep Creek

Land Use Category	Acres	% of Watershed
Cropland	4,339	16%
Hay	3,035	11%
CRP	2,673	10%
Grass	2,237	8%
Pasture	1,361	5%
Grass\Shrub\Trees	603	2%
Meadow	76	0.3%
Forest	12,600	46%
Residences	246	0.9%
TOTAL:	27,326	100%

Flannigan Creek

Land Use Category	Acres	% of Watershed
Cropland	1,558	13%
Hay	442	4%
CRP	800	7%
Grass	652	5%
Pasture	392	3%
Meadow	38	0.3%
Grass\Shrub\Trees	140	1%
Forest	8,200	67%
Residences	35	0.3%
TOTAL:	12,257	100%

Gold Creek

Land Use Category	Acres	% of Watershed
Cropland	3,570	20%
Hay	191	1%
Grass	400	2%
CRP	709	4%
Pasture	64	0.4%
Meadow	175	1%
Grass\Shrub\Tree	144	0.8%
Forest	12,595	70%
Residences	47	0.3%
TOTAL:	17,925	100%

Hatter Creek

Land Use Category	Acres	% of Watershed
Cropland	355	2%
Hay	1,047	6%
CRP	1,253	8%
Grass	182	1%
Pasture	925	6%
Grass\Shrub\Trees	331	2%
Tree Farm	204	1%
Forest	11,711	73%
Residences	130	0.8%
TOTAL:	16,139	100%

Rock Creek

Land Use Category	Acres	% of Watershed
Cropland	507	10%
Hay	1,165	22%
CRP	637	12%
Pasture	502	10%
Grass\Shrub\Trees	108	2%
Forest	2,240	43%
TOTAL:	5,222	100%

TMDL Watersheds Descriptions

TMDL watersheds are shown in Figure 7. Watershed descriptions that include land uses, management, and listing criteria are included in narratives largely derived from the TMDL document (IDEQ, 2005).

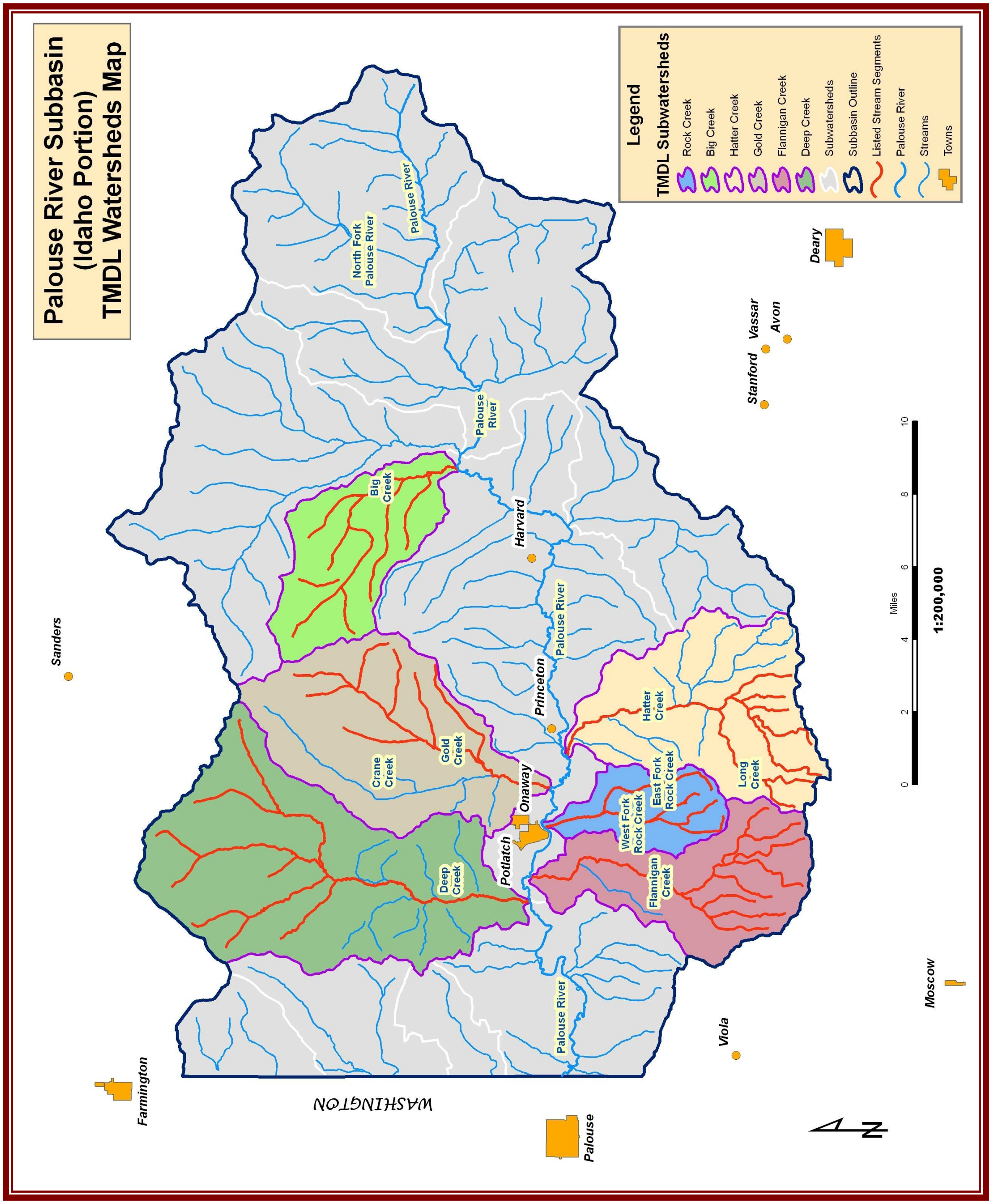

Figure 7. Palouse River Tributaries TMDL Watersheds Map

Big Creek

Big Creek is a third order stream at its confluence with the Palouse River; headwaters originate off the east side of Gold Hill and Prospect Peak. The Big Creek watershed is about 10,250 acres in size. Most of the land drained by Big Creek is owned and managed by Potlatch Corporation. The uppermost headwaters are managed by the Clearwater National Forest (CNF). The lower portion is privately owned. The State of Idaho manages a few small parcels within the watershed (IDEQ, 2005). Location of Big Creek relative to other TMDL watersheds is shown on Figure 7.

The primary land uses in the watershed are forestry, grazing, and recreational activities. Some hayland and CRP acres are present in the very lowest portion of the watershed. Distribution is shown in Figure 8. Big Creek generally flows from the northwest to the southeast. Elevations range from 2,611 feet to 4,138 feet. The geology of the watershed is highly weathered metasediments with some areas of weathered granitics. The valley bottoms of lower Big Creek and its tributaries are underlain by coarse textured alluvium (IDEQ, 2005).

Big Creek is §303(d) listed for sediment, nutrients, temperature, and bacteria; the boundaries are defined as headwaters to the Palouse River. The designated beneficial uses for Big Creek include salmonid spawning, cold water aquatic life, and secondary contact recreation. Rainbow trout and sculpin have been detected in upper Big Creek and in Last Chance Creek. Based on monitoring data, IDEQ recommended that Big Creek be de-listed for bacteria, sediment and nutrients. A temperature TMDL was developed for Big Creek.

Big Creek shows the fewest anthropogenic environmental impacts of all the §303(d) listed streams in the Palouse River Subbasin (IDEQ, 2005).

Deep Creek

Deep Creek is a fourth order stream at its confluence with the Palouse River. The watershed is about 27,300 acres in size. The headwaters originate off the south side of Mission and Mineral Mountains, the ridgeline where McCroskey State Park (5,300 acres) is located. Most of the land in Deep Creek is privately owned. In addition to the state park, the uppermost watershed has some Clearwater National Forest and Bennett Lumber ownership. Location of Deep Creek relative to other TMDL watersheds is shown on Figure 7.

Deep Creek generally flows from the north to the south with a dendritic drainage pattern Elevations range from 2,483 feet to 4,320 feet. Bedrock in the upper watershed is weathered metasediments with a few granite outcrops along the upper divide ridgeline. Palouse Loess blankets basalt bedrock in the mid to lower elevation portions of the watershed. In the valley bottoms along the mainstem of Deep Creek, coarse textured alluvium is present (IDEQ, 2005).

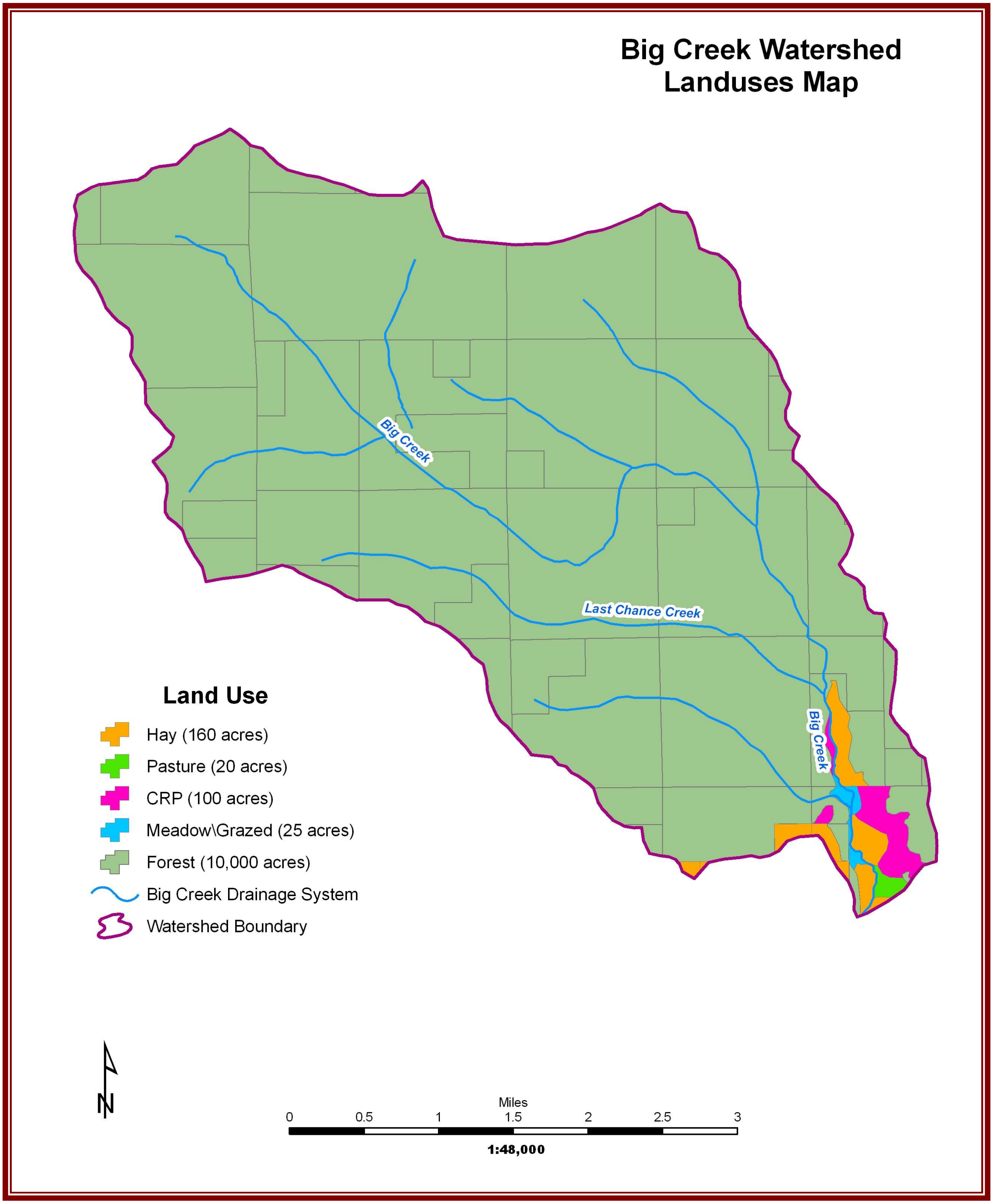

Figure 8. Big Creek Landuse Map

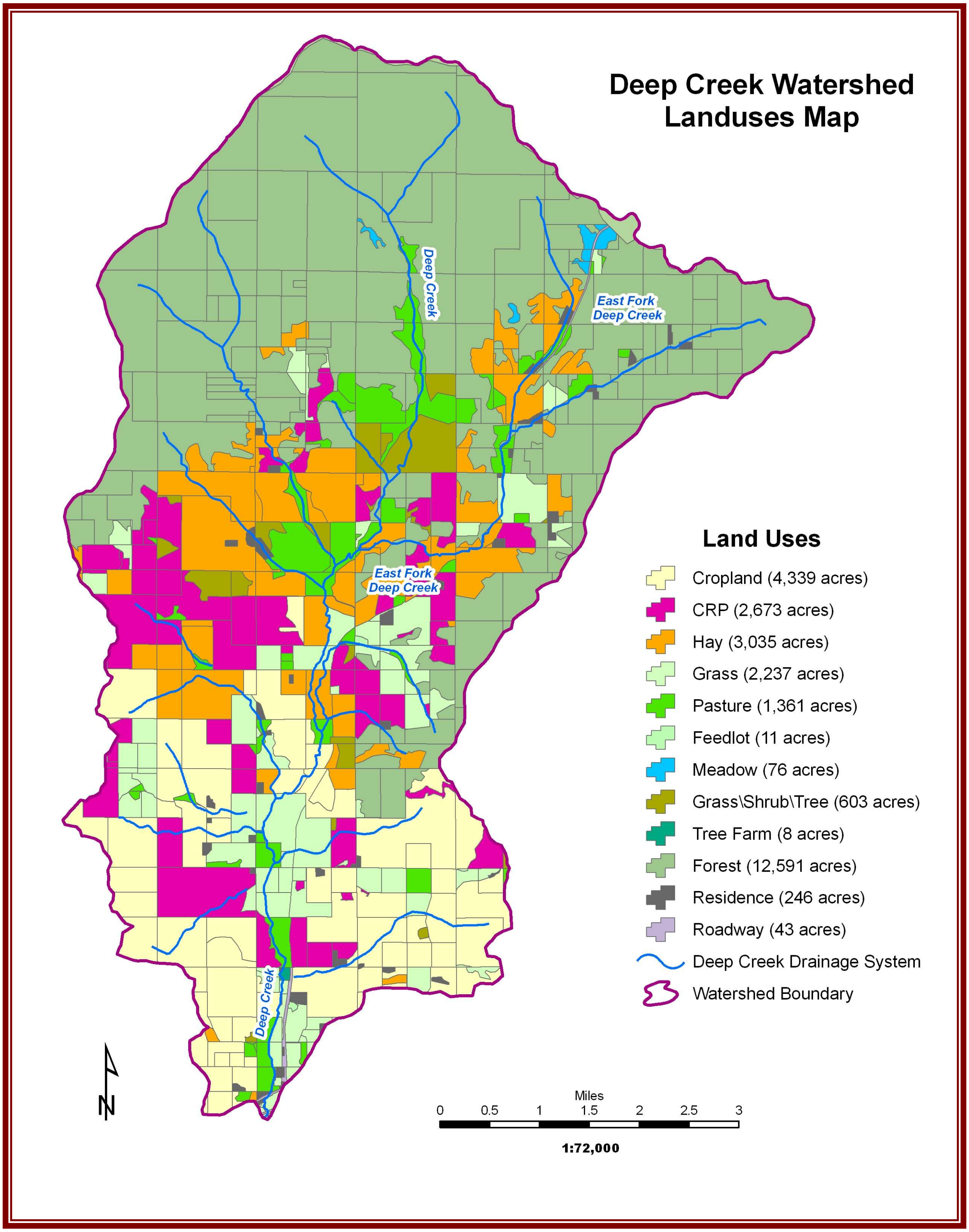

Figure 9. Deep Creek Landuse Map

Three major tributaries of Deep Creek—the West, Middle, and East Forks—converge near the forest to agricultural landuse interface. Forestry and recreation are the primary land uses in the forested upper watershed. Farming and grazing are the dominant land uses in the middle and lower portions of the watershed. State Highway 95 also parallels Deep Creek for several miles. Landuse distribution is illustrated in Figure 9.

Deep Creek is §303(d) listed for sediment, temperature, nutrients and bacteria. The boundaries are defined as its headwaters to the Palouse River. Deep Creek beneficial uses include cold water aquatic life and secondary contact recreation.

Most of Deep Creek dries up from late July through October, and is classified as an intermittent stream. IDAPA 58.01.02.070.06 states, "numeric standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. For recreation, the optimum flow is equal to or greater than five cfs. For aquatic life uses, optimum flow is equal to or greater than 1 cfs." IDEQ (2005) interpreted that fish data collected in the lower section of Deep Creek supports a seasonal cold water fishery rather than cold water aquatic life but that a fishery with pockets of salmonids and sculpin might exist in the uppermost portions of the watershed (IDEQ, 2005).

IDEQ developed TMDLs for sediment, temperature, nutrients, and bacteria. IDEQ recommended that Deep Creek be de-listed for nutrients. There were no dissolved oxygen (DO) or total phosphorus (TP) target exceedances recorded when flows were greater than 1 cfs (IDEQ, 2005).

Flannigan Creek

The Flannigan Creek Watershed is 12,300 acres in size. Most of the land in the watershed is under private ownership. Bennett Lumber owns and manages forested land near the headwaters except for approximately 500 acres managed by the state of Idaho. Location of Flannigan Creek relative to other TMDL watersheds is shown on Figure 7.

Flannigan Creek is a third order stream at its confluence with the Palouse River, and the headwaters originate off the north side of Moscow Mountain and the Palouse Range. Flannigan Creek generally flows from south to north; the drainage pattern could be described as dendritic (like veins in a leaf). Two major tributaries, the West Fork of Flannigan Creek and the main stem Flannigan Creek, join about mid-watershed. Elevations range from 2,484 feet to 4,553 feet. Bedrock in the upper watershed is weathered granitics. In the middle to lower portions of the watershed, the Palouse Loess blankets basalt bedrock. The valley bottom of lower Flannigan Creek and its tributaries are underlain by coarse textured alluvium (IDEQ, 2005).

Agriculture, grazing, and forestry are the major land uses. Most agricultural lands are located in the lower half of the drainage area. Rural homesites are scattered throughout the watershed. Distribution of land uses is shown in Figure 10.

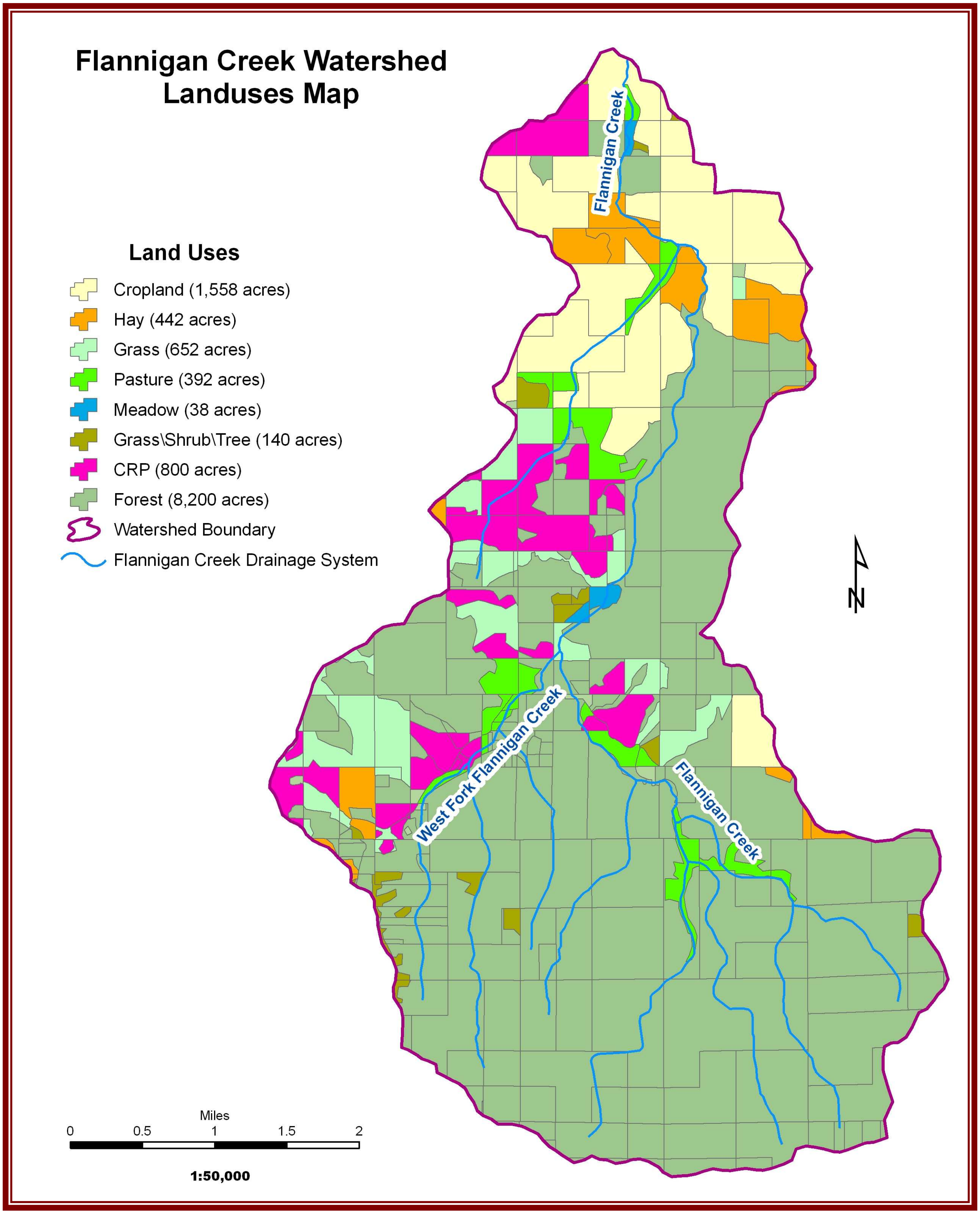

Figure 10. Flannigan Creek Landuse Map

Flannigan Creek is §303(d)-listed from headwaters to the Palouse River for sediment, temperature, nutrients, and bacteria. Beneficial uses are cold water aquatic life and secondary contact recreation, with salmonid spawning considered an existing use in the upper portion of the drainage (IDEQ, 2005).

Flannigan Creek itself is a perennial stream; however, some of the tributary streams in the headwaters are intermittent. Rainbow trout, dace, suckers, shiners, and northern pike minnows are some of the species found in Flannigan Creek. IDEQ developed TMDLs for sediment, temperature, nutrients, and bacteria for Flannigan Creek (IDEQ, 2005).

Gold Creek

The Gold Creek Watershed is about 18,000 acres in size. Land ownership is mixed. The uppermost portion of the watershed is managed by the Clearwater National Forest. Bennett Lumber owns the uppermost portion of Crane Creek, a main tributary to Gold Creek. Potlatch Corporation owns much of the middle section of the watershed. The lower portion of the watershed is mostly under other private ownership. Location of Gold Creek relative to other TMDL watersheds is shown on Figure 7.

Gold Creek is a fourth order stream at its confluence with the Palouse River. The headwaters originate near Crane Point and on the western slopes of Gold Hill and Prospect Peak. Gold Creek generally flows from north to south with a dendritic drainage pattern. Crane Creek is the largest tributary to Gold Creek; Hoteling Creek, Waterhole Creek, and the East Fork of Gold Creek are other major tributaries. Elevations range from 2,504 feet to 4,677 feet (IDEQ, 2005).

Bedrock in the upper watershed is mostly highly weathered metasediments; Gold Hill, which occupies the upper eastern portion of the watershed, is a weathered granitic outcrop. Palouse Loess blankets basalt bedrock in the lower portions of the watershed. The valley bottoms along lower Gold Creek and Crane Creek contain coarse textured alluvium (IDEQ, 2005).

The major land uses in the middle to upper portion of this watershed are forestry and recreation. Primary land uses for the lower portion are agriculture with minimal grazing, forestry and recreation. Landuse distribution is shown in Figure 11.

Gold Creek is §303(d) listed from headwaters to Palouse River for sediment, temperature, nutrients, and bacteria. Beneficial uses are cold water aquatic life and secondary contact recreation, with salmonid spawning considered an existing use in the upper portion of the drainage (IDEQ, 2005).

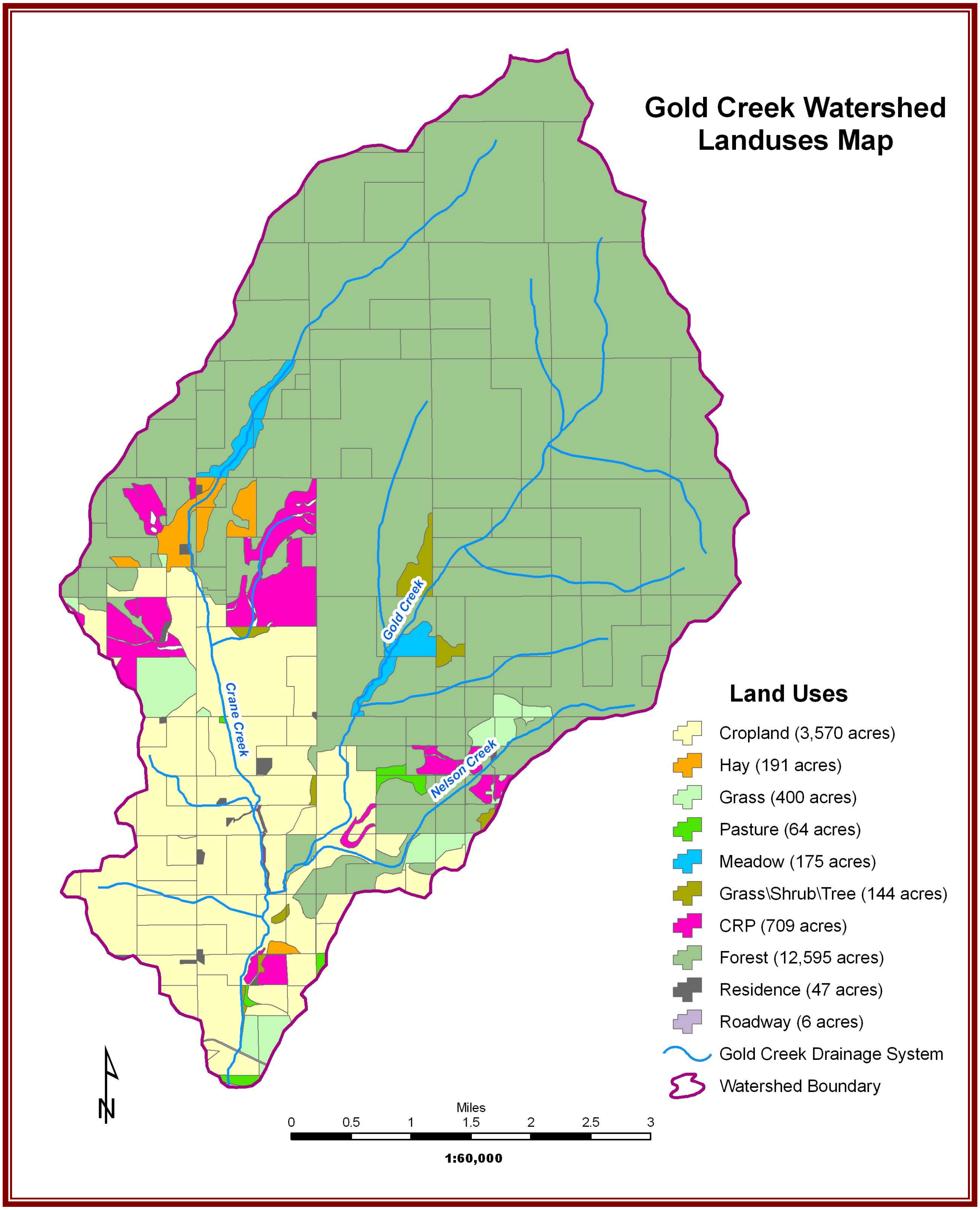

Figure 11. Gold Creek Landuse Map

Gold Creek is a perennial stream but some of the tributary streams in the headwaters are intermittent. Rainbow trout, brook trout and sculpin inhabit the upper half of the watershed while dace, suckers, shiners, and northern pike minnows inhabit the lower portion (IDEQ, 2005). IDEQ developed TMDLs for sediment, temperature, and bacteria for Gold Creek but recommended that Gold Creek be de-listed for nutrients. Water quality data indicate nutrient levels are not impairing beneficial uses.

Hatter Creek

The Hatter Creek Watershed is roughly 16,000 acres in size. Much (3,600 acres) of the uppermost watershed is the University of Idaho Experimental Forest. A few acres are managed by the Clearwater National Forest. The rest of the watershed is privately owned. Bennett Lumber owns most of the private timberland. Location of Hatter Creek relative to other TMDL watersheds is shown on Figure 7.

Hatter Creek is a fourth order stream at its confluence with the Palouse River. Headwaters begin on the north slope of Moscow Mountain. Hatter Creek generally flows from south to north in a dendritic pattern. Elevations range from 2,511 feet to 4,983 feet. Long Creek and the main stem Hatter Creek join in the upper middle section of the watershed. Weathered granitics comprise bedrock in the upper watershed. In the lower portion of the watershed metaphoric rocks underlay the Palouse Loess. In the valley bottoms along lower Hatter Creek, coarse textured alluvium is present (IDEQ, 2005).

The primary land uses in the upper watershed are forestry and recreational activities. Forestry, agriculture, and grazing occur in the lower watershed. The primary access road into the watershed parallels the mainstem of Hatter Creek for many miles; significant grazing occurs along this stretch. This road has several cut slope and fill slope failures directly into Hatter Creek. There are several homes located along Hatter Creek. Landuse distribution is shown in Figure 12.

Hatter Creek is §303(d) listed from headwaters to the Palouse River for sediment, temperature, nutrients, and bacteria. Beneficial uses are cold water aquatic life and secondary contact recreation, with salmonid spawning considered an existing use in the upper portion of the drainage.

Hatter Creek is a perennial stream; however, some of the tributary streams in the watershed are intermittent. Rainbow trout, brook trout, dace, and shiners are found in Hatter Creek. IDEQ developed TMDLs for sediment, temperature, and bacteria for Hatter Creek. A nutrient TMDL was developed for the lower half of Hatter Creek. IDEQ recommended that the upper half of Hatter Creek be de-listed for nutrients; water quality data indicate nutrient levels are not impairing beneficial uses (IDEQ, 2005).

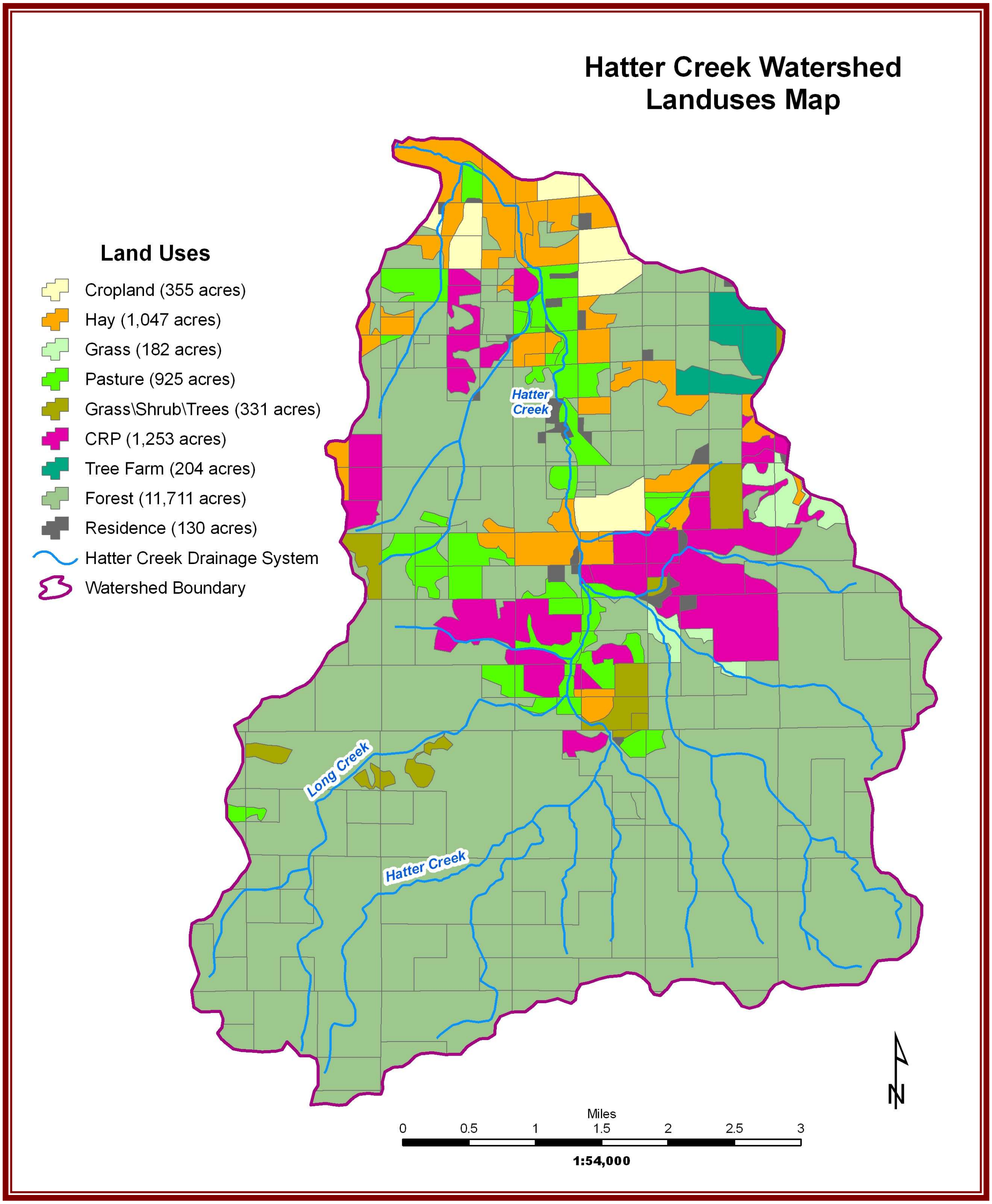

Figure 12. Hatter Creek Landuse Map

Rock Creek

The Rock Creek Watershed is relatively small, only 5,200 acres in size. Most of the land in Rock Creek is under private ownership. The only public lands are approximately 300 state-owned acres on the western edge of the watershed and about 10 acres of Clearwater National Forest at the southern divide. Location of Hatter Creek relative to other TMDL watersheds is shown on Figure 7.

Rock Creek is a third order stream at its confluence with the Palouse River. The headwaters originate on the north slope of Rocky Point. Rock Creek generally flows from the south to the north with a dendritic drainage pattern. The West Fork and East Fork join about 2 miles above the watershed outlet to form Rock Creek. Elevations range from 2,503 feet to 3,737 feet. Weathered granitics comprise bedrock in the upper watershed. In the lower portion of the watershed metaphoric rocks underlay the Palouse Loess. In the valley bottoms along lower Rock Creek, coarse textured alluvium is present (IDEQ, 2005).

Primary land uses are agriculture, grazing, forestry and recreational activities. Several rock pits and a junkyard are also present in the watershed. The main access road into this watershed parallels the mainstem of Rock Creek for several miles. Landuse distribution is shown in Figure 13.

The West Fork Rock Creek is §303(d) listed from headwaters to the Palouse River for sediment, temperature, nutrients, and bacteria. Beneficial uses are cold water aquatic life and secondary contact recreation. The listing includes only the West Fork of Rock Creek and the section of Rock Creek downstream of the West Fork. Based on the flow data that has been collected on Rock Creek, Rock Creek is an intermittent stream that goes completely dry during July and August. Rock Creek is also classified as an intermittent stream according to the USGS quadrangle map (IDEQ, 2005).

IDEQ was unable to find any fish data for Rock Creek although it is suspected that Rock Creek supports dace, redside shiners, and suckers. In the upper tributaries, there may be pockets of salmonids and sculpin. Temperature and nutrients were found not to be impairing beneficial uses, primarily based on the intermittent classification of Rock Creek. When temperature and nutrient levels exceeded state standards or EPA criteria, stream flows were below 1 cfs. Aquatic life beneficial uses do not apply for flows below 1 cfs on intermittent streams. IDEQ proposed delisting Rock Creek for temperature and nutrients and wrote TMDLs for sediment and bacteria (IDEQ, 2005).

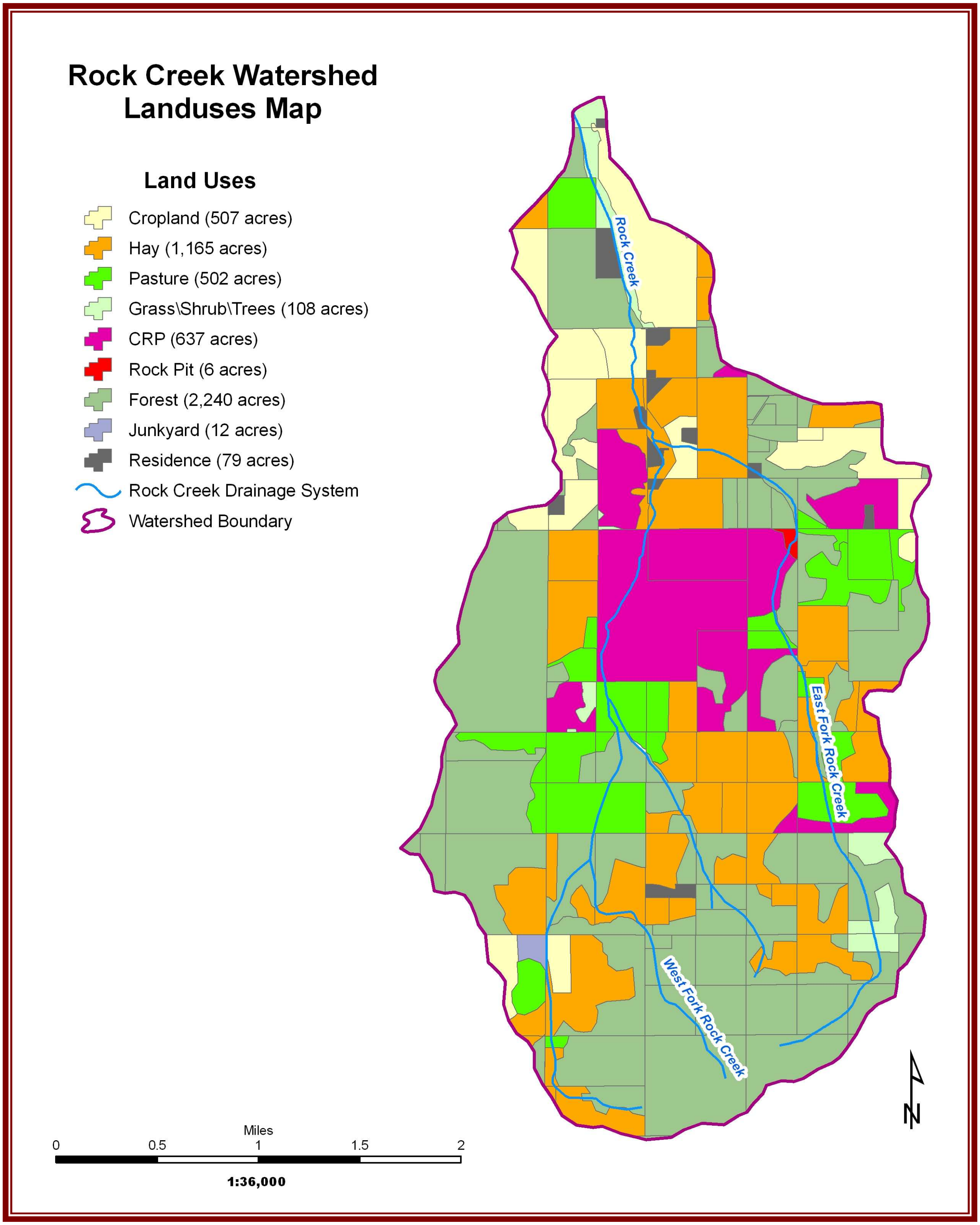

Figure 13. Rock Creek Landuse Map

Past Agricultural Conservation Efforts

Ebbert and Roe (1998) stated that erosion control practices instituted in the Palouse River Basin since the late 1970's have reduced erosion from cropland by at least 10%.

According to IDEQs survey of land uses in the North Fork Palouse Subbasin, an estimated 62,874 acres are in cropland, 18,361 acres are in hayland and 4,661 acres in pasture (IDEQ, 2003). Currently about 28,000 acres of agricultural lands are located within the watersheds of the six §303(d) listed creeks. This represents slightly more than one third of the total agricultural acres located within the North Fork Palouse River Subbasin.

The common crop rotation in the Idaho portion of the subbasin today is either a winter wheat/spring cereal grain rotation, a winter wheat/spring cereal grain/spring legume (pea or lentil) rotation, or a winter wheat/spring legume rotation. Research has shown that maximizing residues from the previously harvested crop reduces erosion potential on farm fields (Gilmore, 2004).

Conventional tillage, which involves inverting much of the soil surface during multiple field passes, has been traditionally practiced on cropland in the watershed. Mulch tillage uses equipment that disturbs the full soil surface but does not invert the soil or bury excessive amounts of crop residue (Mahler, et.al, 2003). Mulch till, which usually includes only one or two tillage passes, manages the amount, orientation and distribution of plant residue on the soil surface year round. No-till farming is gradually becoming utilized in the watershed. No-till farming includes using specialized equipment to place the fertilizer and seed directly into the previous year's crop residue without performing prior tillage operations. At least in one leg of the rotation, it is common to see a no-till operation replace conventional practices. For example, winter wheat is often no-tilled into lentil, pea, or spring grain stubble, where the fertilizer is applied during the same operation as seeding. Implementing no-till operations for every leg of the rotation is referred to as direct seed. This evolution of crop residue management throughout the subbasin has increased the over-winter crop stubble throughout the agricultural areas and decreased vulnerability of the soil surface to erosion. It is becoming more common for a no-till seeding operation to follow the low residue crop (lentils or peas). Minimum tillage operations, designed to minimize ground disturbance and maximize surface residue cover, are used throughout the watershed (Gilmore, 2004). Conversion from conventional tillage to mulch tillage and direct seeding has been ongoing in the Palouse River Basin; a significant transition has occurred since the 2002 water quality monitoring effort (IASCD, 2003) upon which the Palouse River Tributaries TMDL is based.

The Soil Conservation Service (SCS) became active in the Palouse River Basin 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 North Fork of the Palouse Subbasin through the Latah SWCD to assist with conservation planning and assistance. The Latah

Soil Survey, which encompasses 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 research 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 USDA Farm Service Agency (FSA) has cost-shared, through various farm programs, implementation of selected conservation practices with landowners and operators in the watershed.

FSA and 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 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 six North Fork Palouse TMDL watersheds, approximately 6,200 acres have been removed from production and placed into permanent vegetative cover under the Conservation Reserve Program (CRP).

The 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 North Fork Palouse 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 EQIP projects are active in the watershed.

The Idaho Association of Soil Conservation Districts (IASCD) has performed water quality monitoring within the watershed under an agreement with IDEQ thru the Latah SWCD to assist in development of the TMDL.

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 Latah SWCD serves as the lead in administering the Section 319 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, two projects have been implemented within the North Fork Palouse Subbasin.

The Latah SWCD applied for and was awarded a CWA §319 grant, in 2006, through IDEQ to fund the Palouse River Water Quality Improvement Project (PRWQIP), with non-federal match provided by landowner PRWQIP participants. The project focus is implementation of best management practices in three categories: riparian restoration, rural roads and agriculture/rangelands/pasturelands.

WATER QUALITY PROBLEMS

Table C lists all the §303(d) water bodies addressed in the Palouse River Tributaries TMDL (IDEQ, 2005) along with boundaries, listing basis, pollutants and segment IDs.

Table C. §303(d) segments in the Palouse River Subbasin. (IDEQ, 2005)

Waterbody	Assessment Unit-ID	1998 §303 (d)[1] Boundaries	Pollutants[2]	Listing Basis[3]
Big Creek	ID1706108CL027a_02 ID1706108CL027b_02	Headwaters to Palouse River	Sed, Nut, Temp, Bac	A
Deep Creek	ID1706108CL032a_02 ID1706108CL032a_03 ID1706108CL032b_02 ID1706108CL032b_03	Headwaters to Palouse River	Sed, Nut, Temp, Bac	A, B
Flannigan Creek	ID1706108CL011a_02 ID1706108CL011a_03 ID1706108CL011b_02 ID1706108CL011b_03	Headwaters to Palouse River	Sed, Nut, Temp, Bac	A
Gold Creek	ID1706108CL029_02 ID1706108CL029_03 ID1706108CL030_02 ID1706108CL031a_02 ID1706108CL031b_02	Waterhole Creek to Palouse River	Sed, Nut, Temp, Bac	A
Hatter Creek	ID1706108CL015a_02 ID1706108CL015b_02 ID1706108CL015b_03	Headwaters to Palouse River	Sed, Nut, Temp, Bac	A
Rock Creek	ID1706108CL012_03 ID1706108CL013a_02 ID1706108CL013b_03 ID1706108CL014a_02 ID1706108CL014b_02	Headwaters to Palouse River (West Fork Rock Creek)	Sed, Nut, Temp, Bac	A

1 Refers to a list created in 1998 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 Sed = Sediment, Nut = Nutrients, Temp = Temperature, Bac = Bacteria
3 Listing Basis A= Streams were on the 1992 305(b) report, B = Information submitted by the Columbia River Intertribal Fish Commission

Beneficial uses/status

The Idaho Water Quality Standards designate cold water aquatic life, secondary contact recreation, and agricultural water supply as beneficial uses for all of the §303(d) listed waterbodies; in addition, salmonid spawning is a designated use listed for the uppermost portions of Big Creek and Gold Creek (IDEQ, 2005). In the TMDL document, salmonid spawning is shown as an existing use for both upper Flannigan Creek and upper Hatter Creek.

The Palouse River Tributaries TMDL was developed to foster water quality appropriate to the protection and maintenance of the designated beneficial use of cold water aquatic life. Pollutants that most often affect this beneficial use include nutrients (that can spur aquatic growth resulting in low dissolved oxygen), increased sediment loading, and temperature loading (IDEQ, 2005). Table D lists designated beneficial uses and TMDLs developed for each waterbody.

Table D. Beneficial uses for §303(d) listed stream segments (IDEQ, 2005)

Waterbody	Boundaries	Uses	TMDLs developed
Big Creek	Headwaters to Palouse River.	Designated: CW, SCR, Upper - SS	Temperature
Deep Creek	Headwaters to Palouse River.	CW, SCR	Sediment, Temperature, Bacteria
Flannigan Creek	Headwaters to Palouse River.	Designated: CW, SCR, Upper – SS (existing)	Sediment, Temperature, Bacteria, Nutrients
Gold Creek	Waterhole Creek to Palouse River.	Designated: CW, SCR, Upper – SS	Sediment, Temperature, Bacteria
Hatter Creek	Headwaters to Palouse River.	Designated: CW, SCR, Upper – SS (existing)	Sediment, Temperature, Bacteria Nutrients (lower reach)
Rock Creek	Headwaters to Palouse River .	CW, SCR	Sediment, Bacteria
CW - Cold Water, SS - Salmonid Spawning, SC - Seasonal Cold Water, PCR - Primary Contact Recreation, SCR - Secondary Contact Recreation, DWS - Domestic Water Supply			

Pollutants

All of the §303(d) listed water bodies have sediment, temperature, nutrients, and bacteria listed as a possible pollutants. Changes to the §303(d) list recommended in the TMDL document included removing nutrients from the listed pollutants for Big Creek, Deep Creek, Gold Creek, Rock Creek and the upper half of Hatter Creek. The TMDL also recommended the removal of sediment and bacteria for Big Creek and temperature for Rock Creek. 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 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.

<u>Point Sources</u>

There are no point sources identified for the §303(d) waterbodies listed in the TMDL.

<u>Sediment</u>

All six §303(d) listed waterbodies addressed in the Palouse River Tributaries TMDL have sediment listed as a pollutant. Nonpoint sources of sediment in the Palouse 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. Sediment loads from agriculture, grazing, forestry, roads, and instream erosion were quantified. The effects of increased sedimentation to water bodies from mining, recreation, administrative activities, and air deposition are much less significant and were not assigned a load estimate (IDEQ, 2005).

Temperature (Heat Sources)

All six water bodies in the Palouse River Subbasin are §303(d) listed for temperature; 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, 2005).

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, 2005).

Nutrients

All six TMDL waterbodies are §303(d) listed for nutrients. 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 (May-October) nutrient target of 0.1mg/L and DO levels above the 6.0 mg/L was established in the TMDL (IDEQ, 2005).

Bacteria

All six TMDL waterbodies are §303(d) listed for bacteria. Sources of bacteria include livestock, wildlife, humans, pets or septic system drain fields. The §303(d) listed water bodies for bacteria were sampled from November 2001 through November 2002 for *E-coli* organisms and total fecal coliform. Five out of the six §303(d) streams were in violation of the secondary contact recreational standard.

TMDLs

Section §303(d) of the Clean Water Act (CWA) requires states to develop Total Maximum Daily Loads (TMDLs) 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, 2005).

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, 2005).

TMDL calculations are gross estimates based on very limited field data collection. Loads determined were based on water quality data collected for one monitoring year (2002). Load targets, although they appear static in the TMDL, should be fluid and change 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, 2005).

Sediment TMDLs

Sediment TMDLs were developed for five of the six §303(d) listed streams in this report: Deep Creek, Flannigan Creek, Gold Creek, Hatter Creek, and Rock Creek. The targets for the sediment TMDLs was based on the turbidity standard, which states that waters shall not exceed 25 NTU over background levels for greater than 10 days and shall not exceed 50 NTU over background at any time. Results of the sediment load analysis is listed in Table E.

Table E. Sediment Load Analysis (IDEQ, 2005).

Source (Creek)	Existing Load	Back ground	Load Capacity	Load Allocation	Load Reduction	Load Reduction (%)
Deep	7041 t/yr	234 t/yr	613 t/yr	380 t/yr	6541 t/yr	96%
Flannigan	1453 t/yr	62 t/yr	526 t/yr	464 t/yr	938 t/yr	67%
Gold	661 t/yr	26 t/yr	369 t/yr	343 t/yr	294 t/yr	46%
Hatter	1223 t/yr	219 t/yr	796 t/yr	547 t/yr	467 t/yr	46%
Rock	148 t/yr	12 t/yr	55 t/yr	42 t/yr	95 t/yr	69%

t/yr = tons per year

Temperature TMDLs

IDEQ did not compose a temperature TMDL for Rock Creek and recommended that Rock Creek be de-listed for temperature as a possible pollutant. The load capacities determined for temperature TMDLs on Deep, Gold, Big, Flannigan, and Hatter Creeks 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.

All *Very Good* and *Good* cover condition classes meet PNV targets within limits of variability. According to table 5-20 in the TMDL document, Big Creek meets this standard for all listed segments (IDEQ, 2005). Stream segments in the remaining four TMDL watersheds that fall below the *Good* cover class are listed below in Table F.

Table F. Temperature load allocations (IDEQ, 2005)

Segment	Average PNV (Load Capacity)	Average Existing Cover (Existing Load)	Average Cover Condition Class	Average Load Allocation (LA)
Lower Deep Creek (AU#ID17060108CL032b_03)	54.4%	15.6%	Poor	-70.2%
Tributaries to Lower Deep (AU#ID17060108CL032b_02)	65.2%	21.2%	Poor	-69.3%
Upper Deep Creek (AU#ID17060108CL032a_03)	50%	25%	Poor	-50%
East Fork Deep Creek (AU#ID17060108CL032a_02)	68.5%	47.7%	Fair	-30%
Middle Fork Deep & Tribs (AU#ID17060108CL032a_02)	69.5%	54%	Fair	-23.7%
Tributary to Upper Deep (AU#ID17060108CL032a_02)	68.9%	43.3%	Fair	-37.3%
Lower Flannigan (AU#ID17060108CL011b_03)	68%	43%	Fair	-36.3%
Tributary to Lower Flannigan (AU#ID17060108CL011b_02)	70%	35.7%	Poor	-49%
Lower Gold & Lowest Trib (AU #ID17060108CL029_03)	60%	23.3%	Poor	-60.8%
Lower Crane Creek (AU #ID17060108CL031b_02)	70%	55%	Fair	-21.5%
Tributaries to Lower Crane	70%	31.3%	Poor	-53.2%

(AU #17060108CL031b_02)				
Lower Hatter (AU#ID17060108CL015b_03)	63.3%	38.7%	Fair	-37.6%
Tributary to Lower Hatter (AU#ID17060108CL015b_02)	70%	47%	Fair	-35.1%
Tributary to Lower Hatter (AU#ID17060108CL015b_02)	78.6%	58.6%	Fair	-25%
Tributary to Lower Hatter (AU#ID17060108CL015b_02)	77.1%	58.6%	Fair	-24%

LA= ((Existing cover – Potential cover)/Potential cover) x 100

Nutrient TMDLs

Nutrient TMDLs were developed only for Flannigan Creek and the lower section of Hatter 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.

The nutrient load capacities and existing loads established by the TMDL were estimated, by stream segment, in pounds (lbs) per day. In addition to the total phosphorus (TP) target, the DO readings within Flannigan Creek and lower Hatter Creek will need to stay above 6.0 mg/L. The nutrient TMDLs only apply during the growing season, May until October, of each year (IDEQ, 2005).

Table G. Nutrient load allocations (IDEQ, 2005)

Source (Creek)	**Month**	**Pollutant**	**Existing Load**	**Load Capacity**	**Load Allocation**	**Load Reduction**
Flannigan (PR-16)	June	Total Phosphorus	1.883 lbs/day	1.487 lbs/day	1.368 lbs/day	0.396 lbs/day
Flannigan (PR-17)	June	Total Phosphorus	2.397 lbs/day	2.122 lbs/day	1.655 lbs/day	0.275 lbs/day
Flannigan (PR-16)	July	Total Phosphorus	0.501 lbs/day	0.418 lbs/day	0.355 lbs/day	0.083 lbs/day
Flannigan (PR-17)	July	Total Phosphorus	0.743 lbs/day	0.474 lbs/day	0.578 lbs/day	0.269 lbs/day
Flannigan (PR-16)	August	Total Phosphorus	0.087 lbs/day	0.083 lbs/day	0.083 lbs/day	0.004 lbs/day
Hatter (PR-12)	8/15-9/15	Total Phosphorus	0.061 lbs/day	0.051 lbs/day	0.051 lbs/day	0.011 lbs/day

Bacteria TMDLs

Bacteria TMDLs were developed for five of the six §303(d) listed streams: Deep Creek, Flannigan Creek, Gold Creek, Hatter Creek and Rock Creek. Deep Creek is an intermittent stream; therefore, bacteria TMDLs only apply to periods when discharges are greater than 5 cfs. TMDL analysis is summarized in Table(s) H1 to H5 below.

Table H1. Bacteria nonpoint source load allocations for Gold Creek. (IDEQ, 2005)

Source (Creek)	**Month**	**Current Load** *(E.coli organism/day)*	**Load Allocation** *(E.coli organisms/day)*	**MOS (10%)**	**Load Reduction** *(E.coli organisms/day)*
Gold (PR-9)	Nov	1.18×10^{11}	2.82×10^{10}	8.98×10^{9}	9.88×10^{10}
Gold (PR-9)	Dec	1.34×10^{11}	1.19×10^{11}	1.5×10^{9}	1.65×10^{10}
Gold (PR-8)	Aug	2.59×10^{9}	1.35×10^{9}	1.24×10^{8}	1.36×10^{9}
Gold (PR-9)	Sep	1.96×10^{10}	4.71×10^{9}	1.49×10^{9}	1.64×10^{10}
Gold (PR-8)	Oct	3.80×10^{9}	3.78×10^{9}	2.0×10^{6}	2.2×10^{7}

Table H2. Bacteria nonpoint source load allocations for Flannigan Creek. (IDEQ, 2005)

Source (Creek)	**Month**	**Current Load** *(E.coli organism/day)*	**Load Allocation** *(E.coli organisms/day)*	**MOS (10%)**	**Load Reduction** *(E.coli organisms/day)*
Flannigan (PR-16)	Mar	6.65×10^{11}	6.28×10^{11}	3.7×10^{9}	4.07×10^{10}
Flannigan (PR-16)	May	5.81×10^{11}	1.39×10^{10}	4.42×10^{10}	4.86×10^{11}
Flannigan (PR-17)	May	4.16×10^{11}	1.50×10^{11}	2.66×10^{10}	2.93×10^{11}
Flannigan (PR-17)	June	3.35×10^{10}	2.79×10^{10}	5.6×10^{8}	6.16×10^{9}
Flannigan (PR-17)	July	8.83×10^{10}	2.12×10^{10}	6.71×10^{9}	7.38×10^{10}
Flannigan (PR-17)	July	1.27×10^{10}	1.09×10^{10}	1.8×10^{8}	1.98×10^{9}
Flannigan (PR-17)	July	2.09×10^{10}	5.02×10^{9}	1.59×10^{9}	1.75×10^{10}
Flannigan (PR-17)	August	2.44×10^{9}	2.34×10^{9}	1.0×10^{7}	1.1×10^{8}
Flannigan (PR-17)	Sept	8.17×10^{9}	4.71×10^{9}	3.46×10^{8}	3.81×10^{9}
Flannigan (PR-17)	Sept	1.04×10^{10}	2.51×10^{9}	7.89×10^{8}	8.68×10^{9}
Flannigan (PR-17)	Oct	8.94×10^{9}	5.99×10^{9}	2.95×10^{8}	3.25×10^{9}

Table H3. Bacteria nonpoint source load allocations for Hatter Creek. (IDEQ, 2005)

Source (Creek)	**Month**	**Current Load** *(E.coli organism/day)*	**Load Allocation** *(E.coli organisms/day)*	**MOS (10%)**	**Load Reduction** *(E.coli organisms/day)*
Hatter (PR-12)	Dec	4.54×10^{10}	3.79×10^{10}	7.5×10^{8}	8.25×10^{9}
Hatter (PR-12)	March	3.72×10^{12}	8.93×10^{11}	2.83×10^{11}	3.11×10^{12}
Hatter (PR-13)	March	3.29×10^{12}	7.89×10^{11}	2.5×10^{11}	2.75×10^{12}
Hatter (PR-12)	May	1.0×10^{12}	5.25×10^{11}	4.75×10^{10}	5.23×10^{11}
Hatter (PR-12)	June	1.19×10^{11}	9.96×10^{10}	1.94×10^{9}	2.13×10^{10}
Hatter (PR-12)	July	2.21×10^{10}	1.96×10^{10}	2.5×10^{8}	2.75×10^{10}
Hatter (PR-13)	July	5.59×10^{10}	3.28×10^{10}	2.31×10^{9}	2.54×10^{10}
Hatter (PR-12)	July	1.45×10^{10}	8.35×10^{9}	6.15×10^{8}	6.77×10^{9}
Hatter (PR-13)	July	2.43×10^{10}	2.03×10^{10}	4.0×10^{8}	4.4×10^{9}
Hatter (PR-12)	August	1.53×10^{9}	1.21×10^{9}	3.2×10^{7}	3.52×10^{8}

Table H4. Bacteria nonpoint source load allocations for Deep Creek. (IDEQ, 2005)

Source (Creek)	**Month**	**Current Load** *(E.coli organisms/day)*	**Load Allocation** *(E.coli organisms/day)*	**MOS (10%)**	**Load Reduction** *(E.coli organisms/day)*
Deep (PR-5)	Dec	2.99×10^{11}	1.01×10^{11}	1.98×10^{10}	2.18×10^{11}
Deep (PR-6)	Dec	3.26×10^{11}	7.83×10^{10}	2.48×10^{10}	2.73×10^{11}
Deep (PR-5)	Dec	3.95×10^{11}	2.32×10^{11}	1.63×10^{10}	1.79×10^{10}
Deep (PR-6)	Dec	3.49×10^{11}	3.24×10^{11}	2.5×10^{9}	2.75×10^{10}
Deep (PR-5)	Mar	1.53×10^{12}	1.01×10^{12}	5.2×10^{10}	5.72×10^{11}
Deep (PR-5)	Mar	8.49×10^{11}	7.08×10^{11}	1.41×10^{10}	1.55×10^{11}
Deep (PR-6)	May	2.15×10^{11}	2.03×10^{11}	1.2×10^{9}	1.32×10^{10}
Deep (PR-7)	June	3.64×10^{10}	1.75×10^{10}	1.89×10^{9}	2.08×10^{10}

Table H5. Bacteria nonpoint source load allocations for Rock Creek. (IDEQ, 2005)

Source (Creek)	**Month**	**Current Load** *(E.coli organism/day)*	**Load Allocation** *(E.coli organisms/day)*	**MOS (10%)**	**Load Reduction** *(E.coli organisms/day)*
Rock (PR-14)	Dec	8.91×10^{10}	8.41×10^{10}	5.0×10^{8}	5.5×10^{9}
Rock (PR-15)	March	8.29×10^{10}	8.24×10^{11}	$5.0x 10^{7}$	5.5×10^{8}

Water Quality Monitoring

The Idaho Association of Soil Conservation Districts (IASCD) collected water quality data from several tributaries to the Palouse River from November 2001 through November 2002. This monitoring project was initiated to provide background data on the State of Idaho's §303 (d) listed tributaries of the Palouse River to aid in TMDL development (IASCD, 2003).

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, dissolved oxygen (DO), and air and water temperatures.

All six TMDL streams that were sampled have their headwaters located on forested slopes; with the exception of Big Creek, the streams continue to flow through stretches of predominantly agricultural lands until they reach the North Fork of the Palouse River (IASCD, 2003). Monitoring site locations, listed in Table I below, are displayed in Figure 14.

Table I. Monitoring Sites for the §303(d) listed Palouse tributaries (IASCD, 2003)

SITE ID	SITE NAME	LEGAL DESCRIPTION
PR-5	DEEP CREEK (LOWER)	
PR-6	DEEP CREEK (MID)	
PR-7	DEEP CREEK (UPPER)	
PR-8	GOLD CREEK (UPPER)	
PR-9	GOLD CREEK (LOWER)	
PR-10	LAST CHANCE CREEK (UPPER BIG)	
PR-11	BIG CREEK (LOWER)	
PR-12	HATTER CREEK (LOWER)	
PR-13	HATTER CREEK (UPPER)	
PR-14	ROCK CREEK (LOWER)	
PR-15	W.F. ROCK CREEK (UPPER)	
PR-16	FLANNIGAN CREEK (LOWER)	
PR-17	FLANNIGAN CREEK (UPPER)	

Sample collection began in November of 2001 and continued for a full calendar year, with IASCD, Latah SWCD, and IDEQ staff sampling the sites every two weeks. 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, 2005).

Sites PR-5, PR-6, PR-9, PR-10, PR-15, and PR-16 all dropped below the 6.0 mg/L DO criteria once during the sampling period. PR-7, PR-11, and PR-12 fell below the criteria twice during the sampling period. It should also be noted that most of the sites in violation of the 6.0 mg/L standard were only observed to be in violation when stream flow was less that 1.0 cubic foot per second (cfs). Low flow or stagnant conditions often cause oxygen sags to occur (IASCD, 2003).

This page has been redacted per the 2008 Farm Bill, Section 1619, codified as 7 U.S.C. 8791(b)(2).

The EPA Gold Book recommended criterion of 0.1 mg/L for total phosphorus (TP) was exceeded several times at all monitoring sites except PR-10. Correlation to the state's narrative standard could not be conclusively established because corresponding DO violations only occurred when stream flows were very low (<1cfs). Lack of flow was as likely as the slight TP criteria exceedances to be responsible for oxygen sags.

Sites PR-5, PR-6, PR-16 and PR-17 all exceeded the cold-water biota temperature criteria of 22˚C. Site PR-8 exceeded the 13˚ C threshold associated with being listed for salmonid spawning; the remaining sites did not exceed the temperature criteria (IASCD, 2003) .

Turbidity levels appeared to be highest during spring flows, and the water often appeared visibly murky. However, using the upstream monitoring sites as a proxy for background turbidity, none of the sites near the mouth of these streams surpassed the instantaneous exceedance of 50 NTUs, except during the highest peak of spring runoff. Stream name and number below give the number of turbidity exceedances over estimated background levels (IASCD, 2003) :

Gold Creek (PR8-PR9) = 2
Hatter Creek (PR12-PR13) = 1
Flannigan Creek (PR16-PR17) = 1

Based on visual assessments, TSS rates, and turbidity levels, Hatter Creek, Flannigan Creek, Gold Creek, and Deep Creek seem to have the highest rates of bank erosion. Hatter and Flannigan also appear to have more cattle accessing the channel than the other streams in the subbasin. Cattle, horses, and goats were noticed in lesser concentrations on Deep, Gold, and Rock creeks, respectively (IASCD, 2003).

With the exception of PR-11 (Big Creek), all of the sites sampled exceeded the secondary contact criteria for bacteria, at least once. Many of the sites had the most elevated levels of bacteria during periods of extremely low flow, usually during July and August. There were a few sites, however, that showed elevated bacteria levels even during spring flows, when one might expect low bacteria levels due to dilution. These creeks were Deep Creek (PR-5-7), Gold Creek (PR-9), Hatter Creek (PR-12-13), and Flannigan Creek (PR-16). All of these streams had cattle, horses, sheep, or goats directly accessing them in areas adjacent to, or at, the monitoring sites. There were many instances, however, when cattle were not present but bacteria levels exceeded criteria. This may be due to faulty septic systems in the area, although wildlife may also be a contributing factor (IASCD, 2003).

Beneficial Use Reconnaissance Program (BURP) surveys were completed, by IDEQ, on the §303(d) streams within the Palouse River Subbasin during the summer monitoring seasons of 1996 and 2002. Based on the scoring system, Big Creek and Hatter Creek fully support beneficial uses. Upper Deep Creek and upper Gold Creek also support beneficial uses. Lower Deep Creek, lower Flannigan Creek, and lower Gold Creek don't fully support beneficial uses. Upper Flannigan Creek and the West Fork Rock Creek were dry when the BURP surveys were conducted (IDEQ, 2005).

Temperature monitoring of the TMDL watersheds was conducted by Dansart in 2005 and 2007. Loggers recorded temperatures at 1 hour intervals from mid July to October of each year; upper and lower monitoring sites were utilized for each tributary stream when flow was present. Rock Creek was not monitored, the creek was dry during the summer months of both years. No temperature exceedances were recorded at any monitoring site after the month of July; streams were either dry or running at baseflows (flows at which the streams are essentially groundwater-fed). No exceedances were recorded for Gold Creek, in either year, at either site. A single exceedance of the 22˚C instantaneous standard was recorded for lower Hatter Creek on July 28, 2005. For Flannigan Creek, nine exceedances of the 19˚C daily average were recorded during July of 2007 at the lower site; none were recorded at either site during 2005. The lower monitoring site for Deep Creek showed one exceedance of the 19˚C daily average on July 16, 2005 and three exceedances during July, 2007; temperature loggers at the upper site were destroyed by livestock both years. Ten exceedances of the 19˚C daily average were recorded at the lower site on Big Creek during 2007; however, according to 1996 and 2002 BURP monitoring, Big Creek fully supports beneficial uses and average cover condition class for the lower segment of Big Creek was listed as *Good* in the TMDL (IDEQ, 2005).

Modeling

From the 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".

According to IDEQ (2005) modeling, the highest annual sediment delivery comes from the Deep Creek watershed (7,040 tons), followed by Flannigan Creek (1,452 tons), Hatter Creek (1,223 tons), Gold Creek (662 tons), and Rock Creek (148 tons). Since very little sediment is delivered to Big Creek, a sediment TMDL was not calculated. According to Table D-4 in the TMDL, relatively little channel erosion was estimated for Big Creek (9 tons) and Rock Creek (25 tons) compared to more significant channel erosion from Deep Creek (398 tons), Hatter Creek (219 tons), Flannigan Creek (177 acres) and Gold Creek (162 tons). The highest percentage (24%) of total sediment delivered due to channel erosion is found in the Gold Creek watershed. This is greater than the percentage of total load delivered by channel erosion estimated for Hatter (18%), Rock (17%), Flannigan (12%), and Deep (6%) Creeks. Sediment delivered by roads ranges from 33 tons for the Big Creek watershed to 93 tons for the Deep Creek watershed.

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 DEQs (2003) landuse map; Dansart (2004) modeled potential for cropland sediment delivery reduction due to tillage conversion, by TMDL watershed. 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:

Deep Creek – 2.5 tons/acre
Flannigan Creek – 4.0 tons/acre
Gold Creek – 2.6 tons/acre
Hatter Creek – 1.0 ton/acre
Rock Creek – 4.3 tons/acre
Big Creek – N/A; no cropland, no sediment TMDL

Based on sediment load reduction targets outlined in the TMDL document, the cropland acreage that would need to be converted to meet these targets utilizing only the cropland tillage conversion scenario (without implementation of other BMPs) is:

Deep Creek – 2,616 acres
Flannigan Creek – 235 acres
Gold Creek – 113 acres
Hatter Creek – 467 acres
Rock Creek – 22 acres
Big Creek – N/A; no cropland, no sediment TMDL

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 monitoring to determine how distant instream water quality targets are from being met is likely a good use of funds prior to major BMP implementation efforts.

Threatened And Endangered Species

No bull trout or anadromous fish occur within the Palouse Subbasin (IDFG, 2008). 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). A lynx sighting was reported in 1994 near the northeastern Palouse Subbasin divide. There have been occasional gray wolf sightings in recent years, but it is unknown if any resident wolf packs exist. Water Howellia, a threatened aquatic plant, is known to exist in wetland areas within the watershed (Heekin, 2009)

Agricultural Water Quality Inventory and Evaluation

According to IDEQ's 2002 survey of land uses in the North Fork Palouse Subbasin, an estimated 62,874 acres are in cropland, 18,361 acres are in hayland and 4,661 acres in pasture. At the present time, approximately 28,000 acres of agricultural lands are located within the watersheds of the six §303(d) listed tributary streams.

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 North Fork Palouse Subbasin are primarily located in the Palouse and Nez Perce Prairies - Palouse Hills Common Resource Area (USDA, 2008). This area is part of the western foothills of the Northern Rocky Mountains and characterized by a non-forested, loess-covered area with greater than 15 inches of precipitation. The highly productive soils have high organic matter and clay content.

Soils underlying agricultural lands within the Palouse Subbasin area in Idaho belong to three major soils groups. Near the Idaho-Washington border are very deep to moderately deep soils formed in loess and rock fragments on scattered buttes at elevations greater than 2,500 feet; these are typically soils of the Palouse-Thatuna-Naff association. Farther east, deep soils formed in loess on upland hills less than 3,000 feet are represented by the Larkin-Southwick association and the Freeman-Joel-Taney association. Transecting these deep soils are very deep valley soils formed in loess known as the Palouse-Athena association (USDA, 1978).

Within the TMDL watersheds, it is believed that most landowners/operators are participating in USDA programs. It is estimated that 6,200 acres or about 22% of agricultural lands within the watersheds are contracted under the Conservation Reserve Program (CRP). Table B lists estimated acreage totals for each landuse by TMDL watershed.

Dry Cropland

In 1978, USDA estimated annual erosion rates of 6 to 14 tons/acre/year for Palouse River Basin cropland with greater than 18 inches annual precipitation. The Palouse-Thatuna-Naff and the Freeman-Joel-Taney soil association croplands averaged 12 tons/acre/year soil loss rates; the Larkin-Southwick soils had 7 tons/acre annual erosion rates reported (USDA, 1978). According to information collected by the USGS, it appears that sediment runoff into the streams has decreased since the 1960s and 1970s. Suspended sediment levels in the Palouse River show a decreasing trend (Ebbert and Roe, 1998).

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. Some concentration (gully) erosion occurs in places due to the steepness of the slopes, even where high residue levels are maintained on the fields (Latah SWCD, 2004).

The common crop rotation in the Idaho portion of the watershed today is either a winter wheat/spring cereal grain rotation, a winter wheat/spring cereal grain/spring legume (pea or lentil) rotation, or a winter wheat/spring legume rotation. Research has shown that maximizing residues from the previously harvested crop reduces erosion potential on the farm fields (RPU, 2004).

Most cropland is under an Idaho/Washington 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 consisted of 3 year rotations of winter wheat, spring cereal (barley or wheat), and a legume (peas or lentils) or canola.

It is estimated that 10,330 acres are currently cropped under some type of grain/legume rotation within the TMDL watersheds, with an additional 3,000 acres of cropped grass. About 10,000 acres of this total is split between two watersheds, Deep Creek (6,500) and Gold Creek (3,500). It is believed that most of the 6,200 acres contracted under the Conservation Reserve Program (CRP) was previously cropland.

Pasture/hayland/shrubland

Pasture and hayland within the TMDL watersheds totals about 9,300 acres. Hay is cut on approximately 6,000 acres. The Deep Creek watershed has the most acres of pasture (1,350) and hayland (3,000). The Gold Creek and Big Creek watersheds have the least pasture/hay acreage; there are less than 300 combined acres for each watershed.

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 Hatter Creek, Flannigan Creek and Deep Creek. Monitoring results (IASCD, 2003) showed these creeks exhibited most violations of the bacteria standard for secondary contact recreation.

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 areas are scattered randomly throughout the watershed in small plots. Most are located on steep slopes inaccessible to farming operations; they 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.

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.

Water Quality Concerns Related to Agricultural Land Use

Agricultural activities in TMDL watersheds contribute to sediment, bacteria, and temperature problems identified in the TMDL document. Nutrients don't appear to be a major problem. IDEQ (2005) recommended that Deep Creek, Gold Creek, Rock Creek and Big Creek be de-listed for nutrients. Evidence for nutrient problems in Hatter Creek and Flannigan Creek are inconclusive; the dissolved oxygen problems attributed to nutrients are likely to be due to extremely low stream flows ($\leq$ 0.1 cfs) and stagnant conditions at the time monitoring occurred. Sediment contributions are associated with sheet and rill, concentrated flow, and streambank soil erosion processes. 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, 2003).

The occasionally high stream temperatures recorded are a function of both an inadequate vegetative canopy and low flows along some stream reaches. If addressing temperature concerns becomes necessary, 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, 2005). 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

The highest priority for BMP implementation is the adoption of conservation tillage practices to minimize cropland sheet and rill erosion and decrease sediment delivery to the Palouse 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) Deep Creek – contains the most cropland, hayland, and pastureland acreage in addition to several winter feed areas; several bacteria violations, highest estimated sediment load, most sediment load reduction needed.
2) Flannigan Creek- third highest cropland acreage, second highest sediment load, several bacteria violations, second highest sediment load reduction needed, temperature and nutrient criteria exceedances.
3) Gold Creek – second most cropland acreage, fourth highest sediment load, several bacteria violations, fourth highest sediment load reduction needed; highest portion of total sediment load delivered by channel erosion (24%)
4) Hatter Creek – riparian area most impacted by livestock, highest bacteria readings, temperature exceedances, third highest sediment load, third highest sediment load reduction needed; second highest portion of total sediment load delivered by channel erosion (18%).Very little cropland is present. BURP surveys (2002) indicate Hatter Creek fully supports beneficial uses.
5) Rock Creek – bacteria violations, lowest sediment load reduction needed. Relatively little cropland present in watershed.
6) Big Creek - has no cropland and very little livestock grazing. Average *Good* canopy cover class in lowest reach where occasional temperature exceedances are recorded. No TMDLs for pollutants other than temperature. BURP surveys (2002) indicate Big Creek fully supports beneficial uses.

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 North Latah County Highway District along with the responsibility for roads BMPs installation.

<u>Cropland</u>

The Palouse is 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).

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 3 to 13 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.

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 more than 3 tons/acre on average.

Treatment: Reduce or eliminate ephemeral gully erosion (concentrated source of soil erosion) by installing water and sediment control structures.

Riparian Zone

Channel erosion is a significant source of sedimentation in the TMDL watersheds. A cursory examination of the watersheds revealed that some streambanks are unstable. 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 resistive substrate, then the stream’s energy is re-directed to bank erosion. According to the TMDL (IDEQ, 2005) Gold Creek has the largest percentage (24%) of total sediment load as channel erosion of the TMDL watersheds, followed by Hatter Creek (18%). Deep Creek has the highest estimated total sediment load, 398 tons, delivered from channel 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.

Riparian Zone Cropland Resource Issues

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.

Pasture

Field observations conclude that grazing activities contribute to riparian area denudation and to the overall sediment and bacteria loads within the Palouse 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 Palouse River Subbasin. All of the §303(d) listed water bodies have some grazing impacts to their riparian areas.

Pasture lands (>3,000 acres) are generally adjacent to stream channels where livestock can access water. Concentrated winter feeding occurs along some §303(d) drainages.

> *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 (>6,000 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 in addition to 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 J thru O 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 Palouse River Tributaries 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), leave 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 conventional tillage (Gilmore, 1995). Conservation tillage is proposed for use on cropland acres within the Palouse River Tributaries TMDL watersheds. Direct seeding practices undertaken on cropland in the Paradise Creek watershed, several miles south of the Palouse River Tributaries 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. Research (Young, 1999) 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 such as the Palouse; 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 14 tons/acre to 3 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:

Deep Creek – 2.5 tons/acre
Flannigan Creek – 4.0 tons/acre
Gold Creek – 2.6 tons/acre
Hatter Creek – 1.0 ton/acre
Rock Creek – 4.3 tons/acre
Big Creek – N/A; no cropland

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 (Mahler, et. al, 2003). The use of strip-cropping and contour buffer strips on the steeper slopes characteristic of much of the Palouse 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 Palouse 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 and other Palouse 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 Palouse 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 Palouse Tributaries 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. Appendix D of the TMDL document compiled coarse streambank erosion estimates utilizing NRCS (1983) field estimate procedure. Estimated channel erosion sediment delivery was:

Deep Creek – 398 tons/year	6% of total load
Flannigan Creek – 177 tons/year	12% of total load
Gold Creek – 162 tons/year	24% of total load
Hatter Creek – 219 tons/year	18% of total load
Rock Creek – 25 tons/year	17% of total load
Big Creek – 9 tons/year	4% of total load

Permanent vegetative buffers could eventually reduce streambank erosion substantially once stream channel stability and hydraulic equilibrium are restored.

As enhanced vegetative 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 (>6,000 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 3,300 acres, grazed by livestock is scattered throughout the watersheds. Cattle are present in all watersheds, with numbers ranging from 50 to 400 head per watershed. Horses were observed in much lower quantity (<50 head) per watershed. Smaller numbers of sheep, goats and llamas occur in some watersheds. Riparian livestock impact is spotty but severe in several areas where concentrated winter feeding occurs adjacent to creek channels.

It is likely much of the sediment and 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. 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.

Recommended BMPs And Estimated Costs

A summary of water quality concerns and BMP recommendations were developed for the six TMDL watersheds that encompass the 303 (d) listed tributaries to the North Fork Palouse River. They are: Big Creek, Deep Creek, Flannigan Creek, Gold Creek, Hatter Creek and Rock Creek. The summary information, list of BMPs, and estimated costs organized by TMDL watershed are presented below.

<u>Big Creek</u>

Big Creek has a small (10,300 acres) watershed with very few (300 acres) agricultural lands. Big Creek has no cropland and little livestock pasture; it is the lowest priority for implementation of BMPs. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section.

There are roughly 10,000 acres of forested lands in the Big Creek watershed. About 3,000 forest acres are managed by the US Forest Service, 600 acres by Idaho Department of Lands (IDL), with the remaining forest owned by private timber interests. 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.

Landuse distribution is shown in Figure 8 of the *TMDL Watersheds Descriptions* section. Estimated agricultural landuse acres in the Big Creek Watershed are:

Hay	160 acres
CRP	100 acres
Grazed Meadow	25 acres
Pasture	20 acres

<u>Agricultural Activities</u>

Agricultural activities are practiced in only a small portion (3%) of the watershed, primarily near the mouth of Big Creek. Little cumulative water quality impact can be attributed to agriculture. Hay is cut on a few hundred acres and probably grazed after cutting. A forest meadow immediately upstream of the hay fields also appears to be grazed. Less than 50 head of cattle were observed in August. Most livestock concentration (est. 12 head) was noted in a 20 acre pasture just above the stream mouth.

<u>Water Quality Concerns</u>

Rainbow trout and sculpin have been observed in upper Big Creek and a tributary. Big Creek has the fewest anthropogenic impacts of all the 303(d) streams in the Palouse River Subbasin (IDEQ, 2005). BURP surveys completed in 2002 indicate that Big Creek fully supports beneficial uses. IDEQ recommended delisting the watershed for all pollutant sources except temperature.

Any existing temperature problem would be isolated to agricultural lands along the lower two miles of drainage. IDEQ (2005) rated the average cover condition class for this stream segment as *Good*; this is explained in Table 5-20 from the TMDL as meeting potential natural vegetation within the limits of variability. Several temperature standard exceedances were recorded during July of 2007 (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.

There may be minor bacteria contributions from cattle grazing near the stream mouth. No bacteria violations were recorded. IDEQ (2005) recommended delisting Big Creek for bacteria and did not perform a bacteria TMDL analysis.

No obvious sediment or nutrient problems related to agricultural activities were observed. Minor bank trampling occurs where cattle graze. DEQ recommended delisting Big Creek for sediment and nutrients.

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 near the Big Creek mouth. Recommendations include exclusion of the lowermost stream corridor by fencing; water gaps are acceptable because no sediment or bacteria problem was 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 J.

Table J. Big Creek Recommended BMPs (potential future work).

Future Level of Treatment for Grass/Pasture/Hay Lands				
Grass/Pasture/Hay Lands Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	13		
Fence (382)	Ft.	18,000	$ 36,000	$ 720
Riparian Forest Buffer (391)	Ac.	13	$ 19,500	$ 200
Riparian Herbaceous Cover (390)	Ac.	13	$ 3,900	$ 40
Tree/Shrub Establishment (612)	Ac.	13	$ 5,900	$ 60
Use Exclusion (472)	Ac.	13	$ -	$ 10
Total Costs			$ 65,300	$ 1,030

Rock Creek

Rock Creek has a very small watershed (5,200 acres) with approximately 3,000 acres of agricultural land. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section. Forested lands (2,200 acres) within the watershed are privately owned except for 300 state-owned acres on the western edge of the watershed and about 10 acres of CNF land at the southern divide. Several rock pits and a junkyard are also present in the watershed.

Figure 13 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres in the Rock Creek Watershed are:

CRP	637 acres
Crop	507 acres
Hay	1,170 acres
Pasture	510 acres
Grass\Shrub\Trees	110 acres

Agricultural Activities

More than half of the watershed is agricultural lands. Approximately 20% of those acres have been enrolled in the CRP program. Some CRP parcels may have been retired or grass stands re-established due to weed problems; chemical treatment to kill existing vegetation was noted. Additional CRP lands appear to have been cut for hay; a local hay shortage resulted in a temporary CRP rules exemption in the region.

There are approximately 500 acres of cropland in the watershed. Hay is produced on 1,200 acres; some of the hayland is grazed by cattle after the last seasonal cutting.

Pastureland grazed by cattle (est.100-200 head) abuts drainages throughout the watershed. Dispersed cattle forage on forest lands. Approximately 50 goats and 14 horses were observed.

Farmland is being divided into residential tracts, generally less than 50 acres each. These residences sometimes have riding horses, and most of the surrounding ground is in grass, pasture, hay, or CRP.

Water Quality Concerns

IDEQ (2005) was unable to find any fish data for Rock Creek although it is suspected that Rock Creek supports dace, red-side shiners, and suckers. In the upper tributaries, there may be pockets of salmonids and sculpin. Temperature and nutrients were found not to be impairing beneficial uses, primarily based on the intermittent classification of Rock Creek. When temperature and nutrient levels exceeded state standards or EPA recommended criteria, stream flows were below 1 cfs. Aquatic life beneficial uses do not apply for flows below 1 cfs on intermittent streams. Based on these facts, IDEQ proposed delisting Rock Creek for temperature and nutrients and wrote TMDLs for sediment and bacteria (IDEQ, 2005).

No obvious water quality impacts were observed related to cropland; very little of the cropland directly abuts stream drainages and much what previously was cropland is in CRP. Hayland provides surface ground cover throughout the year. The sediment load estimated by IDEQ (2005) is relatively low (148 tons), with a reduction of 95 tons annually called for in Table 5-30 of the TMDL. Channel erosion was estimated to comprise 25 tons, or about 17%, of the total load. The load reduction is likely easily achieved; how this translates to changes in pollutant concentration in the stream remains to be determined.

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 tends to break down streambanks and contribute to channel erosion.

Recommended Treatments

There are relatively few (500) acres of cropland within the Rock Creek watershed and very few fields (76 acres) abut drainage channels. More CRP 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. Recommended BMPs include additional land conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices where gully erosion is present and filter strips where cropland abuts drainage channels. Implementation of cropland BMPs are a relatively low priority in this watershed.

Some of the hayland (1100+ 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 sediment and bacteria contributions to the drainage system originates from the concentrated presence of a limited number (150-200) of livestock in pastures (500 acres) that abut stream channels. Pastures border an estimated 7,000 feet of stream channel. BMPs implemented to limit livestock access to the riparian area and help stabilize channel banks 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. Spot channel bank stabilization work is also recommended to deal with specific problem areas. BMP recommendations, with associated cost estimates are listed in Table K.

Table K. Rock 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.	507		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	250	$ 22,500	$ 7,500
Residue Mgmt. Mulch Till (345)	Ac.	250	$ 11,300	$ 3,750
Water& Sediment Control Basin(638)	No.	4	$ 16,000	$ 480
Filter Strip (393)	Ac.	2	$ 200	$ -
Total Costs			$ 50,000	$ 11,300

Future Level of Treatment for Pasture/Hay Lands				
Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Pasture/Hay Lands	Ac.	1,672		
Channel Bank Vegetation (322)	Ac.	4	$ 12,000	$ 240
Channel Stabilization (584)	Ft.	1,400	$ 28,000	$ 140
Diversion (362)	Ft.	1,350	$ 3,700	$ 70
Fence (382)	Ft.	14,000	$ 28,000	$ 560
Riparian Herbaceous Cover (390)	Ac.	11	$ 3,300	$ 30
Watering Facility (614)	No.	9	$ 13,500	$ 140
Well (642)	No.	9	$ 72,000	$ 720
Total Costs			$ 160,500	$ 1,900

Hatter Creek

Hatter Creek is a watershed (16,000 acres) with approximately 4,300 acres of agricultural land. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section. A significant portion (3,600 acres) of the uppermost watershed is the University of Idaho Experimental Forest. A few acres (est. 20) are managed by the Clearwater National Forest. The rest of the watershed is privately owned.

Figure 12 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres for the Hatter Creek Watershed are:

CRP	1,253 acres
Crop	354 acres
Hay	1,046 acres
Pasture	924 acres
Grass\Shrub\Trees	324 acres
Tree Farm	204 acres

Agricultural Activities

Approximately 25% of the watershed acres are agricultural lands. Almost 30% of the agricultural lands are in CRP. Some CRP lands appear to have been cut for hay; a local hay shortage resulted in a temporary CRP rules exemption in the region.

There is less than 400 acres of cropland currently being farmed in the watershed. Hay is cut on approximately 1,000 acres; much of the hayland is grazed by cattle after cutting.

Farmland is being divided into residential tracts, generally less than 50 acres each. These residences sometimes have riding horses, and most of the surrounding ground is in grass, pasture, hay, or CRP.

Pastureland, about 900 acres, grazed by cattle (est.150-300 head) is scattered throughout the watershed. Approximately 25 horses were observed. Dispersed cattle forage on forest lands of the upper watershed. There may be concentrated winter feeding in several locations adjacent to the creek.

A tree farm has been established on what were previously agricultural lands in the eastern portion of the watershed.

Water Quality Concerns

Hatter Creek itself is a perennial stream; however, some of the tributary streams in the watershed are intermittent. Rainbow trout, brook trout, dace, and shiners are some of the species found in Hatter Creek. Based on stream fish data, Hatter Creek has the potential to be a productive recreational fishery (IDEQ, 2005).

IDEQ developed TMDLs for sediment, temperature, and bacteria for Hatter Creek. A nutrient TMDL was developed for the lower half of Hatter Creek. IDEQ recommends that the upper half of Hatter Creek be de-listed for nutrients; water quality data indicate nutrient levels are not impairing beneficial uses. BURP surveys completed in 2002 indicate that Hatter Creek fully supports beneficial uses.

There are several long stretches of creek without canopy cover in hayland, cropland, and pasture areas. Additional temperature monitoring needs to be conducted to confirm that elevated water temperatures are of genuine concern for Hatter Creek. Monitoring, using temperature loggers, was conducted at two sites by Dansart, from July to October, in both 2005 and 2007. Only one temperature standard exceedance, at the lower site, was recorded; it occurred on July 28, 2005. No temperature violations were recorded during the monitoring (IASCD, 2003) used to establish baseline data for the TMDL document.

Few obvious water quality impacts were observed related to cropland; very little of the cropland directly abuts stream drainages and much what previously was cropland is in CRP. Hayland provides surface ground cover throughout the year. The average total annual sediment load estimated by IDEQ (2005) is 1,223 tons, with a reduction of 467 tons annually called for in Table 5-29 of the TMDL. Channel erosion was estimated to comprise 219 tons, or 18%, of the total load. The load reduction target is likely easily achieved; how this translates to changes in pollutant concentration in the stream remains to be determined.

Much of the pollutant load is likely attributable to livestock presence near, or in, the drainage system. Hatter Creek appeared to have more livestock access to stream channels than any other of the TMDL watersheds. Riparian livestock impact is spotty but severe in several areas, particularly a section along Hatter Creek just upstream of the mouth of the West Fork. There are several stretches of Hatter Creek denuded of riparian vegetation due to livestock grazing; these may contribute to temperature concerns. Livestock activity in the riparian area tends to break down streambanks and contribute to channel erosion. Concentrated winter livestock feeding may occur at several sites along Hatter Creek and likely degrades water quality at these locations.

Several bacteria exceedances were recorded during the 2002 monitoring (IASCD, 2003). Hatter Creek had the highest average bacteria concentrations of any of the §303(d) listed waterbodies. Bacteria concentration increases are largely due to livestock grazing and watering along the creek. Bacteria originate from manure in the riparian area or from manure-laden runoff.

As with Flannigan Creek, the DO violations recorded at the lower monitoring site were at extremely low flows (≤0.01 cfs) and more likely to be due to this condition than the slight elevations in TP values (0.1, 0.12 mg/L) above the recommended criteria.

Recommended Treatments

More than three times as many CRP (1,250) acres exist in the watershed than cropland. Only about 1,300 feet of stream channel intersects cropland acres. Cropland is not a source of bacteria; it is also unlikely to be a major source of sediment delivery to the drainage system. Recommended BMPs include conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices where gully erosion is present and filter strips where cropland abuts drainage channels. BMPs that may effect temperature include those that promote establishment of riparian vegetation. Implementation of cropland BMPs are a relatively low priority in this watershed.

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 are recommended.

Pastures abut an estimated 25,000 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 the highest priority. Off site watering should be established where livestock are concentrated to limit the need for livestock to access the riparian area, particularly where animals are not excluded by fencing. Runoff diversion from concentrated winter feed areas would be beneficial to water quality. Removal of livestock or exclusion by fencing riparian areas is strongly recommended. Spot channel bank stabilization and establishment of overhanging canopy cover should be a priority.

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

Table L. Hatter 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.	355		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	175	$ 15,800	$ 5,250
Residue Mgmt. Mulch Till (345)	Ac.	180	$ 8,100	$ 2,700
Water& Sediment Control Basin(638)	No.	3	$ 12,000	$ 360
Filter Strip (393)	Ac.	1	$ 100	$ -
Riparian Forest Buffer (391)	Ac.	2	$ 3,000	$ 30
Riparian Herbaceous Cover (390)	Ac.	2	$ 600	$ 10
Tree/Shrub Establishment (612)	Ac.	2	$ 900	$ 10
Total RMS Costs			$ 40,500	$ 8,360
Future Level of Treatment for Pasture/Hay Lands				
Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Pasture/Hay Lands	Ac.	1,972		
Channel Bank Vegetation (322)	Ac.	12	$ 36,000	$ 720
Channel Stabilization (584)	Ft.	2,600	$ 52,000	$ 260
Diversion (362)	Ft.	1,500	$ 4,100	$ 80
Fence (382)	Ft.	50,000	$ 100,000	$ 2,000
Riparian Forest Buffer (391)	Ac.	25	$ 37,500	$ 380
Riparian Herbaceous Cover (390)	Ac.	38	$ 11,400	$ 110
Tree/Shrub Establishment (612)	Ac.	19	$ 8,600	$ 90
Watering Facility (614)	No.	20	$ 30,000	$ 300
Well (642)	No.	10	$ 80,000	$ 800
Total RMS Costs			$ 359,600	$ 4,740

Flannigan Creek

Flannigan Creek is a relatively small watershed (12,000 acres) with approximately 4,000 acres of agricultural land. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section. Forest lands (about 8,200 acres) in the watershed are privately owned with the exception of 500 state-owned acres on the eastern divide and in the southern third of the watershed.

Figure 10 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres in the Flannigan Creek Watershed are:

CRP	800 acres
Crop	1,560 acres
Hay	450 acres
Pasture	400 acres
Grass	650 acres
Grass\Shrub\Trees	150 acres
Tree Farm	40 acres

Agricultural Activities

Approximately one third of the watershed acres are agricultural lands. CRP tracts comprise 20% of the agricultural land total. Some CRP fields may have been retired or grass stands re-established due to weed problems. Additional CRP fields appear to have been cut for hay; a local hay shortage resulted in a temporary CRP rules exemption in the region. Several non-CRP parcels covered with permanent grass stands are scattered throughout the watershed. These mature stands did not appear to have been grazed or hayed as of October 2008.

There are nearly 1,600 acres of cropland currently being farmed in the watershed. Hay is cut on roughly 450 acres; some of the hayland is grazed by cattle after the last seasonal cutting.

Pastureland, about 400 acres, grazed by cattle (est.150-300 head) is scattered throughout the watershed. Dispersed cattle forage on forest lands. Thirty horses were observed on a drive through the watershed, during October.

Farmland is being divided into residential tracts, generally less than 50 acres each. These residences sometimes have riding horses, and most of the surrounding ground is in grass, pasture, hay, or CRP.

Water Quality Concerns

Flannigan Creek is a perennial stream; however, some of the tributary streams in the headwaters are intermittent. Rainbow trout, dace, suckers, shiners, and northern pike minnows are some of the species found in Flannigan Creek. IDEQ developed TMDLs for sediment, temperature, nutrients, and bacteria for Flannigan Creek (IDEQ, 2005).

Additional monitoring needs to be conducted to confirm that nutrient exceedances are a valid concern relative to Flannigan Creek. Although several minor (0.11 to 0.16 mg/l) TP target criteria (not standards) violations occurred from 6/15 to 9/5/2002, the single DO violation recorded during the monitoring (IASCD, 2003) used for TMDL development occurred on August 18, 2002. The TP value was below the target criteria of 0.1 mg/l and the recorded flow was less than 0.1 cfs; the stream was almost dry at that location. Even at only slightly elevated discharge levels with higher associated TP concentrations, the DO standard was met; the minor DO exceedance is more likely due to extremely low flow levels than to elevated nutrient levels.

Much of the pollutant load is attributed to cropland erosion and livestock. Cropland fields abut drainages that receive sheet, rill, and gully runoff. Flannigan Creek was noted to have more livestock accessing the stream channels than any other TMDL waterbody but Hatter Creek (IASCD, 2003). Hayland provides surface ground cover throughout the year and is likely a minor pollutant contributor.

Livestock activity in the riparian area tends to break down streambanks and contribute to channel erosion. Concentrated winter livestock feeding may occur at several locations along Flannigan Creek and likely degrades water quality at these locations. Bacteria originate from manure in the riparian area or from manure-laden runoff; 23% of samples collected during the 2002 monitoring exceeded *E. coli* criteria. Other possible contributors are failed septic systems or wildlife in the riparian area. There are several stretches of the Flannigan Creek denuded of riparian vegetation due to livestock grazing; these may contribute to temperature concerns; a few temperature exceedances were recorded during 2002 (IASCD, 2003) and 2007 monitoring (Dansart, 2008).

The average total annual sediment load estimated by IDEQ (2005) is 1,453 tons; a load reduction of 938 tons/year was called for in Table 5-27 of the TMDL (IDEQ, 2005). Channel erosion was estimated to comprise 177 tons, or about 12% of the total load. Sediment delivered from croplands comprises a large portion of this total. The targeted load reduction could likely be achieved by conservation tillage conversion on several hundred acres and the installation of several water and sediment control structures. How this translates to changes in pollutant concentration in the stream remains to be determined.

Recommended Treatments

There is approximately 1,600 acres of cropland currently being farmed; most is in the lower quarter of the watershed. About 7,000 feet of stream channel intersects cropland acres. There are about 800 CRP acres in the watershed. 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 cropland 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 might effect temperature include those that help establishment of riparian vegetation. Implementation of cropland BMPs are a relatively high priority in this watershed.

Livestock presence is scattered and seasonal on haylands; 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 are recommended.

Riparian livestock impact is spotty but significant in several areas along Flannigan Creek where the riparian vegetation has been denuded. Pastures abut an estimated 18,000 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 the highest priority. BMPs recommended are removal of livestock from riparian 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 Flannigan Creek watershed, with associated cost estimates are listed in Table M.

Table M. Flannigan 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.	1,558		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	400	$ 36,000	$ 12,000
Residue Mgmt. Mulch Till (345)	Ac.	400	$ 18,000	$ 6,000
Water& Sediment Control Basin(638)	No.	10	$ 40,000	$ 1,200
Filter Strip (393)	Ac.	5	$ 500	$ 10
Riparian Forest Buffer (391)	Ac.	10	$ 15,000	$ 150
Riparian Herbaceous Cover (390)	Ac.	10	$ 3,000	$ 30
Tree/Shrub Establishment (612)	Ac.	10	$ 4,500	$ 50
Total RMS Costs			**$ 117,000**	**$19,440**

Future Level of Treatment for Pasture/Hay Lands				
Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Pasture/Hay Lands	Ac.	834		
Channel Bank Vegetation (322)	Ac.	5	$ 15,000	$ 300
Channel Stabilization (584)	Ft.	1,800	$ 36,000	$ 180
Diversion (362)	Ft.	900	$ 2,500	$ 50
Fence (382)	Ft.	36,000	$ 72,000	$ 1,440
Riparian Forest Buffer (391)	Ac.	15	$ 22,500	$ 230
Riparian Herbaceous Cover (390)	Ac.	15	$ 4,500	$ 50
Tree/Shrub Establishment (612)	Ac.	15	$ 6,800	$ 70
Watering Facility (614)	No.	12	$ 18,000	$ 180
Well (642)	No.	6	$ 48,000	$ 480
Total RMS Costs			$ 225,300	$ 2,980

Deep Creek

Deep Creek is the largest of the TMDL watersheds (27,300 acres) with approximately 13,600 acres of agricultural land. An additional 700 acres could be considered shrub or rangeland. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section. Most land parcels in the watershed are privately owned except for approximately 2,000 state-owned acres in the northern upper portion of the watershed, which includes part of Mary McCroskey State Park. The US Forest Service manages 1,300 acres of forest lands along the northern and eastern watershed divides. The remaining 9,000 acres of forest lands are privately owned.

Landuse distribution is shown in Figure 9 of the *TMDL Watersheds Descriptions* section. Estimated agricultural landuse acres for the Deep Creek Watershed are:

CRP	2,516 acres
Crop	4,339 acres
Grass	2,236 acres
Hay	3,036 acres
Pasture	1,360 acres
Feedlot	11 acres
Meadow	76 acres
Tree Farm	8 acres
Grass\Shrub\Trees	602 acres

Agricultural Activities

Half of the watershed acres are agricultural lands. Approximately 18% of agricultural lands are enrolled in CRP, or about 10% of the entire watershed. Some CRP fields may have been retired or grass stands re-established due to weed problems. Several non-CRP parcels covered with permanent grass stands are scattered throughout the watershed. These mature stands did not appear to have been grazed or hayed as of October 2008. Approximately 2,200 non-CRP acres are in some sort of grass cover; about half those acres appear to be cropped grass.

There is approximately 4,300 acres of cropland currently being farmed in the watershed. Hay is cut on approximately 3,000 acres; much of the hayland is grazed by cattle after the last seasonal cutting. A small tree farm (about 8 acres) is located along Highway 95, several miles north of Highway 6.

Pastureland, about 1,360 acres, grazed by cattle (est.150-300 head) is distributed throughout the watershed. Dispersed cattle forage on forest lands and shrublands. Approximately 60 horses were observed on a drive through the watershed. About 35 sheep were observed in one pasture in addition to several hundred sheep that were being rotationally grazed on cropped grass fields as an alternative to burning; these sheep are not permanent residents of the watershed, but temporary management tools. Two small parcels adjacent to highway 95 could be considered feedlots for winter feeding. There may be other concentrated winter feeding in some locations adjacent to the creek, but none were observed.

Farmland is being divided into residential tracts, generally less than 50 acres each. These residences sometimes have riding horses, and most of the surrounding ground is in grass, pasture, hay, or CRP.

Water Quality Concerns

Deep Creek is an intermittent stream. IDEQ interpreted that fish data collected in the lower section of Deep Creek supports a seasonal cold water fishery rather than cold water aquatic life but that a fishery with pockets of salmonids and sculpin might exist in the uppermost portions of the watershed. IDEQ developed TMDLs for sediment, temperature, nutrients, and bacteria for Deep Creek. IDEQ recommended that Deep Creek be de-listed for nutrients. There were no DO or TP violations when flows were greater than 1 cfs (IDEQ, 2005).

The largest portion of the pollutant load likely originates from cropland; cultivated fields abut drainages that receive sheet, rill, and gully runoff. A smaller, 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.

Livestock activity in the riparian area tends to break down streambanks and contribute to channel erosion. Concentrated winter livestock feeding occurs at several locations along Deep Creek and likely degrades water quality at these locations. Bacteria originate from manure in the riparian area or from manure-laden runoff; 13% of samples collected during the 2002 monitoring exceeded *E. coli* criteria. Other possible contributors are failed septic systems or wildlife in the riparian zone. Portions of Deep Creek are denuded of riparian vegetation due to livestock grazing; these may contribute to temperature concerns.

Temperature concerns are probably due to large stretches of creek without canopy cover across all landuse types. Of seven stream sections rated, three stream segments were rated as having a *Poor* average cover condition; only one segment, the West Fork of Deep Creek, had a *Good* cover condition rating. In spite of these less than optimal ratings, instantaneous temperature exceedances were recorded for only two days, 7/3 and 7/16, during the 2002 monitoring (IASCD, 2003); flow was less than 1 cfs on 7/16, so only one of the reported exceedances could actually be considered a violation. Dansart (2005, 2007) reported one exceedance of the 19˚C average in 2005 and two in 2007; none occurred later than July of either year.

According to DEQ (2005) modeling, the highest (7,040 tons/year) annual sediment delivery is from the Deep Creek watershed. A sediment load reduction target of 6,540 tons/year was called for in Table 5-26 of the TMDL (IDEQ, 2005). Channel erosion was estimated to comprise 398 tons, or 6%, of the total load. Unstable banks occur throughout the watershed where minimal bank vegetation is present and contribute to channel erosion. Sheet, rill and gully erosion from cropland is a major upland sediment source.

Recommended Treatments

There is approximately 4,300 acres of cropland currently being farmed in the lower half of the watershed. About 36,000 feet of stream channel intersects cropland acres. There are about 2,700 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.

Meeting the sediment load reduction targets for Deep Creek will likely require substantial cropland BMP implementation. Dansart (2004) estimated conversion from conventional tillage to direct seeding of 2,500 to 3,000 cropland acres would be needed to meet the target utilizing solely this BMP. Additional cropland acres would be required if the conversion was a mixture of conventional tillage to mulch till, or mulch till to direct seeding. How this translates to changes in pollutant concentration in the stream 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.

Hay is cut on approximately 3,000 acres; grass covers additional 2000+ acres. About 64,000 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 (1,400 acres) that abut stream channels. Pastures abut an estimated 40,000 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 Deep Creek watershed, with associated cost estimates are listed in Table N.

Table N. Deep 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.	4,339		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	1,000	$ 90,000	$ 30,000
Residue Mgmt. Mulch Till (345)	Ac.	1,000	$ 45,000	$ 15,000
Wtr.& Sediment Control Basin(638)	No.	27	$ 108,000	$ 3,240
Filter Strip (393)	Ac.	25	$ 2,500	$ 50
Riparian Forest Buffer (391)	Ac.	25	$ 37,500	$ 380
Riparian Herbaceous Cover (390)	Ac.	25	$ 7,500	$ 80
Tree/Shrub Establishment (612)	Ac.	25	$ 11,300	$ 110
Total RMS Costs			**$ 301,800**	**$ 48,860**

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.	6,633		
Channel Bank Vegetation (322)	Ac.	20	$ 60,000	$ 1,200
Channel Stabilization (584)	Ft.	4,000	$ 80,000	$ 400
Diversion (362)	Ft.	4,800	$ 13,200	$ 260
Fence (382)	Ft.	80,000	$ 160,000	$ 3,200
Riparian Forest Buffer (391)	Ac.	53	$ 79,500	$ 800
Riparian Herbaceous Cover (390)	Ac.	53	$ 15,900	$ 160
Tree/Shrub Establishment (612)	Ac.	53	$ 23,900	$ 240
Watering Facility (614)	No.	32	$ 48,000	$ 480
Well (642)	No.	16	$ 128,000	$ 1,280
Total RMS Costs			$ 608,500	$ 8,020

<u>Gold Creek</u>

The Gold Creek Watershed is about 18,000 acres in size. Watershed location within the Palouse Subbasin is shown in Figure 7 of the *TMDL Watersheds Descriptions* section. Land ownership is mixed in this watershed. About 8,500 acres of forested lands in the watershed are privately owned, primarily by commercial timber companies, Potlatch Corporation and Bennett Lumber. The Clearwater National Forest manages 4,100 acres of timberland in the northeastern portion of the watershed. The lower portion of the watershed is mostly under private ownership with approximately 5,250 acres of agricultural land.

Figure 8 of the *TMDL Watersheds Descriptions* section shows landuse distribution. Estimated agricultural landuse acres for the Gold Creek watershed are:

CRP	709 acres
Crop	3,570 acres
Hay	291 acres
Pasture	64 acres
Grass\Crop	400 acres
Meadow	175 acres
Grass\Shrub\Trees	144 acres

<u>Agricultural Activities</u>

Approximately 30% of the watershed acres are agricultural lands. CRP tracts comprise 14% of the agricultural lands or about 4% of the watershed. Some CRP fields may have been retired or grass stands re-established due to weed problems. Approximately 400 non-CRP acres are in some sort of grass cover; about half those acres appear to be cropped grass.

There are about 3,600 acres of cropland currently being farmed in the watershed. Hay is cut on approximately 200 acres; some of the hayland may be grazed by cattle after cutting. Some farmland is being divided into residential tracts; this conversion is not as commonly seen as in other TMDL watersheds.

Gold Creek may be the TMDL watershed least impacted by livestock. Less than 100 acres were observed to be dedicated grazed pasture. Only 50 head of cattle and 4 horses were observed on pastureland within the watershed. Dispersed cattle forage allotments on forested lands throughout the watershed.

Water Quality Concerns

Gold Creek itself is a perennial stream; however, some of the tributary streams in the headwaters are intermittent. Rainbow trout, brook trout and sculpin inhabit the upper half of the watershed while dace, suckers, shiners, and northern pike minnows inhabit the lower portion of the watershed. IDEQ developed TMDLs for sediment, temperature, and bacteria for Gold Creek; it recommended that Gold Creek be delisted for nutrients. Water quality data indicate nutrient levels are not impairing beneficial uses (IDEQ, 2005).

The largest portion of the pollutant load probably originates from cropland erosion; little appears due to livestock activity. Riparian livestock impact is spotty along Gold Creek and its tributaries Nelson and Crane Creeks. Although several bacteria exceedances were recorded during the 2002 monitoring, the elevated *E. coli* values may have been due to livestock presence adjacent to the monitoring site. Hayland and permanent grass stands provide surface ground cover throughout the year.

According to DEQ (2005) modeling, the average annual sediment delivery is 662 tons. A sediment load reduction target of 295 tons/year was called for in Table 5-28 of the TMDL (IDEQ, 2005). Channel erosion was estimated to comprise 162 tons, or 24% of the total load. Unstable banks occur throughout the watershed where minimal bank vegetation is present. Sheet and rill erosion, in addition to gully erosion, from cropland is a major sediment source. Riparian livestock activity appears to be a minor contributor.

Temperature concerns probably stem from large expanses of channel with little canopy cover that span all landuse types. There are several stretches of Gold Creek denuded of riparian vegetation due to historic conversion to cropland production and livestock grazing; several large meadows exist in forested areas. Of ten stream sections rated, three stream segments were rated as having a *Poor* or *Fair* average cover condition; the other stream segments had *Good* or *Very Good* average cover condition ratings. The less than optimal ratings were applied to the lower portions of Gold Creek and its Crane Creek tributary. In spite of unfavorable cover condition ratings, temperature exceedances were never recorded during the 2005 and 2007 temperature monitoring by Dansart (2008). IASCD (2003) reported no exceedances of the cold water criteria during 2002 monitoring but the salmonid spawning criteria (13˚C) was exceeded at the upper monitoring site. There is no prospect to provide additional canopy cover near the upper monitoring location; it is located at the lower end of an extensive mature cedar grove.

Recommended Treatments

Sheet and rill erosion occur on croplands during spring runoff although residue management appears fairly good throughout the watershed. Other cropland water quality impacts observed include scattered gully erosion sites and bank erosion of stream channels. About 46,000 feet of stream channel intersects cropland acres. In addition to the 3,600 cropland acres, there are about 700 CRP acres in the watershed. 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 conversion to CRP, residue management to the mulch till level or greater where not previously implemented, structural practices where gully erosion is present, and filter strips where cropland abuts drainage channels. BMPs that might effect temperature include those that help establish riparian vegetation and promote riparian canopy restoration. Implementation of cropland BMPs are the highest priority in this watershed.

Meeting the sediment load reduction target (162 tons) for Gold Creek should not be difficult. Dansart (2004) estimated conversion from conventional tillage to direct seeding of several hundred cropland acres would be sufficient to meet the target utilizing solely this BMP. Additional cropland acres would be required if the conversion was a mixture of conventional tillage to mulch till, or mulch till to direct seeding. How this translates to changes in pollutant concentration in the stream 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.

There is very little hayland or pastureland located in this watershed. Hay is cut on approximately 200 acres. Grassland totals about 400 acres; half of it appears to be cropped. About 4,000 feet of stream channel intersects hayland or grassland acres. Some grazing of hayland occurs along the upper portion of the Crane Creek tributary. Ungrazed hayfields and grass fields are not generally a significant contributor of sediment, nutrients or bacteria; only BMPs that address temperature concerns are recommended.

Although some of the hayland and grassland is grazed after cutting, it is probable most of the sediment and bacteria contributions to the drainage system originate from the presence of a limited number of livestock in pastures that abut stream channels. Pasturelands are intersected by roughly 400 feet of stream channels. Although several exceedances of the bacteria criteria are reported in the TMDL for 2002 at both upper and lower monitoring sites, it would be difficult to attribute major bacteria problems to livestock in the upper portion of the watershed, based on the current level of livestock presence observed. Livestock should be excluded from access to Gold Creek in the pasture area near the stream mouth. It would be advisable to confirm that bacteria exceedances still occur on Gold Creek before expending funds to fix a problem identified six years ago.

BMPs implemented to limit livestock access to the riparian area, establish stream canopy, and help stabilize channel banks should be completed. Off site watering should be established where livestock are concentrated to limit the need for livestock to access the riparian area, particularly where animals are not excluded by fencing. BMPs considered would be removal of livestock from these areas, development of offsite watering sites, or riparian use exclusion by fencing.

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

Table O. Gold Creek Recommended BMPs.

Project 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.	3,570		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	900	$ 81,000	$ 27,000
Residue Mgmt. Mulch Till (345)	Ac.	900	$ 40,500	$ 13,500
Wtr.& Sediment Control Basin(638)	No.	22	$ 88,000	$ 2,640
Filter Strip (393)	Ac.	32	$ 3,200	$ 60
Riparian Forest Buffer (391)	Ac.	32	$ 48,000	$ 480
Riparian Herbaceous Cover (390)	Ac.	32	$ 9,600	$ 100
Tree/Shrub Establishment (612)	Ac.	32	$ 14,400	$ 140
Total RMS Costs			$ 284,700	$ 43,920

Future Level of Treatment for Grass/Pasture/Hay Lands				
Grass/Pasture/Hay Lands	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Lands	Ac.	650		
Channel Bank Vegetation (322)	Ac.	1	$ 3,000	$ 60
Channel Stabilization (584)	Ft.	400	$ 8,000	$ 40
Diversion (362)	Ft.	300	$ 800	$ 20
Fence (382)	Ft.	1,000	$ 2,000	$ 40
Riparian Forest Buffer (391)	Ac.	7	$ 10,500	$ 110
Riparian Herbaceous Cover (390)	Ac.	7	$ 2,100	$ 20
Tree/Shrub Establishment (612)	Ac.	53	$ 23,900	$ 240
Watering Facility (614)	No.	2	$ 3,000	$ 30
Well (642)	No.	2	$ 16,000	$ 160
Total RMS Costs			$ 69,300	$ 720

Current BMP Status

Restoration activities have been on-going in the Palouse River TMDL subwatersheds for the past several years. The TMDL was based on 2002 water quality monitoring results.

Table P is a summary of BMPs applied since 2002 in the Palouse Subbasin (Idaho) as reported by the NRCS. The District Conservationist estimated approximately 60% of these practices have been implemented in North Fork Palouse Subbasin (Evans, 2008).

Table P: BMPs implemented since 2002; Palouse Subbasin (Idaho)

NRCS PRS DATA								
Conservation Treatment Applied	**FY02**	**FY03**	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**Total**
Access Road (ft)					123			123
Comprehensive Nutrient Mgt Plan (no)		29			1			30
Conservation Buffers (ac)	120	116						136
Conservation Cover (ac)			1,658	4,393	2235	2,252	4,013	14,551
Conservation Crop Rotation (ac)			1,092	2,128	2096	315		5,631
Contour Farming (ac)			1,092	1,651	1845	396		4,984
Fence (ft)				10,801	22,212	1,344		34,357
Field Border (ft)						3,123		3,123
Filter Strip (ac)					9		17	26
Firebreak (ft)				2,000	39,850	213,388	9,800	255,238
Grade Stabilization Structure (no)			3	12	2			17
Nutrient Management (ac)	4,454	7,569	1,092	730	2,049	1,320	561	17,775
Pasture and Hay Planting (ac)							12	12
Pest Management (ac)	4,899	6,473	1,491	515	2,433	1,527	7,711	25,049
Prescribed Grazing (ac)		122						122
Range Planting (ac)						18	4	22
Residue Management (ac) (777)				307			159	466
Residue Management (ac) (329B)	7,415	11,396	868	835	1,203	190		21,907
Residue Management (ac) (329A)			224	121	1,391	887	281	2,904
Restoration and Management of Declining Habitats (643) (ac)				17			1	18
Riparian Forest Buffer (ac)							20	20
Riparian Herbaceous Cover (ac)					3	11		14
Streambank and Shoreline Protection (ft)				445	797			1,242
Tree/Shrub Establishment (ac)	491	72	188	150	30	39	50	1,020
Tree/Shrub Site Preparation (490) (ac)						22	2	22
Underground Outlet (ft)				1,024				1,024
Upland Wildlife Habitat Management (ac)			913	2,758	2,038	2,208	3,797	11,714
Use Exclusion (ac)			1,197	1,650	793	989	3,787	8,416
Water and Sediment Control Basin (no)					1			1
Watering Facility (no)					3			3
Wetland Practices (ac)	63	6			6		21	96
Wildlife Habitat Management (644) (ac)	2,899		5	10	16	3	16	2,949
Wildlife Watering Facility (no)				4	3			7

TMDL implementation efforts were initiated by the Latah SWCD in 2006. The Latah SWCD applied for and was awarded a CWA §319 grant through IDEQ to fund the Palouse River Water Quality Improvement Project (PRWQIP), with non-federal matching funds provided by landowner PRWQIP participants. There was limited producer interest in the program and limited funding available. Project sites for BMP installation were identified. Contracts and associated plans were developed for approximately 420 acres with one operator for conversion to direct seeding and the installation of erosion control structures; these practices are currently in progress. Riparian restoration consisting of streambank stabilization structures, planting native riparian vegetation, and native seeding is currently being undertaken (Latah SWCD, 2008). Road rocking of unsurfaced rural roads has been completed. Culverts, to minimize flooding over local roads, were installed by the North Latah Highway District (NLHD). The NLHD will complete road bank stabilization projects this year

The Latah Soil and Water Conservation District (2008), in their most current 319 Palouse River Semiannual Report, show estimated load reductions, based on the original scope of the project as:

Sediment:	2,690 tons
Phosphorus:	2 tons
Nitrogen:	4 tons

The Latah SWCD serves as the lead in administering, through IASCD, the CWA §319 funded AFO project which identifies problem areas and implements best management practices for animal feeding operations (AFOs). The project was initiated in 2001 and presently continues; it involves five north-central Idaho Conservation Districts. Several projects have been implemented within the North Fork Palouse Subbasin. Projects include two livestock watering facilities in addition to various riparian BMPs.

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 Palouse River Water Quality Improvement Project (PRWQIP), AFO Project, and other State or Federal BMP implementation efforts as monitoring results indicate.

FUNDING

To adequately address the TMDL concerns within the Palouse River Tributaries 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. The Latah Soil and Water Conservation District has received funding for the Palouse River Water Quality Improvement Project (PRWQIP) and Division II AFO Project to implement BMPs on private agricultural lands; depending on the 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

OUTREACH

The Latah Soil and Water Conservation District has undertaken formal outreach efforts to inform residents within the Palouse River Tributaries watersheds of the status of Palouse River Water Quality Improvement Project (PRWQIP) and the applicability of these practices to other areas in the region. Formally and informally, landowners were notified about the available programs. A direct mailing was sent to each operator within the watershed. In addition, the program has been formally announced through district newsletters and through the Palouse River Tributaries 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.

Once a variety of functional BMPs are installed, field tours will be conducted to educate operators and landowners about benefits and costs of implementing BMPs. Additionally, conservation district newsletters and web sites 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 Palouse River Tributaries 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 Palouse River Tributaries.

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.

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, most 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 SWCD, IASCD and the Palouse River Tributaries 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 the Latah SWCD, 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
IDHW-	Idaho Department of Health and Welfare
IDL -	Idaho State Department of Lands
ISCC -	Idaho State Soil Conservation Commission
ISDA-	Idaho State Department of Agriculture
IWRRI -	Idaho Water Resources Research Institute
kg/d -	kilograms per day
LA -	Load Allocation
Latah SWCD-	Latah Soil and Water Conservation District
MCL -	maximum contaminant level
mg/l -	milligrams per liter
NLCHD-	North Latah County Highway District
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
PRWQIP -	Palouse River Water Quality Improvement Project
RUSLE -	Revised Universal Soil Loss Equation
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