Hatwai Creek Watershed

Total Maximum Daily Load

Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality
Prepared by:
Idaho Soil and Water Conservation Commission
In Cooperation With:
Nez Perce Soil and Water Conservation District
Hatwai/Lindsay/Tammany Creeks Watershed Advisory Group (WAG)
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INTRODUCTION

The “Hatwai Creek Watershed Assessment and Total Maximum Daily Loads” was developed by the Idaho Department of Environmental Quality. The document was submitted to EPA and approved in December of 2010.

From IDEQ’s website:

> “Hatwai Creek, a tributary of the Clearwater River, is located near the boundary between the Columbia Plateau and the Northern Rocky Mountains. The main stem of Hatwai Creek originates on the southern breaks of the Palouse prairie, along the east side of Idaho State Highway 95, flowing south into a steep basalt canyon where it is fed by several springs before reaching the Clearwater River three miles east of Lewiston, Idaho.
>
> During the TMDL investigation conducted by DEQ water quality analysts in summer 2006, bacteria, nutrients, and temperature were examined. Results for bacteria monitoring indicate that E. coli bacteria concentrations exceed water quality standards. Average nitrogen and total phosphorus concentrations also measured significantly higher than recommended. In addition, elevated temperatures were recorded as a result of the removal of riparian vegetation and replacement with agricultural crops, roads and pasture lands. To address these pollutants, TMDLs have been developed to control excess bacteria and nutrients and elevated temperature.”

Hatwai Creek is an interstate drainage on the State of Idaho’s Integrated report §303(d) list of impaired water bodies; the westernmost headwaters portion of the watershed (about 15%) lies in Whitman County, Washington. Hatwai Creek is listed from the headwaters to the Clearwater River, three miles east of Lewiston. For waters identified on the 303(d) list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. Hatwai Creek has been designated for cold water aquatic life, salmonid spawning, and secondary contact recreation beneficial uses (IDEQ, 2010).

The Hatwai /Lindsay/Tammany Creek Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for the Hatwai Creek Watershed. The plan will specify projects and controls designed to improve water quality and meet the load allocations presented in the TMDL document. Implementation of best management practices (BMPs) within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis (IDEQ, 2010). This “Implementation Plan for Agriculture” is a component of the Hatwai Creek 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 assistance of the WAG. Although specific targets and allocations are identified within a TMDL assessment, the ultimate success of a TMDL plan is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved (IDEQ, 2005).

The Idaho Soil and Water Conservation Commission (ISWCC) works with the Nez Perce Soil and Water Conservation District (NPSWCD), the Idaho Association of Soil Conservation Districts (IASCD), and the Natural Resource Conservation Service (NRCS) in a partnership to reach common goals and successfully deliver conservation programs within the Hatwai Creek Watershed (Figure 1). ISWCC is the designated state agency in Idaho for managing agricultural nonpoint source pollution.

Purpose

The agricultural component of the Hatwai Creek 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 §303(d) listed stream segments.

Goals and Objectives

This implementation plan is intended to assist and document ongoing efforts of the Nez Perce SWCD and agricultural producers in the Hatwai Creek watershed to identify critical agricultural acres and suggest BMPs necessary to meet the requirements of the Hatwai Creek TMDL, where economically feasible. This work has already begun due to the efforts of individual farm operators within the watershed.

Agricultural pollutant reductions will be achieved through the application of best management practices (BMPs) developed and implemented on-site with willing individual agricultural landowners and operators. The majority of 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 support BMP effectiveness evaluation and monitoring to determine pollutant load reductions and the cumulative impact on designated beneficial uses of the listed stream segments. Emphasis will also be placed on the continuance of an on-going outreach program initiated by the Nez Perce SWCD to encourage landowner participation in water quality improvement efforts within the watershed.

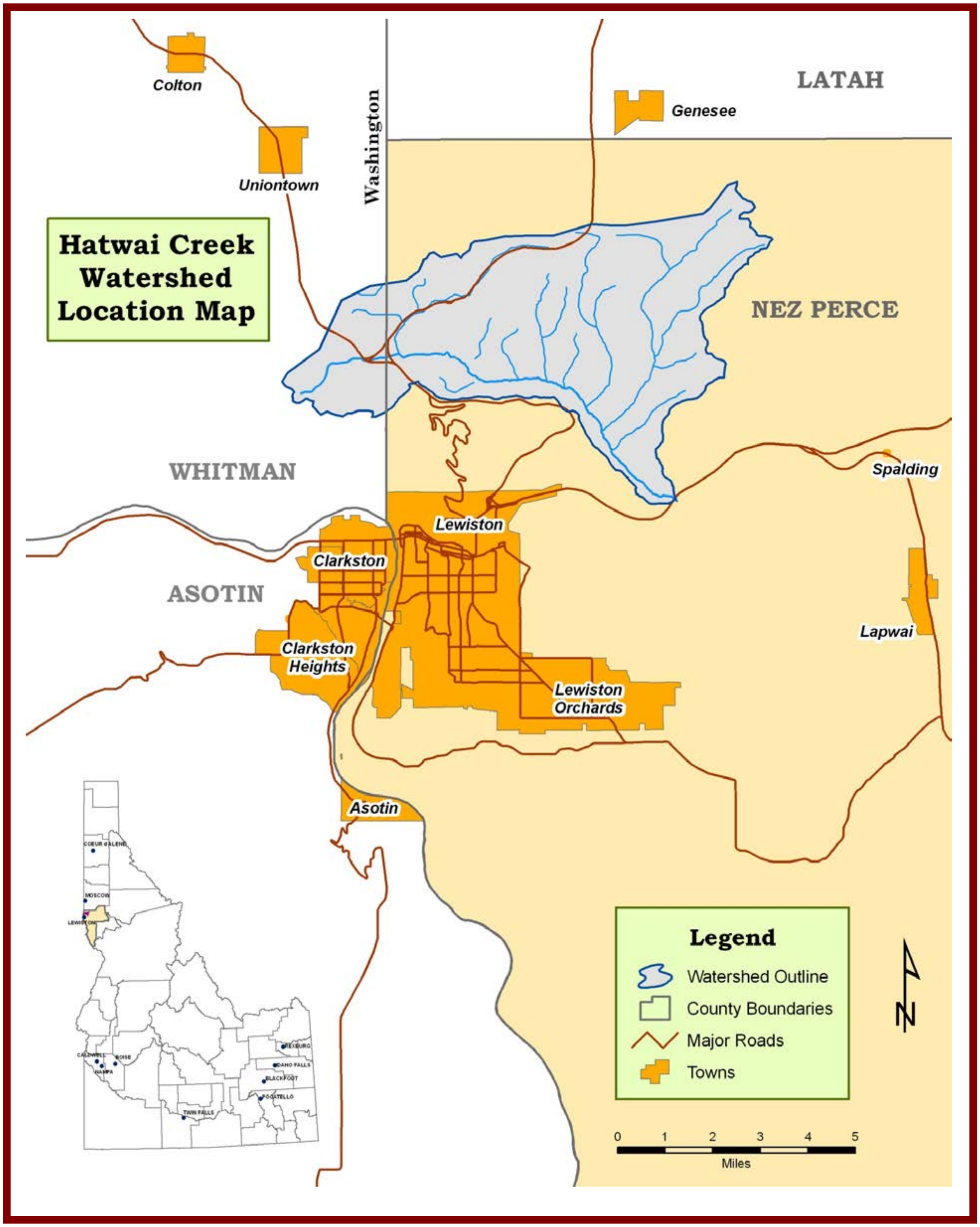

Figure 1. Hatwai Creek Location Map

BACKGROUND

The Hatwai Creek TMDL was submitted by the Idaho Department of Environmental Quality (IDEQ) and approved by the US Environmental Protection Agency (EPA) in December of 2010. There are no known point sources in the Hatwai Creek subwatershed. Industrial warehouses are located on both banks at the mouth of the stream, but no direct piping from either warehouse has been found entering the creek (IDEQ, 2010). The primary nonpoint sources (NPS) of pollutants in the Hatwai Creek Watershed are non-irrigated croplands, grazing lands, land development (construction activities), roads and septic systems.

Hatwai Creek Assessment Unit # ID17060306CL067_02 is listed as not meeting state water quality standards in Section 5 of the 2008 Integrated Report. Pollutants of concern are bacteria, temperature and nutrients (IDEQ, 2010). Designated and existing beneficial uses for Hatwai Creek include secondary contact recreation, cold water aquatic life and salmonid spawning.

Section §303(d) of the Clean Water Act requires states to develop a TMDL management plan for water bodies determined to be water quality limited. A water body is determined water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a water body 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, 2010).

Based on monitoring data collected at Hatwai Creek's mouth by IDEQ during 2006 and 2007, TMDLs were developed for the Hatwai Creek subwatershed.

Project setting

Hatwai Creek is a third order tributary of the Clearwater River. It is a relatively small subwatershed, encompassing approximately 20,000 acres and located within Hydrologic Unit ID17060306. Most of the the watershed is cropland and rangeland; the remaining landuses are pastureland, rural dwellings and industrial facilities. The main stem of Hatwai Creek originates on the southern breaks of the Palouse Prairie, along the east side of Idaho State Highway 95, and flows into a steep basalt canyon where it is fed by several springs before reaching the Clearwater River three miles east of Lewiston, Idaho. Elevation (Figure 2) in the watershed ranges from almost 3,000 feet in headwater areas to below 800 feet at the mouth (IDEQ, 2010).

According to archeological evidence, the mouth of Hatwai Creek has been used as a fishery for thousands of years. The Nez Perce were the historic inhabitants of the Hatwai Creek area. Lewis and Clark traveled past the mouth of Hatwai Creek and noted its use as a tribal fishing camp in the fall of 1805. Currently, the Idaho Department of Fish and Game considers Hatwai Creek to have strong potential for salmonid spawning and rearing; the stream is considered to provide critical habitat for threatened anadromous steelhead (IDEQ, 2010).

Climate

Summers (June thru September) are hot and dry in the semi-arid Hatwai Creek subwatershed interrupted by rainfall from occasional thunderstorms. From 1948 through 2004, maximum daily summer temperatures averaged 83.4^{o}F, with an average daily low temperature of 55^{o}F. The average summer monthly precipitation was 0.87 inches, with a total average precipitation of 3.48 inches, or 27% of the total annual precipitation. Mean annual precipitation in Lewiston, Idaho is 12.73 inches (Western Regional Climate Center, 2005). Mean annual precipitation within the Hatwai Creek watershed is somewhat higher (12-24 inches), depending on the watershed location.

The winter months, December through March, are usually cool. The average daily maximum temperature for the years 1948 through 2004 was 45^{o}F, while the average minimum temperature was 30.1^{o}F. Winter monthly precipitation averaged 1.09 inches. Total winter precipitation averaged 4.37 inches with an annual snowfall of 15.8 inches (IDEQ, 2010).

Soils

Deep soils formed in loess, mostly silty loams, underlie agricultural lands. Stony soils lie beneath forest and grasslands in canyon areas.

Higher elevation portions of the watershed are located along the southern edge of the Palouse Prairie and are characterized by predominantly treeless, loess-covered terrain. The highly productive soils are high in organic matter and clay content. Original plant cover has been almost entirely supplanted by wheat farms that incorporate legumes within the crop rotation. Hayland and pasture are also present in a few localities.

Cropland generally occurs at elevations greater than 2,000 feet, in areas with less than 30% slope. The most common cropland soils belong to the Palouse-Athena, Thatuna-Naff, and Naff-Palouse associations. These soils are generally very deep and well drained, with severe erosion potential.

The lower elevations in the watershed consist of deep canyons that dissect basalt layers of the Columbia Plateau. Canyon walls are steep, with slopes (Figure 3) generally between 100% and 200%. The canyons receive little precipitation relative to the plateau; these areas provide wildlife habitat for deer and game birds in addition to livestock forage. Canyon soils are mostly of the Lickskillet-Alpowa and Linville- Kettenbach associations. Erosion potential of these well drained soils is severe.

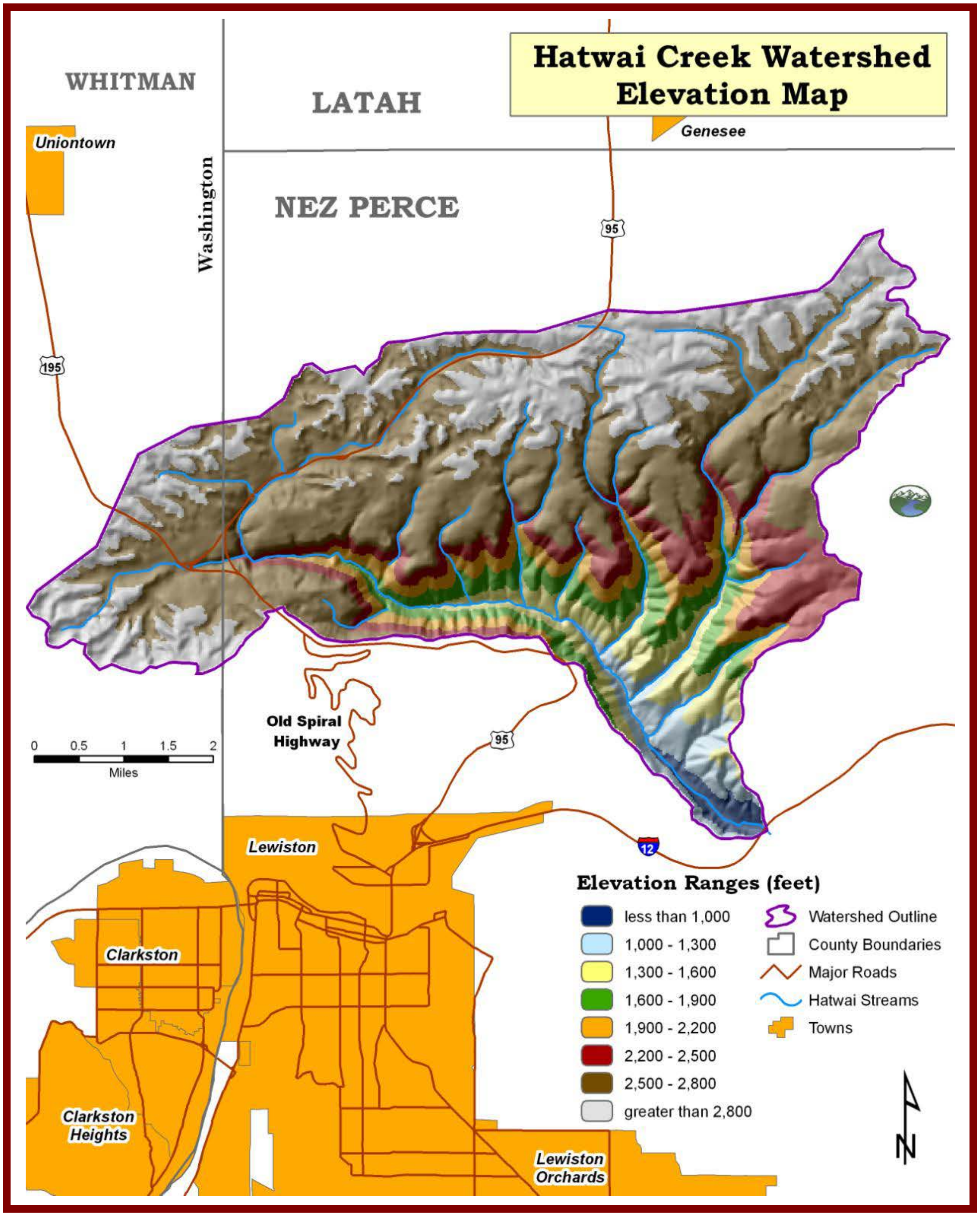

Figure 2. Elevation Map

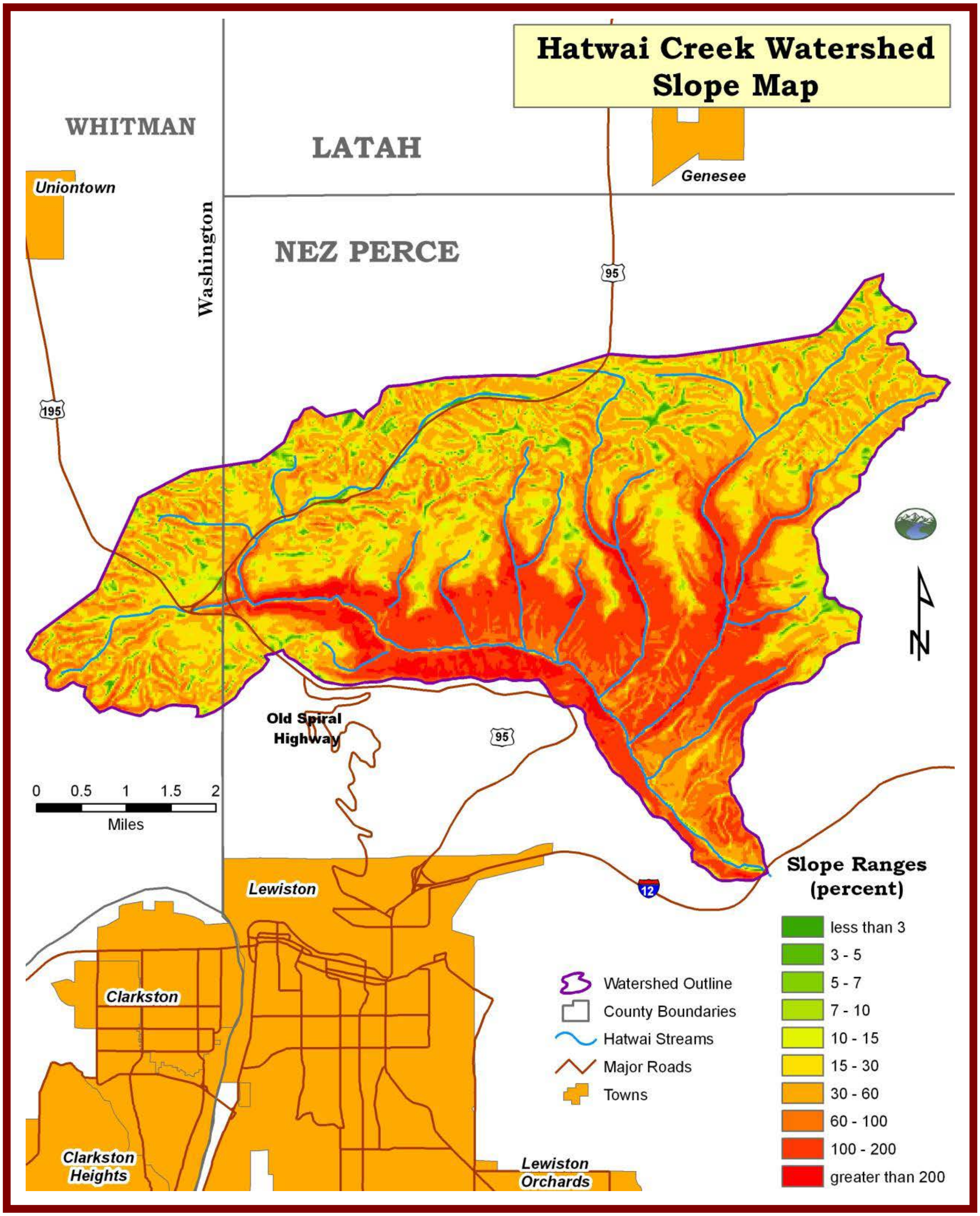

Figure 3. Slope Map

Hydrology

Little historic flow data is available for Hatwai Creek. IDEQ collected flow measurements on a bi-weekly basis from July 2006 through July 2007. Measured precipitation was lower than average during the monitoring year, and the majority of the measurements represent base flow conditions. Higher flows beginning in January and then occurring sporadically through April reflect the weather pattern. Most of the precipitation occurs during winter and early spring, with very little precipitation occurring during the summer months. This pattern causes flows to peak in early spring and return to base flows by summer. Base flows in Hatwai Creek were relatively constant during the monitoring year, due to shallow ground water (springs) inflow. The highest measured flow during the monitoring year of July 2006 through July 2007 was less than 10 cubic feet per second (cfs) while the lowest measured flow was just under one-third of 1 cfs. This very limited flow data set does not indicate that Hatwai Creek exhibits the flashy peak flows that characterize many local drainage systems (IDEQ, 2010).

Drainage Description

Hatwai Creek extends about 9.5 miles from its headwaters in Washington to its Clearwater River outlet. The upper two thirds of the creek drains roughly west to east with the lowest section draining northwest to southeast. Eight unnamed tributaries connect to Hatwai Creek from canyon areas to the north. These tributaries drain the plateau that comprises the watershed above 2,500 feet in elevation. Channel modifications occurred during the 1960's; stream sections were straightened and flood plain areas leveled and sloped for drainage. Most riparian vegetation had already been removed prior to the major channel reconfiguration efforts (NPSWCD, 2010).

Fisheries

According to archeological evidence, the mouth of Hatwai Creek has been used as a fishery for thousands of years (Ames, 2000). The Idaho Department of Fish and Game considers Hatwai Creek critical habitat for threatened anadromous steelhead. IDEQ stream survey fishing efforts in 1996 and 1998 recorded rainbow trout, shiners, dace and suckers. IDEQ's determination was that both the salmonid spawning and cold water aquatic life beneficial uses were fully supported in the stream's lower section (IDEQ, 2010).

In the late 1990's, restoration efforts were initiated to improve fish habitat and canopy cover along Hatwai Creek . The Idaho Department of Fish and Game monitored the responses of trout to these restoration activities. Results, for 1995 to 1998, from a demonstration project indicate that trout density increased annually. Trout density in the project area rose from 0.32 per 100 square meters (100 m^2) in 1995 to a high of 13.24/100 m^2 in 1998; in the control area, trout density was 0.87/100 m^2 in 1996, 3.00/100 m^2 in 1997, and 3.06/100 m^2 in 1998. The improvement was attributed to enhanced riparian conditions that included stabilized stream banks, more canopy cover, and reduced stream temperatures (IDEQ, 2010).

Land Use

Primary land uses (Table A) in the Hatwai Creek watershed consists of dryland agriculture and livestock grazing. Other landuses are rural residences, several small industrial facilities and roads. Landuse distribution is illustrated in Figure 4.

The roads network within the Idaho portion of the watershed totals 48 miles. US Highway 95 winds through the western watershed from south to north. US Highway 195 splits the Washington portion of the watershed. Roads that cross agricultural lands of the watershed represent most of the total road surface.

The Hatwai Creek watershed consists of mostly agricultural lands. Cereal crops of wheat and barley, and legume crops like peas and lentils dominate agricultural land use within the watershed. Dryland farming (~12,600 acres) is conducted on upland areas of the watershed. Some land is used as pasture for grazing animals in addition to more scattered grazing on rangelands that comprise canyon areas; minor hay production may occur as well. Winter feeding of livestock was observed at two locations along the Central Grade Road during February, 2011.

Forested lands are scarce. Industrial warehouses, a BPA substation, and a sizable rock pit are also located within the Hatwai Creek watershed.

Table A. Land Uses in the Hatwai Creek Watershed

Land Use Category	Acres	% of Subbasin
Cropland	12,582	62%
Grass \ Grass Crop	4,104	20.5%
Grass\Shrub (Rangeland)	2,534	2.6%
Tree\Shrub\Grass	311	1.6%
Tree\Shrub	90	0.4%
Pasture	242	1.2%
Hay	24	0.1%
Rural Residence/Farmstead	73	0.4%
Industrial	80	0.4%
Rock Pit	12	0.1%
TOTAL:	20,052	100%

Land Ownership (Management)

The Hatwai Creek watershed is almost entirely privately owned. Approximately 350 acres are managed by the Nez Perce Tribe (Figure 5). Rural residences are scattered throughout the area. About 20 farm operators control the bulk of the watershed's cropland; two livestock operations were reported (nezperceswcd.org, 2010).

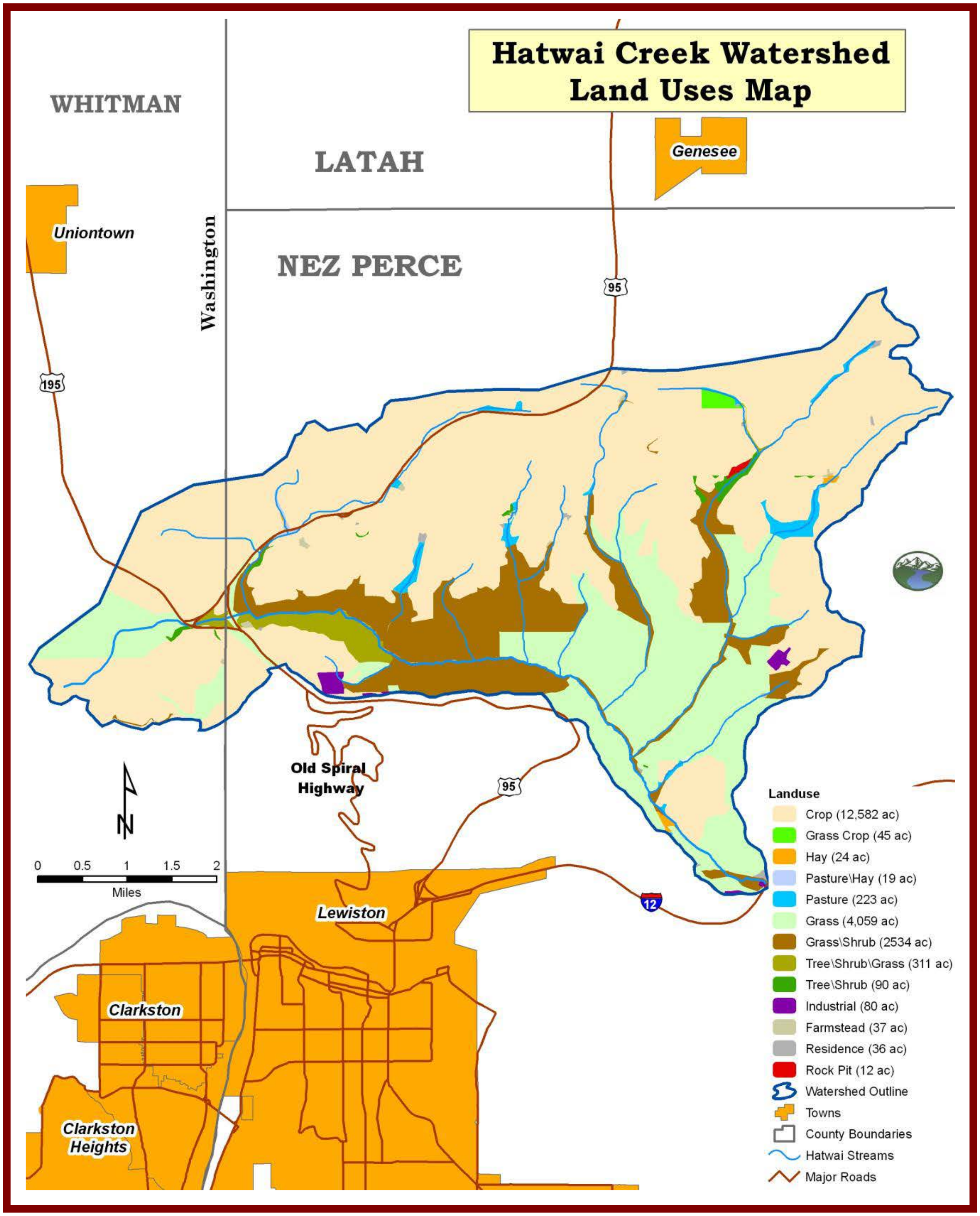

Figure 4. Land Uses

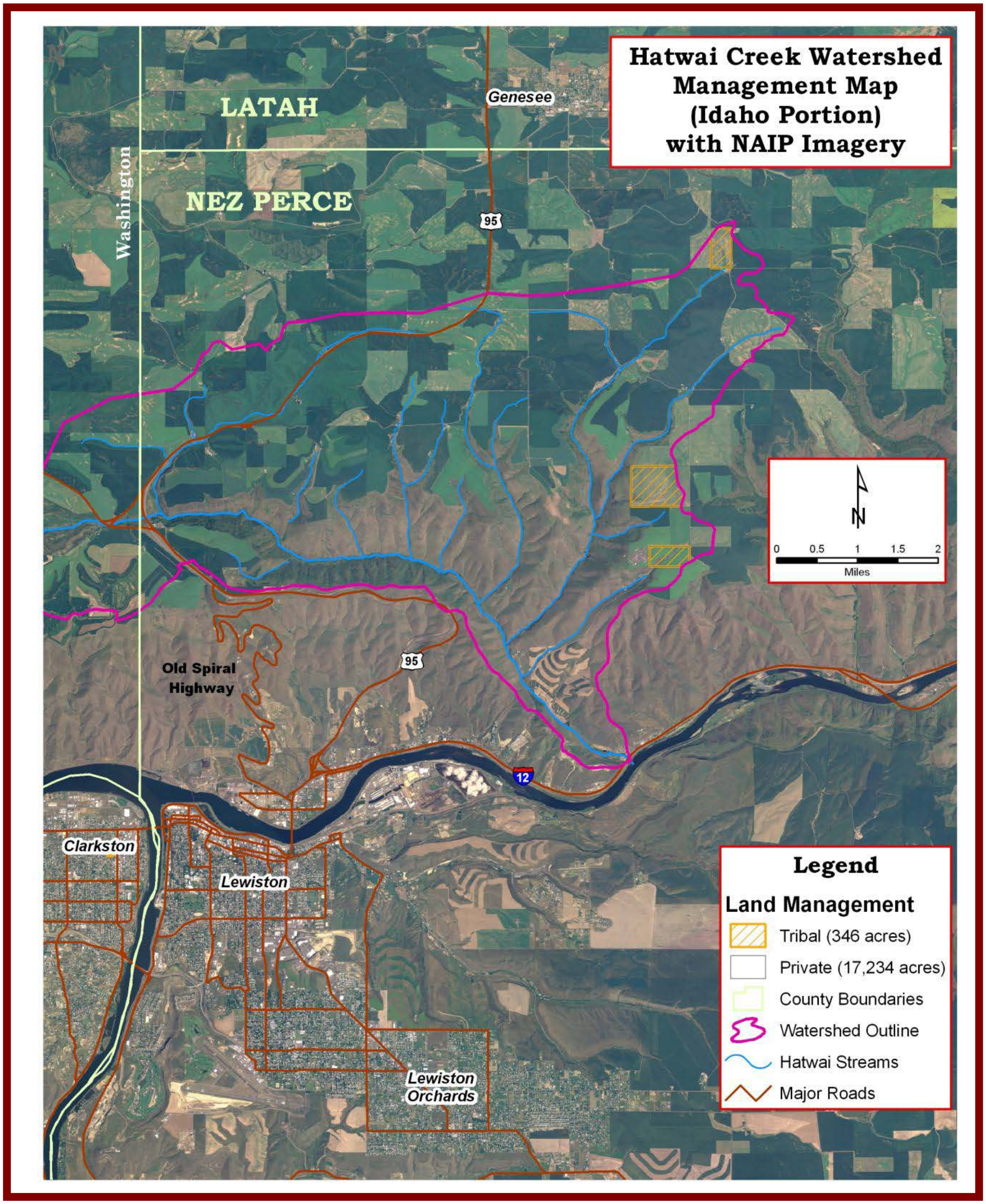

Figure 5. Management

WATER QUALITY PROBLEMS

Beneficial uses/status

Hatwai Creek is an interstate waterbody flowing from Washington into Idaho. Idaho has designated Hatwai Creek for cold water aquatic life, salmonid spawning, and secondary contact recreation beneficial uses. (Table B) (IDEQ, 2010).

Beneficial Use Reconnaissance Program (BURP) data was collected from sites in the Hatwai Creek watershed in 1996 and 1998. Analysis of the BURP data concluded the stream was fully supporting both salmonid spawning and cold water aquatic life beneficial uses. The recreation beneficial use is not fully supported in Hatwai Creek due to the measured violation of the State criteria for *E. coli* bacteria (Table C) (IDEQ, 2010).

Table B. §303(d) listing information for Hatwai Creek (IDEQ, 2010)

Assessment Unit ID17060108	§303(d) Boundaries	Designated Uses	Pollutants
CL067_02 CL067_03	Hatwai Creek Source to Mouth Hatwai Creek Source to Mouth	Cold Water Aquatic Life Secondary Contact Recreation Salmonid Spawning	Nutrients, Temperature, Bacteria

Table C. Beneficial use support status (IDEQ, 2010)

Stream Name	Extent	Salmonid Spawning	Cold Water Aquatic Life	Recreation	Pollutants
Hatwai Creek	Source to Mouth	Full Support	Full Support	Not Fully Supporting	Nutrients, Temperature, Bacteria

The Hatwai Creek TMDL was developed to foster water quality appropriate to the protection and maintenance of the designated beneficial uses of secondary contact recreation, cold water aquatic life and salmonid spawning. Pollutants that most often affect the aquatic beneficial uses include nutrients (that can result in aquatic plant growth and low dissolved oxygen), increased sediment loading, and temperature/heat loading. Recreational use is commonly degraded by excess bacteria. Based on the data collected, bacteria (*E. coli*), nutrient and temperature TMDLs were developed for the Hatwai Creek subwatershed (IDEQ, 2010).

Pollutants

Hatwai Creek has temperature, nutrients, and bacteria listed as pollutants. The source for temperature is solar radiation (the sun). Possible sources of nutrients include natural background, fertilizers, grazing sources, septic systems, and storm runoff. Potential sources of bacteria include grazing, septic systems and wildlife. Although habitat alteration is not a pollutant requiring a TMDL load allocation, improvements to water quality resulting from nutrient, temperature and bacteria load reductions will improve habitat conditions within the watershed.

Point Sources

There are no known point sources of pollution in the Hatwai Creek subwatershed.

NonpointSources

Nonpoint sources within the subwatershed include agriculture, grazing, roads and septic systems that contribute to excess pollutant loads of bacteria, nutrients, and temperature noted, by monitoring, near the Hatwai Creek outlet.

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.

The average nitrite + nitrate as nitrogen (NO_2+NO_3 =N) concentration (mg/L) measured in Hatwai Creek during the 2006-2007 monitoring year was 2.27mg/L, nearly thirty (30) times higher than the EPA recommendation of 0.072 mg/L. The average total phosphorous (TP) concentration measured during the same period was 0.17 mg/L; again, significantly higher than the recommended 0.03 mg/L. Samples with concentrations of NH_3 show that the ammonia had not yet oxidized, which may mean that the ammonia had recently been contributed to Hatwai Creek (IDEQ, 2010).

No DO violations were recorded in DEQ's water quality monitoring data. The connection between nutrient enrichment and subsequent sags in DO concentrations are not evident though nutrient concentrations, reported from water sample analysis, are quite high.

Bacteria

Hatwai is §303(d) listed for bacteria. Bacteria sources can include livestock, wildlife, pets or septic system drainfields (humans). Samples collected and analyzed for *E. coli* bacteria were in violation of Idaho's secondary contact recreational standard. Samples taken from Hatwai Creek were analyzed for the presence of the human gene biomarker and the results of those tests were negative (IDEQ, 2010).

Temperature(HeatSources)

Hatwai Creek is §303(d) listed for temperature; the heat source is solar radiation. This is a natural condition that can be affected by changes in landuse. Heat absorbed by a waterbody, at a level above background conditions, is usually a function of shade reduction. Stream sinuosity, stream width, depth and channel bank conditions also effect water temperatures, but are not as easily managed. The stream segments that are listed for temperature have been altered by landuse changes that decreased stream shading (IDEQ, 2010).

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).

Instantaneous temperature data collected during the 2001-2002 monitoring season showed violation of the 22°C maximum for cold water aquatic life on only one occasion (7/6/2007); stream flow was less than 0.5 cfs. Temperature did not exceed 13°C until May; based on this limited data, it appears that the salmonid spawning criteria was not exceeded.

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

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 water body 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, 2010).

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 the Hatwai Creek drainage 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 (IDEQ, 2010).

TMDL calculations are gross estimates based on very limited field data collection. Water quality data collected for a single monitoring year (2006-2007) was used to calculate the load figures presented in the IDEQ (2010) TMDL document. 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 insure 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.

The TMDL assigns *E. coli* bacteria, nutrient and temperature load allocations throughout the watershed.

E. coli TMDL

Load allocations were not developed for specific source categories (i.e., tributaries). An instream allocation was developed for Hatwai Creek, based on bacteriological data collected during the months of July and early August in 2006, whereby the geometric mean was computed and assessed against Idaho's numeric criterion set forth to protect the secondary contact recreation designated beneficial use (IDEQ, 2010).

Table D lists the existing *E. coli* bacteria concentrations found in 2006 at the monitoring station, the secondary contact recreation geometric mean capacity (load capacity), the load allocation, and the reduction in *E. coli* bacteria concentrations that must occur to meet the load allocation. Sources extending upstream from this location must be managed to reduce the instream *E. coli* bacteria concentrations by 244 cfu/100 ml, or 70%. To ensure that the criterion is not exceeded, this allocation will apply daily throughout the year (IDEQ, 2010).

Consequently, an *E. coli* bacteria TMDL was developed and allocated a monthly concentration equal to the state standard minus a 10% margin of safety (MOS) to all sources contributing *E. coli* bacteria to the Hatwai. It was determined that all contributing sources should be reduced by 70% (Table D) (IDEQ, 2010).

Table D. Bacteria (*E. coli*) allocations for Hatwai Creek (IDEQ, 2010)

Location	Existing Load (cfu/100ml)	30 day Load Allocation (cfu/100ml)	Margin of Safety	Required Load Reduction
Hatwai Creek	348	126	10%	70%

Nutrient TMDL

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 (IDEQ, 2007).

Monitoring data (IDEQ, 2006 to 2007) indicated that no violations of Idaho's 6.0 mg/L dissolved oxygen criterion were observed in the Hatwai Creek drainage. The lowest DO value presented in the monitoring data is 8.3 mg/L, well above the 6.0 mg/L concentration required by Idaho Water Quality Standards.

Impairments to beneficial uses due to nuisance aquatic growths were undocumented. In addition, previously collected BURP data indicated that the aquatic life beneficial uses were fully supported.

The nutrient load capacities and existing loads established by the TMDL were estimated, in pounds per month (lbs/month). Previous nutrient TMDLs for northern Idaho were generally applied during the growing season, May until October, of each year (IDEQ, 2007). The Hatwai Creek Nutrient TMDLs are applied year round; the logic behind the year-round target application is not clearly explained within the TMDL document. In contrast to previous northern Idaho TMDL documents, the TMDL nutrient targets used are based on Columbia Plateau Ecoregion Water Quality Criteria (EPA, 2000) rather than the older and less stringent "EPA Gold Book" Criteria used previously in older TMDL documents describing other nearby watersheds.

Table E. EPA Ambient Nutrient Water Quality Criteria by Ecoregion (IDEQ, 2010)

Ecoregion	Description	Nitrite + nitrate	Total Phosphorus
10	Columbia Plateau	0.072 mg/L	0.03 mg/L

The average nitrite + nitrate as nitrogen (NO_2+NO_3 =N) concentration (mg/L) measured in Hatwai Creek during the 2006-2007 monitoring year was 2.27mg/L, nearly thirty (30) times higher than the EPA recommendation of 0.072 mg/L. Nutrient reductions recommended in the Hatwai TMDL document ranged from 55% to 90% for total phosphorus and 93% to 99% for nitrogen (Table E).

The TMDL document (IDEQ, 2010) states "Nitrogen, ammonia, and phosphorous concentrations at the levels measured in Hatwai Creek can cause visible slime growths or other nuisance aquatic growth that can cause DO to sag and impair the creek's existing beneficial uses".

Temperature TMDL

Streamside vegetation and channel morphology are factors influencing shade which can be most readily corrected and addressed by a TMDL. IDEQ used the Potential Natural Vegetation (PNV) model to develop the temperature TMDL. This methodology uses the narrative natural condition state standard as a temperature target instead numeric criteria (IDEQ, 2010).

The temperature TMDL was based on potential natural vegetation, which is equivalent to background loading. The load allocation is the desire to achieve background conditions. Load allocations are assigned to nonpoint source activities that have affected or may have an effect on riparian vegetation and shade. Load allocations (Table F) are therefore stream reach specific and are dependent upon the target load for a given reach.

The potential natural vegetation (PNV) TMDL identifies which stream segments have been the most affected or disturbed by riparian plant removal, channelization, impoundment, and possibly wildfire. Completion of the PNV temperature TMDL has resulted in the quantification of nonpoint source solar heat loading for each stream segment and illustrates both where and how excess solar radiation is reaching the Hatwai Creek drainage (IDEQ, 2010).

Desired riparian shade for each stream segment to achieve the recommended load reductions varies from an additional 45% to none and is illustrated in Figure 6. Five of 16 stream segments surveyed showed sufficient existing riparian vegetative cover.

Table F . Excess Solar Loads and Percent Reductions for Hatwai Creek (IDEQ, 2010).

Waterbody	Excess Load (kWh/day)	Percent Reduction
Hatwai Creek	-36,948	-9%

Although shade was lacking on multiple creek segments relative to PNV analysis, instantaneous temperature data collected during the 2006-2007 monitoring season showed a violation of the 22°C maximum for cold water aquatic life on only one occasion (7/6/2007); this occurred when recorded discharge was less than 0.5cfs. Temperature did not exceed 13°C until May. BURP data indicated that both aquatic life beneficial uses were fully supported.

Hatwai Creek Monitoring

From July 2006 to July 2007, IDEQ collected water quality data at a monitoring station near the mouth of Hatwai Creek. This site was monitored every two weeks for instantaneous stream temperature, dissolved oxygen, ammonia, nitrite+nitrate as nitrogen (NO_2+NO_3-N), total phosphorus, instantaneous stream flow and specific conductance. *E. coli* samples taken at the site violated the secondary contact beneficial use criterion and triggered additional monitoring over the following 30 days. Further bacteria monitoring focused on DNA analysis to determine possible sources contributing bacteria to Hatwai Creek (IDEQ, 2010).

Precipitation was lower than average during the monitoring period; the majority of the measurements represent base flow conditions. Most precipitation occurs during winter and early spring, with dry summer months. This pattern causes flows to peak in early spring and return to base flows by summer. Base flows in Hatwai Creek were relatively constant during the monitoring year, due to shallow ground water (spring) inflow.

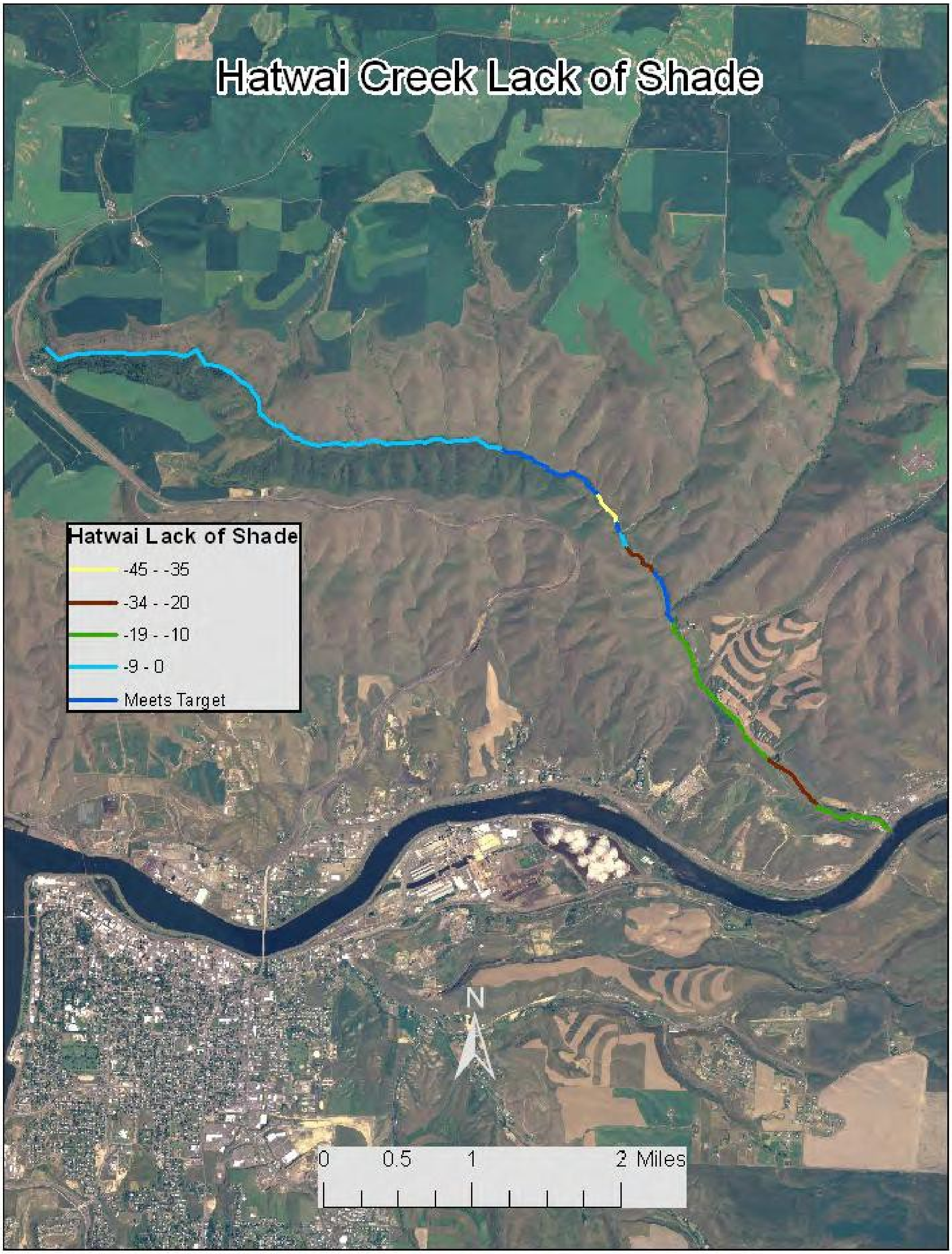

Figure 6. Percent Change in Riparian Shade Needed to Meet the Required Load Reductions (figure from Hatwai Creek TMDL document (IDEQ, 2010)).

The highest measured flow between July 2006 and July 2007 was slightly less than 10 cubic feet per second (February 2007); the lowest discharge measurement was under one-third cfs (November 2006).

No temperature loggers were deployed. The maximum instantaneous temperature recorded (22.4°C) and only violation of the Cold Water Aquatic Life standard was noted on July 6, 2006. Flow recorded for that date was less than 0.5 cfs.

No Dissolved Oxygen (DO) violations were recorded during the monitoring period. DO measurements ranged from 8.3 mg/l to 12.4 mg/l, well above the 6.0 mg/l criteria listed in the Idaho Water Quality Standards.

Nutrient concentrations of collected samples were significant. Total Phosphorus (TP) values consistently exceeded the EPA recommended criteria, averaging 0.17 mg/l. The average nitrite + nitrate as nitrogen concentration (NO_2+NO_3 =N) measured during the 2006-2007 monitoring year was 2.27 mg/L, nearly thirty (30) times higher than the EPA recommendation.

The *E. coli* sample taken at the monitoring station on Hatwai Creek in July 2006 violated the secondary contact recreation criterion and triggered the subsequent sampling necessary to calculate a geometric mean concentration. Five additional *E. coli* bacteria samples were taken over the next 30 days. The resulting *E. coli* geometric mean concentration (348 cfu/100ml) is in violation of the 126 cfu/100ml State standard.

Two Beneficial Use Reconnaissance Program (BURP) surveys, 1996 and 1998, were completed in the third-order segment of Hatwai Creek. These surveys provide data on habitat conditions, stream macroinvertebrates, and fish.

According to the Montana Water Center (2009), The Idaho Department of Fish and Game collected fish data in Lower Hatwai Creek, monitoring the responses of wild rainbow trout and steelhead trout. Monitoring results for the 1995 to 1998 period indicate that the trout density increased annually within the project area. Trout density in the project area increased from 0.32 per square meter in 1995 to a high of 13.24 per square meter in 1998. In the control area, trout density was only 0.87 per square meter in 1996, 3.00 per square meter in 1997, and 3.06 per square meter in 1998. Progress is attributed to better riparian health, including improved streambank stability, enhanced canopy cover, and diminished stream temperatures.

Threatened and Endangered Species

Fish surveys conducted by Idaho Fish & Game show that steelhead trout utilize Hatwai Creek. Several species of concern are listed for Nez Perce County. Canada lynx, bull trout, and Spalding's catchfly are threatened. The wolverine is a candidate species. The gray wolf is listed as experimental nonessential. Lynx and wolverine are unlikely to be present within the watershed due to the lack of forest cover. Spalding's catchfly, a threatened plant, has potential to occur within any Palouse Prairie remnant.

Agricultural Water Quality Inventory and Evaluation

Most of the Hatwai Creek Watershed is cropland, almost 12,600 acres; about 11,150 acres are located in Idaho. More than 4,300 acres of grass covered lands are present. About 2,500 acres of other open or shrub-covered lands are present. Native grasses include bluebunch wheatgrass and Idaho fescue; introduced grasses are intermediate wheatgrass, smooth brome and timothy. Forested lands are scattered along canyon walls and riparian areas but comprise only about 400 acres; tree species include Douglas fir, Ponderosa Pine, Cottonwood and Alder. Several rural residences, a few industrial sites, and one large rock pit are present. The Nez Perce SWCD estimated 20 small grain farms and 2 livestock operations are located within the Hatwai Creek watershed (http://nezperceswcd.org/).

Cropland

Croplands occur within Common Resource Area 9.2, the Palouse and Nez Perce Prairies. This area has little forest and greater than 15 inches of precipitation. Highly productive deep loess soils of the Palouse/Athena/Naff association overlie basalt geology. The soils are considered highly erodible when they occur on slopes greater than 3%. In general, most cropland has been under production since the late 19th century.

Many of the cropland acres are classified as Highly Erodible Land (HEL) under the 1985 Food Security Act. Sheet and rill erosion is variable and dependent primarily on slope gradient. Erosion 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.

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

Within the watershed, it is believed that all landowners/operators are participating in USDA programs. No Idaho cropland acres contracted under the Conservation Reserve Program (CRP) were noted.

Pasture/grass/shrubland

Grasslands and mixed grass\shrub lands within the Hatwai Creek watershed totals about 6,900 acres. Very little hay is cut on these lands; a few hundred acres of pastureland are grazed by horses or cattle. Many of the pastures are located adjacent to channels at higher elevations just above canyon areas. Several other pasture areas are scattered throughout the watershed, primarily in lowland areas adjacent to the perennial and intermittent drainages. There are small winter feeding sites near the lower end of the tributary drainage that parallels Central Grade Road, closest to the watershed's outlet. Several hundred cattle may be present at these locations during winter months. Livestock grazing is dispersed during non-winter months.

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. In the wetter fields, meadow foxtail is the invader species. Erosion potential is based primarily on steepness of slope and vegetative cover.

Native grass and shrubland areas, about 6,600 acres, comprise most lands within and adjacent to Hatwai drainage canyons throughout the watershed. Most lands that fall in this category occur on steep slopes inaccessible to farming operations in canyons and along canyon walls. These lands experience light grazing from livestock as well as wildlife.

Where present in the higher elevation plateau localities, uncultivated areas 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.

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. The erosion potential is slight if that good vegetative cover is maintained.

Riparian areas

Erosion is occurring along most streambanks adjacent to cropland and pastureland fields because of the lack of woody vegetation and rhizomatous herbaceous species. Livestock activity sometimes promotes streambank deterioration, as well as the removal of vegetation. This lack of root mass allows for bank sloughing which contributes significant amounts of sediment into drainages. Many portions of the stream have 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. There are very few remnant areas; historically diverse and multi-layered vegetation along drainage channels is largely missing.

Water Quality Concerns Related to Agricultural Land Use

Agricultural activities within the Hatwai Creek watershed contribute to pollutant problems identified in the TMDL. Nutrient and sediment contributions are associated with sheet and rill, concentrated flow, and streambank soil erosion processes. Elevated stream temperatures can result from inadequate/absent vegetative canopy as well as low flows. Bacteria violations are generally a symptom of livestock access to riparian areas. In addition to livestock sources of bacterial contamination, wildlife and faulty septic systems are other potential contributors.

Although several exceedances of the total phosphorus (TP) recommended criteria were observed, correlation to the state's narrative standard could not be conclusively established at the stream outlet monitoring site. There were no DO standard violations recorded. Although visible slime growths were reported to be present by the TMDL document, corresponding deleterious effects were not documented that would negatively impact beneficial uses.

While there is some uncertainty identifying specific nonpoint sources of phosphorus from agricultural lands, phosphorus is generally assumed to be transported with sediment. Those activities and problem areas that contribute sediment to the stream due to runoff or bank erosion are assumed to provide the largest sources of phosphorus. Additionally, some nutrients enter the system from forested areas, from roads and rural landscapes, and from groundwater. Nitrogen contaminants could be transported to drainages via groundwater or overland flow from fertilized fields.

Any elevated stream temperatures recorded are a function of both an inadequate vegetative canopy and low flows along some stream reaches. IDEQ monitoring recorded only one exceedance of the temperature standard for the cold water aquatic life beneficial use. Elevated temperatures don't appear to be problematic when salmonid spawning is likely to occur.

TREATMENT

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, 2010). Data from water quality monitoring, field inventory and subsequent evaluations were used to identify critical agricultural areas affecting water quality and set priorities for treatment.

Critical Areas

The Hatwai Creek watershed is mostly (63%) cropland with about 5% of the watershed comprised of other agricultural lands. Minor pastureland occurs as small scattered patches of ground, largely adjacent to tributary streams; scattered grazing occurs on rangelands present throughout the canyon terrain that makes up most of the southern portion of the watershed. Some hay production may occur in areas that are also utilized for grazing, but very little was noted. Only 13 horses and a few head of cattle were observed in April of 2010; more livestock was assumed to be dispersed, but not visible, within the watershed. Some winter feeding of livestock occurs along tributaries at lower watershed elevations and was observed at several sites during February of this year (Dansart, 2011).

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

Agricultural critical areas within the Hatwai Creek watershed potentially include:

- Cropland (Upland)
  - Areas generating erosion (sheet or rill)
  - Areas of severe gully erosion
- Riparian zones
  - Cropland riparian areas
  - Areas lacking canopy cover
  - Unstable and erosive stream banks
  - Pasture Lands
  - Other grazed lands where livestock have access to stream channels
- Road Corridors

Treatment Units (TU)

Four 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 Hatwai Creek watershed are: cropland (upland), cropland (riparian), pasture (riparian) and rangeland (riparian). Another treatment unit (road corridors) intersects agricultural lands throughout the watershed; it falls under the authority of the Nez Perce County Highway District along with the responsibility for roads BMPs installation.

<u>Cropland (Upland)</u>

Approximately 70% of the Hatwai Creek watershed lies within the Palouse Hills, a non-forested, loess-covered region. Original plant cover has been almost entirely supplanted by wheat farms with few Palouse Prairie remnants remaining. Of the cropland total (~12,600 acres), most is located at elevations greater than 2,200 feet. 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). Concentration erosion continues in places due to the steepness of the slopes, even though high residue levels are maintained on the fields.

Cropland Resource Issues

Soil

Sheet/rill erosion

Problem: Erosion rates exceed the soil loss tolerance (T)

Treatment: Reduce soil erosion through implementation of a reduced tillage system. Conversion to such a system from conventional tillage resulted in a reduction of soil loss that averaged 8 tons per acre on average, for croplands of the Paradise Creek drainage, a watershed about 15 miles to the north. Conversion to reduced tillage systems within the Cow Creek watershed, the adjacent drainage area to the north, was estimated to result in up to a 3 tons/acre drop in soil erosion (Latah SWCD, 2004). Because Hatwai Creek watershed farm operators have adopted some conservation tillage practices on cropland, actual reductions in erosion are expected to be significantly less.

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 0.03 mg/L TMDL target.

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. Although excess sediment is not noted as a water quality problem within the Hatwai Creek watershed, it is a primary source of nutrients, sorbed on soil particles, delivered to the drainage system.

Treatment: Reduce soil erosion through implementation of a reduced tillage system. Reduction of soil loss per acre varies depending on conservation practices previously adopted by farm operators.

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

Riparian Zones

Nutrient loading is identified as a water quality concern within the watershed; nutrients are sorbed to soil particles. Channel erosion may be the largest source of sedimentation in the Hatwai Creek watershed. A cursory examination of the watershed revealed that many streambanks are unstable. Fields are sometimes cultivated to the channel edge, overtopping the bank edges and delivering sediment directly into the adjacent channels or road ditches. 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 then re-directed to bank erosion.

The removal of natural riparian vegetative canopy has contributed to temperature exceedances observed, at times, in some locations. A lack of stream canopy exists on agricultural lands throughout the watershed.

Riparian Zone Cropland Resource Issues

Erosion from adjacent cropland

> *Problem:* Suspended sediment is a concern for downstream water quality, as a nutrient carrier, and the habitat of stream-dwelling organisms. Cropland is cultivated close to stream's 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.

Riparian Zone Pasture Lands Resource Issues

Grazing activities contribute to riparian area denudation and to the overall sediment and bacteria loads within the Hatwai Creek watershed. In addition to sediment/nutrient loading due to channel erosion, bacteria loads originating from livestock presence is a problem within the riparian zone on pastureland.

Pasture lands (~250 acres) are generally adjacent to stream channels where livestock can access water. Concentrated winter feeding occurs at several locations along Hatwai Creek tributaries.

> *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.

Riparian Zone /Range Lands Resource Issues

Range lands comprise approximately 2,500 acres located at elevations below 2,500 feet within the Lower Snake and Clearwater Canyons Common Resource Area. This area is host to scattered livestock grazing and provides wildlife habitat throughout. Range lands generally provide continuous ground cover and therefore supply relatively little pollutant load when compared to cropland and pastureland. Although these lands are grazed at times, they are not likely significant sources of bacteria and sediment contributions to the drainage system. However stream canopy cover is often limited and contributes to temperature concerns within the watershed.

Problem: Lack of stream canopy along some channel segments. Occasional grazing by livestock contributes manure to streams and to bank erosion
*Treatment**:*** Exclude cattle from the riparian zone at times when runoff is likely. Promote channel bank stabilization and establishment of riparian vegetation to help filter pollutants and promote stream canopy restoration in previously denuded areas. Attract livestock away from active channels by establishing off-stream watering sites. Rotate salt or strategically place salt away from riparian area.

Conservation Treatments

Best management practices (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.

Agricultural resource management planning to address water quality typically involves the application of BMPs to address particular resource concerns. For the Hatwai Creek watershed, 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 Hatwai Creek watershed, 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.

<u>Agronomic Practices</u>

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

<u>Conservation Cropping Sequence / Conservation Tillage / Residue Management</u>

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

Locally, extended research efforts at the Palouse Conservation Field Station from 1978 through 1985 showed that with a 50% surface residue cover, a 92% reduction in soil loss was achieved (McCool, *et al*., 1993) when comparing conservation tillage practices to conventional tillage (Gilmore, 1995). Conservation tillage conversion has occurred, at least to the mulch till level, on most cropland acres in the Hatwai Creek watershed.

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). Although orthophosphate data for Hatwai Creek was not collected, phosphorus values in water quality samples collected from the adjacent Cow Creek drainage typically show a 2:1 ratio of total phosphorus to orthophosphate. A 10,000 ton reduction in sediment delivered to Hatwai Creek would equate to 617 lbs (280 kg) reduction (.014 kg *2*10,000) in TP delivered to Hatwai Creek annually. This is approximately the total load reduction targeted by the TMDL for the mouth of Hatwai Creek: 1.7 lbs TP/daily * 360 = 620 lbs/year. Since the mid 1990's, most of the Hatwai Creek watershed cropland has converted to conservation tillage, either mulch till or direct seed. *Note: An associated average of less than one ton/acre in sediment delivery would meet the targeted nutrient reduction at the stream outlet if the entire load reduction was reflected. Exactly how sediment transport within the stream channel from the multiple delivery points to the drainage mouth factors into the hypothetical scenario is unknown.*

In addition to nutrient-rich sediment reductions, additional nutrient reductions will occur through the implementation of comprehensive nutrient management plans that could be developed with each individual grower that participates in the program. 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 indicating an 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/Mulch Tillage High Residue Management Systems

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; equilibrium is reached and benefits are fully achieved from the system. 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). According to the Revised Universal Soil Loss Equation (RUSLE), erosion rate reductions from continuous direct seeded fields ranged from 14 tons/acre to 3 tons/acre, when compared to conventional tillage for the nearby Paradise Creek watershed (Dansart, 2004).

Mulch tillage is managing the amount, orientation, and distribution of crop residue year-round on the tilled soil surface. It provides much of the water quality benefits associated with direct seeding because it does not invert the soil and maintains significant surface vegetative residue. The practice goals include leaving the soil rough with at least 60% surface cover to inhibit erosion due to surface runoff (Mahler, 2003).

Once fully adopted, conservation tillage systems make significant contributions to the reduction in sediment and nutrient delivery to local water bodies through decreases of sheet and rill erosion. In the nearby Paradise Creek watershed, direct seeding practices, supported by IDEQ §319 and ISCC WQPA funding, were estimated to reduce sediment delivery to Paradise Creek by an average of 2.3 tons/acre/year (Dansart, 2002). About 1,300 acres converted to continuous direct seeding within the Paradise Creek watershed resulted in approximately 3,000 tons/year of projected sediment delivery reduction to the stream. Modeling by Brooks (2008) indicated that, for the Paradise Creek watershed, conversion from conventional tillage would result in estimated average sediment delivery reductions of 2.4 tons/acre/year for direct seeding, or 1.6 tons/acre/year for mulch tillage. This sediment reduction directly relates to reductions in nutrients.

In June 1999, an EQIP special project for reducing sheet and rill erosion on Hatwai Watershed cropland was initiated. The project focus was the implementation of direct seeding systems, a new technology for this area. Installing sheet and rill erosion control practices on 10,000 acres of cropland resulted in an estimated reduction of 7 tons per acre per year. Installing 9,000 acres of pest and nutrient management practices produced an estimated 20 percent reduction in the amount of pesticides and fertilizers applied (EPA, 2002).

An additional benefit of conservation tillage systems is carbon sequestration. Area growers that have incorporated direct seeding systems 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 uphill 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).

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 Hatwai Creek watershed 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 cropland similarities between the Paradise Creek and Hatwai Creek watersheds, it is anticipated each proposed structure within the Hatwai Creek watershed should reduce sediment delivery within the range mentioned.

Nineteen erosion control structures were installed as a component of the 1999 Hatwai Creek EQIP project. Concentrated-flow erosion of sediment was reduced by an average of 20 tons per year per structure.

When conservation tillage and erosion control structures are coordinated within a watershed, significant reduction in erosion and sedimentation can occur. Conversion to 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).

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 countered by a VFS. Erosion associated with concentrated flow cannot be addressed by VFS installation. With respect to temperature, VFS installed on agricultural lands may slightly improve base flow conditions of Hatwai Creek. However, given the predicted size of the strips, this effect is likely to be negligible.

Analysis of USGS 24K topographic maps shows 31 miles of stream (intermittent and perennial) channels which flow through agricultural lands. A 30-foot buffer strip on each side of the creek on agricultural lands would encompass a total of 231 acres.

Channel erosion is a significant source of sedimentation in the Hatwai Creek watershed. A cursory examination of the drainage areas 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. Coarse streambank erosion estimates were compiled in an NRCS Preliminary Investigation (USDA, 1995) for the nearby Paradise Creek. Average streambank erosion rates were estimated at 0.04 tons/year per linear foot of stream channel. 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. Potential problems include: difficultly of stand establishment due to weeds and rodents, loss of productive cropland, lost income, future large woody debris causing obstruction and flood problems. Installation should be encouraged, particularly on idle cropland or pastureland. Besides filtering sediment and helping stabilize streambanks through additional root mass, such a buffer strip would help maintain base flow to the creek by decreasing upland runoff to the creek, encouraging infiltration, and increasing 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 the woody vegetation matured, canopy cover to the stream would increase, likely resulting in some water temperature decrease and blocking sunlight necessary for algal growth. Fish habitat would be improved over time with recruitment of large woody debris and development of undercut banks offset by small increases in channel and bank erosion at these locations. Wildlife habitat would be enhanced for both game and non-game 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 bank erosion and sediment load.

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 collect annual rental payments.

Riparian Area Pasture BMPs

A small amount (~250 acres) of pastureland is dispersed throughout the watershed, largely adjacent to tributary streams. Some concentrated winter feeding of livestock was observed to occur along tributaries at lower watershed elevations (Dansart, 2011).

It is likely some of the sediment and much of the bacteria contributions to the drainage system are due to the presence of a limited number of livestock in pasture areas that abut stream channels. Trampling of channel banks by livestock can be a significant sediment contributor. In addition, stretches of riparian area may 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 a 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.

RiparianAreaGrassland/HaylandBMPs

Because ungrazed grass stands are not generally a large source of nutrients, sediment or bacteria, no specific BMPs that address those pollutants are recommended for the grass-covered tracts other than to limit grazing to times when runoff is unlikely and to exclude cattle from the riparian zone. Only BMPs that address temperature concerns are recommended, particularly those that promote establishment of overhanging canopy and promote increased base flows.

Riparian Rangeland BMPs

Approximately 6,900 acres of grass and shrub covered lands are located at elevations below 2,500 feet within the Hatwai Creek watershed. This area is host to scattered livestock grazing and provides wildlife habitat throughout. Range lands generally provide continuous ground cover and therefore supply relatively little pollutant load when compared to cropland and pastureland. Although these lands are grazed at times, they are not likely significant sources of bacteria and sediment contributions to the drainage system. Occasional grazing by livestock contributes manure to streams and to bank erosion. However, stream canopy cover is often limited and contributes to temperature concerns within the watershed.

Grazing should be limited to times when runoff is unlikely and exclude cattle from heavily accessed stretches of 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. Attract livestock away from more heavily used active channel stretches by establishing off-stream watering sites; install exclusion fencing if necessary.

Recommended Priorities for BMP implementation

Since elevated nutrient levels occur within the Hatwai Creek Watershed, a priority for BMP implementation would be the adoption of conservation tillage practices to minimize cropland sheet and rill erosion and decrease sediment delivery, with associated nutrients, to the Hatwai Creek drainage network. However, it is believed most croplands have converted to conservation tillage. There may be little opportunity or interest for additional cropland tillage practice conversion at the present time. More efficient nutrient management should be encouraged where appropriate.

Reduction of ephemeral gully erosion remains a priority; where conservation tillage practices have already been adopted, water and sediment control basins are the BMP of choice. Filter strips adjacent to stream channels mitigate sheet and rill erosion from contiguous cultivated fields. On-site retention of nutrient-laden sediment should reduce sediment, phosphorus and nitrogen loads delivered to Hatwai Creek. This will help ensure that TSS concentrations are minimized, nutrient loads are reduced, and that dissolved oxygen (DO) continues to meet the Idaho Water Quality Standards. 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 where feasible. 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.

The Hatwai Creek drainage is a relatively small (20,000 acres) watershed. No subwatersheds are prioritized for treatment. Croplands are dominant and exhibit similar types of water quality problems. Rangelands comprise most the remaining watershed acreage.

Past Agricultural Conservation Efforts

Hatwai Creek croplands are primarily found at higher watershed elevations that are located on the southern edge of the Palouse Prairie. The common crop rotation in the Idaho portion of the Palouse 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 gradually became utilized within 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 no-till operations 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 (Gilmore, 2004).

The Soil Conservation Service (SCS) became active in this part of Idaho 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 Hatwai Creek Watershed through the Nez Perce SWCD to assist with conservation planning and assistance. The first SCS Soil Survey of Nez Perce County, which encompasses the watershed, was published in 1920; a new soil survey for the area was published by NRCS in 2004.

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

During the 1990's, the Nez Perce Soil and Water Conservation District (NPSWCD) organized an effort to address water quality and fishery concerns. The resulting watershed plan consisted of four separate projects to address water quality and fisheries issues: an EPA 319 project, a U.S. Department of Agriculture Water Quality Incentives Project, a riparian demonstration project funded by the Idaho Soil Conservation Commission, and a USDA Environmental Quality Incentives Program project (EPA, 2002). Conservation practices implemented were: 1) a grazing system management plan, which focused on improving riparian habitat with exclusion of grazing only from April through October and improving range condition and trend through enhanced range management practices while maintaining a viable livestock operation, 2) streambank stabilization with herbaceous and woody vegetation planting in the riparian area, and instream rock jetties, 3) grade control with the installation of 10 log (drop) structures to prevent downcutting, 4) upland erosion control to reduce concentrated flow erosion, using water and sediment control basins on 10,000 acres of non-irrigated cropland, and 5) provision of information and education to landowners of over 11,000 acres, on the subjects of soil testing, nutrient budgeting, Integrated Pest Management and wellhead protection (EPA, 2002) .

The Idaho Department of Fish and Game collected fish data in Lower Hatwai Creek. Monitoring results for the 1995 to 1998 period indicate that the trout density increased annually throughout the length of the demonstration project. Trout density in the project area increased from 0.32 per 100 square meters in 1995 to a high of 13.24/100 m^2 in 1998. This improvement is attributed to improved riparian health, including improved streambank, increased canopy cover, and decreased stream temperatures (EPA, 2002).

Current BMP Status

Cropland erosion control efforts have been on-going in the Hatwai Creek watershed for the past several years. Transition of croplands from conventional tillage to conservation tillage systems was initiated by progressive farm operators in the decade prior to the 2006 water quality monitoring upon which the TMDL document was based. Beginning in the early 1990's several state and federal water quality incentive projects have been implemented within the Hatwai Creek watershed resulting in adoption of improved conservation tillage practices, nutrient management and installation of multiple erosion control structures. Surveys indicate landowners and operators are interested in continued conservation improvements if funding assistance is available (EPA, 2002).

The EQIP special project, initiated in 1999, focused on the implementation of direct seeding systems, a new technology for this area. Nineteen erosion control structures were installed, reducing concentrated-flow erosion of sediment by an average of 20 tons per year per structure. Installing sheet and rill erosion control practices on 10,000 acres of non-irrigated cropland resulted in a reduction of 7 tons per acre per year. Installing 9,000 acres of pest and nutrient management practices produced a 20 percent reduction in the amount of pesticides and fertilizers applied (EPA, 2002).

Today, most watershed croplands are farmed utilizing conservation tillage systems, mulch till or direct seed, along with crop rotations that utilize high residue crops for two thirds of the rotation length and associated best management practices targeted at erosion reduction. A landowner survey, previously conducted by NPSWCD, indicated that 85% of those surveyed had participated in at least one conservation project. Potential for further conversion to direct seeding for cropland acres presently mulch tilled is likely low at the present time, due to current economic factors. The potential for the implementation of structural practices to mitigate gully erosion is likely high if cost share funds become available.

Recommended BMPs and Estimated Costs

As documented in the prior sections, best management practices (BMPs) implementation has been an on-going effort within the Hatwai Creek Watershed for several decades. How much additional BMP implementation is warranted, or the relative priority of the Hatwai watershed for water quality funding, is a topic for the Watershed Advisory Group to consider.

The Hatwai Creek TMDL documents elevated nutrient and bacteria levels via monitoring conducted at the stream mouth. A lack of shade is indicated utilizing the Potential Natural Vegetation (PNV) methodology.

While violation of the numeric water quality standard for bacteria indicates non-support of the secondary recreation beneficial use, the elevated nutrient levels and lack of shade show less direct relationships to water quality standards violations and lack of beneficial use support. Elevated nutrient levels, based on EPA recommended criteria, don't cause low DO levels in Hatwai Creek, nor were any other "deleterious effects" clearly documented. The shade deficiency exhibited relative to PNV, was not shown to produce multiple temperature standard violations. The TMDL document stated BURP data indicated full support of the Cold Water Aquatic Life and Salmonid Spawning beneficial uses; temperatures recorded by the most recent DEQ water quality monitoring support that determination.

In addition to the goal of achieving water quality standards; there is the supplementary requirement to prevent the degradation of current water quality in streams.

The Watershed Advisory Group (WAG) will evaluate water quality status, previous BMP implementation efforts and results, potential for future landowner participation, and the various project funding sources available to determine what future implementation is warranted. Water quality program funding priorities relative to other local TMDL watersheds will be evaluated by the WAG in concert with the Clearwater Basin Advisory Group (BAG).

Additional best management practice recommendations to consider for the Hatwai Creek watershed, with associated cost estimates, are listed in Table G. These are best estimates based on a watershed-wide overview. More accurate BMP recommendations and associated costs would be determined after detailed site specific field examination at proposed project locations.

Table G. Recommended BMPs and Estimated Costs

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.	12,600		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	3,000	$270,000	$90,000
Water & Sediment Control Basin(638)	No.	24	$96,000	$3,000
Comp. Nutrient Mgt. Plan (100)	No.	10	$50,000	$50,000
Nutrient Management (590)	Ac.	11,340	$56,700	$2,840
Filter Strip (393)	Ac.	188	$18,800	$380
Riparian Forest Buffer (391)	Ac.	80	$120,000	$1,200
Riparian Herbaceous Cover (390)	Ac.	80	$24,000	$240
Tree/Shrub Establishment (612)	Ac.	80	$36,000	$360
Total RMS Costs			$671,500	$ 148,020

Future Level of Treatment for Grass/Pasture/Hay Lands Riparian				
Grass/Pasture/Hay Lands Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/Hay Total	Ac.	300		
Riparian Grass/Pasture/Hay	Ac.	43		
Nutrient Management (590)	Ac.	300	$1,500	$100
Comp. Nutrient Mgt. Plan (100)	No.	2	$10,000	$10,000
Channel Bank Vegetation (322)	Ac.	5	$15,000	$300
Channel Stabilization (584)	Ft.	3,000	$60,000	$300
Diversion (362)	Ft.	300	$825	$18
Fence (382)	Ft.	30,000	$60,000	$1,200
Riparian Forest Buffer (391)	Ac.	43	$64,500	$650
Riparian Herbaceous Cover (390)	Ac.	43	$12,900	$130
Tree/Shrub Establishment (612)	Ac.	43	$19,350	$190
Watering Facility (614)	No.	4	$6,000	$60
Well (642)	No.	1	$8,000	$80
Total RMS Costs			$258,080	$13,030

Future Level of Treatment for Range Lands Riparian				
Range Lands Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Rangelands Total	Ac.	6,900		
Riparian Rangelands	Ac.	215		
Channel Bank Vegetation (322)	Ac.	22	$66,000	$1,320
Channel Stabilization (584)	Ft.	15,000	$300,000	$1,500
Fence (382)	Ft.	30,000	$60,000	$1,200
Prescribed Grazing (528)	Ac.	6,000	$30,000	$30,000
Riparian Forest Buffer (391)	Ac.	22	$33,000	$330
Riparian Herbaceous Cover (390)	Ac.	22	$6,600	$70
Tree/Shrub Establishment (612)	Ac.	22	$9,900	$100
Spring Development (574)	No.	4	$9,400	$50
Watering Facility (614)	No.	4	$6,000	$60
Total RMS Costs			$520,900	$34,630

Treatment Alternatives

Relative to several other streams within the Clearwater (17060306) HUC, Hatwai Creek has less significant water quality problems but may have higher fisheries potential. Idaho Fish and Game has identified Hatwai Creek as having high potential as steelhead habitat and has documented significant fish population increases due to previous habitat restoration efforts.

This agricultural implementation plan is focused primarily on addressing water quality concerns relative to Idaho's TMDL process. Limited funds intended solely for water quality improvement efforts perhaps should be first directed to higher priority watersheds with more severe water quality problems. High fishery potential watersheds, like Hatwai Creek, would be logical targets for funding intended for fisheries restoration and habitat improvement.

Beneficial Uses

Two Beneficial Use Reconnaissance Program (BURP) surveys, 1996 and 1998, were completed in the third-order segment of Hatwai Creek. These surveys provide data on habitat conditions, stream macroinvertebrates, and fish. Index scores from both of these biological surveys show full support of the salmonid spawning and cold water aquatic life beneficial uses. According to the Hatwai Creek TMDL (2010): "DEQ stream survey fishing efforts in 1996 and 1998 found the following fish species: rainbow trout, redside shiner, speckled dace, dace, and sucker. These surveys determined that both the salmonid spawning beneficial use and cold water aquatic life beneficial use were fully supported in the stream's lower reach."

Data collected during the most recent 2006 to 2007 water quality monitoring indicates the recreation beneficial use is not fully supported in Hatwai Creek due to the measured violation of the State geometric mean criteria for *E. coli* bacteria.

Pollutants

Bacteria

As stated above, violation of the State geometric mean criteria for *E. coli* bacteria has been documented. This exceedance indicates that the secondary recreation beneficial use is not fully supported. The violation is most likely livestock related; the logical fix is to restrict livestock access to flowing water.

Nutrients

Nitrogen, ammonia, and phosphorous concentrations at the levels measured in Hatwai Creek can cause visible slime growths or other “nuisance” aquatic growth that can cause DO to sag and impair the creek’s existing beneficial uses (IDEQ, 2010). The lowest DO value presented in the monitoring data is 8.3 mg/L, well in excess of the 6.0 mg/L concentration required by Idaho Water Quality Standards. Previously collected BURP data indicated that both aquatic life beneficial uses are fully supported.

Temperature

Temperatures recorded by IDEQ monitoring indicates that temperature is not documented as problematic during times (March to April) steelhead or other salmonids would be likely to spawn at lower elevations within the Clearwater Basin. In fact, Hatwai Creek has some of the higher steelhead densities reported for Clearwater tributary streams (Rees, 2011). Salmonids are present and likely increasing in density; this is in spite of the fact that a notable lack of riparian vegetation exists within the watershed. Spawning may exist, although it has not been documented in the last five years (Bowersox, 2011).

Although shade was lacking on multiple creek segments relative to PNV analysis, instantaneous temperature data collected during the 2006-2007 monitoring season showed violation of the 22°C maximum for cold water aquatic life on only one occasion (7/6/2007); this occurred when recorded discharge was less than 0.5cfs. Temperature did not exceed 13°C until May. Prior BURP analyses indicated that both aquatic life beneficial uses were fully supported.

Potential Income Loss to Operators

Although the BMPs recommended will likely lead to some improvement in water quality, the cost of installation comes with some potential income loss to the landowner/operator. The Hatwai Creek watershed contains some of the most productive cropland in Nez Perce County. Using the vegetative filter strip BMPs as an example, installation cost of complete treatment of all the potential 30 foot-wide cropland buffer area (188 acres) with a 60% filter strip to 40% forest buffer ratio is estimated at $200,000 but would sacrifice significant prime cropland acres. Using an estimate of 80 bushels/acre for wheat and an average price of $10/bu, the conversion of the recommended acreage from cropland to buffer strips would result in a $150,000 annual gross income loss to the watershed landowner/operator(s) for those years when wheat was planted in the rotation. Some lost income would be offset by annual rental payments if the BMPs were installed under the CRP program. The economic tradeoffs to the landowners and/or operators should be taken into consideration.

A viable alternative to an immediate major BMP implementation effort on agricultural lands within the Hatwai Creek watershed might be to work with willing landowners as the opportunities present themselves but utilize regularly scheduled (ex. two consecutive years of monitoring spaced at 5 year intervals) water quality monitoring to track the effects of previous implementation efforts as well as guide future implementation priorities. Limited funding could then be directed to build upon the previous cropland implementation efforts or to higher priority watersheds, as monitoring results indicate.

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

The agricultural implementation plan should be viewed as a dynamic document, subject to change as current conditions dictate. In addition to outlining specific goals and objectives related to the agricultural sector, this document will support the Hatwai Creek TMDL approved by EPA in December 2010 and promote comprehensive management of water quality. 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 are supported and water quality standards are achieved.

FUNDING

To adequately address the TMDL concerns within the Hatwai Creek watershed a significant collaborative effort for technical and financial assistance will be required. If needed, the Nez Perce Soil and Water Conservation District will pursue funding sources to implement water quality enhancements on private agricultural and grazing lands. 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 and Water Conservation Commission (ISWC). This program is also coordinated with the TMDL process. Source: ISCC http://www.scc.state.id.us/programs.htm

Pacific Coastal Salmon Recovery Funds (PCSRF) – NOAA Grant Program to support the restoration and conservation of Pacific salmon and steelhead populations and their habitat. The program provides funding to the States of Alaska, Washington, Oregon, Idaho and California for salmon habitat restoration, salmon stock enhancement, sustainable salmon fisheries and salmon research. It also provides funding to the Pacific Coastal tribes and the Columbia River tribes.

Snake River Basin Adjudication Fund (SRBA) – Congressionally allocated trust fund established to implement habitat improvement projects. Expenditure of one-third of the Fund will be directed by the Nez Perce Tribe; expenditure of two-thirds of the Fund will be directed by the State with input from the Tribe. Administered through the Governor's Office of Species Conservation.

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

PL-566 –This is the small watershed program administered by the USDA Natural Resources Conservation Service (NRCS).

Agricultural Management Assistance (AMA) –The AMA provides cost-share assistance to agricultural producers for constructing or improving water management structures or irrigation structures; planting trees for windbreaks or to improve water quality; and mitigating risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. http://www.nrcs.usda.gov/programs/ama/

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/

Conservation Technical Assistance (CTA) –The CTA provides free technical assistance to help farmers and ranchers identify and solve natural resource problems on their farms and ranches. This might come as advice and counsel, through the design and implementation of a practice or treatment, or as part of an active conservation plan. http://www.nrcs.usda.gov/programs/cta/

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

Grassland Reserve Program (GRP) –The GRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. http://www.nrcs.usda.gov/programs/GRP/

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

Grazing Land Conservation Initiative (**GLCI) –**The GLCI's mission is to provide high quality technical assistance on privately owned grazing lands on a voluntary basis and to increase the awareness of the importance of grazing land resources. http://www.glci.org/

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

In the past, the Nez Perce SWCD has undertaken formal outreach efforts to inform members of the agricultural community within the Hatwai Creek watershed of BMP implementation projects. Significant BMP implementation has been completed within the watershed prior to the TMDL process. 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. Additionally, a portion of the conservation district newsletters and web sites 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.

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 project sites.

At the field level, annual status reviews will be conducted to insure that the contracts are on schedule 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 effectiveness of implemented BMPs in reducing water quality impacts. The 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 water bodies. The determination will tell if a water body 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.

Prior to the 2006 water quality monitoring effort used to establish baseline conditions for watershed assessment in the TMDL document, most cropland had been converted to some form of conservation tillage (mulch till or direct seed). Monitoring to determine how distant water quality targets are from being currently achieved is likely a good use of funds prior to major future BMP implementation.

A long-term monitoring program characterizing agricultural lands within the watershed should be developed in cooperation with the Hatwai/Lindsay/Tammany Creeks WAG and Nez Perce SWCD. When funds are available, additional monitoring that is conducted on a regular schedule could be useful to determine long term trends and annual fluctuations in pollutant loads. 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 installed as well as to guide future implementation priorities. Monitoring to characterize pollutant loads attributable to episodic events may provide useful information in adjusting the pollutant load estimates derived from the existing data set. Limited funding could then be directed to higher priority concerns to build upon the previous implemented work, in a cost-effective manner.

RUSLE (Revised Universal Soil Loss Equation) in combination with a flow routing model processed using GIS may be used 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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GIS Coverages:

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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
CRP -	Conservation Reserve Program
CWA -	Federal Clean Water Act
DO -	dissolved oxygen
EPA -	U.S. Environmental Protection Agency
EQIP -	USDA Environmental Quality Incentive Program
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; renamed "Idaho Soil and Water Conservation Commission" in 2010; (see ISWCC)
ISDA-	Idaho State Department of Agriculture
ISWCC -	Idaho Soil and Water Conservation Commission
IWRRI -	Idaho Water Resources Research Institute
kg/d -	kilograms per day
LA -	Load Allocation
MCL -	maximum contaminant level
mg/l -	milligrams per liter
NPSWCD	Nez Perce SWCD
NPDES -	National Pollution Discharge Elimination System
NPS -	Nonpoint Source Pollution
NRCS -	USDA Natural Resource Conservation Service
PNDSA -	Pacific Northwest Direct Seed Association
RUSLE -	Revised Universal Soil Loss Equation
SFPR -	South Fork Palouse River
SWCD -	Soil and Water Conservation District
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; ISWCC)

APPENDIX B

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