South Fork of the Palouse River

Total Maximum Daily Load

Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality
Prepared by:
Idaho Soil Conservation Commission
In Cooperation With:
Latah Soil Water Conservation District
South Fork Palouse River Watershed Advisory Group (WAG)
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INTRODUCTION

The “South Fork Palouse River Watershed Assessment and Total Maximum Daily Loads” was developed by the Idaho Department of Environmental Quality. The document was approved by EPA in October of 2007.

From IDEQ’s website:

> “The South Fork Palouse River TMDL follows other TMDLs developed for Hydrologic Unit Code 17060108: Paradise Creek, Palouse River tributaries, and Cow Creek. The South Fork Palouse River drains from the southern slope of Moscow Mountain, skirts the south side of the City of Moscow, and enters Washington State upstream of the City of Pullman.
>
> Most of the wetlands and flood plains in the Palouse have been eliminated by modern land use, urbanization, and transportation infrastructure. These activities have affected instream flows, channel sinuosity, and habitat diversity. In addition, the topography, soils, and climate make the Palouse watershed very susceptible to erosion. Land uses that contribute excess sediment, nutrients, and bacteria to the river can degrade water quality.
>
> Total maximum daily loads were established for *E. coli* bacteria and temperature throughout the watershed, and for sediment and nutrients in specific portions of the watershed.
>
> In addition to nonpoint source load allocations, wasteload allocations were developed for February and March for Syringa Mobile Home Park and Country Homes Mobile Park, both of which discharge small amounts of wastewater to the river from wastewater lagoons. These are included with the load allocation in the existing load. “

The South Fork of the Palouse River (SFPR) is an interstate drainage on the State of Idaho’s 2002 Integrated report §303(d) list of impaired water bodies. The SFPR is listed from the headwaters to the Washington State line. For waters identified on the list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards (IDEQ, 2007).

The Clean Water Act requires interstate waters meet downstream receiving water state water quality standards when the water body crosses state lines. Idaho State has designated the South Fork Palouse River for cold water aquatic life, salmonid spawning, and contact recreation beneficial uses. These designated beneficial uses are considered to be comparable to the aquatic life and recreational beneficial uses designated by Washington State for the South Fork Palouse River (IDEQ, 2007).

The SFPR Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for the South Fork Palouse River Watershed. The plan will specify projects and controls designed to improve SFPR 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, 2007). This "Implementation Plan for Agriculture" is a component of the SFPR TMDL Implementation Plan**. Only the Idaho portion of the South Fork Palouse River watershed is described in this report.**

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 SFPR WAG. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved (IDEQ, 2005).

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

Purpose

The agricultural component of the South Fork Palouse River 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 Latah SWCD and agricultural producers in the SFPR watershed to identify critical agricultural acres and suggest BMPs necessary to meet the requirements of the SFPR TMDL, where economically feasible. This work has already begun due to the efforts of individual farm operators within the watershed. Whether or not the TMDL targets are attainable remains to be seen.

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.

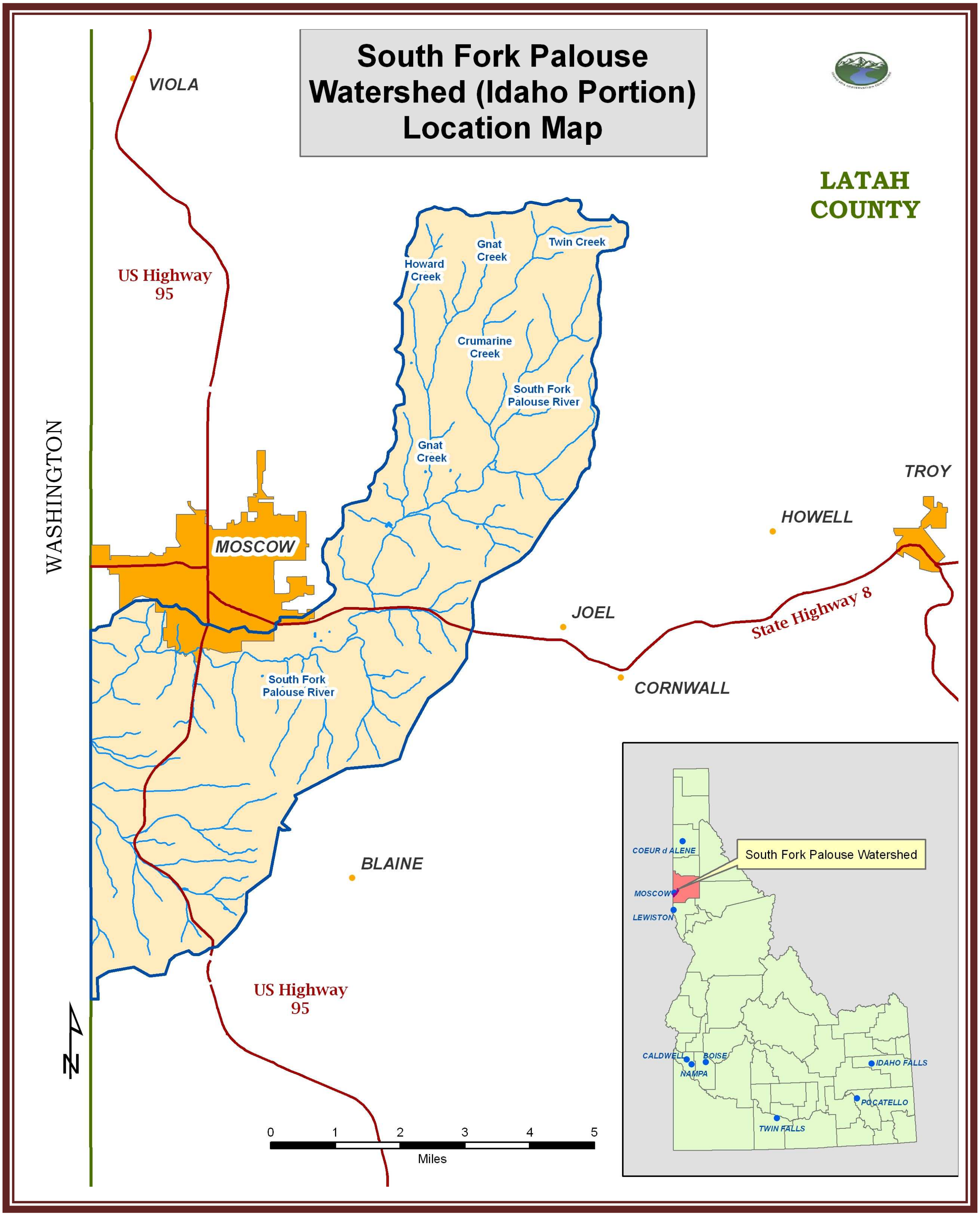

Figure 1. South Fork Palouse River Watershed (Idaho) Location Map

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

BACKGROUND

The SFPR TMDL was submitted by Idaho Department of Environmental Quality (IDEQ) and approved by the US Environmental Protection Agency (EPA) in October 2007. The only permitted point sources of pollution are the Syringa Mobile Home Park and Country Homes Mobile Park. The primary nonpoint sources (NPS) of pollutants in the SFPR Watershed are non-irrigated croplands, grazing lands, land development (construction activities), urban runoff, and roads.

The South Fork Palouse River Assessment Unit #s ID17060108CL002_03 (Gnat Creek to Idaho/Washington border), ID17060108CL003_02 (Source to Crumarine Creek) and ID17060108CL003_03 (Crumarine Creek to Gnat Creek) were listed as not meeting state water quality standards in Section 5 of Idaho’s 2002 Integrated Report. Pollutants of concern included sediment, bacteria, temperature and nutrients.

Table A. 2002 §303(d) list information for the South Fork Palouse River

Water body Assessment Unit ID	2002 §303(d) Boundaries	Listed Pollutants
ID17060108CL002_03	Gnat Cr. To ID/WA Border	Sediment, Nutrients, Temperature, Bacteria
ID17060108CL003_02	Source to Crumarine Creek	Sediment, Nutrients, Temperature, Bacteria
ID17060108CL003_03	Crumarine Creek. To Gnat Creek	Sediment, Nutrients, Temperature, Bacteria

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, 2007).

Project setting

The South Fork of the Palouse River has an interstate watershed of 31,400 acres; about 25,450 acres are located within Latah County, Idaho; the remainder is in Whitman County, Washington. Elevations range from 4,900 feet on Moscow Mountain to 2,550 feet at the state line. Figures 2 & 3 illustrate watershed topography. Approximate distance from the headwaters to the Idaho-Washington border is 14 stream miles. The SFPR originates in a forested area on the southwest slope of Moscow Mountain. Four main tributaries contribute flow to the drainage system; these are Gnat Creek, Howard Creek, Crumarine Creek and Twin Creek. These tributaries are very small in size and only flow intermittently throughout the year. Above Gnat Creek, the SFPR passes through an area of mixed coniferous forest with interspersed cropland. Below the Gnat Creek junction, the SFPR flows south through agricultural lands until it reaches the city of Moscow (IASCD, 2003).

Numerous homes and small farmsteads lie within the watershed outside Moscow, providing a suburban aspect to the drainage (IASCD, 2003). Other landuses downsteam of Robinson Park are two golf courses, an arboretum, a nursery, cemetery, two mobile home parks, and some light industrial uses. As the SFPR leaves Moscow it flows for about a mile through agricultural lands before it reaches the state line.

There are no anadromous fish in the Palouse River system. Palouse River Falls, located in Washington, blocks fish migration.

Climate

Average annual precipitation for the SFPR Watershed ranges from about 27 inches in the Moscow area to approximately 40 inches on Moscow Mountain. Nearly 40 percent of annual precipitation falls as rain and snow during November, December, and January. A seasonal snow pack generally covers elevations above 4,000 feet from December until May. Some winter precipitation is in the form of rain which thaws the frozen soil surface. This shallow thawing creates rapid runoff from the area's cropland since the soil remains frozen below the surface and prevents infiltration (IDEQ, 2007).

July and August are the driest months and the period of greatest evaporative moisture loss; precipitation, if any, usually occurs as brief thunderstorms. Summers are typically hot and dry, with daily temperatures sometimes reaching 100°F; evening temperatures can drop to 30°F. There is a considerable temperature difference based on elevation. The City of Moscow (elevation 2,660 feet) averages over 25 days per year where the temperature exceeds 90°F, while Moscow Mountain (elevation 4,700 feet) averages 3 days per year where temperatures exceed 90°F. In the summer months, the average temperatures are about 10-15°F warmer at the lower elevations than at the summit and butte locations. Hot summer temperatures are common at the middle to lower elevations and are the major factor influencing water temperatures. Air temperatures at the middle to lower elevations will exceed 90°F anywhere from 20% to 70% of the time during July and August (IDEQ, 2007).

Soils

Much of the Palouse River Subbasin consists of rolling hills of wind-blown silt deposits known as the Palouse Loess. These deposits cover most of the watershed at elevations of 3,000 feet or less. The Palouse Loess forms some of the most productive cropland soils in the United States.

Soils underlying agricultural lands belong to three major soils groups. The lower half of the watershed is dominated by very deep to moderately deep soils formed in loess; these are typically soils of the Palouse-Thatuna association. Farther upstream, deep soils formed in loess on upland hills less than 3,000 feet high are represented by the Larkin-Southwick association and the Freeman-Joel-Taney association. Transecting these deep soils are very deep valley soils formed in loess known as the Palouse-Athena association (USDA, 1978).

Forested higher elevation areas within the watershed are dominated by other soil group associations. The northern watershed boundary areas are dominated by soils formed from weathered rocks, the Vassar-Moscow-Grano association. The watershed divide south of State Highway 8 is covered with soils formed from loess and metasedimentary colluvium, the Palouse-Thatuna-Tekoa association (USDA, 1978).

Soil erosion is a major concern in the SFPR watershed. Natural landscape shaping processes have been modified and accelerated by agricultural practices. The rolling hills characteristic of the watershed are largely a result of both water and tillage erosion. North and northeast facing slopes tend to be steeper than south facing slopes; this phenomenon has been attributed to higher erosion and slump potential on northerly slopes caused by snow drift accumulation (USDA, 1981).

Drainage description

The South Fork of the Palouse River (SFPR) is characterized as a youthful to early mature stream. Stream erosion and deposition processes associated with the SFPR, in Idaho, have not adjusted to the disruption caused by basalt emplacement and associated deposition of sediments. Loess deposition during the Pleistocene further slowed that adjustment. Deposition of sediments upon near horizontal basalt flows that lapped up against the granitic uplands in the SFPR watershed led to creation of a stream channel with a very gentle gradient (<0.5%) within most of the Idaho side of the watershed that steepens (7% avg. gradient) rapidly above an elevation of 2,700 feet within the upper portion of the watershed (see Figures 2&3). The drainages relative age, geologic setting and sediment characteristics suggest that the channel is prone to meander within a larger flood plain. A continuously meandering creek located within such a system indicates a naturally high background level of fine grained sediment input to the channel system and a relatively sensitive cold water biota habitat.

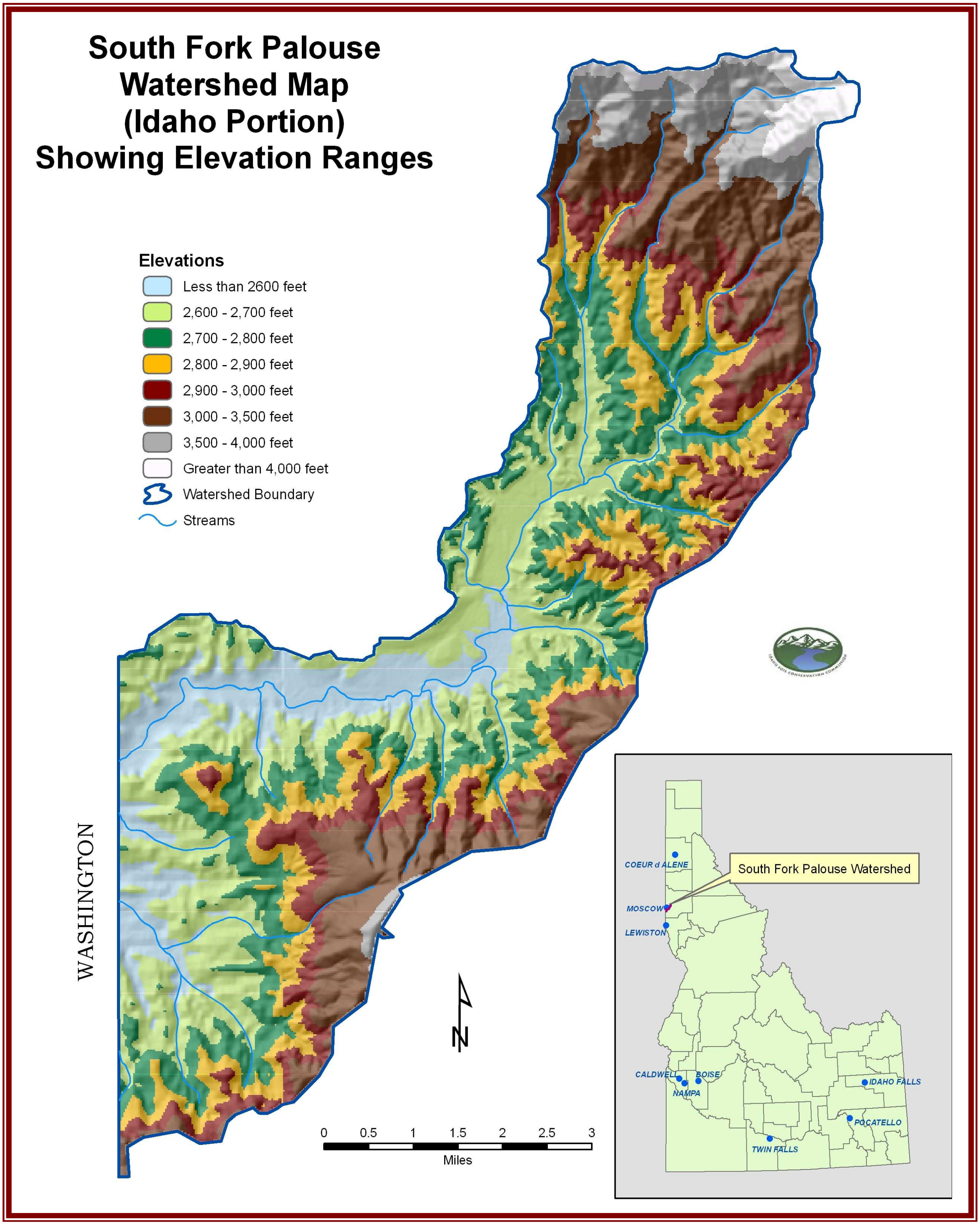

Figure 2. Elevation Map

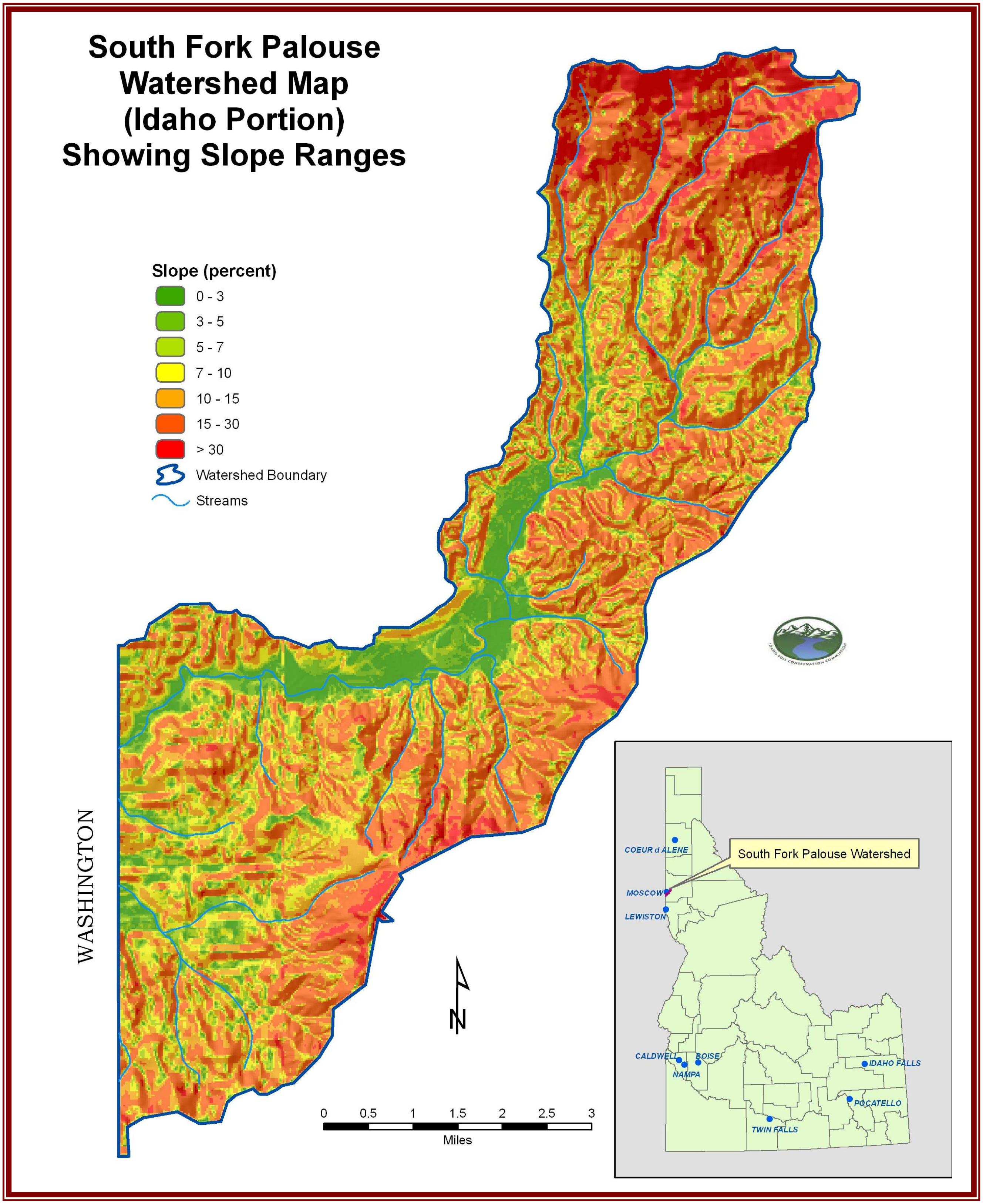

Figure 3. Slope Map

The South Fork Palouse River flows approximately 14 miles from its headwaters on Moscow Mountain to the Washington state line. From the state line the SFPR flows through Colfax to its confluence with the Palouse River. Four main tributaries contribute flow to the drainage system; these are Gnat Creek and its tributary Howard Creek, Crumarine Creek and its tributary Twin Creek. These tributaries are very small in size and only flow intermittently throughout the year. Crumarine Creek flows into the river about a half mile upstream of Robinson Park. Gnat Creek flows into the South Fork about three quarters of a mile downstream of Robinson Park (IDEQ, 2007).

The South Fork Palouse River exhibits low flows during the late summer and early fall months and high flows during spring runoff that taper off during early summer months. By mid-July, stream flows are generally less than 1 cfs above the city of Moscow. The peak discharge typically occcurs in late February, March or April. A peak discharge of 1,000 cubic feet per second was recorded at the gage site in Colfax in February 1996: a minimum flow of 0.09 cubic feet per second was recorded on September 24, 1973 (IDEQ, 2007).

Wetland conditions are deteriorated due to past and present management activities. Most of the historic wetlands and flood plains along the South Fork Palouse River have been eliminated by land use changes. The changes likely have caused higher peak flows over a shorter time period, with resulting increased flood frequency and higher channel erosion rates (IDEQ, 2007).

Land Use

Primary land uses (Table B) in the watershed consist of dryland agriculture, light commercial industries, the University of Idaho and the city of Moscow urban area. Other landuses are timber production, livestock grazing, suburban/rural residences, and roads. Sewage lagoon facilities are located at two mobile home parks along the SFPR upstream of Moscow. Recreational open space, including public parks, golf courses and an arboretum occur adjacent to the SFPR; hiking trails are scattered throughout the watershed. Landuse distribution is illustrated in Figure 4.

The roads network within the watershed totals 130 miles. US Highway 95 cuts across the lower watershed from south to north. State Highway 8 bisects the watershed from west to east. The forest road network totals about 50 miles; the urban area has more than 12 miles of road. Roads that cross agricultural lands of the watershed represent half the total road surface.

Outside of the city of Moscow, the SFPR 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 is conducted throughout the watershed; irrigation is uncommon, if it exists at all. Some land is used as pasture for grazing animals; minor hay production may occur as well. Numerous tracts of highly erodible croplands have been removed from production through the USDA Conservation Reserve Program (CRP).

Table B. Land Uses in the South Fork Palouse River Watershed

Land Use Category	Acres	% of Subbasin
Cropland	12,900	51%
CRP	2,700	10%
Pasture	620	2.5%
Shrubland/Grassland	1,900	7.5%
Forest	5,640	22%
Urban	442	2%
Public Open Space	430	1.7%
Rural Residence/Farmstead	360	1.4%
Light Industrial	60	0.2%
Roads	130 miles/400 acres	1.6%
TOTAL:	25,450	100%

Land Ownership (Management)

Outside the municipal area of Moscow, several University of Idaho tracts, the network of county roads and US Highway 95, the watershed is almost entirely privately owned. The city of Moscow is the only incorporated municipality in the watershed and is currently home to over 21,000 residents; less than 10% of the urban population resides within the SFPR watershed. Rural residences are scattered throughout the area. Fewer than 20 farm operators control the bulk of the watershed's cropland. Bennett Lumber Products owns a large portion of watershed forest lands; remaining timbered acreage is owned by private non-industrial land owners.

Agricultural Conservation Efforts

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

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

Conventional tillage, which involves inverting much of the soil surface during multiple field passes, has been traditionally practiced on cropland in the watershed. Mulch tillage uses equipment that disturbs the full soil surface but does not invert the soil or bury excessive amounts of crop residue (Mahler, et.al, 2003). Mulch till, which usually includes only one or two tillage passes, manages the amount, orientation and distribution of plant residue on the soil surface year round. No-till farming is gradually becoming utilized in the watershed. No-till farming includes using specialized equipment to place the fertilizer and seed directly into the previous year's crop residue without performing prior tillage operations. At least in one leg of the rotation, it is common to see no-till

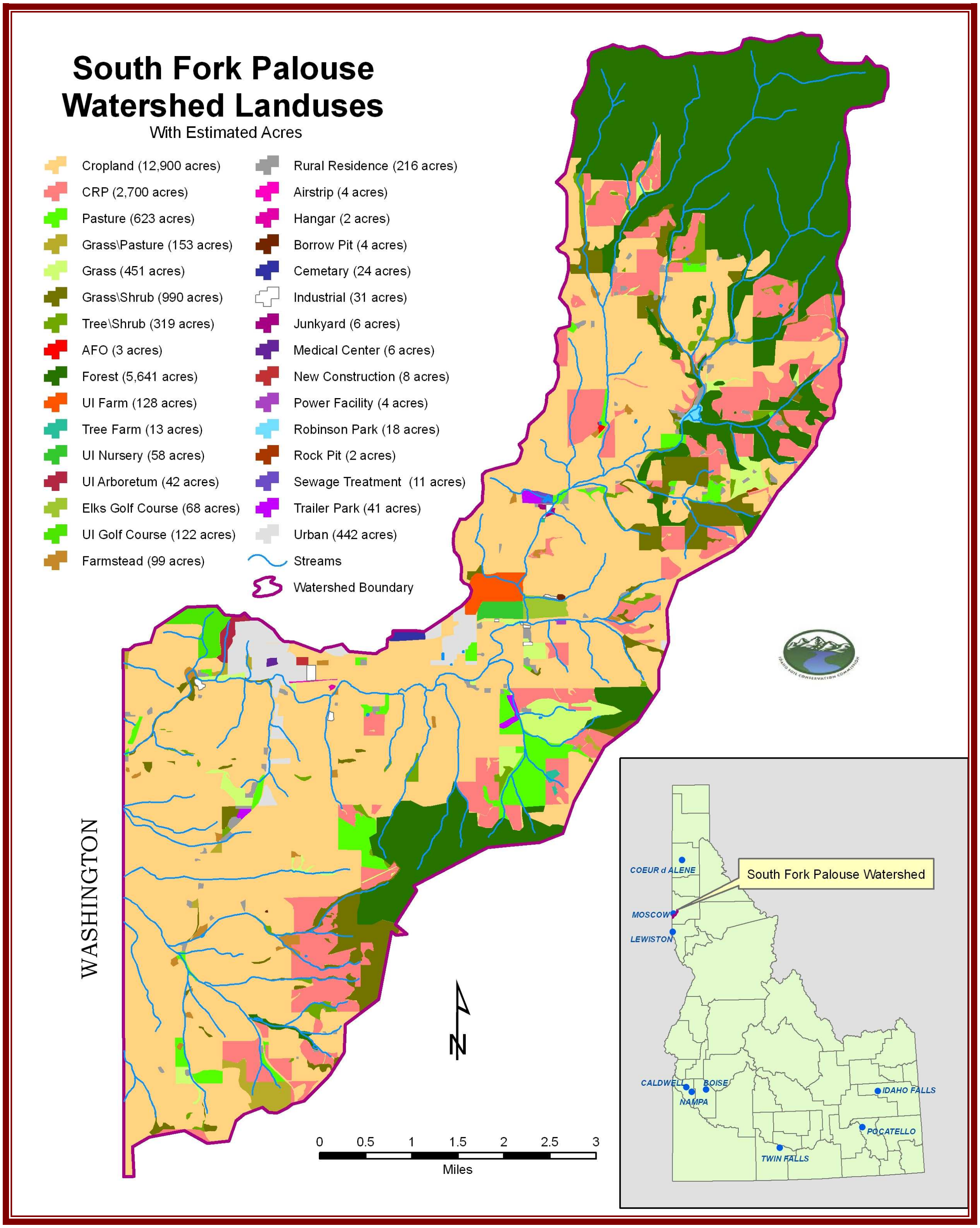

Figure 4. Land Uses

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). It is becoming more common for a no-till seeding operation to follow the low residue crop (lentils or peas). Minimum tillage operations, designed to minimize ground disturbance and maximize surface residue cover, are used throughout the watershed.

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

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

FSA and NRCS administer and implement the federal Conservation Reserve Program (CRP) and Continuous Conservation Reserve Program (CCRP).

Agricultural lands with a previous cropping history are enrolled into CRP to remove highly erodable land from production. The land is converted into herbaceous or woody vegetation to reduce soil and water erosion. CRP contracts are for a minimum of 10 years. Practices that occur under CRP include planting vegetative cover, such as introduced or native grasses, wildlife cover plantings, conifers, filter strips, grassed waterways, riparian forest buffers, and field windbreaks (Gilmore, 2004). Within the South Fork Palouse River Watershed, approximately 2,700 acres, or 10% of the watershed, has been removed from production and placed into permanent vegetative cover under the Conservation Reserve Program (CRP).

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

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

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

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

Due to the efforts of landowner/operators within the watershed, with the assistance of the Latah SWCD and state/federal programs, conservation tillage is currently practiced on more than 90% of watershed cropland. Conversion from conventional tillage to mulch tillage and direct seeding has been ongoing in the South Fork Palouse River Watershed; a significant transition has occurred since IASCD's 2002 water quality monitoring effort upon which the South Fork Palouse River Watershed TMDL is based.

The Latah SWCD, with the assistance of ISCC, is currently preparing a CWA §319 grant proposal through IDEQ, on behalf of the SFPR Watershed Advisory Group (WAG), to fund the South Fork Palouse River Water Quality Improvement Project (SFPRWQIP); non-federal match will be provided by landowner SFPRWQIP participants. The project focus is implementation of structural best management practices, such as rock chutes, culvert outlets, and water and sediment control structures on agricultural lands throughout the watershed. Project sites for structural BMP installation were identified with the assistance of farm operators; estimates of implementation costs and associated pollutant reduction projections were prepared. Field inspection of installation sites and practice design will occur as soon local weather conditions allow. Current estimated annual load reduction due to structural practice implementation is 2,000 tons/yr of sediment, 62 kg/yr of phosphorus, and 10 kg/yr or nitrogen.

WATER QUALITY PROBLEMS

Beneficial uses/status

The South Fork Palouse River is an interstate waterbody flowing from Idaho into Washington. The Clean Water Act requires interstate waters meet downstream receiving water state standards when the water body crosses state lines. Idaho has designated the South Fork Palouse River for cold water aquatic life, salmonid spawning, and secondary contact recreation beneficial uses. These designated beneficial uses are considered to be comparable to the aquatic life and recreational beneficial uses designated by Washington State for the South Fork Palouse River (IDEQ, 2007).

Beneficial Use Reconnaissance Program (BURP) data was collected from two sites (Figure 5) in the South Fork Palouse River watershed in 1996 and at one site in 2002; additional data was collected from Crumarine Creek in 2005. Analysis of the 1996 BURP data concluded that downstream of site SF-2, the stream was not fully supporting cold water aquatic life beneficial uses. Macroinvertebrate populations found, poor habitat conditions observed, and violations of the numeric temperature standards resulted in the determination. The 2005 BURP survey of Crumarine Creek verified salmonid spawning as an existing use for Assessment Unit ID17060108CL003_02. Salmonids were not found in the lower segment, CL002_03. Fish observed during the sampling efforts include rainbow trout, brook trout, brown trout, longnose dace, speckled dace, redside shiner, bridgelip sucker, and largescale sucker (IDEQ, 2007).

Table C. 2002 §303(d) listing information for South Fork Palouse River

Assessment Unit ID17060108	2002 §303(d) Boundaries	Designated Uses	Pollutants
CL002_03 CL003_02 CL003_03	Gnat Creek To ID/WA Border Source to Crumarine Creek Crumarine Creek To Gnat Creek	Cold Water Aquatic Life Secondary Contact Recreation Salmonid Spawning	Sediment, Nutrients, Temperature, Bacteria

From the South Fork Palouse River TMDL document (IDEQ, 2007):

> "The South Fork Palouse River Watershed Advisory Group has voiced concern with the accuracy of the Salmonid Spawning designated beneficial use in the water body assessment unit ID 17060108CL002_03, and felt the procedures required to develop and gain federal approval of a Use Attainability Analysis to change the lower assessment unit should not delay the development of TMDLs for the South Fork Palouse River.
>
> Based on the advice provided by the South Fork Palouse River Watershed Advisory Group, TMDLs in assessment unit CL002_03 will be written to reflect a Cold Water Aquatic Life beneficial use. Whether the beneficial use in the lower assessment unit is referenced as Salmonid Spawning or Cold Water Aquatic Life

> is a minimal concern for water quality protection since the same criteria, TMDLs, and TMDL targets will be applied."

The SFPR TMDL was developed to foster water quality appropriate to the protection and maintenance of the designated beneficial use of cold water aquatic life. Pollutants that most often affect this beneficial use include nutrients (that can result in aquatic plant growth and low dissolved oxygen), increased sediment loading, and temperature/heat loading (IDEQ, 2007).

Pollutants

The South Fork Palouse River has sediment, temperature, nutrients, and bacteria listed as possible pollutants. Potential sources of sediment, excluding natural watershed background, include urban and industrial runoff, in-stream erosion, roads, agriculture, logging, mining, and grazing activities. The source for temperature is solar radiation, i.e., the sun. Possible sources for nutrients include natural background, fertilizers, grazing sources, septic systems, and storm runoff. Potential sources of bacteria include grazing activities, septic systems, wildlife, and humans (IDEQ, 2005). These sources of pollutants will be discussed in more detail in the following section. Although habitat alteration is not a pollutant requiring a TMDL load allocation, improvements to water quality resulting from nutrient, temperature and sediment load reductions will improve habitat conditions within the watershed.

Point Sources

Point sources in the watershed include the Syringa and the Country Homes mobile home parks. Both facilities operate waste treatment systems which include a storage lagoon which discharges for a limited period during high stream flows. Both operations have applied to the USEPA for National Pollution Discharge Elimination Sytem (NPDES) permits.

Nonpoint Sources

Nonpoint sources of pollutants within the South Fork Palouse River watershed include all common landuse practices: agriculture, urban uses, industrial uses, timber harvest, mining, grazing, recreation, road maintenance and construction activities, and residential drain fields.

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

Sediment

Nonpoint sources of sediment in the SFPR watershed include urban and industrial runoff, forest management practices, agricultural activities, grazing, landslides, instream erosion, fires, and air deposition. The precise amount of pollutant contribution from each of these nonpoint sources to the subbasin is unknown, as it is nearly impossible to determine the exact amount from each source. Sediment concentrations found during the 2001-2002 monitoring season from February through April warrant sediment load reductions during the peak flow period. Controlling sediment loads will also assist in managing nutrient loads in the South Fork Palouse River since nutrients, particularly phosphorous, bind to soil particles delivered to the stream (IDEQ, 2007).

Natural sediment erosion within the rolling hills of the Palouse country is considered to be extensive because of loess soil properties and the characteristic watershed topography. Annual natural background soil erosion rates have been estimated to be approximately 60 to 80 tons per square mile (IDEQ, 2005). Most sediment transport occurs during the spring runoff period or other major precipitation events as water delivers sediment eroded from upland areas into the drainage network. Loss of wetlands and flood plains, in addition to unvegetated and/or straightened stream channels, result in amplified peak stream flows that drive channel and bank erosion processes.

Nutrients

The South Fork Palouse River is §303(d) listed for nutrients. Nutrients are delivered predominantly from agriculture, grazing activities, residential sources and natural sources. Monitoring data indicates that phosphorus is the limiting nutrient for aquatic plant growth within the watershed. The Idaho general surface water quality standard states: “Surface waters must be free of excess nutrients that cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses.” A numeric standard for dissolved oxygen (DO) of 6.0 mg/L applies as well. A total phosphorous TMDL was developed to control aquatic vegetation growth when dissolved oxygen concentrations fall below the water quality criterion. A growing season (May-October) nutrient concentration of 0.1mg/L or less and DO levels above 6.0 mg/L were established as targets in the TMDL (IDEQ, 2007).

Bacteria

The South Fork Palouse River is §303(d) listed for bacteria. Sources of bacteria include livestock, wildlife, humans, pets or septic system drain fields. Monitoring conducted in June-July of 2006 indicates that the development of a bacteria TMDL is needed to comply with Idaho water quality standards. Samples collected and analyzed for *E. coli* bacteria were in violation of Idaho’s secondary contact recreational standard (IDEQ, 2007).

Temperature (Heat Sources)

The South Fork Palouse River 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. Additional heat absorbed by a waterbody, 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, 2005).

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

Instantaneous temperature data collected during the 2001-2002 monitoring season showed violations of the 22°C maximum for cold water aquatic life. Continuous temperature data collected at site SF-4 showed violations of both the salmonid spawning criteria and cold water aquatic life criteria. Data indicated a temperature TMDL was needed (IDEQ, 2007).

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 (IDEQ, 2005).

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, 2005).

Water quality standards for the State of Idaho are intended to provide protection of designated beneficial uses. TMDL targets are based on these water quality standards. Numeric water quality criteria are used where they exist. Narrative water quality criteria have numerical interpretations that are applied to the SFPR 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 SFPR load capacity (IDEQ, 2005).

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

The TMDL assigns *E. coli* bacteria and temperature load allocations throughout the watershed. Sediment and nutrient TMDLs have been assigned to assessment units CL003_03 and CL002_03 to reflect cumulative loads. Assessment Unit CL003_03 (South Fork Palouse River, source to Gnat Creek) is represented by SF-2. Assessment Unit CL002_03 (Gnat Creek to WA state line) is represented by SF-4. Load reductions and load allocations are assigned at monitoring stations SF-2 and SF-4 to represent the load reductions and allocations corresponding to assessment units CL003_03 and CL002_03 (IDEQ, 2007).

E. coli TMDL

During the 2001-2002 monitoring season, seven samples measured for *E. coli* bacteria were above Idaho's instantaneous water quality criterion of 576 colony forming units per 100 milliliters of solution (cfu/100 ml): three at site SF-1, two at site SF-2, one at site SF-3, and one at site SF-4.

Additional monitoring was conducted between mid-June and early July, in 2006, at two monitoring sites (SF-2 and SF-4) and at a site (Mill Road Bridge) between SF-2 and SF-3 to augment the data set. The purpose was to assess compliance with Idaho's 126 cfu/100 ml geometric mean criterion. Analysis of the results showed *E. coli* bacteria in the South Fork Palouse River were above Idaho's geometric mean criterion (IDEQ, 2007).

Consequently, an *E. coli* bacteria TMDL was developed and allocated a daily concentration equal to the state standard to all sources contributing *E. coli* bacteria to the South Fork Palouse River. It was determined that all contributing sources should be reduced by 25%-41% (Table D).

Table D. Bacteria (*E. coli*) allocations for the South Fork Palouse River (IDEQ, 2007)

Location (Control Point)	Existing Load (cfu/100ml)	Daily Wasteload and Load Allocation (cfu/100ml)	Load Reduction
SF-2 (Source to Robinson Park)	169	126	25%
Mill Bridge (Robinson Park to Mill Bridge)	213	126	41%
SF-4 (Mill Bridge to ID/WA State Line)	215	126	41%

Nutrient TMDL

Nutrient TMDLs were assigned to assessment units CL003_03, and CL002_03 to reflect cumulative loads. Assessment Unit CL003_03 (South Fork Palouse River, source to Gnat Creek) is represented by SF-2. Assessment Unit CL002_03 (Gnat Creek to WA state line) is represented by SF-4. 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).

Violations of Idaho's 6.0 mg/L dissolved oxygen criterion have been observed in the South Fork Palouse River. The low dissolved oxygen measurements observed are most likely affected by aquatic vegetative growth cycles during the late summer low flow period. The critical time period for nutrients in the South Fork Palouse River coincides with these violations of the dissolved oxygen standard (mid May through October).

Monitoring data (IASCD, 2003) indicated that total phosphorous is the limiting nutrient for aquatic plant growth in the watershed. Since phosphorus is also considered to be more cost-effective to manage than nitrogen, total phosphorous was the primary nutrient of concern in the TMDL. The nutrient load capacities and existing loads established by the TMDL were estimated, by stream assessment unit, in kilograms (kg) per day (Table E). The nutrient TMDLs only apply during the growing season, May until October, of each year (IDEQ, 2007).

National Pollutant Discharge Elimination System permits for Syringa Mobile Home Park and Country Homes Mobile Park will be developed based on seasonal existing loads and for the periods (usually February-April) when the operations discharge to the South Fork Palouse River. No load or wasteload reductions are required during these periods because discharges during these times occur prior to the critical time period for nutrients in the South Fork Palouse River (IDEQ, 2007).

Table E. Total Phosphorus Load Allocations (From IDEQ, 2007)

Location	Existing Load	Target Load Capacity	Load Reduction (after 10% margin of safety removed)
SF-2	0.46 kg/day	0.27 kg/day	48%
SF-4	1.1 kg/day	0.62 kg/day	49%

Sediment TMDL

Sediment criteria found in Idaho Water Quality Standards (IDAPA 58.01.02) is a narrative standard that states sediment shall be limited to a quantity that does not impair beneficial uses. Guidance developed by IDEQ for application of the narrative sediment criteria indicates that a sediment target should incorporate both concentration and duration of exposure to allow for episodic spikes that can occur naturally with spring runoff or heavy precipitation events. Based on the information contained in the guidance, a 25 milligram per liter (mg/L) TSS target averaged over a 30-day period, not to exceed 50 mg/L daily, was used to develop the sediment TMDL for the upper assessment units. A 50 mg/L TSS target averaged over a 30-day period, not exceed 80 mg/L daily, has been used to develop the sediment TMDL for the lower assessment unit. This target is designed to maintain a moderate level of protection for salmonid rearing populations in the South Fork Palouse River drainages (IDEQ, 2007).

The targets attempt to provide a higher level of protection for the upper assessment unit to reflect different habitat conditions within the watershed. The weathered granite in the upper portion of the watershed provides an important source for stream bed gravels which are lacking in the lower watershed. The critical time period for TSS in the South Fork Palouse River occurs in February, March and April when TSS concentrations are elevated due to seasonal snowmelt and spring runoff (IDEQ, 2007).

Daily and monthly TSS allocations, using 2001-2002 monitoring data, are shown in Tables F thru I *for those time periods where load reductions are indicated**.***

Table F. Daily TSS load reduction information for site SF-2 (IDEQ, 2007)

Date	Daily Flow (cfs)	TSS (mg/l)	Existing Load (lbs/day)	Load Allocation (lbs/day)	Load Reduction Needed
2/26/2002	19.7	48	5,091	4,772	6%
3/12/2002	39.9	330	70,988	9,680	86%
3/25/2002	35.2	60	11,397	8,458	25%
4/8/2002	21.5	55	6,362	5,206	18%

Table G. Daily TSS load reduction information for site SF-4 (IDEQ, 2007)

Date	Daily Flow (cfs)	TSS (mg/l)	Existing Load (lbs/day)	Load Allocation (lbs/day)	Load Reduction Needed
3/12/2002	99.1	560	299,154	38,463	87%
3/25/2002	89.2	100	48,100	34,632	28%

Table H. Monthly TSS load reduction information for site SF-2 (IDEQ, 2007)

Month	Flow (cfs)	TSS (mg/l)	Existing Load (lbs/month)	Load Allocation (lbs/month)	Load Reduction Needed
February	13.3	28	59,113	48,365	18%
March	37.6	195	1,184,836	136,712	88%
April	17.2	48	133,421	62,541	53%
June	3.4	26	13,877	12,244	12%

Table I. Monthly TSS load reduction information for site SF-4 (IDEQ, 2007)

Month	Flow (cfs)	TSS (mg/l)	Existing Load (lbs/month)	Load Allocation (lbs/month)	Load Reduction Needed
March	94	330	5,025,272	685,264	86%

Temperature TMDL

Streamside vegetation and channel morphology are factors influencing shade which can be most readily corrected and addressed by a TMDL, since they are the factors influenced by anthropogenic activities. 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 (IDEQ, 2007).

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 are therefore stream reach specific and are dependent upon the target load for a given reach. The potential shade and load capacity of the stream that is necessary to achieve background conditions are listed in Tables 24 and 25 or the SFPR TMDL document (IDEQ, 2007). The potential shade has been converted to a summer load by multiplying the inverse fraction (1-the shade fraction) by the average loading to a flat plate collector for the months of April through September. Table J shows the excess heat load (kWh/day) experienced by each water body examined and the percent reduction necessary to bring that water body back to target load levels. Figure 6 illustrates the desired riparian shade for each stream segment to achieve the recommended load reductions.

Table J . Excess Solar Loads and Percent Reductions for the South Fork Palouse River Watershed (IDEQ, 2007).

Waterbody	Excess Load (kWh/day)	Percent Reduction
Crumarine Creek	-3,818	31%
South Fork Palouse River	-143,391	38%

Water Quality Monitoring

The Idaho Association of Soil Conservation Districts (IASCD) collected water quality data from several tributaries to the Palouse River from November 2001 through November 2002. This monitoring project provided background data for the South Fork Palouse River to aid in TMDL development (IASCD, 2003).

Analyses performed on collected water samples were: total phosphorus (TP), nitrate and nitrite (NO_2/NO_3), ammonia (NH_4), total suspended solids (TSS), and fecal and total coliform counts. Other parameters collected in the field included flow, pH, specific conductivity, dissolved oxygen (DO), and air and water temperatures. Instantaneous sampling occurred approximately every two weeks at four sites throughout the watershed. Additional data was collected by Idaho Department of Environmental Quality (IDEQ) personnel as needed. The four sites are identified as SF-1, SF-2, SF-3, and SF-4 progressing from the upper watershed to the Washington state line (IDEQ, 2007). The site locations are illustrated in Figure 5.

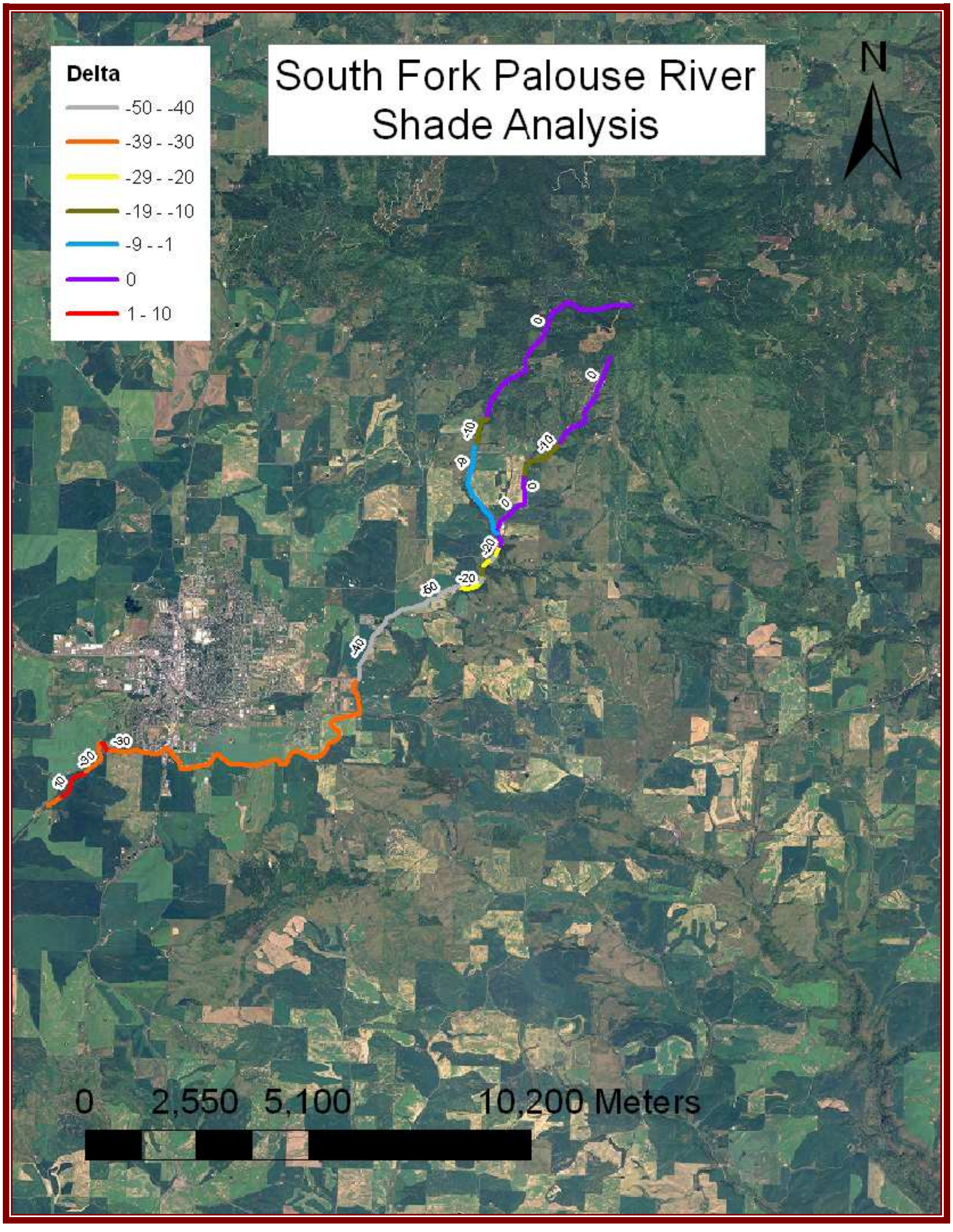

Figure 6. Percent Change in Riparian Shade Needed to Meet the Required Load Reductions (figure from SFPR TMDL document (IDEQ, 2007)).

Table K. Monitoring Sites for the South Fork Palouse River (IASCD, 2003)

SITE ID	SITE NAME	LOCATION
SF-1	SOUTH FORK PALOUSE RIVER (UPPER)	
SF-2	SOUTH FORK PALOUSE RIVER (ROBINSON PARK)	
SF-3	SOUTH FORK PALOUSE RIVER (MIDDLE)	
SF-4	SOUTH FORK PALOUSE RIVER (LOWEST)	

Sample collection began in November of 2001 and continued for a full calendar year, with IASCD, Latah SWCD, and IDEQ staff sampling the sites every two weeks. Sites were not always sampled; in the winter and spring, snow and large runoff events made accessibility impractical, and in the summer some sites were dry (IDEQ, 2007).

Instantaneous flow measurements indicate the South Fork Palouse River sustains perennial flow below monitoring site SF-2 (Robinson Park) to the Washington state line. At the uppermost site (SF-1), streamflow is intermittent.

Site SF-2 dropped below the 6.0 mg/L DO criteria once during the sampling period. Site SF-4 fell below the criteria eight times during the sampling period. It should be noted that when site SF-2 was in violation of the 6.0 mg/L standard, flow was only 0.3 cubic feet per second (cfs); site SF-4 was impounded by a pool. Low flow or stagnant conditions often cause oxygen sags to occur (IASCD, 2003).

The EPA Gold Book recommended criterion of 0.1 mg/L for total phosphorus (TP) during the critical (May through October) period was exceeded several times at all monitoring sites. Natural background was the target proposed by EPA Region 10 for total phosphorus in Paradise Creek TMDL. Based on data collected by the Washington Water Research Center (Schnabel and Wilson, 1996) at the Idler's Rest Nature Conservancy monitoring site, natural background total phosphorus levels average approximately 0.136 mg/l. Observations at this upper watershed site indicate that even at these relatively elevated phosphorus levels, nuisance algae problems do not exist (DEQ, 1997). It would be reasonable to assume, that since the Paradise Creek is a tributary to the South Fork of the Palouse River, background TP values exceeding EPA Gold Book recommended criteria could be expected in sister tributaries.

Although two exceedances of the TP criteria were observed at flows well below 1 cfs, correlation to the state's narrative standard could not be conclusively established at SF-1 because no corresponding DO violations occurred. In addition, flow of this stream segment was intermittent so the TP criteria does not apply.

Site SF-2 at Robinson Park, showed more (10) TP exceedances than the other three monitoring sites combined total. SF-2 was located immediately below the park area created from a previously existing lake impoundment that had completely filled with trapped sediment. The SFPR dissects this nutrient-enriched sediment deposit; elevated TP values should be expected. Despite the numerous TP exceedances, only one DO criteria violation was noted; flow at sample collection time was only 0.3 cfs; lack of flow was as likely as the slight TP criteria exceedance (0.15 mg/l) to be responsible for the oxygen sag.

Although site SF-3 showed three TP criteria exceedances, all TP values were below the 0.136 mg/l natural background value accepted by EPA for the Paradise Creek TMDL. No DO violations were noted; the narrative nutrient standard correlation was not established.

Site SF-4 showed four TP criteria exceedances, but eight DO violations. Only one of the DO violations corresponds with a TP criteria exceedance. Low DO values observed do not correlate with TP exceedances or with low flows. The monitoring site became a large, stagnant pool during the period that low DO values were recorded; site selection was not optimal and the circumstances that produced DO sags are a mystery (Clark, 2009).

A large episodic spike in water column TSS concentrations was observed on March 12, 2002 at sites SF-2, SF-3, and SF-4 relative to other TSS values obtained throughout the monitoring year. Late winter snowmelt runoff led to the spike of TSS concentrations recorded (IDEQ, 2007). Based on visual assessments, TSS rates and turbidity levels, the South Fork Palouse River appears to have a high rate of bank erosion. Cropland is sometimes tilled to the bank's edge; horses have direct access to the channel at several locations (IASCD, 2003).

During the 2001-2002 monitoring season, 7 samples analyzed for *E. coli* bacteria exceeded the 576 cfu/100 ml criterion: three from site SF-1, two at site SF-2, one at site SF-3, and one at site SF-4. Additional monitoring was conducted between mid-June and early July 2006 at two monitoring sites (SF-2 and SF-4) and at a site to augment the data set between SF-2 and SF-3 (Mill Road Bridge) to assess compliance with Idaho's 126 cfu/100 ml geometric mean criterion. Samples collected and analyzed for *E. coli* bacteria at the three sites exceeded Idaho's geometric mean criterion (IDEQ, 2007).

Data suggests that stream temperatures can naturally exceed criteria in the South Fork Palouse River during the summer months (IDEQ, 2007). Continuous temperature data collected at SF-4 showed several exceedances of the cold water biota temperature criteria (19°C daily average) from mid-June thru July. The instantaneous temperature criteria (22°C) was exceeded once, on 7/16/2002, at both SF-3 and SF-4 (IASCD, 2003).

Beneficial Use Reconnaissance Program (BURP) data was collected from two sites in the South Fork Palouse River watershed in 1996 and at one site in 2002. An additional site at Crumarine Creek was sampled in 2005. Fish observed during the sampling efforts include rainbow trout, brook trout, brown trout, longnose dace, speckled dace, redside shiner, bridgelip sucker, and largescale sucker. Based on the macroinvertebrate population and poor habitat conditions found, in addition to exceedance of the numeric temperature standards, the sites located downstream of SF-2 were determined to be not fully supporting cold water aquatic life beneficial uses. Salmonid spawning was verified as an existing beneficial use in segment CL003_02 due to three age classes of salmonids collected during the 2005 BURP survey of Crumarine Creek (IDEQ, 2007).

Additional monitoring, conducted on a regular schedule, would be useful to determine long term trends and annual fluctuations in pollutant loads. Calendar-based sample collection typically misses some, if not all, episodic pollutant loading events that occur. Monitoring episodic events may provide useful information in adjusting the pollutant load estimates derived from the existing data set (IDEQ, 2007).

Agricultural Water Quality Inventory and Evaluation

Approximately half the Idaho portion of the SFPR watershed, 12,900 acres, is cropland. An additional 2,700 acres are enrolled in the Conservation Reserve Program (CRP). More than 1,200 acres of pasture or grass lands were observed; some minor hay production may occur. About 1,300 acres of other open or shrub-covered lands are present. Forest lands comprise about 5,600 acres. Remaining lands are urban areas, rural residences that include two mobile home parks, University of Idaho parcels, county and municipal parks, and light commercial/industrial properties.

Cropland

Croplands occur within the Major Land Use Area B-9, the Palouse and Nez Perce Prairies. The soils are generally deep loess soils, and often considered highly erodible when they occur on slopes greater than 3%. In general, the cropland has been under production for decades, often since the late 19^{th} century (~1870).

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 (Knecht, 2008). It is estimated that 2,700 acres, or more than 10% of the Idaho watershed are contracted under the Conservation Reserve Program (CRP).

Pasture/grass/shrubland

Pasture or grass lands within the South Fork Palouse River Watershed totals about 1,300 acres. Some hay is cut on these lands, but most is pastureland for grazing horses, sheep or cattle; most fields are 20 acres or less in size. Many of the pastures are located south of State Highway 8, on the southern flank of Paradise Ridge. Several other pasture areas are scattered throughout the watershed, primarily in lowland areas adjacent to the perennial and intermittent drainages. Approximately 35 horses, 34 sheep, 13 cattle and 4 bison were observed during a drive through the watershed in February of 2009. There may be a small winter feeding operation site along the SFPR drainage a short distance below Robinson Park.

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 are distributed randomly throughout the watershed in small plots. Most are located on steep slopes inaccessible to farming operations; they are often comprised of remnant islands of grass and shrub mixtures with occasional pine or cottonwood that separate cultivated fields. These isolated patches offer zones of stable vegetation that intercept overland flow from cropped fields and filter sediment from upslope farming operations. They also act as small refuges, containing food and cover for wildlife.

Additional areas with mixed shrub and grass cover are scattered throughout the watershed; these areas may experience light grazing from livestock as well as 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. Approximately 90% of the fields have good vegetative cover; the erosion potential is slight if that good vegetative cover is maintained.

<u>Riparian areas</u>

Erosion is occurring along most streambanks adjacent to cropland and pastureland fields because of the lack of woody vegetation and rhizomatus herbaceous species. Livestock activity often promotes streambank deterioration, as well as the removal of vegetation. This lack of root mass allows for bank sloughing which contributes significant amounts of sediment into SFPR drainages. Many portions of the stream have been channelized or 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. While there are some remnant areas; much of the historically diverse and multi-layered vegetation along the stream is missing.

Water Quality Concerns Related to Agricultural Land Use

Agricultural activities within the SFPR watershed contribute to pollutant problems identified in the TMDL. Phosphorus and sediment contributions are associated with sheet and rill, concentrated flow, and streambank soil erosion processes. High stream temperatures are a function of both an inadequate/absent vegetative canopy as well as low flows. Bacteria violations are generally a symptom of livestock access to riparian areas; livestock presence was noted at, or adjacent to, water quality monitoring sites. In addition to livestock sources of bacteria contamination, possible contamination from wildlife and faulty septic systems should not be overlooked (IASCD, 2003).

Although several exceedances of the total phosphorus (TP) criteria were observed, correlation to the state's narrative standard could not be conclusively established at any monitoring site. All of the corresponding DO violations could also be correlated to extremely low stream flows. In addition, most reported DO violations occurred when TP concentrations recorded **did not** exceed the recommended criteria.

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 phosphorus enters the system from forested areas, from roads and rural landscapes, and from groundwater.

The occasionally high stream temperatures recorded are a function of both an inadequate vegetative canopy and low flows along some stream reaches. If addressing temperature concerns becomes necessary, the most effective management practices will be the ones that increase base flow during the summer in addition to those that emphasize shading.

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

Threatened And Endangered Species

No bull trout or anadromous salmonids occur within the South Fork Palouse River drainage. Wolf sightings within the watershed have been recently reported. Lynx have been sighted in other areas of the Palouse Subbasin. Spalding's silene, a threatened plant, has potential to occur.

IMPLEMENTATION PRIORITY

The TMDL implementation planning process includes assessing impacts to water quality from agricultural lands and recommending priorities for installing BMPs to meet water quality objectives stated in the TMDL document (IDEQ, 2007). 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 South Fork Palouse River watershed is mostly (51%) cropland, more than 10% CRP, with about 5% of the watershed comprised of other agricultural lands. Minor pastureland or other grazed lands occur as small scattered patches of ground, largely south of State Highway 8. Some hay production may occur in areas that are also utilized for grazing, but none were noted. Approximately 13 cattle, 35 horses, and 34 sheep were observed in the watershed, in February of the current year (Dansart, 2009).

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 South Fork Palouse River watershed potentially include:

Cropland
- Areas generating erosion (sheet or rill)
- Areas of severe gully erosion

Riparian zones
Unstable and erosive stream banks
Pasture Lands
Other grazed lands where livestock have access to streams and riparian areas
Road Corridors

Recommended Priorities for BMP implementation

Generally, the highest priority for BMP implementation would be the adoption of conservation tillage practices to minimize cropland sheet and rill erosion and decrease sediment delivery to the SFPR drainage network. However, since the year (2002) the water quality monitoring program was completed and upon which the South Fork Palouse River TMDL document was based, most croplands have converted to conservation tillage. There is little opportunity or interest for additional cropland tillage practice conversion at the present time.

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 the SFPR during the critical flow periods identified in the TMDL. This will help ensure that TSS concentrations are reduced and that violations of the Idaho Water Quality Standard for dissolved oxygen (DO) continue to occur only during periods of extremely low flow, when waters are stagnant. Livestock should be excluded from riparian areas by fencing or removal, wherever possible, to minimize the presence of bacteria; offstream watering sites should be developed. Vegetative plantings should be implemented in riparian zones to both mitigate streambank erosion and to establish future stream canopy cover to help reduce stream temperatures.

The South Fork Palouse River drainage is a relatively small (25,000 acres) watershed. No subwatersheds are prioritized for treatment. With the exception of forest lands at the higher elevations in upper watershed areas, agricultural lands are dominant and exhibit similar types of water quality problems.

TREATMENT

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 SFPR watershed are: cropland (upland), cropland (riparian), pasture (riparian) and grass/hay/CRP lands (riparian). A fifth treatment unit (road corridors) intersects agricultural lands throughout the watershed; it falls under the authority of the South Latah County Highway District along with the responsibility for roads BMPs installation.

Cropland (Upland)

The Palouse is one of the most erosive areas in the United States. The USDA estimated that from 1939 through 1977, the average annual rate of soil erosion in the Palouse was 14 tons/acre on cultivated cropland (Ebbert and Rowe, 1998). Sediment delivery to the drainage system was likely in range of 3 to 4 tons/acre annually (USDA, 1978). 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, in the similar Paradise Creek drainage, the adjacent watershed to the west. Because SFPR farm operators, at the time of TMDL development, had adopted some conservation tillage practices on cropland, actual reductions in erosion are expected to be significantly less. Conversion to reduced tillage systems, under a scenario similar to the SFPR, was estimated to result in a 3 tons/acre drop in soil erosion in the Cow Creek drainage, the adjacent watershed to the south (Latah SWCD, 2004).

Ephemeral gully erosion

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

Water

Surface water – excessive nutrients and organics

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

Surface water – excessive suspended sediment and turbidity

Problem: Suspended sediment is a concern for downstream and onsite water quality and stream-dwelling organisms. Inversion tillage is a primary source within the watershed.
Treatment: Reduce soil erosion through implementation of a reduced tillage system. Conversion to such a system may result in a reduction of soil loss by more than 3 tons/acre on average.
Treatment: Reduce or eliminate ephemeral gully erosion (concentrated source of soil erosion) by installing water and sediment control structures.

<u>Riparian Zones</u>

Channel erosion may be the largest source of sedimentation in the SFPR 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.

In addition to sediment loading due to channel erosion, bacteria loads originating from livestock presence is a problem within the riparian zone on pastureland. 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 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

Field observations conclude that grazing activities contribute to riparian area denudation and to the overall sediment and bacteria loads within the South Fork Palouse River watershed. In addition to grazing conducted on private agricultural lands, some grazing occurs on forested lands and residential parcels throughout the drainage area.

Pasture lands (<1,000 acres) are generally adjacent to stream channels where livestock can access water. Concentrated winter feeding may occur at one or more locations along the South Fork Palouse River.

> *Problem*: Channel bank erosion due to livestock traffic contributes sediment with attached nutrients. Nutrient/bacteria enrichment from direct manure deposition or manure-laden runoff. Removal of riparian vegetation due to grazing activity.
> *Treatment*: Limit livestock access to stream by fencing and off-site water development. Develop waste storage facilities where concentrated feeding occurs. Promote channel bank stabilization and establishment of riparian vegetation to help filter pollutants and promote stream canopy restoration in previously denuded areas.

Riparian Zone Grass/Hay/CRP Lands Resource Issues

These agricultural lands generally provide continuous ground cover and therefore supply relatively little pollutant load when compared to cropland and pastureland. Although some of these lands are likely 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**:*** Limit grazing on fields to times when runoff is unlikely and exclude cattle from the riparian zone. Promote channel bank stabilization and establishment of riparian vegetation to help filter pollutants and promote stream canopy restoration in previously denuded areas.

Conservation Treatments

Best management practices (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. Table L summarizes the recommended BMPs and provides estimated implementation costs.

Agricultural resource management planning to address water quality typically involves the application of BMPs to address particular resource concerns. For the South Fork Palouse River 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 South Fork Palouse River 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.

Agronomic Practices

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.

Conservation Cropping Sequence / Conservation Tillage / Residue Management

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 SFPR watershed since the last (2002) water quality monitoring effort. Direct seeding practices undertaken on cropland in the adjacent Paradise Creek watershed reduced sediment delivery by an average of 2.3 tons/acre/year (Dansart, 2002).

EPA (2002) reported that reduced tillage systems could decrease sediment by 75%, total phosphorus by 45% and total nitrogen by 55% over conventional tillage practices. A one ton reduction in sediment can reduce orthophosphate (H_2PO_4) loads by 14,000 mg and total nitrogen loads by 4,500 mg (Gardner, 2003). Although orthophosphate data for the SFPR 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 7,000 ton reduction in sediment delivered to the SFPR would equate to a 196 kg reduction (.014 kg *2*7,000) in TP delivered to the SFPR annually. This is more than the total load reduction targeted at the compliance point (SF-4); 0.54 kg TP/daily * 360 = 194 kg/year. Since 2002, most of the SFPR watershed cropland has converted to conservation tillage, either mulch till or direct seed. *Note: An associated average of less than one ton/acre reduction (significantly less than estimated for the adjacent Paradise Creek watershed) in sediment delivery would meet the targeted reduction at the compliance point, if the entire load reduction was reflected at the state line. Exactly how sediment transport within the stream channel from the multiple delivery points to the compliance point 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 will 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 adjacent 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 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. Since there are numerous similarities (e.g., topography, climate, soil types, agronomic practices) between the Paradise Creek and South Fork Palouse River watersheds, similar results could be expected.

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). The use of strip-cropping and contour buffer strips on the steeper slopes characteristic of much of the South Fork Palouse River watershed will be encouraged.

Structural Practices

Erosion associated with concentrated flow is best addressed with structural practices. Structural practices that address concentrated flow erosion work in two ways; structures trap sediment that has been eroded by concentrated water flow, or impede the eroding action of the water (either by armoring the soil or by slowing the water down to reduce the eroding energy). When properly designed, installed, and maintained, the right combination of structural practices can virtually eliminate erosion associated with concentrated flow. The practices most applicable to the South Fork Palouse River 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 strong similarities between the Paradise Creek and the South Fork Palouse watersheds, it is anticipated each proposed structure within the SFPR watershed should reduce sediment delivery within the range mentioned.

Numerous potential locations for implementation of structural practices have been recommended by agricultural operators that are members of the South Fork Palouse River Watershed Advisory Group. With the assistance of ISCC and Latah SWCD staff, preliminary costs and anticipated pollutant reduction estimates have been prepared. Field inventory of proposed BMP sites, practice selection and engineering design of structures will commence later this month (March).

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

Riparian Buffer Strips

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

Sheet and rill erosion are the types of erosion most likely to be 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 the South Fork Palouse River. However, given the predicted size of the strips, this effect is likely to be negligible.

Analysis of USGS 24K topographic maps shows 100 miles of stream (intermittent and perennial) channels, of which more than half (65%) flows through agricultural land. A 30-foot buffer strip on each side of the creek on agricultural lands would encompass a total of 472 acres. Figure 7 outlines the potential extent of vegetative buffer strips within the South Fork Palouse River watershed.

Channel erosion is a significant source of sedimentation in the South Fork Palouse River 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 rootmass, 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

Pastureland and other grazed lands occur as small scattered patches of ground, primarily to the south of State Highway 8. Some tracts where hay production occurs may later be utilized for grazing, but none were noted. Approximately 13 cattle, 35 horses, and 34 sheep were observed in the watershed during February of the current year (Dansart, 2009). Riparian livestock impact is spotty but could be severe in areas where concentrated winter feeding occurs adjacent to creek channels.

It is likely some of the sediment and much of the bacteria contributions to the drainage system are due to the presence of a limited number of livestock in pasture areas that abut stream channels. Wildlife is another bacteria source. Bacteria originates from livestock or wildlife manure in the riparian area or from manure-laden runoff. Another possible contributor is failed septic systems that drain to the riparian area. Trampling of channel banks by livestock 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.

Riparian Area Grassland/Hayland/CRP lands BMPs

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

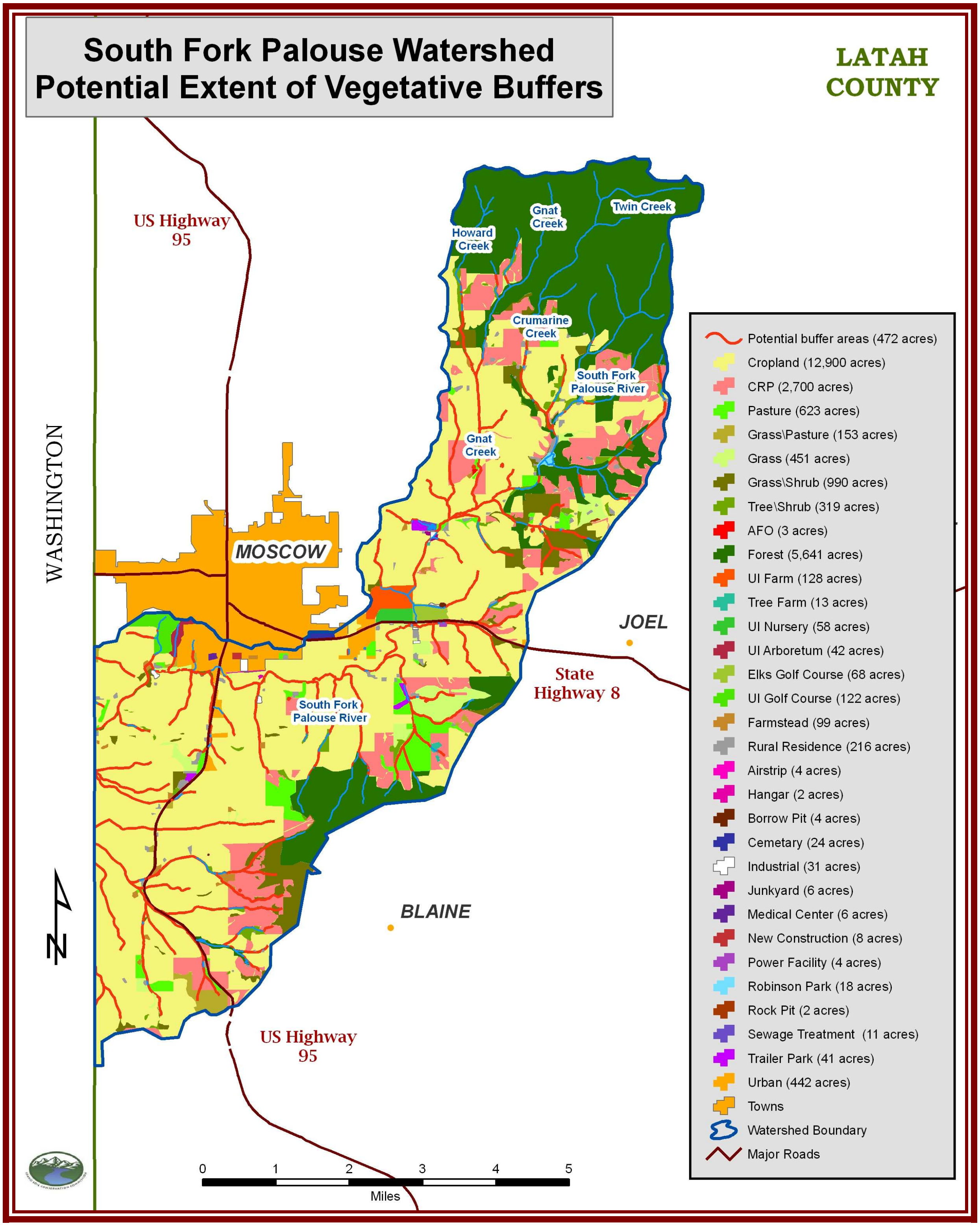

Figure 7. Agricultural Lands Vegetative Buffer Potential

recommended, particularly those that promote establishment of overhanging canopy and promote increased base flows.

Agricultural lands, approximately 2,700 acres, currently enrolled in the Conservation Reserve Program are covered with permanent stands of introduced or native grasses. Only a few hundred acres are listed with practices implemented that would specifically target temperature concerns.

Recommended BMPs and Estimated Costs

Best management practice recommendations for the South Fork Palouse River watershed, with associated cost estimates, are listed in Table L.

Table L. 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.	12,900		
Residue Mgmt. NoTill, Strip Till, Direct Seed (329)	Ac.	3,250	$292,500	$97,500
Water & Sediment Control Basin(638)	No.	60	$240,000	$7,200
Filter Strip (393)	Ac.	242	$24,200	$480
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			**$736,700**	**$ 106,980**
Future Level of Treatment for Grass/Pasture/CRP Lands Riparian				
Grass/Pasture/CRP Lands Riparian	Quantity		Costs	
Practices	Unit	Quantity	Investment Cost	Annual O&M and Mngt.Cost
Grass/Pasture/CRP Lands	Ac.	3,900		
Channel Bank Vegetation (322)	Ac.	25	$75,000	$1,500
Channel Stabilization (584)	Ft.	5,400	$108,000	$540
Diversion (362)	Ft.	1,200	$3,300	$70
Fence (382)	Ft.	52,000	$104,000	$2,080
Riparian Forest Buffer (391)	Ac.	75	$112,500	$1,130
Riparian Herbaceous Cover (390)	Ac.	75	$22,500	$230
Tree/Shrub Establishment (612)	Ac.	75	$33,800	$340
Watering Facility (614)	No.	8	$12,000	$120
Well (642)	No.	4	$32,000	$320
Total RMS Costs			**$503,100**	**$6,330**

Current BMP Status

Cropland erosion control efforts have been on-going in the South Fork Palouse River watershed for the past several years. Transition of croplands from conventional tillage to conservation tillage systems was initiated by progressive farm operators subsequent to the 2002 water quality monitoring upon which the TMDL document was based; this continued during the development of the TMDL. 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. Potential for conversion to direct seeding for cropland acres presently mulch tilled is low at the present time, due to current economic factors. The potential for the implementation of structural practices to mitigate gully erosion is currently high, if and when cost share funds become available.

The SFPR WAG recently set the control of sediment delivery from gully erosion as its highest priority. In February, WAG members that are farm operators identified sites for BMP installation on agricultural lands within the watershed. With the assistance of ISCC and Latah SWCD staff, the sites were compiled on maps and estimates of installation costs and pollutant delivery reductions developed. Currently, 33 potential structural BMP implementation sites have been identified with an estimated installation cost of $130,000 and anticipated pollutant reductions of roughly 2,200 tons/yr sediment and 62 kg/yr TP. Field examination of proposed BMP sites and engineering design will begin in late March. The information collected will be utilized by the Latah SWCD to develop a 319 grant proposal on behalf of the SFPR WAG.

The Latah SWCD will apply for a CWA §319 grant through IDEQ to fund the South Fork Palouse River Water Quality Improvement (SFPRWQIP) with non-federal matching funds provided by landowner participants and hopefully other state agencies, such as ISCC. In addition to agricultural BMPs, other project sites for BMP installation were identified by the Latah County Highway District and Bennett Lumber Products and will be included in the grant proposal. If the 319 grant is awarded, contracts and associated conservation plans will be developed with farm operator participants. There is producer interest in agricultural BMP implementation if future funding assistance becomes available.

Treatment Alternative Considerations

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 SFPR watershed contains some of the most productive cropland in Latah 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 (323 acres) with a 75% filter strip to 25% forest buffer ratio is estimated at $206,000 but would sacrifice significant prime cropland acres. Using an estimate of 80 bushels/acre for wheat and a average price of $10/bu, the conversion of the recommended acreage from cropland to buffer strips would result in a $258,000 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 SFPR 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 efforts of the South Fork Palouse River Water Quality Improvement (SFPRWQIP) or to higher priority watersheds, as monitoring results indicate.

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 South Fork Palouse River TMDL approved by EPA in October 2007 and promote comprehensive management of water quality. The TMDL document states “Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved” (IDEQ, 2007).

FUNDING

To adequately address the TMDL concerns within the South Fork Palouse River watershed a significant collaborative effort for technical and financial assistance will be required. The Latah Soil and Water Conservation District will pursue funding sources for the South Fork Palouse River Water Quality Improvement Project 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 Conservation Commission (ISCC). This program is also coordinated with the TMDL process. Source: ISCC http://www.scc.state.id.us/programs.htm

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

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

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

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

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

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

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

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

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

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

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

OUTREACH

The Latah SWCD has undertaken formal outreach efforts to inform members of the agricultural community within the SFPR watershed of the status of the South Fork Palouse River TMDL and the implementation planning process. Several agricultural landowners/operators are WAG members. The Latah SWCD is presently assisting the WAG in the development of a CWA §319 proposal to fund implementation of BMPs within the watershed. WAG members representing agriculture, with the assistance of Latah SWCD and ISCC, have proposed a suite of structural BMPs to be implemented and identified BMP implementation sites. Preliminary estimates of costs and anticipated pollutant reductions have been prepared. Field inspections to finalize site locations and to collect data for BMP design will be initiated later this month (March). Information to the agricultural community, conservation agencies and organizations, and the general public, will be relayed through public presentations, district newsletters and announcements to various agencies and local news media.

Once a variety of functional BMPs are installed, field tours will be conducted to educate operators and landowners about benefits and costs of implementing BMPs. Additionally, a portion of the conservation district newsletters and web sites will continually update local landowners on project progress and status.

MONITORING AND EVALUATION

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

Field Level

Prior to riparian area BMP implementation, Stream Visual Assessment Protocol (SVAP) and NRCS channel erosion procedures should be conducted to establish a baseline for future comparison.

At the field level, annual status reviews will be conducted to insure that 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.

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

The Latah SWCD, IASCD, and the South Fork Palouse River WAG should coordinate the development of a long-term monitoring program characterizing agricultural lands within the watershed. Additional monitoring, 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.

REFERENCES

Barker, 1981. Soil Survey of Latah County Area, Idaho. U.S. Department of Agriculture, Soil Conservation Service. Washington, D.C. 168 pp. plus maps.

Boll, J., E. Brooks, and D. Traeumer. 2002. Hydrologic and Sediment delivery analysis of Agriculturally Dominated Watersheds in the Clearwater River Basin. Report submitted by the Department of Biological and Agricultural Engineering, University of Idaho to the Idaho Soil Conservation Commission. 92 pp.

Brooks, Erin. 2008. Power Point presentation to South Fork Palouse River WAG.

Clapperton, 1999. The Benefits of Direct Seeding for Soil Ecology. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan 5-7,1999, Spokane, WA.

Clark, Ken. 2009. IASCD Water Quality Analyst. Personal communication

Clean Water Act (Federal Water Pollution Control Act), 33 U.S.C. §1251-1387. 1972.

Dansart, 2000. Idaho Water Quality Program for Agriculture, Paradise Creek Watershed Project Proposal Draft. Idaho Soil Conservation Commission. Moscow, ID.

Dansart, 2002. Paradise Creek Water and Sediment Control Structure Efficiency. Draft Report. Idaho Soil Conservation Commission. Moscow, ID.

Dansart, 2004. Palouse TMDL Watersheds Cropland Erosion. Draft ArcView/ RUSLE model results. Idaho Soil Conservation Commission. Moscow, ID.

Dansart, Bill. 2009. ISCC GIS Analyst. Personal communication

DEQ, 1997. Paradise Creek TMDL, Water Body Assessment and Total Maximum Daily Load. Idaho Dept. of Health and Welfare; Division of Environmental Quality. Lewiston Regional Office

Ebbert, James C., and Roe, R. Dennis. 1998. Soil Erosion in the Palouse River Basin: Indications of Improvement: USGS Fact Sheet FS_069-98 Retrieved from http://wa.water.usgs.gov/ccpt/pus/fs-069-98.html.

EPA, 2002. National Management Measures to Control Nonpoint Source Pollution from Agriculture. Retrieved from http://www.epa.gov/owow/nps/agmm.

Evans, Patrick. 2008. Personal Communication. NRCS District Conservationist. Moscow Field Office.

Gardner, 2003. Soil Scientist, Idaho Soil Conservation Commission. Personal communication.

Gilmore, 1995. BMP Effectiveness Review. Report prepared for the Latah Soil and Water Conservation District.

Gilmore, 2004. Palouse Subbasin Management Plan. Prepared for the Palouse-Rock Lake Conservation District and Northwest Power Planning Council.

IASCD, 2003. Tributaries of the Palouse River Monitoring Report; Technical results summary KPC-PR-02, 60 pp. Prepared by Ken Clark.

IDAPA 58.01.02. Idaho Water Quality Standards and Wastewater Treatment Requirements.

Idaho Code § 39-3601 (7). Designation of agencies.

IDEQ, 2005. Palouse River Tributaries Subbasin Assessment and TMDLs. Idaho Department of Environmental Quality, Lewiston Regional Office.

IDEQ, 2007. South Fork Palouse River Subbasin Assessment and TMDLs. Idaho Department of Environmental Quality, Lewiston Regional Office.

IDFG, 2008. Threatened and Endangered Species List. Idaho Conservation Data Center. Retrieved from http://fishandgame.idaho.gov/cms/tech/CDC/

Knecht, 2008. USDA Farm Service Agency - Latah County Executive Director. Personal communication.

Latah SWCD, 2004. Idaho Nonpoint Source Program 319 Grant Proposal. Cow Creek Water Quality Improvement Project.

Mahler, Tindall & Mahler, 2002. Best Management Practices for Phosphorus Management to Protect Surface Water (Quality Water for Idaho Current Information Series No. 963). Moscow, ID: University of Idaho, College of Agriculture.

Mahler, et. al, 2003. Best Management Practices (BMPs) for Erosion Control. University of Idaho Water Quality Brochure No. 27. A cooperative publication of University of Idaho Extension and USDA-Soil Conservation Service.

McCool, et al. 1993. Unpublished, for presentation at the 1993 International Winter Meeting of American Society of Agricultural Engineers. Crop Management Effects on Winter Hydrology of the Northwestern Wheat Region. Paper 93-2535.

PNDSA, 2002. Pacific Northwest Direct Seed Association. *Direct Link. Volume 3(2).*

Preston, 2008. Latah SWCD Resource Conservation Planner. Personal communication.

Shumar, M. 2003. Feasibility of Canopy Coverage Estimation for Temperature TMDL Targets in Non-Forested Streams. Idaho Department of Environmental Quality. Boise. 17 p.

USDA, 1978. United States Department of Agriculture, Soil Conservation Service, Forest Service, and Economic, Statistics, and Cooperative Service. Palouse Cooperative River Basin Study.

USDA, 1995. United States Department of Agriculture; Natural Resource Conservation Service. Preliminary Investigation Report for the Paradise Creek Watershed.

USDA, 1997. United States Department of Agriculture, Natural Resource Conservation Service (NRCS). RUSLE Revised Universal Soil Loss Equation section 1, Erosion Prediction. C factor look up tables.

USDA, 2008. United States Department of Agriculture, Natural Resources Conservation Service. National Coordinated Common Resource Area (CRA) Geographic Database at http://soils.usda.gov/survey/geography/cra.html

USDA Farm Services Agency, 2005. CRP acres from GIS (CLU) database.

USGS, 1970. Sediment Transport by Streams in the Palouse River Basin, Washington and Idaho, July 1961-June 1965. Prepared by P.R. Boucher. Water Supply Paper 1899-C; 37p.

Veseth, 1999. Grower Direct Seed Pea Trials in Eastern Washington and Northern Idaho. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan 5-7. 1999, Spokane, WA.

Young, 1999. Cost and Profitability Results of Farmers Using Direct Seed Systems in the Pacific Northwest. *In*: R. Veseth, (ed.) Northwest Direct Seed Intensive Cropping Conference Proceedings, Jan 5-7, 1999, Spokane, WA.

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
DEQ -	Idaho Dept. of Health and Welfare; Division of Environmental Quality
DO -	dissolved oxygen
EPA -	U.S. Environmental Protection Agency
FPA -	Idaho State Forest Practices Act
FSA -	USDA Farm Service Agency
HEL -	Highly Erodible Land
IASCD-	Idaho Association of Soil Conservation Districts
IDEQ -	Idaho Department of Environmental Quality
IDHW-	Idaho Department of Health and Welfare
IDL -	Idaho State Department of Lands
ISCC -	Idaho State Soil Conservation Commission
ISDA-	Idaho State Department of Agriculture
IWRRI -	Idaho Water Resources Research Institute
kg/d -	kilograms per day
LA -	Load Allocation
Latah SWCD -	Latah Soil and Water Conservation District
MCL -	maximum contaminant level
mg/l -	milligrams per liter
NLCHD-	North Latah County Highway District
SFPR -	South Fork Palouse River
SLCHD-	South Latah County Highway District
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
TMDL -	Total Maximum Daily Load
TP -	total phosphorus
USDA -	United States Department of Agriculture
USGS -	United States Geologic Service
VFS -	Vegetative Filter Strip
WAG -	Watershed Advisory Group
WLA -	Waste Load Allocation
WQPA -	Water Quality Program for Agriculture (ISCC)

APPENDIX B

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