Blackfoot River Total Maximum Daily Load Implementation Plan for Agriculture

Developed for the Idaho Department of Environmental Quality

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Introduction

The purpose of this document is to identify best management practices (BMPs) that are needed to meet Total Maximum Daily Load (TMDL) targets on the Blackfoot River and its tributaries. This implementation plan identifies BMPs to improve approximately 158 miles of §303d-listed rivers and creeks and 255,000 acres of private agricultural land within the subbasin. This plan outlines an adaptive management approach for developing conservation plans and implementing BMPs to meet the recommendations of the Blackfoot River TMDL.

TMDL Targets and Reductions

The TMDL was completed by IDEQ in December 2001 and approved by EPA in April 2002. The TMDL addresses 11 segments for sediment and 3 segments for nutrients. Sediment and nutrient concentrations appear to increase during runoff events (IASCD, 2002). The TMDL establishes sediment targets for turbidity (not to exceed 20.15 NTU) on Dry Valley Creek; a streambank stability target of 80% or more on all streams; and depth fine targets for streambeds (IDEQ, 2001). The TMDL identifies 25 reaches or 54% of assessed reaches are below the 80% streambank stability target. The TMDL estimates the sediment load reductions vary from 19% to 77% depending on the stream segment. The estimated TP reduction for the Blackfoot River at the Shelley USGS station is 35% and an 80% reduction of TP on Wolverine Creek (IDEQ, 2001).

Goal

The goal of the Blackfoot River TMDL Agricultural Implementation Plan is to restore the impaired beneficial uses such as cold water aquatic life and salmonid spawning.

Objectives

The objectives of this plan will reduce the amount of sediment, phosphorus, and nitrogen in the Blackfoot River and its tributaries from agricultural sources. Several technical, educational, and financial tasks will be needed to accomplish the objectives, which include:

- Reduce sediment from sheet/rill, gully, irrigation-induced, and streambank erosion on agricultural land
- Reduce nutrient runoff and leaching from fertilizer and animal waste applications on agricultural land
- Monitor implementation progress and BMP effectiveness

Installation costs for agricultural lands are estimated in this plan to provide landowners, local communities, government agencies, residents, and stakeholders some perspective on the technical and economic demands of meeting the TMDL goals. Sources of available funding and technical assistance for the installation of BMPs on private agricultural land are outlined in Table 22.

This plan recommends that agricultural landowners contact the Central Soil and Water Conservation District (CBSWCD), North Bingham Soil and Water Conservation District (NBSWCD), Caribou Soil Conservation District (CSCD), Natural Resources Conservation Service (NRCS), Blackfoot River Watershed Council (BRWC), Idaho Association of Soil Conservation Districts (IASCD), Idaho State Department of Agriculture (ISDA) or the Idaho Soil Conservation Commission (ISCC) for assistance. These agencies will help landowners determine the need to address water quality and other natural resource concerns on their property.

This plan is not intended to identify which specific BMPs are appropriate for specific agricultural fields, but rather provides a subbasin approach to address water quality problems on agricultural lands.

Background

Project Setting

The Blackfoot River subbasin is located in southeastern Idaho and covers parts of Bingham, Bonneville, and Caribou counties as shown in Figure 1. The subbasin covers 699,489 acres or 1,093 square miles.

Figure 1. Location of the Blackfoot River Subbasin

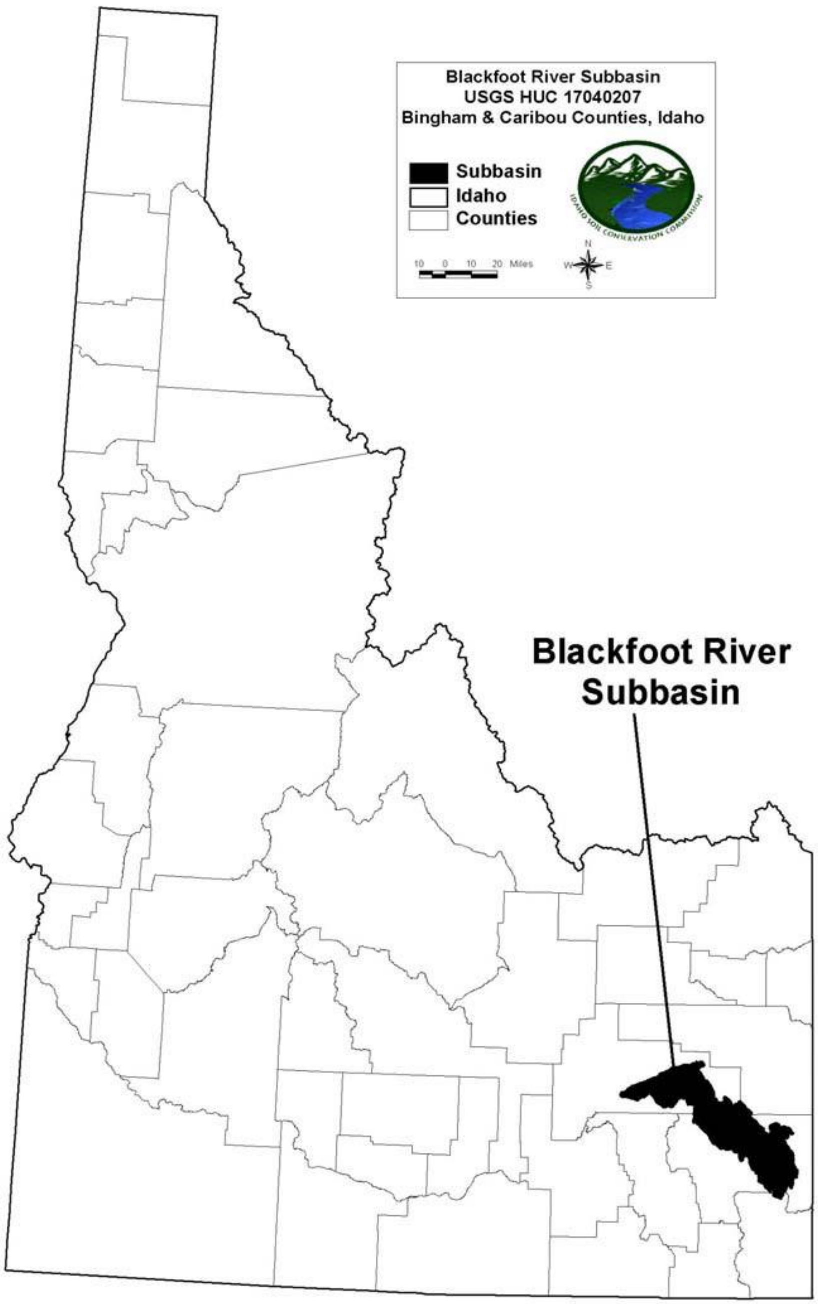
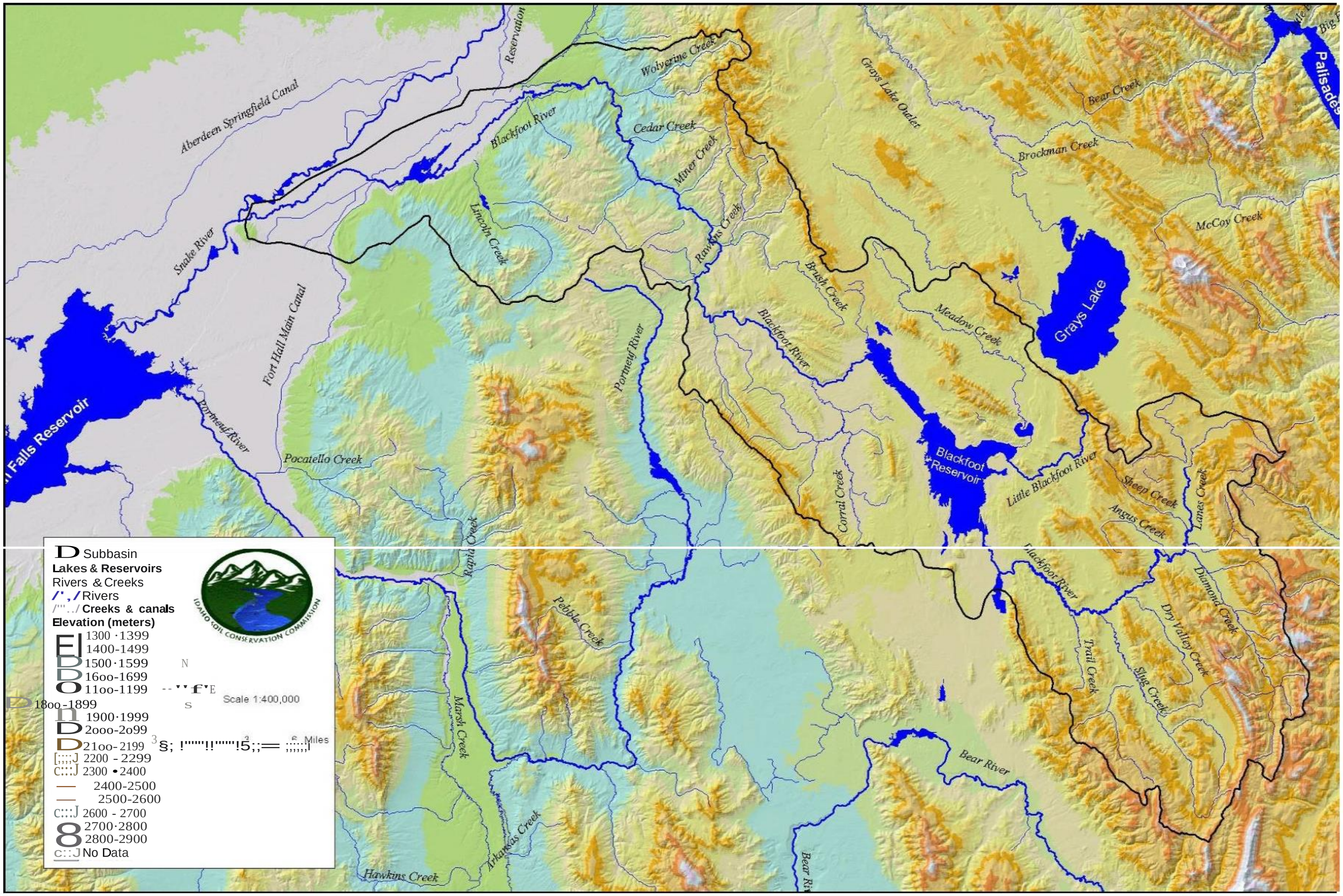


Figure 2. Area Map of the Blackfoot River Subbasin



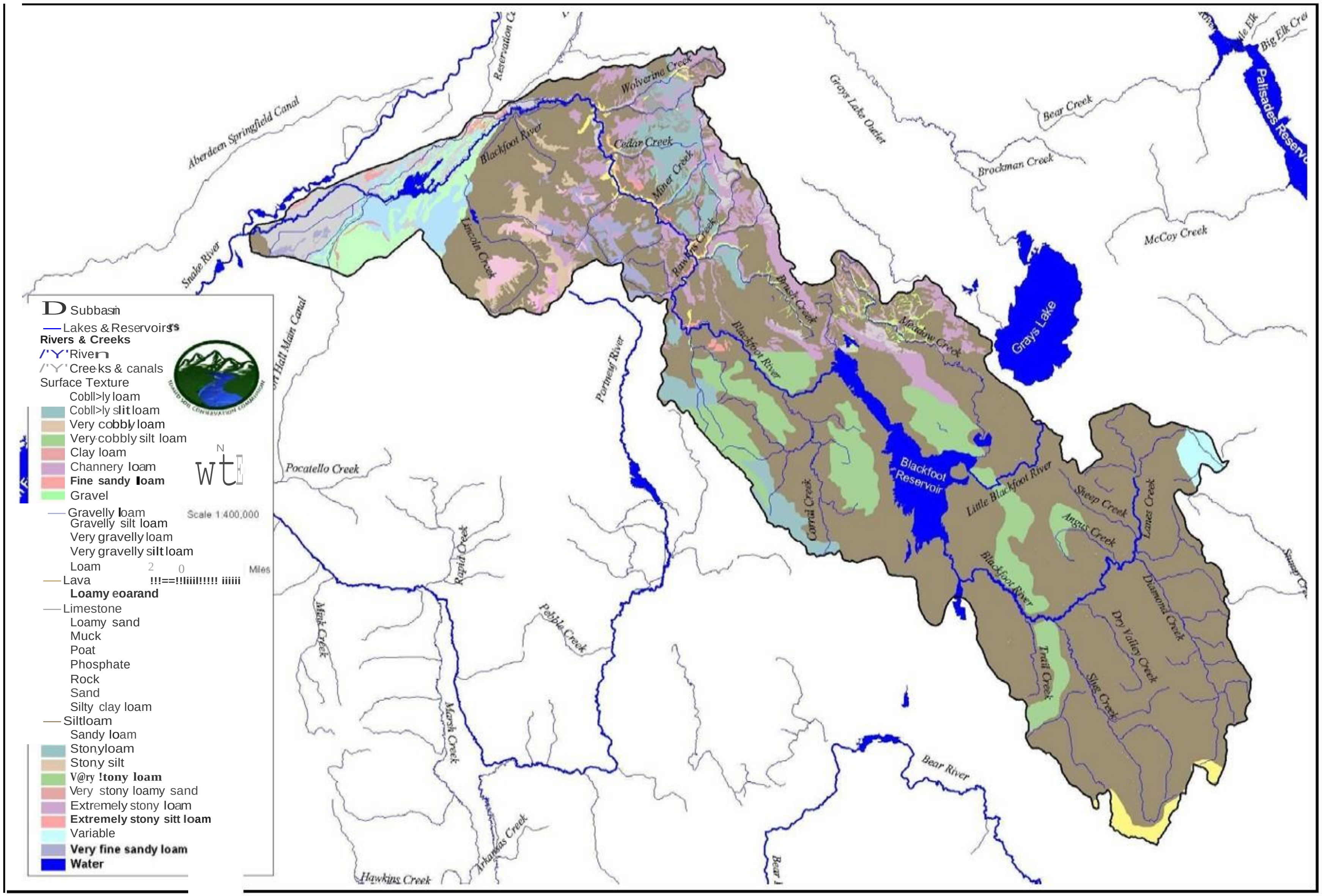
Soils

The Soil Survey of Bingham Area, Idaho was published in 1973 by the US Department of Agriculture (USDA) Soil Conservation Service (SCS) and covers about 23% of the subbasin. In addition to the Bingham Area survey, the SCS published the Soil Survey of Fort Hall Area in 1977 and covers 18% of the subbasin. There is no published soil survey in Caribou County. Soils in the subbasin are predominantly silt loams on 4 to 20% slopes, as shown in Table 1 and Figure 3.

Table 1. General Soil Associations in the Blackfoot River Subbasin

Soil Association	Description
Bannock-Bock	Nearly level to moderately sloping, well drained, deep, medium textured soils on alluvial terraces
Declo-Fingal	Nearly level to strongly sloping, well drained and moderately well drained, deep, medium textured and moderately coarse textured soils on lake terraces
Pancheri-Polatis	Nearly level to moderately sloping, well drained, deep and moderately deep, medium textured soils on basalt plains
Robin-Lanark	Nearly level to steep, well drained, deep, medium textured soils on loess covered uplands
Wolverine-Sasser-Stan	Nearly level to moderately steep, excessively drained and well drained, deep, coarse textured and moderately coarse textured soils on terraces
Newdale-Swanner-Tetonia	Nearly level to steep, well drained, deep and shallow, medium textured soils on uplands
Wahtigup-Ricrest-Hymas	Moderately sloping to very steep, somewhat excessively drained and well drained, deep and shallow, gravelly, stony and extremely stony, medium textured soils on mountain slopes and ridges
Dranyon-Sessions-Nielsen	Nearly level to steep, well drained, deep and shallow, medium textured soils on mountainous and foot slopes
Sheege-Pavohroo	Nearly level to steep, well drained, shallow and deep, medium textured soils on mountains
Bear Lake-Lago-Merkley	Very deep, moderately well to very poorly drained, soils formed in mixed alluvium
Rexburg-Ririe-Iphil	Deep and very deep, well drained soils formed in loess and silty alluvium from loess
Blacknoll-Sadorous	Moderately deep, well drained soils formed in eolian sands with some influence from silty loess and silty alluvium from loess
Bancroft-Paulson-Lanark	Very deep, well drained soils formed in loess and mixed alluvium
Ireland-Cedarhill-Pavohroo	Moderately deep to very deep, well drained soils formed in residuum and alluvium from limestone and dolomite
Lanark-Dranyon-Nielson	Shallow to very deep, well drained soils formed in loess and mixed alluvium
Yeate Hollow-Ant Flat-Frenchollow	Very deep, well drained and moderately well drained soils formed in residuum and alluvium from sandstone, conglomerate and quartzite

Figure 3. Soil Surface Texture in the Blackfoot River Subbasin



Climate

Annual precipitation, shown in Figure 4, averages 10 inches at Blackfoot to 20 inches at Henry (Abramovich et al., 1999). Mountainous regions above 7,000 feet receive 30 to 40 inches annually with the semi-arid regions receiving less than 11 inches per year.

Topography

The subbasin is 66 miles long and 20 miles wide with very mountainous terrain including mountain valleys, basalt and lava fields, alluvial fans, and valley plains. The Blackfoot Mountains, Caribou, Grays, and Webster ranges comprise the eastern boundary with tributaries flowing west into Upper Valley. The Chesterfield and Portneuf ranges comprise the western edge with tributaries flowing east towards the Blackfoot River. The Snake River Plain comprises the northern boundary, with tributaries flowing west along the Snake and Blackfoot rivers. The Blackfoot Lava Field, Aspen and Preuss ranges bound the subbasin on the south with tributaries flowing north into Lower Valley.

The subbasin is oblong, 66 miles wide and 20 miles long. The subbasin drains 699,489 acres or 1,093 square miles. Elevations range from 8,975 feet at an unnamed peak on Dry Ridge to 4,450 feet elevation where it enters the Snake River north of Ferry Butte. Almost 60% of the subbasin's elevations occur between 6,000 and 7,000 feet. About 21% of the subbasin is flat with slopes less than 2%. Thirty percent of its slopes are gentle, from 2% to 8%. The residual 49% has slopes greater than 8%, shown in Figure 5.

Surface Water

The subbasin is located in the Snake River basin. The Blackfoot River begins at the confluence of Lanes, Diamond, and Bacon creeks at an elevation of 6,420 feet and flows 108 miles descending to 4,450 feet elevation where it enters the Snake River north of Ferry Butte. The river originates on private land and runs west-northwest for 34 miles to the Blackfoot Reservoir. The river leaves the reservoir at Government Dam and flows north-northwest for 59 miles to the Equalizing Reservoir. From that reservoir the river flows northwest and enters the Snake River about three miles west of Blackfoot.

The subbasin has 419 miles of perennial streams, 101 miles of intermittent streams, and 96 miles of canals, shown in Figure 6. Major tributaries are the Little Blackfoot River, Angus, Brush, Corral, Diamond, Dry Valley, Lanes, Meadow, Trail, and Slug creeks. The watersheds are shown in Figure 7.

Water Quality

Water quality in the subbasin varies from poor to excellent and has been the subject of several studies summarized in the TMDL (IDEQ, 2001). The Idaho Department of Health and Welfare (IDHW) collected water samples from 1975 to 1976 on the Blackfoot River and concluded that the river is degraded by sediment during runoff and coliform bacteria during low flows in the summer (McSorley, 1977). Another study, (Perry, 1977) concluded the Blackfoot Reservoir has a short residence time; and is shallow with winds suspending sediment and aiding in the dissolution of nutrients in the sediments.

In 1986 and 1987, IDHW collected water samples and found that several tributaries to the lower Blackfoot River had high amounts of suspended sediment, nitrates and nitrites, total kjeldahl nitrogen, total phosphorus, orthophosphate, and bacteria (Drewes, 1987). USGS sampled water quality at several sites in the subbasin from 1965 until 2002. IASCD sampled water quality from 2000 to 2002 on tributaries and the Blackfoot River as shown in Figure 8. Results suggest sediment and nutrients increase during spring runoff, precipitation events, and downstream of the Reservation Canal (Fischer, 2002).

Water Quantity

Subbasin water yield averages 268,000 acre-feet annually with a high of 584,000 acre-feet in 1984 and a low of 103,000 acre-feet in 1925 (USGS, 2003). Discharge peaks in late April or early May. These peaks are regulated by storage reservoirs and irrigation diversions. During the rest of the year, the flows tend to be moderately high and constant. River discharge at the USGS gage near Shelley, Idaho from 1909 to 2002 averaged 371 cfs with a low of 27 cfs and peaked at 2,020 cfs. The average peak flow during that same period was 1,227 cfs and normally occurred in late May and June (USGS, 2003).

Blackfoot River flows from 1909 to 2002 at the Henry USGS gage, above the Blackfoot Reservoir, averaged 162 cfs, ranging between 5 cfs to 2,060 cfs. The average peak was 1,242 cfs and usually occurred mid-April to late May. The flow in the lower river is regulated by the BIA. BIA controls the Blackfoot Reservoir releases. The reservoir was completed in 1909, covers 18,000 acres, and stores 413,000 acre-feet. Consumptive uses of surface water include mining, livestock watering, and irrigation. An estimated 146 million gallons per day of surface water is used in the subbasin annually (USGS, 1995).

Table 2. USGS Gages in the Blackfoot River Subbasin

Agency	Site Number	Site Description	Period of Record
USGS	13063000	Blackfoot River above Reservoir near Henry	1914 to 2002
USGS	13063500	Little Blackfoot River at Henry	1914 to 1925
USGS	13064500	Meadow Creek near Henry	1914 to 1925
USGS	13065500	Blackfoot River near Henry	1908 to 1925
USGS	13065940	Wolverine Creek near Goshen	1979 to 1986
USGS	13066000	Blackfoot River near Shelley	1909-2002
USGS	13066500	Blackfoot River near Presto	1903 to 1909
USGS	13067500	Fort Hall Upper Canal near Blackfoot	1912 to 1924
USGS	13068000	Fort Hal Lower Canal near Blackfoot	1912 to 1924
USGS	13068495	Blackfoot River near Blackfoot	1964 to 2002
USGS	13068500	Blackfoot River near Blackfoot	1913 to 2002
USGS	13068501	Blackfoot River and Bypass Channel near Blackfoot	1913 to 2002

Table 3. IDWR Regulated Dams in the Blackfoot River Subbasin

IDWR Dam	Dam Name	County	River	Purpose	Capacity (acre feet)	Height (ft)
27-2007A1	Blackfoot	Caribou	Blackfoot River	L	350,000	35
27-2007A2	Blackfoot China Hat	Caribou		Auxiliary	0	20
27-2007B	Blackfoot Equalizing	Bingham	Blackfoot River	O	1,500	18
27-2009	Enders	Caribou	Cutoff Canyon Creek	L	60	11.4
27-7118	Indian Creek Upper	Caribou	Chicken Creek	I	48	12.5
27-7127	Indian Creek Lower	Caribou	Chicken Creek	I	15	11.7

Irrigation Diversions

There are approximately eight irrigation companies or districts in the subbasin that manage about 96 miles of canals and ditches. They supply water to over 32,000 irrigated acres. The largest is the Fort Hall Indian Irrigation Project, formed in 1907 by congressional act to supply water to approximately 31,000 acres on the reservation. Irrigation water is stored in the Blackfoot and Equalizing reservoirs conveyed by the river and diverted into the Fort Hall Main, Little Indian, and North canals, south and east of the city of Blackfoot (Shoshone-Bannock Tribes, 1990).

Figure 4. Annual Precipitation in the Blackfoot River Subbasin

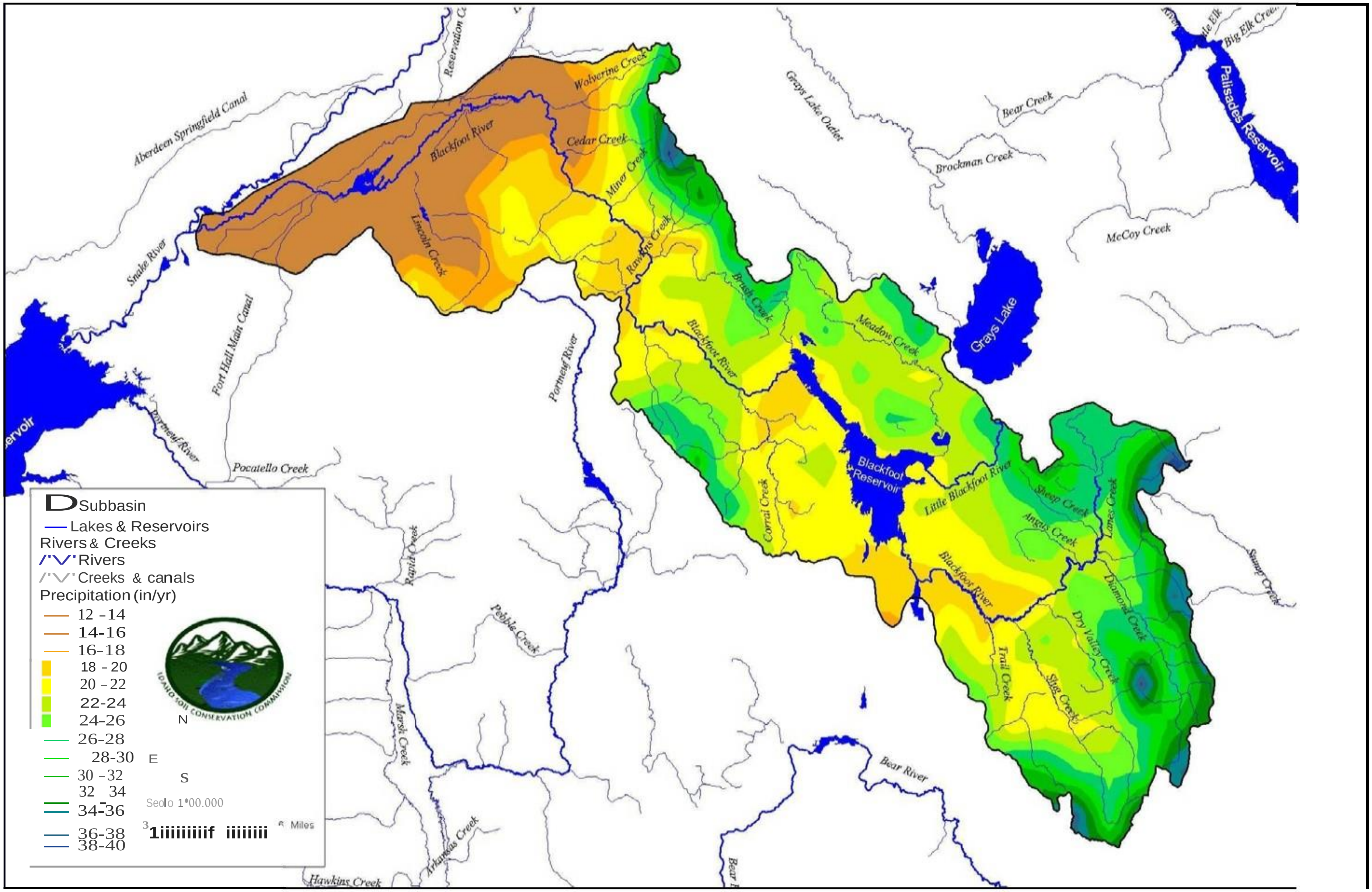


Figure 5. Slope Classes in the Blackfoot River Subbasin

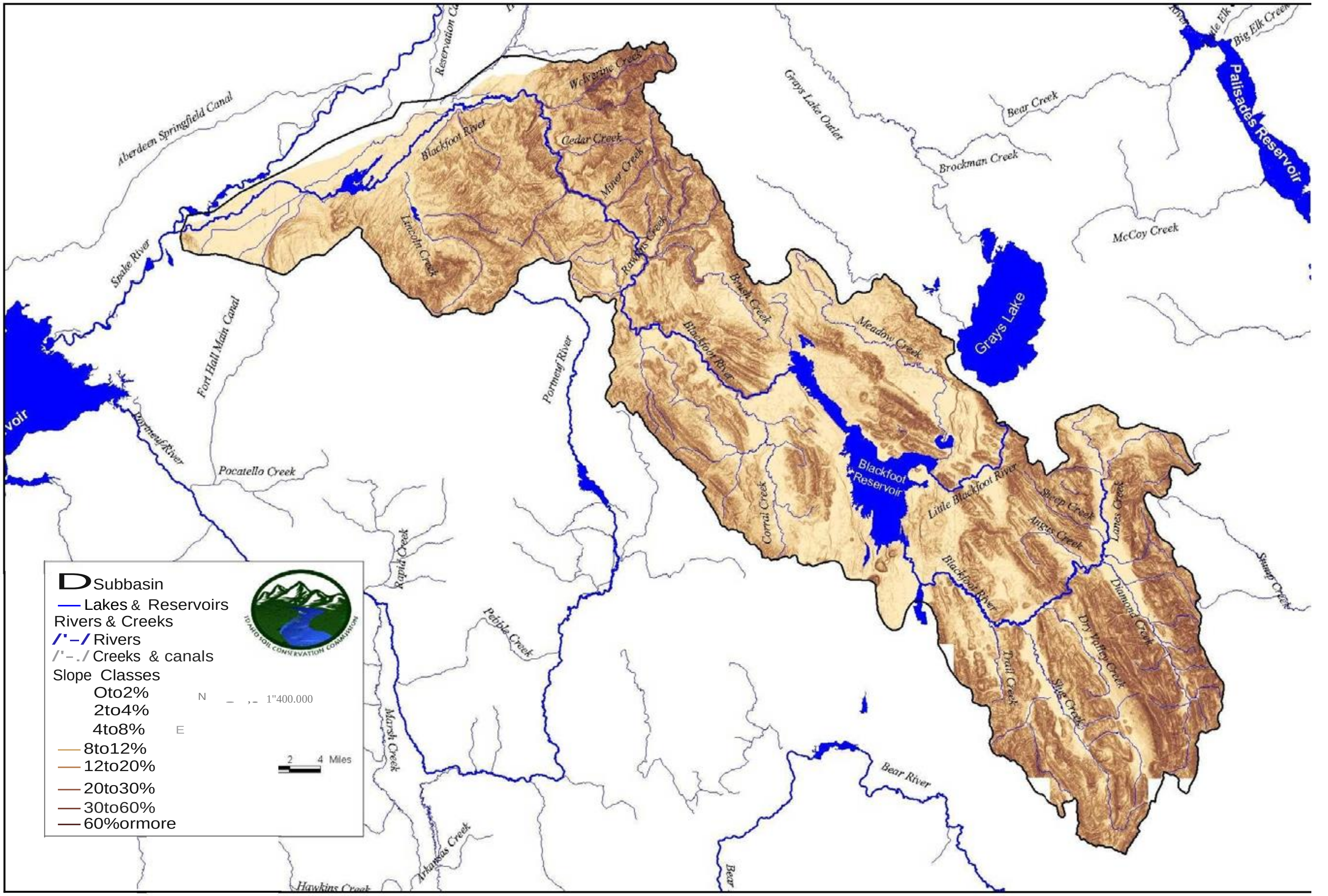


Figure 6. Surface Hydrology in the Blackfoot River Subbasin

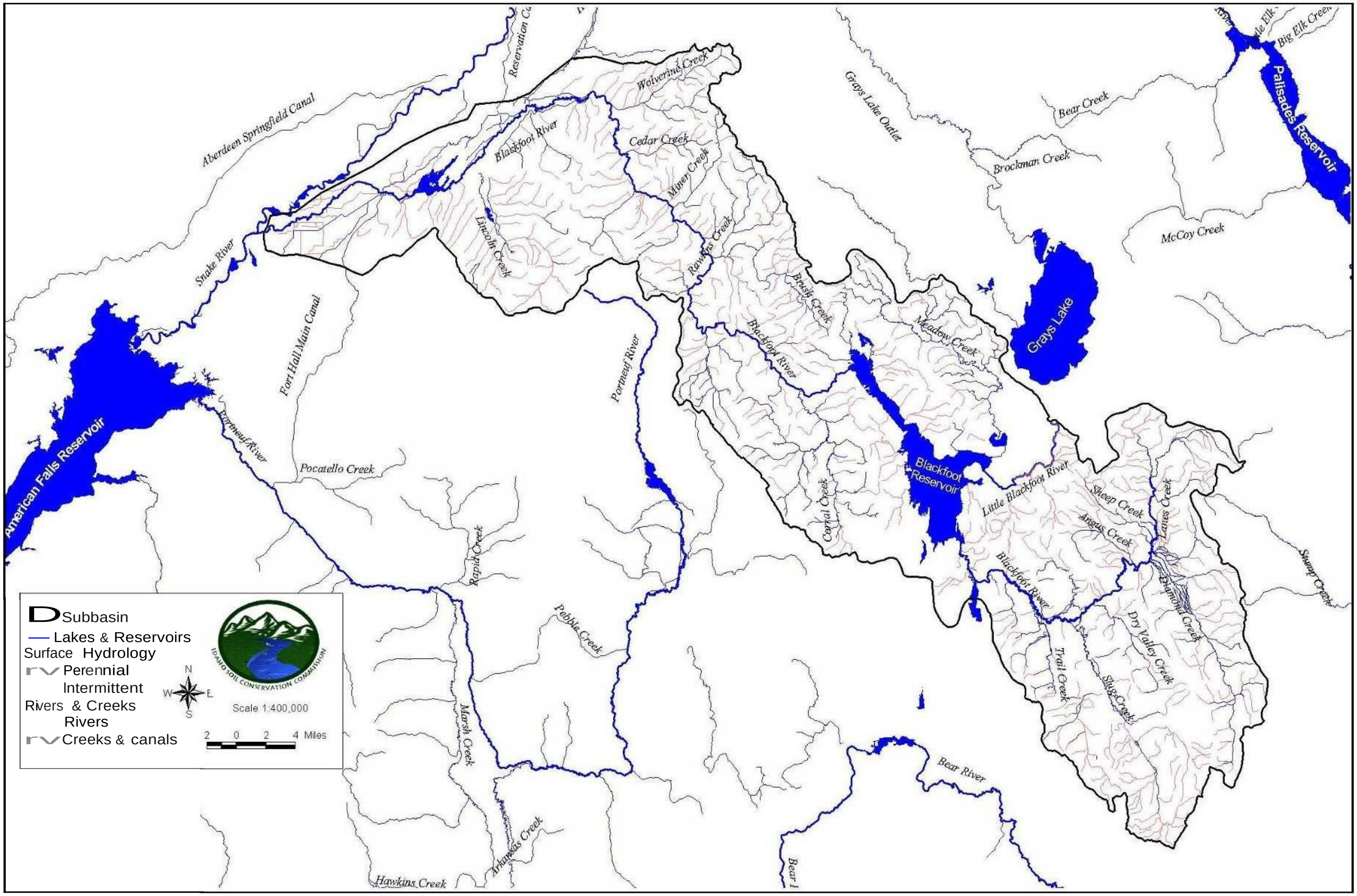


Figure 7. Watersheds in the Blackfoot River Subbasin

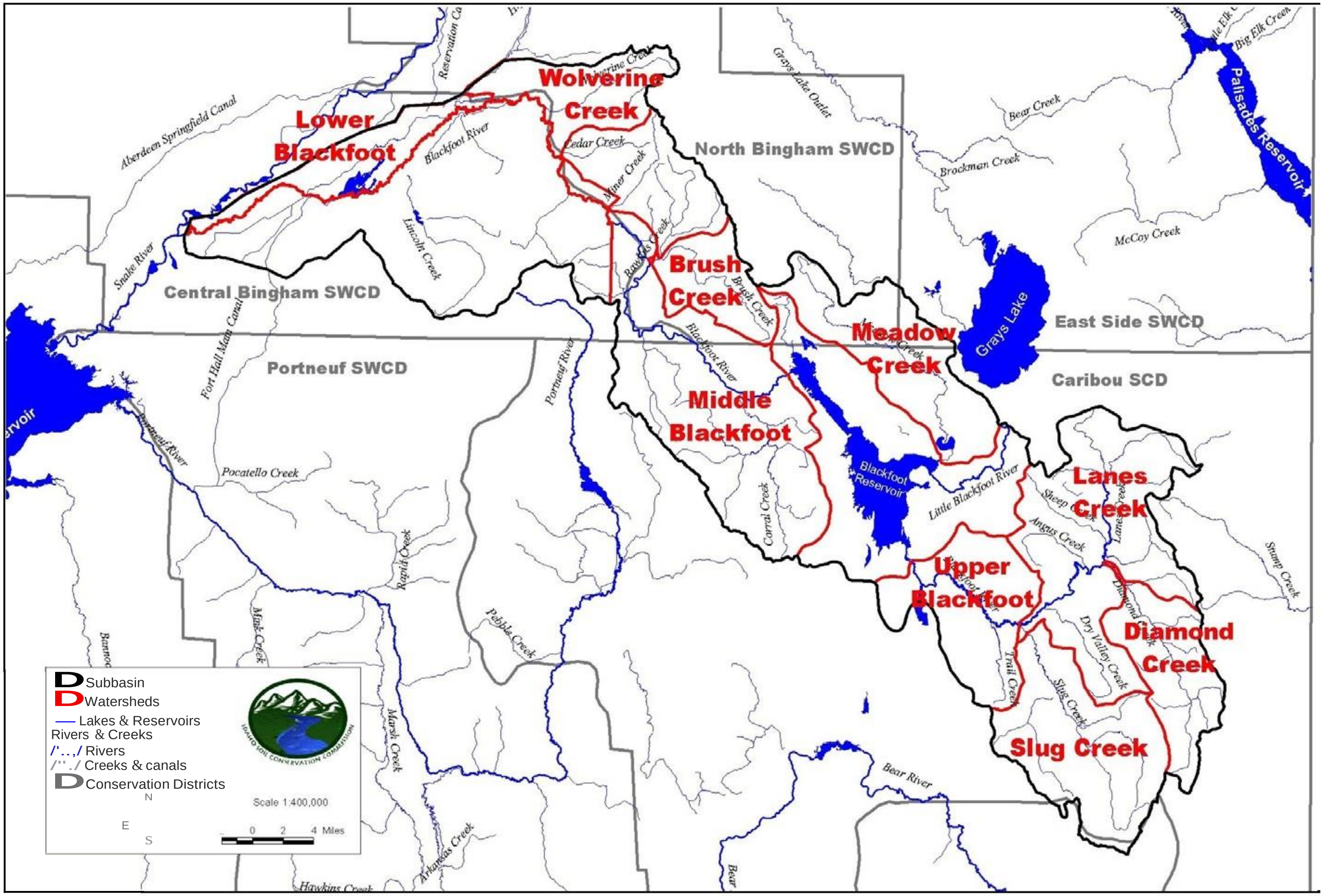
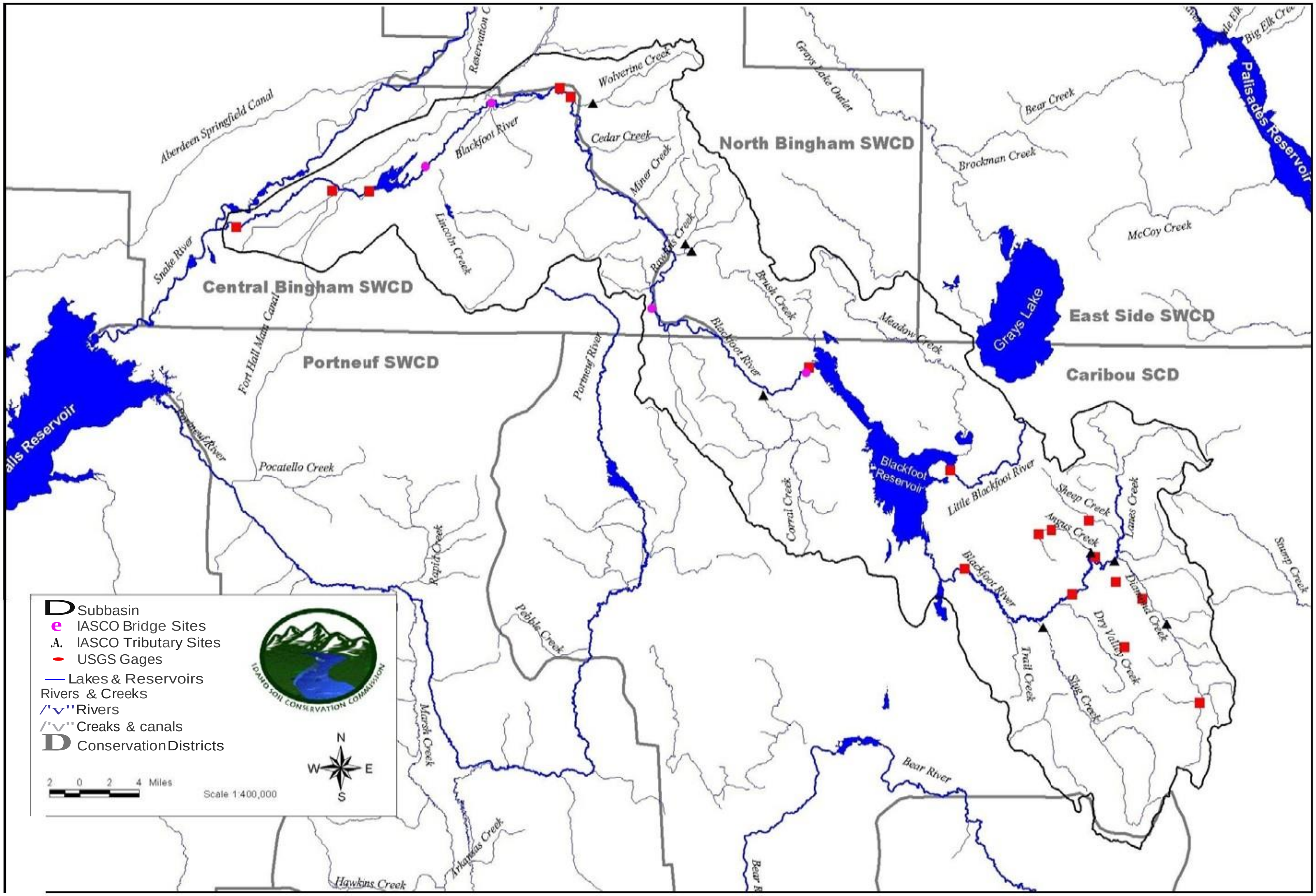


Figure 8. IASCO and USGS Monitoring Sites in the Blackfoot River Subbasin



Land Ownership

Private lands encompass 38% or 263,700 acres of the subbasin. In comparison the subbasin also consists of 289,000 acres or 41% of federal lands managed by the Bureau of Land Management (BLM), Bureau of Indian Affairs and Forest Service (FS). State lands are managed by the Idaho Department of Lands (IDL) and comprise 129,410 acres or 19% of the subbasin, as shown in Table 4 and Figure 9.

Table 4. Land Ownership in the Blackfoot River Subbasin

Land Ownership	Central Bingham SWCD	North Bingham SWCD	Caribou SCD	East Side SWCD	Total Acres	Percent of Total
Private	30,700	71,540	156,980	4,480	263,700	37.7%
BLM	3,970	10,920	26,380	20	41,290	5.9%
BIA	124,200	100	0	0	124,300	17.8%
IDL	790	38,410	90,210	0	129,410	18.5%
FS	0	0	123,140	0	123,140	17.6%
Water	280	0	17,300	0	17,580	2.5%
Total	**159,940**	**120,970**	**414,010**	**4,500**	**699,420**	**100.0%**

Land Use

Range land is the major land use with approximately 404,000 acres or 58% of the subbasin. In comparison, the subbasin also consists of 119,000 acres or 17% of crop and pasture lands, including non-irrigated and irrigated lands. Forest lands comprise 145,000 acres or 21% of the subbasin. They're shown in Table 5 and Figure 10.

Table 5. Land Use in the Blackfoot River Subbasin

Land Use	Central Bingham SWCD	North Bingham SWCD	Caribou SCD	East Side SWCD	Total Acres	Percent of Total
Range Land	107,200	83,500	210,600	2,590	403,890	57.7%
Irrigated Crop/Pasture	35,400	4,470	8,300	0	48,170	6.9%
Non-Irrigated Crop/Pasture	10,410	13,600	46,500	0	70,510	10.1%
Forest Land	5,050	19,400	118,300	1,910	144,660	20.7%
Urban & Industrial	1,260		5,050	0	6,310	0.9%
Wetlands	160	0	8,270	0	8,430	1.2%
Lakes & Reservoirs	460	0	16,990	0	17,450	2.5%
Total	**159,940**	**120,970**	**414,010**	**4,500**	**699,420**	**100.0%**

Private Land Use

The subbasin has approximately 262,190 acres of private land. Of these lands, range land is the predominant private land use with 136,864 acres or 52%. Private land also consists of 34% of crop and pasture lands, including non-irrigated and irrigated grain, hay, or pasture. Forest land comprises about 10%. Urban and industrial areas account for one percent of private land. These land uses are displayed in Table 6 and Figure 11.

For the purposes of this plan, a farm or ranch is defined as any place which produced and sold or normally would have produced or sold $1,000 worth of agricultural products during the year (IASS, 1998 and NASS, 2002). Agricultural statistics are shown in Table 7.

Table 6. Private Land Uses in the Blackfoot River Subbasin

Land Use	Central Bingham SWCD	North Bingham SWCD	Caribou SCD	East Side SWCD	Total Acres	Percent of Total
Range Land	5,945	45,336	83,015	2,568	136,864	52.2%
Irrigated Crop & Pasture	19,006	4,370	7,861	0	31,237	11.9%
Non-Irrigated Crop & Pasture	4,161	12,571	39,816	0	56,548	21.6%
Forest Land	179	8,906	15,536	1,913	26,534	10.1%
Urban & Industrial	943	0	1,547	0	2,490	1.0%
Wetlands	146	172	7,244	0	7,562	2.9%
Lakes & Reservoirs	232	0	723	0	955	0.3%
Total	**30,612**	**71,355**	**155,742**	**4,481**	**262,190**	**100.0%**

Table 7. Agricultural Inventory Data for Bingham and Caribou Counties

Agricultural Category	Bingham			Caribou		
	1987	**1992**	**1997**	**1987**	**1992**	**1997**
Total Number of Farms	1,466	1,282	1,168	428	384	427
Land in Farms (total acres)	1,406,990	1,371,605	796,065	587,384	587,693	469,381
Land in Farms (average size)	960	1,070	682	1,372	1,530	1,099
Land in Irrigated Farms (acres)	306,187	307,812	321,610	273,910	258,384	280,596
Commercial Fertilizer (acres applied)	265,934	275,342	279,812	102,072	104,763	107,446
Number of Farms (1 to 9 acres)	199	224	185	25	22	17
Number of Farms (10 to 49 acres)	374	345	336	39	33	48
Number of Farms (50 to 179 acres)	317	236	224	50	54	78
Number of Farms (180 to 499 acres)	252	184	156	100	83	85
Number of Farms (500 to 999 acres)	151	131	110	89	72	60
Number of Farms (1,000 acres or more)	173	162	157	125	120	139

Crop or Commodity	Bingham			Caribou			
	1987	**1992**	**1997**	**1987**	**1992**	**1997**	**2002**
Wheat (acres)	131,338	145,119	147,789	35,580	34,800	40,897	20,800
Barley (acres)	41,749	24,528	20,118	75,482	73,692	74,912	78,200
Alfalfa Hay (acres)	51,763	50,376	61,271	29,322	29,289	32,073	30,000
Potatoes (acres)	67,697	67,007	63,344	4,353	4,313	5,823	7,400*
Beef Cows (head)	32,102	29,376	25,876	13,791	15,284	14,254	12,400*
Dairy Cows (head)	8,703	8,996	8,484	2,311	2,011	1,346	1,100*
Sheep and Lambs	17,365	14,486	10,853	13,254	16,359	10,144	8,000*
Horses and Ponies	4,100	3,358	4,383	1,065	844	1,025	--

* 2001 data

Accomplishments

Several conservation practices have been implemented on thousands of acres in the Central Bingham, North Bingham, and Caribou conservation districts as shown in Table 9. The most recent BMP projects and the associated conservation programs are shown in Figure 11. Most of the projects have focused on sprinkler irrigation, residue management, conservation cover, terraces, sediment basins, and grazing. The estimated installation cost of these conservation practices was approximately $15 million.

In the subbasin, roughly 8,500 acres are enrolled in the Conservation Reserve Program (CRP). The Farm Service Agency (FSA) pays an annual rental rate of $34 per acre in Bingham County (Burgoyne, 2004) and $39 per acre in Caribou County (Christensen, 2002). FSA pays about $320,000 annually for these CRP acres.

Table 9. BMPs Completed in Caribou, Central and North Bingham Conservation Districts

Conservation Practice	NRCS Practice	Central Bingham SWCD Amount*	North Bingham SWCD Amount*	Caribou SCD Amount**	Total Amount
Brush Management (ac)	314	2,100	1,379	12,158	15,637
Conservation Cover CRP (ac)	327	7,862	380	68,373	76,615
Contour Farming (ac)	330	1,931	109	146,621	148,661
Fence (ft)	382	130,447	203,130	51,272	384,849
Forage Harvest Management (ft)	511	1,382	3,351	90,817	95,550
Irrigation System-Sprinkler (no)	442	5	87	8,198	8,290
Irrigation Water Management (ac)	449	712	6,746	15,735	23,193
Irrigation Water Conveyance (ft)	430	26,552	197,232	335,099	558,883
Pasture and Hay Planting (ac)	512	125	2,179	61,107	63,411
Pipeline (ft)	516	12,865	1,984	402,206	417,055
Prescribed Grazing (ac)	528A	30,817	14,960	139,834	185,611
Residue Management (ac)	329	675	3,740	200,159	204,574
Riparian Forest Buffer (ac)	391A	6	20	25	51
Spring Development (no)	574	6	2	34	42
Streambank Protection (ft)	580	8,535	9,586	5,000	23,121
Tree/Shrub Establishment (no)	612	5,575	0	2,000	7,575
Upland Wildlife Habitat Mgmt (ac)	645	5,335	1,372	12,053	18,760
Waste Storage Facility (no)	313	1	4	6	11
Watering Facility (no)	614	7	4	58	69
Windbreak/Shelterbelt (ft)	380	39,657	116,700	80,000	236,357

**BMP estimated amounts from 1991 to 2001* ***BMP estimated amounts from 1968 to 2001*

Figure 9. Ownership in the Blackfoot River Subbasin

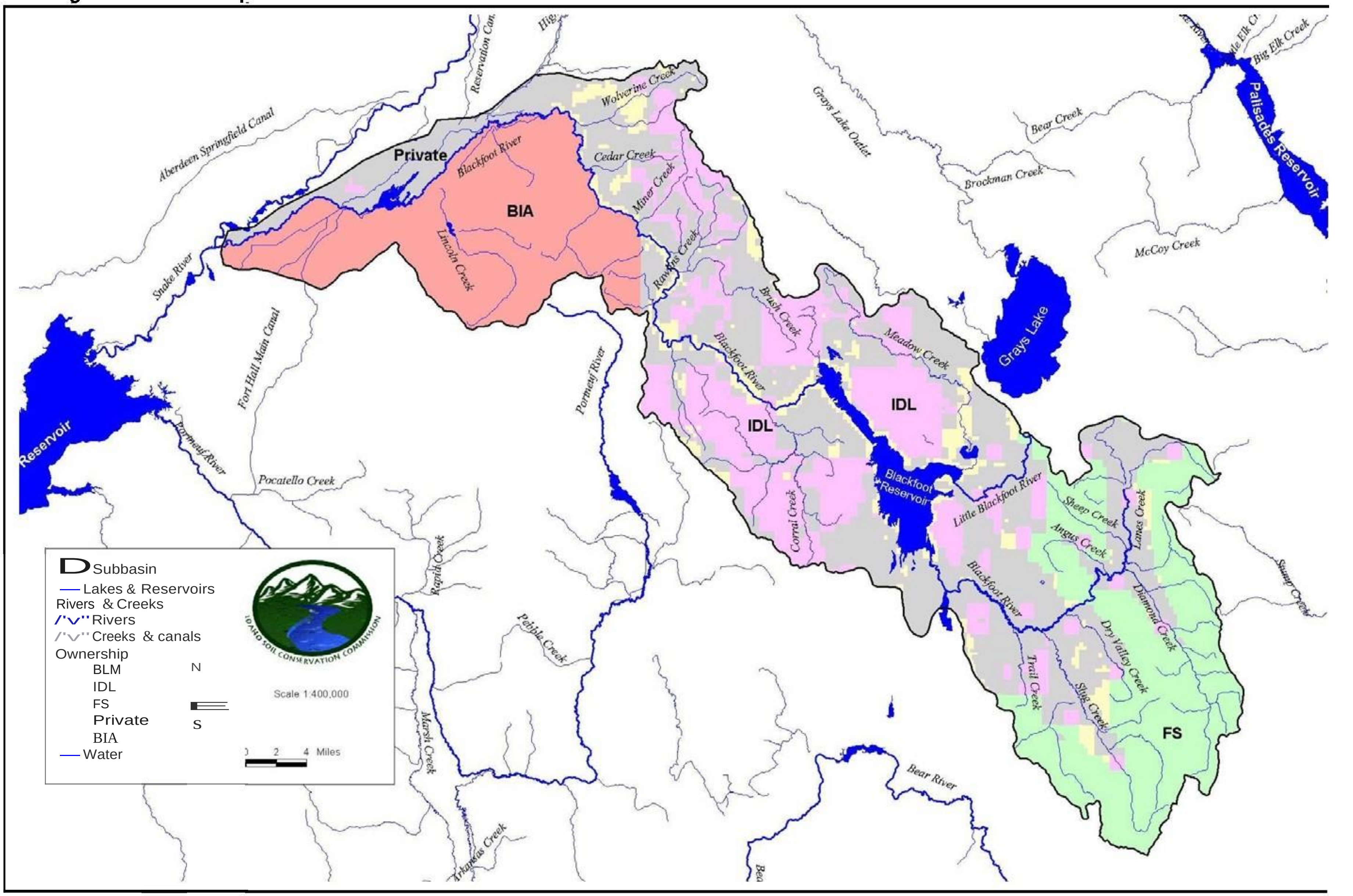


Figure 10. Land Use in the Blackfoot River Subbasin

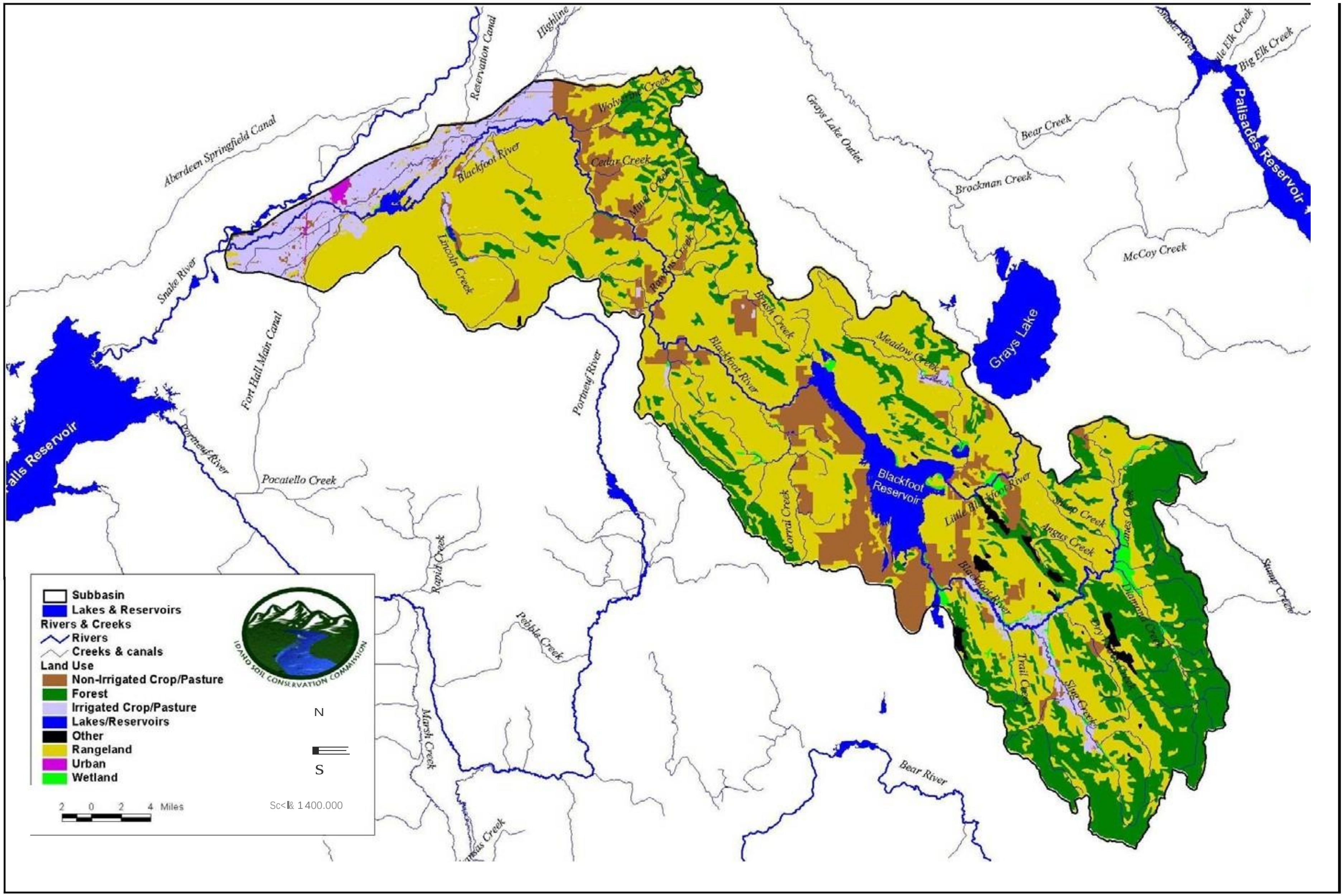


Figure 11. Private Land Use in the Blackfoot River Subbasin

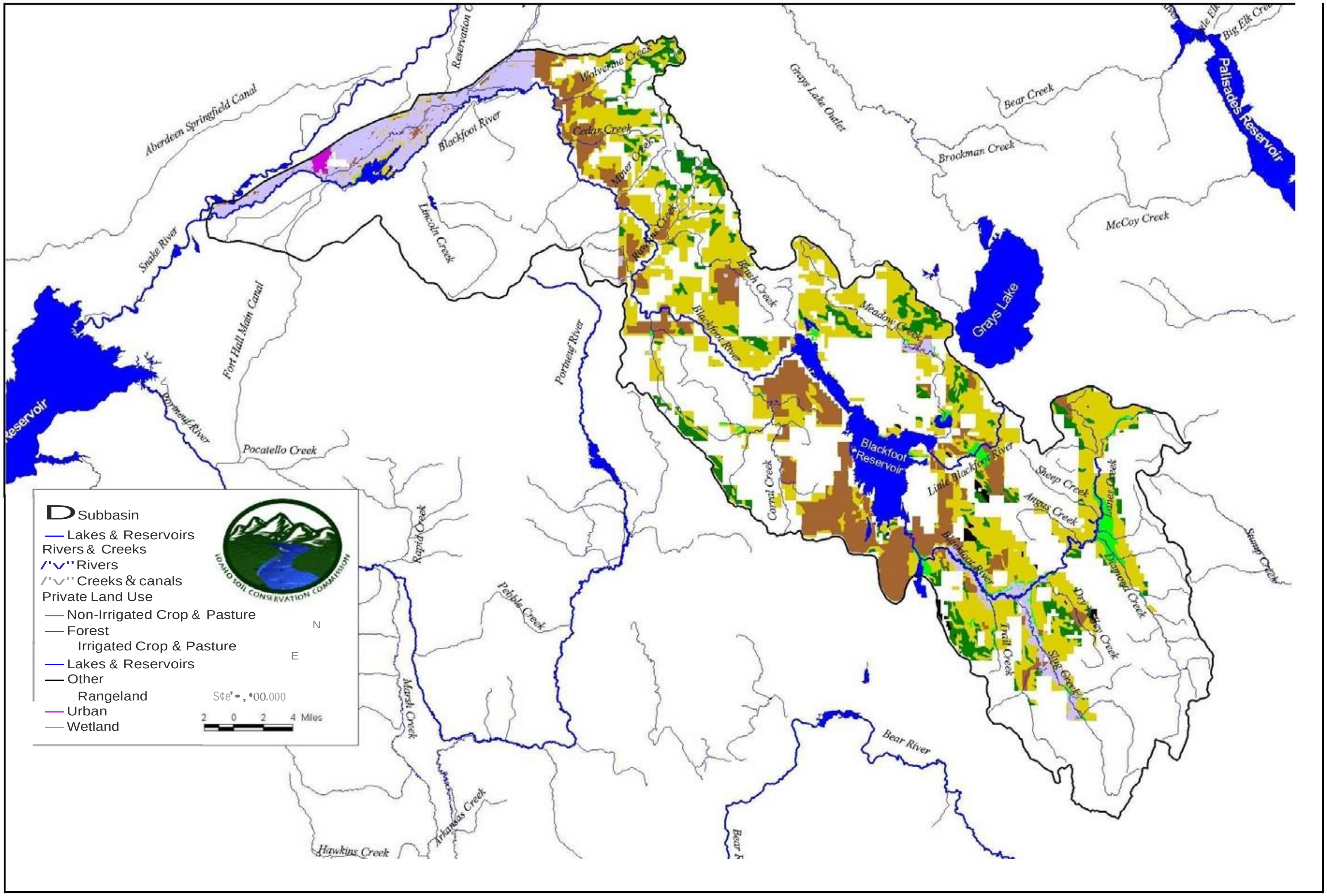


Figure 12. Conservation Program Projects in the Blackfoot River Subbasin
Figure 12 redacted to comply with section 1619 of the 2008 Farm Bill

Riparian Assessment

Introduction

Over 85 miles of the Blackfoot River and its tributaries were assessed from 1997 to 2000. Teams made up of landowners, permittees, lessees, local volunteers, state and federal employees assessed these reaches. The teams evaluated direct and indirect impacts to creeks, rivers, and their riparian areas. The data was used to develop realistic goals for TMDL watershed improvement.

Past Efforts

IDEQ determined the Blackfoot River's beneficial uses are impaired by sediment, nutrients, organics, and unknown pollutants (IDEQ, 2001). In 1996, the North Bingham and Central Bingham SWCDs signed a memorandum of understanding (MOU) with the Shoshone-Bannock Tribes and Blackfoot River Watershed Council (BRWC) to initiate recovery efforts in the watershed (Weaver, 1996).

IDFG currently manages the Blackfoot River, its tributaries, and the Blackfoot Reservoir as a coldwater fishery with Rainbow trout, Mountain whitefish, Brook trout, and Yellowstone Cutthroat trout present (IDFG, 2001). From 1994 to 1997, IDEQ conducted BURP assessments on the Blackfoot River and several of its tributaries (IDEQ, 2001). From 1997 to 2000, 85 miles of river and creek reaches were assessed by BRWC, ISCC, IDEQ, IDL, BLM, IDFG, FS, and NRCS staff to determine proper functioning and erosion conditions in the subbasin (ISCC, 2000). In 2002, BLM finished their *Blackfoot River Wild and Scenic Eligibility Study and Tentative Classification* (BLM, 2002).

Assessment Methods

The assessment teams used: NRCS Technical Note ID-67; IDEQ Protocol #8; BLM PFC; NRCS SECI; and NRCS Technical Note ID-29 (SVAP). The streams were divided into reaches using soils, geology, slope, sinuosity, vegetation, hydrology, roads, drainage area, valley type, and land use. Elevations, slopes, stream order, and sinuosity were estimated from USGS 7.5' maps.

NRCS Tech Note ID-67

NRCS Riparian Appraisal and Aquatic Habitat Evaluation, Range Technical Note ID-67 is an evaluation system to determine the condition of the riparian zone and help develop management alternatives (NRCS, 1995). This evaluation integrated several other methods including PFC; Rosgen Stream Classification; COWFISH; Cold Water Stream Appraisal Guide for Wyoming; and prior IDHW Protocols 1 through 7.

IDHW-DEQ Protocol #8

IDHW-DEQ Protocols for Classifying, Monitoring, and Evaluating Stream/Riparian Vegetation on Idaho Rangeland and Streams, Protocol #8 describes the levels of data required for implementing the Idaho Antidegradation Policy; basic, reconnaissance, and intensive (IDHW, 1992). The monitoring strategy requires stratifying the stream into sub-areas based upon natural features, land use, and sampling recommendations. This protocol included; stream classification, green line, Solar Pathfinder, streambank stability, photo points, and channel cross sections.

Proper Functioning Condition (PFC)

The USDI-BLM Assessing Proper Functioning Condition consists of 17 factors to qualitatively assess stream function. Three categories include; proper functioning, functional at risk, or nonfunctional. PFC is used to assess riparian/wetland areas. PFC evaluates features that dissipate energy, reduce erosion, improve water quality, capture bedload, develop floodplains, improve flood-water retention, recharge groundwater, stabilize streambanks, provide habitat, and support greater biodiversity (BLM, 1998).

NRCS Tech Note ID-29 (SVAP)

The Stream Visual Assessment Protocol (SVAP) provides a simple procedure to evaluate stream conditions based on visual characteristics. SVAP includes 15 qualitative factors and corresponding numeric values, which are averaged to rate the reach's condition. Eleven ranking factors are required with three factors ranked when applicable. The protocol assesses riparian ecosystems condition; identifies opportunities to enhance biological value; conveys information on stream function; and stresses the need to protect or to restore riparian areas (NWCC, 1998). Currently, NRCS uses SVAP to assess aquatic habitat and recommends a "fair" rating as a minimum goal for conservation planning (NRCS, 2004).

Stream Classification

Rosgen offers a consistent method to describe and to measure stream characteristics (Rosgen 1996). The classification consists of four levels. This assessment used the first two levels. Level 1 is a geomorphic characterization that categorizes streams based on pattern, slope, and shape. Level 2 is the morphological description and requires measuring bankfull width and depth, floodplain width, channel materials, slope, and sinuosity. These factors are used to distinguish individual sub-categories for each stream type.

Estimating Streambank Erosion

Streambank Erosion Condition Inventory (SECI) is used to estimate long-term stream erosion rates. This method produces an index by ranking six factors; bank stability, bank condition, bank cover, channel shape, channel bottom and deposition. SECI is based on the direct volume method outlined in the Channel Evaluation Workshop (NRCS, 2000). The teams used SECI to estimate erosion on habitat units and the entire reach. Erosion is estimated by applying lateral recession rates (LRRs) to bank heights and lengths. SECI is used for comparison rather than erosion rates in a sediment budget (NRCS, 2000).

Assessment Results

From 1997 to 2000, seventy reaches were assessed on approximately 85 miles of rivers and creeks in the Blackfoot River subbasin, shown in Figure 13. BRWC, ISCC, IDEQ, IDL, BLM, IDFG, FS, and NRCS staff assessed where permission was granted by the landowners. The teams didn't assess where permission wasn't granted. They completed field sheets at each reach. Results are listed in Table 10.

PFC

The teams found 44% or 35 miles of the assessed reaches were at proper functioning condition (PFC). About 33% or 26 miles of reaches were found to be functional at risk (FAR). While 23% or 18 miles of reaches were rated as nonfunctional (N). Those results are shown in Figure 14.

Streambank Stability

Approximately 57% or 46 miles of the assessed reaches had streambank stability greater than or equal to the 80% TMDL target. About 43% or 34 miles of reaches had streambank stability less than the TMDL target, as shown in Figures 15 and 16.

SECI

SECI results show 54% or 24 miles of assessed reaches had slight erosion. While 26% or 11 miles rated in moderate erosion condition and 20% or 9 miles rated in the severe category. SECI reach conditions and total scores are shown in Figures 17 and 18.

Stream Classification

The stream classification of the assessed reaches found 37% or 28 miles were C channels; 24% or about 18 miles were B streams; 22% or 17 miles were E channels; 8% were F types; 5% were G type; and 4% were A channels. Stream types for assessed reaches are shown in Table 10.

Table 10. Riparian Assessment Reach Summary in the Blackfoot River Subbasin

Stream	Reach	Length (miles)	Bank Stability (%)	PFC Status	SECI Condition	Rosgen Type
Angus Creek	AC1	0.4	100%	PFC	Slight	E4
Blackfoot River	BR-C1	1.6	90%	PFC	Slight	B
Blackfoot River	BR-C2	1.3	70%	FAR	Slight	C3
Blackfoot River	BR-C3	0.9	35%	FAR	Slight	B3
Blackfoot River	BR-J1	2.1	50%	N	--	F5
Blackfoot River	BR-P1	3.7	35%	N	Severe	C5/C6
Blackfoot River	BR-R1	1.9	25%	N	Severe	B3
Brush Creek	BC4	1.3	10%	FAR	Severe	E5
Brush Creek	BC6	0.6	25%	FAR	Moderate	E6
Brush Creek	BC7	1.3	20%	FAR	Severe	B6
Brush Creek	BC10	1.0	90%	PFC	Moderate	C5
Brush Creek	BC11	1.7	97%	PFC	Moderate	E5
Corral Creek	CC1	1.5	100%	PFC	--	C2
Corral Creek	CC2	0.9	85%	FAR	--	C
Corral Creek	CC3	1.1	50%	PFC	--	F6
Corral Creek	CC4	0.5	50%	PFC	--	C
Corral Creek	CC5	1.3	90%	PFC	--	C
Corral Creek	CC6	1.2	80%	FAR	--	C
Corral Creek	CC7	1.3	100%	FAR	--	E
Corral Creek	CC8	2.6	100%	PFC	--	E
Corral Creek	CC9	0.8	100%	PFC	--	C
Corral Creek	CC10	0.8	95%	PFC	--	E
Corral Creek	CC11	1.4	95%	PFC	--	E
Corral Creek	CC12	1.2	100%	PFC	--	E
Corral Creek	CC12b	0.5	90%	FAR	--	E
Diamond Creek	DC1	1.6	30%	--	--	E4
Diamond Creek	DC2	2.6	75%	--	--	F/B3
Diamond Creek	DC3	2.1	70%	--	--	B3
Diamond Creek	DC4	2.9	70%	PFC	Slight	C4
Diamond Creek	DC5	1.7	100%	PFC	Slight	C4
Diamond Creek	DC6	1.2	100%	PFC	Slight	B3
Diamond Creek	DC7	0.3	70%	N	Severe	G
Diamond Creek	DC8	1.2	100%	FAR	Slight	B4
Diamond Creek	DC9	1.4	25%	PFC	Moderate	--
Dry Valley Creek	DVC1	2.0	100%	N	Moderate	--
Dry Valley Creek	DVC2	0.5	100%	PFC	Slight	E
Dry Valley Creek	DVC3	4.3	--	FAR	Slight	--
Dry Valley Creek	DVC4	1.9	100%	FAR	Moderate	C6
Dry Valley Creek	DVC5	0.8	100%	PFC	Slight	E
Dry Valley Creek	DVC6	0.9	85%	FAR	Moderate	C4
Dry Valley Creek	DVC7	0.5	100%	PFC	Slight	B6

Table 10. Riparian Assessment Reach Summary (continued)

Stream	Reach	Length (miles)	Bank Stability (%)	PFC Status	SECI Condition	Rosgen Type
Horse Creek	HC1	0.1	50%	N	--	F/G5
Horse Creek	HC2	0.3	35%	FAR	--	--
Horse Creek	HC3	0.1	100%	BC	--	B2
Horse Creek	HC4	0.1	100%	BC	--	--
Horse Creek	HC5	0.5	60%	FAR	--	C
Horse Creek	HC6	0.5	100%	FAR	--	--
Horse Creek	HC7	0.6	80%	FAR	--	C6
Lanes Creek	LC4	0.8	100%	FAR	Moderate	--
Lanes Creek	LC5	0.7	90%	FAR	Slight	B
Lanes Creek	LC6	1.2	--	N	Slight	C4
Lanes Creek	LC7	1.8	80%	PFC	Slight	C3
Lanes Creek	LC8	1.8	100%	PFC	Slight	C4
Maybe Creek	MC3	0.8	90%	PFC	--	B2
Poison Creek	PC1	0.3	100%	PFC	--	A3
Poison Creek	PC2	0.4	50%	FAR	--	B2
Poison Creek	PC3	0.8	80%	PFC	--	BC
Poison Creek	PC4	1.3	100%	PFC	--	A2/BC
Poison Creek	PC5	0.6	100%	PFC	--	E6/B2
Rawlins Creek	RC1	1.0	100%	FAR	--	B5
Rawlins Creek	RC2	1.4	100%	FAR	--	C4
Slug Creek	SC1	0.8	100%	PFC	Slight	E6
Slug Creek	SC2	0.9	100%	PFC	Moderate	E6
Wolverine Creek	WC1	0.6	95%	FAR	--	B5
Wolverine Creek	WC3	0.6	30%	N	--	C5
Wolverine Creek	WC4	1.1	100%	N	--	G
Wolverine Creek	WC5	0.4	100%	PFC	--	C5
Wolverine Creek	WC6	0.5	90%	PFC	--	B4
Wolverine Creek	WC7	2.0	50%	N	--	G
Wolverine Creek	WC8	1.4	15%	N	--	B4
Wolverine Creek	WC9	1.4	50%	FAR	--	B
Wolverine Creek	WC10	1.7	60%	N	--	A3
	Total	**85.3 Miles**				

Discussion

Over half of the reaches (57%) had greater streambank stability than IDEQ's TMDL target. About 44% of the assessed reaches were proper functioning and 54% of the reaches had only slight erosion. Overall, Corral Creek had proper function, stable streambanks, and slight erosion. Other reaches on Angus, Diamond, Dry Valley, Horse, Lanes, Poison, Rawlins, and Slug creeks also exhibit those same characteristics. Corral, Diamond, Dry Valley, Horse, Poison, Rawlins, and Slug creeks had several reaches with 80% of the banks covered and stable. Meadow, Sheep, and Trail creeks weren't assessed.

IDEQ (2001) concluded there were substantial, unstable segments on Brush, Corral, Diamond, Dry Valley, Lanes, and Wolverine creeks and the Blackfoot River. They also estimated load reductions ranging from 38% to 77% needed on Angus, Brush, Diamond, Dry Valley, Lanes, and Slug creeks. Of these streams, Brush Creek has the largest sediment reductions, from 51% to 77% (IDEQ, 2001).

Reaches having unstable, active head cuts include; BR-R1, CC1, DC7, DVC6, HC5, LC8, RC1, WC1, WC4, and WC7. These reaches may continue to degrade and affect adjacent reaches.

Nonfunctional reaches include BR-J1, BR-P1, BR-R1, DC7, DVC1, HC1, LC6, WC3, WC4, WC7, WC8, and WC10. These reaches tended to have higher stream instability and moderate to severe erosion conditions. Unstable reaches (<50% stable) included; BC4, BC6, BC7, BR-R1, BR-P1, BR-C3, DC1, DC9, HC2, WC3, and WC8. Severely eroding reaches were BR-P1, BR-R1, BC4, BC7, and DC7.

Reaches rated as functional at risk include; BC4, BC6, BC7, BR-C2, BR-C3, CC2, CC6, CC7, CC12b, DC8, DVC6, DVC3, DVC4, HC2, HC5, HC6, HC7, LC4, LC5, PC2, RC1, RC2, WC1, and WC9. These reaches vary greatly in ranges of streambank stability, erosion condition, and stream types.

As shown in Figure 19, when PFC and streambank stability values are combined, the worst reaches occur on the lower Blackfoot River, Brush and Wolverine creeks. Figure 20 shows reaches in the Blackfoot subbasin in the middle grouping when comparing erosion categories to other eastern Idaho watersheds.

More characteristics were assessed, but these are the major items evaluated. Because grazing is the primary land use along streams, the teams carefully evaluated livestock impacts on these streams (Blew, 1999). In some cases, livestock caused problems and some they didn’t. Several reaches were degraded by other factors and grazing hampered recovery efforts. Those other factors included: roads; droughts; floods; mass wasting; channelization; culverts; diversions; mining; farming; and beaver dynamics.

Recommendations

Those reaches on Brush, Corral, Diamond, Dry Valley, Horse, Lanes, Rawlins, and Wolverine creeks with active head cuts should be monitored and evaluated to determine if stabilization structures should be installed to prevent further degradation. Nonfunctional reaches on the lower Blackfoot River, Diamond, Dry Valley, Horse, Lanes, and Wolverine creeks should be surveyed to determine BMP alternatives, impacts on other reaches, and long term channel changes.

Functional at risk (FAR) reaches on the Blackfoot River and its tributaries should be high priorities because changing management with minor structural measures could improve these reaches substantially. The best opportunities for improvement occur on reaches along the upper and middle Blackfoot River, Brush, Corral, Dry Valley, Horse, Lanes, and Rawlins creeks.

When planning specific stabilization or restoration projects on the lower Blackfoot River, participants and planners must consider and address hydrologic modification and flow regulation from the Blackfoot Reservoir, and the Reservation, Just, and Little Indian canals. Those efforts should be in conjunction or consultation with the BIA and the Shoshone-Bannock Tribes. The reservation boundary is most often the other river bank. The MOU should be updated as the TMDL implementation plans are completed.

The ISCC and IASCD recognize the landowners, residents, operators, BRWC, SWCDs, BLM, FS, NRCS, and IDL are the entities working in the watershed to address problems on private and public lands. We can assist those entities in providing technical and financial assistance in developing and implementing conservation plans and best management practices.

Figure 13. Assessed Reaches in the Blackfoot River Subbasin

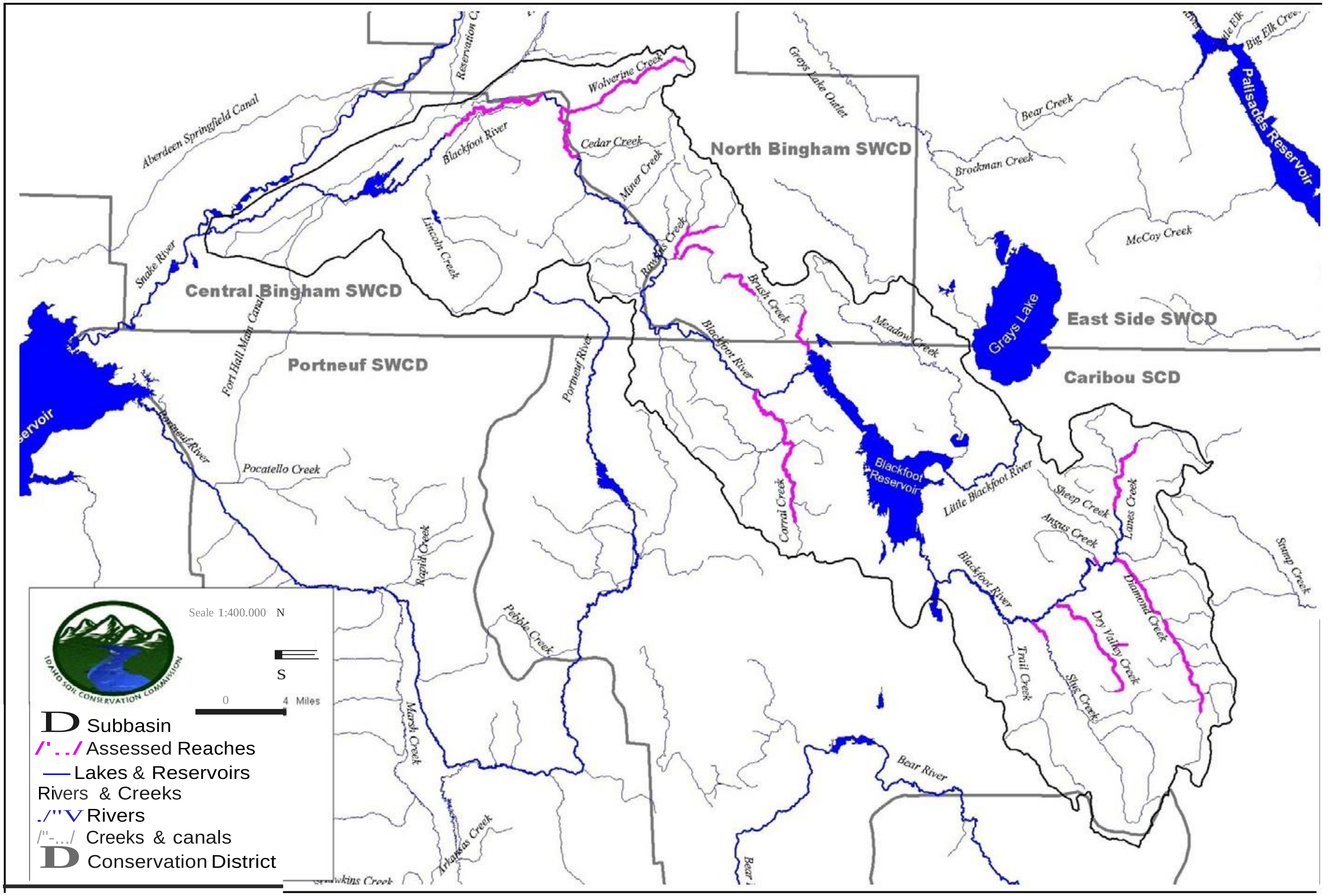


Figure 14. PFC Status of Assessed Reaches in the Blackfoot River Subbasin

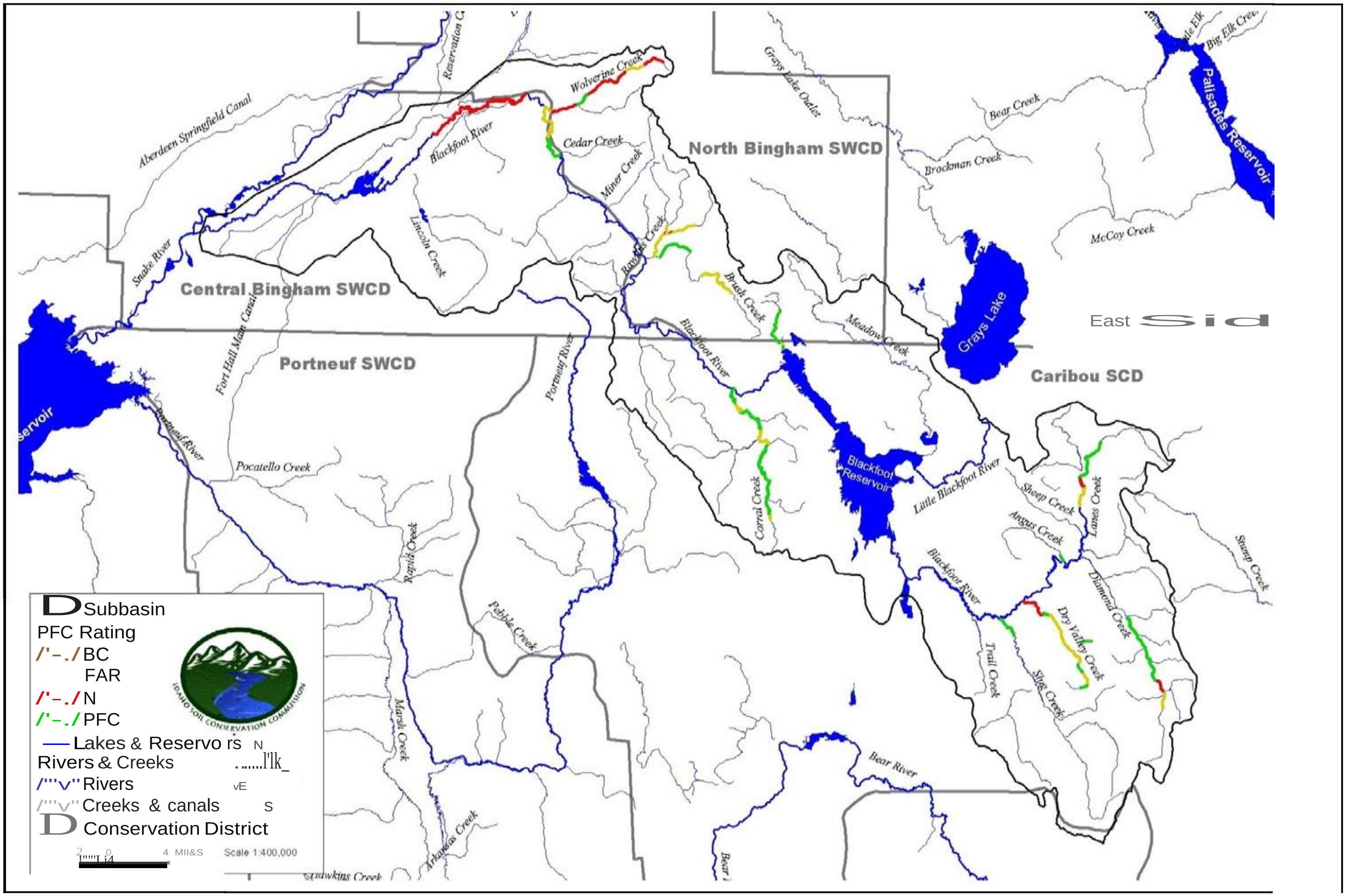


Figure 15. Streambank Stability of Assessed Reaches in the Blackfoot River Subbasin

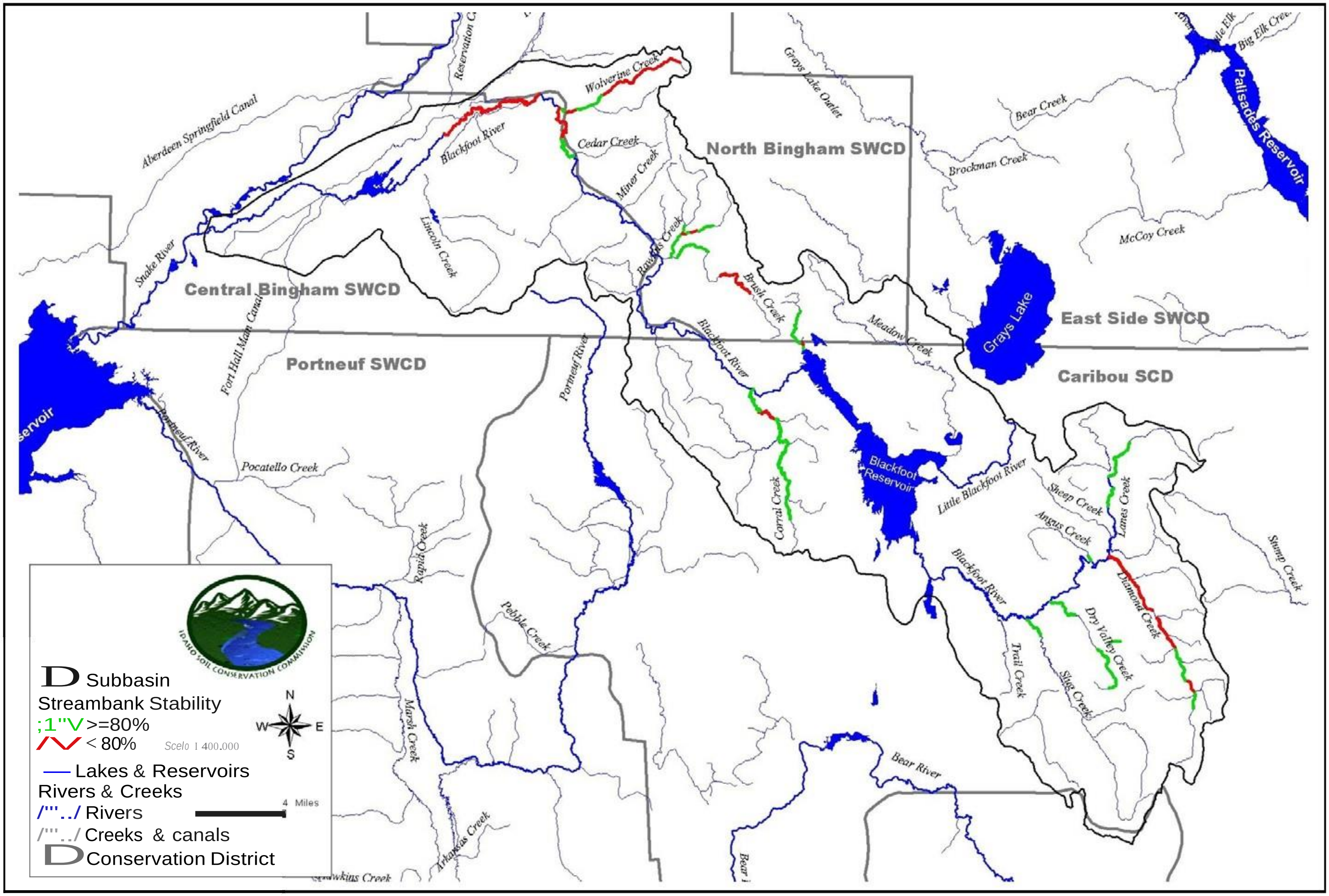


Figure 16. Percent Streambank Stability of Assessed Reaches in the Blackfoot River Subbasin

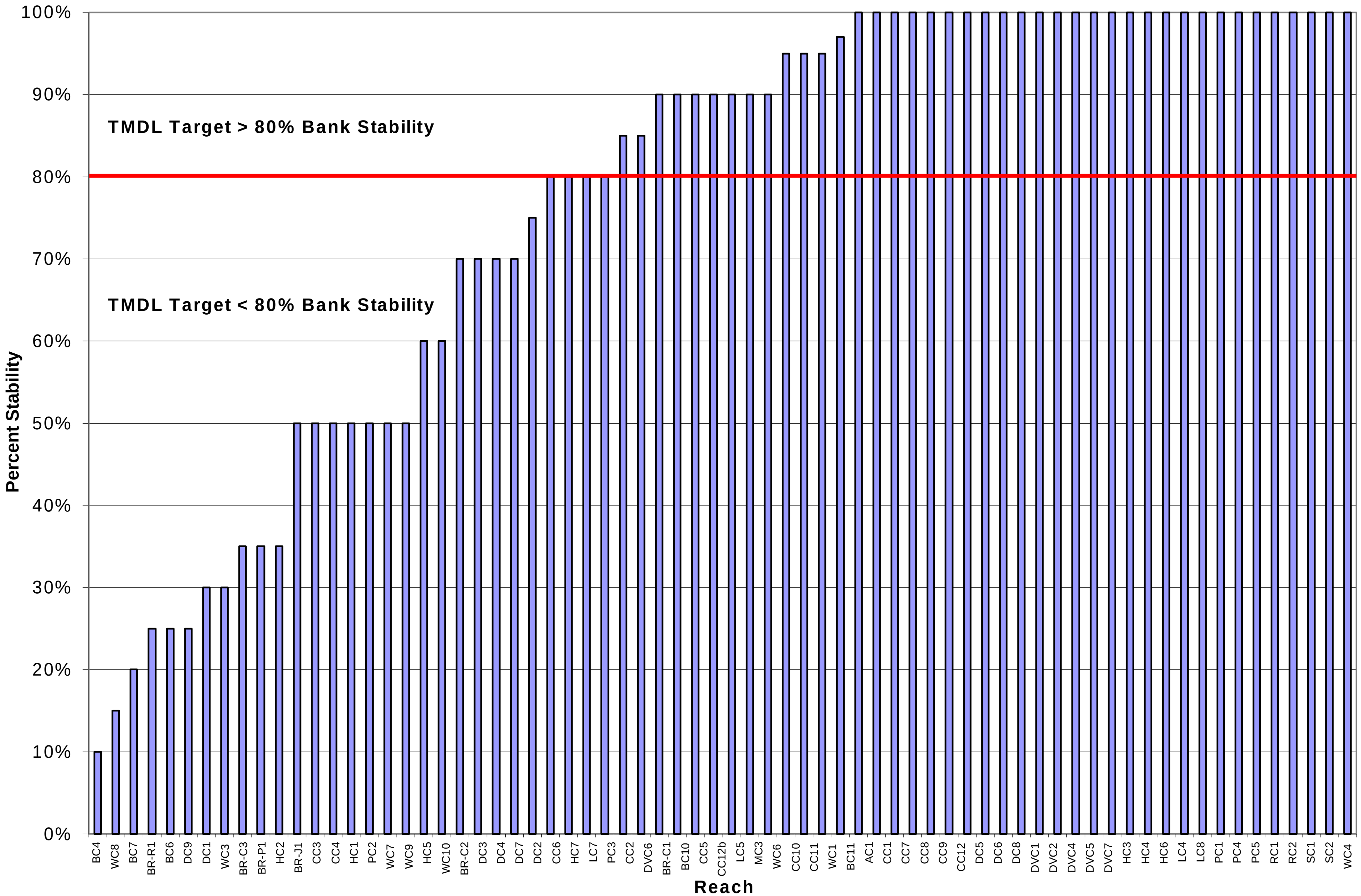


Figure 17. SECI Condition of Assessed Reaches in the Blackfoot River Subbasin

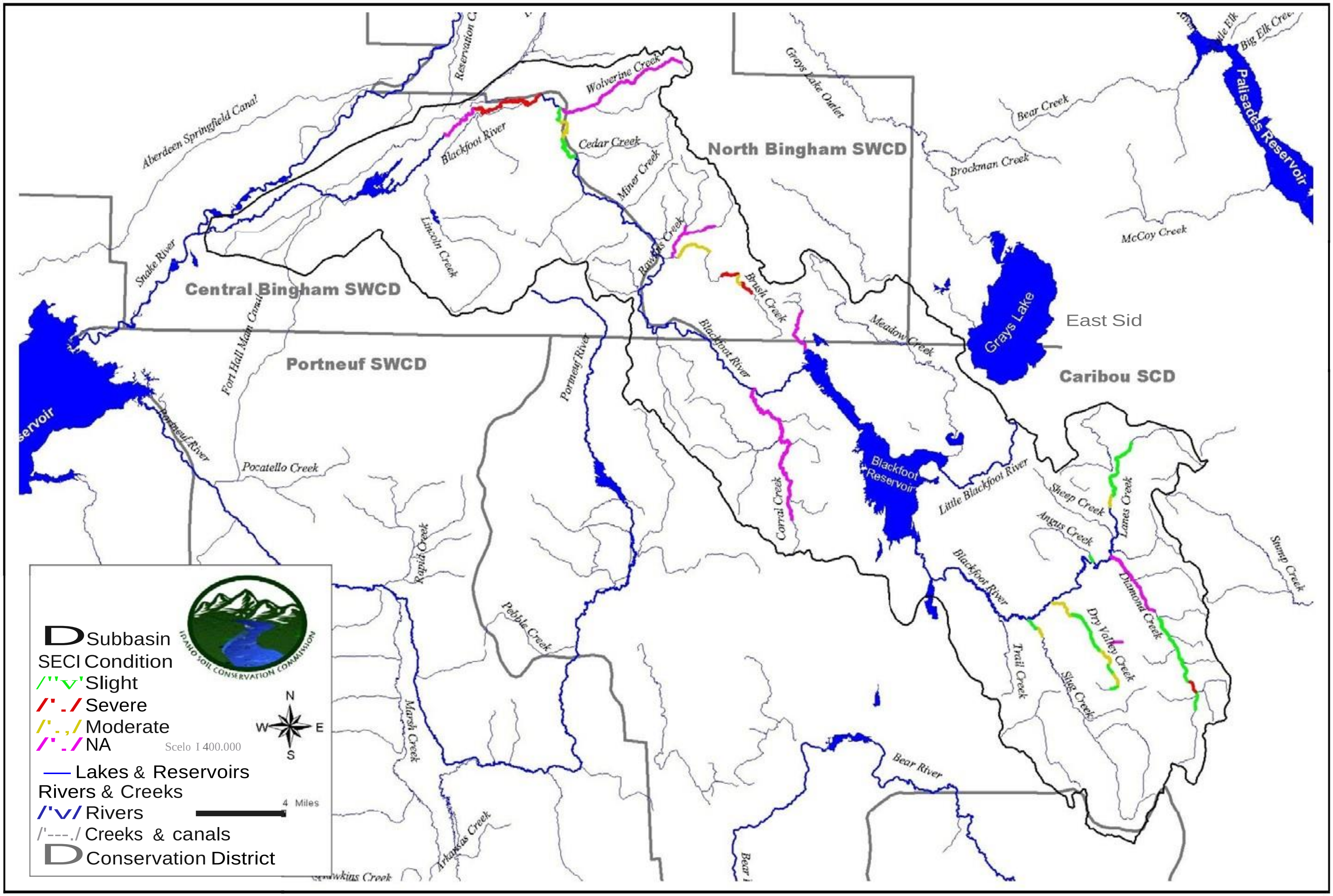


Figure 18. SECI Total Scores of Assessed Reaches in the Blackfoot River Subbasin

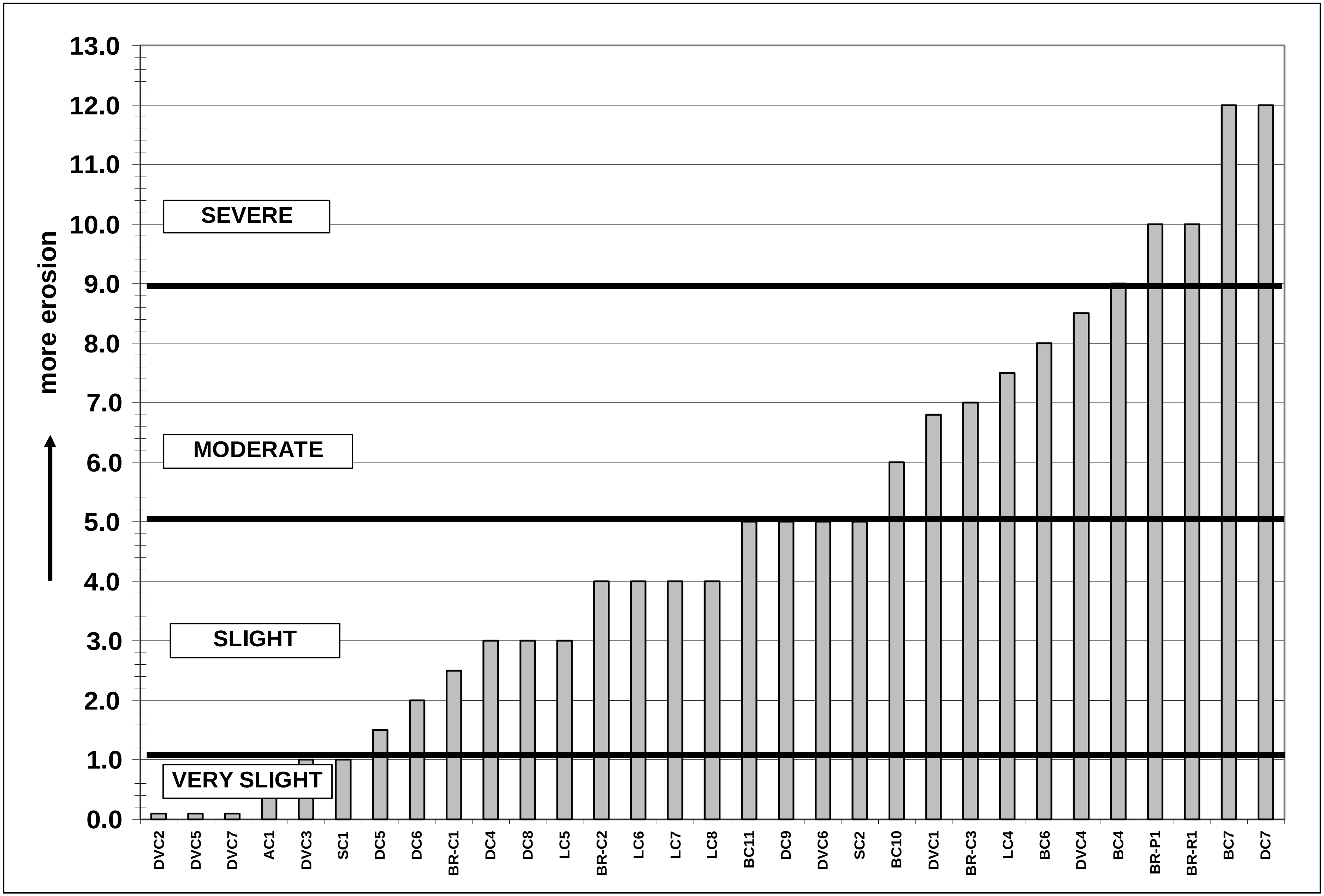


Figure 19. Streambank Stability and PFC Combined Scores of Assessed Reaches in the Blackfoot River Subbasin

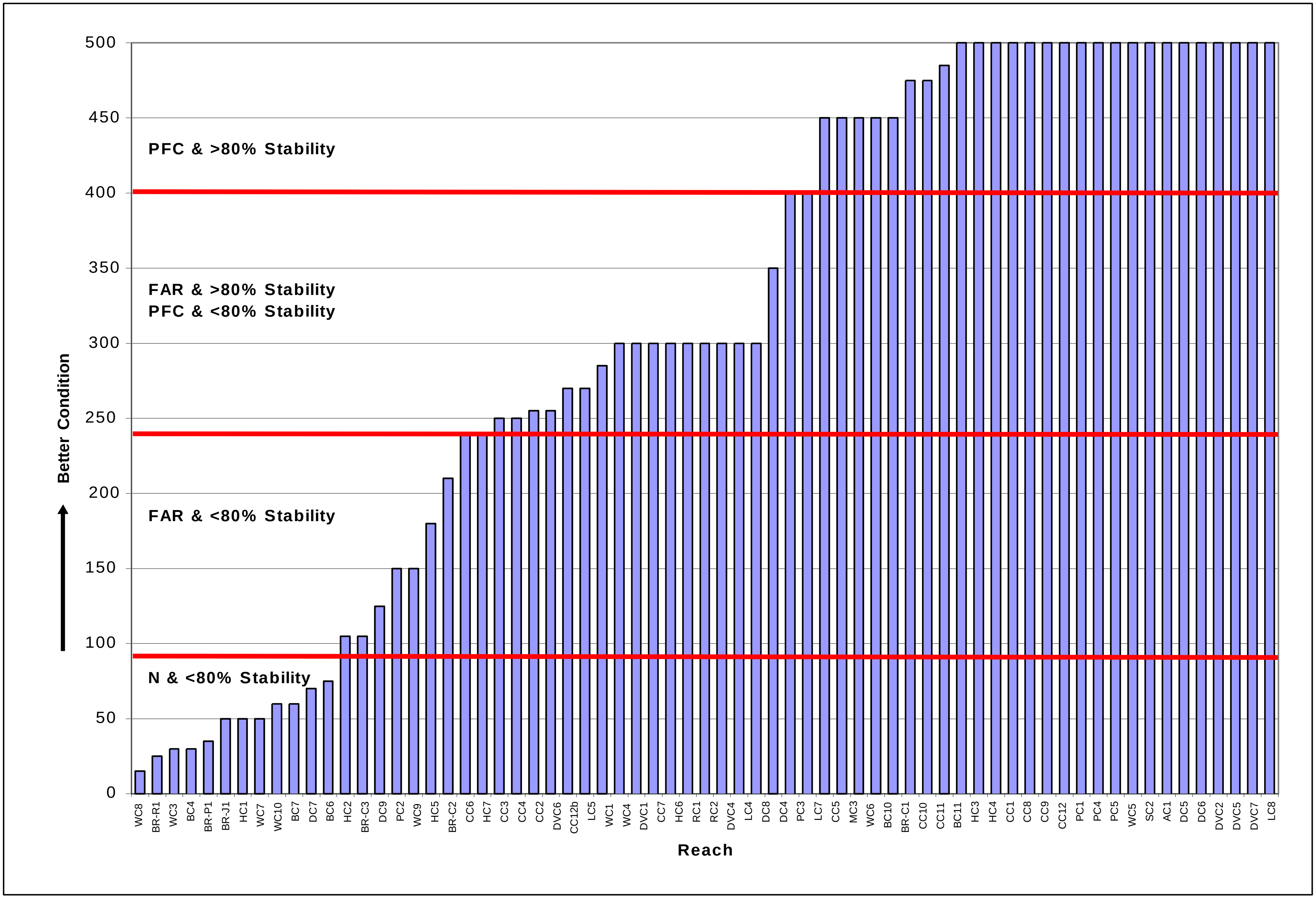
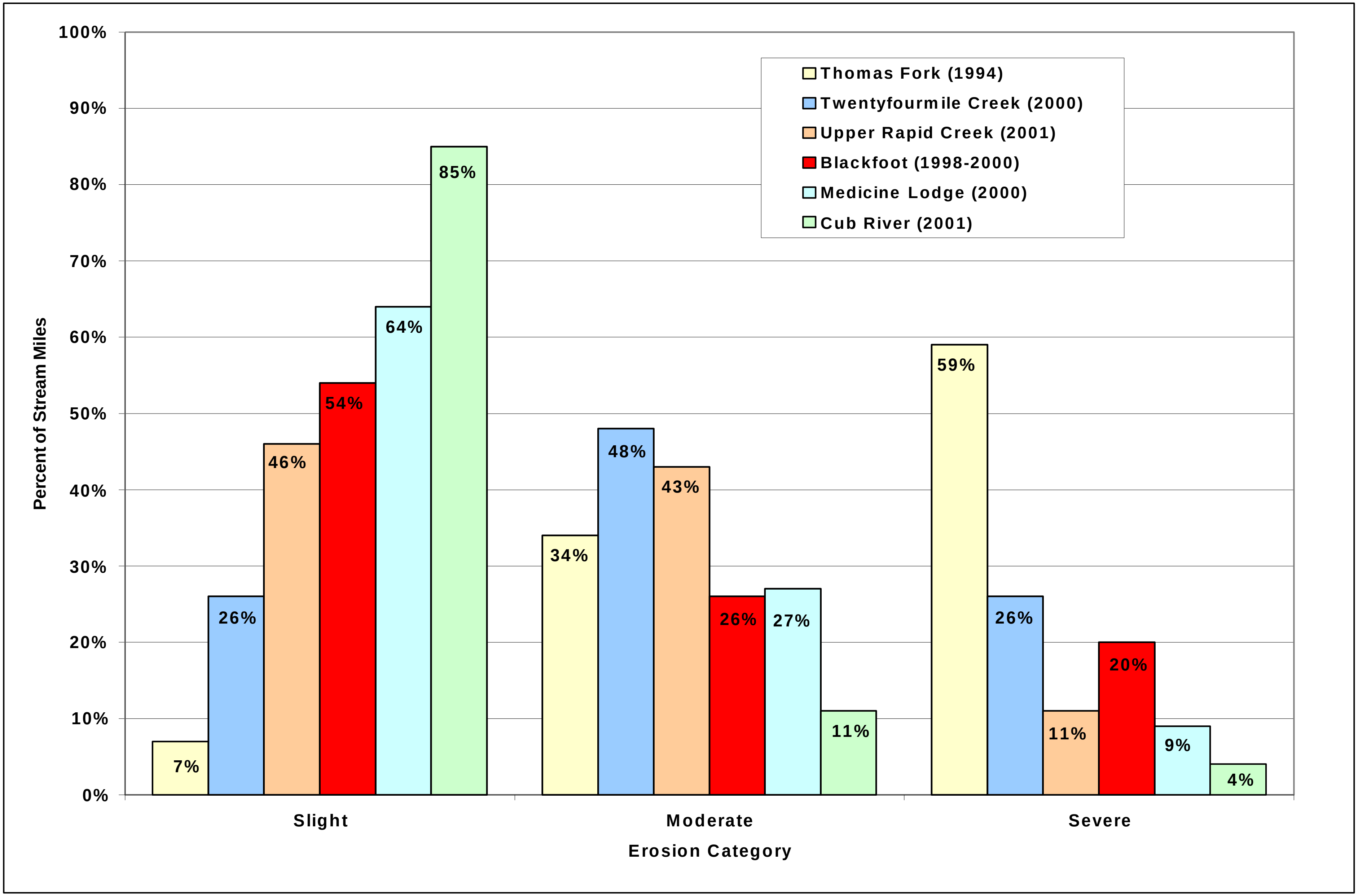


Figure 20. Comparison of Assessed Reaches in the Blackfoot River Subbasin and Eastern Idaho Watersheds



Problem Identification

Beneficial Use Status

The Blackfoot River's designated beneficial uses include cold water aquatic life, salmonid spawning, primary contact recreation, secondary contact recreation, domestic water supply, agricultural water supply, industrial water supply, wildlife habitat, and aesthetics. Current information suggests that some beneficial uses, such as cold water aquatic life and salmonid spawning are impaired and are not fully supported in several streams (IDEQ, 2001). The Blackfoot River has three segments listed from its headwaters to the Main Canal. Additionally there are 3 river segments and 14 tributaries on the state of Idaho's 1998 §303(d) list (IDEQ, 2001), shown in Figure 12. The Blackfoot River's cold water aquatic life and salmonid spawning beneficial uses are not supported due to sediment and nutrients (IDEQ, 2001).

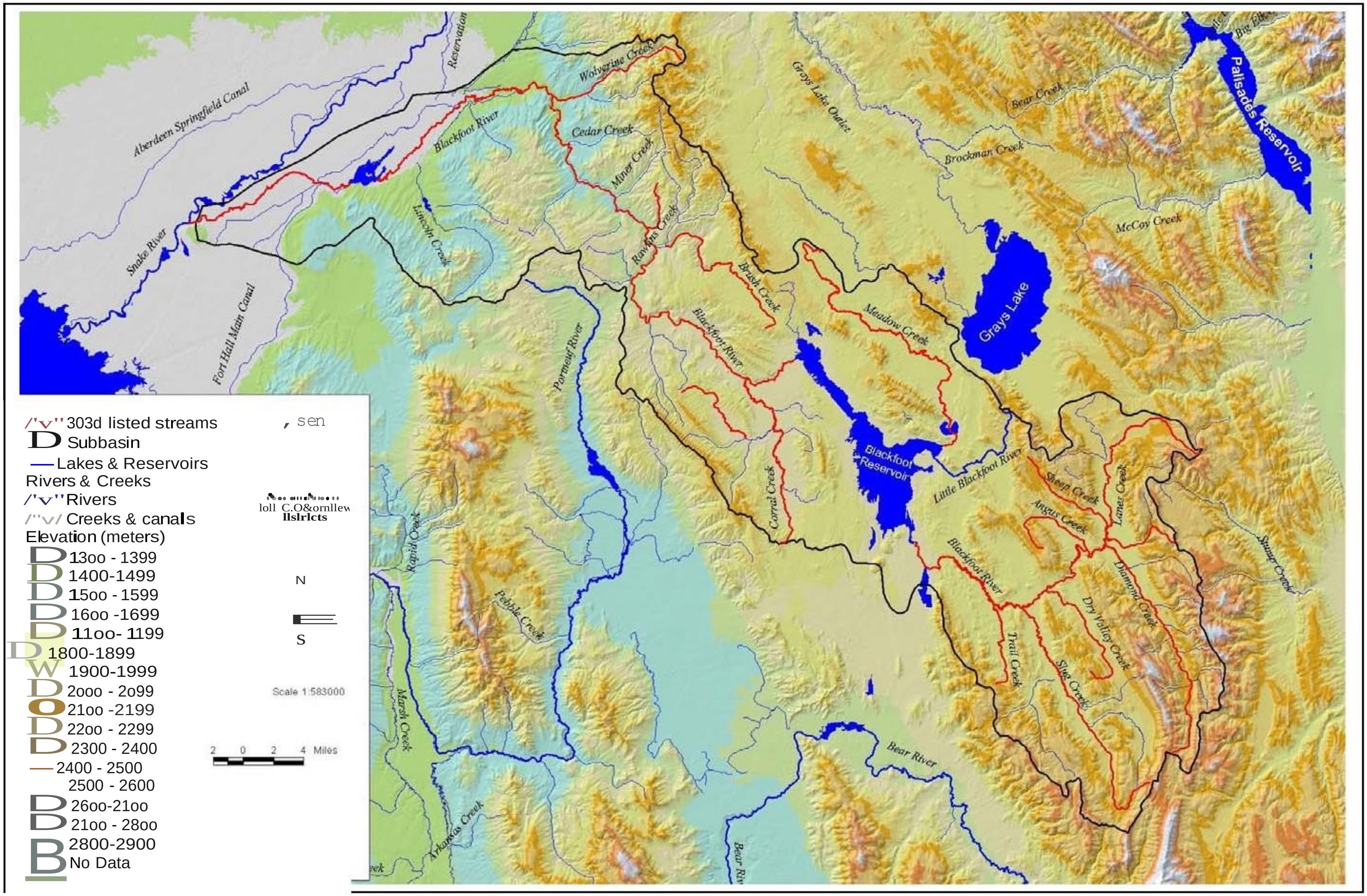
Table 11. 1998 State of Idaho's §303(d) Listed Segments in the Blackfoot River Subbasin

Waterbody	Segment Boundaries	Pollutants
Blackfoot River	Wolverine Creek to Main Canal	Sediment & nutrients
Blackfoot River	Blackfoot Dam to Wolverine Creek	Sediment, nutrients & flow alteration
Blackfoot River	Headwaters to Blackfoot Reservoir	Sediment & nutrients
Wolverine Creek	Headwaters to Blackfoot River	Sediment & nutrients
Corral Creek	Headwaters to Blackfoot River	Sediment
Meadow Creek	Headwaters to Blackfoot Reservoir	Sediment
Trail Creek	Headwaters to Blackfoot River	Sediment
Slug Creek	Headwaters to Blackfoot River	Sediment
Angus Creek	Headwaters to Blackfoot River	Sediment
Dry Valley Creek	Headwaters to Blackfoot River	Sediment
Diamond Creek	Headwaters to Blackfoot River	Sediment
Bacon Creek	Forest Service boundary to Lanes Creek	Sediment
Lanes Creek	Headwaters to Blackfoot River	Sediment
Sheep Creek	Headwaters to Lanes Creek	Sediment
Brush Creek	Headwaters to Blackfoot River	Unknown
Grizzly Creek	Headwaters to Corral Creek	Unknown
Maybe Creek	Maybe Canyon waste dump to Dry Valley Creek	Unknown

Table 12. Beneficial Uses for §303(d) Listed Waterbodies in the Blackfoot River Subbasin

Segment	Designated & Existing Uses
Blackfoot River, Wolverine Creek to Main Canal	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Primary Contact Recreation, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Blackfoot River, Blackfoot Dam to Wolverine Creek	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Primary Contact Recreation, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Blackfoot River, Headwaters to Blackfoot Reservoir	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Primary Contact Recreation, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Wolverine Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Corral Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Meadow Creek, Headwaters to Blackfoot Reservoir	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Trail Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Slug Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Angus Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Dry Valley Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Diamond Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Industrial Water Supply, Aesthetics and Wildlife Habitat
Bacon Creek, Forest Service Boundary to Lanes Creek	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Lanes Creek, Headwaters to Blackfoot River	Cold Water Aquatic life, Salmonid Spawning, Industrial Water Supply, Aesthetics and Wildlife Habitat
Sheep Creek, Headwaters to Lanes Creek	Agricultural Water Supply, Cold Water Aquatic life, Salmonid Spawning, Industrial Water Supply, Aesthetics and Wildlife Habitat
Brush Creek, Headwaters to Blackfoot River	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Grizzly Creek, Headwaters to Corral Creek	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat
Maybe Creek, Maybe Canyon Waste Dump to Dry Valley Creek	Agricultural Water Supply, Cold Water Aquatic life, Secondary Contact Recreation, Industrial Water Supply, Aesthetics and Wildlife Habitat

Figure 21. 1998 303(d) Listed Waterbodies in the Blackfoot River Subbasin



Pollutant Ranking

Sediment Priority Watersheds

Blackfoot River watersheds were ranked using TSS loads, percent reductions, TMDL target exceedance, PFC status, and percent streambank stability. Large contributors such as the lower and middle Blackfoot River segments and Wolverine Creek are considered high priority for BMPs. Sediment BMP priorities for the subbasin are presented in Table 13. The TMDL targets were applied to IASCD water quality data shown in Table 14.

Table 13. Sediment Priorities for Agricultural BMP Implementation

Priority	Watershed or Subwatershed	Segment	TSS Rank	Nonfunctional Rank	%Unstable Rank
HIGH	Lower Blackfoot	Blackfoot River from Little Indian Diversion to Snake River	1	3	1
	Wolverine Creek	Headwaters to the Blackfoot River Blackfoot River from Cedar Creek to Just	3	1	2
	Brush Creek	Headwaters to the Blackfoot River	5	5	3
MEDIUM	Middle Blackfoot	Blackfoot River from Government Dam to Cedar Creek	2	6	5
	Lanes Creek	Headwaters to Lanes Creek Blackfoot River from Diamond Creek to Slug	4	2	6
	Diamond Creek	Forest Service Boundary to Lanes Creek	8	4	4
LOW	Slug Creek	Headwaters to the Blackfoot River	6	7	7
	Meadow Creek	Headwaters to the Blackfoot Reservoir	7	8	8
	Upper Blackfoot	Blackfoot River from Slug Creek to the Blackfoot Reservoir	9	9	9

Table 14. TSS Loads and Exceedances for the Blackfoot River and Tributaries

Monitoring Site	Average TSS Load (tons/day)	Average TSS Load @ TSS^{50} Target (tons/day)	Average TSS Load Reduction	TSS^{50} Target Exceedance
Wolverine Creek*	0.40	0.34	15%	17%
Brush Creek*	0.13	0.11	15%	8%
Rawlins Creek*	0.20	0.20	0%	0%
Corral Creek*	0.18	0.16	11%	3%
Slug Creek*	0.02	0.02	0%	10%
Angus Creek*	0.03	0.03	0%	0%
Blackfoot River @ IDFG WMA*	0.91	0.87	3%	3%
Diamond Creek*	0.01	0.01	0%	0%
Blackfoot River @ Rich Lane Bridge*	65.6	52.3	20%	18%
Blackfoot River @ Little Indian Bridge *	29.9	24.2	19%	14%
Blackfoot River @ Morgan’s Crossing Bridge*	18.1	18.1	0%	0%
Blackfoot River @ Government Dam Bridge*	11.1	8.5	23%	10%

* 2000-2003 water quality data from IASCD on the Blackfoot River and its tributaries

Nutrient Priority Watersheds

Segments and tributaries of the Blackfoot River were ranked based upon their TP loads, percent reduction, and TMDL target exceedance. The IASCD didn't test for ammonia but still used 0.30 mg/L target for nitrate+nitrite (Fischer, 2002).

The Blackfoot River at Henry and below Government Dam has significant TP loads and TP target exceedance. Rawlins, Brush, and Angus creeks have much smaller loads of TP but exceed the TP targets regularly. The Blackfoot River at Rich Lane Bridge and near Blackfoot has significant NNO3 loads.

Phosphorus and nitrogen runoff includes two processes, surface runoff and subsurface flow. The loss of phosphorus occurs in sediment bound and dissolved forms (Sharpley et al., 1999). Nitrogen doesn't readily bind to sediment, moves easily in the water column, and cycles continuously (FISRWG, 1998).

Nutrient BMP priorities are presented in Table 15. Water quality monitoring data collected by IASCD and USGS were compared to estimate these load reductions which are shown in Tables 16 and 17.

Table 15. Blackfoot River Nutrient Priorities for Agricultural BMP Implementation

Priority Category	Watershed or Subwatershed	TP Rank	NNO3 Rank	Segment
HIGH	Upper Blackfoot	1	1	Blackfoot River from Slug Creek to the Blackfoot Reservoir
	Brush Creek	2	2	Headwaters to the Blackfoot River
	Middle Blackfoot	3	3	Blackfoot River from Government Dam to Cedar Creek
MEDIUM	Lower Blackfoot	4	4	Blackfoot River from Little Indian Diversion to Snake River
	Lanes Creek	5	5	Headwaters to Lanes Creek Blackfoot River from Diamond Creek to Slug Creek
	Wolverine Creek	6	6	Headwaters to the Blackfoot River Blackfoot River from Cedar Creek to Just Canal Diversion
LOW	Diamond Creek	7	7	Forest Service Boundary to Lanes Creek
	Slug Creek	8	8	Headwaters to the Blackfoot River
	Meadow Creek	9	9	Headwaters to the Blackfoot Reservoir

Table 16. TP Loads and Exceedance for the Blackfoot River and Tributaries

Monitoring Site	Average TP Load (lbs/day)	Average TP Load @ TP Target (lbs/day)	Average TP Load Reduction	TP Target Exceedance
Wolverine Creek*	1.0	0.9	10%	9%
Brush Creek*	1.7	1.0	41%	25%
Rawlins Creek*	2.1	1.1	48%	15%
Corral Creek*	1.4	0.8	43%	8%
Slug Creek*	0.1	0.1	0%	40%
Angus Creek*	1.1	0.8	27%	59%
Blackfoot River @ IDFG WMA*	6.3	5.7	10%	3%
Diamond Creek*	0.1	0.1	0%	0%
Blackfoot River @ Rich Lane Bridge*	162.1	144.8	11%	18%
Blackfoot River @ Little Indian Bridge*	113.4	102.4	10%	14%
Blackfoot River @ Morgan's Crossing Bridge*	175.4	170.3	3%	25%
Blackfoot River @ Government Dam Bridge*	159.8	127.9	20%	50%
Blackfoot River nr Blackfoot (USGS 13068500)**	73.9	43.1	42%	22%
Blackfoot River nr Henry (USGS 13065500)***	442.5	146.6	67%	30%

* 2000-2003 water quality data from IASCD on tributaries to the Blackfoot River
** 1971-1997 water quality data on Blackfoot River USGS Gage Station near Blackfoot
*** 1970-1981 water quality data on Blackfoot River USGS Gage Station near Henry

Table 17. NNO3 Loads and Exceedance for the Blackfoot River and Tributaries

Monitoring Site	Average NNO3 Load (lbs/day)	Average NNO3 Load @ TIN Target (lbs/day)	Average NNO3 Load Reduction	NNO3 Target Exceedance
Wolverine Creek*	7.4	3.1	58%	31%
Brush Creek*	3.4	1.2	65%	18%
Rawlins Creek*	9.3	3.1	67%	28%
Corral Creek*	8.7	2.9	67%	24%
Slug Creek*	0.0	0.0	0%	10%
Angus Creek*	1.8	0.6	67%	3%
Blackfoot River @ IDFG WMA*	40.7	15.3	62%	11%
Diamond Creek*	9.2	3.3	64%	33%
Blackfoot River @ Rich Lane Bridge*	1,108.6	377.9	66%	59%
Blackfoot River @ Little Indian Bridge*	503.9	168.1	67%	21%
Blackfoot River @ Morgan's Crossing Bridge*	814.5	290.7	64%	25%
Blackfoot River @ Government Dam Bridge*	147.8	57.9	61%	30%
Blackfoot River nr Blackfoot (USGS 13068500) **	436.8	109.8	75%	26%
Blackfoot River nr Henry (USGS 13065500) ***	267.8	180.0	33%	22%

* 2000-2003 water quality data from IASCD on tributaries to the Blackfoot River
** 1971-1997 water quality data on Blackfoot River USGS Gage Station near Blackfoot
*** 1970-1981 water quality data on Blackfoot River USGS Gage Station near Henry

Critical Acres

Critical acres are those areas having the most significant impact on the quality of the receiving waters. These critical acres include pollutant source and transport areas. Private agricultural land accounts for 262,190 acres in the subbasin while the major private land use is range land with 403,890 acres.

Because the TMDL reductions are so substantial, it is estimated that 73% or 191,085 acres of private agricultural land would need BMPs implemented for sediment, phosphorus, and nitrogen. In order to allocate available resources effectively, implementation should be focused in high priority watersheds. Furthermore, BMP implementation efforts should be focused toward tiers as shown in Table 18.

Implementation Tiers

Critical areas adjacent to the Blackfoot River and its tributaries in Tier 1 are considered high priority for implementation due to the increased potential to directly impact surface water quality. Accordingly, the following is a general rule that applies to the priority of critical acres.

Tier 1 **Stream channels and riparian areas directly impacting beneficial uses**

Tier 2 **Fields indirectly, yet substantially altering water quality**

Tier 3 **Upland areas or fields indirectly affecting water quality**

Tier 4 **Animal facilities directly or indirectly influencing water quality**

Table 18. Critical Areas by Watershed or Subwatershed in the Blackfoot River Subbasin

Implementation Tiers		Tier 1	Tier 2	Tier 3	Tier 4
Priority	**Watershed or Subwatershed**	**Riparian Acres**	**Crop and Pasture Acres**	**Range Acres**	**Animal Facilities**
HIGH	Wolverine Creek	250	9,700	9,440	4
	Lower Blackfoot	843	18,599	1,835	5
	Brush Creek	81	2,114	10,094	2
MEDIUM	Middle Blackfoot	819	5,643	27,672	7
	Meadow Creek	845	1,593	24,861	2
	Lanes Creek	3,408	1,813	24,949	3
	Upper Blackfoot	1,676	9,206	20,175	15
LOW	Slug Creek	512	3,992	8,145	8
	Diamond Creek	508	0	2,312	2
	Total	**8,942**	**52,660**	**129,483**	**55**

Proposed Treatment

Each agricultural critical area is divided into one or more treatment units. These units describe critical areas with similar land uses, soils, productivity, resource concerns, and treatment needs.

Approximately 271 acres of riparian and wetlands; 11,489 acres of crop and pasture; 1,790 acres of range land; and 9 animal facilities, shown in Table 19, were removed from the critical area amounts in Table 18. These were removed because they meet NRCS resource quality criteria. The remaining treatment amounts, shown in Table 18, should be treated to NRCS resource quality criteria in order to meet the TMDL targets and pollutant reductions.

Table 19. Treated Acres by Watershed or Subwatershed in the Blackfoot River Subbasin

Implementation Tiers	**Tier 1**	**Tier 2**	**Tier 3**	**Tier 4**
Watershed or Subwatershed	**Riparian Acres**	**Crop and Pasture Acres**	**Range Acres**	**Animal Facilities**
Wolverine Creek	2	0	450	1
Lower Blackfoot	23	326	0	8
Brush Creek	0	342	0	0
Middle Blackfoot	30	8,668	1,290	0
Meadow Creek	0	606	0	0
Lanes Creek	0	0	0	0
Upper Blackfoot	216	1,547	0	0
Slug Creek	0	0	0	0
Diamond Creek	0	0	0	0
Total	**271**	**11,489**	**1,740**	**9**

Treatment Unit (TU1) Stream Channels and Riparian Areas

Acres	Soils	Resource Problems
8,942	**Bear Lake-Lago-Merkley or Downata-Bear Lake-Tendoy:** deep, moderately well to poorly drained soils that formed in silty alluvium on floodplains and low terraces with slopes ranging from 0 to 2 percent **Newdale-Swanner-Tetonia:** Nearly level to steep, well-drained, deep and shallow, medium-textured soils on uplands with 12 to 60 percent slopes	Unstable & erosive stream channels Lack of riparian vegetation Barriers to fish migration

Treatment Unit (TU2) Crop and Pasture Lands

Acres	Soils	Resource Problems
52,660	**Bannock-Bock:** Nearly level to moderately sloping, well-drained, deep, medium textured soils on alluvial terraces with slopes from 0 to 12 percent **Wolverine-Sasser-Stan:** Nearly level to moderately steep, excessively drained and well-drained, deep, coarse-textured and moderately coarse textured soils on terraces with 0 to 30 percent slopes **Rexburg-Ririe-Iphil or Bancroft-Paulson-Lanark or Lanark-Dranyon-Nielsen:** shallow to deep, well drained, soils formed in loess and silty alluvium, mixed alluvium, with slopes from 0 to 20 percent	Accelerated sheet & rill, gully, or irrigation-induced erosion, nutrient leaching & runoff

Treatment Unit (TU3) Range Lands

Acres	Soils	Resource Problems
129,483	**Newdale-Swanner-Tetonia:** Nearly level to steep, well-drained, deep and shallow, medium-textured soils on uplands with 12 to 60 percent slopes **Rexburg-Ririe-Iphil or Bancroft-Paulson-Lanark or Lanark-Dranyon-Nielson:** deep and very deep, well drained, soils formed in loess and silty alluvium, mixed alluvium, colluvium and residuum derived from limestone, dolomite and related rock with slopes from 0 to 60 percent **Sheege-Pavohroo:** Nearly level to steep, well-drained, shallow and deep, medium-textured soils on mountains with slopes from 0 to 60 percent **Wahtigrup-Ricrest-Hymas:** Moderately sloping to very steep, excessively drained and well drained, gravelly, stony, and extremely stony, medium textured soils on mountain slopes and ridges with 8 to 60 percent slopes	Accelerated gully erosion Lack of drinking water sources

Treatment Unit (TU4) Animal Facilities

Units	Soils	Resource Problems
55	**These facilities are found on all the soils described in (TU1) Stream Channel and Riparian Areas; (TU2) Crop and Pasture Lands; and (TU3) Range Lands**	Lack of drinking water sources Inadequate waste storage Bacteria & nutrient runoff from corrals or pens

Estimated Costs for TMDL Agricultural Implementation

The IASCD estimated the cost to implement the agricultural component of the Blackfoot River TMDL would be approximately $11 million (Koester, 1997). Currently, the estimated cost for the agricultural portion of the TMDL is approximately $16 million. This estimate is based on the proposed treatment unit amounts in Table 18 and then applied to BMP cost-share lists (NRCS, 2004). This figure was derived by summing the implementation, administrative, and technical costs for each watershed or subwatershed shown in Table 20. Sources of available assistance are listed in Table 22.

Table 20. Estimated Cost for TMDL Agricultural BMPs in the Blackfoot River Subbasin

Watershed or Subwatershed	Tier 1 Riparian Cost	Tier 2 Crop/Pasture Cost	Tier 3 Range/Forest Cost	Tier 4 Animal Facilities Cost	Watershed or Subwatershed Total Cost
Wolverine Creek	$520,100	$452,100	$502,800	$138,500	$1,613,500
Lower Blackfoot	$895,700	$870,400	$100,700	$173,100	$2,039,900
Brush Creek	$90,900	$31,700	$478,100	$69,300	$670,000
Middle Blackfoot	$129,500	$269,200	$1,441,400	$242,400	$2,082,500
Meadow Creek	$146,700	$86,000	$1,307,300	$69,300	$1,609,300
Lanes Creek	$349,800	$101,700	$1,307,300	$103,900	$1,862,700
Upper Blackfoot	$142,600	$482,600	$1,072,600	$519,500	$2,217,300
Slug Creek	$79,900	$178,900	$435,800	$33,900	$728,500
Diamond Creek	$58,700	$0	$112,800	$69,300	$240,800
BMP Subtotal	**$2,413,900**	**$2,472,600**	**$6,758,800**	**$1,419,200**	**$13,064,500**
Administration & Technical (20% of BMPs)	$482,800	$494,500	$1,351,800	$283,400	$2,612,900
Subbasin Total	**$2,896,700**	**$2,967,100**	**$8,110,600**	**$1,702,600**	**$15,677,400**

Implementation Alternatives

Implementation alternatives were developed that focused on the identified treatment units. The following alternatives were developed for consideration:

1. No action
2. Land treatment with structural and management BMPs
3. Riparian and stream channel restoration
4. Animal facility waste management

Description of Alternatives

Alternative 1 - No action

This alternative continues the existing conservation programs without additional project activities or voluntary landowner participation. The identified problems would continue to negatively impact beneficial uses in the subbasin and the Blackfoot River.

Alternative 2 - Land treatment with BMPs on crop, pasture & range lands

This alternative would reduce accelerated sheet and rill, gully, and irrigation-induced soil erosion. It would also reduce nutrient runoff from animal waste and fertilizer applications. This will improve water quality and reduce pollutant loading to the Blackfoot River. Beneficial uses would be sustained or improved with implementation of this alternative. This alternative includes voluntary participation.

Alternative 3 - Riparian and stream channel restoration

This alternative would reduce accelerated streambank and channel erosion. It would also reduce nutrient runoff from animal waste and fertilizer applications. This alternative would improve water quality, riparian vegetation, aquatic habitat, and fish passage and reduce pollutant loading to the Blackfoot River. Beneficial uses would be improved with implementation of this alternative. This alternative includes voluntary participation.

Alternative 4 - Animal facility waste management

This alternative would reduce sediment, nutrients, and bacteria from animal waste storage and application areas. This will improve water quality and reduce pollutant loading to the Blackfoot River. Beneficial uses will be sustained or improved with implementation of this alternative. This alternative includes voluntary and mandatory participation.

Alternative Selection

The CBSWCD, NBSWCD, and CSCD selected alternatives that combined Alternatives #, #, and # for the subbasin. These alternatives meet the objectives set forth in their resource conservation plans by improving water quality in the Blackfoot River. The timeline for implementation, shown in Table 21, can only occur if all actions are fully funded and all residents, landowners, and operators participate.

Table 21. Estimated Timeline for TMDL Agricultural Implementation

Task	Output	Milestone
Evaluate the project areas	Assessment reports	2008
Develop conservation plans and contracts	Completed plans and contracts	2010
Finalize BMP designs	Completed BMP plans and designs	2012
Design and install approved BMPs	Certify BMP installations	2015
Track BMP installations	Implementation progress reports	2017
Evaluate BMP & project effectiveness	Complete project effectiveness reports	2020

Table 22. Sources of Technical and Financial Assistance in the Blackfoot River Subbasin

Funding Program	Acronym	Agency
Water Quality Program for Agriculture	WQPA	ISCC
Resource Conservation & Development	RC&D	NRCS
Emergency Watershed Protection Program	EWP	NRCS
Small Watershed and Flood Prevention Program	PL-566	NRCS
Cooperative River Basin Studies Program	CRBS	NRCS
Rural Clean Water Program	RCWP	NRCS
Food Security Act of 1985	FSA	NRCS
Food, Agricultural, Conservation and Trade Act of 1990	FACTA	NRCS
Section 319 Nonpoint Source Management Program Grants	319	IDEQ
Resource Conservation and Rangeland Development Program	RCRDP	ISCC
Grazing Lands Conservation Initiative	GLCI	NRCS
Natural Resource Conservation Credit	--	ISCC
Environmental Quality Incentives Program	EQIP	NRCS
Soil and Water Conservation Assistance Program	SWCA	NRCS
FWS Partners Program	--	USFWS
Columbia Basin Fish and Wildlife Program	CBFWP	CBFWA
Conservation Reserve Program	CRP	FSA
Continuous Sign-Up Conservation Reserve Program	CCRP	FSA
Wetland Reserve Program	WRP	NRCS
Wildlife Habitat Incentives Program	WHIP	NRCS
Habitat Improvement Program	HIP	IDFG
State Revolving Fund	SRF	IDEQ &ISCC
Conservation Security Program	CSP	NRCS
Grasslands Reserve Program	GRP	FSA
Conservation Reserve Enhancement Program	CREP	FSA
Emergency Conservation Program	ECP	FSA
National Fish and Wildlife Foundation Grants Program	NFWFGP	NFWF
Fisheries Restoration and Irrigation Mitigation Program	FRIMA	USFWS
Water Conservation Field Services Program	WCFSP	BOR
Conservation of Private Grazing Land	CPGL	NRCS
Conservation Technical Assistance	CTA	NRCS
Farmland Protection Program	FPP	NRCS
Forestry Incentives Program	FIP	NRCS & FS
Aberdeen, Idaho Plant Materials Center	PMC	NRCS
National Cooperative Soil Survey Program	NCSS	NRCS
Stewardship Incentive Program	SIP	FS
Nutrient Management Program	NMP	ISDA
Floodplain Management Services Program	FPMS	USACE
Continuing Authorities Program, Sections 206 & 1135	CAP	USACE
Idaho Water Resource Board Financial Program	--	IDWR
Idaho Fish Screening & Passage Program	--	IDFG

Nonpoint Source Pollution Control Efforts

Watershed Council Efforts

The Blackfoot River Watershed Council (BRWC), Caribou, North and Central Bingham conservation districts have held several public tours, meetings, workshops, and mini-courses to learn more about resource issues, TMDL inventories, conservation projects, and conservation programs.

The BRWC and its members are very active in the watershed. They cooperate with landowners, residents, government agencies, tribes, consultants, engineers, and schools. Charlotte Reid, BRWC provided the information on projects implemented since the council began working in the watershed (Reid, 2004).

They're most ambitious project was along the lower Blackfoot River above Rich Lane Bridge. The river bank is comprised of Blackfoot silt loam, about four feet deep with very fine sand and heavy clay layers. High river flows washed about eight feet of the bank away. Volunteers installed steel pilings with welded rebar and cable between them. They then tied cedar trees to the rebar and cable. Volunteers planted willow cuttings on the top and bottom of the bank. This effort reduced streambank erosion. The council monitors the project and noticed the trees didn't collect the expected amount of sediment. They think its because anchors weren't used on the trees and they fluctuate with river flows.

In the 1990s, a downcut on Wolverine Creek was blocking fish passage. Folks living upstream were concerned and asked the BRWC for assistance. After looking into several possibilities, a restoration company suggested the best alternative. The landowner paid for the company's restoration work. A series of pools made from native rock was built. Riparian shrubs were planted by volunteers. The project's total cost was less than $10,000 and was a great success.

The council helped fence riparian areas, install water gaps, and plant willows/dogwoods on an eroding river. They observed the project and found beavers were eating the plantings. So, Russian olive trees were cut down and placed over the planted cuttings thus discouraging the beavers. The tree revetments also captured sediment along the bank and more cuttings were planted.

They have found that Coyote willow cuttings are the most successful. Additionally, Elderberry roots have survived and grown. Dogwood cuttings have grown. Golden currant root balls were planted and survived. Red Western river birch rooted plants haven't survived. They recognized livestock won't linger on a streambank if they are crowded and will move away after watering.

Another project transplanted beaver into Jones Creek. Streambanks were beginning to heal but the beavers were becoming a nuisance to the neighbors and damaging landscape trees. Consequently, the beavers were trapped or shot. The BRWC hopes to try again, making the neighbors aware of their goal and prevent the beaver from damaging the trees.

Eastern Idaho Grazing Association move livestock daily and weekly through the range to improve upland and riparian areas. Annual vegetation monitoring shows improvement with this effort. Many monitoring points are established on streams and uplands to show management results. A CRP field was intensively grazed using portable fence and moving cattle closely across the field to improve resources. Grazing associations in the Blackfoot Mountains are fencing more rotational grazing while paying attention to streams and grazing pressure. Many ranchers are more aware of riparian health and feed cattle away from the stream. Chesterfield and Idaho Citizens associations are also monitoring streambanks.

BRWC mini-courses began in 2004. Numerous Bingham County High School students, landowners, and residents attended: macro invertebrate sampling and identification; riparian plants identification; streambank planting techniques; stream and riparian assessment; livestock herding; range land monitoring; and biological control of weeds.

TMDL Implementation Monitoring

Our goal is to evaluate the impact of crop, pasture, and range lands on the Blackfoot River and its tributaries. Water quality and discharge measurements collected are used to identify streams exceeding standards and to determine contributing areas of pollutant loading. This information was used to locate areas where BMPs should be implemented to reduce sediment and nutrient loads.

BMP Effectiveness

Monitoring provides evidence of changes in water quality and beneficial use status. BMP effectiveness monitoring is part of the conservation planning process. Assessment of a BMP's effectiveness involves three types of monitoring: evaluation of onsite practices; monitor pollutant source and transport; and evaluation of beneficial use status and water quality (RPU, 2003). Many methods evaluate resource condition before and after BMP implementation. Prior to implementation, resources are inventoried and their condition is assessed with specific tools.

RUSLE and SISL are used to predict sheet and rill erosion on non-irrigated and irrigated lands. The Alutin method, Imhoff Cones, and direct volume measurements are used to measure sheet and rill, irrigation-induced, and gully erosion. SVAP and SECI are used to assess aquatic habitat and streambank erosion, and lateral recession rates. Idaho OnePlan, CAFO/AFO assessment worksheet, and IDAWM are used to evaluate livestock waste, feeding, storage, and application areas. Water Quality Indicators Guide is utilized to assess nitrogen, phosphorus, sediment, and bacteria contamination from agricultural land.

These same methods determine BMP effectiveness and pollutant reductions. BMP effectiveness monitoring, evaluation worksheets, and project tracking will be completed by IASCD, ISCC, and ISDA.

Water Quality

IASCD and ISDA have recently completed a water quality monitoring project on the Blackfoot River and its tributaries. Twelve sites were monitored from 2000 to 2002. Four sites were on the river below Blackfoot Reservoir and eight sites were on tributaries to the Blackfoot River. Sampling occurred twice a month from April to October and monthly from November to March.

Water quality samples were collected using a depth integrated sampler when water depths were greater than one foot, otherwise grab samples were taken. Samples were analyzed for suspended solids, total phosphorus, orthophosphorus, nitrogen, fecal coliform bacteria, and *E. coli* bacteria. At each site, dissolved oxygen, specific conductance, pH, temperature, and total dissolved solids were measured.

The data can be compared to future data collected at these sites. Monitoring will be conducted to track changes in water quality of the river and its tributaries. This will occur after BMP implementation projects are completed in the subbasin or its watersheds. Monitoring will occur at the previously sampled sites for direct comparison of results over time.

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