

Blackfoot River Watershed Restoration Plan

A Water Quality Addendum to the Blackfoot Subbasin Plan



December 2014

Prepared by:
Blackfoot Challenge
P.O. Box 103
Ovando, MT 59854
406-793-3900

www.blackfootchallenge.org

TABLE OF CONTENTS

TABLES.....	3
FIGURES.....	3
1.0 INTRODUCTION.....	4
1.1 History.....	4
1.2 Process.....	4
1.3 Vision.....	5
1.4 Executive Summary.....	5
2.0 WATERSHED CHARACTERISTICS.....	6
2.1 Geography.....	6
2.2 Water Resources.....	7
2.3 Species of Concern.....	8
3.0 WATERSHED CONDITION: THREATS AND IMPAIRMENTS.....	9
3.1 Water Quality.....	9
3.2 TMDLs / Causes of Impairment.....	9
4.0 POLLUTION LOAD REDUCTION GOALS	13
5.0 WATERSHED RESTORATION STRATEGIES.....	14
5.1 Project Prioritization	14
5.2 Projects and Strategies	14
5.3 Best Management Practices	18
5.4 Technical and Financial Needs	19
5.5 Sources of Technical and Financial Assistance	20
5.6 Implementation Schedule	21
6.0 MONITORING & MILESTONES.....	23
6.1 Monitoring Targets	23
6.2 Types of Monitoring	24
6.3 Indicators of Success	25
6.4 Key Milestones	26
7.0 EDUCATION & OUTREACH STRATEGIES.....	27
8.0 REFERENCES	30
8.1 Sources	30
8.2 Appendices	32
8.2.1 Causes of Impairment	
8.2.2 TMDL Reduction Tables	
8.2.3 Blackfoot Subbasin Plan	
8.2.4 A Basin-wide Restoration Action Plan for the Blackfoot Watershed	
8.2.5 Big Blackfoot Watershed Water Quality Monitoring Program: Quality Assurance Project Plan (QAPP)	

TABLES

Table 1.1 – Watershed Plan Elements 6
Table 2.1 – Watershed Characteristics7
Table 2.2 – Aquatic Habitat Types in the Blackfoot Subbasin 8
Table 3.1 – Blackfoot TMDLs11
Table 4.1 – Restoration Goals and Load Reductions 13
Table 5.1 – Project Ranking Criteria 14
Table 5.2 – Watershed Restoration Projects and Strategies 15
Table 5.3 – Best Management Practices 18
Table 5.4 – Implementation Schedule 22
Table 6.1 – Monitoring Elements 24
Table 6.2 – Milestones Over Five Years 26
Table 7.1 – Summary Education & Outreach Plan29

FIGURES

Figure 2.1 – Blackfoot Watershed Boundary6
Figure 3.1 – TMDL Planning Areas in the Blackfoot Watershed10
Figure 3.2 – Blackfoot TMDL Map12

1.0 INTRODUCTION

1.1 History

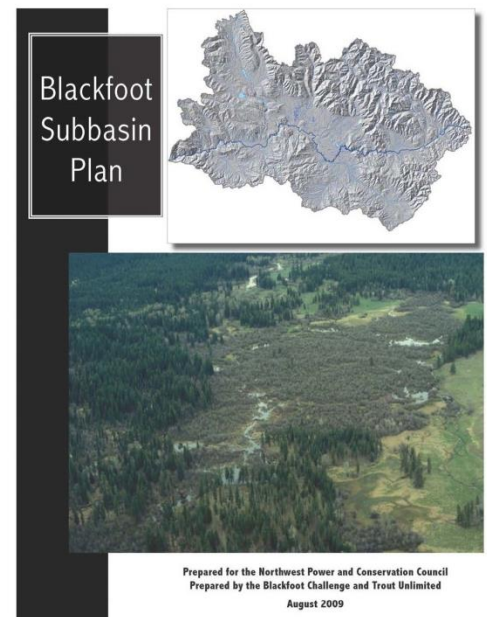
The Blackfoot Watershed has a strong history of locally led conservation and restoration. Beginning in the mid-1970s, private landowners developed the Blackfoot River Recreation Corridor Agreement and established two walk-in hunting areas on private lands near the confluence of the Clearwater and Blackfoot rivers. Around that same time, the first conservation easement in Montana was acquired in the Blackfoot Valley. Thanks to the vision of these landowners, an important foundation was established for public and private partners to work together on restoring and protecting habitat, fisheries and wildlife in the Blackfoot River Basin.

In 1992, the Blackfoot River was listed as one of the 10 most endangered rivers in the United States due to a century of unsustainable mining, livestock grazing and timber harvest practices. The impacts to water quality and fisheries of the Blackfoot associated with these land uses generated interest in river management and enforcement via top-down, agency-led planning and decision-making. Housing development, increased recreational use and the spread of noxious weeds were also beginning to impact the overall health of the river. A few key landowners and natural resource professionals responded by seeking a non-regulatory approach to conservation on the Blackfoot River in the model of the innovative walk-in hunter program formed in the 1970s.

Building on these efforts, the Blackfoot Challenge was formed in 1993 to facilitate collaboration between those who have a stake in the landscape and those who have natural resource decision-making authority. In a valley centered around an iconic river, water resources are critical to community well-being, economics, fish and wildlife, agriculture and more – making water a core focus for the Blackfoot Challenge and its partners. The Challenge aims to create lasting conservation solutions that benefit people, the wildlife and the land. Developing this Blackfoot Watershed Restoration Plan supports the long-term success of Challenge’s mission and provides a roadmap for our continued success collaboratively caring for the Blackfoot Watershed.

1.2 Process & Source Material

Over the last two decades, natural resource agencies, conservation organizations and community leaders have put tremendous collaborative effort into managing the Blackfoot Watershed’s resources and planning for its future. The Blackfoot Watershed Restoration Plan is designed to compile those high-quality, existing resources into one plan that addresses water quantity and quality priorities. The foundation of this Watershed Restoration Plan was built from the “Blackfoot Subbasin Plan,”



completed in August 2009 by a diverse and expert group of people representing public agencies, private organizations, and the general public. This plan is also supported by “A Basin-wide Restoration Action Plan for the Blackfoot Watershed,” completed in August 2005 by the Blackfoot Challenge, Big Blackfoot Chapter of Trout Unlimited, and other public and private partners. Our third primary source material comes from the Blackfoot TMDL documents and the public process that has supported their completion.

1.3 Vision

The Blackfoot Watershed Restoration Plan elaborates on a vision for the Blackfoot Watershed first described by diverse stakeholders who developed the Blackfoot Subbasin Plan (BC and TU, 2009). In describing current conditions and goals for future conditions, the plan incorporates the values and priorities of Blackfoot communities and stakeholders. The resulting Blackfoot Watershed Restoration Plan will guide prioritization and implementation of watershed conservation objectives and strategies to ensure the continued health and resilience of ecological and human communities in the watershed.

THE VISION for the Blackfoot Watershed is for a place characterized by dynamic natural processes that create and sustain diverse and resilient communities of native fish and wildlife and the aquatic and terrestrial habitats on which they depend, thereby assuring substantial ecological, economic and cultural benefits. The efforts to conserve and enhance those natural resources will be implemented through a cooperative partnership between public and private interests that will seek to sustain not only those natural resources, but the rural way of life of the Blackfoot River Valley for present and future generations.

1.4 Executive Summary

The Blackfoot Watershed Restoration Plan aggregates years of community discussions, partnership-based planning, and shared stakeholder priorities. The plan is founded in the collaborative process through which the Blackfoot Challenge steers all of its watershed stewardship work – from drought planning to weed management. In 2009, public and private partners completed the Blackfoot Subbasin Plan, which outlines conservation priorities that remain vital to the agencies and conservation organizations working in the Blackfoot today. The Subbasin Plan provided much of the content for this Watershed Restoration Plan, which is also based on findings and resources developed through the Blackfoot TMDL process.

Blackfoot Watershed Restoration Plan Goal:

To direct partnership building and public outreach that engages partners and landowners in voluntary, collaborative measures to improve water quantity and water quality throughout the Blackfoot Watershed.

Table 1.1: Watershed Plan Elements

Nine Minimum Elements of a Watershed Plan	
1. Identify the causes and sources of impairment.	Blackfoot Subbasin Plan: pp. 37-40 and 136; WRP Subsection 3.0: pp. 9-12
2. Estimate load reductions expected through management measures.	Blackfoot Subbasin Plan: pp. N/A WRP Subsection 4.0: pp. 13
3. Describe the non-point source pollutant management measures.	Blackfoot Subbasin Plan: pp. 218-243; 201-209 WRP Subsection 5.0: pp. 14-19
4. Estimate technical and financial assistance needed.	Blackfoot Subbasin Plan: pp. 183-194 WRP Subsection 5.0: pp. 19-20
5. Describe information and education activities for public involvement.	Blackfoot Subbasin Plan: pp. 243 WRP Subsection 7.0: pp. 26-28
6. Outline schedule for implementing non-point source pollutant management measures.	Blackfoot Subbasin Plan: pp. N/A WRP Subsection 5.0: pp. 22
7. Describe interim, measurable milestones.	Blackfoot Subbasin Plan: pp. 244-248 WRP Subsection 6.0: pp. 23-25
8. Establish criteria for determining whether loading reductions are being achieved over time.	Blackfoot Subbasin Plan: pp. 245 WRP Subsection 6.0: pp. 23-25
9. Define monitoring plan.	Blackfoot Subbasin Plan: pp. 244-248 WRP Subsection 6.0: pp. 23-25

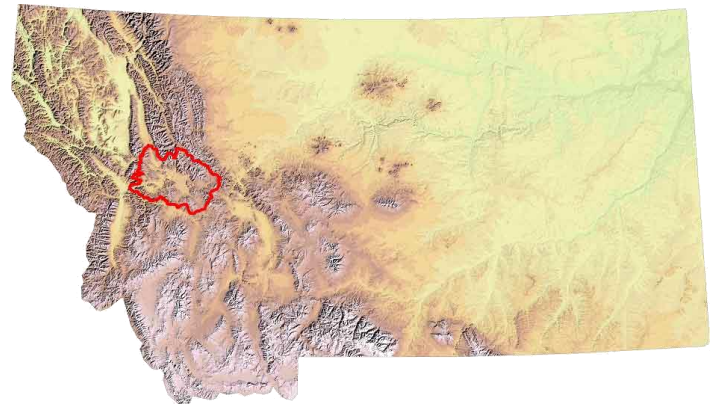
2.0 WATERSHED CHARACTERISTICS

(See Blackfoot Subbasin Plan, pp. 23-73 for further detail on watershed characteristics.)*

Figure 2.1: Blackfoot Watershed Boundary

2.1 Geography

The Blackfoot Watershed encompasses 1.5 million acres (2,345 square miles) of biologically rich and diverse lands in portions of four Montana counties: Lewis and Clark, Powell, Missoula and Granite. The watershed is bordered to the east by the Continental Divide, to the south by the Garnet Mountains, to the north by the Bob Marshall and Lincoln-Scapegoat Wilderness Areas, and to the west by the Rattlesnake Wilderness. Elevations in the watershed range from 9,202 feet on Scapegoat Peak to 3,280 feet near Bonner, Montana, where the Blackfoot River enters the Clark Fork River.



Part of the larger Columbia River Basin watershed, the free-flowing Blackfoot River flows 132 miles from its headwaters near Rogers Pass to its confluence with the Clark Fork in Bonner. The watershed is characterized by narrow headwater canyons opening to generally rolling terrain at

the heart of the basin and ending in a narrow, incised, stream-cut canyon. The Blackfoot River is ranked as a Tier I Aquatic Conservation Focus Area in Montana’s Comprehensive Fish and Wildlife Conservation Strategy. Tier I species, communities and focus areas are considered by MFWP to be of the greatest conservation need in Montana (MFWP 2005a).

Table 2.1: Watershed Characteristics

Blackfoot Watershed Characteristics	
Watershed size	1.5 million acres ~ 2,345 square miles
Miles of Blackfoot River	132 miles
Counties	Powell, Lewis & Clark, Missoula, Granite
Species of concern	41 invertebrates, birds, fish, mammals, reptiles, amphibians
Land ownership	54% federal, 31% private, 10% state, 5% corporate timber
Native fish priorities	Bull trout, westslope cutthroat trout
Average annual precipitation	15 – 21 inches rainfall; 54 – 120 inches snowfall
Major tributaries	Nevada Creek, Monture Creek, North Fork Blackfoot, Landers Fork, Clearwater River

The Blackfoot sits at the southern edge of the Crown of the Continent Ecosystem (COCE) – a 10-million-acre area of the Northern Rocky Mountains that extends north into Canada and includes Waterton-Glacier International Peace Park, Canada’s Castle Wilderness, the Bob Marshall-Great Bear-Scapegoat Wilderness Complex, parts of the Flathead and Blackfeet Indian Reservations, Bureau of Land Management (BLM) lands, and significant acreage of state and private lands. The COCE is one of the most intact ecosystems in North America. The Blackfoot watershed provides critical connections between the COCE and the Selway/Bitterroot and High Divide ecosystems to the south.

2.2 Water Resources

The Blackfoot River is the key surface water feature in the Blackfoot Watershed. The Blackfoot is a free-flowing river that flows southwest for 132 river miles from its headwaters at Rogers Pass to its confluence with the Clark Fork River at Bonner. This river system drains a 2,320-square-mile watershed through a 3,700-mile stream network of which 1,900 miles are perennial streams capable of supporting fish (BC 2005). There are several major tributaries to the Blackfoot River, including the Landers Fork, the North Fork of the Blackfoot River, Monture Creek, Clearwater River, Nevada Creek and Poorman Creek. The area is also home to numerous natural ponds and lakes, including Kleinschmidt Lake, Browns Lake, Coopers Lake, and the Clearwater chain of lakes (Lake Alva, Lake Inez, Placid Lake, Seeley Lake, and Salmon Lake). Aquatic habitat types found in the Blackfoot Watershed, according to Montana’s Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005a), are listed in Table 2.2.

Table 2.2: Aquatic Habitat Types in the Blackfoot Subbasin

Habitat Type	Acres/Miles
Intermountain Valley Rivers	127
Intermountain Valley Streams	316
Lowland Lakes	6,525
Lowland Reservoirs	390
Mountain Lakes	2,604
Mountain Reservoirs	5
Mountain Streams	3,207

Surface water hydrology in the Blackfoot River is driven by 1) winter snowpack accumulation, 2) spring snowmelt runoff and 3) late summer, fall and winter base flows. The historic (72-year) mean daily discharge in the Blackfoot River, measured at the Bonner USGS gage station, is 1,968 cubic feet per second (cfs); the mean peak flow is 6,070 cfs, and the mean low flow is 642 cfs. In 2000, a drought year, the mean daily discharge was 1,261 cfs, peak flow (April) was 4,860 cfs, and low flow (September) was 466 cfs, all of which are substantially below the historic means. This pattern has been replicated in most years since 2000. In addition, the annual hydrograph since 2000 has been characterized by peak flows occurring one to three weeks earlier and summer flows arriving earlier and dropping lower than the historic means.

2.3 Species of Concern

The Blackfoot River and its tributaries support native westslope cutthroat trout and bull trout, both of which are Species of Concern in Montana (MTNHP 2009, Shepard et al. 2005). Bull trout is federally listed as threatened under the Endangered Species Act (USFWS 2002). Abundance and distribution of native trout in the Blackfoot River and its tributaries vary greatly (Pierce et al. 2008). This variation can be explained by variation in life-history forms, natural geological/environmental conditions, human influences (such as environmental degradation and historic fishery exploitation), hybridization and interspecific competition among non-native fishes (Swanberg 1997, Schmetterling 2001, Pierce et al. 2007, 2008). With the general exception of high mountain lakes, these species are widely distributed across the broad gradients found in streams, rivers and lakes and represent the range of aquatic environments in the Blackfoot Watershed. Because westslope cutthroat trout and bull trout are sensitive to changes in water quality (e.g., temperature and sediment) and other physical habitat characteristics (Behnke 2002, Shepard et al. 2005, MBTRT 2000), they are excellent indicators of the overall health of the Blackfoot River ecosystem. Conservation and restoration of these target species and their habitats will provide secondary benefits to other native fishes and aquatic organisms found throughout the subbasin.

3.0 WATERSHED CONDITION

(See Blackfoot Subbasin Plan pp. 134 – 171 for detailed evaluation of threats to aquatic and terrestrial natural resources.)*

3.1 Water Quality

The Blackfoot River and its tributaries provide critical fish and wildlife habitat, irrigation water for agricultural lands, water for domestic use and high quality recreational opportunities for the public—all beneficial uses dependent upon clean water. Naturally high sediment production, low stream flows, drought prone areas and other natural factors account for some impairment issues and compound problems when combined with human influences (BC 2005). The major human-caused water quality issues identified in the Blackfoot Subbasin include excess sediment and siltation, instream and riparian habitat alterations, flow alterations, elevated water temperature, and elevated nutrients and metals concentrations. Water quality impairment results from a variety of land uses, including mining, excessive timber harvest, grazing in riparian zones, excessive irrigation diversions, poorly designed roads, unplanned residential development and climate change. The impacts of poor water quality are most often reflected in the health of fisheries, which therefore provide a measure of overall watershed health. Impaired water quality can impact recreational uses, crop yields, wildlife health and livestock survival. In severe cases, poor water quality can limit drinking water availability (BC 2005). Page 136 of the Blackfoot Subbasin Plan provides a threat assessment ranking for native salmonids that identifies the causes of water quality impairments and ranks them according to their contribution and irreversibility (how feasible and costly it would be to address). For water quality impairments, the table identifies mining, unplanned development, drainage and diversion systems, channel alteration, physical road issues, incompatible grazing and incompatible forestry practices as the leading contributors and most challenging to resolve.

3.2 TMDLs / Causes of Impairment

The primary vehicle for addressing water quality impairments in the Blackfoot Subbasin is the voluntary Total Maximum Daily Load (TMDL) planning process. Section 303(d) of the federal Clean Water Act (and related regulations) requires states to assess the condition of surface waters within their borders to identify water bodies that do not fully meet water quality standards. The resulting list of water quality impaired water bodies is known as the 303(d) list. In Montana, the Montana Department of Environmental Quality (MDEQ) is responsible for the development of TMDLs. Montana's approach is to develop TMDLs in the context of comprehensive water quality restoration plans. The goal of a TMDL and water quality restoration plan is to identify causes and sources of water quality impairment in water bodies on the 303(d) list, the level of water quality improvement necessary for a water body to fully support all intended beneficial uses and strategies for achieving restoration goals.

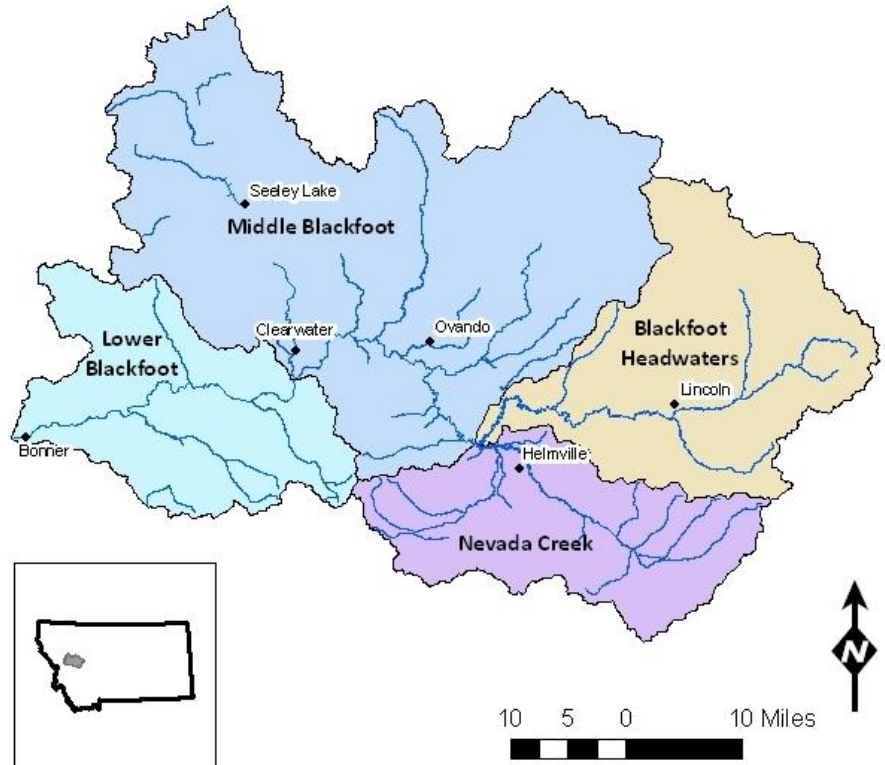
Since 1996, 49 water body segments in the Blackfoot Subbasin have been included on Montana's

303(d) list because they do not, according to MDEQ, fully support beneficial uses such as aquatic habitat, recreation and drinking water. The status of these water bodies is released every two years by MDEQ. The specific sources and levels of impairment are referenced in Blackfoot TMDL documents as listed in Appendix 8.2.1: Causes of Impairment.

The Blackfoot Subbasin is divided into the following four planning areas for purposes of TMDL development (Figure 3.1):

1. *Blackfoot Headwaters Planning Area*, extending from the Blackfoot Headwaters to the confluence with Nevada Creek;
2. *Middle Blackfoot Planning Area*, including the Blackfoot River drainage from Nevada Creek to the confluence with the Clearwater River;
3. *Nevada Creek Planning Area*, including the Nevada Creek drainage from its headwaters to the confluence with the Blackfoot River; and
4. *Lower Blackfoot Planning Area*, extending from the Clearwater River downstream to the confluence with the Clark Fork River.

Figure 3.1 TMDL Planning Areas in the Blackfoot River Watershed



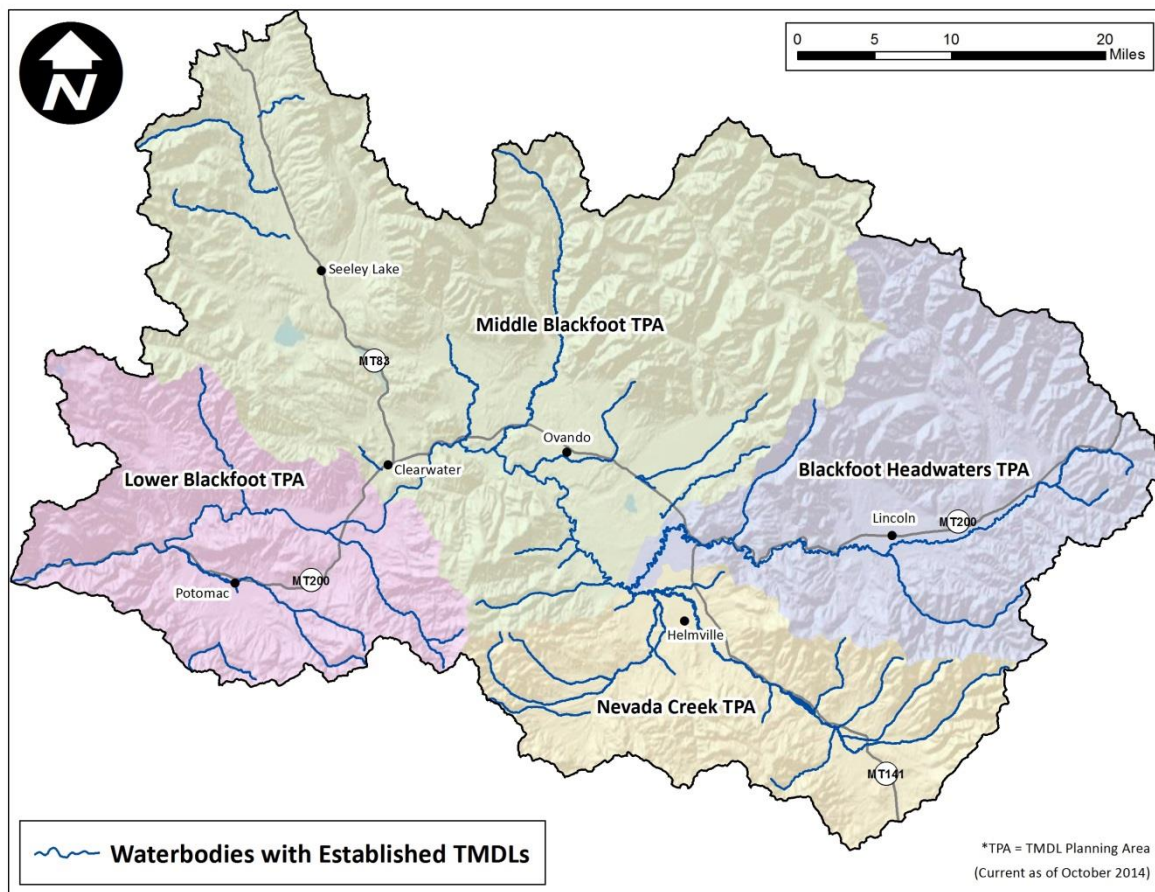
In 2000, MDEQ partnered with the Blackfoot Challenge to develop TMDL plans in the Blackfoot Subbasin. TMDL development began in the Headwaters Planning Area in 2001, with the first TMDLs completed in 2003. As of September 2014, 142 TMDLs and associated addendums have been written for the Blackfoot Watershed. These documents identify causes and sources of water quality impairments in 303(d)-listed water bodies and outline conceptual strategies for addressing identified causes and sources of impairment. Table 3.1 lists all TMDLs currently identified in the Blackfoot Watershed. Figure 3.2 highlights the water bodies that have undergone TMDL development (at the time of writing, these TMDLs have all been completed).

Table 3.1: Blackfoot TMDLs

STREAM	Metals	Nutrients (both N & P)	Sediment	Temperature
Ashby Creek, East Fork		X	X	
Ashby Creek, West Fork		X	X	
Arrastra Creek			X	
Beartrap Creek	X			
Belmont Creek			X	
Black Bear Creek		X	X	
Blackfoot River (Headwaters to Landers Fork)	X			
Blackfoot River (Landers Fork to Nevada Creek)	X		X	
Blackfoot River (Nevada Creek to Monture Creek)		X	X	X
Blackfoot River (Monture Creek to Clearwater River)		X	X	
Blackfoot River (Monture Creek to Belmont Creek)		X		X
Blanchard Creek			X	
Braziel Creek		X	X	
Buffalo Gulch			X	
Camas Creek		X	X	
Cottonwood Creek (Blackfoot)			X	
Cottonwood Creek (Douglas Creek)			X	X
Deer Creek			X	
Douglas Creek	X			
Douglas Creek, Lower		X		X
Douglas Creek, Upper	X	X	X	X
Elk Creek, Lower		X	X	X
Elk Creek, Upper	X	X	X	
Frazier Creek		X	X	
Gallagher Creek		X	X	
Jefferson Creek, Lower	X	X	X	
Jefferson Creek, Upper			X	
Keno Creek			X	
Kleinschmidt Creek	X		X	X
McElwain Creek		X	X	
Mike Horse Creek	X			
Monture Creek			X	
Murray Creek	X	X	X	X
Nevada Creek, Lower		X	X	X

Nevada Creek, Upper	X	X	X	X
STREAM	Metals	Nutrients (both N & P)	Sediment	Temperature
Nevada Lake		X	X	
Nevada Spring Creek			X	
Poorman Creek	X		X	
Richmond Creek			X	
Rock Creek			X	
Sandbar Creek	X		X	
Union Creek	X	X	X	X
Wales Creek		X	X	
Ward Creek			X	
Warren Creek			X	
Washington Creek, Lower	X		X	
Washington Creek, Upper			X	
Washoe Creek		X	X	
West Fork Clearwater River		X	X	
Willow Creek		X	X	
Yourname Creek			X	

Figure 3.2: Blackfoot TMDL Map



4.0 POLLUTION LOAD REDUCTION GOALS

The non-point source pollution reduction goals for the Blackfoot Watershed are derived from the recommendations of TMDLs written for the Blackfoot Headwaters, Middle Blackfoot, Lower Blackfoot and Nevada Creek planning areas. (*See TMDL reduction tables, Appendix 8.2.1.) Restoration and BMPs will focus on reducing sediment loading, which will have secondary benefits of helping to reduce nutrients and metals in many stream segments. Additional projects will focus on reducing water temperatures through water conservation, BMPs, in-stream flow protection, and riparian plantings to address TMDL-prescribed temperature reduction goals.

Sediment reduction goals:

- To reduce sediment loading as a result of streambank erosion, roads, road crossings, road sanding, incompatible grazing practices, hillslope erosion and historic mining practices.

Temperature reduction goals:

- To maintain healthy coldwater fisheries and tributary spawning habitat for westslope cutthroat trout and bull trout.
- To implement restoration activity that improves temperatures in priority tributaries (high priority streams for fisheries from “A Basin-wide Restoration Action Plan”) and helps to ensure colder water feeds into the mainstem Blackfoot River.

Table 4.1: Restoration Goals and Load Reductions

Project Focus	Goals	Associated Load Reduction	Reference
Sediment	Improve road crossings; decommission roads; implement road BMPs; implement streambank restoration; implement grazing BMPs	<ul style="list-style-type: none"> • 30% reduction in Middle Blackfoot-Nevada Creek planning area. • 26% reduction in sediment load in Nevada Lake. • 30% reduction in sediment from roads in Blackfoot Headwaters to Nevada Creek. • 30% reduction in sediment loading from roads in Lower Blackfoot planning area. 	Blackfoot Headwaters TMDLs 2004; Middle Blackfoot-Nevada Creek TMDLs 2008; Lower Blackfoot TMDLs 2009; Blackfoot Headwaters TMDL Addendum 2014; Middle Blackfoot TMDL Addendum 2014
Temperature	Plant riparian vegetation; implement grazing plans; conserve in-stream flow; implement drought management plans; increase riparian shading along tributaries; increase streamflow through water conservation measures	<ul style="list-style-type: none"> • For Blackfoot River, allow maximum 1°F allowing increase over naturally occurring temperature when naturally occurring is <66°F or maximum 0.5°F increase over naturally occurring temperature when it is >66.5°F. • Increase bank shade to meet TMDL targets based on stream width (73% - 91% in Middle & Lower Blackfoot). 	Middle Blackfoot-Nevada Creek TMDLs 2008; Lower Blackfoot TMDLs 2009; Middle Blackfoot-Nevada Creek TMDL addendum 2014

5.0 WATERSHED RESTORATION STRATEGIES

(* See *Blackfoot Subbasin Plan pp. 202 – 223 for additional watershed restoration targets and strategies.*)

5.1 Project Prioritization

Project prioritization will be based on a number of key factors, including an overlay of critical native trout habitat with Blackfoot TMDLs and dewatered streams. (See A Basin-wide Restoration Action Plan for the Blackfoot Watershed, Table 1-1, page 10.) In addition, the Blackfoot Challenge and partners in an NRCS Regional Conservation Partnership Program effort have established ranking criteria to prioritize watershed stewardship and restoration work. These criteria are listed in Table 5.1.

Table 5.1: Project Ranking Criteria

Ranking Criteria	Description
Water quality	TMDLs identified; more than one TMDL raises priority level
Aquatic habitat	More points for native trout habitat & sensitive species benefits
Partnerships	Multiple public & private partners involved
Threats	Imminent and ongoing threats to water quality and habitat value
Landowner willingness	Willing landowner who is EQIP eligible
Project readiness	Funding in place; environmental assessments completed
Scale / Impacts	Project has potential to provide widespread / downstream benefits

5.2 Projects and Strategies

Since the 1970s, a unique conservation legacy has evolved in the Blackfoot Watershed. It is a legacy built on dialogue and collaboration, community sustainability and voluntary action. For the Blackfoot, community-based decision-making has worked. These are strategies that the Blackfoot Challenge and its partners seek to perpetuate and expand as we work to address water quality issues. Principal to the collaborative process, the Blackfoot Challenge will maintain and expand a community-based structure for project planning and implementation. This includes continuing to use committees made up of diverse stakeholders (such as the Blackfoot Drought Response Committee) to facilitate agreement on water quality improvement activities. Identifying some initial projects here provides a starting point, but this watershed restoration plan is predicated on continuing that stakeholder process in future years to identify and implement projects that can be supported by willing landowners and diverse partners in the watershed. Projects identified in past management plans will also help guide restoration plans (these previously identified projects are in addition to those listed in Table 5.2):

- A Basin-wide Restoration Action Plan for the Blackfoot Watershed, Appendix B: “Potential Restoration Projects on TMDL Streams in the Blackfoot Watershed.”
- An Integrated Stream Restoration and Native Fish Conservation Strategy for the Blackfoot River Basin, pages 33-132.
- Table of Potential Restoration Projects; Appendix M; Blackfoot Subbasin Plan, pages 374-375.

Table 5.2: Watershed Restoration Projects and Strategies

Project Category	Goals	Potential Projects & Milestones	Estimated Annual Costs	Responsible Partners
Drought response	Conserve water; protect native fisheries in times of drought; mitigate rising river temperatures; retain 50 cfs of water in the river annually as needed.	Communicate seasonally with 100 Blackfoot irrigators to ensure individual water conservation plans are activated. Recruit new participants and monitor individual response.	Drought coordination: \$3,500	Blackfoot Challenge; Blackfoot Drought Response Committee; MT Fish, Wildlife & Parks
Irrigation efficiency	Ensure irrigators are not over- or under-watering; ensure both energy and water use efficiency of irrigation systems.	Generate weekly irrigation scheduling reports & distribute to 100 irrigators; work directly with 2-5 irrigators per year across at least 2,500 acres to design custom irrigation scheduling.	Irrigation scheduling: \$20,000 Irrigation efficiency: \$7,500	Blackfoot Challenge
Water conservation	Conserve water and keep water in-stream to improve aquatic habitat and mitigate temperature issues.	1. Work with irrigators to install water control structures, line leaky ditches, convert from flood to sprinkler systems, use irrigation pipeline, upgrade to more efficient sprinkler equipment, etc. 2. In Potomac Valley, address water losses through poorly designed ditch system.	TBD once specific projects and landowner partners identified	NRCS; Blackfoot Challenge; BBCTU; TU
Fish passage	Remove obstacles to fish passage; improve habitat connectivity and native fish survival / productivity.	1. With private landowners, install fish screens; improve poorly designed culverts; in-stream water leases; diversion and ditch improvements. 2. Restore 18 miles of connectivity for westslope cutthroat trout and 10 miles of connectivity for bull trout by removing / improving five in-stream barriers in Centerhorse and Poorman Creeks. (3 in 2015; 2 in 2016)	1. Commit \$150,000 per year 2. Centerhorse \$500,000 (over 2 years)	BBCTU; Blackfoot Challenge; MT FWP; USFS; USFWS; TU

Riparian protection	Improve riparian vegetation, reduce sediment loading and reduce temperature impacts due to grazing impacts.	Working with willing landowners, utilize grazing management plans, riparian fencing, off-stream water, and riparian planting to revitalize riparian areas.	TBD once projects id'd; Commit \$25,000 per year	Blackfoot Challenge; BBCTU; NRCS; BLM; USFS
Road improvements & Stream crossings	Reduce sediment sources by improving roads and implementing road BMPs	<ol style="list-style-type: none"> 1. Decommission / obliterate 30 miles of U.S. Forest Service roads in Centerhorse and Chilly drainages to reduce sedimentation and habitat fragmentation for westslope cutthroat trout and bull trout. (20 miles in 2015; 10 miles in 2016) 2. Reduce delivery of fine sediments to streams by 80-90 percent on 41 miles of U.S. Forest Service roads through the implementation of Best Management Practices (e.g. install surface and ditch drainage) in Centerhorse, Poorman and Chilly creeks. (2015 – 2016) 3. In upper watershed, collaborate with USFS to employ road BMPs in areas of heavily eroding roadside banks. 4. Work with landowners watershed-wide to improve poor stream crossings, replace culverts, install hardened crossings, etc. 	<ol style="list-style-type: none"> 1. Road decommission in Chilly-Centerhorse: \$300,000 (over 2 years) 2. Upper watershed road BMPs: \$10,000 per mile 3. Stream crossings: Commit \$50,000 per year 	USFS; Blackfoot Challenge; BBCTU; BLM; NRCS
Stream restoration	Reduce sediment, nutrient and temperature issues by restoring healthy stream channel conditions.	<ol style="list-style-type: none"> 1. Stream channel, wetland and riparian zone restoration; streamside and riparian area vegetation planting; aspen coppice treatments. 2. Address sources leading to sediment build-up in Nevada Reservoir through restoration on Upper Nevada Creek, Indian Creek and Buffalo Gulch. 3. Focus initial restoration on streams with overlay of TMDLs and priority native fish habitat 	Specific project costs TBD as projects approved with partners; commit \$200,000 per year toward these activities	BBCTU; Blackfoot Challenge; USFS; NRCS; BLM

		(Monture, Poorman, Cottonwood, Rock, Kleinschmidt, Belmont, etc.).		
Mine reclamation	Reduce metals and sediment contamination as a result of past mine activity	Support USFS, DEQ and other partners in the Mike Horse mine waste clean-up effort; conduct community outreach and education related to mine clean-up.	Clean-up funded; Outreach & education: \$500	USFS; Blackfoot Challenge
Outreach & education	Encourage voluntary conservation practices that improve water temperatures and reduce sedimentation, metals and nutrients.	Host two training workshops per year; distribute educational materials on BMPs and restoration projects; provide one-on-one technical assistance services; connect producers to sources of financial assistance.	Workshops & tours: \$2,000; Materials: \$1,000; Technical assistance: \$15,000	NRCS; Blackfoot Challenge

5.3 Best Management Practices

Key to our collaborative strategies will be offering tools and resources that landowners and producers can adopt on a voluntary basis, with sufficient technical and financial support provided by the various partner organizations involved. Best management practices from the 2012 Montana Nonpoint Source Management Plan (Appendix A) aligned with accepted conservation practices from the Natural Resources Conservation Service (EQIP and CSP) provide guidance for the management and restoration strategies Blackfoot partners will use. Many of these practices have already proven successful in improving water quality and quantity conditions within Blackfoot tributaries.

Table 5.3: Best Management Practices

BMP	DESCRIPTION
Stream crossing	Create a stabilized area or structure across a stream to provide a travel way for people, livestock, equipment, or vehicles.
Off-stream watering facility	Install a permanent or portable device to provide drinking water for livestock and wildlife away from a surface waterbody.
Filter strip	Plant a strip of permanent perennial vegetation on the downgradient edge of a field to slow surface runoff, filter particulate matter, or absorb and use nutrients.
Livestock distribution improvements	Establish such things as rotational grazing, cross-fencing, or watering facilities, to promote uniform forage use and nutrient deposition, which then leads to more vigorous plant growth and nutrient uptake, as well as reduced soil erosion and pollutant runoff.
Grazing management plan	Write a plan describing how livestock grazing will occur on a particular property and how grazing management strategies will be used to prevent nonpoint source pollution.
Water gap	Create a controlled access point from which livestock can obtain drinking water directly from a waterbody.
Riparian fencing	Install fencing to permanently or temporarily control livestock access to riparian areas, thereby preventing streambank trampling, reducing nutrient pollution, or promoting vegetative growth and plant species diversity.
Irrigation diversion maintenance or replacement	Repair or replace a structure designed to divert surface water for the purpose of watering crops or livestock.
Irrigation canal conversion	Add an impermeable liner to an unlined irrigation canal or replace an irrigation canal with an underground pipe.
Irrigation system conversion	Convert one type of irrigation system to another, resulting in significant improvements to water quality, e.g. converting from flood irrigation to sprinkler irrigation in order to eliminate tailwater contamination.

Irrigation tailwater control	Install structures, vegetation, or managerial controls to prevent sediment, nutrient, or temperature pollution from irrigation tailwater. Practices may include rehabilitating wasteway, capturing and reusing tailwater, creating settling basins, remotely controlling headgates, or revegetating tailwater-induced erosion.
Riparian buffer	Plant a strip of perennial vegetation adjacent to and upgradient from a waterbody to prevent NPS pollution.
Revegetation	Establish permanent, native vegetative cover to prevent soil erosion.
Road repair & maintenance	Timely repair of water bars, sediment traps, road ditches, culverts, and other runoff control structures.
Road crossing	Construct bridges, culverts, hardened crossings, and fords to prevent disruption of stream sediments, erosion of stream banks, or removal of large amounts of riparian vegetation.
Road relocation	Relocate roads outside of riparian areas and floodplains.
Stream restoration	Streambank stabilization, stream channel and in-stream habitat restoration
Wetland restoration	Restore, re-create, or enhance wetlands to address NPS pollution

5.4 Technical and Financial Needs

Blackfoot partners have a history of pooling their technical and financial resources to make restoration projects happen. This collaboration speeds up the pace and improves the efficiency of conservation projects – and will remain an important foundation of successful watershed restoration plan implementation. The entities and processes that will help identify future technical and financial resources and support pooling of those resources will include:

1. ***Blackfoot Challenge Technical Advisory Group (TAG) and Watershed Advisory Group (WAG):*** These two committees bring together representatives of private industry, state and federal agencies, conservation organizations and private landowners to review water quality and quantity needs and advise on potential project activity.
2. ***Blackfoot Drought Response Committee:*** Made up of diverse public and private stakeholders, the committee advises on water temperature and flow issues, particularly during times of drought.
3. ***NRCS Regional Conservation Partnerships Program:*** A group of more than 20 partners is pursuing a multi-year proposal with NRCS, largely focused on water quality and quantity restoration projects in the Blackfoot Watershed. This partnership will bring millions of dollars in financial and technical resources, greater investment of NRCS technical expertise, and a high level of partner coordination to the Blackfoot.
4. ***Southern Crown of the Continent Collaborative Forest Landscape Restoration Partnership:*** This multi-year forest restoration partnership involves many partners who are meeting and working together regularly, fundraising jointly and generating a great deal of monitoring science on natural resource conditions in the Blackfoot.

5.5 Sources of Technical and Financial Assistance

(See Blackfoot Subbasin Plan pp. 183 – 195 for more information on sources of technical and financial assistance.)*

The organizations and agencies working in the Blackfoot Watershed share a strong record of watershed stewardship and restoration work to date supported by innovatively uniting diverse sources of capacity and funding. Success has come from public-private partnerships that share financial and technical resources. To pursue the watershed goals set forth in this plan, a number of proven and potential funding sources have been identified.

Federal

- Bonneville Power Administration
- U.S. Department of Agriculture: National Institute of Food and Agriculture water quantity and quality program grants
- U.S. Forest Service: Urban and Community Forest Program, Forest Legacy Program
- Natural Resources Conservation Service: Wildlife Habitat Incentives Program (WHIP), Wetlands Reserve Program (WRP), Conservation Reserve Program (CRP), Conservation Stewardship Program (CSP), Conservation Innovation Grants (CIG), Environmental Quality Incentives Program (EQIP), Regional Conservation Partnerships Program (RCPP)
- U.S. Fish and Wildlife Service: Cooperative Endangered Species Conservation Fund, Partners for Fish and Wildlife Program, North American Wetlands Conservation Act

State

- Department of Natural Resources and Conservation (DNRC): Various grant funds, including RRGL, 223 funds
- Department of Environmental Quality (DEQ): 319 Funds
- Montana Fish, Wildlife and Parks: Future Fisheries Improvement Program

County

- Conservation Districts
- County government (Missoula, Powell, Lewis & Clark, Granite counties)

Private

- Foundations such as the M.J. Murdock Charitable Trust, Doris Duke Foundation and the Brainerd Foundation
- Corporate entities, such as the Coca-Cola Foundation
- NGO partners, such as the Blackfoot Challenge, Five Valleys Land Trust and Trout Unlimited
- Individual donors and supporters of the Blackfoot NGOs

Blackfoot Watershed Partners

Watershed stewardship results will continue to depend upon effective public-private partnerships among those organizations working in the Blackfoot. The foundation of this watershed restoration plan begins with a commitment to continue to work together in an inclusive and collaborative manner among partners that include:

Big Blackfoot Chapter of Trout Unlimited
Blackfoot Challenge
Bureau of Land Management
Clearwater Resources Council
Conservation Districts
Fishing Outfitters
Five Valleys Land Trust
Forest Industry
Landowners
Montana Department of Environmental Quality
Montana Department of Natural Resources and Conservation
Montana Fish, Wildlife and Parks
Natural Resources Conservation Service
Ranchers / Producers
The Nature Conservancy
Trout Unlimited
U.S. Forest Service
U. S. Fish and Wildlife Service



5.6 Implementation Schedule

The Blackfoot Subbasin Plan, TMDLs, Fisheries Restoration Action Plans, and this WRP provide a framework and prioritization method for implementation of water quality restoration projects. As soon as funding is available through sources like 319 funds and NRCS, Blackfoot partners will launch projects identified in this WRP and as a result of related outreach.

Table 5.4: Implementation Schedule

(Shaded cells = work to be accomplished by year; (#) = number or scale of projects per year)

TASK	2015	2016	2017	2018	2019
Drought Response Coordination					
Irrigation Efficiency					
• Weekly water scheduling reports					
• Efficiency evaluations					
• Efficiency improvement projects	(1)	(1)	(2)	(2)	(2)
Water Conservation					
• Line ditches, install pipe, fix headgates	(1)	(2)	(2)	(2)	(2)
Restoration of Priority Streams					
• Channel repair, riparian plantings		(1)	(1)	(2)	(2)
• Reduce sediment from Upper Nevada Creek, Indian Creek, Buffalo Gulch					
Fish Passage					
• Install fish screens, improve diversions			(2)	(3)	(3)
• Remove barriers in Centerhorse/Poorman	(3)	(2)			
Riparian Protection					
• Fencing, off-stream water, grazing management	(1)	(2)	(2)	(3)	(4)
Road Improvements					
• Decommission Centerhorse/Chilly roads	(20 mi.)	(10 mi.)			
• BMPs Centerhorse/Chilly/Poorman	(20 mi.)	(20 mi.)			
• BMPs in upper Blackfoot USFS roads					
• Improve private lands stream crossings	(1)	(1)	(2)	(2)	(2)
Mine Reclamation					
• Mike Horse mine waste clean-up					
Outreach & Education					
• Irrigation workshops	(1)	(1)	(1)	(1)	(1)
• BMP training events	(1)	(1)	(1)	(1)	(1)
• Individual landowner technical assistance	(5)	(5)	(7)	(7)	(10)
• Public tours and education events	(2)	(2)	(2)	(2)	(2)
• Drought response meetings	(1)	(2)	(2)	(2)	(2)

6.0 MONITORING & MILESTONES

(See Blackfoot Subbasin Plan pp. 244 – 248 for additional monitoring information.)*

6.1 Monitoring Targets

As we approach water quantity and quality improvement strategies in the Blackfoot through voluntary, collaborative activity, monitoring will track community engagement levels and watershed conditions. Both technical and nontechnical criteria will be employed in measuring outcomes. Monitoring responsibilities will be shared by a network of partner organizations, while past and ongoing studies will provide baseline information for comparison. Since 1990, Montana Fish, Wildlife and Parks has led substantial monitoring of aquatic habitats and fish populations. These studies have allowed restoration partners in the watershed to evaluate the impacts of ongoing stream restoration projects. In addition to FWP's ongoing monitoring, the Blackfoot Subbasin Plan points to well-established monitoring protocols that will continue to guide future monitoring efforts. These guiding documents include:

- A Basin-wide Restoration Action Plan for the Blackfoot Watershed (Blackfoot Challenge, 2005; Appendix J; Appendix L).
- The Blackfoot River Valley Conservation Area Draft Plan (The Nature Conservancy and Blackfoot Challenge, 2007; Appendix H).
- Big Blackfoot Watershed Water Quality Monitoring Program: Quality Assurance Project Plan (QAPP).

Table 6.1: Monitoring Elements

MONITORING COMPONENT	RESPONSIBLE ORGANIZATION	GOALS	MEASURABLE CRITERIA	TIMELINE
Stream flows --USGS gage stations --TU gages --Individual measuring	DNRC, Trout Unlimited, Blackfoot Challenge, volunteers	Improved water quantity; reduced need for drought response	Conserve 50 cfs annually through drought response and conservation	Real-time gages + weekly readings each summer
Stream temperatures --USGS gage stations --Individual measuring	DNRC, DEQ, Trout Unlimited, Blackfoot Challenge, volunteers	Lower stream temps, especially in bull trout tributaries	Post-restoration temperatures meet naturally occurring TMDL targets ¹	Real-time gages + weekly readings each summer
Fish populations	MT Fish, Wildlife and Parks	Improved distribution and increased numbers of bull and westslope cutthroat trout	Montana FWP fisheries goals ²	Annual counts
Habitat improvements: --miles of stream --acres of habitat --miles of road	BBCTU, MT FWP, U.S. Forest Service, NRCS, DNRC, Blackfoot Challenge	Healthier riparian zones; increase in numbers and distribution of native fish; decrease in sediment, nutrients, metals & temps	TMDL targets for sediment, nutrients, metals & temperature met in restored areas ³	Reported on project-by-project basis
BMPs implemented	Blackfoot Challenge, NRCS, BBCTU	Improved water quality and quantity	TMDL targets met ³	Annual summary report
Education & Outreach	Blackfoot Challenge	More landowners & partners interested in projects	Engage at least 100 individuals annually	Annual summary report

¹ 2008 Middle Blackfoot-Nevada Creek temperature targets: pp. 294-304; 2009 Lower Blackfoot temperature targets: pp. 122-128; 2014 Middle Blackfoot-Nevada Creek Addendum temperature targets: pp. 4-3 – 4-11.

² Blackfoot Challenge (BC). 2005. *A Basin-wide Restoration Action Plan for the Blackfoot Watershed*; Prepared for: Montana Department of Natural Resources and Conservation Renewable Resource Grant & Loan Program and The Blackfoot Watershed Restoration and Monitoring Partners. Prepared by: the Blackfoot Challenge in Partnership with the Big Blackfoot Chapter of Trout Unlimited, Montana Fish, Wildlife and Parks, Hydrometrics Inc., and other partners. AND MFWP. 2005b. *An Integrated Stream Restoration and Native Fish Conservation Strategy for the Blackfoot River Basin*. By Montana Fish, Wildlife and Parks, Helena.

³ 2004 Blackfoot Headwaters sediment targets: pp. 47-70; 2008 Middle Blackfoot-Nevada Creek sediment, metals and nutrients targets: pp. 251-292; 2009 Lower Blackfoot sediment and metals targets: pp. 107-122; 2014 Middle Blackfoot-Nevada Creek Addendum sediment targets: pp. 2-16 – 2-18, metals targets: pp. 3-10 – 3-28; 2014 Sandbar Creek Addendum sediment targets: pp. 3-7 – 4-1.

6.2 Types of Monitoring

Several ongoing monitoring systems in the Blackfoot Watershed will continue to support analysis of project results on present and future restoration activities. These monitoring protocols include work being conducted by the U.S. Forest Service, Southwest Crown of the Continent partners, BBCTU, Blackfoot Challenge, and Montana Fish, Wildlife and Parks.

1. Geomorphic Roads Analysis Inventory Package (GRAIP), which identifies sediment sources leaving the road and entering streams and rivers (calibrated using eight erosion plots in the Seeley Lake Ranger District of the Forest Service);
2. Pacfish Infish Biological Opinion (PIBO), which:
 - a. measures fine sediment in gravel stream bottoms,
 - b. measures suspended sediments within the water column,
 - c. evaluates the integrity of key structures of streambeds (e.g. pool depth, bandwidth, etc.), and
 - d. surveys aquatic macroinvertebrate populations from each sampling site.
3. Water Erosion Prediction Project (WEPP) roads modeling, which is used largely by the Forest Service to calculate erosion and deposition to estimate the annual amount of sediment leaving the road.
4. The U.S. Forest Service, in cooperation with Montana Fish, Wildlife & Parks, routinely monitors key parameters of two coldwater native trout populations (bull trout and westslope cutthroat trout) that act as key indicators of aquatic ecosystem health (due to their reliance on clean, extremely cold water to survive) throughout the watershed.
5. Photopoints are established and monitored on restoration projects conducted by BBCTU, Montana DNRC, U.S. Forest Service and other restoration partners.
6. River gaging stations of the USGS, Montana DNRC and Trout Unlimited are monitored by the Blackfoot Challenge, Trout Unlimited and Blackfoot Drought Response Committee to track stream flows and temperatures.

6.3 Indicators of Success

Working together, Blackfoot Watershed partners will evaluate success based on a variety of water quality, quantity and community engagement criteria. With a voluntary program for private landowners, in the short term it will be challenging to predict the number and scale of projects that can be implemented. Over the longer term as we identify willing landowner participants, as outreach and education reinforce the value of voluntary BMPs and watershed restoration work, measurable results will be easier to predict.

On at least an annual basis, partners will evaluate and report on the following indicators:

- Number of stream miles improved or restored.
- Reduction in sediment loads.
- Reduction in average temperature (critical measuring points include the Blackfoot River at Bonner, the North Fork of the Blackfoot River, and other critical bull trout tributaries).
- Reduction in metals.

- Reduction in nutrients.
- Improved riparian vegetation health/growth.
- Collaborative partnerships built to facilitate restoration (among state and federal agencies, landowners, donors, conservation organizations).
- Number of landowners implementing BMPs or restoration projects.
- Number of community members attending public meetings, trainings or workshops.
- Improved populations and distribution of native trout.
- Gallons / CFS of water conserved through water conservation projects and drought response.

6.4 Key Milestones

Table 6.2: Milestones Over Five Years

(X = milestones planned by year; (#) = number of projects per year)

MILESTONES	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Host workshop on BMPs (NRCS & Blackfoot Challenge)	X	X	X	X	X
Reach at least 100 people with education / training / outreach	X	X	X	X	X
Landowner BMP implementation	X	X (2)	X (2)	X (3)	X (4)
Implement stream restoration project		X (1)	X (1)	X (2)	X (2)
Implement irrigation infrastructure improvement project	X (1)	X (2)	X (2)	X (3)	X (3)
Reduce/eliminate a sediment source		X (1)	X (2)	X (2)	X (3)
Maximize drought response participation (90+ irrigators engaged)	X	X	X	X	X

7.0 EDUCATION & OUTREACH

The Blackfoot Challenge leads a natural resource stewardship approach that focuses on providing regular communication and education to watershed stakeholders. With a representative board of private landowners, federal and state resource managers, and conservation professionals, the Challenge follows a consensus-based model, including diverse watershed landowners and agency partners to build partnerships and share resources that benefit the Blackfoot Watershed. Through this approach we identify common ground on which Blackfoot constituents can agree and respond through consensus of volunteer committees.

Achieving this consensus relies on our ability to be good communicators, keeping our communities aware and involved. The Challenge and its partners will maintain and expand existing strategies for outreach and education to support implementation of the Watershed Restoration Plan.

Goal: Implement consistent and diverse communications strategies targeting both residents of and visitors to the Blackfoot watershed with information that educates and involves people in how we all work together to ensure a healthy watershed.

General Community Outreach

- Distribute electronic and print newsletters incorporating water quality and quantity information at least 3-4 times per year.
- Post information and resources online through key web sites (Blackfoot Challenge, NRCS, Big Blackfoot Chapter of Trout Unlimited, Montana Fish, Wildlife and Parks, etc.).
- Place periodic watershed health articles in community newspapers (Seeley Swan Pathfinder, Blackfoot Valley Dispatch, Silver State Post, Missoulian).
- Host tours for target groups as well as members of the general public; multiple agency and NGO partners take part in these tours to demonstrate how multiple groups work together to improve water quality and quantity.
- Host public meetings and workshops on timely water quality and quantity topics.
 - Annual drought planning meeting.
 - TMDL public meetings.
 - BMP training workshops for landowners.
 - Annual irrigation efficiency workshops.



Technical Assistance

- Create and distribute best management practices guides for Blackfoot landowners, irrigators, anglers and outfitters.
- Distribute (in print and on web site) Blackfoot Drought Plan guides for irrigators and outfitters/anglers.
- Train and engage community members in citizen-based water monitoring.
- Provide irrigation scheduling and efficiency guidance through workshops, print materials, email distribution and web site to support wise use of water resources during peak demand and low flows.
- Provide easily accessible one-on-one technical assistance through watershed and land stewards who work on-the-ground in the Blackfoot (primarily through Blackfoot Challenge).
- Connect landowners to resources that support their ability to implement voluntary water quality improvement measures.

Partner Coordination

- Continue Blackfoot Drought Committee coordination to keep water stakeholders meeting regularly on addressing water quantity issues. (This group also plays an important role related to water temperature concerns.)
- Utilize Blackfoot Watershed Advisory Group (WAG) and Technical Advisory Group (TAG) to coordinate education and planning surrounding water quality concerns.
- Continue the coordination and project work taking place through multi-partner work groups, like the stream restoration team led by BBCTU and the Southwest Crown of the Continent team.
- Utilize partnerships to more broadly distribute watershed news and activities through each partner organization's network.

Youth Education

- Continue water monitoring partnership with Seeley, Lincoln and other local elementary schools.
- Maintain regular meetings of Blackfoot Teacher Steering Committee to develop and implement ongoing programs that involve youth in watershed stewardship and education.
- Engage Lincoln youth in ongoing monitoring of Mike Horse Mine reclamation process.
- Continue collaboration with annual youth watershed education events, including Montana Natural Resources Youth Camp, Blackfoot Challenge Youth Field Days, and Trumpeter Swan Restoration Program releases.

Table 7.1: Summary Education & Outreach Plan

Education & Outreach Plan		
STRATEGY	TOOLS	COSTS
Community Outreach	News media; community meetings & training workshops; website; e-mail newsletter; print publications	Staff time: \$25/hour – 80 hours per month Meetings: \$200 per meeting Printing (posters, meeting calendars): \$50 per meeting
Technical Assistance	Regular website updates; print materials; workshops; volunteer training; one-on-one landowner outreach	Staff time: \$25/hour – 50 hours per month Printing: \$2,500 / year Meetings: \$200 per meeting
Partner Coordination	Committee meetings; ongoing outreach	Staff time: \$25/hour – 20 hours per month
Youth Education	Special events; Ongoing coordination with teachers & schools; Teacher steering committee meetings	Staff time: \$25/hour – 20 hours per month Meetings: \$200 per meeting Educational materials: \$500 per year

8.0 REFERENCES

8.1 Source Material

Blackfoot Challenge (BC). 2005. A Basin-wide Restoration Action Plan for the Blackfoot Watershed; Prepared for: Montana Department of Natural Resources and Conservation Renewable Resource Grant & Loan Program and The Blackfoot Watershed Restoration and Monitoring Partners. Prepared by: the Blackfoot Challenge in Partnership with the Big Blackfoot Chapter of Trout Unlimited, Montana Fish, Wildlife and Parks, Hydrometrics Inc., and other partners.

Blackfoot Challenge and Trout Unlimited (BC/TU). August 2009. Blackfoot Subbasin Plan; prepared for the Northwest Power and Conservation Council; prepared by the Blackfoot Challenge and Trout Unlimited.

Behnke, R. 2002. Trout and salmon of North America. Chanticleer Press, New York.

MBTRT (Montana Bull Trout Restoration Team). 2000. Restoration plan for bull trout in the Clark Fork River Basin and Kootenai River Basin Montana. A report to Governor Marc Racicot from the Montana Bull Trout Restoration Team, c/o Montana Fish, Wildlife and Parks, Helena, Montana.

MFWP. 2005a. Montana's Comprehensive Fish and Wildlife Conservation Strategy. Montana Fish, Wildlife and Parks, Helena.

MFWP. 2005b. An Integrated Stream Restoration and Native Fish Conservation Strategy for the Blackfoot River Basin. By Montana Fish, Wildlife and Parks, Helena.

MTNHP (Montana Natural Heritage Program). 2009. Montana Field Guide, available at www.nhp.nris.mt.gov. Montana Natural Heritage Program, Helena, MT.

Pierce, R., R. Aasheim and C. Podner. 2007. Fluvial westslope cutthroat trout movements and restoration relationships in the Upper Blackfoot Basin, Montana. Intermountain Journal of Sciences Vol. 13(2).

Pierce, R., C. Podner, M. Davidson, L. Knotek, and J. Thabes. 2008. The Big Blackfoot River Fisheries and Restoration Investigations for 2006 and 2007. Montana Department of Fish, Wildlife and Parks, Missoula.

Schmetterling, D.A. 2001. Seasonal movements of fluvial westslope cutthroat trout in the Blackfoot River drainage, Montana. North American Journal of Fisheries Management 21:507-520.

Shepard, B.B., B.E. May and W. Urie. 2005. Status and conservation of westslope cutthroat trout within the Western United States. *North American Journal of Fisheries Management* 25:1426-1440.

Swanberg, T.R. 1997. Movement of and Habitat Use by Fluvial Bull Trout in the Blackfoot river, Montana. *Transactions of the American Fisheries Society* 126:735-746.

USFWS (U.S. Fish and Wildlife Service). 2002. Draft Recovery Plan for Three of the Five Distinct Population Segments of Bull Trout (*Salvelinus confluentus*). Chapter 3 – Clark Fork Recovery Unit. U.S. Fish and Wildlife Service Region 1, Portland, OR.

Blackfoot TMDLs:

- Water Quality Restoration Plan for Metals in the Blackfoot Headwaters TMDL Planning Area; Montana Department of Environmental Quality; June 2003.
- Blackfoot Headwaters Planning Area Water Quality and Habitat Restoration Plan and TMDL for Sediment; Montana Department of Environmental Quality; April 9, 2004.
- Blackfoot Headwaters Planning Area Water Quality and Habitat Restoration Plan and TMDL Addendum for Sediment – Sandbar Creek; Montana Department of Environmental Quality; August 2014.
- Lower Blackfoot Nutrients TMDLs and Water Quality Improvement Plan; Montana Department of Environmental Quality; September 2013.
- Lower Blackfoot Total Maximum Daily Loads and Water Quality Improvement Plan; Sediment, Trace Metal and Temperature TMDLs; Montana Department of Environmental Quality; December 2009.
- Middle Blackfoot – Nevada Creek Total Maximum Daily Loads and Water Quality Improvement Plan; Sediment, Nutrient, Trace Metal and Temperature TMDLs; Montana Department of Environmental Quality; September 22, 2008.
- Middle Blackfoot – Nevada TMDL and Water Quality Improvement Plan Addendum; Montana Department of Environmental Quality; August 2014.

8.2 APPENDICES

8.2.1 Causes and Sources of Impairment

STREAM	POLLUTANT	TMDL DOCUMENT*	PAGES
Sandbar Creek	Metals	A	18-19
Willow Creek	Metals	A	24-25
Poorman Creek	Metals	A	31-32
Beartrap Creek	Metals	A	44-46
Mike Horse Creek	Metals	A	44-46
Blackfoot River, upstream of Landers Fork	Metals	A	64-69
Blackfoot River, upstream of Landers Fork	Sediment	B	28-31
Blackfoot River, Landers Fork to Nevada Creek	Sediment	B	32-34
Arrastra Creek	Sediment	B	35
Poorman Creek	Sediment	B	36-37
Willow Creek	Sediment	B	38-39
Sandbar Creek	Sediment	B	39
Beartrap Creek	Sediment	B	39
Mike Horse Creek	Sediment	B	39
Elk Creek	Nutrients	C	Pages 5-19 to 5-23
Washoe Creek	Nutrients	C	Pages 5-23 to 5-28
Ashby Creek, West Fork	Nutrients	C	Pages 5-29 to 5-31
Camas Creek	Nutrients	C	Pages 5-31 to 5-36
Union Creek	Nutrients	C	Pages 5-36 to 5-41
Ashby Creek, East Fork	Sediment	D	67-68, 74-82
Ashby Creek, West Fork	Sediment	D	68-69, 74-82
Belmont Creek	Sediment	D	63-65, 74-82
Camas Creek	Sediment	D	69-71, 74-82
Elk Creek, Upper	Sediment	D	58-61, 74-82
Elk Creek, Lower	Sediment	D	61-63, 74-82
Keno Creek	Sediment	D	57-58, 74-82
Union Creek	Sediment	D	71-82
Washoe Creek	Sediment	D	65-67, 74-82
Union Creek	Metals	D	86-88
Elk Creek, Lower	Temperature	D	91-104, 122-127
Union Creek	Temperature	D	91-104, 122-127
Washington Creek, Upper	Sediment	E	96-98, 148-160
Washington Creek, Lower	Sediment	E	98-99, 148-160

Washington Creek, Lower	Metals	E	162-174
Jefferson Creek, Upper	Sediment	E	100-101, 148-160
Jefferson Creek, Lower	Sediment	E	101-102, 148-160
Jefferson Creek, Lower	Metals	E	162-174
Jefferson Creek, Lower	Nutrients	E	190-195
Gallagher Creek	Sediment	E	103-104, 148-160
Gallagher Creek	Nutrients	E	190-195
Buffalo Gulch	Sediment	E	104-105, 148-160
Nevada Creek, Upper	Sediment	E	107-109, 148-160
Nevada Creek, Upper	Temperature	E	199-205, 207-212
Nevada Creek, Upper	Metals	E	162-174
Nevada Creek, Upper	Nutrients	E	190-195
Braziel Creek	Sediment	E	105-106, 148-160
Braziel Creek	Nutrients	E	190-195
Black Bear Creek	Sediment	E	113-114, 148-160
Black Bear Creek	Nutrients	E	190-195
Murray Creek	Sediment	E	120-121, 148-160
Murray Creek	Metals	E	162-174
Murray Creek	Nutrients	E	190-195
Murray Creek	Temperature	E	199-205, 220
Douglas Creek, Upper	Sediment	E	114-116, 148-160
Douglas Creek, Upper	Metals	E	162-174
Douglas Creek, Upper	Nutrients	E	190-195
Douglas Creek, Upper	Temperature	E	199-205, 224-228
Cottonwood Creek (trib to Douglas Creek)	Temperature	E	199-205, 220-224
Cottonwood Creek (trib to Douglas Creek)	Nutrients	E	190-195
Cottonwood Creek (trib to Douglas Creek)	Sediment	E	117-119, 148-160
Nevada Spring Creek	Sediment	E	111-113, 148-160
McElwain Creek	Sediment	E	119-120, 148-160
McElwain Creek	Nutrients	E	190-195
Nevada Creek, Lower	Sediment	E	109-111, 148-160
Nevada Creek, Lower	Temperature	E	199-205, 212-220
Nevada Creek, Lower	Nutrients	E	190-195
Blackfoot River, Nevada to Monture	Sediment	E	121-124, 148-160
Blackfoot River, Nevada to Monture	Nutrients	E	190-195
Blackfoot River, Nevada to Monture	Temperature	E	199-205, 238-246

Yourname Creek	Sediment	E	124-125, 148-160
Yourname Creek	Nutrients	E	190-195
Wales Creek	Sediment	E	126-127, 148-160
Wales Creek	Nutrients	E	190-195
Frazier Creek	Sediment	E	127-128, 148-160
Frazier Creek	Nutrients	E	190-195
Ward Creek	Sediment	E	128-129, 148-160
Kleinschmidt Creek	Metals	E	162-174
Kleinschmidt Creek	Sediment	E	130-131, 148-160
Kleinschmidt Creek	Temperature	E	199-205, 232-238
Rock Creek	Sediment	E	131-133, 148-160
Monture Creek	Sediment	E	138-140, 148-160
Cottonwood Creek (trib to Blackfoot River)	Sediment	E	140-142, 148-160
Richmond Creek	Sediment	E	142-143, 148-160
Clearwater River, West Fork	Sediment	E	143-144, 148-160
Deer Creek	Sediment	E	144-145, 148-160
Buck Creek	Sediment	E	145-146, 148-160
Blanchard Creek	Sediment	E	146-160
Douglas Creek, Lower	Nutrients	E	190-195
Douglas Creek, Lower	Temperature	E	199-205, 228-232
Douglas Creek, Lower	Metals	E	162-174
Douglas Creek, Lower	Sediment	E	116-117, 148-160
Blackfoot River, Monture to Clearwater	Sediment	E	121-124, 148-160
Blackfoot River, Monture to Clearwater	Nutrients	E	190-195
Blackfoot River, Monture to Clearwater	Temperature	E	199-205, 246-249

***For this table, each TMDL document has been represented by a single letter as follows:**

A = Water Quality Restoration Plan for Metals in the Blackfoot Headwaters TMDL Planning Area (June 2003)

B = Blackfoot Headwaters Planning Area Water Quality and Habitat Restoration Plan and TMDL for Sediment (April 2004)

C = Lower Blackfoot Nutrients TMDLs and Water Quality Improvement Plan (September 2013)

D = Lower Blackfoot Total Maximum Daily Loads and Water Quality Improvement Plan – Sediment, Trace Metal and Temperature TMDLs (December 2009)

E = Middle Blackfoot-Nevada Creek Total Maximum Daily Loads and Water Quality Improvement Plan – Sediment, Nutrient, Trace Metal and Temperature TMDLs (September 2008)

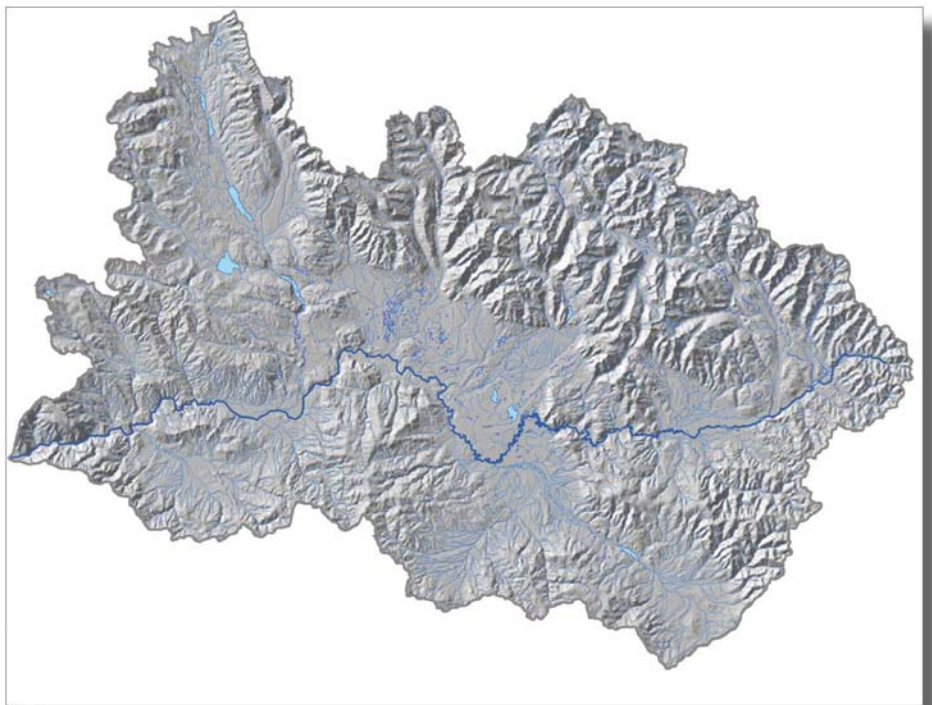
8.2.2 TMDL Load Reduction Tables

Nevada Creek and Middle Blackfoot River Sediment Loading Reduction Allocations by Contributing Land Use

Stream Name	Annual Load Reduction (tons/year)	Allocations by Land Use (tons/year)					
		Livestock Grazing	Hay Production	Silviculture	Placer Mining	Road Crossings	Rural Residential
Yourname Creek	181	130	1	1	1	48	0
Wales Creek	87	52	29	0	0	6	0
Frazier Creek	17	7	0	0	0	10	0
Ward Creek	48	22	0	8	0	18	0
Kleinschmidt Creek	12	1	0	0	0	11	0
Rock Creek	754	503	0	219	0	32	0
Warren Creek	128	13	1	4	0	110	0
Monture Creek	342	36	0	146	0	160	0
Blackfoot River (Nevada Cr. to Monture Cr.)	2560	1127	876	504	0	54	0
Cottonwood Creek (Blackfoot)	583	286	7	77	0	213	0
Richmond Creek	13	0	0	1	0	12	0
West Fork Clearwater River	175	0	0	90	0	85	0
Deer Creek	271	0	0	148	0	124	0
Blanchard Creek	146	21	0	7	0	119	0
Blackfoot River (Monture Cr. To Clearwater River)	948	477	64	0	0	280	127
Totals	6,265	2,675	978	1,205	1	1,282	127

- 8.2.3 Blackfoot Subbasin Plan**
- 8.2.4 A Basin-wide Restoration Action Plan for the Blackfoot Watershed**
- 8.2.5 Big Blackfoot Watershed Water Quality Monitoring Program: Quality Assurance Project Plan (QAPP)**

Blackfoot Subbasin Plan



**Prepared for the Northwest Power and Conservation Council
Prepared by the Blackfoot Challenge and Trout Unlimited**

August 2009

© 2009 Blackfoot Challenge and Trout Unlimited

Citation: Blackfoot Challenge and Trout Unlimited 2009. Blackfoot Subbasin Plan. *A report prepared for the Northwest Power and Conservation Council.* Portland, OR.

Subbasin Plan Coordination: Stan Bradshaw & Ali Duvall
Document Prepared By: Jenny Tollefson
GIS Work By: Heather Kreilick, SEM LLC

For information on this document, contact:

Blackfoot Challenge
405 Main Street
P.O. Box 103
Ovando, MT 59854
Phone: 406-793-3900
Email: info@blackfootchallenge.org

Trout Unlimited, Montana Water Project
432 N. Last Chance Gulch, Ste S
PO Box 412
Helena, MT 59624
Phone: 406-449-9922
Email: SBradshaw@tu.org

List of Participants

A remarkable group of people representing public agencies, private organizations, and the general public dedicate their energy and expertise to the ecological, social, and economic well-being of the Blackfoot Subbasin and its inhabitants. Many of those people served on the technical work groups that steered the development of the Blackfoot Subbasin Plan. Numerous others contributed to the editorial process, helping us to refine the plan into a form that will be most useful to conservation and restoration partners working in the subbasin. We thank them for their generous assistance throughout the subbasin planning process.

Blackfoot Subbasin Technical Work Group Participants:

Native Salmonids Work Group

Ryen Aasheim - Big Blackfoot Chapter of Trout Unlimited
Ali Duvall - Blackfoot Challenge
Shane Hendrickson - U.S. Forest Service, Lolo National Forest
Steve Kloetzel - The Nature Conservancy
Brian McDonald - Blackfoot Challenge
Greg Neudecker - U.S. Fish and Wildlife Service
Ron Pierce - Montana Fish, Wildlife and Parks
Karen Pratt - Seeley Lake Landowner
Bruce Rieman - Clearwater Resources Council

Forest Work Group

Matt Arno - Woodland Restoration, Inc.
Gary Burnett - Blackfoot Challenge
Richard Briskin - Ovando Landowner
Jim Costamagna - Department of Natural Resources & Conservation
Ali Duvall - Blackfoot Challenge
Hank Goetz - Blackfoot Challenge
George Hirschenberger - Community Member
Amber Kamps - U.S. Forest Service, Helena National Forest
Steve Kloetzel - The Nature Conservancy
Rich Lane - Big Blackfoot Chapter of Trout Unlimited
Tim Love - U.S. Forest Service, Lolo National Forest
Maria Mantas - The Nature Conservancy
Carolyn Mehl - Clearwater Resources Council
Steve Shelly - U.S. Forest Service, Lolo National Forest
Scott Tomson - U.S. Forest Service, Lolo National Forest

Vegetation Work Group

Elaine Caton - Ovando Landowner
Ali Duvall - Blackfoot Challenge
Kevin Ertl - U.S. Fish and Wildlife Service
Steve Kloetzel - The Nature Conservancy
Maria Mantas - The Nature Conservancy

Vegetation Work Group (cont.)

Mary Manning - U.S. Forest Service, Lolo National Forest
Mike McGrath - Department of Natural Resources & Conservation
Carolyn Mehl - Clearwater Resources Council
Greg Neudecker - U.S. Fish and Wildlife Service
Steve Shelly - U.S. Forest Service, Lolo National Forest
Brad Weltzien - North Powell Conservation District
Leigh Wiley - Potomac Landowner

Grizzly Bear Work Group

Jamie Jonkel - Montana Fish, Wildlife and Parks
Steve Kloetzel - The Nature Conservancy
Jay Kolbe - Montana Fish, Wildlife and Parks
Maria Mantas - The Nature Conservancy
Greg Neudecker - U.S. Fish and Wildlife Service
Seth Wilson - Blackfoot Challenge

Other

Colden Baxter - Idaho State University
Jeff Collins - Department of Natural Resources & Conservation
Lynn Ducharme - Confederated Salish and Kootenai Tribes
Jon Haber - U.S. Forest Service, Region One
Dick Hutto - University of Montana
Land Lindbergh - Greenough Landowner
Martin Miller - Montana Natural Heritage Program
Scott Mincemoyer - Montana Natural Heritage Program
Eileen Ryce - Montana Fish, Wildlife and Parks
Dave Stagliano - Montana Natural Heritage Program
Brian Sugden - Plum Creek Timber Company
Leonard Walch - U.S. Forest Service, Helena National Forest
Carly Walker - Missoula County Rural Initiatives

Table of Contents

1.0 Executive Summary	11
1.1 Overview	11
1.2 Subbasin Planning Process	12
1.3 Elements of the Blackfoot Subbasin Plan	12
1.3.1 Subbasin Assessment	12
1.3.2 Inventory of Existing Programs	14
1.3.3 Management Plan	15
2.0 Introduction to the Blackfoot Subbasin Plan	18
2.1 What is a Subbasin Plan?	18
2.2 Purpose of the Blackfoot Subbasin Plan	19
2.3 Overview of the Blackfoot Subbasin Planning Process	19
2.3.1 Subbasin Plan Partners	19
2.3.2 Integration with Related Planning Efforts in the Blackfoot Subbasin	20
2.3.3 Blackfoot Subbasin Planning Framework: Conservation Action Planning	21
2.3.4 Public Involvement	22
3.0 Subbasin Assessment	23
3.1 What is the Subbasin Assessment?	23
3.2 Blackfoot Subbasin Overview	23
3.2.1 Geography and Regional Context	23
3.2.2 Geology	25
3.2.3 Soils	26
3.2.4 Climate	29
3.2.4.1 Blackfoot Subbasin Climate	29
3.2.4.2 Macroclimate Trends	32
3.2.5 Water Resources	33
3.2.5.1 Water Uses and Modifications	35
3.2.5.1.1 Water Rights	35
3.2.5.1.2 Dams	36
3.2.5.2 Water Quality	37
3.2.6 Fish and Wildlife	40
3.2.6.1 Overview of Fish and Wildlife of the Blackfoot Subbasin	40
3.2.6.2 Special Status Fish and Wildlife Species	40
3.2.6.3 Non-native Aquatic Animal Species	50

3.2.7	Vegetation	53
3.2.7.1	Overview of Vegetation Types in the Blackfoot Subbasin	53
3.2.7.2	Special Status Plant Species	55
3.2.7.3	Non-native Plant Species	61
3.2.8	Ecological Relationships	66
3.2.9	Socioeconomic and Land Use Characteristics	67
3.2.9.1	Settlement History	67
3.2.9.2	Population	68
3.2.9.3	Land Ownership	69
3.2.9.4	Land Use and Economy	72
3.2.9.5	Conservation Legacy	73
3.3	Conservation Targets	74
3.3.1	Conservation Target Selection Process	74
3.3.2	Assessing Conservation Target Viability	76
3.3.3	Conservation Target Descriptions and Viability Assessments	79
3.3.3.1	Native Salmonids	79
3.3.3.2	Herbaceous Wetlands	99
3.3.3.3	Moist Site and Riparian Vegetation	105
3.3.3.4	Native Grassland/Sagebrush Communities	109
3.3.3.5	Low Elevation Ponderosa Pine/Western Larch Forest	114
3.3.3.6	Mid to High Elevation Coniferous Forest	118
3.3.3.7	Grizzly Bear	123
3.3.3.8	Rural Way of Life	128
3.3.4	Summary of Viability	133
3.4	Threat Assessment	134
3.4.1	Overview	134
3.4.2	Conservation Target Threat Assessments	135
3.4.3	Summary of Threats	143
3.4.4	Description of Threats	146
3.4.4.1	Unplanned Residential and Resort Development	146
3.4.4.2	Climate Change	148
3.4.4.3	Exotic/Invasive Species	150
3.4.4.4	Lack of Fire	154
3.4.4.5	Incompatible Forestry Practices	155
3.4.4.6	Physical Road Issues	156
3.4.4.7	Conversion to Agriculture	158
3.4.4.8	Mining	159
3.4.4.9	Motorized Vehicle Use (On and/or Off Road)	160

3.4.4.10 Incompatible Grazing	161
3.4.4.11 Drainage and Diversion Systems	162
3.4.4.12 Channel Alteration	164
3.4.4.13 Epidemic Levels of Native Insects and Pathogens	164
3.4.4.14 Non-Motorized Recreational Use	165
3.4.4.15 Existing Crop Production	166
3.4.4.16 Filling of Wetlands	166
3.4.4.17 Lack of Human Tolerance	167
3.4.4.18 Human-Caused Mortality	167
3.4.4.19 Altered Wildlife Use Patterns	168
3.4.4.20 Presence of Bear Attractants	169
3.4.5 External Threats	171
4.0 Inventory of Existing Programs and Activities	172
4.1 Background	172
4.2 Current Management Activities	172
4.2.1 Existing Protection	172
4.2.1.1 Federal Protection	172
4.2.1.2 State Protection	173
4.2.1.3 Other Special Designations and Projects	174
4.2.2 Existing Management Plans	175
4.2.2.1 Federal Plans	175
4.2.2.2 Tribal Plans	177
4.2.2.3 State Plans	177
4.2.2.4 County Plans	182
4.2.2.5 Other Plans	182
4.2.3 Management and Funding Programs	183
4.2.3.1 Federal Programs	183
4.2.3.2 State Programs	189
4.2.3.3 County Programs	191
4.2.3.4 Institutions, Non-Profit Organizations, and Private Funding	192
4.3 Restoration and Conservation Projects	194
4.3.1 BPA-Funded Restoration Projects in the Blackfoot Subbasin	194
4.3.2 Non-BPA-Funded Restoration Projects in the Blackfoot Subbasin	195
4.3.3 Ongoing and Potential Restoration Projects on TMDL Streams	195
4.4 Gap Assessment	210

5.0 Management Plan	218
5.1 Background	218
5.2 Subbasin Vision	218
5.3 Conservation Objectives and Strategic Actions	219
5.4 Monitoring, Evaluation, and Research Plan	244
5.5 Endangered Species Act and Clean Water Act Requirements	248
6.0 References	251

Tables

Table 2.1	Elements of a Subbasin Plan	18
Table 2.2	Overview of Conservation Action Planning	22
Table 3.1	Major Soil Units in the Nevada Creek Planning Area	27
Table 3.2	Major Soil Units in the Middle Blackfoot Planning Area	27
Table 3.3	Major Soil Units in the Lower Blackfoot Planning Area	28
Table 3.4	Aquatic Habitat Types in the Blackfoot Subbasin	34
Table 3.5	Animal Species of Concern in the Blackfoot Subbasin	46
Table 3.6	Summary of histological results summarized as mean grade infections	53
Table 3.7	Plant Species of Concern in the Blackfoot Subbasin	56
Table 3.8	State-listed Noxious Weed Species Established in the Blackfoot Subbasin	61
Table 3.9	Noxious and Invasive Weeds with High Potential to Become Problem Plants in the Blackfoot Subbasin	63
Table 3.10	Alert List for Recently Invading or Less Well-Known Weeds and Risk Ratings for Blackfoot Subbasin Habitats	64
Table 3.11	Conservation Targets and Associated Nested Targets in the Blackfoot Subbasin	76
Table 3.12	Native fish priority streams sorted alphabetically high to low priority	82
Table 3.13	Bull Trout Viability Assessment	89
Table 3.14	Westslope Cutthroat Trout Viability Assessment	95
Table 3.15	Herbaceous Wetlands Viability Assessment	103
Table 3.16	Moist Site and Riparian Vegetation Viability Assessment	108
Table 3.17	Native Grassland/Sagebrush Communities Viability Assessment	113
Table 3.18	Low Elevation Ponderosa Pine/Western Larch Forest Viability Assessment	117
Table 3.19	Mid to High Elevation Coniferous Forest Viability Assessment	122

Table 3.20	Grizzly Bear Viability Assessment	126
Table 3.21	Viability Summary for Blackfoot Subbasin Conservation Targets	133
Table 3.22	Native Salmonids Threat Assessment	136
Table 3.23	Herbaceous Wetlands Threat Assessment	137
Table 3.24	Moist Site and Riparian Vegetation Threat Assessment	138
Table 3.25	Native Grasslands/Sagebrush Communities Threat Assessment	139
Table 3.26	Low Elevation Ponderosa Pine/Western Larch Forest Threat Assessment	140
Table 3.27	Mid to High Elevation Coniferous Forest Threat Assessment	141
Table 3.28	Grizzly Bear Threat Assessment	142
Table 3.29	Summary of Threats to Blackfoot Subbasin Conservation Targets	144
Table 4.1	Completed BPA-Funded CBWTP Projects in the Blackfoot Subbasin	196
Table 4.2	Completed Restoration Projects in the Blackfoot Subbasin	197
Table 4.3	Potential Restoration Projects on TMDL Streams in the Blackfoot Subbasin	201
Table 5.1	Strategy Development Reference Table	220
Table 5.2	Restoration Effectiveness Monitoring Metrics Applicable To Various Restoration Objectives/Sources	245
Table 5.3	Relationship of Blackfoot Subbasin Conservation Objectives to the ESA and CWA	249

Figures

Figure 3.1	Location of the Blackfoot Subbasin within the Columbia River Basin	24
Figure 3.2	Soils/Groundwater Profile	28
Figure 3.3	Farmland Soils	29
Figure 3.4	Precipitation Ranges across Blackfoot Subbasin	30
Figure 3.5	Thirty-Year Average Temperature and Precipitation at Four Sites across the Blackfoot Subbasin	31
Figure 3.6	Projected Changes in Average PNW Temperature – 21 st century	33
Figure 3.7	Major Rivers, Lakes, and Streams	34
Figure 3.8	Blackfoot River Discharge: Year 2000 Compared to Historic Mean	35
Figure 3.9	Impaired Streams	38
Figure 3.10	TMDL Planning Units	39
Figure 3.11	Critical Bull Trout Habitat in the Blackfoot Sub-unit	43
Figure 3.12	Critical Bull Trout Habitat in the Clearwater River and Lakes Sub-unit	44

Figure 3.13	Land Cover Class	54
Figure 3.14	Communities and Counties	68
Figure 3.15	2000 Population Density	69
Figure 3.16	Land Ownership and Conservation Easements	71
Figure 3.17	Public Lands and Wilderness	72
Figure 3.18	Native Fish Restoration Priorities for the Blackfoot River	81
Figure 3.19	Distribution of Six Salmonids Within the Blackfoot Sub-basin	84
Figure 3.20	Bull Trout “Core Areas” for the Blackfoot Basin	86
Figure 3.21	Bull trout redd counts for index reaches in three primary fluvial bull trout streams	87
Figure 3.22	CPUE for juvenile bull trout near spawning sites of three primary spawning streams	88
Figure 3.23	WSCT densities at eight sampling locations on the Blackfoot River	93
Figure 3.24	Generalized WSCT life history traits and summary of genetic test results ...	94
Figure 3.25	Herbaceous Wetlands	99
Figure 3.26	Moist Site and Riparian Vegetation	105
Figure 3.27	Bald Eagle Nesting Sites	107
Figure 3.28	Native Grassland/Sagebrush Communities	109
Figure 3.29	Ungulate Winter Range	112
Figure 3.30	Low Elevation Ponderosa Pine/Western Larch Forest	114
Figure 3.31	Mid to High Elevation Conifer Forest	118
Figure 3.32	Canada Lynx Habitat	120
Figure 3.33	Suitable and Occupied Habitat for Grizzly Bears	123
Figure 3.34	2008 Montana Wolf Pack Locations	125
Figure 3.35	Roads	157
Figure 3.36	Dewatered Streams	163
Figure 3.37	Blackfoot Watershed Restoration Projects and Monitoring Locations	246
Figure 3.38	Blackfoot Watershed Status and Trends Monitoring Network	247

Appendices

Appendix A	Dewatered Stream List for the Blackfoot Subbasin	272
Appendix B	List of Wildlife species	274
Appendix C	Explanation of Montana Natural Heritage Program Ranks	284
Appendix D	Vascular Plant Species associated with Glacial Wetlands in the Ovando Valley	286
Appendix E	Native Salmonid Viability: Definitions of Key Attributes	288
Appendix F	Invertebrate Species of Concern and Potential Species of Concern Associated with Herbaceous Wetlands West of the Continental Divide	292
Appendix G	Montana State Noxious Weed List (3/27/08)	293
Appendix H	Blackfoot River Valley Conservation Area Monitoring Plan (DRAFT 2007)	294
Appendix I	Acronyms and Abbreviations	301
Appendix J	An integrated stream restoration and native fish conservation strategy for 182 streams in the Blackfoot Basin, Montana	303
Appendix K	U.S. Fish And Wildlife Service, 2002. Bull Trout Draft Recovery Plan, Clark Fork River Recovery Unit	313
Appendix L	Restoration Effectiveness Monitoring Protocol For TheBlackfoot Watershed	353
Appendix M	Table of Potential Restoration Projects	374

Executive Summary

1.1 Overview

The Blackfoot Subbasin has a strong history of locally-led conservation and restoration. Beginning in the mid1970s, private landowners developed the Blackfoot River Recreation Corridor Agreement and established two Walk-In Hunting areas near the confluence of the Clearwater and Blackfoot Rivers. In that same timeframe, the first conservation easement in Montana was acquired in the Blackfoot Valley. Thanks to the vision of these landowners, an important foundation was established for public and private partners to work together on restoring and protecting habitat, fish and wildlife populations in the Blackfoot River basin.

Building on this legacy, the Blackfoot Challenge, Trout Unlimited and The Nature Conservancy began the process of developing a subbasin plan for the Blackfoot Watershed in fall 2007. The purpose of the subbasin plan is to create a comprehensive strategy for conserving, restoring and enhancing the natural resources and rural lifestyle of the Blackfoot Subbasin. The Blackfoot Subbasin Plan is one of more than 50 such plans that have been written for tributaries and mainstem segments of the Columbia River under the leadership of the Northwest Power and Conservation Council (NPCC 2000).

The Blackfoot Subbasin Plan was developed collaboratively by a wide range of stakeholders including private landowners and representatives from public agencies and non-government organizations working in the subbasin. This community-based approach to natural resource and conservation planning ensures a local voice and vision for land management and restoration activities in the Blackfoot Subbasin. It also provides opportunities to work across public and private boundaries and to coordinate technical and funding resources.

1.2 Subbasin Planning Process

Based on community, agency and partner interest, four technical work groups were formed in early 2008 to capture in the subbasin plan the local knowledge, professional expertise and on-the-ground experience of people living and working in the Blackfoot Subbasin. Technical work groups held regular meetings between March 2008 and May 2009.

The Blackfoot Subbasin Plan was developed following The Nature Conservancy's Conservation Action Planning process (citation?). Conservation Action Planning provides a framework for designing, implementing and evaluating conservation projects at any scale, from small sites to large landscapes such as the Blackfoot Subbasin. Technical work groups used this adaptive framework in the Blackfoot Subbasin to 1) identify key natural and community resources, 2) assess viability of the resources, 3) identify factors that threaten the health and viability of the resources, 4) develop conservation and management strategies to abate critical threats and ensure long-term viability of the resources and 5) incorporate quantitative measures to track effectiveness of the conservation strategies over time.

The Blackfoot Subbasin Plan integrates existing information contained in a variety of planning and management documents, including two key documents that have been cornerstones for conservation and restoration planning and action in the Blackfoot Subbasin: the Blackfoot River Valley Conservation Area Draft Plan (TNC and BC 2007) and A Basin-Wide Restoration Action Plan for the Blackfoot Watershed (BC 2005a).

1.3 Elements of the Blackfoot Subbasin Plan

1.3.1 Subbasin Assessment

The primary purpose of the Subbasin Assessment is to synthesize and evaluate the biological, physical and socioeconomic characteristics of the Blackfoot Subbasin, forming a scientific and technical foundation for prioritization of restoration and protection strategies for habitat and fish and wildlife populations. The Assessment begins with a broad overview of subbasin geography, geology, soils, climate, water resources, fish and wildlife, vegetation and socioeconomic and

land use characteristics, followed by an examination of the subbasin in a regional context. The remainder of the Assessment focuses on the following eight key conservation targets considered by the subbasin technical work groups to be representative of the natural and cultural resources of the Blackfoot Subbasin:

- Native salmonids
- Herbaceous wetlands
- Moist site and riparian vegetation
- Native grassland/sagebrush communities
- Low elevation ponderosa pine/western larch forest
- Mid to high elevation coniferous forest
- Grizzly bears
- Rural way of life

Each conservation target includes one or more “nested targets” that are expected to benefit from conservation of the main targets. Conserving and/or restoring this set of targets will help to ensure the viability of the species, natural systems and rural way of life that make the Blackfoot Subbasin unique and that contribute to the larger-scale significance of the Crown of the Continent Ecosystem.

After selecting the representative list of focal conservation targets for the Blackfoot Subbasin, technical work groups conducted viability and threat assessments for each target. Viability indicates the ability of a conservation target to persist for many generations. All conservation targets within the Blackfoot Subbasin were determined to have a current viability rating of *good*, *fair* or *poor*, suggesting that each conservation target will require some degree of human intervention in order to persist under current conditions. In the subbasin threat assessment, technical work groups identified the most critical factors that currently impact or have the potential to impact target viability over the next ten years. Critical threats to subbasin conservation targets are:

1. Unplanned Residential and Resort Development
2. Climate Change
3. Exotic/Invasive Species
4. Lack of Fire
5. Incompatible Forestry Practices
6. Physical Road Issues
7. Conversion to Agriculture
8. Mining
9. Motorized Vehicle Use
10. Incompatible Grazing
11. Drainage and Diversion Systems
12. Channel Alteration
13. Epidemic Levels of Native Insects and Pathogens

14. Non-motorized Recreational Use
15. Existing Crop Production
16. Filling of Wetlands
17. Lack of Human Tolerance
18. Human-Caused Mortality
19. Altered Wildlife Use Patterns
20. Presence of Bear Attractants

The threats are ranked from very high to low. The highest ranking threats are those that have the greatest impact on the greatest number of conservation targets in the subbasin. In addition to this list of threats, there are external factors that impact fish and wildlife in the Blackfoot Subbasin including climate change, fish migration barriers, habitat conditions, land use in adjacent subbasins and human population growth at a regional scale. Of the Blackfoot Subbasin conservation targets, bull trout, westslope cutthroat trout and grizzly bears are all wide-ranging species that are particularly vulnerable to threats originating outside of the subbasin.

The cumulative impact of threats results in an overall subbasin threat rank of *very high*, indicating that all of the conservation targets face some threat of degradation or extirpation across portions of the subbasin over the next 10 years. A *very high* rating suggests that, without conservation action, the viability of conservation targets within the subbasin will decline. These threats are viewed both as challenges to sustaining natural and cultural resources in the Blackfoot Subbasin and as opportunities for collaboration and conservation action. Conservation objectives and strategic actions outlined in the Subbasin Management Plan are designed to abate the critical threats in the subbasin, thereby ensuring the long-term viability of conservation targets.

1.3.2 Inventory of Existing Programs and Activities

The purpose of the Subbasin Inventory is to summarize current fish, wildlife and habitat protection and restoration activities in the subbasin. The Inventory includes a description of 1) protected areas in the subbasin, 2) management plans, including endangered species recovery plans, 3) management and funding programs and 4) on-the-ground conservation and restoration projects that target fish, wildlife and habitat in the subbasin. To complete the Inventory, we surveyed a large number of agencies, organizations and individuals involved directly or indirectly in fish and wildlife activities in the subbasin.

This review of existing protections and current management strategies enabled the subbasin planning team to evaluate and identify gaps in conservation and restoration activities in the subbasin, particularly in relation to the threats identified in the Blackfoot Subbasin Assessment. This gap assessment illustrates that, while most of the factors threatening the viability of subbasin conservation targets and associated nested targets have received some level of attention in an effort to abate them, the extent of actions varies widely. While conservation accomplishments in the subbasin have been significant, much work remains to be done.

1.3.3 Management Plan

The Management Plan is the heart of the Blackfoot Subbasin Plan. It consists of five elements: 1) a vision for the subbasin, 2) conservation objectives, 3) strategic actions, 4) research, monitoring and evaluation and 5) consistency with the Endangered Species Act and Clean Water Act. The Blackfoot Subbasin Management Plan is a living document that is based on a 10-15 year planning horizon. It reflects current knowledge of conditions in the Blackfoot Subbasin and will be updated through an adaptive management process as knowledge of ecological processes and socioeconomic conditions in the subbasin grows. The Blackfoot Subbasin Management Plan, which was developed collaboratively by a wide range of stakeholders, will serve as a guide for partners working to sustain the outstanding ecological, economic and cultural values and resources in the Blackfoot Subbasin.

The Management Plan includes a vision for the Blackfoot Subbasin that describes the desired future condition and incorporates the values and priorities of a wide spectrum of stakeholders. The Blackfoot Subbasin Vision will guide prioritization and implementation of conservation objectives and strategic actions to ensure the continued viability of ecological and human communities in the subbasin.

The vision for the Blackfoot Subbasin is for a place characterized by dynamic natural processes that create and sustain diverse and resilient communities of native fish and wildlife and the aquatic and terrestrial habitats on which they depend, thereby assuring substantial ecological, economic and cultural benefits. The efforts to conserve and enhance those natural resources will be implemented through a cooperative partnership between public and private interests that will seek to sustain not only those natural resources, but the rural way of life of the Blackfoot River Valley for present and future generations.

The core of the Blackfoot Subbasin Management Plan consists of a comprehensive set of conservation objectives and strategic actions designed to abate the critical threats to subbasin conservation targets, resulting in healthy, viable conservation targets. The ten conservation objectives included in the Management Plan are:

Conservation Objective 1 – Maintain the large, intact working landscapes that sustain the natural resources and rural way of life in the Blackfoot Subbasin through support to local communities, counties, and land conservation partners.

Conservation Objective 2a – Maintain and/or restore viable populations of bull trout within the three major population groups in the Blackfoot Subbasin.

Conservation Objective 2b – Maintain and/or restore viable populations of migratory (fluvial and adfluvial) westslope cutthroat trout within each of the three major population groups within the Blackfoot Subbasin.

Conservation Objective 2c – Maintain and/or restore viable populations of resident westslope cutthroat trout within each of the three major population groups within the Blackfoot Subbasin.

Conservation Objective 3 – Control existing noxious and invasive plant species abundance and distribution, and prevent establishment of all new noxious and invasive species in the Blackfoot Subbasin. Emphasis should be placed on protecting the highest quality habitats, which should be identified and prioritized by 2012.

Conservation Objective 4 – Maintain or restore the viability of priority herbaceous wetlands based on historic conditions across the Blackfoot Subbasin.

Conservation Objective 5 – Maintain or restore the viability of priority moist site and riparian vegetation based on historic conditions across the Blackfoot Subbasin.

Conservation Objective 6 – Maintain or restore the viability of priority native grassland and sagebrush communities based on historic conditions across the Blackfoot Subbasin.

Conservation Objective 7 – Maintain or restore the viability of low severity fire regime ponderosa pine and western larch forest communities based on historic stand conditions across the Blackfoot Subbasin.

Conservation Objective 8 – Maintain or restore the viability of mid to high elevation coniferous forest communities based on historic stand conditions across the Blackfoot Subbasin.

Conservation Objective 9a – Maintain functional connectivity for grizzly bears across biologically suitable habitats in the Blackfoot Subbasin.

Conservation Objective 9b – Reduce human-caused grizzly bear mortality in the Blackfoot Subbasin.

Conservation Objective 9c – Improve human acceptance of grizzly bears and wolves by building a community-supported conservation and management process that reflects the interests and values of residents and landowners throughout the Blackfoot Subbasin.

Conservation Objective 10 – Increase public awareness and education about conserving and enhancing the natural resources and rural way of life in the Blackfoot Subbasin.

The Management Plan concludes with a discussion of the Blackfoot Subbasin Monitoring and Evaluation Plan. This plan will be based on the draft monitoring plan contained in the Blackfoot River Valley Conservation Area Plan (TNC and BC 2007) and will incorporate the results of the Blackfoot Subbasin viability assessments that describe the current and desired viability ratings for a variety of indicators for each conservation target. The plan will also incorporate a conceptual plan for restoration effectiveness monitoring in the Blackfoot Watershed, contained in A Basin-Wide Restoration Action Plan for the Blackfoot Watershed (BC 2005).

Completion of the Blackfoot Subbasin Monitoring and Evaluation Plan will: 1) provide a framework for measuring conservation target viability over time, 2) ensure that strategic actions

are abating the critical threats to conservation targets and 3) verify that the stresses and threats identified in the Subbasin Assessment are, in fact, the factors that are limiting the viability of each conservation target. Through this process, existing strategies will be modified and new strategies will be developed. The process will also generate a cooperative research agenda to address management uncertainties and fill information gaps related to subbasin objectives and strategies.

2.0 Introduction to the Blackfoot Subbasin Plan

2.1 What is a Subbasin Plan?

The Northwest Power and Conservation Council was created in 1980 by Congress to give the states of Idaho, Montana, Oregon, and Washington a voice in how the region plans for its energy needs, while at the same time mitigating the effects of the hydropower system on fish and wildlife in the Columbia River Basin. The Council's Columbia River Basin Fish and Wildlife Program organizes the Columbia River Basin into 11 ecological provinces. Within these provinces there are groups of adjacent subbasins with similar climate and geology; in all there are 62 subbasins. The subbasin planning process has resulted in separate subbasin plans for more than 50 tributaries and mainstem segments of the Columbia River (NPCC 2000).

Subbasin plans identify and prioritize restoration and protection strategies for habitat and fish and wildlife populations in the U.S. portion of the Columbia River Basin. Each year the Council reviews proposals for on-the-ground projects and research. Proposals meeting the highest standards are then recommended to the Bonneville Power Administration (BPA) for funding. Local subbasin plans are intended to guide the review, selection, and funding of projects that will protect, mitigate, and enhance fish and wildlife affected by the development and operation of the Columbia River hydropower system (NPCC 2000).

Subbasin plans are developed locally and in collaboration with public agencies, local planning groups, conservation groups, landowners, and other stakeholders (NPCC 2001). The subbasin planning process emphasizes broad participation from a wide range of constituents who contribute and review technical information and reach consensus on the elements of subbasin plans. In this way, subbasin plans adopted by the Council reflect a wide range of support from interested parties (NPCC 2000, 2001). The basic elements of a subbasin plan are outlined below.

Table 2.1 Elements of a Subbasin Plan (NPCC 2001).

Section	Description
Introduction	An introduction to the subbasin plan.
Subbasin Assessment	A technical analysis, including a detailed description of subbasin characteristics and conditions, to determine the biological potential of the subbasin and the opportunities for conservation and restoration.
Inventory of Existing Activities	A summary of existing conservation and restoration projects and programs in the subbasin.
Management Plan	The overall vision for the subbasin, conservation objectives and strategies, and a monitoring and evaluation plan for 10-15 years.
Technical Appendix	Data, references, maps, and other supporting documentation.

2.2 Purpose of the Blackfoot Subbasin Plan

The Blackfoot Subbasin has a strong history of locally-led conservation and restoration. Beginning in the mid-1970s, private landowners developed the Blackfoot River Recreation Corridor Agreement and established two Walk-In Hunting areas near the confluence of the Clearwater and Blackfoot Rivers. In that same timeframe, the first conservation easement in Montana was acquired in the Blackfoot Subbasin. Thanks to the vision of these landowners, an important foundation was established for public and private partners to work together on restoring and protecting habitat, fish and wildlife populations in the Blackfoot Subbasin.

Building on this legacy, the Blackfoot Challenge and Trout Unlimited began the process of developing a subbasin plan for the Blackfoot Subbasin in fall 2007. During development of the Blackfoot Subbasin Plan, a broad base of stakeholders assessed the viability of natural resources and the rural way of life in the Blackfoot Subbasin and designed proactive strategies for abating critical threats to these resources. The purpose of the Blackfoot Subbasin Plan is to describe these resources, document the viability and threat assessment processes, and outline the conservation objectives and strategic actions that will restore and protect natural and cultural resources in the subbasin. The plan is intended to support and strengthen conservation and restoration partnerships in the subbasin. The plan is an iterative document that will be adapted over time to incorporate new knowledge and changes in the biological, social and economic characteristics of the subbasin.

2.3 Overview of the Blackfoot Subbasin Planning Process

2.3.1 Subbasin Plan Partners

The Blackfoot Subbasin Plan was developed collaboratively by a wide range of stakeholders including private landowners and representatives from public agencies and non-government organizations working in the subbasin. This community-based approach to natural resource and conservation planning ensures a local voice and vision for land management and restoration activities in the Blackfoot Subbasin. It also provides opportunities to work across public and private boundaries and to coordinate technical and funding resources. The following organizations coordinated the planning process:

The Blackfoot Challenge (<http://www.blackfootchallenge.org>): The Blackfoot Challenge is a landowner-based group that coordinates management of the Blackfoot River, its tributaries and adjacent lands. The mission of the Blackfoot Challenge is to coordinate efforts that will enhance and conserve the natural resources and rural way of life in the Blackfoot River Valley for present and future generations. Its membership is composed of private landowners, federal and state land managers, local government officials, non-government organizations, corporate landowners and representatives of economic interests. It is organized locally and known nationally as a model for conserving the natural resources, rural character, and scenic beauty of the Blackfoot Watershed. The Blackfoot Challenge provided partial funding for the Blackfoot Subbasin Plan.

Trout Unlimited (<http://www.tu.org>): Funding for the Blackfoot Subbasin Plan was also provided by Trout Unlimited, a national organization working to conserve, protect, and

restore North America's coldwater fisheries and their watersheds. More than 150,000 volunteers organized into about 400 chapters from Maine to Montana to Alaska and a respected staff of lawyers, policy experts and scientists ensure that Trout Unlimited is at the forefront of fisheries restoration work at the local, state and national levels. The local chapter of Trout Unlimited, the Big Blackfoot Chapter (BBCTU), and the Blackfoot Challenge have a long history of partnering with private landowners, public agencies and nonprofit organizations to conserve, protect and restore tributaries of the Blackfoot River using a community-based approach to conservation.

The Nature Conservancy (<http://www.nature.org>): Staff from the Montana Chapter of The Nature Conservancy provided extensive technical assistance throughout the subbasin planning process. The Nature Conservancy's mission is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. The Nature Conservancy is a long-term member of and active participant in the Blackfoot Challenge.

Four technical work groups were formed to capture in the subbasin plan the local knowledge, professional expertise, and on-the-ground experience of people living and working in the Blackfoot Subbasin (see *List of Participants*, page 2). Technical work group members included local landowners and representatives from public agencies and non-government organizations. The Confederated Salish and Kootenai tribes were invited but declined to participate in the subbasin planning process. Technical work groups held regular meetings between March 2008 and May 2009 to assess the viability of key conservation targets in the Blackfoot Subbasin, identify critical threats to targets and develop conservation objectives and strategic actions to abate critical threats.

2.3.2 Integration with Related Planning Efforts in the Blackfoot Subbasin

The Blackfoot Subbasin Plan integrates two key documents that have been cornerstones for conservation and restoration planning and action in the Blackfoot Subbasin: the Blackfoot River Valley Conservation Area Draft Plan and A Basin-Wide Restoration Action Plan for the Blackfoot Watershed, both of which are described below. The Blackfoot Subbasin Plan also integrates existing information contained in a wide variety of other subbasin planning and management documents.

Blackfoot River Valley Conservation Area Draft Plan (TNC and BC 2007): In 2000, The Nature Conservancy published an assessment of the Blue Mountain-Middle Rockies Ecoregion that identified areas within the ecoregion important for the conservation of biodiversity. The Blackfoot Watershed was selected as a high priority site due to its biological diversity, habitat connectivity and feasibility of conservation action. A six-member planning team was convened to develop conservation strategies that would conserve and enhance the viability of significant ecological and social/economic components of the Blackfoot Watershed. The planning process resulted in a Blackfoot River Valley Conservation Area Draft Plan in January 2007. This Conservation Area Plan was developed with the intent of engaging a broader and more diverse set of stakeholders for future conservation action in the Blackfoot Watershed. Its methodology helped set the stage for designing the Blackfoot Subbasin Plan.

A Basin-Wide Restoration Action Plan for the Blackfoot Watershed (BC 2005a): This document defines strategies for prioritization, development, implementation, and monitoring of water quality, aquatic habitat, and fisheries restoration projects for impaired and dewatered streams in the Blackfoot Watershed. The Restoration Action Plan was developed collaboratively by restoration partners in the Blackfoot and serves to strengthen restoration partnerships and programs through pooling of resources, greater information sharing, and the creation of a restoration network. The Restoration Action Plan encompasses three established restoration programs currently operating in the Blackfoot Watershed: 1) native fish species management and recovery, led by Montana Fish, Wildlife and Parks (MFWP) and the Big Blackfoot Chapter of Trout Unlimited (BBCTU), 2) the Total Maximum Daily Load (TMDL) Program, led by the Montana Department of Environmental Quality (MDEQ) and the Blackfoot Challenge, and 3) water conservation and instream flow management, led by BBCTU and the Blackfoot Challenge. The Restoration Action Plan serves as a restoration guide for partners by identifying opportunities for cooperative restoration and monitoring efforts, promoting implementation of a variety of restoration strategies and monitoring to assess effectiveness and creating a tracking system for completed restoration projects and associated monitoring. To access the complete plan, please visit www.blackfootchallenge.org. Since completion of the Restoration Action Plan, updated data for streams in the Clearwater drainage have been made available in the MFWP report, *The Big Blackfoot River Fisheries and Restoration Investigations for 2006 and 2007* (Pierce et al. 2008).

2.3.3 Blackfoot Subbasin Planning Framework: Conservation Action Planning

The Blackfoot Subbasin Plan was developed following The Nature Conservancy's Conservation Action Planning process. Conservation Action Planning provides a framework for designing, implementing and evaluating conservation projects at any scale, from small sites to large landscapes such as the Blackfoot Subbasin (Low 2003). Technical work groups used this adaptive framework in the Blackfoot Subbasin to 1) identify key natural and community resources, 2) assess viability of the resources, 3) identify factors that threaten the health and viability of the resources, 4) develop conservation and management strategies to abate critical threats and ensure long-term viability of the resources and 5) incorporate quantitative measures to track effectiveness of the conservation strategies over time.

Conservation Action Planning is an iterative, adaptive process that is driven by data and expert opinion on the distribution and status of biodiversity, current and future threats to biodiversity and socioeconomic and political conditions within a project area. This information is used to develop strategies and actions of sufficient scope and scale to abate threats, maintain or restore biodiversity and strengthen capacity to ensure long-term results. The data used in Conservation Action Planning also provide a baseline for measuring the effectiveness of conservation strategies and adapting strategies over time (Low 2003, TNC 2006).

A brief overview of the Conservation Action Planning process is provided in the table below. Each step is discussed in greater detail in subsequent sections of the Blackfoot Subbasin Plan. More detailed information on Conservation Action Planning is available on the The Nature Conservancy's website at <http://conserveonline.org/workspaces/cbdgateway> and in *The Five-S*

Framework for Site Conservation: A Practitioner’s Handbook for Site Conservation Planning and Measuring Conservation Success (TNC 2003).

Table 2.2 Overview of Conservation Action Planning.

Step	Description
Define Conservation Targets	Select the specific species and natural systems that represent the overall biodiversity of the project area.
Assess Viability of Conservation Targets	Identify the key ecological attributes that maintain target viability, select indicators to measure each key ecological attribute, and determine the current and desired future status of each indicator.
Identify Stresses	Identify and rank the various factors that negatively impact each conservation target.
Identify Critical Threats (Sources of Stresses)	Identify the social, economic, political, and cultural factors contributing to each stress.
Develop Strategies	Develop specific and measurable conservation objectives and strategic actions to abate critical threats and enhance or restore target viability.
Establish Measures	Define specific, quantitative measures of target viability to assess progress in abating threats and improving overall biodiversity health of the project area.
Implement Strategies	Put the plan into action and monitor the outcomes.
Analyze, Learn, Adapt, & Share	Evaluate strategic actions, update and refine knowledge of conservation targets, and review the results available from monitoring data.

2.3.4 Public Involvement

Public involvement was instrumental in the Blackfoot Subbasin planning process. Members of the general public were invited to participate in technical work groups and were updated and solicited for feedback at various times throughout the two-year planning process. Public meetings were hosted in September 2007 (Lubrecht), November 2007 (Ovando), January 2008 (Lubrecht) and March 2009 (Ovando and Lubrecht). An update on the plan was given monthly to the Blackfoot Challenge Board of Directors and interested parties in the subbasin. Four semi-annual newsletters also gave over 700 members of the Blackfoot Challenge an update on the process. Between May and July 2009, portions of the plan were posted on the Blackfoot Challenge website for public comment. This public process is a requirement of the Northwest Power Act’s program amendment standards (NPCC 2000). Providing opportunities for public comment and participation is also integral to the Blackfoot Challenge’s mission and overall approach to conservation, restoration and natural resource management in the Blackfoot Subbasin. Implementation of the Blackfoot Subbasin Plan will continue to involve direct participation by local landowners and residents through committees, work groups, one-on-one discussions and website updates.

3.0 Subbasin Assessment

3.1 What is the Subbasin Assessment?

The primary purpose of the Subbasin Assessment is to synthesize and evaluate the biological, physical and socioeconomic characteristics of the Blackfoot Subbasin, forming a scientific and technical foundation for prioritization of restoration and protection strategies for habitat and fish and wildlife populations in the subbasin. The Assessment begins in Section 3.2 with a broad characterization of the subbasin environment and examination of the subbasin in a regional context. This overview provides the geographical, ecological, and cultural context for the remainder of the subbasin plan.

Section 3.3 and 3.4 focus on eight key conservation targets considered to be representative of the natural and cultural resources of the Blackfoot Subbasin. In these sections, we describe the conservation targets and provide an assessment of the viability, or ecological health, of each. We then focus on the stresses and threats (i.e., human impacts) that jeopardize the viability of conservation targets. This assessment of critical threats sets the stage for the development of conservation objectives and strategic actions presented in the Subbasin Management Plan (Section 5.0).

3.2 Blackfoot Subbasin Overview

3.2.1 Geography and Regional Context

The Blackfoot Subbasin encompasses 1.5 million acres (2,345 square miles) of biologically rich and diverse lands in portions of four northwest Montana counties: Lewis and Clark, Powell, Missoula and Granite. The Blackfoot Subbasin is bordered to the east by the Continental Divide, to the south by the Garnet Mountains, to the north by the Bob Marshall and Lincoln-Scapegoat Wilderness areas and to the west by the Rattlesnake Wilderness area. Elevations in the subbasin range from 9,202 feet on Scapegoat Peak to 3,280 feet near Bonner, Montana where the Blackfoot enters the Clark Fork River.

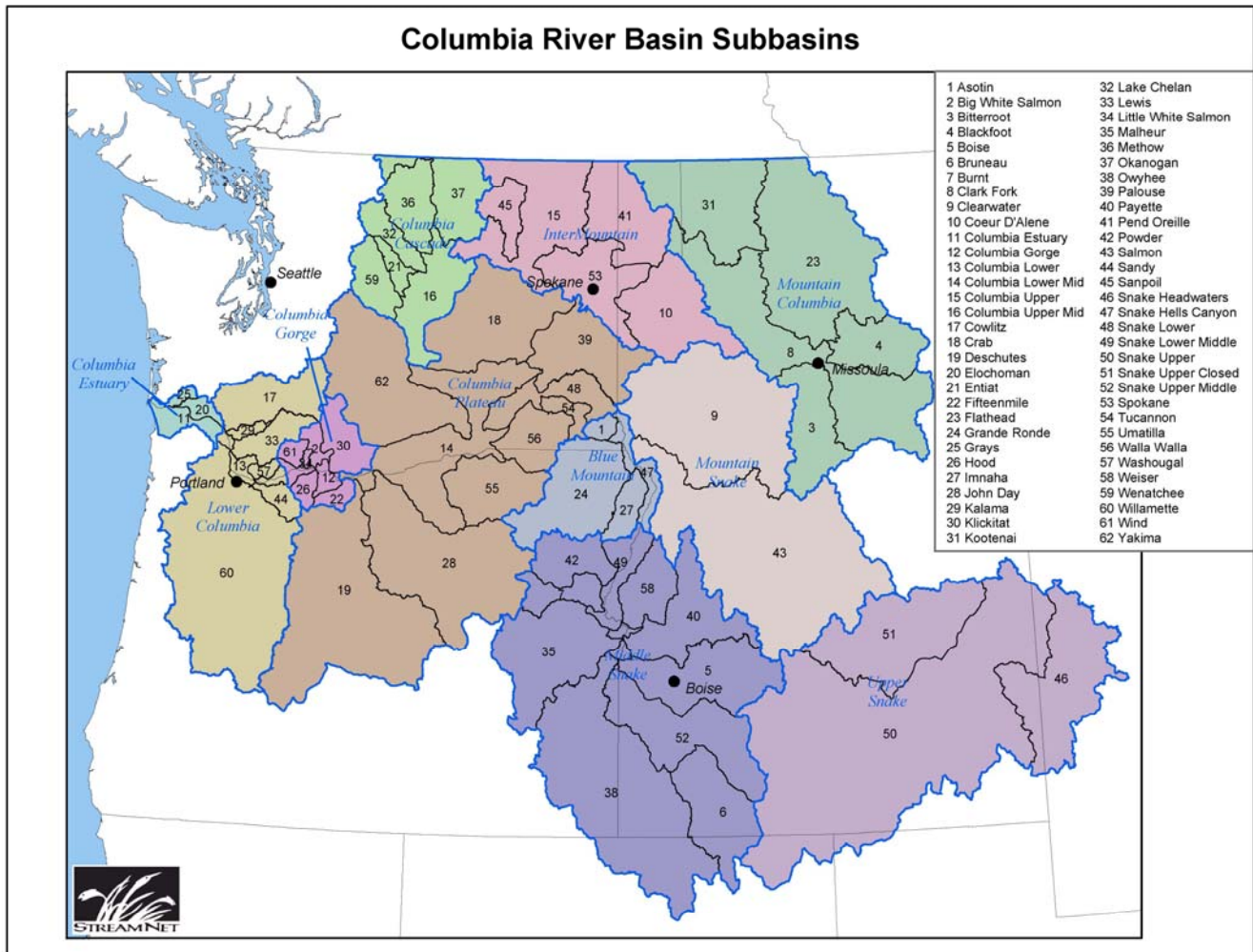
A tributary of the Columbia River, the free-flowing Blackfoot River flows 132 miles from its headwaters near Rogers Pass on the Continental Divide to its confluence with the Clark Fork River at Bonner. The subbasin is characterized by narrow headwater canyons opening to generally rolling terrain at the heart of the subbasin and ending in a narrow, incised, stream-cut canyon. The Blackfoot River is ranked as a Tier I Aquatic Conservation Focus Area in Montana's Comprehensive Fish and Wildlife Conservation Strategy. Tier I species, communities, and focus areas are considered by MFWP to be of the greatest conservation need in Montana (MFWP 2005).

The Blackfoot Subbasin is part of the Clark Fork-Pend Oreille River Basin and is identified by the U.S. Geological Survey (USGS) 8-digit HUC number 17010205.¹ The Blackfoot is one of

¹ HUC is the acronym for Hydrologic Unit Code (HUC). Every hydrologic unit is identified by a unique HUC consisting of two to eight digits based on the levels of classification in the hydrologic unit system. A hydrologic unit describes the area of land upstream from a specific point on the stream (generally the mouth or outlet) that

the easternmost subbasins within the Columbia River Basin (Figure 3.1). The Columbia River Basin Fish and Wildlife Program organizes the subbasins of the Columbia River Basin into 11 ecological provinces, or groups of adjoining subbasins with similar hydrology, climate, and geology. The Blackfoot Subbasin is part of the Mountain Columbia Ecological Province along with the Bitterroot, Clark Fork, Flathead, and Kootenai Subbasins (NPPC 2000). Although anadromous fisheries do not extend into the Blackfoot, the subbasin is significant as a headwaters drainage of the Columbia River system.

Figure 3.1 Location of the Blackfoot Subbasin within the Columbia River Basin.



The Blackfoot Subbasin is located at the southern edge of the Crown of the Continent Ecosystem (COCE), a ten million-acre area of the Northern Rocky Mountains that extends north into

contributes surface water runoff directly to this outlet point. Another term for this concept is drainage area. It is delineated by starting at a designated outlet point (usually the river mouth) and proceeding to follow the highest elevation of land that divides the direction of surface water flow (usually referred to as the ridge line). This boundary will follow the basin ridges until connected back at the outlet point. This federal interagency system conveys the hierarchical nature of the sizes and assemblages of typical natural hydrology.

Canada and includes Waterton-Glacier International Peace Park, Canada's Castle Wilderness, the Bob Marshall-Great Bear-Scapegoat Wilderness Complex, parts of the Flathead and Blackfoot Indian Reservations, Bureau of Land Management (BLM) lands and significant acreage of state and private lands. The COCE is one of the most intact ecosystems in North America. The Blackfoot Subbasin provides critical connections between the COCE and the Selway/Bitterroot Ecosystem to the south.

3.2.2 Geology

The Blackfoot Subbasin has a complex geologic history. The mountains near the Blackfoot River between Missoula and Rogers Pass consist mostly of Precambrian-age (1.5 billion-year-old) sedimentary rocks, including shale, siltstone, sandstone, and carbonate. These rocks, known collectively as the Belt Formation, formed as a result of almost 500 million years of deposition of sediments into a large inland sea referred to as the Belt Basin. These sedimentary deposits are remarkably consistent over large distances and have been measured locally to be over 40,000 feet thick. During the formation of the Rocky Mountains from 75 to 60 million years ago, Precambrian Belt rocks in the vicinity of the Blackfoot Subbasin were uplifted, folded, and thrust eastward over younger Paleozoic and Mesozoic Era (~543-65 million-year-old) sedimentary rocks. Between Lincoln and Rogers Pass, the Blackfoot is a narrow valley cut through this overthrust belt (Alt and Hyndman 1986).

Granitic intrusions were emplaced within the Belt rocks both before and after thrusting and resulted in the formation of mineral deposits (Alt and Hyndman 1986). Large portions of the subbasin were subsequently covered with volcanic deposits during the middle Tertiary Period (~40 million years ago). Remnants of these volcanic rocks are found primarily in the southern portion of the subbasin (Mudge et al. 1982, Lewis 1998). The Potomac Valley and the broad valley around Clearwater Junction are structural basins filled with deep sediment that deposited during the Tertiary Period, when the region had a dry climate. The two valleys were once one continuous basin until a fault raised Greenough Ridge to separate them (Alt and Hyndman 1986).

Glaciation strongly influenced the current subbasin landscape as evidenced by numerous moraines and associated hummocky topography, glacial pothole lakes and broad expanses of flat glacial outwash (Whipple et al. 1987, Cox et al. 1998). The Blackfoot Subbasin was subjected to two major periods of glaciation, the Bull Lake glaciation (~70,000 years ago) and the Pinedale glaciation (~15,000 years ago). During these periods, large continuous ice sheets extended from the mountains southward into the Blackfoot and Clearwater River valleys (Witkind and Weber 1982). During the latter part of the Pleistocene Era, the Blackfoot Valley was further shaped by the repeated filling and catastrophic draining of Glacial Lake Missoula, a massive lake formed by a series of ice dams that impounded the Clark Fork River downstream of Missoula. In the Blackfoot Valley, Glacial Lake Missoula extended upstream as far as Clearwater Junction (Alt and Hyndman 1986).

When the glaciers receded, large deposits of glacial till, glacial outwash, and glacial lakebed sediments were left behind. These deposits cover much of the Blackfoot Valley floor, shaping the topography of the valley and the geomorphology of the Blackfoot River and the lower reaches of most tributaries. Glacial features evident on the landscape today include moraines, outwash plains, kame terraces and glacial potholes. The landscape between Clearwater Junction

and Lincoln, for example, is characterized by alternating areas of glacial moraines and their associated outwash plains. In this area, ice pouring down from the mountains to the north spread out to form large ponds of nearly stagnant ice several miles across known as piedmont glaciers. Muddy meltwater draining from these piedmont glaciers spread sand and gravel across the ice-free parts of the valley floor to create large outwash plains. The town of Ovando sits on one of these smooth outwash plains (Alt and Hyndman 1986). Due to the highly permeable nature of coarse outwash sediments, streams generally lose water through infiltration and often go dry where they cross outwash plains. Such is the case with the Blackfoot River between the Landers Fork and the town of Lincoln. Since glaciation, the geomorphology of the lower elevation portions of the subbasin has been modified by alluvium originating from reworked glacial deposits. Alluvial deposits cover most drainage bottoms and reach depths of several hundred feet in portions of the Blackfoot Subbasin (MDEQ 2008a, 2008b, Tetra-tech 2004).

3.2.3 Soils

Soils in the Blackfoot Subbasin are extremely variable due to the diverse influences of climate, topography, and geology (Figures 3.2 and 3.3). In general, the soils are strongly related to the geologic substrates and landforms of the subbasin. The State Soil Geographic (STATSGO) database provides a consistent method of assessing generalized soil characteristics on a subbasin scale. Although generalized, the STATSGO database also provides information on the physical and chemical properties of soils. The majority of soil types present in the subbasin have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet. These dominant soils are neither prime farmland nor hydric soils supporting wetlands. For the following soils characterization, the subbasin is divided into four sections: 1) Blackfoot Headwaters planning area, 2) Nevada Creek planning area, 3) Middle Blackfoot planning area and 4) Lower Blackfoot planning area. These sections correspond with the planning areas used for TMDL development in the subbasin (Section 3.2.5.2). The soils characterizations are taken from the four Blackfoot TMDL plans (MDEQ 2003, 2004, 2008a, 2008b).

Blackfoot Headwaters planning area

In the Blackfoot Headwaters Planning Area, Quaternary alluvium and glacial deposits cover much of the Blackfoot River and Landers Fork valley bottoms as well as much of the Beaver Creek, Stonewall Creek and Willow Creek sub-watersheds. The headwaters of the Landers Fork deeply down cut through this Quaternary glacial till, providing a significant natural source of fine sediment and coarse cobbles to the Landers Fork and ultimately, the Blackfoot River.

Nevada Creek planning area

Eight soil units are present in the Nevada Creek planning area. Of these, four collectively comprise 83% of the planning area (Table 3.1). Textures of the soil units closely reflect the geology of the area. Gravelly soils are typically found in areas covered by a veneer of glacial deposits. The textural term “channery” refers to flat rock fragments, most likely derived from sedimentary Precambrian Belt rocks. The majority of soil types present have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet.

Table 3.1 Major Soil Units in the Nevada Creek Planning Area, Blackfoot Subbasin.

Soil Map Unit Name	Percent Area	Surface Texture
STEMPLE-MOCMONT-HELMVILLE (MT546)	30.4%	Very channery loam
BIGNELL-YOURAME-ROY (MT045)	22.0%	Gravelly clay loam
FERGUS-ROY-TETONVIEW (MT199)	18.7%	Loam
REPP-WHITORE-WINKLER (MT473)	12.1%	Very gravelly loam
WOROCK-GARLET-DANAHER (MT662)	9.2%	Gravelly loam
WINKLER-PERMA-BIGNELL (MT650)	3.0%	Gravelly loam
WARSING-VASTINE FAMILY-FLUVAQUENTIC HAPLAQUOLLS (MT665)	2.0%	Loam
LOBERG-DANAHER-WOROCK (MT342)	1.6%	Clay loam
OVANDO-ELKNER-SHADOW (MT436)	0.9%	Gravelly silty loam

Middle Blackfoot planning area

Thirty soil units are present in the Middle Blackfoot planning area, of which seven cover 75% of the planning area (Table 3.2). The majority of these seven soil units are gravelly loams and silty loams that correlate with the location of Quaternary alluvium and glacial deposits. The exception is the Worock-Garlet-Danaher Association, which appears to correlate with the location of coarser grained sedimentary Precambrian Belt rocks. The 23 minor soil units as a group correlate well with exposures of intrusive and extrusive igneous rocks as well as various Belt lithologies. The majority of soil types present have similar surface textures, are moderately well to well drained, and have a depth to water table between three and six feet.

Table 3.2 Major Soil Units in the Middle Blackfoot Planning Area, Blackfoot Subbasin.

Soil Map Unit Name	Percent Area	Surface Texture
WALDBILLIG-HOLLOWAY-BATA (MT610)	19.6%	Gravelly silty loam
WOROCK-GARLET-DANAHER (MT662)	11.6%	Gravelly loam
PERMA-QUIGLEY-WILDGEN (MT445)	9.0%	Gravelly loam
ROCK OUTCROP-COEROCK-PHILLCHER (MT483)	8.5%	Unweathered bedrock
STEMPLE-GARLET-COWOOD (MT139)	8.3%	Very channery loam
WILDGEN-WINFALL-RUMBLECREEK (MT634)	7.5%	Gravelly loam
TOTELAKE-WINFALL-YOURAME (MT579)	6.8%	Gravelly loam

Lower Blackfoot planning area

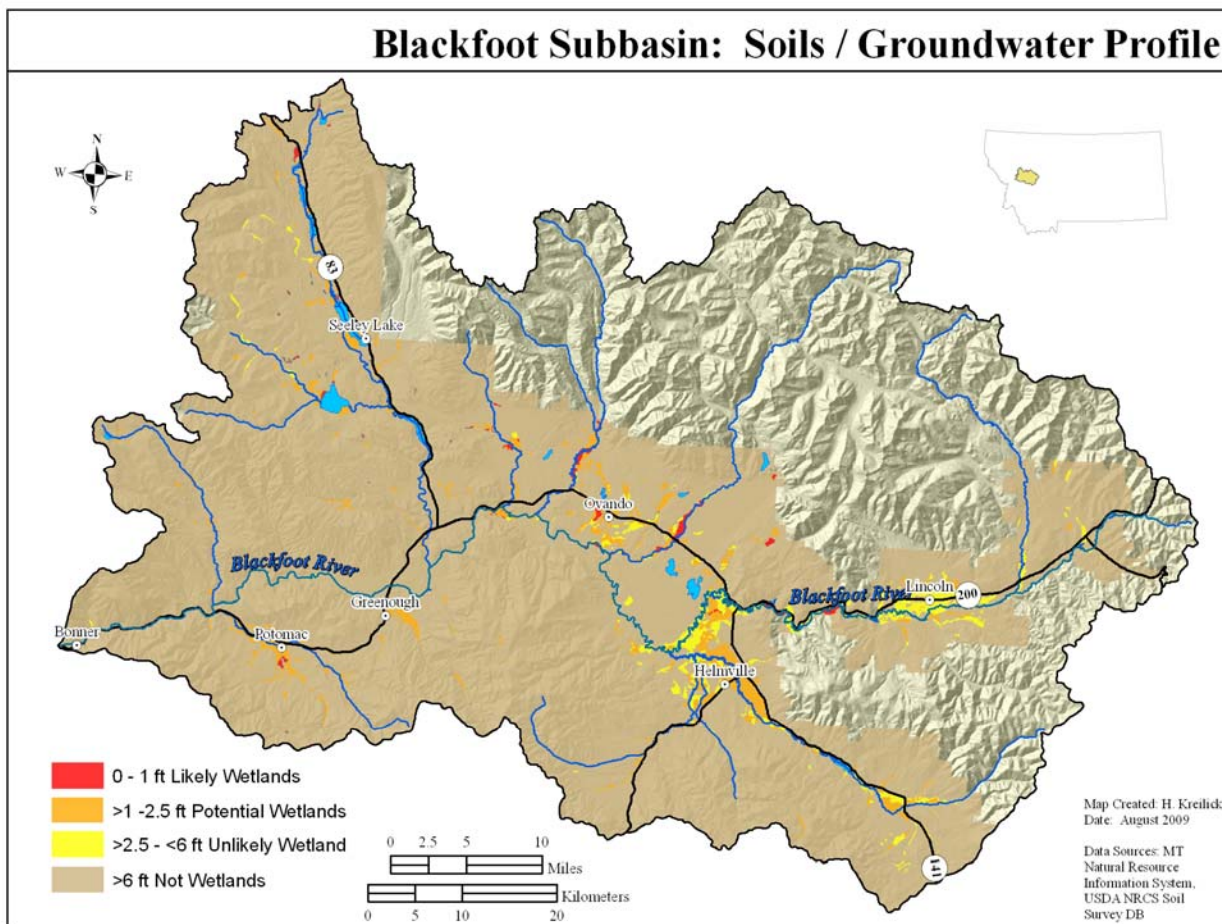
Fifteen soil units are present in the Lower Blackfoot planning area, five of which cover 76% of the planning area (Table 3.3). The most abundant five soil units are gravelly loams and correspond with the location of Quaternary alluvium and glacial deposits. The 10 minor soil units as a group correlate well with exposures of intrusive and extrusive igneous rocks as well as various Belt lithologies.

Table 3.3 Major Soil Units in the Lower Blackfoot Planning Area, Blackfoot Subbasin.

Soil Map Unit Name	Percent Area	Surface Texture
WINKLER-EVARO-ROCK OUTCROP (MT647)	25.5%	Gravelly sandy loam
WINKLER-EVARO-TEVIS (MT646)	20.8%	Gravelly loam
WALDBILLIG-HOLLOWAY-BATA (MT610)	13.5%	Gravelly silty loam
BIGNELL-WINKLER-CROW (MT046)	10.4%	Gravelly loam
HOLLOWAY-WINKLER-ROCK OUTCROP (MT283)	5.8%	Gravelly silty loam

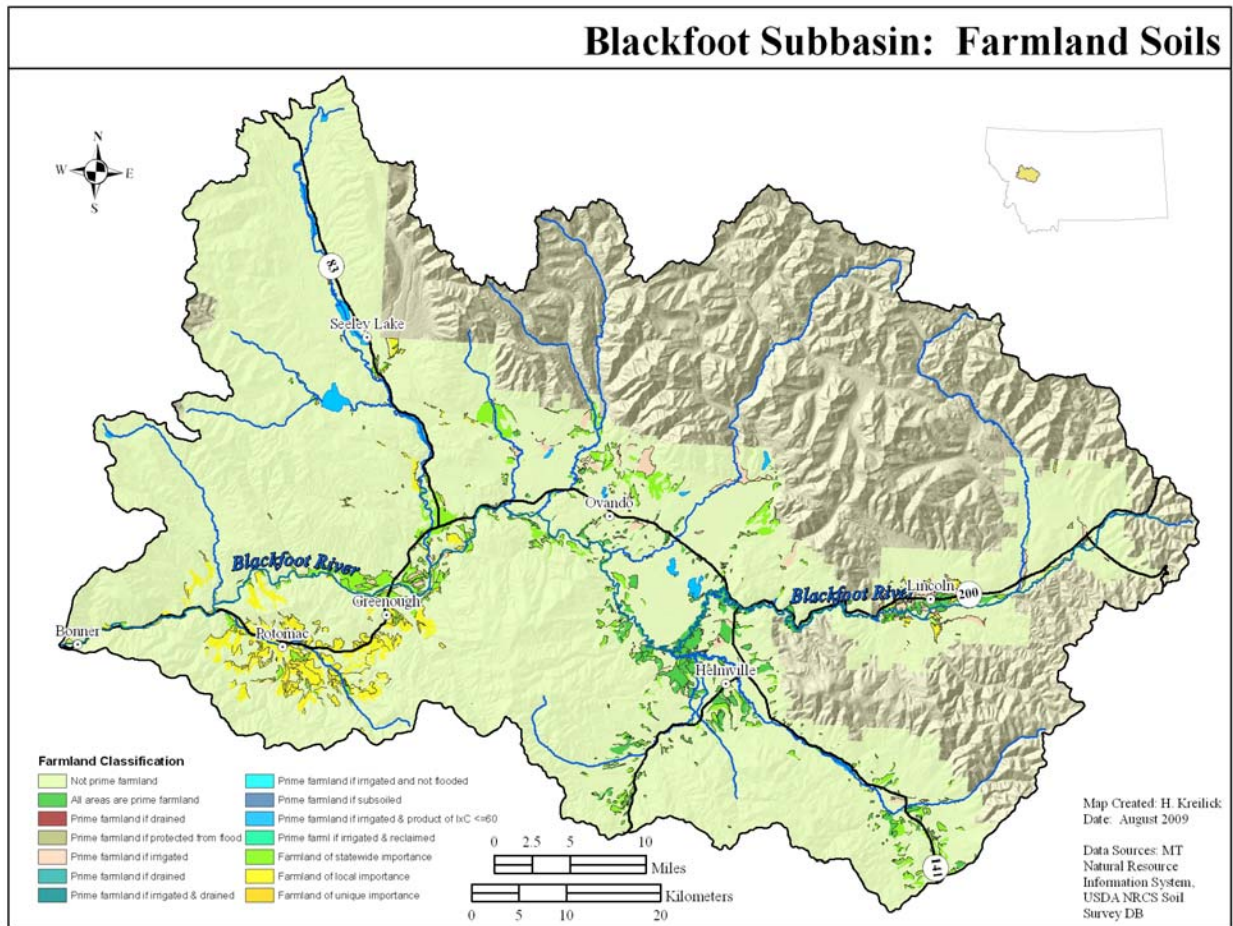
More detailed soils data are available in the Missoula, Powell, and Granite County Soil Survey Geographic (SSURGO) databases.² The U.S. Forest Service (USFS) Region 1 Land Type Association database, which covers national forest areas, is a good surrogate for detailed soil data and can assist with identification of soils that are sensitive to natural and human-caused disturbances.

Figure 3.2 Soils/Groundwater Profile.



² Information on the STATSGO and SSURGO soil geographic databases is available from the Natural Resources Conservation Service (www.nrcs.usda.gov).

Figure 3.3 Farmland Soils.



3.2.4 Climate

3.2.4.1 Blackfoot Subbasin Climate

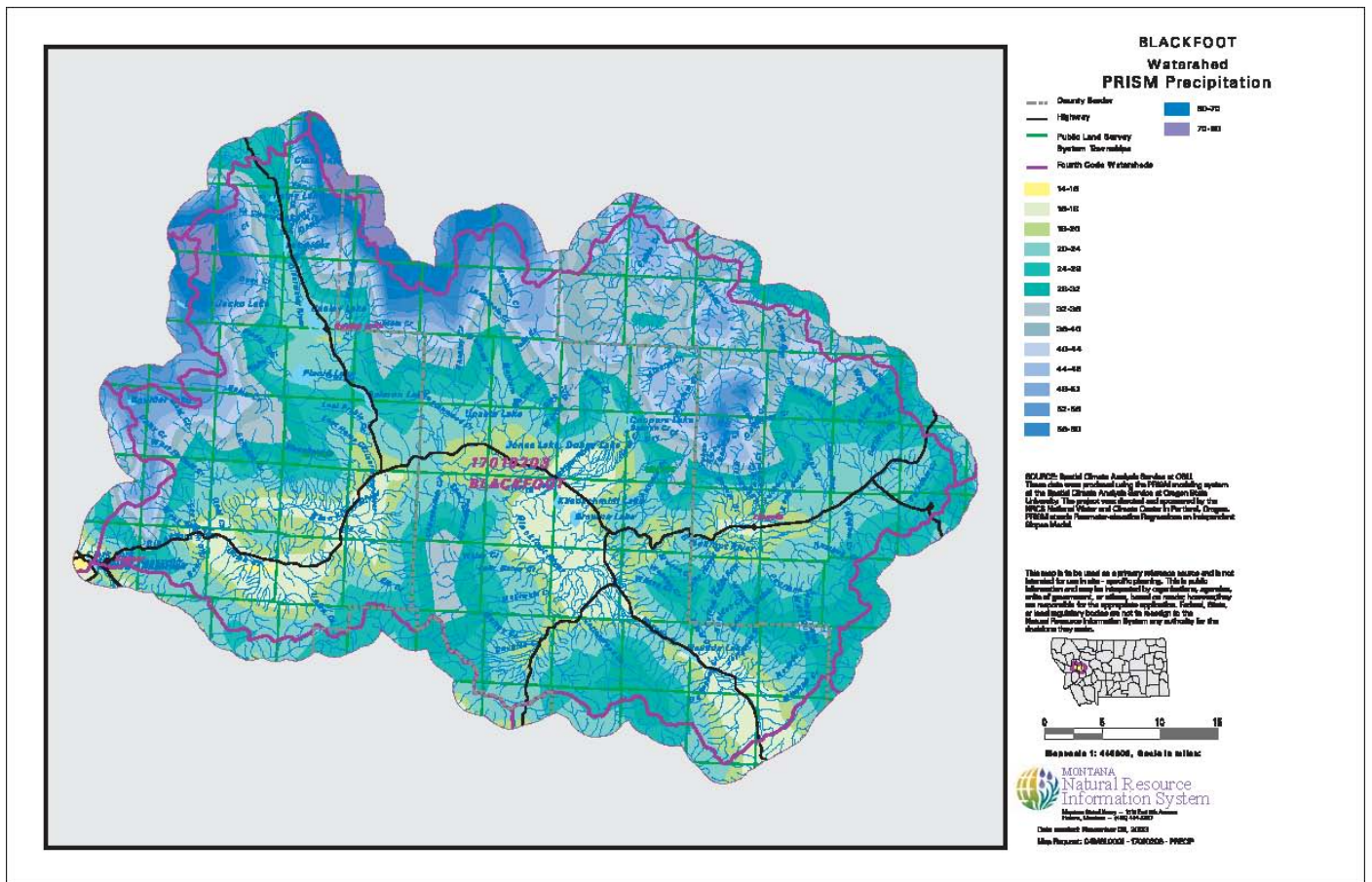
The Blackfoot Subbasin climate is dominated by Pacific maritime characteristics. Moderately moist and cool conditions prevail and cloudy weather is most frequent from late fall through early spring. Valley fog is common during the fall and winter months. The physiography of the nearby Continental Divide can generate extreme winter temperatures in the Blackfoot Subbasin that are more often associated with central Montana’s continental climate. The coldest temperature (-70 °F) ever recorded in the lower 48 states occurred at Roger’s Pass, approximately 40 miles east of Ovando (Caprio et al. (unknown date)). Occasionally, central Montana winter storm systems are powerful enough to breach the Continental Divide, resulting in strong east winds and blizzard conditions in the subbasin.

Average annual minimum temperatures in the subbasin range from 24 °F (Ovando) to 27 °F (Seeley Lake) and average annual maximum temperatures range from 54 °F (Ovando) to 56 °F (Potomac). Average total annual precipitation ranges from 15 inches (Potomac) to 21 inches (Seeley Lake) and average total annual snowfall ranges from 54 inches (Potomac) to 120 inches

(Seeley Lake). June is the wettest month and snowfall is greatest in January. Higher levels of precipitation and snowfall occur at higher elevations in the subbasin.³ Figure 3.4 displays precipitation ranges across the subbasin. Figure 3.5 displays 30-year average temperature and precipitation recorded by the Western Regional Climate Center at four sites across the Blackfoot Subbasin.

Recent trends in the Blackfoot Subbasin climate have been consistent with anticipated effects of global and regional climate change, including general warming, increased variability in total precipitation and drier summers. For example, peak runoff as measured in streamflow on the Blackfoot River at Bonner since 2000 has been one to three weeks earlier than the mean date of runoff over 72 years of record, indicating warmer spring temperatures.⁴ Such climatic changes could have important implications for both aquatic and terrestrial systems in the Blackfoot Subbasin. More information on climate change is provided in Sections 3.2.4.2 and 3.4.4.2.

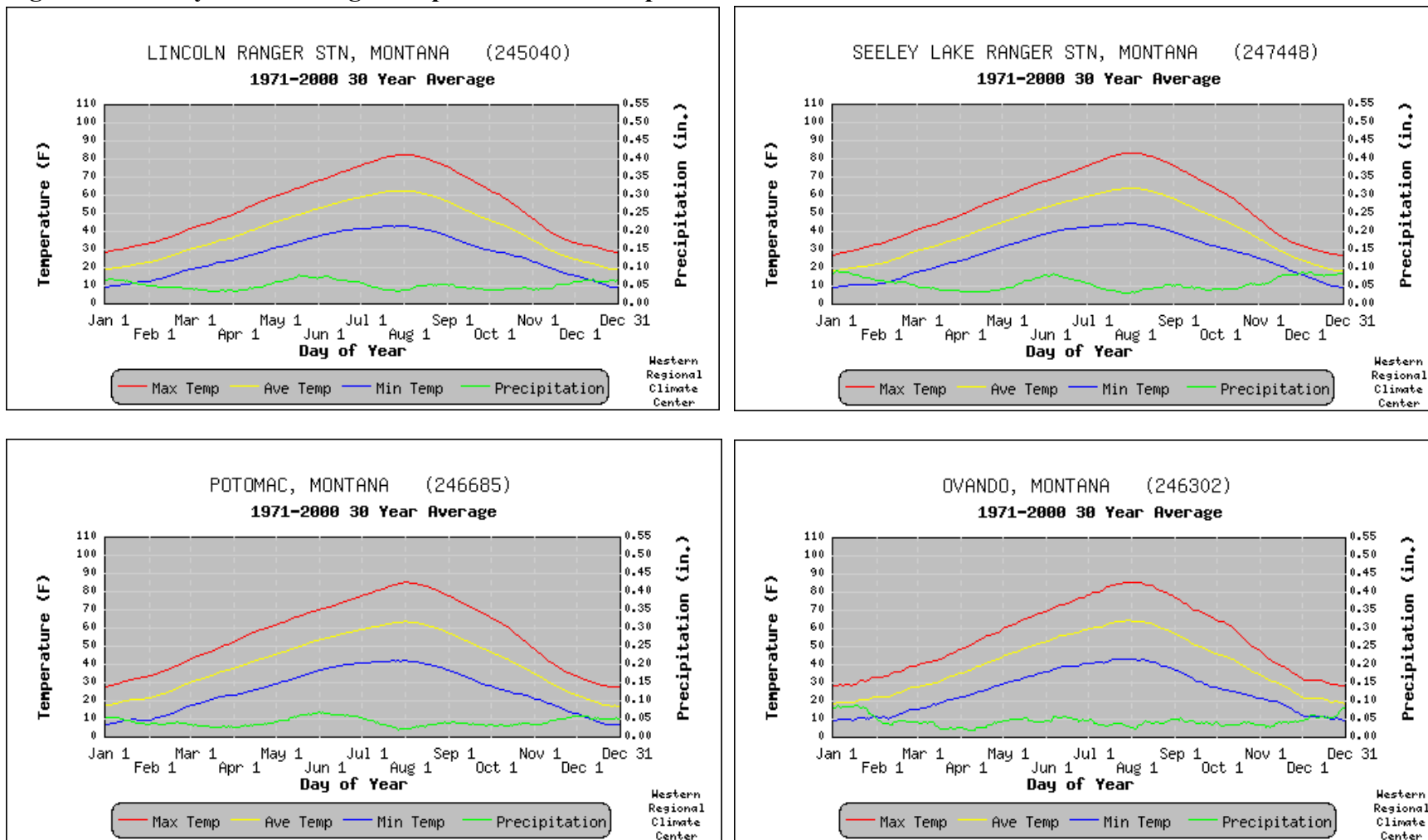
Figure 3.4 Precipitation Ranges across the Blackfoot Subbasin.



³ Climate data is from the Western Regional Climate Center website (<http://www.wrcc.dri.edu/>).

⁴ Data from the USGS National Water Information System website (<http://waterdata.usgs.gov>).

Figure 3.5. Thirty-Year Average Temperature and Precipitation at Four Sites across the Blackfoot Subbasin.



3.2.4.2 Macroclimate Trends

In this discussion, “macroclimate” is the climate occurring over a relatively large geographic area and over a relatively long period of time (i.e., 50 years), as opposed to the microclimate of the Blackfoot Subbasin. The years 1995-2006 rank among the 12 warmest years in the instrumental record of global surface temperature since 1850. The warming trend over the last 50 years is nearly twice that for the last 100 years. In the 20th century, the rate of warming in the northern hemisphere appears to be unprecedented in the past 2,000 years (ISAB 2007).

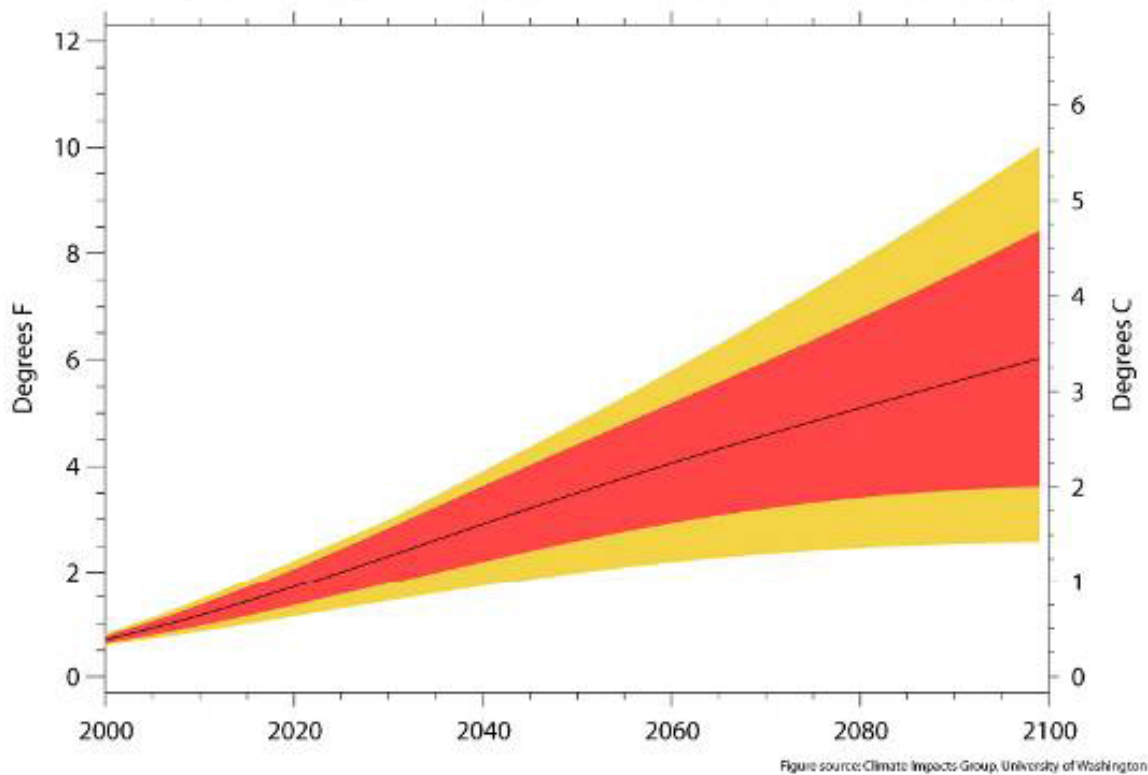
During the 20th century, the average annual temperature in the western United States rose by 1.7 °F, which is 70% more warming than the planet as a whole during the same time period (Kinsella 2008). Climate records show that the Pacific Northwest has warmed about 1.8 °F since 1900, or about 50% more than the global average warming over the same period. Regularly collected measurements indicate that springtime snow pack from the western Rockies to the Pacific coast and from the central Sierras in California to southern British Columbia declined substantially between 1950 and 1997 in part due to a reduction in precipitation and in part due to rising winter temperatures during this period (ISAB 2007).

Climate models predict continued hot and dry weather well into the future. Global climate models show that average annual temperatures could increase anywhere from 3 to 10 °F by 2100 if nothing is done to reduce carbon dioxide emissions, the primary cause of global warming. Regional average temperatures could be even higher, especially in higher latitudes where scientists predict the most dramatic climate changes will occur. Climate models specific to the northwest United States predict that warming will continue at a rate of 0.18-1.0 °F/decade, or in the range of 1.6-10.0 °F between 2010 and 2100 (Figure 3.6) (ISAB 2007). In the Columbia Basin this warming is likely to result in the following alterations (ISAB 2007):

- More precipitation will fall as rain rather than snow
- Snow pack will diminish and stream flow timing will be altered
- Peak river flows will increase
- Water temperatures will continue to rise

The potential impacts of climate change on aquatic and terrestrial ecosystems are widespread and include changes in hydrology, water temperature, plant community composition and distribution, susceptibility to invasive species invasion and wildfire frequency and severity. Further discussion of the impacts of climate change on Blackfoot Subbasin conservation targets is provided in Section 3.4.4.2.

Figure 3.6. Projected Changes in Average PNW Temperature – 21st Century.



3.2.5 Water Resources

The Blackfoot River is the key surface water feature in the Blackfoot Subbasin. The Blackfoot is a free-flowing river that flows southwest for 132 river miles from its headwaters at Rogers Pass to its confluence with the Clark Fork River at Bonner. This river system drains a 2,320-square mile watershed through a 3,700-mile stream network of which 1,900 miles are perennial streams capable of supporting fish (BC 2005a). There are several major tributaries to the Blackfoot River, including the Landers Fork, the North Fork of the Blackfoot River, Monture Creek and the Clearwater River in the northern part of the subbasin and Nevada Creek and Poorman Creek in the southern part of the subbasin (Figure 3.7). The subbasin is also home to numerous natural ponds and lakes including Kleinschmidt Lake, Browns Lake, Coopers Lake and the Clearwater chain of lakes (Lake Alva, Lake Inez, Placid Lake, Seeley Lake, and Salmon Lake) (Figure 3.7). Aquatic habitat types found in the Blackfoot Subbasin, according to Montana’s Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005), are listed in Table 3.4.

Figure 3.7 Major Rivers, Lakes and Streams.

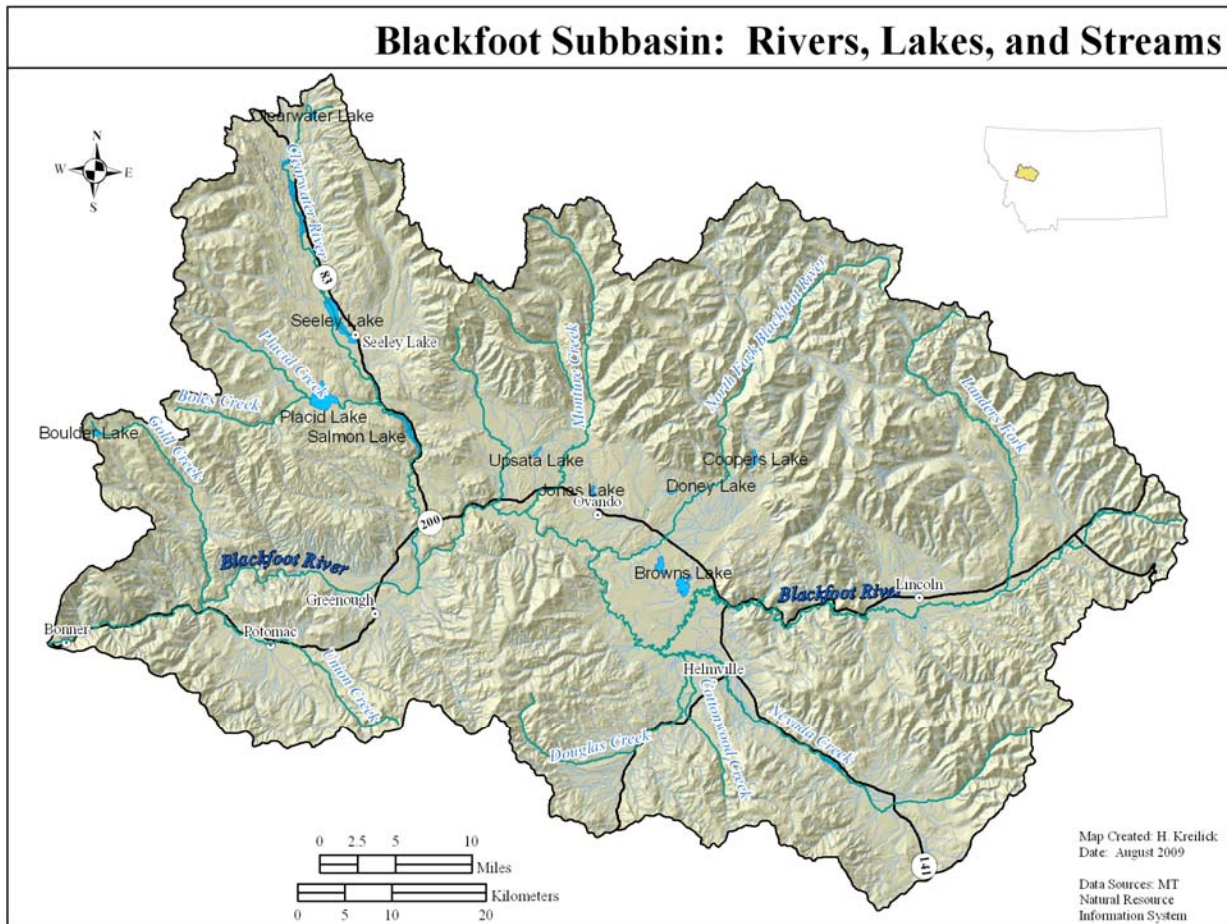


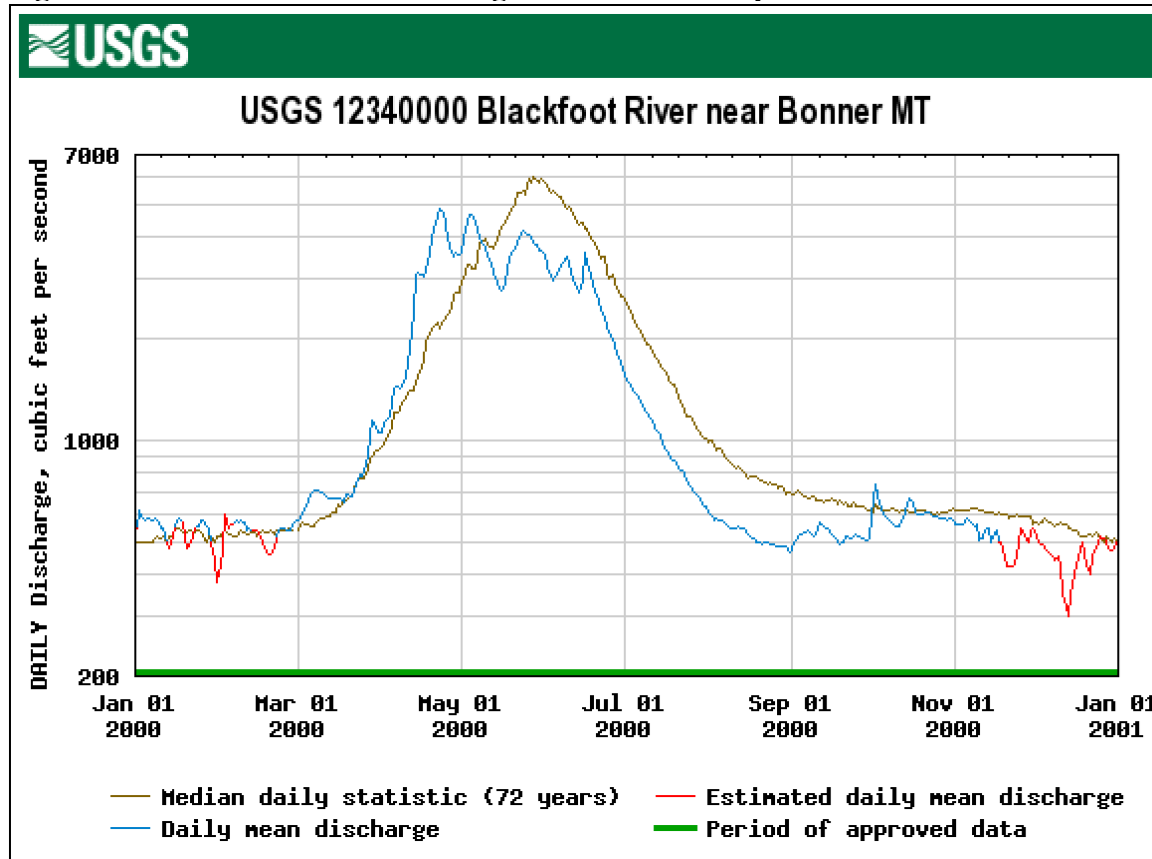
Table 3.4 Aquatic Habitat Types in the Blackfoot Subbasin.

Habitat Type	Acres/Miles
Intermountain Valley Rivers	127
Intermountain Valley Streams	316
Lowland Lakes	6,525
Lowland Reservoirs	390
Mountain Lakes	2,604
Mountain Reservoirs	5
Mountain Streams	3,207

Surface water hydrology in the Blackfoot River is driven by 1) winter snowpack accumulation, 2) spring snowmelt runoff and 3) late summer, fall and winter base flows. The historic (72-year) mean daily discharge in the Blackfoot River, measured at the Bonner USGS gage station, is 1,968 cubic feet per second (cfs); the mean peak flow is 6,070 cfs, and the mean low flow is 642 cfs. In 2000, a drought year, the mean daily discharge was 1,261 cfs, peak flow (April) was 4,860 cfs and low flow (September) was 466 cfs, all of which are

substantially below the historic means (Figure 3.8). This pattern has been replicated in most years since 2000. In addition, the annual hydrograph since 2000 has been characterized by peak flows occurring one to three weeks earlier and summer flows arriving earlier and dropping lower than the historic means.⁵

Figure 3.8. Blackfoot River Discharge: Year 2000 Compared to Historic Mean.



3.2.5.1 Water Uses and Modifications

3.2.5.1.1 Water Rights

There are 6,452 water rights in the Blackfoot Subbasin including 3,583 groundwater permits and 2,869 surface water permits. Over 50% of groundwater permits are for domestic uses. Groundwater is also used for stock water, irrigation, lawns and gardens. Although stock water represents the greatest number of surface water permits, the largest volume (65%) of water diverted and consumed is for irrigation. This volume of water covers almost 44,280 irrigated acres and, over the irrigation season, translates to a flow of about 730 cfs in diversions and 365 cfs consumed (CFTF 2004). Irrigation impacts and instream flow problems affect numerous streams and stream reaches in the Blackfoot Subbasin (Pierce et al. 2005). A discussion of stream dewatering in the subbasin is provided in the subbasin threat assessment (Section 3.4.4.11) and a list of dewatered streams in the subbasin is provided in Appendix A. Projected demand for future water use by irrigation depends on the amount of

⁵ Data from the USGS National Water Information System website (<http://waterdata.usgs.gov>).

irrigable lands that remain in the subbasin and the frequency of future droughts. Domestic and municipal demands for groundwater are limited in the Blackfoot Subbasin due to the relatively sparse population (CFTF 2004).

A number of legal and regulatory constraints and tools provide opportunities for addressing the various, potentially conflicting, demands for water in the subbasin. First, in recognition of over-appropriated water rights, the Upper Clark Fork Basin (including the Blackfoot Subbasin) is closed to permits for new surface water uses (Montana Code Annotated (MCA) §85-2-336). In addition, as of 2007, any applicant for a groundwater permit in a closed basin must assess the connectivity of ground and surface water, and if the proposed groundwater source is tributary to surface water, must provide a plan for offsetting any depletions to surface waters. The closure has the practical effect of dramatically reducing demand on ground and surface water supplies. An exemption for small groundwater permits (< 35 gallons/minute, 10 acre-feet) allows some development of groundwater without any assessment of its impact on either aquatic resources or senior water rights.

Another Montana law allows water rights to be severed from the land and changed from one purpose to another, as long as the change will not adversely affect other water users (MCA §85-2-402). The law also allows for temporary changes in water rights to instream uses for the benefit of fisheries (MCA §85-2-408 and 436). MFWP has a limited ability to permanently convert consumptive use rights to instream uses (MCA §85-2-436). Collectively, these legal and regulatory tools can assist in the resolution of future water management issues.

Despite this legal and regulatory framework, there are some specific challenges regarding municipal water use within the Blackfoot Subbasin. Specifically, the community of Seeley Lake faces potential water shortages in the future. As of 2009, Seeley Lake has water rights for up to 350 acre-feet per year, and currently uses about 250 acre-feet year. While Seeley Lake is in the midst of upgrading its infrastructure to improve water delivery to its customers, recent population projections suggest that by 2030, Seeley Lake could reach water demand levels that exceed its water rights (Petersen-Perlman and Shively 2009). Seeley Lake is part of the Upper Clark Fork Basin Closure that precludes issuance of new permits for surface water uses or for tributary groundwater use without mitigation for depletions. In addition, there are few, if any, significant existing surface water rights in the vicinity of Seeley Lake that could be secured and changed to municipal use. Increased water demand in Seeley Lake could, therefore, pose both legal and water management issues in the future.

3.2.5.1.2 Dams

The Mike Horse Dam, constructed in the 1940s across the mouth of Beartrap Creek just above its confluence with Mike Horse Creek in the Blackfoot River headwaters, was intended to contain metals-laced tailings from the Mike Horse Mine and other copper, zinc, and gold mines. The mine blew out in 1975, releasing heavy metals into the upper Blackfoot. The safety of the shored-up tailings dam continues to be a threat to water quality in the Blackfoot, and the USFS is moving forward with plans to remove the dam (CFC 2009).

The Milltown dam, a run-of-the-river hydroelectric facility located immediately below the Blackfoot - Clark Fork River confluence, has blocked upstream fish passage on the Clark Fork River and affected natural migrations between the Clark Fork and Blackfoot Rivers since 1907 (BC 2005a). The Milltown Dam has been removed.

A number of small dams in the Blackfoot Subbasin may be seasonal fish passage barriers, including a small dam at the Stimson Lumber Mill at the mouth of the Blackfoot River, the Nevada Creek Dam and dams on the Clearwater Lakes (Seeley Lake and Placid Lake). Fish passage barriers were installed at the outlets of Rainy Lake and Lake Inez in the 1960s in an attempt to control the reintroduction of nongame fish into these lakes following chemical rehabilitation. MFWP is researching the feasibility of removing these barriers (USFWS 2002).

3.2.5.2 Water Quality

The Blackfoot River and its tributaries provide critical fish and wildlife habitat, irrigation water for agricultural lands, water for domestic use and high quality recreational opportunities for the public—all beneficial uses dependent upon clean water. Naturally high sediment production, low stream flows and drought prone areas and other natural factors account for some impairment issues and compound problems when combined with human influences (BC 2005a).

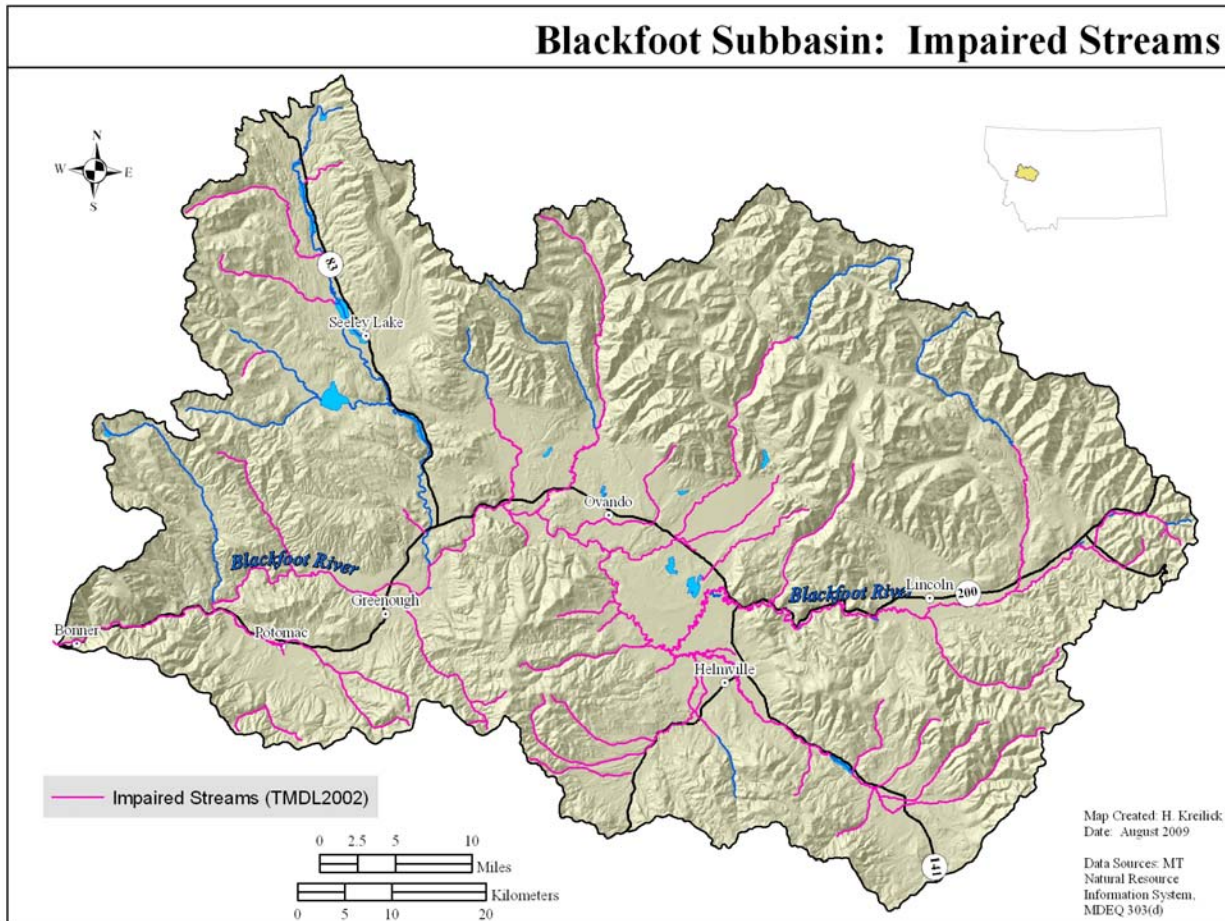
The major human-caused water quality issues identified in the Blackfoot Subbasin include excess sediment and siltation, instream and riparian habitat alterations, flow alterations, elevated water temperature and elevated nutrients and metals concentrations. Water quality impairment results from a variety of land uses, including mining, excessive timber harvest, grazing in riparian zones, excessive irrigation diversions, poorly designed roads, and unplanned residential development. The impacts of poor water quality are most often reflected in the health of fisheries, which therefore provide a measure of overall watershed health. Impaired water quality can impact recreational uses, crop yields, wildlife health and livestock survival. In severe cases, poor water quality can limit drinking water availability (BC 2005a). Further discussion of water quality impacts in the Blackfoot Subbasin resulting from residential development, silvicultural activities, livestock grazing and mining is provided in the subbasin threat assessment (Section 3.4).

The primary vehicle for addressing water quality impairments in the Blackfoot Subbasin is the voluntary Total Maximum Daily Load (TMDL) planning process. Section 303(d) of the federal Clean Water Act (and related regulations) requires states to assess the condition of surface waters within their borders to identify water bodies that do not fully meet water quality standards. The resulting list of water quality impaired water bodies is known as the 303(d) list. In Montana, MDEQ is responsible for the development of TMDLs. Montana's approach is to develop TMDLs in the context of comprehensive water quality restoration plans. The goal of a TMDL and water quality restoration plan is to identify causes and sources of water quality impairment in water bodies on the 303(d) list, the level of water quality improvement necessary for a water body to fully support all intended beneficial uses and strategies for achieving restoration goals. To encourage water quality restoration efforts

in 303(d)-listed water bodies, various state and federal agencies offer funding in the form of grants and other programs to implement TMDL-identified restoration projects.

Since 1996, 56 water bodies in the Blackfoot Subbasin have been included on Montana's 303(d) list because they do not, according to MDEQ, fully support beneficial uses such as aquatic habitat, recreation and drinking water (Figure 3.9). The status of these water bodies is reassessed every two years by MDEQ.

Figure 3.9 Impaired Streams.

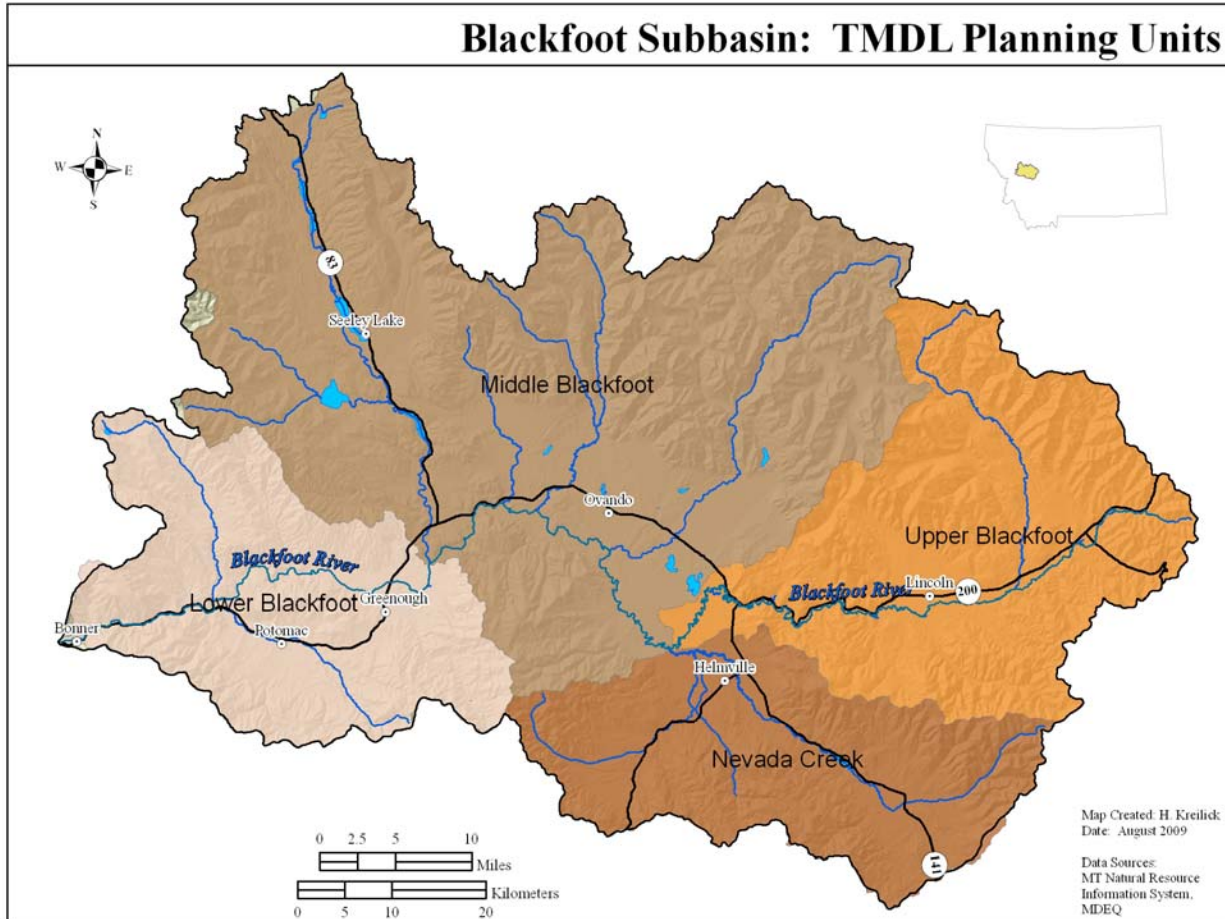


The Blackfoot Subbasin is divided into the following four planning areas for purposes of TMDL development (Figure 3.10):

1. *Blackfoot Headwaters Planning Area*, extending from the Blackfoot Headwaters to the confluence with Nevada Creek;
2. *Middle Blackfoot Planning Area*, including the Blackfoot River drainage from Nevada Creek to the confluence with the Clearwater River;
3. *Nevada Creek Planning Area*, including the Nevada Creek drainage from its headwaters to the confluence with the Blackfoot River; and

4. *Lower Blackfoot Planning Area*, extending from the Clearwater River downstream to the confluence with the Clark Fork River.

Figure 3.10 TMDL Planning Units.



In 2000, MDEQ partnered with the Blackfoot Challenge to develop TMDL plans in the Blackfoot Subbasin. TMDL development began in the Headwaters Planning Area in 2001. As of March 2009, TMDL plans have been completed for the Blackfoot Headwaters (MDEQ 2003, 2004) and Middle Blackfoot-Nevada Creek Planning Areas (MDEQ 2008a) and a plan is pending for the Lower Blackfoot Planning Area (MDEQ 2008b). These documents identify causes and sources of water quality impairments in 303(d)-listed water bodies and outline conceptual strategies for addressing identified causes and sources of impairment.

Since the 1990s, BBCTU, in cooperation with a variety of partners in the subbasin including the Blackfoot Challenge, the U.S. Fish and Wildlife Service (USFWS), MFWP, North Powell Conservation District, private landowners and many others, has undertaken a suite of restoration projects that address the impairments identified in the TMDL planning process. See Table 4.2 in the Blackfoot Subbasin Inventory for a complete list of these projects.

There is evidence that, in many instances, water quality has improved in water bodies where restoration has occurred. This has been especially true where projects have targeted high water temperatures. For example, Jacobsen Spring Creek, Wasson Creek, and Kleinschmidt Creek have all shown measurable temperature reductions after completion of restoration projects that have addressed the conditions that lead to high temperatures (e.g. dewatering or livestock-induced channel degradation) (Pierce, 2006, 2008).

In addition to the TMDL effort described above, the Clearwater Resources Council coordinates a lake monitoring program on Seeley Lake, Salmon Lake, Placid Lake, Lake Alva, and Lake Inez. The purpose of this effort is to develop a long-term water quality database to better inform land management and community development decisions that may affect lake water quality (Rieman and Birzell 2008).

In 2010-2011, in partnership with MDEQ, partners will develop an implementation schedule with estimated costs, technical and financial assistance needed to implement restoration practices and management measures.

3.2.6 Fish and Wildlife

3.2.6.1 Overview of Fish and Wildlife of the Blackfoot Subbasin

The Blackfoot Subbasin is one of the most biologically diverse and intact landscapes in the western United States. The subbasin supports an estimated 250 species of birds, 63 species of mammals, five species of amphibians, six species of reptiles, and 25 species of fish (MTNHP 2009a). Because of its rural and largely intact nature, the Blackfoot Subbasin retains the full complement of large mammals, many of which have been extirpated from portions of their historic ranges. The subbasin provides excellent habitat for grizzly bear, black bear, elk, mule deer, white-tailed deer, mountain lion, Canada lynx, bobcat, gray wolf, coyote, wolverine, fisher and a wide variety of small mammals. The subbasin also provides high quality breeding, nesting, migratory and wintering habitat for a diversity of bird species, many of which are Species of Concern in Montana (see below). There are currently 12 native fish species and 13 non-native fish species in the Blackfoot Subbasin, as well as several hybrid salmonids (MFIS 2009).⁶ Maps characterizing critical fish and wildlife habitat are located in Section 3.3. A complete list of wildlife species found in the Blackfoot Subbasin is provided in Appendix B.

3.2.6.2 Special Status Fish and Wildlife Species

According to the Montana Natural Heritage Program database (MTNHP 2009a) there are 41 animal Species of Concern in the Blackfoot Subbasin (Table 3.5).⁷ These include invertebrates, birds, fish, mammals, reptiles and amphibians. Eight of the 14 bird species ranked by Montana Partners in Flight (PIF 2000) as Level I priority species in the state are

⁶ Detailed information on native and exotic fish species present in the Blackfoot Subbasin is provided in Sections 3.3.3.1 and 3.4.4.3.

⁷ Species of Concern are plants and animals considered by the Montana Natural Heritage Program to be at risk or potentially at risk. The Species of Concern list is updated as new population status/trend data is obtained (<http://www.mtnhp.org>).

found in the subbasin: Common Loon, Trumpeter Swan, Harlequin Duck, Columbian Sharp-tailed Grouse, Black-Backed Woodpecker, Flammulated Owl, Olive-sided Flycatcher and Brown Creeper.⁸

Federally listed animal species found in the subbasin include the threatened bull trout, grizzly bear, and Canada lynx. The gray wolf, which was delisted from endangered status in March 2009 and subsequently re-listed in 2010 after litigation in federal court, the Bald Eagle, which was delisted from threatened status in July 2007, and the fisher, which is a candidate for listing, also occur in the subbasin (USFWS 2009b). The relationship of the Blackfoot Subbasin to Endangered Species Act planning units is as follows:

Bull Trout: For listing purposes, the USFWS divided the range of bull trout into distinct population segments and 27 recovery units. The Blackfoot Subbasin falls within the Clark Fork River Recovery Unit and the Upper Clark Fork Recovery Subunit. Within this subunit, the USFWS identified the both Blackfoot sub-basin and the Clearwater River watershed as core recovery areas (USFWS 2002). The 2002 proposal for critical habitat described six local populations within the Blackfoot: the Landers Fork, North Fork, and Monture, Cottonwood, Belmont and Gold Creeks; and four within the Clearwater: the West Fork Clearwater, Deer Creek, Morrell Creek, and Placid Creek (USFWS 2002). The bull trout populations within the Clearwater drainage are considered to be distinct from the mainstem Blackfoot populations because the Clearwater population is adfluvial, with the lakes in the Clearwater drainage providing bull trout with foraging, migrating and overwintering habitat (Benson, 2009). The MFWP recovery strategy has tracked closely with both the 2002 and 2010 (see below) descriptions in USFWS recovery plan (Appendix K); except that the state plan identified each watershed where critical habitat is located to be a recovery area (MBTRT 1996; Pierce, 2008).

The Blackfoot Subbasin has been proposed as critical habitat within the Clark Fork River drainage (USFWS 2002), although the current status of this designation is somewhat unclear. In 2005, the USFWS withdrew an earlier critical habitat rule proposal that included much of the Blackfoot as critical habitat, leaving only the mainstem Blackfoot and a small part of the Clearwater drainage listed as critical habitat.

After an Inspector General's report disclosed improprieties at the highest levels of the USFWS in the designation of critical habitat, in January, 2010, the USFWS issued a new description of critical habitat. The new description identifies 11 tributaries and reaches of the Blackfoot as critical habitat and 14 lakes, tributaries and reaches of the Clearwater as critical habitat (figures 3.11 and 3.12; USFWS 2010a).

While the designation of critical habitat confers a higher level of protection and scrutiny when federal agencies propose projects within designated critical habitat, in order to assure that there will be no adverse effect from those activities, the USFWS indicates that bull trout habitat within the Blackfoot and Clearwater are all considered occupied and all

⁸ Partners in Flight Level I priority species have declining population trends and/or high area importance. These are the species for which Montana has a clear obligation to implement conservation (PIF 2000).

projects that involve federal funds or permits receive full Section 7 consultation.
(USFWS 2010b).

Figure 3.11: Critical Bull Trout Habitat in the Blackfoot Sub-unit.

Critical Habitat for Bull Trout (*Salvelinus confluentus*)

Unit: 31, Clark Fork River Basin

Sub-unit: Blackfoot River

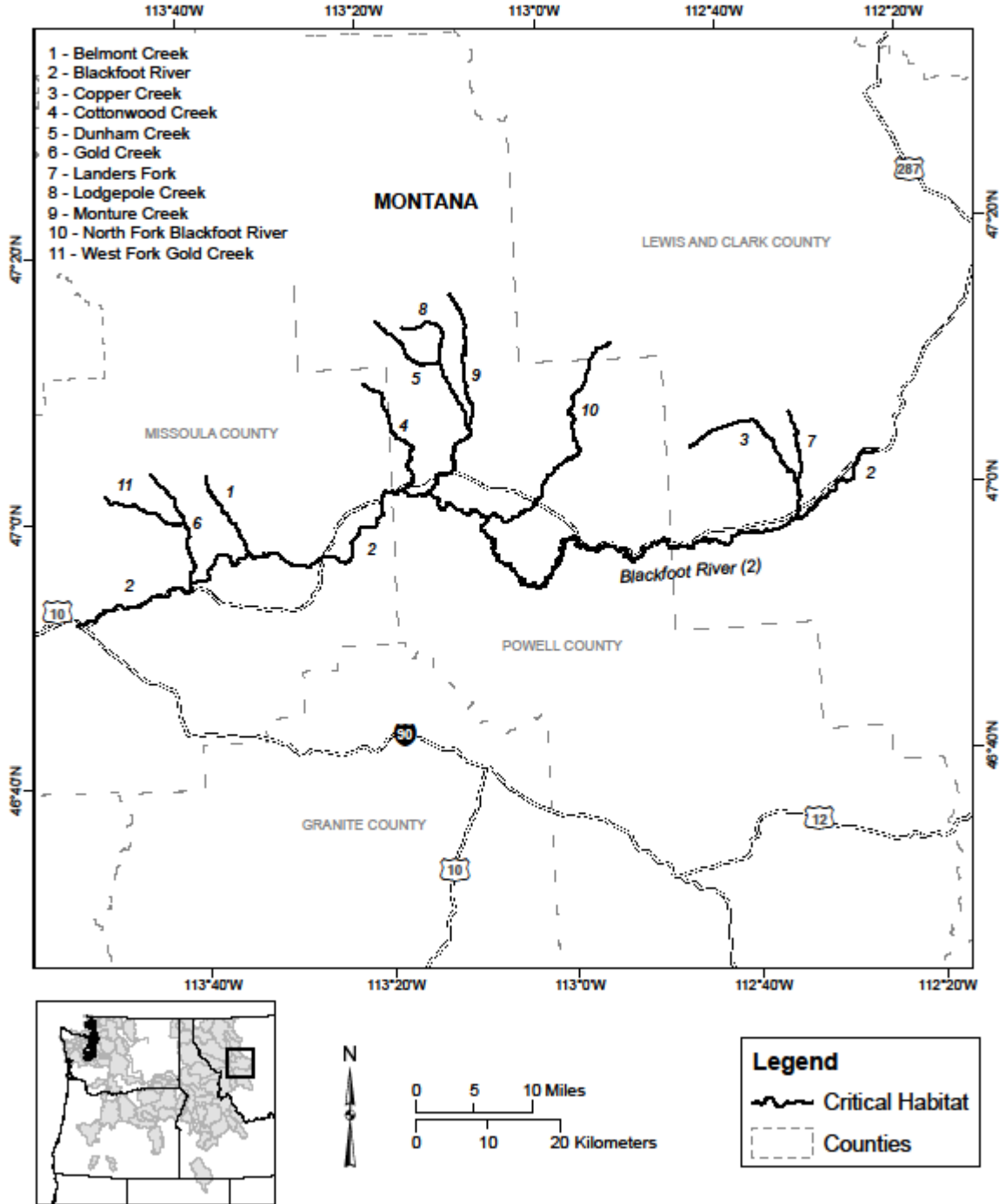
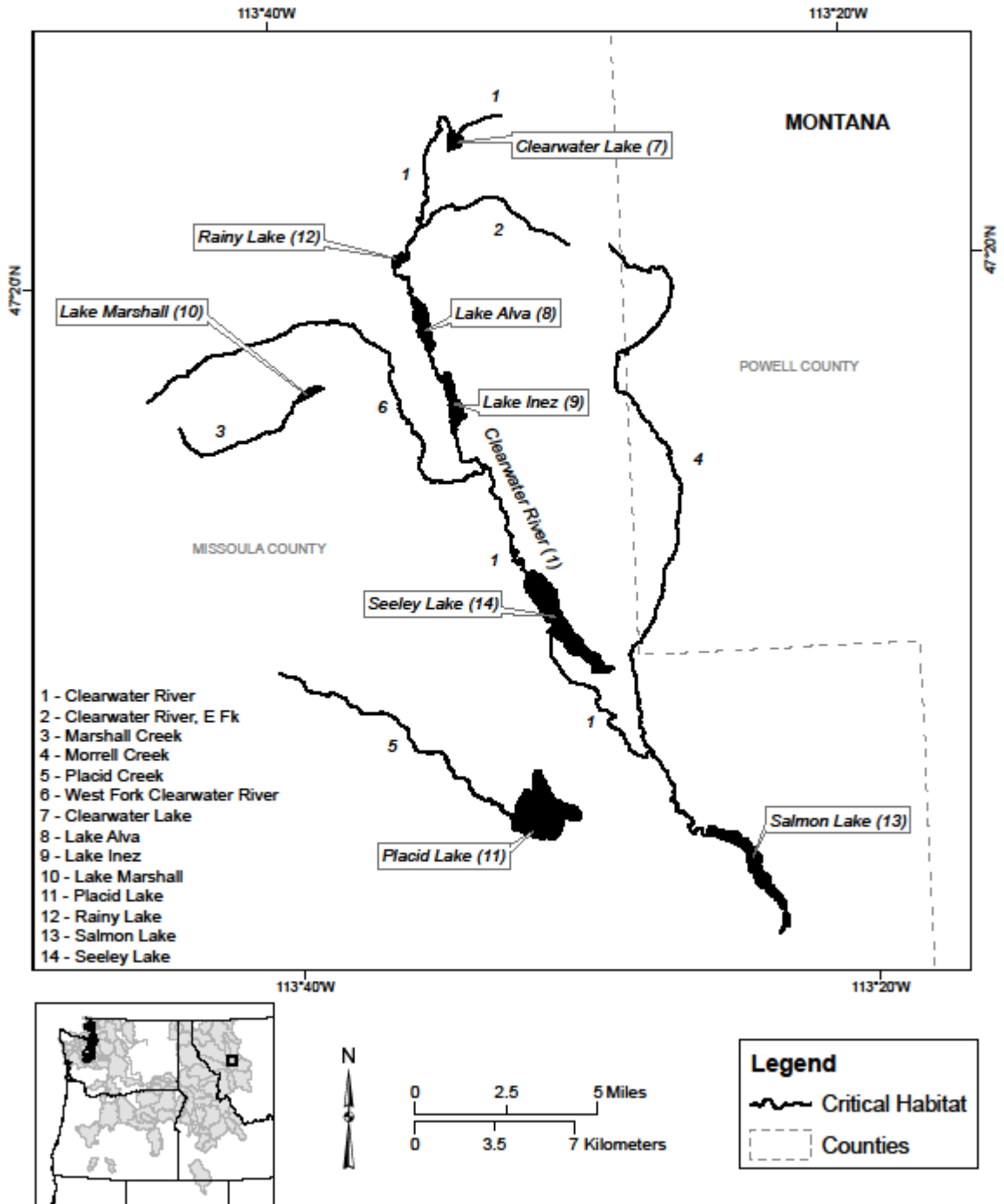


Figure 3.12 Critical Habitat for Bull Trout in the Clearwater River and Lakes Sub-unit.

Critical Habitat for Bull Trout (*Salvelinus confluentus*)

Unit: 31, Clark Fork River Basin
 Sub-unit: Clearwater River and Lakes



Grizzly Bear: The Grizzly Bear Recovery Plan focuses on the six areas in Idaho, Montana, Washington and Wyoming that have habitat suitable for self-sustaining grizzly populations. The northern portion of the Blackfoot Subbasin (north of Highway 200) lies within the Northern Continental Divide Recovery Zone (USFWS 1993).

Northern Rocky Mountain Gray Wolf: The Northern Rocky Mountain Gray Wolf Recovery Plan established three recovery zones in Montana, Idaho and Wyoming. The Blackfoot Subbasin is in the Northwest Montana Recovery Area (USFWS 1987). In March 2009, the USFWS removed the gray wolf from the list of threatened and endangered species in the western Great Lakes, the northern Rocky Mountain states of Idaho and Montana and parts of Washington, Oregon and Utah (USFWS 2009b). The status of the gray wolf, however, is not yet resolved due to the likelihood of litigation over delisting.

Canada Lynx: The Canada Lynx Recovery Outline categorized lynx habitat and occurrence within the contiguous United States as 1) core areas, 2) secondary areas and 3) peripheral areas. Core areas are defined as the areas with the strongest long-term evidence of the persistence of lynx populations. Core areas have both persistent verified records of lynx occurrence over time and recent evidence of reproduction. Six core areas and one “provisional” core area are identified within the contiguous United States. The Blackfoot Subbasin is located within the Northwestern Montana/Northeastern Idaho Core Area (Ruediger et al 2000).

Table 3.5 Animal Species of Concern in the Blackfoot Subbasin.

Common Name	Scientific Name	MTNHP Rank ¹	PIF Priority Level ²	USFS Status	BLM Status	Notes
<i>BIRDS</i>						
American White Pelican	<i>Pelecanus erythrorhynchos</i>	G4 S3B	III			
Bald Eagle	<i>Haliaeetus leucocephalus</i>	G5 S3	II	Delisted threatened	Special status	Delisted from threatened status on July 9th, 2007. Now designated as Delisted Taxon-Recovered.
Black Tern	<i>Chlidonias niger</i>	G4 S3B	II		Sensitive	The largest known black tern colonies in Montana are at Freezout Lake WMA, Benton Lake NWR, Blackfoot WPA, and on the Blackfeet Reservation (PIF 2000).
Black-backed Woodpecker	<i>Picoides arcticus</i>	G5 S2	I	Sensitive	Sensitive	
Bobolink	<i>Dolichonyx oryzivorus</i>	G5 S2B	III			
Brewer's Sparrow	<i>Spizella breweri</i>	G5 S2B	II		Sensitive	
Brown Creeper	<i>Certhia americana</i>	G5 S3	I			
Caspian Tern	<i>Hydroprogne caspia</i>	G5 S2B	II			
Common Loon	<i>Gavia immer</i>	G5 S2B	I	Sensitive	Sensitive	
Common Tern	<i>Sterna hirundo</i>	G5 S3B	II			
Flammulated Owl	<i>Otus flammeolus</i>	G4 S3B	I	Sensitive	Sensitive	
Forster's Tern	<i>Sterna forsteri</i>	G5 S2B	II			
Franklin's Gull	<i>Leucophaeus pipixcan</i>	G4G5 S3B	II		Sensitive	
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	G5 S3B	II			
Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>	G5 S2B, S5N				
Great Gray Owl	<i>Strix nebulosa</i>	G5 S3	III		Sensitive	

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	PIF Priority Level ²	USFS Status	BLM Status	Notes
<i>BIRDS (CONT.)</i>						
Harlequin Duck	<i>Histrionicus histrionicus</i>	G4 S2B	I	Sensitive	Sensitive	Harlequin ducks breed locally on mountain streams in the western part of Montana, including the Kootenai, Flathead, Clark Fork, and Blackfoot River drainages. Scattered breeding also occurs along the Rocky Mountain Front and the north edge of Yellowstone National Park (PIF 2000).
LeConte's Sparrow	<i>Ammodramus leconteii</i>	G4 S3B	III		Sensitive	Not documented by MTNHP in the Blackfoot Subbasin but likely to occur here according to Partners in Flight (PIF 2000).
Lewis's Woodpecker	<i>Melanerpes lewis</i>	G4 S2B	II			
Long-billed Curlew	<i>Numenius americanus</i>	G5 S2B	II		Sensitive	
Northern Goshawk	<i>Accipiter gentilis</i>	G5 S4	II	Sensitive	Sensitive	
Olive-sided Flycatcher	<i>Contopus cooperi</i>	G4 S3B	I			
Peregrine Falcon	<i>Falco peregrinus</i>	G4 S2B	II	Sensitive	Sensitive	Delisted from endangered status on August 25th, 1999. Now designated as Delisted Taxon-Recovered.
Sharp-tailed Grouse (Columbian)	<i>Tympanuchus phasianellus columbianus</i>	G4T3 S1	II			
Trumpeter Swan	<i>Cygnus buccinator</i>	G4 S2	I	Sensitive	Sensitive	
Veery	<i>Catharus fuscescens</i>	G5 S3B	II			
White-tailed Ptarmigan	<i>Lagopus leucura</i>	G5 S3	III			

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
<i>MAMMALS</i>					
Wolverine	<i>Gulo gulo</i>	G4 S3	Sensitive	Sensitive	
Canada Lynx	<i>Lynx canadensis</i>	G5 S3	Listed threatened	Special status	Listed as threatened on March 24th, 2000. Critical Habitat designated on September 9th, 2006.
Fisher	<i>Martes pennanti</i>	G5 S3	Sensitive	Sensitive	The West Coast Distinct Population Segment (DPS) of the fisher has been added to the candidate species list (Federal Register, 15 April 2004).
Gray Wolf	<i>Canis lupus</i>	G4 S3	Delisted endangered	Special status	In March 2009, removed from the list of threatened and endangered species in the western Great Lakes and the northern Rocky Mountain states of Idaho and Montana and parts of Washington, Oregon and Utah (USFWS 2009b).
Grizzly Bear	<i>Ursus arctos</i>	G4 S2S3	Listed threatened	Special status	On July 28th, 1975, the grizzly bear was designated as threatened in lower 48 states. In Montana, populations in the Cabinet/Yaak and Northern Continental Divide Recovery areas are listed as threatened.
Northern Bog Lemming	<i>Synaptomys borealis</i>	G4 S2	Sensitive		
Preble's Shrew	<i>Sorex preblei</i>	G4 S3			
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>	G4 S2	Sensitive	Sensitive	
Fringed Myotis	<i>Myotis thysanodes</i>	G4G5 S3		Sensitive	

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
<i>FISH</i>					
Westslope Cutthroat Trout	<i>Oncorhynchus clarkii lewisi</i>	G4T3 S2	Sensitive	Sensitive	
Bull Trout	<i>Salvelinus confluentus</i>	G3 S2	Listed threatened	Special status	Listed as threatened on June 10th, 1998. Critical Habitat designated on September 26th, 2005.

<i>REPTILES and AMPHIBIANS</i>					
Western Skink	<i>Eumeces skiltonianus</i>	G5 S3			
Western Toad	<i>Bufo boreas</i>	G4 S2	Sensitive	Sensitive	

<i>INVERTEBRATES</i>					
Agapetus Caddisfly	<i>Agapetus montanus</i>	G3 S3			
Carinate Mountainsnail	<i>Oreohelix elrodi</i>	G1 S1			
Smoky Taildropper	<i>Prophysaon humile</i>	G3 S2S3			
Freshwater Sponge	<i>Ephydatia cooperensis</i>	G1G3 S1S3			
Gillette's Checkerspot	<i>Euphydryas gillettii</i>	G2G3 S2			
Lyre Mantleslug	<i>Udosarx lyrata</i>	G2 S1			
Magnum Mantleslug	<i>Magnipelta mycophaga</i>	G3 S2S3			
Millipede	<i>Austrotyla montani</i>	G1G3 S1S3			
Millipede	<i>Corypus cochlearis</i>	G1G3 S1S3			

¹ Montana Natural Heritage Program global (G) and state (S) ranks are explained in Appendix C.

² Partners in Flight Priority Ranks are as follows: Level I: Declining population trends and/or high area importance. These are the species for which Montana has a clear obligation to implement conservation. Level II: Species with lesser threat or stable/increasing populations in the state compared to Level I species. Montana has a high responsibility to monitor the status of these species and/or to design conservation actions. Level III: Species of local concern (often designated as such by one or more agencies) which rank lower, are not at imminent risk, or which are near obligates for high priority habitat. Presence of these species may serve as added criteria in the design and selection of conservation or monitoring strategies (PIF 2000).

3.2.6.3 Non-native Aquatic Animal Species

In this section we focus on the non-native fish, invertebrates, and parasites that are currently found or have the potential to invade aquatic systems in the Blackfoot Subbasin. A brief description of these species is provided below. Further discussion of the threat these species pose to native species and aquatic systems in the subbasin is provided in Section 3.4.4.3.

Non-native fish species

Brook trout: Brook trout were brought to the inland American West from northeastern North America for sport fishing and subsistence between 1920 and 1950 (Benhke 2002, MFWP historic files). Resident brook trout are widely distributed in certain tributaries of the Blackfoot Subbasin. However, they are absent from many streams and they are considered rare in the mainstem Blackfoot River below the Landers Fork tributaries (Pierce et al. 2008). Bull trout are commonly misidentified and harvested as brook trout. To correct this problem, angling regulations have been adjusted to catch-and-release for both brook trout and bull trout in the mainstem Blackfoot River. DFWP conducted an angler survey in 2004 that targeted anglers in key fluvial bull trout and WSCT staging and spawning areas. Among the findings of this survey were that while the percentage of anglers properly identifying all five trout species was relatively low (58 percent of resident anglers, 24 percent of non-resident anglers), the compliance with all fishing regulations was high (Pierce et al 2006).

Brown trout: European brown trout, introduced to North America in the 1880s, rapidly became established and quickly replaced native trout in large rivers of the western United States. Brown trout now support popular sport fisheries in many rivers including the Blackfoot River. Brown trout inhabit stream reaches in the foothills and agricultural bottomlands of the Blackfoot Subbasin. They occupy an estimated 15% of the perennial stream network in the Blackfoot Subbasin, including 110 miles of the Blackfoot River mainstem and the lower reaches of many tributary streams (BC 2005a, USFWS 2002, Pierce et al. 2008). They are often a dominant fish in medium-sized, low-elevation tributaries that provide undercut banks and abundant cover. Brown trout co-exist with other salmonids in the larger river reaches where sufficient habitat complexity creates a diversity of niches. Spawning occurs in the upper mainstem Blackfoot River and lower tributary reaches (MFWP files).

Rainbow trout: Rainbow trout, a renowned sport fish, has been introduced into coldwater habitats around the world (Fausch et al. 2001). Rainbow trout were introduced to western Montana beginning in the late 1800s (Benhke 2002). Since the implementation of “wild trout management” in Montana in 1979, the distribution of rainbow trout in the Blackfoot Subbasin has diminished and the species is no longer present in the upper Blackfoot River (Spence 1975, Pierce et al. 2008). Stream-dwelling rainbow trout currently inhabit the lower mainstem Blackfoot River and reproduce in the lower portions of the larger tributaries (Pierce et al. 2009). They are also established in certain lakes, reservoirs and private ponds as well as tributaries connected to these environments. Stocking programs have been reviewed, and most lakes and private ponds that historically received hatchery rainbow trout have been converted to westslope cutthroat trout or triploid (sterile) rainbow trout. Currently, rainbow trout are stocked by MFWP in only a few lakes in the Blackfoot Subbasin where interactions with native species are not a concern.

Rainbow trout currently occupy an estimated 15% to 20% of the perennial streams in the lower elevation portions of the Blackfoot Subbasin. They are also present in the upper North Fork Basin portion of the Scapegoat Wilderness area in areas of historical lake plants (Pierce et al. 2008). Rainbow trout are highly susceptible to whirling disease (Bartholemew and Wilson 2002), which is expanding within the range of stream-dwelling rainbow trout in the Blackfoot Subbasin (Pierce et al. 2008, 2009). The expansion of *Myxobolus cerebralis*, the causal agent of whirling disease, is thought to impact rainbow trout densities in the middle Blackfoot River (Pierce et al. 2009).

Asian carp: Four species of Asian carp are classified as Priority Class 1 Aquatic Nuisance Species (ANS)⁹ in Montana: bighead, black, grass, and silver carp. All four species were introduced to the United States from Asia and have spread accidentally and by deliberate release. Although not currently present in Montana, the Asian carp are considered a serious threat (E. Ryce, pers. comm.).

Other Fish: Other non-native fish species present in the subbasin include Yellowstone cutthroat trout, largemouth bass, white sucker, fathead minnow, arctic grayling, kokanee salmon, northern pike, yellow perch, walleye, brook stickleback, and pumpkinseed. Coho salmon, an Aquatic Nuisance Species, has been stocked in Browns Lake. The following fish species, although not yet documented in Montana, are considered Priority Class 1 Aquatic Nuisance Species that would pose a serious threat to native aquatic species and systems in the state: round goby, Eurasian ruffe, tench and zander.

Non-native invertebrates¹⁰

New Zealand mudsnail: Native to freshwater streams and lakes of New Zealand and adjacent small islands, the New Zealand mudsnail was first discovered in the United States in the Snake River in 1987. Since then, it has spread into many water bodies in the western United States and the Great Lakes. Although it is not present in the Blackfoot Subbasin, it has been found in Montana in the Madison River and several other rivers in and near Yellowstone National Park. The snail prefers littoral zones in lakes or slow streams but also survives in high flow environments by burrowing into sediment. It thrives in disturbed watersheds, tolerates siltation and benefits from high nutrient flows. The New Zealand mudsnail is a Priority Class 2 Aquatic

⁹ Aquatic Nuisance Species (ANS) pose a serious threat to native aquatic species and aquatic systems. The federal Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, amended by the National Invasive Species Act of 1996, calls for the development of state and regional management plans to control aquatic nuisance species. The 2002 Montana ANS Management Plan addresses specific aquatic nuisance species, provides a management framework, and sets objectives and actions to prevent and reduce the impact of ANS in Montana. The Montana ANS Management Plan will be updated in 2010.

Priority Class 1 Aquatic Nuisance Species are currently not known to be present in Montana but have a high potential to invade. There are limited or no known management strategies for these species. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations.

¹⁰ Information on non-native invertebrates, parasites, and pathogens is from the USGS Nonindigenous Aquatic Species fact sheets (<http://nas.er.usgs.gov>) and the Montana ANS website (<http://fwp.mt.gov/fishing/fishingmontana/ans>).

Nuisance Species in Montana.¹¹ Densities and distribution throughout Montana are declining with the exception of the Bighorn River where densities are increasing.

Mud bithynia/faucet snail: Native to Europe, the mud bithynia was introduced to the Great Lakes Basin in the 1870s. It is now found in the Mid-Atlantic Region, Lake Champlain, across New York, the Potomac River in Virginia, and Chesapeake Bay. According to the USGS Nonindigenous Aquatic Species information system, it is also present in the Blackfoot Subbasin. The mud bithynia is commonly found in freshwater ponds, shallow lakes, and canals.

Zebra and quagga mussel: Native to Eastern Europe, zebra and quagga mussels were introduced to the Great Lakes Basin in the late 1980s in ballast water discharge from freighters. The zebra mussel is now found widely in the Mississippi River drainage and also in the western United States (Colorado, Utah and California). The quagga mussel has spread throughout the Great Lakes Basin and to numerous locations in the western United States including Lake Mead, Lake Havasu, Lake Mohave and numerous reservoirs in Colorado and California. Neither mussel has been documented in Montana. Zebra mussels are classified as a Priority Class 1 Aquatic Nuisance Species.

Other invertebrates: Other invertebrates classified as Priority Class 1 Aquatic Nuisance Species in Montana include rusty crayfish and spiny waterflea.

Non-native parasites/pathogens

Whirling disease: Whirling disease is a Priority Class 2 Aquatic Nuisance Species in Montana. Whirling disease is caused by an exotic parasite *Myxobolus cerebralis*. The parasite was introduced to the United States from Europe in the 1950s and has spread into drainages in 25 states, including over 95 water bodies in Montana. Severe infections in Montana occur in the Madison River, the Missouri River near Helena, Rock Creek near Missoula, the Blackfoot River, and many smaller wild trout streams. In the Blackfoot Subbasin, whirling disease was first detected in 1995 near Ovando and has since increased in distribution and intensity. It now affects the lower 122 miles of the mainstem of the Blackfoot River and at least 17 tributary streams and continues to expand in the lower reaches of certain tributaries (Pierce et al. 2008, 2009, Montana ANS Technical Committee 2002). See Table 3.6 for summary of histological results.

¹¹ Priority Class 2 Aquatic Nuisance Species are present and established in Montana and have the potential to spread further and there are limited or no known management strategies for these species. These species can be managed through actions that involve mitigation of impact, control of population size, and prevention of dispersal to other waterbodies.

Table 3.6 Summary of histological results summarized as mean grade infections from sentinel cages placed in the Blackfoot River (top), the confluence areas of basin-fed tributaries (middle) and spring creeks (lower) for 1998-2007.

Waterbody	Mean Grade Infection									
Blackfoot River	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Blackfoot River-Below Gold Cr	0.22	nd	2.44	nd	0.59	2.42	2.2	2.06	0	nd
Blackfoot River-Below Elk Cr	nd	nd	2.3	nd	1.59	nd	2.3	nd	0.64	0.22
Blackfoot River-above Clearwater	1.1	0.22	3.11	nd	2.79	3.16	3.41	2.96	2.03	1.33
Blackfoot River-Below North Fork	0.25	nd	nd	nd	nd	nd	2.64	2.86	0.79	nd
Blackfoot River-below Nevada Cr	0	0	0.84	nd	0.9	2.12	3.93	3.28	0.1	0.31
Blackfoot River-Below Lincoln	0	0	0.6	nd	2.44	nd	nd	3.89	2.25	nd
Blackfoot River-Headwaters	nd	nd	0	nd	0.02	0.32	nd	0	0.07	0
Basin-fed Streams										
Johnson Creek	nd	nd	nd	nd	nd	nd	nd	0	0	nd
West Twin Creek	nd	nd	nd	nd	nd	nd	nd	0	0	0
East Twin Creek	nd	nd	nd	nd	nd	nd	nd	0	0	nd
Bear Creek	nd	nd	nd	nd	nd	nd	nd	na	0	nd
Union Creek	nd	nd	nd	nd	nd	nd	0	nd	nd	nd
Gold Creek	nd	0.12	0	nd	0	0	nd	0	0	0
Belmont Creek	nd	nd	0	nd	0.19	0.38	1.55	2.48	0.3	3.44
Elk Creek	nd	0	0	nd	0	2.84	4.32	4.82	nd	nd
Clearwater River	nd	nd	nd	nd	nd	nd	0	nd	nd	nd
CottonwoodCreek	3.66	4.52	nd	nd	4.5	nd	nd	3.78	3.96	4.25
Chamberlain Creek	0.16	2.71	3.88	nd	2.63	nd	4.33	3.78	nd	1.89
Monture Creek	0	0	1.76	nd	3.22	nd	nd	4.81	4.57	4.26
Warren Creek	0.21	2.1	1.72	nd	nd	nd	nd	0.0	nd	nd
North Fork Blackfoot River	0	nd	0	nd	0.78	nd	nd	0.27	nd	nd
Arrastra Creek	nd	nd	nd	nd	nd	0.34	1.23	0.02	0.14	nd
Beaver Creek	nd	nd	nd	nd	nd	nd	0.45	0.85	0.3	0
Poorman Creek	nd	nd	nd	nd	nd	nd	0.78	ND	nd	4.69
Landers Fork	nd	nd	nd	nd	nd	nd	0.14	0	0	0
Upper Willow Creek	nd	nd	nd	nd	nd	nd	0	nd	nd	0
Wasson Creek	nd	nd	nd	nd	nd	nd	nd	0	nd	0
Spring Creeks										
Jacobsen Spring Creek	nd	nd	nd	nd	nd	nd	0.13	nd	nd	nd
Rock Creek	nd	0	2.3	3.9	nd	3.38	nd	nd	nd	nd
Kleinschmidt Creek	2.83	3.56	4.52	3.77	nd	4.9	4.7	nd	nd	nd
Nevada Spring Creek	nd	nd	nd	nd	0	nd	3.66	2.22	1.94	nd
Grentier Spring Creek	nd	nd	nd	nd	nd	nd	0.06	1	nd	nd
Lincoln Spring Creek	nd	nd	nd	nd	nd	nd	5	4.7	nd	nd

Other parasites/pathogens: Non-native parasites/pathogens which are not currently present in Montana but have the potential to invade include: heterosporosis (Priority Class 1 ANS), VHS virus, IHN Virus (Priority Class 1 ANS), and Asian Tapeworm (Priority Class 3 ANS).¹²

3.2.7 Vegetation

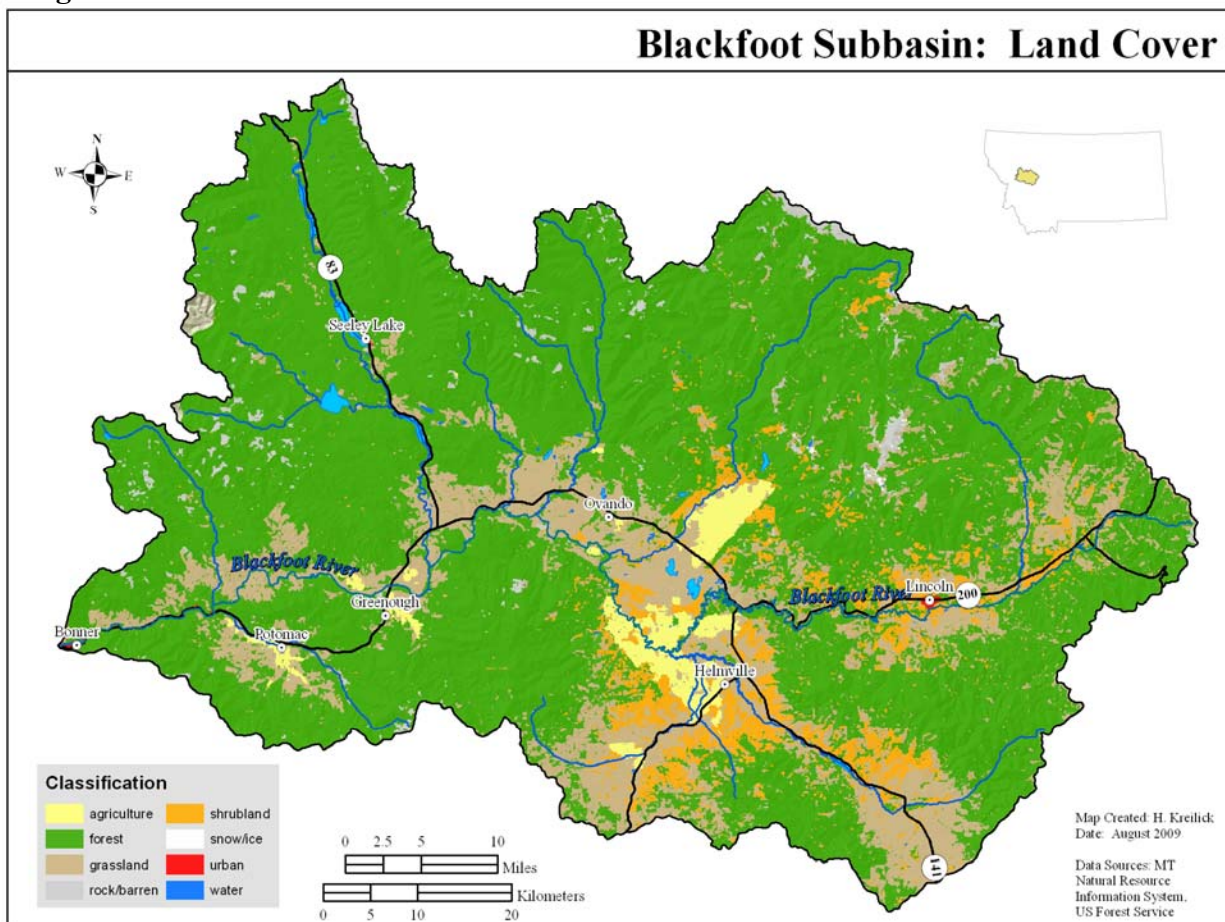
3.2.7.1 Overview of Vegetation Types in the Blackfoot Subbasin

Geologic, hydrologic and geographic features in the Blackfoot Subbasin combine to produce a diversity of vegetation communities including prairie grasslands, sagebrush steppe, coniferous

¹² Priority Class 3 Aquatic Nuisance Species are not known to be established in Montana and have a high potential for invasion and appropriate management techniques are available. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations.

forest and extensive wetland and riparian areas. Over 80% of the subbasin is covered with mixed species conifer forests dominated by ponderosa pine, lodgepole pine, Douglas-fir and western larch at the lower elevations and subalpine-fir and spruce in the higher regions, especially on cool, moist, northerly aspects. The remaining portions of the subbasin consist of native bunchgrass prairie (10%), agricultural lands (5%), and a combination of shrublands, wetlands, lakes and streams (5%) (Figure 3.13). Less than 1% of the subbasin is developed (BC 2005b). The greatest source of biological diversity in the subbasin arises from wetland features such as glacial lakes, vernal ponds, fens, basin-fed creeks, spring creeks, marshes and riparian areas (USFWS 2009a). Lesica (1994) estimates that 600 vascular plant species occur within the subbasin, nearly 30% of which are associated with wetlands (Appendix D).

Figure 3.13 Land Cover Class.



The Blackfoot Subbasin supports a number of rare plant communities. The *three-tip sagebrush/rough fescue plant association* is common in the Ovando area, yet found nowhere else in the world. The *big sagebrush/rough fescue plant association*, endemic to west- and north-central Montana, is common in the Kleinschmidt Flat area (S. Cooper and S. Mincemoyer, pers. comm.). Expanses of the *Drummond's willow plant association* occur in riparian swamps along Monture Creek and mud sedge, sharp bulrush, mannagrass and fen peatland plant communities are unique to the area's glacial pothole wetlands (USFWS 2009a, MTNHP 2009b).

According to Montana Partners in Flight (PIF 2000), the Blackfoot Subbasin contains all of the highest priority habitats for bird conservation in Montana. These habitats include mixed grassland, sagebrush steppe, dry (ponderosa pine/Douglas-fir) forest, riparian deciduous forest and prairie pothole wetlands. The subbasin also contains four of the seven community types in greatest need of conservation, according to Montana's Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005). These include grassland complexes, mixed shrub/grass associations, riparian and wetland communities and mountain streams.

3.2.7.2 Special Status Plant Species

Thirty plant Species of Concern have been documented by the Montana Natural Heritage Program in the Blackfoot Subbasin (Table 3.7) (MTNHP 2009a).¹³ While not documented from the Blackfoot, water howellia (*Howellia aquatilis*), a threatened species listed under the Endangered Species Act, is located immediately north of the subbasin in vernal wetlands in the Swan Valley (MTNHP 2009a).

¹³ Species of Concern are plants and animals considered by the Montana Natural Heritage Program to be at risk or potentially at risk. The Species of Concern list is updated as new population status/trend data is obtained (<http://www.mtnhp.org>).

Table 3.7 Plant Species of Concern in the Blackfoot Subbasin.

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
Austin's knotweed	<i>Polygonum austiniiae</i>	G5T4 S2S3	Sensitive		Sparsely distributed in mountainous areas of MT from the Rocky Mountain Front to the Madison and Gallatin Ranges. Sites are usually on open, gravelly, sparsely-vegetated slopes with shale-derived soils and as such are not generally impacted by human activity. Some sites however, are along forest roads and are susceptible to weed invasion and other disturbances. The probability of finding additional occurrences appears to be good since large areas of suitable habitat across western and central MT remain unsurveyed for the species.
beaked sedge	<i>Carex rostrata</i>	G5 S1	Sensitive		
Beck's water-marigold	<i>Bidens beckii</i>	G4G5 S2	Sensitive	Sensitive	Known from 10 occurrences in the western valleys of the state, including 6 moderate to large populations and 1 historical occurrence dating to 1937. However, the species may be more abundant in the state than what current data suggest. Threats and impacts to populations in MT include boating activity, lake shore development, aquatic weeds and use of aquatic herbicides.
blunt-leaved pondweed	<i>Potamogeton obtusifolius</i>	G5 S2	Sensitive		Known from approximately a dozen occurrences in northwest MT. Most occurrences are moderate to large populations and occur in valley and foothill locations in a variety of federal, state and private ownerships. A few populations are on lands managed specifically for their conservation value. Some populations are vulnerable to impacts associated with development, recreation and increased sediment and nutrient loads.
Chaffweed	<i>Centunculus minimus</i>	G5 S2		Sensitive	
cliff toothwort	<i>Cardamine rupicola</i>	G3 S3			State endemic known from 17 occurrences though many occurrences have not been surveyed for 30 or more years and many are based on a single herbarium specimen. However, the species grows at high elevations in rock and scree fields that generally are not subject to disturbance or other threats. Many populations also occur in designated Wilderness areas, which offer further protection. Additional occurrences likely exist across the known range of the species.

Table 3.7 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
Crawe's sedge	<i>Carex crawei</i>	G5 S2		Sensitive	Known in MT from 8 occurrences, including 5 moderate to large populations.
creeping sedge	<i>Carex chordorrhiza</i>	G5 S2	Sensitive		
crested shieldfern	<i>Dryopteris cristata</i>	G5 S2	Sensitive		Known from approximately 24 extant occurrences in western MT, mostly on National Forest lands, though State Trust Lands and private lands also host significant populations. The species is vulnerable to hydrologic changes.
deer Indian paintbrush	<i>Castilleja cervina</i>	G4 SH			Known from 3 widely separated historic collections in MT.
dense-leaf draba	<i>Draba densifolia</i>	G5 S2			Distributed in the western half of MT in 4 moderate to large populations, 6 small occurrences and 9 historical or poorly documented occurrences. Occupied habitats are at moderate to high elevation, which helps to minimize disturbance. However, livestock grazing, invasive weeds and off-road ATV use impact some populations.
divide bladderpod	<i>Lesquerella klausii</i>	G3 S3			State endemic restricted to central-MT with the majority of populations occurring in the Big Belt Mountains and extending north to the southern end of the Rocky Mountain Front. Many large populations exist and the species typically occurs on gravelly slopes that are not usually subject to human disturbance.
English sundew	<i>Drosera anglica</i>	G5 S2S3	Sensitive		Known from over two dozen populations in the state, most of which are moderate to large-sized, healthy populations. Most occurrences are on federally managed lands with several in designated Wilderness areas, research natural areas or Glacier National Park which help to protect the occurrences from many potential threats. The species may be negatively impacted by fire. Plants are also sensitive to and negatively impacted by trampling of peat mats on which the species grow.

Table 3.7 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
fringed bog moss	<i>Sphagnum fimbriatum</i>	G5 S1			
green-keeled cottonsedge	<i>Eriophorum viridicarinatum</i>	G5 S3			
Hall's rush	<i>Juncus hallii</i>	G4G5 S2	Sensitive		
Howell's gumweed	<i>Grindelia howellii</i>	G3 S2S3	Sensitive	Sensitive	Howell's gumweed occurs on vernal moist, lightly disturbed soil adjacent to ponds and marshes, as well as disturbed sites, such as roadsides and grazed pastures. It is a regional endemic known only from Missoula and Powell Counties, MT and Benewah County, ID and is considered globally threatened. It is known from over 60 mapped occurrences in MT, although most populations are small and many occur on roadsides or other similarly disturbed habitat. It is native to glacial wetlands in the subbasin. Occurrences may drift from place to place or from year to year and, as a result, many occurrences may be ephemeral. These attributes make determination of population numbers as well as the number of populations difficult. Invasive weeds are a threat to many occurrences, as the habitat occupied by <i>G. howellii</i> is also favorable for many weedy species. Application of herbicides to control these weeds, especially along roadsides may also have a direct, negative impact.
hutchinsia	<i>Hutchinsia procumbens</i>	G5 S1		Sensitive	
linear-leaved sundew	<i>Drosera linearis</i>	G4 S1	Sensitive		Only known from 4 populations in MT though all are moderate to large-sized occurrences that are located in either the Bob Marshall Wilderness or Indian Meadows Research Natural Area. These areas afford all known populations some protection from disturbance.

Table 3.7 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
Missoula phlox	<i>Phlox kelseyi</i> <i>var. missoulensis</i>	G2 S2	Sensitive		A state endemic that occurs on open, exposed, limestone-derived slopes. Known from 16 occurrences, most of which are moderate to large-sized populations. Populations occur on a mix of ownerships, including private lands that host several occurrences. The Waterworks Hill population of Missoula is infested with several noxious weeds and heavy recreational trail use also occurs within the occupied habitat. Other populations appear to be at much less risk though some impacts from development, recreation and invasive weeds are likely.
moonwort	<i>Botrychium spp.</i>	G1G2G3 S1S3			This is a general record for <i>Botrychium</i> species tracked by MTNHP and not specific for any particular species. MTNHP tracks and maintains observation data for all <i>Botrychium</i> species in the state excluding <i>B. multifidum</i> and <i>B. virginianum</i> which are fairly common and readily identifiable from all other <i>Botrychium</i> species.
moss	<i>Tetraplodon mnioides</i>	G4 S1			
moss	<i>Scorpidium scorpioides</i>	G4G5 S2	Sensitive	Sensitive	
pale sedge	<i>Carex livida</i>	G5 S3			Listed as a <i>Species of Potential Concern</i> .
pygmy water-lily	<i>Nymphaea tetragona ssp. leibergii</i>	G5 S1			Known from 4 extant occurrences in western valleys and one historical collection from Salmon Lake. Populations are susceptible to impacts from development, recreation, siltation and aquatic weeds.
small yellow lady's-slipper	<i>Cypripedium parviflorum</i>	G5 S3	Sensitive	Sensitive	Listed as a <i>Species of Potential Concern</i> . Known from over 60 occurrences thought to be extant and an additional ~12 historical or poorly documented sites across the western half of MT. Many occurrences have small population numbers, though approximately two dozen occurrences are moderate to large populations. Populations occur on variety of federal, state and private ownerships with varied land uses and management. Appears to be tolerant to some disturbances at low levels and the number of populations scattered over a wide area reduces the risk to the species. A loss of populations or a significant decline in numbers may warrant a re-listing as a Species of Concern in MT. Moderate to large occurrences should be managed to maintain habitat and viable population numbers.

Table 3.7 (continued).

Common Name	Scientific Name	MTNHP Rank ¹	USFS Status	BLM Status	Notes
sphagnum	<i>Sphagnum riparium</i>	G5 S1			
water bulrush	<i>Scirpus subterminalis</i>	G4G5 S2	Sensitive		Over a dozen known occurrences in western MT, most of which are moderate to large-sized populations primarily on National Forest lands. Populations are potentially vulnerable to changes in water levels or increases in nutrient and sediment loads associated with development, agriculture or adjacent timber harvesting.
watershield	<i>Brasenia schreberi</i>	G5 S1S2	Sensitive		Restricted in MT to shallow waters in the valleys of the northwest corner of the state, where it is known from 8 occurrences, including 6 relatively high quality populations. Potential threats to the species include boating activity, aquatic weeds, and several populations are subject to runoff from adjacent agricultural fields, though it is uncertain if this has negatively impacted any populations.
Western Joepye-weed	<i>Eupatorium occidentale</i>	G4 S2	Sensitive	Sensitive	This peripheral species in MT is known from a handful of small to large populations in the extreme western part of the state. Minor impacts associated with a rock quarry at one location and rock climbing at another location are possible. Otherwise, few threats have been documented for the species in MT.

¹ Montana Natural Heritage Program global and state ranks are explained in Appendix C.

3.2.7.3 Non-native Plant Species

One of the most challenging natural resource issues in the Blackfoot Subbasin is the spread of noxious and invasive plants. “Noxious weeds” are non-native species that can directly or indirectly injure agriculture, navigation, fish, wildlife, or public health (Montana Summit Steering Committee and Weed Management Task Force 2005). Landowners, managers and biologists are particularly concerned about the effects of noxious weeds on the structure, organization and function of ecosystems (Olson 1999). Noxious weeds impact the ecological and economic integrity of the Blackfoot Subbasin in a variety of ways (Olson 1999):

- Noxious weeds can outcompete and alter the relative abundance of native plant species by producing abundant seed, growing quickly and exploiting the soil profile for water and nutrients. A lack of natural predators furthers the competitive advantage of noxious weeds.
- Noxious weeds can contribute to soil erosion and alter soil properties by outcompeting native bunchgrasses that naturally bind the soil and producing secondary compounds that may hinder soil microfauna and microfauna from feeding on living roots.
- Noxious weeds impact wildlife by altering the native plant communities they depend on for survival.
- Noxious weed invasion can reduce carrying capacity for livestock, an important land use in the Blackfoot Subbasin. Noxious weeds reduce net returns by increasing operating expenses (for control measures), decreasing returns, or both.

Twenty out of 32 state listed noxious weeds are established in the Blackfoot Subbasin (Table 3.8). Twelve state listed noxious weeds have not yet been identified in the Blackfoot Subbasin, but are considered a high threat. “Invasive” plants, such as cheatgrass and common mullein, are non-native species that spread quickly and can be equally or more difficult to manage as noxious weeds.¹⁴

Table 3.8 State-Listed Noxious Weed Species Established in the Blackfoot Subbasin.¹

Common name	Scientific Name	Infestation Level
spotted knapweed	<i>Centaurea stoebe</i>	Widespread, well-established, infesting 25-50% of potential range
leafy spurge	<i>Euphorbia esula</i>	
yellow toadflax	<i>Linaria vulgaris</i>	
hound's-tongue	<i>Cynoglossum officinale</i>	
Canada thistle	<i>Cirsium arvense</i>	
oxeye daisy	<i>Leucanthemum vulgare</i>	

¹⁴ For more information on the distinction between noxious and invasive species, the State of Montana’s classification process and control recommendations, see <http://agr.mt.gov/weedpest/noxiousweeds.asp>.

Table 3.8 (continued).

Common name	Scientific Name	Infestation Level
St. Johnswort	<i>Hypericum perforatum</i>	Widespread, well-established, infesting 25-50% of potential range.
sulfur cinquefoil	<i>Potentilla recta</i>	
field bindweed	<i>Convolvulus arvensis</i>	
common tansy	<i>Tanacetum vulgare</i>	
Dalmatian toadflax	<i>Linaria dalmatica</i>	
yellowflag iris	<i>Iris pseudacorus</i>	Occur in isolated populations, infesting 10-25% of potential range.
meadow hawkweed	<i>Hieracium pretense, H. floribundum, H. piloselloides</i>	
orange hawkweed	<i>Hieracium aurantiacum</i>	
tall buttercup	<i>Ranunculus acris</i>	
diffuse knapweed	<i>Centaurea diffusa</i>	
hoary allysum	<i>Berteroa incana</i>	
Russian knapweed	<i>Acroptilon repens</i>	
purple loosestrife	<i>Lythrum salicaria and L. virgatum</i>	
blueweed	<i>Echium vulgare</i>	

Since 1994, the Blackfoot Challenge Weeds Committee has coordinated and implemented a holistic strategy for managing undesirable, invasive and noxious weeds in the subbasin. Combining action with education, the core of the program is the locally-led Weed Management Areas program, where neighbors work across property boundaries to manage weeds. Almost 475,000 acres are under active weed management with 380 private landowners participating in the project. Integrated weed management strategies include herbicides, biocontrol, revegetation, multi-species grazing, hand pulling, plowing, mowing, prevention and early detection rapid response.

In 1997, an INVADERS taskforce (Rice et al. 1997) identified non-native plant species that have the potential to become significant problem plants over the next five decades in the Blackfoot Subbasin. Table 3.9 includes a short list of eight well-known weeds that have been established in the northwestern United States since the 1930s and are well described in the weed management literature (Whitson et al. 2002). These species have a high potential to become significant problem plants unless new occurrences are detected early and eradicated. This list also includes well-known weeds that are relatively common but not presently classified as “noxious” in

Montana (although some of these species may be classified as noxious in the future). Table 3.10 includes an alert list of 22 recently invading or less well-known weeds that are not yet classified as noxious by the state of Montana but have high potential to become significant problem plants in the Blackfoot Subbasin during the next half century.

Table 3.9 Noxious and Invasive Weeds with a High Potential to Become Problem Plants in the Blackfoot Subbasin (Rice et al. 1997).

Common name	Scientific Name
absinth wormwood	<i>Artemisia absinthium</i>
yellow starthistle*	<i>Centaurea solstitialis</i>
rush skeletonweed*	<i>Chondrilla juncea</i>
poison hemlock	<i>Conium maculatum</i>
scotch broom*	<i>Cytisus scoparius</i>
common teasel	<i>Dipsacus fullonum</i>
dyer's woad*	<i>Isatis tinctoria</i>
tansy ragwort*	<i>Senecio jacobaea</i>
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>
Whitetop*	<i>Cardaria draba</i>
Japanese knotweed*	<i>Polygonum cuspidatum</i>

* State-listed noxious weed species.

The Nonindigenous Aquatic Species database maintained by the USGS (<http://nas.er.usgs.gov>) lists three non-native aquatic plants that are present in the Blackfoot Subbasin: yellow iris (mentioned above), flowering rush, and white water-lily. Although not currently present in the subbasin, the following aquatic plants have been identified by the Aquatic Nuisance Species Task Force (<http://www.anstaskforce.gov>) as potential invaders that would detrimentally impact aquatic systems in Montana: hydrilla, Brazilian elodea, egeria, Eurasian watermilfoil, curly pondweed, purple loosestrife and salt cedar. Of these potential invaders, Eurasian watermilfoil is the only species that is currently present in the state of Montana.

Table 3.10 Alert List for Recently Invading or Less Well-Known Weeds and Risk Ratings¹ for Blackfoot Subbasin Habitats (Rice et al. 1997).

Plant Name		Risk Rating by Habitat Type					
Common Name	Scientific Name	Agriculture	Grassland	Forest	Riparian	Wetland	Disturbed areas
velvetleaf*	<i>Abutilon theophrasti</i>	possible	possible	possible			High
jointed goatgrass*	<i>Aegilops cylindrica</i>	possible	possible				High
bishop's goutweed	<i>Aegopodium podagraria</i>	Uncertain					
small bugloss*	<i>Anchusa arvensis</i>	possible	possible	possible			High
common bugloss	<i>Anchusa officinalis</i>	possible	possible	possible			High
weedy orache*	<i>Atriplex heterosperma</i>	Uncertain					
white bryony	<i>Bryonia alba</i>			possible	possible		Possible
plumeless thistle	<i>Carduus acanthoides</i>	high	high	possible	high		High
dwarf snapdragon*	<i>Chaenorrhinum minus</i>	possible	possible	possible			High
trailing crownvetch	<i>Coronilla varia</i>	possible	possible	possible	possible		High
sand rocket	<i>Diploaxis muralis</i>	Uncertain					
Russian olive	<i>Elaeagnus angustifolia</i>				limited	limited	
babysbreath	<i>Gypsophila paniculata</i>	possible	possible	possible	possible		High
bluebuttons	<i>Knautia arvensis</i>	possible	possible	possible			High
malcolm stock*	<i>Malcolmia africana</i>	possible	possible				High
scentless chamomile	<i>Matricaria maritima</i>	high	possible		possible		High
cultivated knotweed	<i>Polygonum polystachyum</i>	possible			high		High

Table 3.10 (continued).

Plant Name		Risk Rating by Habitat Type					
Common Name	Scientific Name	Agriculture	Grassland	Forest	Riparian	Wetland	Disturbed areas
sakhalin knotweed	<i>Polygonum sachalinense</i>	possible			high		High
European buckthorn	<i>Rhamnus cathartica</i>	limited		limited	limited		Limited
self salsify*	<i>Scorzonera laciniata</i>	Uncertain					
puncturevine	<i>Tribulus terrestris</i>	possible	possible	possible			High
syrian beancaper	<i>Zygophyllum fabago</i>	possible	possible				High

* An asterisk following the common name indicates species which grow primarily as annuals

¹The ratings are: **High** - the species has high potential to become an important weed in this environment within the Blackfoot River drainage. **Possible** - initial indications are that the species could become a weed of this environment, but current information is limited for specific conditions within the Blackfoot drainage. Further analysis may be warranted. **Limited** - the species is not expected to affect extensive areas of the Blackfoot drainage in the near future, but could become a localized weed under certain conditions. **Uncertain** - current information is inadequate to assess risk. Further analysis may be warranted.

3.2.8 Ecological Relationships

In the preceding sections, we described the aquatic and terrestrial resources that characterize the Blackfoot Subbasin. Ecological function in the subbasin is shaped by the innumerable relationships between species and ecological communities and the biological and physical processes that support and sustain them. Ecological relationships between aquatic and terrestrial species and communities are particularly relevant to subbasin planning in the Blackfoot. The Blackfoot Subbasin contains an extensive network of lakes, ponds, herbaceous wetlands and perennial and intermittent streams that exist within a matrix of grassland, shrubland and forest communities. As such, the aquatic and terrestrial environments in the Blackfoot Subbasin are inextricably linked. Many, if not most, subbasin wildlife species use a combination of aquatic, riparian, wetland and upland habitats. Riparian and wetland areas, which represent the interface between aquatic and terrestrial environments, are the most productive wildlife habitats in the subbasin. In western Montana, 59% of land bird species use riparian and wetland habitats for breeding purposes, and 36% of those breed only in riparian or wetland areas (Mosconi and Hutto 1982).

Research conducted in a variety of locations around the world shows that streams and their adjacent riparian zones are connected by “reciprocal flows” of materials, energy, and organisms (Baxter et al. 2005). Stream systems are subsidized by influxes of organic litter (e.g., leaves), woody debris, nutrients, and invertebrates from adjacent riparian and terrestrial environments. Terrestrial invertebrates can provide a substantial and even dominant portion of the annual energy budget for drift-feeding fishes, such as salmonids. Likewise, riparian and terrestrial systems are subsidized by streams through the emergence of adult insects and energy and nutrients imported by migrating fish. Birds, bats, lizards, spiders and other riparian consumers benefit from this export greatly: prey originating instream contributes 25% to 100% of the energy (carbon) to some terrestrial species (Baxter et al. 2005). Similar stream-terrestrial connections undoubtedly exist in the Blackfoot Subbasin, although these relationships have not been explored in this system.

Stream ecosystems are also tied to the ecological characteristics of upland terrestrial ecosystems well beyond the riparian zone. The structure, composition, and patterns in forest communities directly influence hydrologic process such as the amount and timing of stream flows. Forests are the source of woody debris that can be routed to streams through landslides, avalanches and debris flows. Wildfire, timber harvest and other natural disturbance and land use activities that alter forest structure and composition can have profound effects on the dynamics and quality of stream habitats. Considerable interest is now focused on the restoration of more natural patterns, processes and disturbances such as wildfire in forest ecosystems because of the potential significance for aquatic ecosystems (e.g., Bisson et al. 1995, Naiman and Turner 2000).

Instream relationships among native and non-native fish can factor into the structure of food webs and the availability of terrestrial prey to native salmonids. Research in northern Japan demonstrates that changes in the relative abundance of native (Dolly Varden) and non-native (rainbow trout) salmonids impact the availability of terrestrial invertebrate prey to the native fish. In this study, rainbow trout usurped the terrestrial prey subsidy previously available to Dolly Varden, causing a more than 75% decrease in the biomass of terrestrial invertebrates in Dolly Varden diets and causing them to shift to foraging for insects on the stream bottom (Baxter et al.

2007). Similar changes might be expected with changes in the relative abundance of native and non-native salmonids in the Blackfoot Subbasin.

Relationships between bears and fish have been documented in the Blackfoot Subbasin. MFWP has documented black bear fishing activity at Big Sky Lake near Woodworth, where the primary food source is an introduced run of rainbow trout. MFWP has also documented bears fishing on Monture Creek at bull trout redd sites. There are unverified reports of bear fishing activity in Chamberlin Creek and at the inlet of Browns Lake (J. Jonkel, pers. comm.).

Evidence of the types of relationships described above helps to shape a more holistic view of aquatic and terrestrial ecosystems. To a large extent, the health of aquatic habitats in the subbasin is contingent upon sustainable land use in riparian, wetland, and upland habitats. Incompatible forestry and agricultural practices, unplanned development, and other land uses in terrestrial environments can degrade aquatic habitats by altering runoff patterns, rates of sedimentation, stream morphology, water chemistry, and water temperature. Similarly, aquatic habitat function and quality can impact terrestrial habitats and species. By focusing conservation and restoration efforts in the Blackfoot Subbasin on a range of aquatic and terrestrial species and ecological communities, (see Blackfoot Subbasin Management Plan, Section 5.0), we are intending to provide an umbrella of protection for the myriad ecological processes and relationships, both documented and undocumented, that sustain the overall ecological health of the subbasin.

3.2.9 Socioeconomic & Land Use Characteristics

3.2.9.1 Settlement History

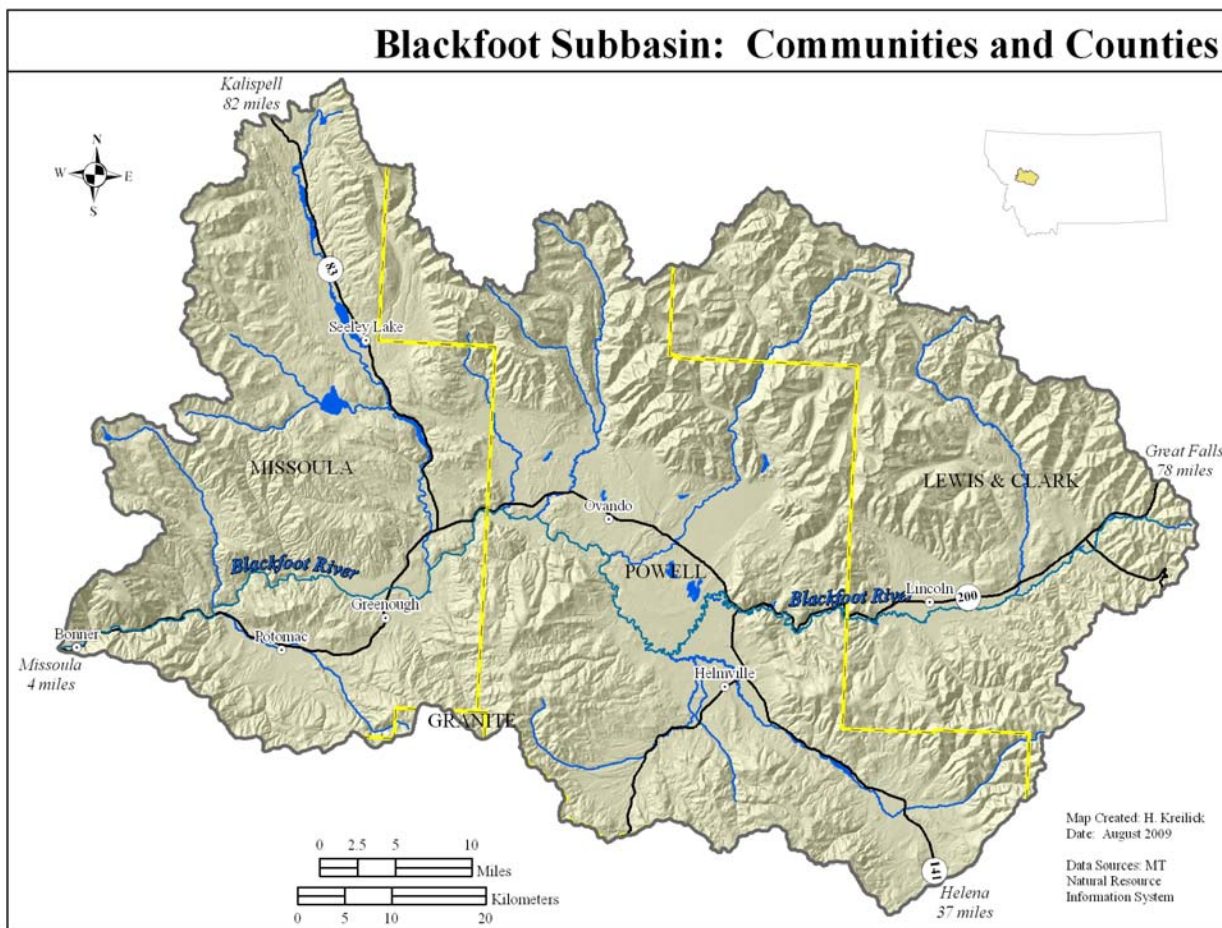
Prior to the arrival of white settlers in the 1800s, the Blackfoot Valley was occupied by the indigenous peoples of western Montana for thousands of years. The Kootenai, Salish, Nez Perce, Shoshone, Blackfeet and Crow tribes utilized the valley, known as *Cokahlahishkit* or the “Road to the Buffalo,” for its plant, animal stone, and mineral resources and for cultural ceremonies. The importance of the Ovando area is documented both in Pend d’Oreille and Salish oral histories and in the archaeological record. The trail up the Blackfoot River was used by the Pend d’Oreille and Salish to access the Rocky Mountain Front for buffalo hunting at least twice a year. Trails led north to what is now the Bob Marshall Wilderness and south to the Clark Fork Valley. Just before the western movement of settlers, many groups of Pend d’Oreille and Salish occupied these valleys year-round. The open valleys of the Ovando area had sufficient resources to sustain a large group and were vital for camping, horse grazing, plant collection, hunting, and other activities (BCCA Council and BC 2008).

White settlers arrived in the Blackfoot in the 1800s. The Blackfoot landscape provided opportunities for ranching, farming, logging, hunting, and food and firewood gathering. By 1885, Montana’s first large-scale logging operation began in the Blackfoot Valley. Gold was discovered in the area in the 1890s and massive mining operations, including the Mike Horse Mine, were set up to retrieve the valuable metal. In the following decades, miners staked claims to more than 150 gold, silver and copper mines and ranchers grazed their cattle on the valley’s lush native grass. Heavy logging continued not only to support mining operations, but also to aid in the construction of the Transcontinental Railroad (BCCA Council and BC 2008, Curtis 2005).

3.2.9.2 Population

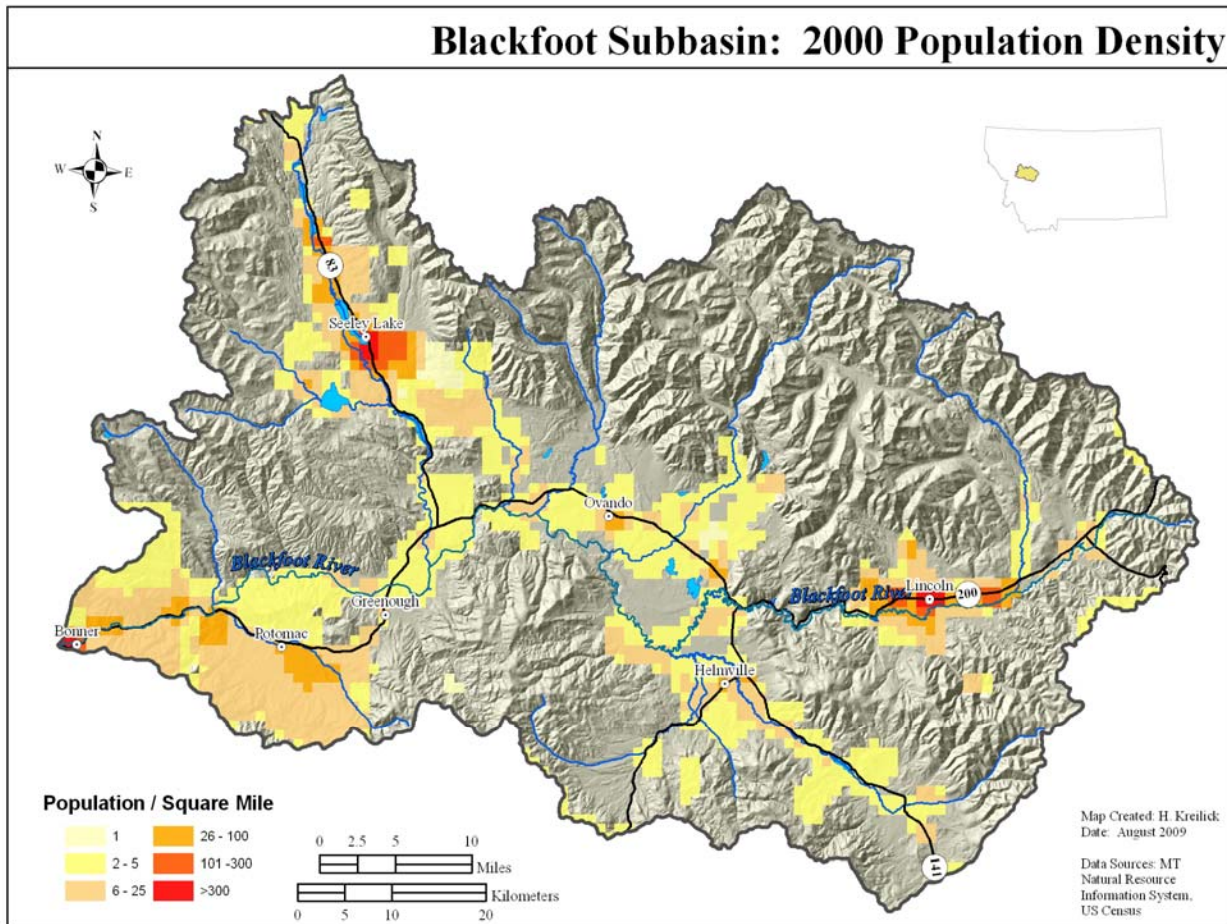
The Blackfoot Subbasin includes the communities of Lincoln, Helmville, Ovando, Seeley Lake, Greenough, Potomac, and Bonner and spans portions of Missoula, Powell, and Lewis & Clark Counties (Figure 3.14). There are approximately 8,100 people and 2,500 households in the subbasin. In this 1.5 million-acre subbasin, this amounts to less than one person per square mile (Figure 3.15). The population is spread throughout the valley, with population densities reaching 300 people per square mile in Seeley Lake, Potomac, and Bonner. The middle and high elevation portions of the subbasin remain largely undeveloped. In 1995, between 8% and 18% of the current residents of the Blackfoot Subbasin had their primary residence located out of state (BC 2005b).

Figure 3.14 Communities and Counties.



While many western Montana valleys experience rapid population growth, the rate of population growth in the Blackfoot Subbasin remains modest. The population in the subbasin is projected to increase to approximately 8,680 by 2010 (BC 2005b). Much of the population increase in the Blackfoot is attributable to in-migration from other states. New residents are attracted to the Blackfoot because of its outstanding scenic beauty, intact landscapes, abundance of wildlife, recreational opportunities, rural character and proximity to the urban centers of Missoula and Helena.

Figure 3.15 2000 Population Density.



3.2.9.3 Land Ownership

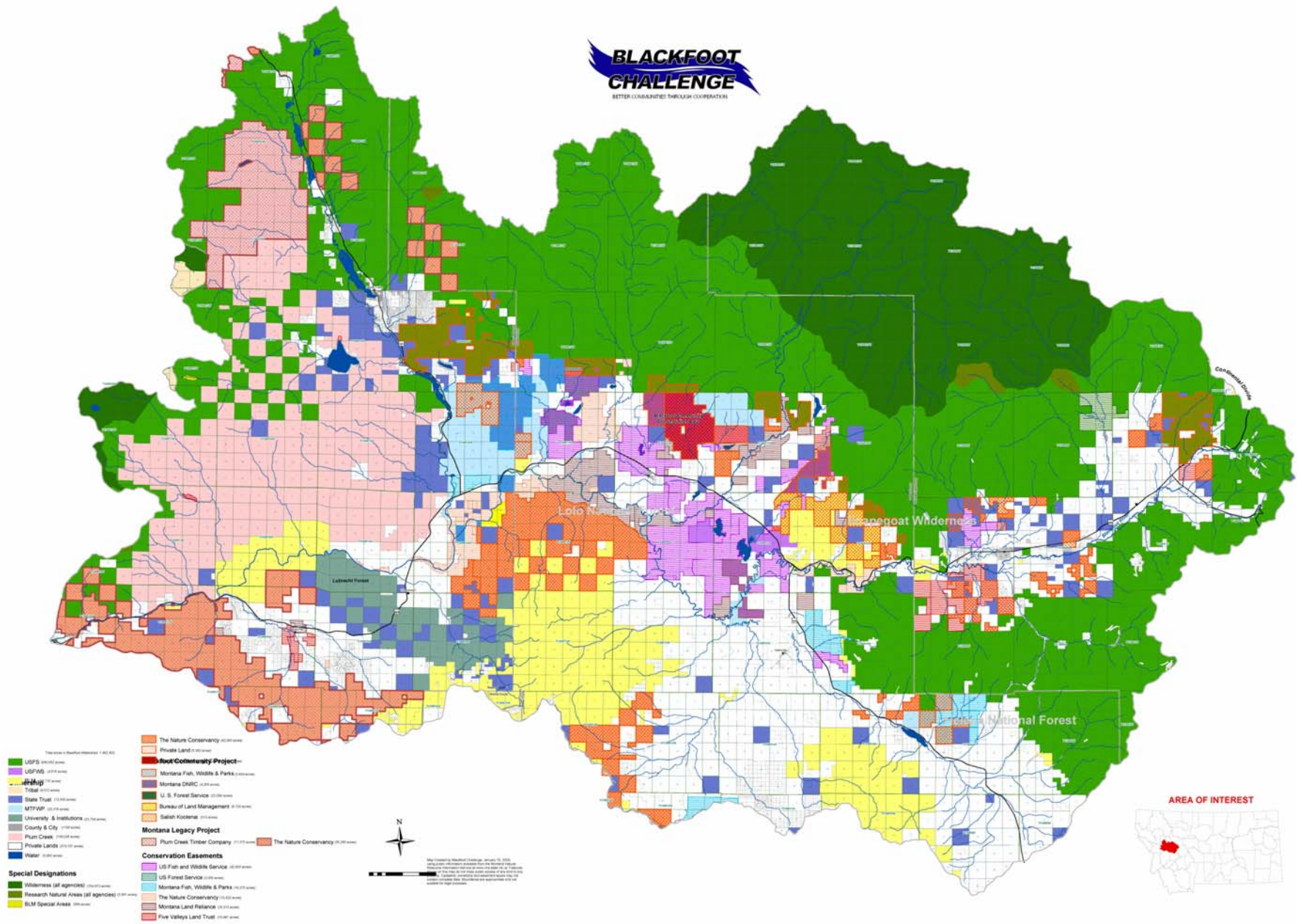
Land ownership in the Blackfoot Subbasin is 54% federal (USFS, USFWS, BLM), 10% state (DNRC, MFWP, University of Montana), 31% private and 5% corporate timber company (Figure 3.16). Most of the middle and high elevation forested lands within the subbasin are administered by the USFS. Private lands are concentrated in the low elevation portions of the subbasin. Land ownership patterns in the Blackfoot Subbasin have changed in recent years due to large-scale transfers of Plum Creek Timber Company (PCTC) lands. In 2003, the Blackfoot Challenge and The Nature Conservancy initiated the Blackfoot Community Project, which involved the purchase and re-sale of 89,215 acres of PCTC lands based on a community-driven disposition plan.¹⁵ The lands encompassed all PCTC lands from the Blackfoot River headwaters near Rogers Pass to the Clearwater drainage. Approximately 75% of the lands have been or will be transferred into federal or state ownership and 25% into private ownership. In 2008, The Nature Conservancy and The Trust for Public Land entered into another agreement with PCTC,

¹⁵ See the Blackfoot Challenge website (www.blackfootchallenge.org) for more information on the Blackfoot Community Project.

the Montana Legacy Project, to purchase 312,500 acres of timberland in western Montana.¹⁶ As part of the Legacy Project, a total of 71,754 acres in the Clearwater and Potomac valleys of the Blackfoot Subbasin will be purchased and resold to public agencies and/or private buyers. The majority these lands are intended to be re-sold to the USFS and DNRC.

¹⁶ See the Montana Legacy Project website (see www.themontanalegacyproject.org) for more information.

Figure 3.16 Land Ownership and Conservation Easements.

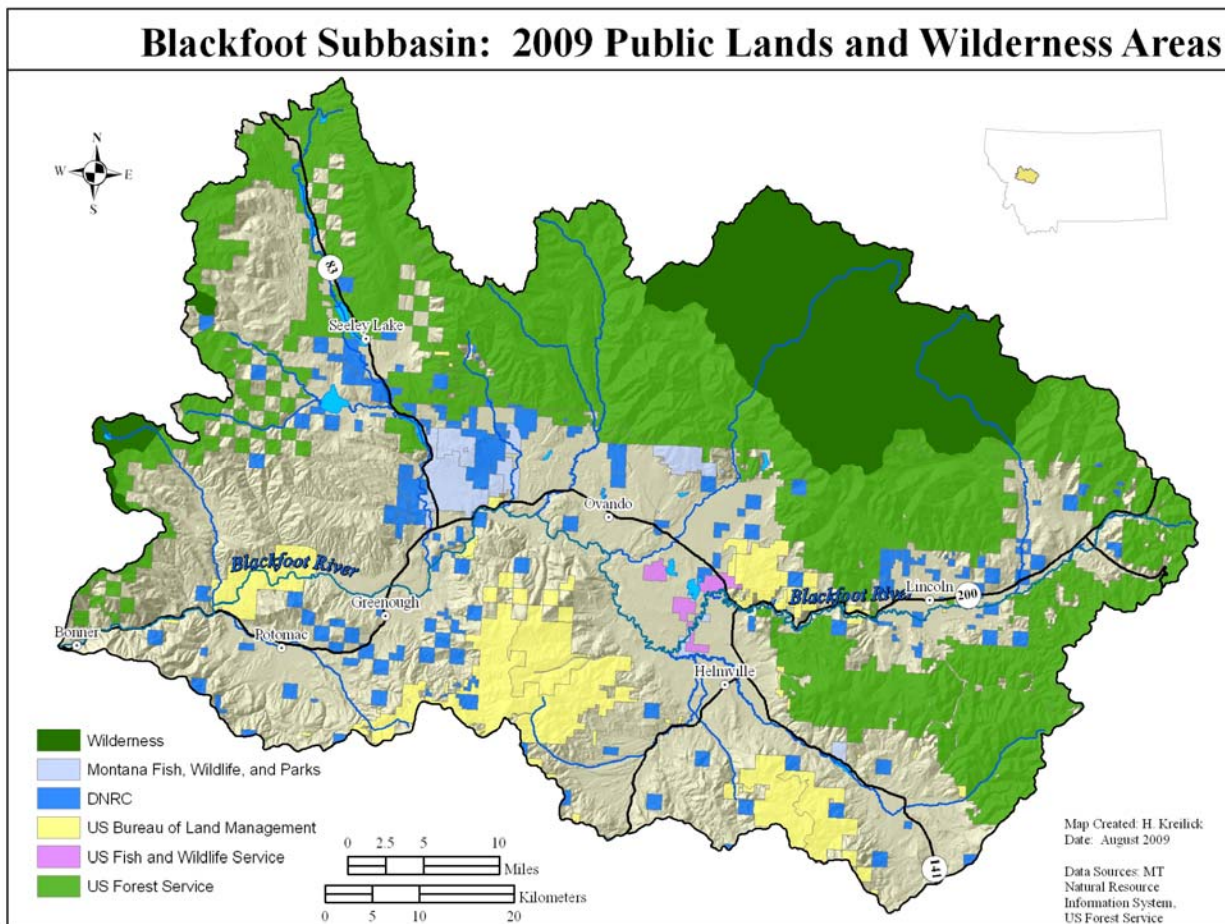


3.2.9.4 Land Use and Economy

Land use and land use change within the Blackfoot Subbasin is the result of complex interactions between geographic, socioeconomic and legal (ownership) characteristics of the subbasin. Consistent with its largely rural nature, dominant land uses in the subbasin include agriculture, timber harvest and recreation. A finer scale assessment, however, particularly within subbasin communities, reveals a range of land uses including residential and commercial development, transportation, communication and utilities, institutional and government facilities and public and private outdoor recreation (e.g., golf courses, resorts, and parks).

The majority of private land in the subbasin is located on the valley floor, where ranching remains the principle land use. Approximately 14.5% of the total acreage in the subbasin is used for agriculture. The subbasin supports 44,280 irrigated acres and 180,283 grazing acres (BC 2005b). Public lands in the subbasin are mixed-use areas for recreation, wildlife habitat, grazing, timber management and research. The Blackfoot is home to the Scapegoat Wilderness area and the eastern edge of the Rattlesnake Wilderness area that together cover 164,400 acres (11%) of the 1.5 million-acre subbasin (Figure 3.17). The Scapegoat Wilderness is adjacent to the Bob Marshall Wilderness Complex. Together, the Scapegoat and Bob Marshall cover about 1.5 million acres of federally protected lands.

Figure 3.17 Public Lands and Wilderness.



The presence of expansive open space in the subbasin provides an abundance of outdoor recreational opportunities, from hunting and fishing to hiking and snowmobiling. Public access to streams, lakes and public lands is highly valued. There are 25 state stream-side and lake-side Fishing Access Sites, 789 miles in the groomed snowmobile system, and 20 campgrounds on state and federal lands in the subbasin. In 2008, 36 ranches in the Blackfoot representing 68,668 acres were enrolled in the MFWP Block Management Program, providing public access for big game hunting. The river itself, a world-renowned native trout fishery, is used for angling, summer camping, and floating. MFWP is in the process of drafting a recreation management plan for the Blackfoot River and the North Fork of the Blackfoot River that will guide recreation management now and into the future (MFWP 2009). The proposed plan is based on the recommendations of the River Recreation Advisory for Tomorrow (RRAFT) Citizen Advisory Committee.

Timber harvest on public lands has declined substantially in the past three decades. Although production from private timberlands has remained relatively constant over that same period of time (BC 2005b), recent market-driven fluctuations continue to impact the amount of timber harvest in the subbasin. In 2008, the Stimson Mill in Bonner ceased operations, laying off over 100 employees. The mill had been active since 1886, when the first logs were floated down the Blackfoot River. Owned by the Anaconda Company for nearly 40 years, it was reputed to be one of the oldest continuously operating mills in the country. In Seeley Lake, Pyramid Mountain Lumber continues to operate but faces the same lumber market pressures as other mills across the northwest.

Mining has historically been a major land use in the Blackfoot Subbasin. Today, there are several abandoned mining sites where reclamation is vital to the long-term health of the watershed. Like many rural communities, the traditional resource extraction economy in the Blackfoot Subbasin is being augmented, and in some places replaced, by a “new economy” based on services, particularly recreation, tourism, and new businesses made possible due to advances in telecommunications. The Blackfoot continues to attract retired professionals, providing transfer and investment income components to the subbasin economy (see *Rural Way of Life*, Section 3.3.3.8).

3.2.9.5 Conservation Legacy

The Blackfoot Subbasin has a history of pioneering innovative land management strategies to support working landscapes and the fish and wildlife that depend on them. Recognizing the strong tie between land and livelihood, private landowners have played a key role in conservation projects for over three decades. One of the earliest efforts involved developing Montana’s enabling legislation for conservation easements, with the first conservation easement in Montana signed in the Blackfoot Valley in 1976.

In 1992, the Blackfoot River was listed as one of the ten most endangered rivers in the United States due to a century of unsustainable practices including mining, livestock grazing and timber harvest. The impacts to water quality and fisheries of the Blackfoot associated with these land uses generated interest in river management and enforcement via top-down, agency-led planning and decision-making. Housing development, increased recreational use and the spread of noxious weeds were also beginning to impact the overall health of the river. A few key

landowners responded with a non-regulatory approach to conservation on the Blackfoot River by developing a recreation corridor and an innovative walk-in hunter program on private lands, demonstrating the effectiveness of community-based conservation and creative solutions that meet both public and private land management objectives.

Due to public-private partnerships and the legacy of cooperation, the Blackfoot has seen limited residential subdivision or unplanned development, unlike many other valleys in western Montana. In Powell County, located in the heart of the Blackfoot Subbasin, development regulations divide the county into four Agricultural Districts. Each of these districts has minimum lot sizes and specified allowable uses, creating what is essentially county-wide zoning. Agricultural District 3, which encompasses Powell County in the Blackfoot Subbasin, has minimum lot sizes of 160 acres. This District was established out of concern from the community over the rate at which family farms were being sold and converted to second homes.

Many working cattle ranches in the subbasin are still intact and over 24% of private lands (108,000 acres) in the subbasin are permanently protected from subdivision and residential development by conservation easements (Figure 3.15). Many Blackfoot landowners also protect habitat and wildlife values through land and water stewardship practices, including sustainable grazing management, stream and wetland protection and restoration, water conservation measures and sustainable resource use (BC 2005b). As a result of large, working ranches, extensive public land, development regulations and conservation easements in the Blackfoot Subbasin, habitat fragmentation has been limited and the biological diversity of the subbasin has been largely maintained (TNC and BC 2007).

At the landscape level, new strategies are being developed to work across political boundaries and leverage financial and technical resources. As part of the Blackfoot Community Project, for example, partners developed the 41,000-acre Blackfoot Community Conservation Area (BCCA) that involves community forest ownership of 5,609 acres and cooperative ecosystem management across public and private lands. As a multiple-use demonstration area, this project will pilot innovative access, land stewardship and restoration practices through management by a 15 member community-based council.

3.3 Conservation Targets

In this section we outline the process used by subbasin technical work groups to select and assess the viability of the eight focal conservation targets in the Blackfoot Subbasin. We then provide background information on each conservation target and present the results of each conservation target viability assessment.

3.3.1 Conservation Target Selection Process

The subbasin planning process in the Blackfoot began with identification of priority conservation targets. Conservation targets, which may include ecological systems, ecological communities, species or other important natural or cultural resources, represent the overall biodiversity of a landscape and the reasons why it is important for conservation (Low 2003). Identifying the right set of conservation targets is the foundation for all subsequent steps in the subbasin planning

process. The targets selected ultimately determine the conservation objectives and strategic actions implemented in the subbasin—in other words, which critical threats must be abated and what types of conservation and ecological restoration must be performed.¹⁷ In the Blackfoot Subbasin, conservation targets fall into the following three categories (adapted from Low 2003):

- 1. Ecological Communities:** Ecological communities are groupings of co-occurring species, including natural vegetation associations and alliances, which share common ecological attributes or conservation requirements. Ecological community targets may have special conservation or management requirements due to distinct locations, ecological process or threats. Examples include *herbaceous wetlands* or *low elevation ponderosa pine/western larch forest*. Ecological communities provide the “coarse filter” for conserving the representative array of species and natural communities at a landscape scale. These are referred to as “nested targets.” Often, conserving an ecological community will lead to conserving a rare species or natural community that is embedded within the system.
- 2. Species:** Species targets have ecological attributes or conservation requirements not adequately captured within the ecological community targets. Types of species targets may include:
 - globally imperiled and endangered native species (e.g., species ranked G1 to G3 by natural heritage inventories);
 - species of special concern due to vulnerability, declining trends, disjunct distributions, or endemism;
 - focal species, including keystone species, wide-ranging regional species and umbrella species (e.g., grizzly bear);
 - major groupings of targeted species that co-occur on the landscape, share common ecological processes, share similar threats or have similar conservation requirements (e.g., native salmonids); or
 - globally significant examples of species aggregations, such as a migratory shorebird stopover area aggregation.
- 3. Other Significant Resources:** Beyond the biodiversity targets described above, there may be other natural or cultural resources—such as groundwater supplies, productive farmland, Wilderness areas or cultural features—that are important to partners engaged in conserving an area.

The Blackfoot Subbasin technical work groups identified eight conservation targets within the subbasin (Table 3.11). Of these, five are ecological community targets, two are species targets and one is a cultural resource target. All of the targets include nested targets that are expected to benefit from conservation of the main targets. These eight conservation targets were selected not only because of their individual value and concern, but also because they, together with the nested targets, represent a high percentage of the total biodiversity and conservation value in the Blackfoot Subbasin. Conserving and/or restoring these targets will help to ensure the viability of

¹⁷ Appendix B in *Landscape-Scale Conservation: A Practitioner’s Guide* (Low 2003) provides a one-page decision support tool for selecting conservation targets.

the species, natural systems and rural way of life that make the Blackfoot Subbasin unique and that contribute to the larger-scale significance of the Crown of the Continent Ecosystem. Detailed target and nested target descriptions are provided in Section 3.3.3.

Table 3.11 Conservation Targets and Associated Nested Targets in the Blackfoot Subbasin.

Conservation Target	Nested Targets
Native salmonids	westslope cutthroat trout; bull trout; western pearlshell mussel
Herbaceous wetlands	herbaceous wetland-associated bird, plant, amphibian and invertebrate Species of Concern
Moist site and riparian vegetation	riparian-dependent birds
Native grassland/sagebrush communities	grassland/sagebrush-associated bird and plant Species of Concern; ungulate winter range
Low elevation ponderosa pine/western larch forest	low elevation ponderosa pine/western larch forest-associated birds; ungulate winter range
Mid to high elevation coniferous forest	Mid to high elevation coniferous forest-associated birds; forest carnivores; whitebark pine
Grizzly bears	Habitat connectivity for wildlife
Rural way of life	Sustainable natural resource-based livelihoods; healthy/resilient communities

3.3.2 Assessing Conservation Target Viability

The purpose of the Blackfoot Subbasin Plan is to develop strategies for conserving *viable* occurrences of native species and ecological systems across the subbasin. Viability indicates the ability of a conservation target to persist for many generations. After selecting a representative list of focal conservation targets for the Blackfoot Subbasin, the subbasin technical work groups conducted a viability assessment for each target. The viability assessment process, including definitions of terms, is outlined below (adapted from Low 2003).¹⁸

Step 1. Identify Key Ecological Attributes

Key ecological attributes are factors that are critical for the long-term viability of a conservation target. These are factors that, if degraded, would seriously jeopardize the target’s ability to persist for a century or longer. Although there are many attributes that could describe all the characteristics of a target, the goal of the viability assessment is to identify a small set of ecological attributes that are critical to each target’s long-term viability. Key ecological attributes are identified based on ecological models, the scientific literature, local scientific data and/or

¹⁸ For more information on assessing conservation target viability, see *Landscape-Scale Conservation: A Practitioner’s Guide* (Low 2003).

comparative data from other areas or similar types of targets and expert opinion. Key ecological attributes fall under the following three categories:

- *Size* is a measure of the area or abundance of the conservation target's occurrence. For ecological systems and communities, size is simply a measure of the occurrence's patch size or geographic coverage. For animal and plant species, size takes into account the area of occupancy and number of individuals. Minimum dynamic area, or the area needed to ensure survival or re-establishment of a target after natural disturbance, is another aspect of size.
- *Condition* is an integrated measure of the composition, structure and biotic interactions that characterize the occurrence. This includes attributes such as reproduction, age structure, biological composition (e.g., presence of native versus exotic species; presence of characteristic patch types for ecological systems), structure (e.g., canopy, understory, and ground cover in a forested community) and biotic interactions (e.g., levels of competition, predation, and disease).
- *Landscape context* includes two factors: ecological processes and connectivity. Ecological processes that maintain a target may include hydrologic regimes (e.g., flooding), fire regimes and many kinds of natural disturbance. Connectivity includes such factors as species targets having access to habitats and resources needed for life cycle completion, fragmentation of ecological communities and systems and the ability of a target to respond to environmental change through dispersal, migration or re-colonization.

Step 2. Select Indicators to Measure Each Key Ecological Attribute

In order for each key ecological attribute to be assessed, the basis for its measurement must be established. These measures are called *indicators*. Indicators must be measurable and therefore frequently involve some type of quantitative assessment—such as number of acres, recruitment, age classes, percent of cover or frequency of fire regime. Other indicators may involve measurable elements that are not numerical, such as the seasonality of fire or flooding regime. Indicators form the basis for monitoring changes in conservation target viability over time. They should therefore be efficient and affordable to measure.

Step 3. Rate the Current Status of Each Indicator

The next step in assessing viability of conservation targets involves determining the current health of each key ecological attribute. This is accomplished by using a simple grading scale to rate the status of each indicator selected in Step 2. This four-part grading scale provides a sufficient degree of distinction among the four scores and allows for a reasonable confidence level, while recognizing the tremendous lack of information and research that would be needed to provide more precise grades for most targets. A description of the ratings follows:

<i>Very Good</i>	The indicator is functioning within an ecologically desirable status, requiring little human intervention for maintenance within the natural range of variation (i.e., is as close to “natural” as possible and has little chance of being degraded by some random event).
<i>Good</i>	The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance.
<i>Fair</i>	The indicator lies outside of its range of acceptable variation and requires human intervention. If unchecked, the target will be vulnerable to serious degradation.
<i>Poor</i>	Allowing the indicator to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible (i.e., it will be too complicated, costly, and/or uncertain to reverse the alteration).

Ideally, over time, a set of quantitative benchmarks should be established for each of these four ratings for each key ecological attribute. These benchmarks should state clearly where the indicator being measured would fall within each level. However, the scientific information needed to establish these benchmarks is often lacking or inadequate. In these cases, well-informed expert opinion is used to determine a credible first iteration of the benchmarks and assessment of the current rating. Benchmarks and ratings will be modified as new information is available.

Step 4. Determine the Desired Status of Each Indicator

The final step in assessing viability is to determine a desired future rating for each indicator. The gap between the current and desired future indicator ratings helps technical work groups determine which conservation targets are in need of the most immediate attention, and drives the development of conservation objectives and strategic actions outlined in the Blackfoot Subbasin Management Plan (Section 5.0). The benchmarks used to quantify the ratings also provide a mechanism for measuring changes in conservation target viability over time as strategic actions are implemented in the subbasin. Assessing the ecological health of conservation targets in this way is an iterative process; key ecological attributes, indicators and ratings will all be refined over time.

3.3.3 Conservation Target Descriptions and Viability Assessments

3.3.3.1 Native Salmonids

Nested Targets: westslope cutthroat trout; bull trout; western pearlshell mussel

The Blackfoot River and its tributaries support native westslope cutthroat trout and bull trout, both of which are Species of Concern in Montana (MTNHP 2009b, Shepard et al. 2005). Bull trout is federally listed as threatened under the Endangered Species Act (USFWS 2002). Abundance and distribution of native trout in the Blackfoot River and its tributaries vary greatly (Pierce et al. 2008). This variation can be explained by variation in life-history forms, natural geological/environmental conditions, human influences (such as environmental degradation and historic fishery exploitation), hybridization and interspecific competition among non-native fishes (Swanberg 1997, Schmetterling 2001, Pierce et al. 2007, 2008). With the general exception of high mountain lakes, these species are widely distributed across the broad gradients found in streams, rivers and lakes and represent the range of aquatic environments in the Blackfoot Subbasin. Because westslope cutthroat trout and bull trout are sensitive to changes in water quality (e.g., temperature and sediment) and other physical habitat characteristics (Behnke 2002, Shepard et al. 2005, MBTRT 2000), they are excellent indicators of the overall health of the Blackfoot River ecosystem. Conservation and restoration of these target species and their habitats will provide secondary benefits to other native fishes and aquatic organisms found throughout the subbasin.

Between 1988 and 2006, the MFWP, in cooperation with other entities, engaged in a basin-wide inventory of fish populations and habitat assessments. These investigations encompass the distribution and abundance of native and nonnative fish. In addition MFWP has extensively surveyed channel (i.e., physical habitat) condition. These include stream temperatures, stream habitat surveys on Blackfoot tributaries (assessing pool/riffle conditions, pool frequency, and large woody debris), substrate composition, stream discharge, overhead canopy vegetation, stream bank stability, stream degradation and Rosgen channel type (Pierce et al, 2008). In addition, DFWP, in cooperation with other researchers, has examined the distribution and severity of whirling disease in the Blackfoot sub-basin (Pierce et al, 2008, 2009). Comprehensive telemetry studies emphasizing the life histories of migratory bull trout, westslope cutthroat trout, and rainbow trout have been completed basin-wide (Swanberg, 1997; Schmetterling, 2001, 2003, Pierce 2007; Benson, 2009). A telemetry study of mountain whitefish is currently underway (Pierce, 2008). Finally, DFWP has engaged in extensive WSCT genetic investigations. The sum of these investigations, which have occurred on the mainstem and on all major tributaries, have provided the foundation for a steadily evolving native trout recovery strategy (MBTRT 1997; MFWP, 2005b; Pierce et al 2008; USFWS 2002, 2010).

The data collection since 1989 has resulted in a description of each tributary, including a description of its fisheries, its habitat impairments, past restoration, and current or planned restoration (MFWP, 2005b; Pierce et al, 2008). The impairments to each stream that lend themselves to potential restoration efforts are summarized in Appendix M. To date, the sum of

these evaluations provide the basis for a hierarchical restoration priority system that establishes native salmonid priorities on 182 inventoried streams within the Blackfoot Subbasin (Figure 3.18). The 2008 effort was an expansion and refinement of an earlier, 2005 ranking effort (Pierce, 2005). Table 3.12 describes the ranking of streams for native fish values. The prioritization effort involved ranking all 182 water bodies by a hierarchical point system that includes native fish values, total fisheries values, total biological values, and total values (Appendix J). The goal of this ranking scheme was to guide the limited resources of the Blackfoot Cooperators to a common set of biologically important tributaries, emphasizing the recovery of native salmonids primarily on private land (Id).

For streams with documented bull trout use, streams were awarded points based on whether a stream supports bull trout spawning, or rearing, and whether a stream is a designated “core area” bull trout stream (Appendix J). For example, a stream that supports spawning, rearing, or is designated a “core” bull trout stream, receives the maximum of 40 biological points. Streams that support bull trout rate a higher priority than other streams because of the bull trout’s status as threatened under the ESA and the state and federal priorities for the recovery of bull trout populations; the high potential for improvement in the Blackfoot, and the downstream and sympatric benefits to other species resulting from bull trout recovery (Id). In addition, the ranking system provides points for the technical feasibility of restoration, the potential to improve downstream water quality, and the likelihood of landowner cooperation. The relatively high priority given to the protection and restoration of bull trout is reflected in Table 3.12, where the fifteen highest priority restoration streams with high restoration potential are located either in critical bull trout habitat (FWS 2010) or in a “core area” for the recovery of bull trout, which include tributaries connected to critical habitat (MTBTRT 2000).

The ranking criteria of a stream for westslope cutthroat trout depends on whether it supports fluvial cutthroat or resident cutthroat. Streams supporting fluvial cutthroat rank higher than streams that support only resident cutthroat (Appendix J). In addition to these criteria, the technical feasibility of restoration on a stream, the potential for a stream to contribute stream flows within the basin, and the potential for landowner cooperation, all play into the ranking system (Id). Fluvial WSCT streams ranked higher than streams supporting resident fish because of “1) the precarious status of the fluvial life-history, 2) high sport fish value to the Blackfoot River, and 3) downstream and sympatric benefits to other species resulting from WSCT recovery efforts. Streams with fluvial WSCT status (20 points) were those identified through 1) telemetry studies, 2) direct observations of fluvial-sized fish by FWP fisheries personnel, or 3) direct tributaries to the Blackfoot River and biologically connected during high flows periods” (Appendix J).

Figure 3.18. Native Fish Restoration Priorities for the Blackfoot River (Pierce et al 2008).

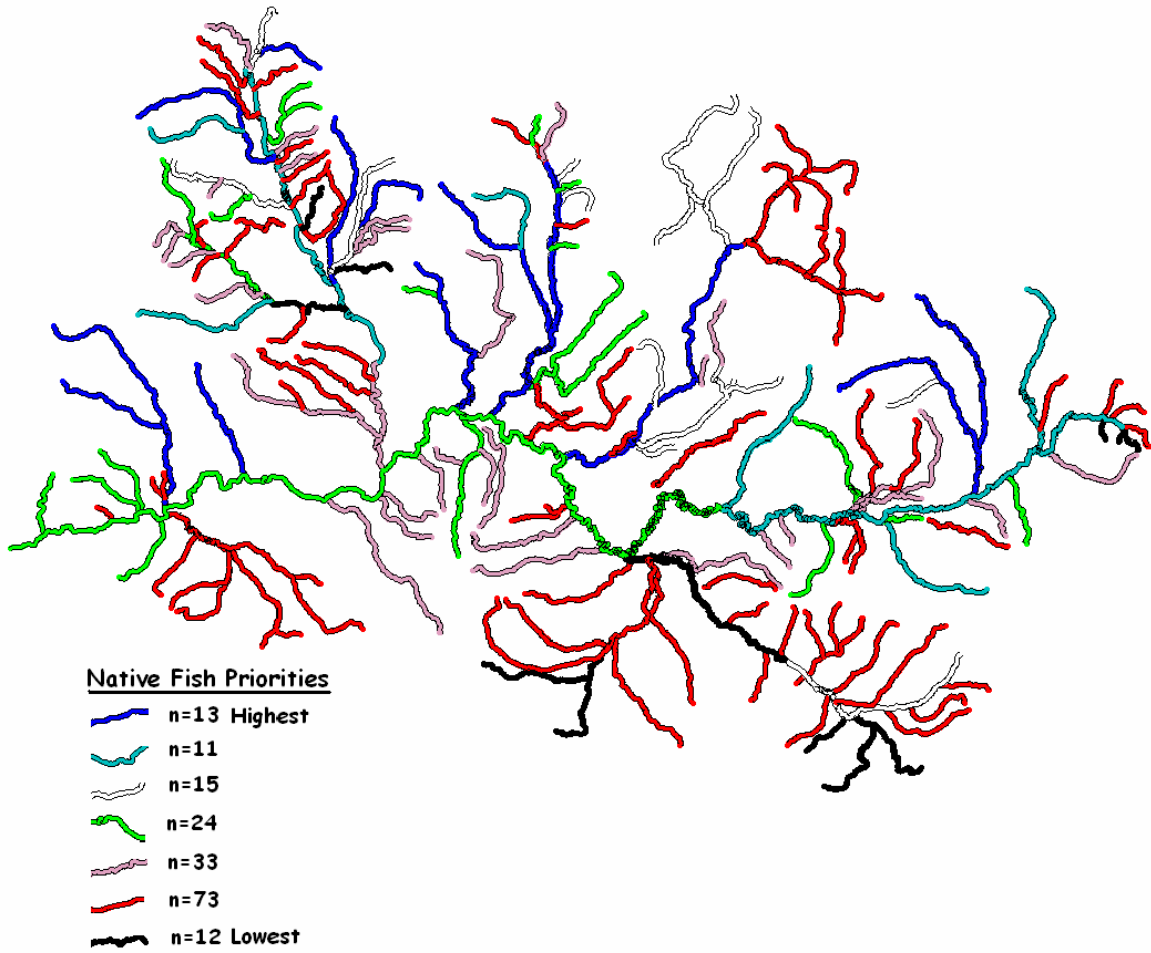


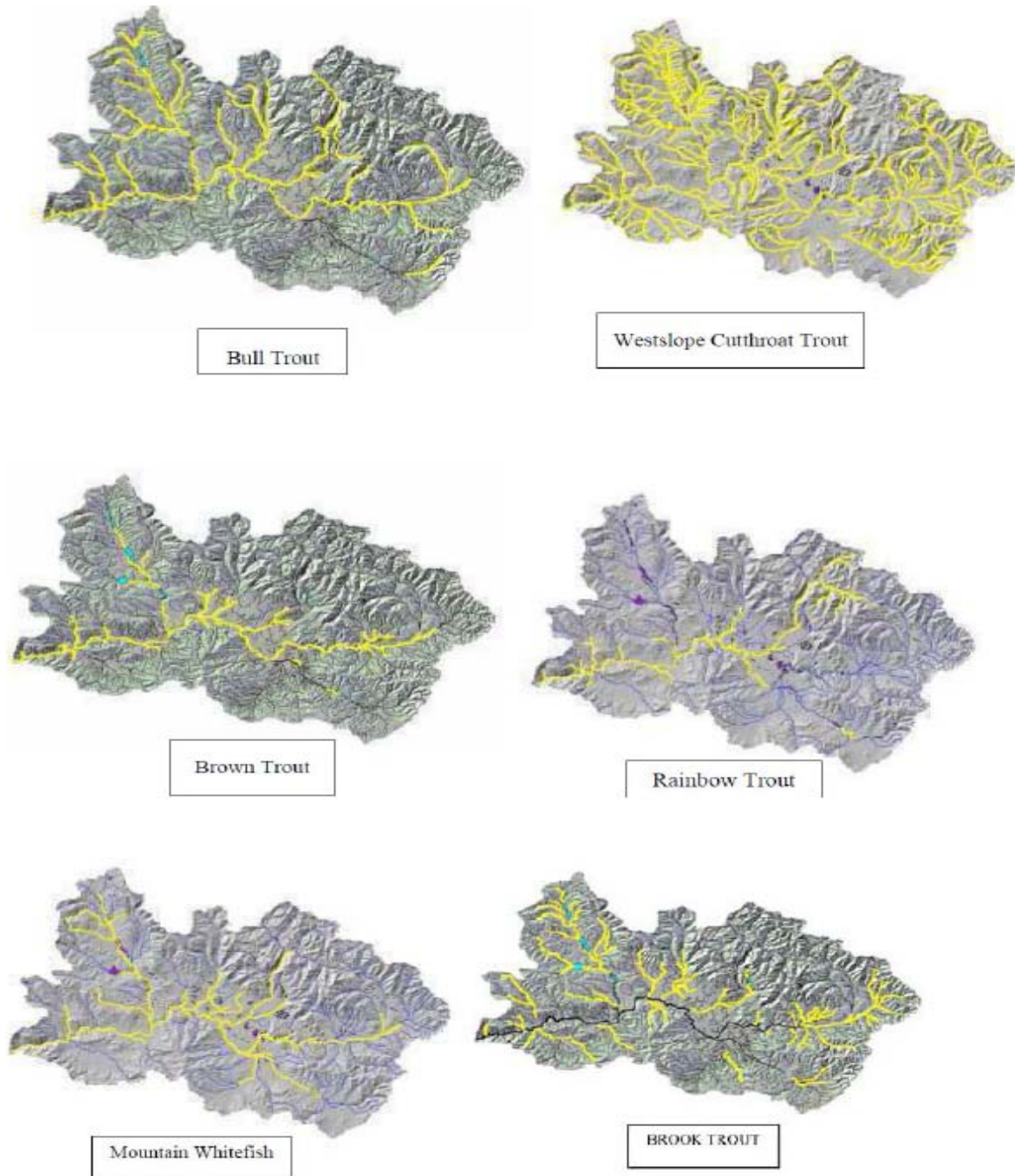
Table 3.12. Native fish priority streams sorted alphabetically high to low priority.

Stream Name	Native Species Total Score	Stream Name	Native Species Total Score	Stream Name	Native Species Total Score	Stream Name	Native Species Total Score
Belmont Creek	60	East Twin Creek	30	Bear Gulch	10	Seeley Creek	10
Clearwater Section 2	60	Ender's Spring Creek	30	Bertha Creek	10	Shaue Gulch	10
Clearwater Section 3	60	Grantier Spring Cr.	30	Blanchard NF	10	Sheep Creek	10
Clearwater Section 4	60	Hogum Creek	30	Brazil Creek	10	Shingle Mill Creek	10
Copper Creek	60	Inez Creek	30	Broadus Creek	10	Smith Creek	10
Cottonwood Cr. (R.M.43)	60	Johnson Creek	30	Buffalo Gulch	10	Sourdough Creek	10
Dunham Creek	60	McCabe Creek	30	Burnt Bridge Creek	10	Stonewall Creek	10
E.F. Clearwater	60	Saurekraut Creek	30	California Gulch	10	Sucker Creek	10
Gold Creek	60	Spring Cr.(Cottonwood)	30	Camas Creek	10	Swamp Creek	10
Gold Creek, W.F	60	Trail Creek	30	Chicken Creek	10	Tamarack Creek	10
Landers Fork	60	Unnamed tributary	30	Chimney Cr. (Douglas)	10	Theodore Creek	10
Monture Creek below the Falls	60	West Twin Creek	30	Chimney Cr. (Nevada)	10	Uhler Creek	10
Morrell Creek	60	Yellowjacket Creek	30	Clear Creek	10	Union Creek	10
North Fork Blackfoot River below the Falls	60	Basin Spring Creek	20	Cold Brook Creek	10	Vaughn Creek	10
W.F. Clearwater	60	Bear Creek trib. to N.F.	20	Colt Creek	10	Warm Springs Cr.	10
Alice Creek	50	Bear Creek (R.M.37.5)	20	Cooney Creek	10	Warren Creek	10
Anastra Creek	50	Benedict Creek	20	Cottonwood Cr. (Nev.)	10	Warren Creek, Doney Lake trib	10
Blackfoot River 1	50	Blanchard Creek	20	Dobrota Creek	10	Washington Creek	10
Blackfoot River 2	50	Chamberlain EF	20	Douglas Creek	10	Washoe Creek	10
Blind Canyon Creek	50	Chamberlain WF	20	East Fork of North Fork	10	Wedge Creek	10
Boles Creek	50	Clearwater Section 1	20	Finley Creek	10	Willow Cr. (lower)	10
Lodgepole Creek	50	Elk Creek	20	First Creek	10	Wilson Creek	10
Poorman Creek	50	Fawn Creek	20	Frazier Creek	10	Auggie Creek	0
Cabin Creek	40	Findell Creek	20	Frazier Creek, NF	10	Bear Trap Creek	0
Canyon Creek	40	Fish Creek	20	Gallagher Creek	10	Black Bear Creek	0
Clearwater Section 5	40	Keep Cool Creek	20	Game Creek	10	Buck Creek	0
Dry Creek	40	Lincoln Spring Cr.	20	Gleason Creek	10	Drew Creek	0
Dry Fork of the North Fork	40	Little Fish Creek	20	Grouse Creek	10	Finn Creek	0
East Fork of Monture	40	Little Moose Creek	20	Hoyt Creek	10	Halfway Creek	0
Hayden Creek	40	McDermott Creek	20	Humbug Creek	10	Horn Creek	0
Kleinschmidt Cr.	40	Middle Fork of Monture Cree	20	Indian Creek	10	Mike Horse Creek	0
Marshall Creek	40	Moose Creek	20	Jacobsen Spring Creek	10	Nevada Cr. (lower)	0
Nevada Cr.(upper)	40	N.F. Placid Creek	20	Jefferson Creek	10	Owl Creek	0
Rock Creek	40	Nevada Spring Cr.	20	Lost Horse Creek	10	Paymaster Creek	0
Salmon Creek	40	Pearson Creek	20	Lost Pony Creek	10	Sheep Creek	0
Snowbank Creek	40	Placid Creek	20	Lost Prairie Creek	10	Slippery John Creek	0
Spring Creek (N.F.)	40	Seven up Pete Cr.	20	McElwain Creek	10	Strickland Creek	0
Bear Creek (R.M.12.2)	30	Shanley Creek	20	Mitchell Creek	10	Sturgeon Creek	0
Beaver Creek	30	Wales Creek	20	Mountain Creek	10	Ward Creek	0
Blackfoot River 3	30	Wales Spring Creek	20	Murphy Creek	10		
Blackfoot River 4	30	Wasson Creek	20	Murray Creek	10		
Blackfoot River 5	30	Willow Cr. (upper)	20	North Fork above the Falls	10		
Blackfoot River 6	30	Yourname Creek	20	Pass Creek	10		
Burnt Cabin Creek	30	Anaconda Creek	10	Rice Creek	10		
Camp Creek	30	Archibald Creek	10	Richmond Creek	10		
Chamberlain Creek	30	Arkansas Creek	10	Sawyer Creek	10		
Deer Creek	30	Ashby Creek	10	Scotty Creek	10		
Dick Creek	30	Bartlett Creek	10	Second Creek	10		

Factors that impact native salmonid viability in the Blackfoot Subbasin include non-native fish introductions (USFWS 2002, Shepard et al. 2005), metals and other chemical contamination (Stratus Consulting 2007), elevated temperatures, nutrient inputs, stream dewatering (Pierce et al 2005), stream and riparian habitat alteration (Marler 1997, Pierce et al. 1998), incompatible grazing management (Fitzgerald 1997, BC 2005a), sub-standard road crossings and other migration barriers into tributaries (Pierce et al. 2007, 2008). Within the Blackfoot Subbasin, the majority of inventoried streams exhibit some level of physical and/or biological impairment (BC 2005a, Pierce et al. 1997, 2005, 2008). The level of impairment varies substantially within and among streams. A detailed discussion of water quality in the subbasin is provided in Section 3.2.5.2.

While functional tributaries play an essential role in the life stages (migration, spawning and rearing) of all fluvial Blackfoot River fish (Swanberg 1997, Schmetterling 2001, Pierce et al. 2007), altered and degraded tributaries generally inhibit movement and reduce spawning and rearing success, contributing to suppressed populations and inadequate recruitment of multiple species over large areas of the river (Peters 1990, Pierce et al. 1997, 2008). Since 1990, restoration partners in the Blackfoot Subbasin have undertaken cooperative habitat restoration tied to fisheries recovery, with over 700 projects completed to date involving more than 200 individual landowners (BC 2005a, Pierce et al. 2008). Because tributaries provide critical spawning and rearing areas, restoration of degraded tributaries has become the primary method of restoring river populations (BC 2005a, Pierce et al. 1997, 2008). Protective harvest regulations that began in 1990 and changes in non-native fish stocking programs have also helped to increase densities of Blackfoot native salmonids in the mainstem Blackfoot River (Pierce et al. 1997). Much work, however, remains in order to recover and stabilize these species, particularly across tributary environments (Pierce and Podner, 2006, Pierce et al. 2008). Figure 3.19 describes salmonid distribution within the Blackfoot sub-basin.

Figure 3.19 Distribution of Six Salmonids within the Blackfoot Subbasin.



Nested target: bull trout

In Montana, bull trout are native to rivers, streams and lakes in the Columbia River (Kootenai, Clark Fork, Bitterroot, Blackfoot, Flathead, and Swan drainages) and Saskatchewan River (St. Mary and Belly drainages) basins (MBTRT 2000). The bull trout is a long-lived species, generally believed to reach sexual maturity between five and seven years of age (Thomas 1992). It spawns in small to intermediate size (second to fourth-order) streams between late August and early October, building nests, or redds, in which it buries its eggs. Bull trout spawning redds are commonly constructed in alluvial stream reaches where upwelling groundwater is available to aerate and thermally protect the buried eggs from severe icing (Swanberg 1997, Pierce and Podner, 2006, Pierce et al, 2008). The hatched fry do not emerge from the redds until the following spring (Thomas 1992, MBTRT 2000).

MFWP has extensively studied the life history of fluvial bull trout in the Blackfoot Sub-basin (Swanberg 1997; Pierce et al, 2008; MBTRT, 1997; BC 2005(a); Benson, 2009). The life histories of Montana bull trout include both resident and migratory strategies. Resident bull trout spend their entire lives in (or near) their small natal streams. In the Blackfoot Subbasin, most bull trout exhibit migratory life histories. This strategy involves an out-migration to larger rivers (fluvial) or lakes (adfluvial) where fish grow to maturity before returning to their natal tributaries to spawn. Migratory bull trout of the Blackfoot Subbasin commonly move long distances (> 70 miles) in response to environmental changes (e.g., river warming) or for spawning (Swanberg 1997, Pierce et al. 2004). Fluvial bull trout currently inhabit at least 16 Blackfoot River tributary streams. The three major bull trout population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek (mostly fluvial stocks), 2) Clearwater River Basin (mostly adfluvial stocks), and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek (mostly fluvial stocks). Figure 3.17 shows generalized distribution of bull trout in the Blackfoot Subbasin.

Bull trout abundance and distribution in the Blackfoot Subbasin has declined from historic levels (MBTRT 2000, USFWS 2002). This decline is attributable to a variety of factors, including habitat loss and degradation from land and water management practices. (USFWS, 2002, 2010; Appendix K), population isolation and fragmentation from dams and other fish passage barriers; competition, predation and hybridization with introduced, non-native fish species (e.g., northern pike, lake trout, brook trout and others) (Pierce, 2001); historical overharvest; and poaching (Peters 1990; Pierce et al. 1997; MTBTRT 2000, USFWS 2010).

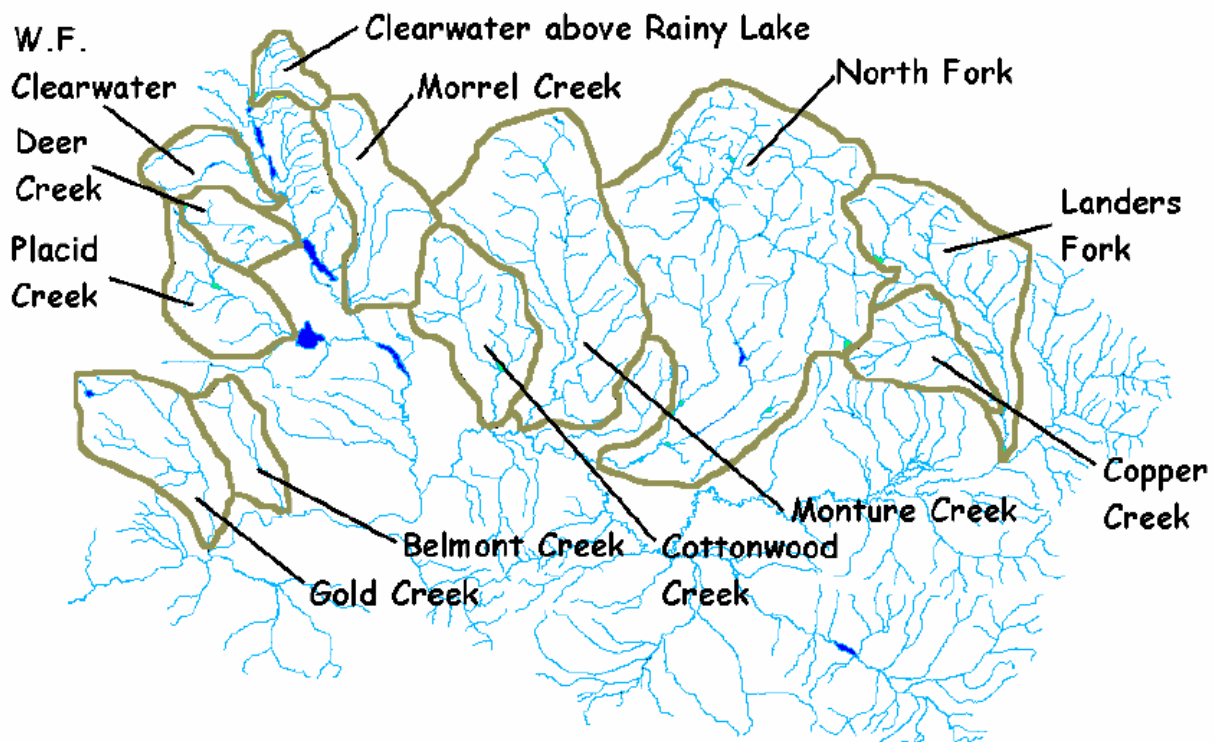
Within the category of land and water management practices, the 2002 USFWS Bull Trout Recovery Plan for the Clark Fork Recovery Unit Describes a more specific set of impacts that encompass the effects of historic forestry practices (increased sedimentation, increased peak flows, thermal modifications, loss of woody instream debris, channel instability, and increased access by anglers and poachers); livestock grazing (riparian damage, increased sedimentation), irrigation demand (destabilization of stream channels, interruption of migratory corridors, thermal impacts, entrainment of fish into ditches); and mining (water quality degradation). (USFWS, 2002). The restoration partners in the Blackfoot sub-basin have identified much the same array of limiting factors over the past two decades and have inventoried limiting factors on 182 tributaries within the sub-basin (Pierce, 2008; Appendix J.). More detailed descriptions of

the source of those impacts are found in the progress reports that DFWP has published since the early 1990s. Those factors are summarized in Table 3.22.

Within the subbasin, bull trout densities are very low in the upper Blackfoot River but increase downstream of the North Fork. Including the Clearwater subbasin, bull trout occupy about 25% of the Blackfoot Subbasin, or about 400 total miles of stream and all mainstem lakes interconnected with the Clearwater River (Pierce et al. 2008, L. Knotek, pers. comm.).

As part of its bull trout recovery effort, the Montana Bull Trout Recovery Team identified the following areas within the Blackfoot as “core areas:” Monture Creek, the North Fork Blackfoot River, Copper Creek, Landers Fork, Cottonwood Creek, Belmont Creek, Gold Creek, Morrell Creek, Deer Creek, Placid Creek, the West Fork Clearwater River and the Clearwater River above Rainy Lake (Figure 3.19). This description provided the basis for the USFWS description of bull trout critical habitat in its 2002 bull trout draft recovery plan for the Clark Fork basin and ultimately the final rule on designation of critical bull trout habitat (USFWS, 2002, 2010). While the map depicted in figure 3.20 does not include all the waterbodies depicted in the 2010 proposed designation of critical habitat (Figures 3.11 and 3.12), DFWP has been conducting habitat and fish population surveys on those waterbodies (Pierce, 2008), and will likely modify the map in 3.20 based upon that data collection (Pierce, personal communication, 2010).

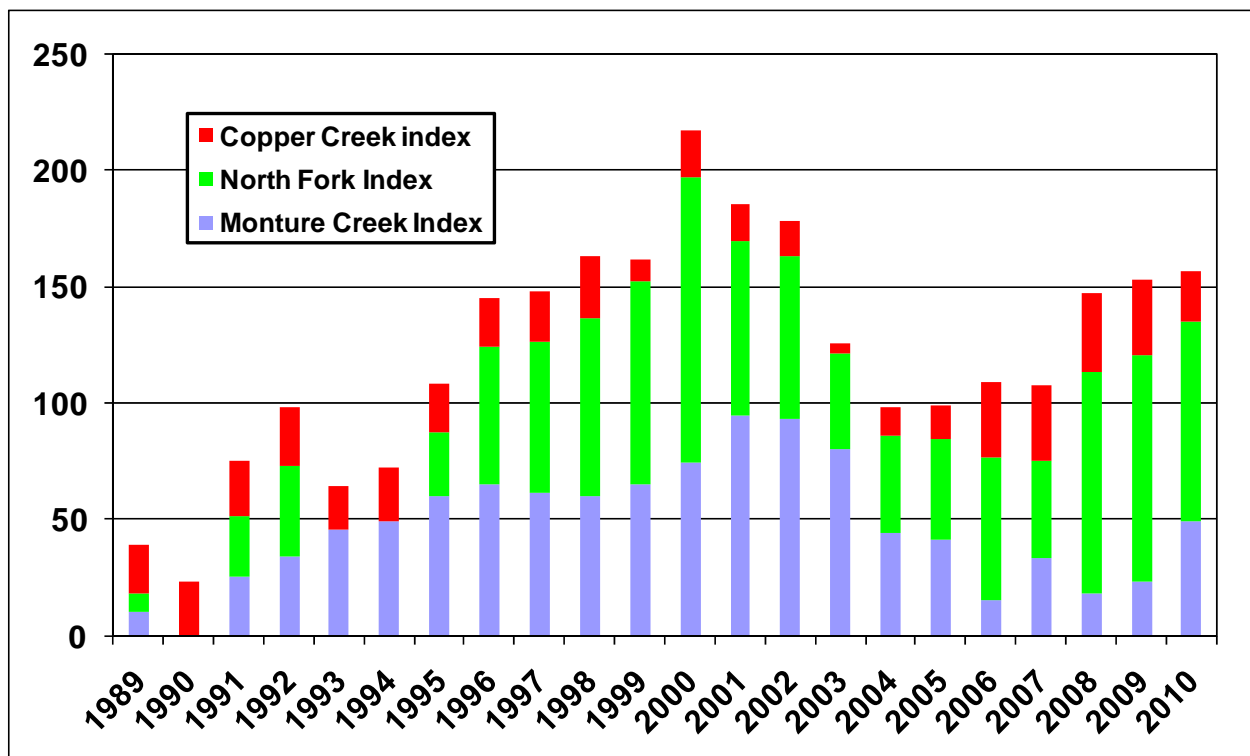
Figure 3.20. Bull trout “core areas” for the Blackfoot Basin (MBTRT 1996).



MFWP began bull trout population estimates in key locations in the Blackfoot subbasin, starting in 1988, and has maintained a comprehensive program of population estimates since then

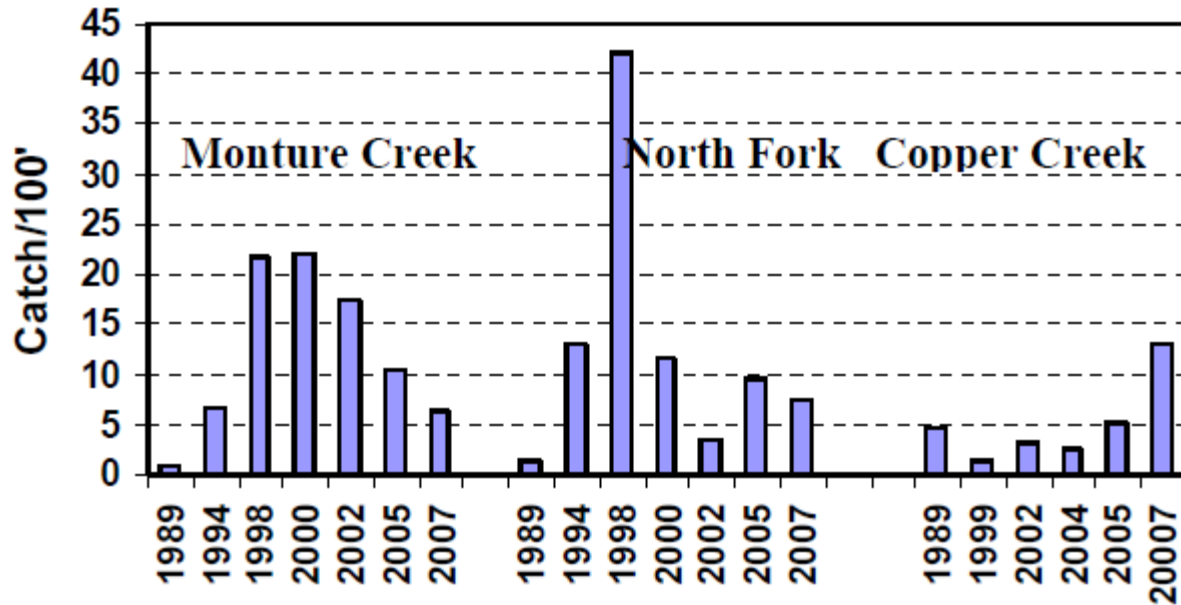
((Peters and Spoon 1989; Peters et al 1990; Pierce et al 2008). Population monitoring has included redd counts in all principle spawning streams and population monitoring sites throughout the Blackfoot River and tributaries supporting bull trout. Since 1989, MFWP has conducted redd counts on Monture Creek, the North Fork of the Blackfoot, and Copper Creek (Pierce et al. 2008) Bull trout redd counts in the Clearwater River began in 2002 on Morrell Creek, and in 2007 on the East Fork and West Fork of the Clearwater River (Ladd Knotek, personal communication, 2010). Bull trout spawner abundance is indexed by the number of identifiable female bull trout nesting areas (redds). Data indicate that Monture Creek has an upward trend from 10 redds in 1989 to an average of 51 redds in subsequent years (Pierce et al. 2008). The North Fork also shows an upward trend from eight redds in 1989 to an average of 58 redds between 1989 and 2008. The Copper Creek drainage (including Snowbank Creek) has experienced a resurgence of bull trout redds—from 18 in 2003 to 117 in 2008— since the 2003 Snow Talon Fire. The total number of redds counted in these three streams (Monture Creek, North Fork, and Copper Creek) increased from 39 in 1989 to 217 in 2000. With the onset of drought, bull trout redd counts then declined to 147 in 2008. Even with the onset of drought, however, numbers have remained substantially above the 1989 baseline (Figure 3.21). These changes are attributed to protective regulations first enacted in 1990, restoration actions in spawning streams during the 1990s and a period of sustained drought between 2000 and the present (Pierce et al. 2008). On the East Fork of the Clearwater redd counts improved from 6 to 20 after the removal of a migratory barrier on Rainy Lake; redd counts on the West Fork of the Clearwater have ranged between 30 and 60; and Morrell Creek redd counts have ranged from 25 to 55 (Ladd Knotek, personal communication, 2010).

Figure 3.21. Bull trout redd counts for index reaches in three primary fluvial bull trout streams, 1989-2007. (Pierce et al. 2008)



In addition to the redd counts, MFWP has monitored juvenile bull trout populations in the three streams described in Figure 3.20 above. The data indicates that except for Copper Creek juvenile bull trout populations increased dramatically in the 1990s, and have shown decline between 1998 and 2007 (Figure 3.21).

Figure 3.22. CPUE for juvenile bull trout near spawning sites of three primary spawning streams, 1989-2007. (Pierce et al. 2008).



The Viability assessment in table 3.13 awaits completion of the analysis to the 6th field HUC of salmonid habitat. Pending the completion of that viability assessment, planners in the sub-basin continue to rely on the assessments of habitat and species condition that have emerged from the two-decades-long data-gathering and analysis that has attended the Blackfoot River habitat restoration effort and which has been summarized in periodic progress reports (e.g. see Pierce, 2008) and in the Native Fish Conservation Prioritization Strategy (Appendix J). The key attributes and indicators described in Table 3.12 come directly from the research effort that has been ongoing since 1990 (Pierce, 2008). While the current information has not yet been organized into the template described below, much of the information to populate the viability assessment resides in the DFWP progress reports. The fisheries working group has developed a map of 6th field HUCs for the Blackfoot Subbasin, and expects to organize the known data into the viability assessment to the 6th field HUC in the winter of 2010-2011 (Ryen Aasheim, personal communication, 2010).

Table 3.13 Bull Trout Viability Assessment. ¹

		Indicator Ratings						
Key Attribute ²	Indicator	Poor	Fair	Good	Very Good	Current Rating	Desired Rating	Comments
Condition: <i>Abundance</i>	Redd counts or population estimates (extrapolated to adults)	Spawning adults occur only occasionally, or adult members are unknown	Spawning adults low or highly variable (average < 10 or vary substantially between < and > 10; but are consistently present)	Spawning adults common (average > 10 but < 100)	Spawning adults consistently abundant (average > 100)	To be determined	To be determined	This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction.
Condition: <i>Life History Expression</i>	Number of migratory forms expressed	No migratory life histories. Local population is isolated by permanent impassible barrier; OR life history expression unknown	Migratory life history occurs, but relative abundance is low or adult access is blocked or limited during typical migration periods	Migratory life history occurs, but access through corridors or to rearing areas occasionally limited	All potential migratory life histories are abundant or dominant	To be determined	To be determined	This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction.

Table 3.13 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Condition: <i>Resilience</i>	Trends in population growth or survival	Population is declining and or habitat is in poor condition and non-natives are abundant or dominate the community OR nothing is known about resilience	Population is stable at low to moderate abundance and or habitat is degraded, but not destroyed. Non-natives may be relatively abundant, but not dominant	Population is stable at moderate abundance or growing slowly. When reduced in abundance population slowly rebuilds. Habitat is in good condition and non-natives are not present or rare.	Population is stable and moderate-high abundance, or when reduced has the capacity to rebuild quickly. Habitat is in excellent condition and expected to stay that way. Non-native salmonids are not important.	To be determined	To be determined	This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction.
Size: <i>Extent of habitat networks within the 6th code</i>	Length of suitable spawning/ rearing habitat	Length of the interconnected stream network supporting spawning and rearing habitat is < 3 km.	Length of the interconnected stream network supporting spawning and rearing habitat is between 3 and 10 km.	Length of the interconnected stream network supporting spawning and rearing habitat is between 10 and 20 km	Length of the interconnected stream network supporting spawning and rearing habitat is > 20 km	To be determined	To be determined	
Landscape Context: <i>Water Quality</i>	Temperature, sediment and chemical contaminants	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk, none at unacceptable risk	Two elements are functioning acceptably, one is functioning at risk	All three elements are considered functioning acceptably	To be determined	To be determined	This would be based on the USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th field (subwatershed). Additional data on water diversion may be used to consider condition & FWP Dewatered Stream list/Minimum instream flow model.

Table 3.13 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context: <i>Habitat Structure</i>	Large wood, width-depth, floodplain connectivity, stream bank conditions	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk, none at unacceptable risk	Three elements are functioning acceptably, one is functioning at risk	All four elements are considered functioning acceptably	To be determined	To be determined	Based on USFS Assessment encompassing 6 th codes. These are only some of the elements in habitat and channel condition. Substrate, pools and off channel habitat are presumably correlated or represented.
Landscape Context: <i>Hydrology</i>	Flow and hydrology	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk	One is functioning acceptable and one is functioning at risk	Both elements are considered functioning acceptably	To be determined	To be determined	Based on USFS Assessment for change in peak/base flows and drainage network increase encompassing 6 th code.
Landscape Context: <i>Barriers</i>	Physical barriers	Permanent barriers exclude adult movement to spawning habitat in > 75% of the 6th field spawning habitat.	Temporary or partial impediments or barriers may exist for juvenile and adult movements; or permanent barriers may exist that exclude adult migrants from 25%-75% of the 6th field spawning habitat.	No barriers to adult movement, or they exclude < 25% of the 6th field spawning habitat. Temporary or partial impediments or barriers may occasionally exist for juvenile movement.	There are no barriers or impediments to fish migration from the 6th field to the lake or river environment where migratory life histories could be expected to rear or stage.	To be determined	To be determined	Presumably would be based on USFS inventory of fish passage barriers.

¹ Based on local populations, not across entire subbasin. The native salmonids technical work group configured this table to assess viability down to the 6th field HUC. After acquiring the maps that describe the basin to the 6th code, the work group will apply this viability assessment to streams at that level.

² See Appendix E for definitions of key attributes used in this assessment.

Nested target: westslope cutthroat trout

In Montana, the historical range of westslope cutthroat trout included all of Montana west of the Continental Divide as well as the upper Missouri River drainage (Shepard et al. 2005). Historical accounts suggest that westslope cutthroat trout were once abundant in the river systems of western Montana (Lewis 1805; Shepard et al. 2005).

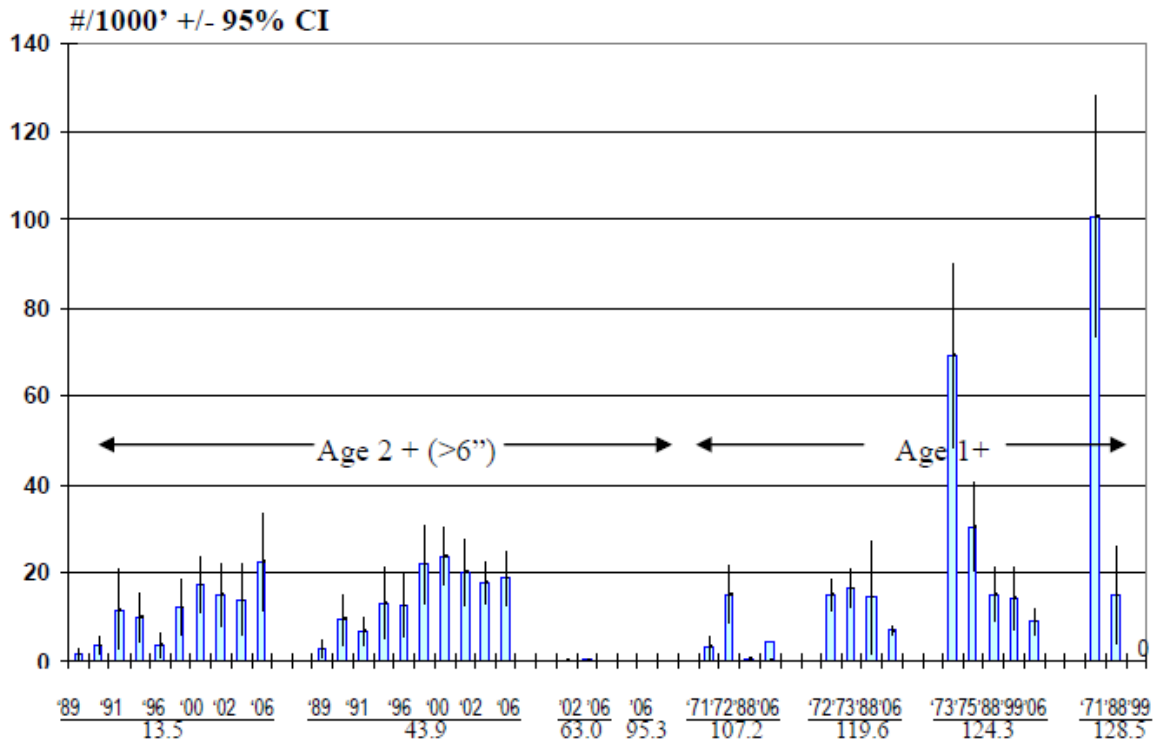
As with bull trout, Montana has been monitoring westslope cutthroat trout in the Blackfoot subbasin since 1989 (Peters et al, 1989; Pierce et al. 2008). This has included population estimates on both the mainstem Blackfoot River and on most of its tributaries (Pierce et al. 2008; Figure 3.23). Westslope cutthroat trout are distributed throughout the Blackfoot Subbasin, inhabiting the mainstem and about 90% (> 150) of headwater tributaries (Pierce et al. 2008). The three major westslope cutthroat population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek, 2) Clearwater River Basin, and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek. Figure 3.17 shows generalized distribution of westslope cutthroat trout in the Blackfoot Subbasin.

Westslope cutthroat trout have three life history forms similar to bull trout: adfluvial (lake dwelling), fluvial (river dwelling), and resident (stream dwelling). While resident fish spend their entire lives in tributary streams, migratory cutthroat trout will migrate >70 miles between wintering areas in rivers and spawning areas in tributary streams (Schmetterling 2001, Schmetterling 2003, Pierce et al. 2007). Westslope cutthroat spawning and rearing streams are small to intermediate in size (first through fourth-order), where large wood sorts gravel and diversifies spawning habitat conditions (Schmetterling 2000). Migratory juvenile cutthroat trout inhabit small tributaries for two to three years before moving downstream to mature in a river environment (Behnke 1992). At about five years of age, fluvial fish then return to their natal streams to spawn (Schmetterling 2001, Pierce et al. 2007). Juvenile cutthroat trout commonly overwinter in the interstitial spaces of larger substrate, though larger fish also aggregate in deep pools. In the Blackfoot River, adult cutthroat trout occupy deep and slow moving pools during winter (Schmetterling 2001, Pierce et al. 2007).

Westslope cutthroat trout have declined over much of their historic range within the last century (Behnke 1992, Shepard et al. 2003, 2005). Westslope cutthroat trout historically occupied about 56,500 miles of habitat within the United States. The species currently occupies an estimated 33,500 miles, or 59%, of historically occupied habitats (Shepard et al. 2003). In general, densities in tributaries decline in the downstream direction because of habitat degradation, historic fishery exploitation, and interactions with non-native trout (Shepard et al. 2005, USFWS 2009a). Despite this rangewide trend, the Blackfoot Subbasin supports a nearly basin-wide distribution of westslope cutthroat trout with ~90% of their historic range occupied compared with ~39% statewide (Pierce et al. 2008). Westslope cutthroat trout densities in the lower mainstem of the Blackfoot River have generally increased between 1989 and 2008, despite an increase in angler pressure in recent years (MFWP angler pressure estimates 1989-2007). Like bull trout, increasing densities of westslope cutthroat trout relate to protective angling regulations enacted in 1990 and restoration actions targeting important spawning and rearing streams. Westslope cutthroat declines in the Blackfoot River upstream of Lincoln correspond with the release of toxic mine waste and related population collapse downstream of the upper Blackfoot

Mining complex (Spence 1975; Peters 1990; Pierce et al. 2008; figure 3.22). Westslope cutthroat trout habitat restoration has occurred in Monture, Chamberlain, Gold, Dunham, McCabe, Morrell, Cottonwood, Pearson, Wasson, Arrastra, Poorman, Spring, and Snowbank Creeks and in the North Fork of the Blackfoot River.

Figure 3.23. WSCOT densities at eight sampling locations on the Blackfoot River. The horizontal axis shows the year of the survey and the river-mile mid-point of the survey. (Pierce et al. 2008)

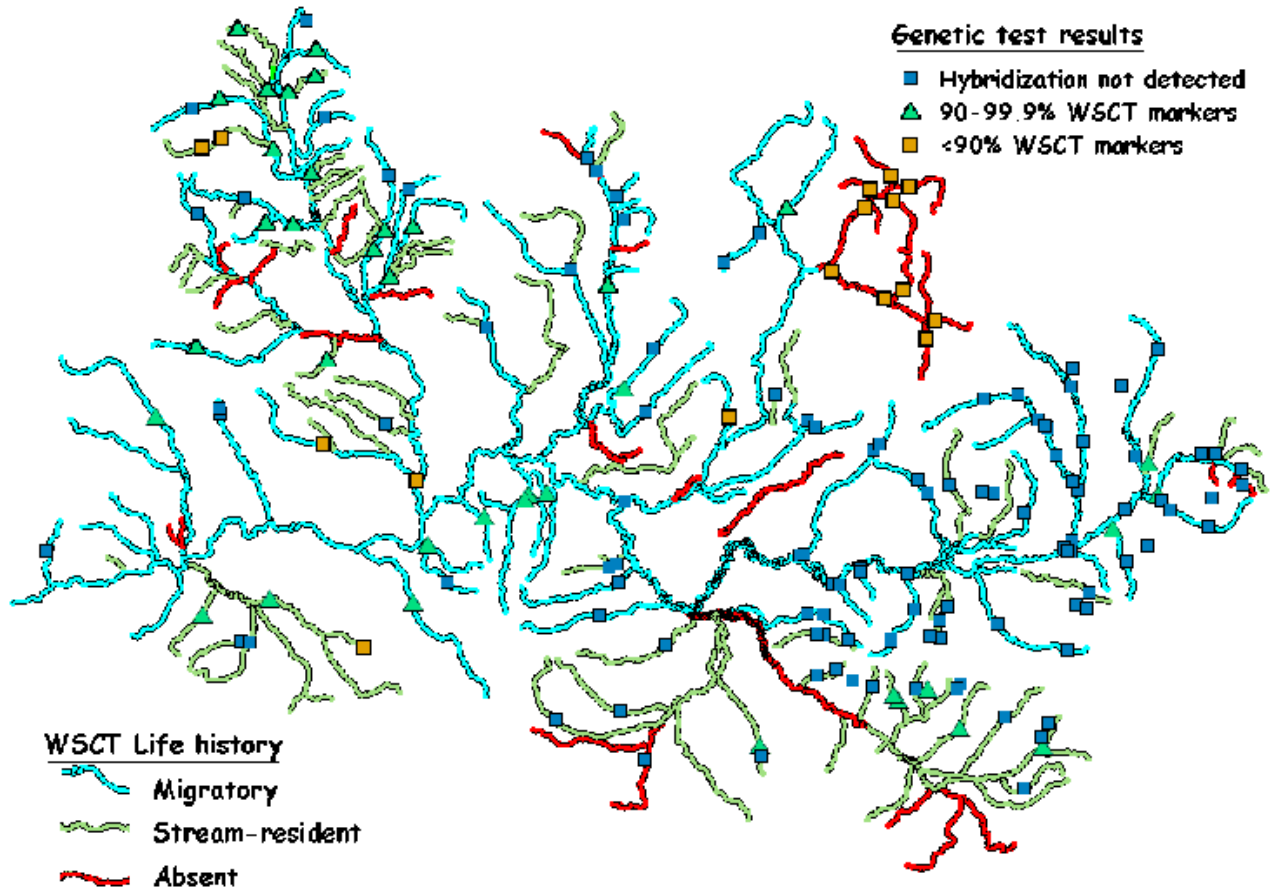


Hybridization and other interactions with non-native fish remain serious threats to westslope cutthroat trout viability (Muhlfeld et al. 2009). In 2001, MDFWP identified the illegal introduction of non-native species—in particular northern pike—as a substantial threat to native salmonid species within the Blackfoot sub-basin (Pierce, 2001). Milltown dam and the Clearwater drainage were identified as significant source of northern pike predation (Id.). Prior to the removal of Milltown Dam, MFWP initiated a pike eradication effort in Milltown Dam (Schmetterling, 2001; Knotek, 2005). With the removal of Milltown dam, that source of predation from northern pike has largely abated (D.A. Schmetterling, personal communication, 2010).

MFWP has conducted genetic investigations of westslope cutthroat trout since 1999 (Pierce et al 2000; 2001; 2002; 2004, 2006, 2008). Rangewide, genetically unaltered westslope cutthroat trout occupy between 13% and 35% of currently occupied habitats (Shepard et al. 2003). In the Blackfoot, about 40% of the current westslope cutthroat trout population has tested as genetically

pure (Pierce et al. 2008). The upper Blackfoot basin upstream of the Nevada Creek confluence is a region of high genetic purity (Figure 3.24).

Figure 3.24. Generalized WSCT life history traits and summary of genetic test results.
(Pierce et al. 2008)



The Viability assessment in table 3.14 awaits completion of the analysis to the 6th field HUC of salmonid habitat. Pending the completion of that viability assessment, planners in the sub-basin continue to rely on the assessments of habitat and species condition that have emerged from the two-decades-long data-gathering and analysis that has attended the Blackfoot River habitat restoration effort and which has been summarized in periodic progress reports (e.g. see Pierce, 2008) and in the Native Fish Conservation Prioritization Strategy (Appendix _J). The key attributes and indicators described in Table 3.14 come directly from the research effort that has been ongoing since 1990 (Pierce, 2008). While the current information has not yet been organized into the template described below, much of the information to populate the viability assessment resides in the DFWP progress reports. The fisheries working group has developed a map of 6th field HUCs for the Blackfoot Subbasin, and expects to organize the known data into the viability assessment to the 6th field HUC in the winter of 2010-2011 (Ryen Aasheim, personal communication, 2010).

Table 3.14 Westslope Cutthroat Trout Viability Assessment. ¹

Key Attribute ²	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Condition: <i>Abundance</i>	population estimates)	Spawning adults occur only occasionally, or adult members are unknown	Spawning adults low or highly variable (average < 10 or vary substantially between < and > 10; but are consistently present)	Spawning adults common (average > 10 but < 100)	Spawning adults consistently abundant (average > 100)	To be determined	To be determined	This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction.
Condition: <i>Life History Expression</i>	Number of migratory forms expressed	No migratory life histories. Local population is isolated by permanent impassible barrier; OR life history expression unknown	Migratory life history occurs, but relative abundance is low or adult access is blocked or limited during typical migration periods	Migratory life history occurs, but access through corridors or to rearing areas occasionally limited	All potential migratory life histories are abundant or dominant	To be determined	To be determined	This element of condition is a bull trout population demographic characteristic influencing the risk of local extinction.
Condition: <i>Genetic Integrity</i>	Genetic data	< 90% pure	90-98% pure	Some hybridization, 98-99.9% pure	Unaltered/pure	To be determined	To be determined	Available information indicates hybridization is primarily limited to F1. When post F1 hybridization does occur, it does not appear to progress to full introgression.

Table 3.14 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Condition: <i>Resilience</i>	Trends in population growth or survival	Population is declining and or habitat is in poor condition and non-natives are abundant or dominate the community OR nothing is known about resilience	Population is stable at low to moderate abundance and or habitat is degraded, but not destroyed. Non-natives may be relatively abundant, but not dominant	Population is stable at moderate abundance or growing slowly. When reduced in abundance population slowly rebuilds. Habitat is in good condition and non-natives are not present or rare.	Population is stable and moderate-high abundance, or when reduced has the capacity to rebuild quickly. Habitat is in excellent condition and expected to stay that way. Non-native salmonids are not important.	To be determined	To be determined	
Size: <i>Extent of habitat networks within the 6th code</i>	Length of suitable spawning/ rearing habitat	Length of the interconnected stream network supporting spawning and rearing habitat is < 3 km.	Length of the interconnected stream network supporting spawning and rearing habitat is between 3 and 10 km.	Length of the interconnected stream network supporting spawning and rearing habitat is between 10 and 20 km	Length of the interconnected stream network supporting spawning and rearing habitat is > 20 km	To be determined	To be determined	
Landscape Context: <i>Water Quality</i>	Temperature, sediment and chemical contaminants	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk, none at unacceptable risk	Two elements are functioning acceptably, one is functioning at risk	All three elements are considered functioning acceptably	To be determined	To be determined	This would be based on the USFS Assessment for change in peak/base flows and drainage network increase encompassing 6th field (subwatershed). Additional data on water diversion may be used to consider condition & FWP Dewatered Stream list/Minimum instream flow model.

Table 3.14 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context: <i>Habitat Structure</i>	Large wood, width-depth, floodplain connectivity, stream bank conditions	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk, none at unacceptable risk	Three elements are functioning acceptably, one is functioning at risk	All four elements are considered functioning acceptably	To be determined	To be determined	Based on USFS Assessment encompassing 6 th codes. These are only some of the elements in habitat and channel condition. Substrate, pools and off channel habitat are presumably correlated or represented.
Landscape Context: <i>Hydrology</i>	Flow and hydrology	One or more elements is functioning at unacceptable risk	Two or more elements are functioning at risk	One is functioning acceptable and one is functioning at risk	Both elements are considered functioning acceptably	To be determined	To be determined	Based on USFS Assessment for change in peak/base flows and drainage network increase encompassing 6 th code.
Landscape Context: <i>Barriers</i>	Physical barriers	Permanent barriers exclude adult movement to spawning habitat in > 75% of the 6th field spawning habitat.	Temporary or partial impediments or barriers may exist for juvenile and adult movements; or permanent barriers may exist that exclude adult migrants from 25%-75% of the 6th field spawning habitat.	No barriers to adult movement, or they exclude < 25% of the 6th field spawning habitat. Temporary or partial impediments or barriers may occasionally exist for juvenile movement.	There are no barriers or impediments to fish migration from the 6th field to the lake or river environment where migratory life histories could be expected to rear or stage.	To be determined	To be determined	Presumably would be based on USFS inventory of fish passage barriers.

¹ Based on local populations, not across entire subbasin. The native salmonids technical work group configured this table to assess viability down to the 6th field HUC. After acquiring the maps that describe the basin to the 6th code, the work group will apply this viability assessment to streams at that level.

² See Appendix E for definitions of key attributes used in this assessment.

Nested target: western pearlshell mussel

The western pearlshell mussel, a Species of Concern in Montana, is Montana's only coldwater stream mussel and the only native mussel found on the west side of the state. This mussel species appears to have crossed the continental divide in Montana from west to east with its salmonid host, the westslope cutthroat trout. Montana's populations of western pearlshell mussel may be significantly declining and becoming less viable due to decreased stream flows, stream warming, eutrophication due to agricultural runoff and siltation from incompatible land uses.

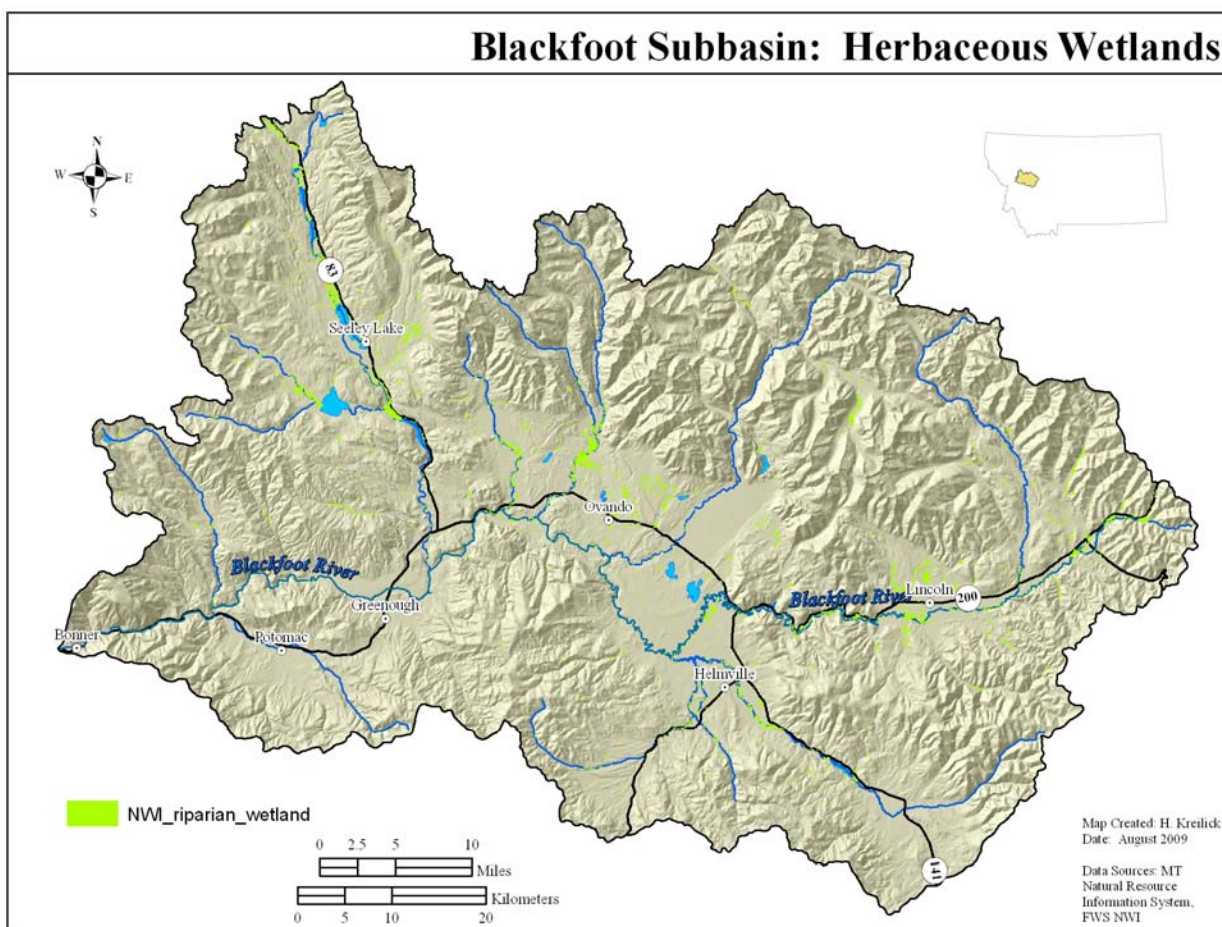
Impoundments and diversions are also continued threats in many of the rivers in this species' range. Previously reported western pearlshell mussel beds in the larger rivers (e.g., Blackfoot, Big Hole, Bitterroot, Clark Fork) are extirpated from those drainages or are at such low densities that long-term viability is unlikely (MFWP 2005, MTNHP 2009b). In 2009, DFWP initiated studies of western pearlshell distribution in the Blackfoot River drainage; in 2010, DFWP re-introduced western pearlshell mussels into a key, recently restored stream in the upper basin (Pierce, personal communication, 2010).

3.3.3.2 Herbaceous Wetlands

Nested Targets: herbaceous wetland-associated bird, plant, amphibian and invertebrate Species of Concern

Hundreds of seasonal and permanent wetlands dot the Blackfoot Subbasin landscape (Figure 3.25). Wetland densities may exceed 100 distinct wetlands per square mile throughout portions of the subbasin. Herbaceous wetlands mainly occur on private land in the prairie-dominated valley bottom. As a result of their location, many of these wetlands are vulnerable to a variety of human impacts such as ditching, draining and plowing.

Figure 3.25 Herbaceous Wetlands.



Herbaceous wetland density in the Blackfoot is due in large part to glaciers and remnant chunks of glacial ice that formed hundreds of depressions, or glacial potholes, across the Blackfoot Valley floor. Glacial pothole wetlands are isolated wetlands that fill from winter snow melt, spring rains and/or groundwater springs. Many dry out completely or in part by the end of summer, although the larger ponds and lakes are maintained year-round by springs. Many of these glacial potholes are lined with fine silts and clays that restrict water drainage, creating

marshes, fens, wet meadows and other wetland communities dominated by herbaceous vegetation. Salinity in pothole wetlands varies greatly, creating unique associations between water and vegetation. In the Ovando Valley, for example, wetlands occurring near the northern forested communities contain relatively fresh water, while southern wetlands are more alkaline. Fen peatlands are a rare alkaline wetland type in Montana that occur in glacial potholes in the middle Blackfoot. The Potomac Valley, bisected by Union Creek, supports a large, low-gradient fen/grassland association. Herbaceous wetlands also occur throughout the Clearwater and Lincoln Valleys of the Blackfoot Subbasin.

Herbaceous wetlands are a great source of biological diversity in the Blackfoot Subbasin. It is estimated that 600 vascular plant species occur within the subbasin, nearly 30% of which are associated with wetlands (Lesica 1994). Herbaceous wetlands also provide important habitat for a range of vertebrate and invertebrate species. Herbaceous wetlands are, for example, an important component of grizzly and black bear habitat in the subbasin (BCCA Council and BC 2008).

Nested target: herbaceous wetland-associated bird Species of Concern

Glacial pothole wetland complexes in the subbasin are of particular importance to breeding and migratory birds including several state Species of Concern (USFWS 2009a, MTNHP 2009b). Brief descriptions of three of these species are provided below.

Black Tern: Breeding Black Terns have been documented in 12 Montana counties (MFWP 2005). Although breeding Black Tern colonies are located throughout many areas of Montana, these locations are scattered and limited to sites with appropriate habitat, size and vegetative composition. Little information is known about Black Tern migratory patterns in Montana. Black Tern breeding habitat in Montana consists mostly of wetlands, marshes, prairie potholes and small ponds (MFWP 2005). Over 100 nesting pairs of Black Terns have been documented in the Blackfoot Subbasin (G. Neudecker, pers. comm.). One of the known Black Tern colonies in Montana is on the Blackfoot Waterfowl Production Area (MTNHP 2009b).

Common Loon: Northwestern Montana supports the highest density of nesting Common Loons in the western United States. A Montana Partners in Flight Level I Priority Species (PIF 2000), the Common Loon occurs throughout Montana during migration.¹⁹ Breeding, however, is restricted to the northwestern corner of the state (Lenard et al. 2003). Most breeding occurs on glacial lakes > 13 acres in size and < 5,000 feet in elevation. Small islands or herbaceous shoreline areas are used for nesting and sheltered, shallow coves with abundant insects and small fish are used as nursery areas (Skaar 1990). Most lakes inhabited by loons are relatively oligotrophic and have not undergone significant siltation or other hydrological changes. The loon population of northwest Montana is limited primarily by the quantity and quality of nesting habitat (PIF 2000). During the nesting period, human caused disturbance can cause loons to leave the nest, resulting in nest failure. For this reason, relatively remote and undisturbed lakes are considered important for loon populations to

¹⁹ Ecological and management information on this and other bird species mentioned in the Blackfoot Subbasin Plan is available in the Partners in Flight Bird Conservation Plan Montana (PIF 2000) and Montana's Comprehensive Fish and Wildlife Strategy (MFWP 2005).

persist. The Blackfoot Subbasin, with numerous undisturbed lakes and ponds, provides nesting habitat for loons. Successful reproduction in the subbasin is documented each year through monitoring of known nesting pairs (BC 2005b).

Sandhill Crane: Although not ranked as a Species of Concern by MTNHP, the Sandhill Crane is a species of note in the Blackfoot Subbasin. Herbaceous wetlands and open grasslands in the subbasin provide excellent habitat for Sandhill Cranes. In the Ovando Valley, the Sandhill Crane population has grown from ~100 birds in 1988 to over 514 birds in 2003. The Potomac Valley also supports a large, breeding Sandhill Crane population (G. Neudecker, pers. comm., MTNHP 2009b).

Trumpeter Swan: The Trumpeter Swan is also a Montana Partners in Flight Level I Priority Species (PIF 2000). The breeding range of Trumpeter Swans in Montana includes the extreme southwestern corner of the state (Beaverhead County), along the Rocky Mountain Front (Lewis and Clark County), and the Flathead Indian Reservation (USFWS 1995, MTNHP 2009b). Trumpeter Swan breeding habitat includes lakes and ponds and adjacent marshes containing sufficient water to maintain submergent and emergent vegetation through the nesting season (MTNHP 2009b, Mitchell 1994). In an effort to restore a breeding Trumpeter Swan population to the Blackfoot Subbasin, the Blackfoot Challenge, working cooperatively with USFWS and MFWP, has released 112 Trumpeter Swans in the subbasin between 2005 and 2009. Twenty-two (20%) of these birds are known to be dead. Eight appear to have died from severe intestinal parasitism and emaciation; three died from power line strikes; three died from legal hunting; two were illegally shot; four died of unknown causes; and two were killed by predators. Thirty-six (32%) birds were seen alive in 2009. The remainder of the release birds were not observed in 2009 and their status is unknown (E. Caton and G. Neudecker, pers. comm.).

Nested target: herbaceous wetland-associated plant Species of Concern

Seven plants listed as Montana Species of Concern are associated with wetlands of the Blackfoot Subbasin: Beck's water marigold, watershield, small yellow lady's-slipper, crested shieldfern, pygmy water-lily, blunt-leaved pondweed and Howell's gumweed (MTNHP 2009a). More information on these species is provided in Table 3.7.

Nested target: herbaceous wetland-associated amphibian Species of Concern

The western toad, a Species of Concern in Montana (MTNHP 2009b), has been documented in the Blackfoot Subbasin. Habitats used by western toads in Montana include low elevation beaver ponds, reservoirs, streams, marshes, lake shores, potholes, wet meadows and marshes, as well as high elevation ponds, fens, and tarns. Surveys conducted since the early 1990s indicate that the western toad has undergone regional population declines in Montana and elsewhere in the western United States. Limiting livestock access to known breeding sites and avoiding use of fertilizers, herbicides, and pesticides within at least 100 meters of breeding sites can reduce impacts on this species (MTNHP 2009b).

Nested target: herbaceous wetland-associated invertebrate Species of Concern

Although invertebrates are not well studied in the Blackfoot Subbasin, there are a number of invertebrate Species of Concern and Potential Species of Concern associated with herbaceous

wetlands west of the Continental Divide. Data on these species are maintained by the Montana Natural Heritage Program and provided in Appendix F.

Table 3.15 Herbaceous Wetlands Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Size (Areal extent): Number, distribution and size of wetlands by wetland type	Number, distribution and size of wetlands by wetland type compared to HRV ^{1, 2}	< 80% intact	80-90% intact	90-95% intact	> 95% intact	good	very good	Use ASCS flyover data; NWI/aerial photo interpretation. Baseline inventory is needed to determine accuracy of these indicator ratings.
Landscape Context (Functional Hydrologic Regime): Intactness of wetland hydrology	Areal extent of filled or drained wetlands by wetland type	< 80% intact	80-90% intact	90-95% intact	> 95% intact	good	very good	NRCS SSURGO soils database may be used to determine historical extent of hydric soils.
Condition (Intactness): Lack of human-caused disturbance	Percent of physically disturbed wetlands by wetland type	< 25% intact	25 to 50% intact	50 to 75% intact	> 75% intact	fair	good	“Disturbance” includes physical and physiological impacts from human activities (e.g., grazing recreational use, draining, filling).
Condition (Native vegetation community intactness)	Extent and proportion of exotic invasive species	< 25% intact	25 to 50% intact	50 to 75% intact	> 75% intact	fair	good	This indicator rating scale is for individual wetlands. Includes exotic pasture grasses and annual grasses.
Condition (Reproductive Success of Common Loons)	Territory occupancy and fledging rate of loons	< 10 occupied territories; < 0.4 chicks per pair fledged	10-12 occupied territories: 0.4-0.5 chicks per pair fledged	12-15 occupied territories: 0.5-0.6 chicks per pair fledged	> 15 occupied territories: > 0.6 chicks per pair fledged	good	very good	This indicator is a measure of <i>disturbance</i> by humans and other factors. Rating numbers developed from Common Loon monitoring data (Hammond 2009). Ratings apply to herbaceous wetlands <i>and</i> to larger lakes used for loon nesting.

Table 3.15 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Condition (<i>Reproductive Success of Trumpeter Swans</i>)	Nesting and fledging rate of Trumpeter Swans	< 2 nests; < 1 chick fledged per nest	2-4 nests; 1-1.5 chicks fledged per nest	5-7 nests; 1.5-2 chicks fledged per nest	> 7 nests; > 2 chicks fledged per nest	poor	very good	This indicator is a measure of <i>disturbance</i> by humans and other factors. Rating numbers developed from Trumpeter Swan monitoring data (UM Watershed Health Clinic and USFWS 2005). Ratings apply to herbaceous wetlands <i>and</i> to larger lakes used for swan nesting.

¹ HRV refers to “historic range of variability,” or the range of critical ecological processes and conditions that have characterized particular ecosystems over specified time periods (i.e., 100-1,000 years ago) and under varying degrees of human influences. An understanding of HRV allows managers to understand the dynamic nature of ecosystems, the processes that sustain and change ecosystems, the current state of the ecosystem in relationship to the past and the possible ranges of conditions that are feasible to maintain. HRV is a useful tool for determining a range of desired future conditions and for establishing the limits of acceptable change. Best available science and on the ground expertise are used to determine HRV. Once the HRV is established for an area, it can be compared to existing vegetative conditions to determine departures from HRV. This information can aid conservation and resource management planning.

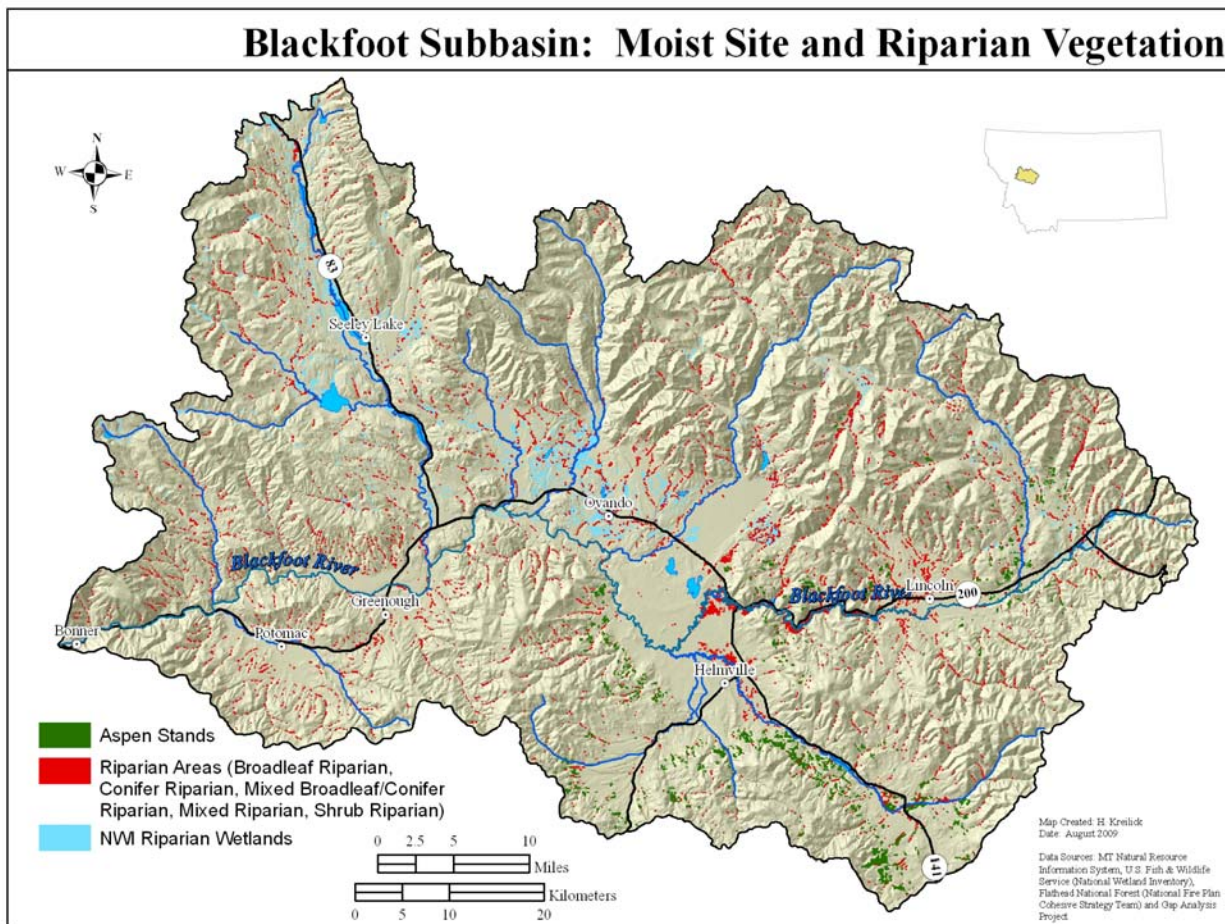
² In this case, HRV refers to the historic number, distribution and size of wetlands by wetland type in the subbasin. Collecting this baseline information is a high priority strategic action listed under conservation objectives 4-8 in the Blackfoot Subbasin Management Plan (Section 5.0).

3.3.3.3 Moist Site and Riparian Vegetation

Nested Targets: riparian-dependent birds

Riparian communities occur along 1,900 miles of creeks, streams, and rivers in the Blackfoot Subbasin (Figure 3.26). Vegetation is typically dominated by black cottonwood, aspen, Engelmann spruce, and/or shrub (willow, birch, alder and dogwood) plant communities. Large willow swamps, for example, occur along Cottonwood and Monture Creeks and riparian cottonwood forests occur along the North Fork and the mainstem of the Blackfoot River. Riparian cottonwood forests develop in river and stream corridors on alluvial bars created by dynamic flows of spring runoff and mature into forests that eventually alter the direction of water flow. These forests keep waters cool in summer and support a variety wildlife species (MFWP 2005). Riparian and wetland communities support the greatest concentration of plants and animals in Montana and serve as a unique transition zone between aquatic and the terrestrial environments (MFWP 2005). Riparian communities provide crucial wildlife habitat in the Blackfoot Subbasin as well as important stream stability and fishery functions.

Figure 3.26 Moist Site and Riparian Vegetation.



Intact riparian vegetation helps to filter sediment, prevent erosion and stabilize streambanks, store water and recharge aquifers and dissipate stream energy (Karr and Schlosser 1978, Platts 1979, Marlow and Pogacnik 1985).

Moist site vegetation in the subbasin includes aspen groves and cottonwood, willow, alder and other woody plant communities not directly associated with surface water systems. Large aspen groves found throughout the subbasin provide essential habitat for a variety of wildlife species including elk, mule deer, and cavity-nesting birds. These communities are located at all elevations but make up the greatest aerial extent within the prairie-dominated valley bottoms and draws where groundwater is at or near the surface for at least a portion of the growing season (Figure 3.26). Aspen communities, like riparian and wetland communities, are highly productive habitat for wildlife and plants in the Rocky Mountain region.

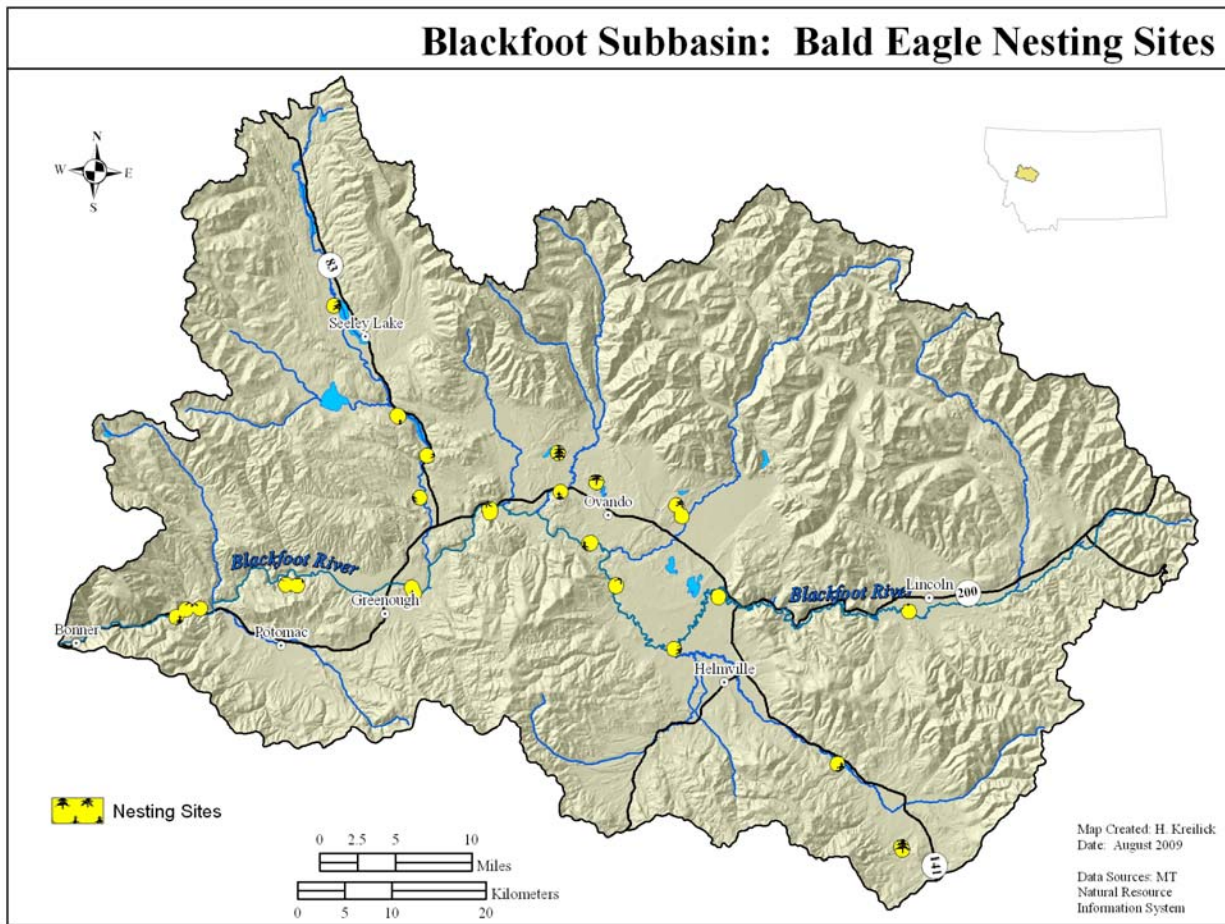
All of the woody plant dominated wetland types encountered in the Blackfoot Subbasin have been subjected to a variety of human impacts since European settlement (ca. 1880) including flood control, clearing, ditching, beaver control, fire control and grazing pressure. These disturbances have resulted in a subbasin-wide reduction in coverage and health of these community types.

Nested target: riparian-dependent birds

Riparian and wetland areas typically support more species of breeding and migratory birds than any other habitat in the West, even though they account for less than 1% of the landscape. In addition, a large proportion of declining bird species and Species of Concern are dependent upon riparian and wetland habitats. Bird communities can serve as indicators of ecosystem health because they reflect an integration of a broad array of ecological conditions, including water quality, productivity, landscape integrity and vegetation structure and composition. Species that indicate intact riparian systems in the Blackfoot Subbasin include Veery, Red-eyed Vireo, Bullock's Oriole, American Redstart, Bald Eagle, Osprey and American Dipper. Riparian zones along small-order streams support different species than riparian bottomlands (e.g., Willow Flycatcher, Wilson's Warbler). Brief descriptions of Bald Eagle and Veery, both Species of Concern in Montana (MTNHP 2009b), are provided below.

Bald Eagle: After serious population declines in the late 1960s and 1970s, the Bald Eagle was listed as a threatened species in the Rocky Mountain states. The species was delisted from threatened status in July 2007 (USFWS 2009b). Bald Eagles prefer late successional forests and shorelines adjacent to open water lakes and rivers. The Montana Bald Eagle Working Group characterized quality habitat as mature forest stands of low to moderate canopy closure consisting of cottonwood, Douglas-fir, ponderosa pine or mixed conifers. Forest stands with nest sites should be 20 acres or larger and be located within one mile of open water. Stands should contain at least two suitable nest trees and more than three perch trees (MBEWG 1991). The Blackfoot River provides year round habitat for Bald Eagles, including a number of nest sites (Figure 3.27).

Figure 3.27 Bald Eagle Nesting Sites.



Veery: Veerys breed in moist, low elevation deciduous forests with a dense understory. They are also found in thick and wide willow or alder riparian habitat (PIF 2000). Veerys have a strong preference for deciduous riparian habitats in many areas (Moskoff 1995). Although Veery populations have increased in the northern Rockies, its preference for large riparian stands with dense understories and its susceptibility to Brown-headed Cowbird nest parasitism make it a vulnerable species (PIF 2000). Mosconi and Hutto (1982) found a negative response to grazing when comparing heavy versus light grazing intensity.

Table 3.16 Moist Site and Riparian Vegetation Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context (<i>Functioning natural disturbance regime</i>): Fire, flooding, browsing, beaver	Composition and structure of native plant community	< 25% of HRV ¹	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair	good	HRV refers here to historic composition and structure of native plant community.
Condition (<i>Intactness</i>): Lack of human disturbance	Percent physically disturbed	< 25% intact	25 to 50% intact	51 to 75% intact	> 75% intact	fair	good	“Human disturbances” include grazing, bank alteration, draining, chemical use, etc.
Condition (<i>Native vegetation community not invaded by exotic plants</i>)	Extent and proportion of exotic invasive species	< 25% intact native plant community	26 to 50% intact native plant community	51 to 75% intact native plant community	> 75% intact native plant community	fair	good	Use USFS Region 1 noxious weed risk assessment (Mantas 2003).
Size (<i>Aerial Extent</i>): Number, size, or area of moist site and riparian vegetation	Miles/acres of current moist site and riparian vegetation relative to HRV	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair	good	HRV refers here to historic extent (miles/acres).

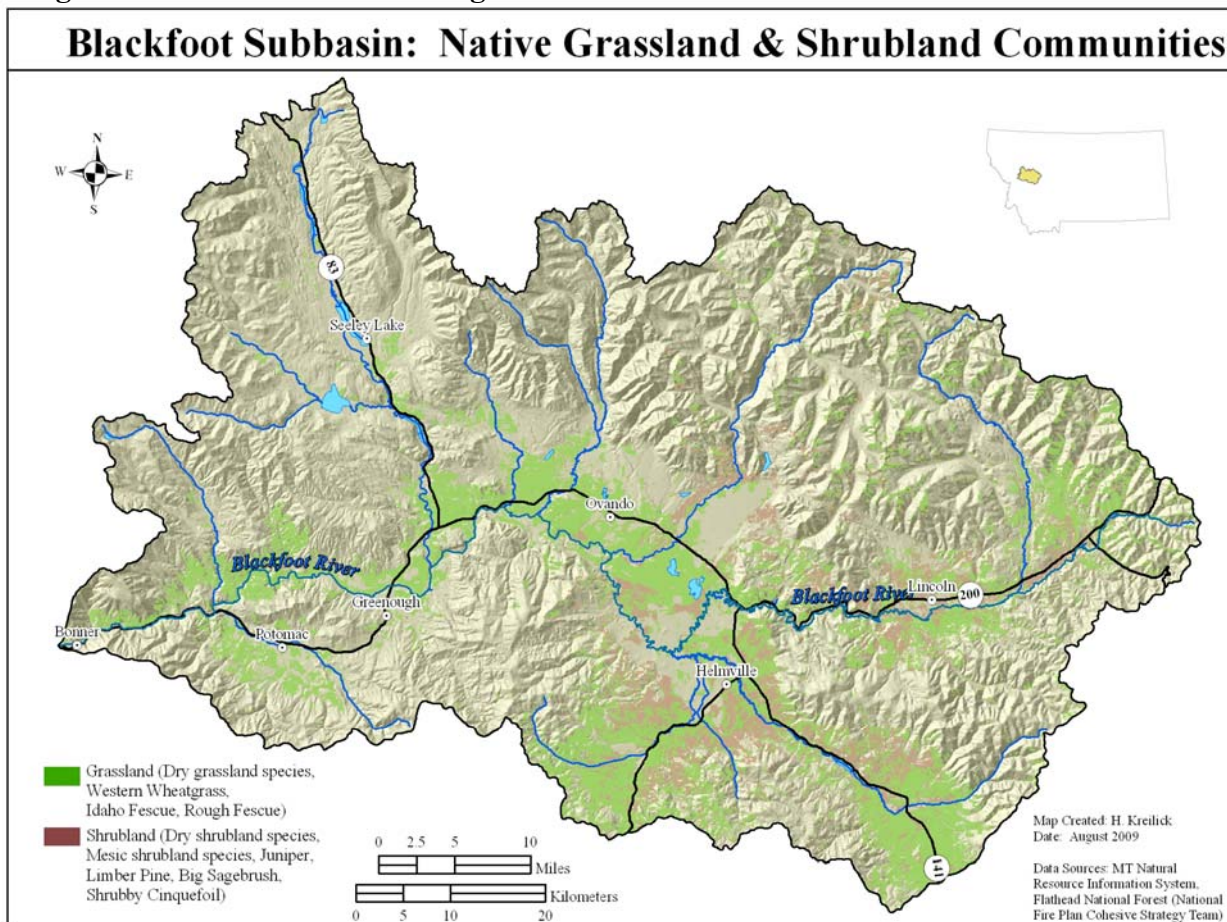
¹ HRV refers to “historic range of variability.” A definition of HRV is provided in Table 3.12

3.3.3.4 Native Grassland/Sagebrush Communities

Nested Targets: grassland/sagebrush-associated bird and plant Species of Concern; ungulate winter range

Sweeping expanses of native bunchgrass prairie are one of the most striking visual elements of the Blackfoot Subbasin. Sagebrush and grassland areas in the subbasin were targeted by early European settlers for grazing and farm lands. Today, the majority of native grassland/sagebrush communities are located on private land in the subbasin (Figure 3.28). Large bunchgrass prairies occur throughout the valley bottoms. The dominant bunchgrass is rough fescue; other common native grasses include bluebunch wheatgrass, Idaho fescue, prairie junegrass and several species of needle grass. The big sagebrush-dominated plant community type is most prevalent in the middle Blackfoot Valley south of the Blackfoot River. Native grassland and sagebrush communities often occur in a matrix throughout the valley. Grassland complexes are associated with more terrestrial species in greatest need of conservation than any other community type in Montana (MFWP 2005). Information on rare grassland/sagebrush communities known to occur in the Blackfoot Subbasin is provided in Section 3.2.7.1.

Figure 3.28 Native Grassland/Sagebrush Communities.



Fire is critical to maintaining native grassland/sagebrush communities. The historic fire regime in rough fescue communities, for example, was characterized by frequent return-interval (five to ten years), low severity fires. The historic fire regime in sagebrush communities was characterized by longer return-interval (>25 years), stand-replacing fires. The exclusion of fire from these communities has resulted in the encroachment of tree seedlings that eventually shade out and eliminate native bunchgrasses. In native grasslands, a longer fire return interval has resulted in an increase in sagebrush cover in some portions of the subbasin.

Nested target: grassland/sagebrush-associated bird Species of Concern

Grassland bird populations are declining throughout North America. Factors contributing to the decline include habitat loss and conversion (PIF 2000). A variety of Montana bird Species of Concern are associated with native grassland/sagebrush communities in the Blackfoot Subbasin. A brief description of five of these species follows.

Columbian Sharp-tailed Grouse: Native grassland/sagebrush communities in the Blackfoot Subbasin provide habitat for Columbian Sharp-tailed Grouse, a Montana Partners in Flight Level I Priority Species (PIF 2000). A Sharp-Tailed Grouse subspecies, the Columbian Sharp-tailed Grouse has undergone significant rangewide decline. Historically, they ranged in suitable habitats from British Columbia south through eastern Oregon and Washington, Idaho, western Montana, Wyoming, and Colorado, and northern Utah, Nevada, and California. They have now been extirpated from Oregon, California and Nevada and currently occupy less than 10% of their historic range. Remaining populations are small and widely separated from other populations. Idaho has the best remaining populations, which include 75% of the remaining birds. In Montana, there are two known remnant populations: 1) in the Tobacco Valley near Eureka and 2) in the Blackfoot Valley near Helmsville. A self-sustaining population of Columbian Sharp-tailed Grouse needs thousands of acres of suitable habitat (Ulliman et al. 1998). Neither of the two remnant populations in Montana, however, currently has enough contiguous habitat to support viable populations over the long term. The conversion of native grassland and shrub/grass communities to agriculture and other incompatible land uses has been primarily responsible for the reduction in Columbian Sharp-tailed Grouse populations. Much of the remaining historical habitat that has not been converted to other uses has been degraded by fire (too much in some areas; not enough in other areas), invasion of non-native annual vegetation and excessive grazing by livestock (Ulliman et al. 1998, PIF 2000).

Long-billed Curlew: The Long-billed Curlew is one of the most threatened shorebird species on the continent (National Audubon Society 2007). It is a Species of Concern in Montana (MTNHP 2009b) and is included on the National Audubon Society's Watch List (National Audubon Society 2007). North America's largest shorebird, the Long-billed Curlew is found throughout the northwestern states where sufficient native grassland remains for nesting sites. In Montana, Long-billed Curlews breed and migrate throughout the state but do not overwinter here. Long-billed Curlews prefer well-drained native grasslands, sagebrush and agricultural land with gently rolling topography (PIF 2000). They use their long, curved bills to feed on grasshoppers and other insects. They seem to require large blocks of grasslands: Bicak et al. (1982) found that territories averaged 35 acres in size. The North American Long-billed Curlew population has declined as suitable nesting habitat has been converted to

incompatible land uses (PIF 2000, Lenard et al. 2003). In Montana, much of the suitable Long-billed Curlew breeding habitat is fragmented and unprotected (Redmond in Clark et al. 1989). Small population size and negative population trends, combined with threats of habitat degradation on both breeding and wintering grounds, make the Long-billed Curlew a high conservation priority (National Audubon Society 2007).

Brewer's Sparrow: Brewer's Sparrows are characteristic of native grassland/sagebrush habitat and nest in large, living sagebrush, mainly using shrubs >20 inches tall (Peterson and Best 1985). Their nests are near the ground, and are usually located in the finest branches of new growth near the tips of branches, so shrubs in good vigor are important to nesting (PIF 2000). They show strong site fidelity, returning year to year to nest in the same area (Wiens and Rotenberry 1985). Brewer's Sparrows are vulnerable to parasitism by Brown-headed Cowbirds, especially where the sagebrush landscape has been fragmented by agriculture and pastures. Reductions in sagebrush cover and vigor from control actions such as burning or herbicides reduces or eliminates habitat suitability for the species. The long-term viability of Brewer's Sparrows in Montana will depend on the maintenance of large stands of sagebrush in robust condition (PIF 2000).

Grasshopper Sparrow: Grasshopper Sparrows breed from southern British Columbia to southern Maine and south to southern California, central Texas and central Georgia. The majority of Grasshopper Sparrows are found in the Great Plains from North Dakota to Texas and east to Illinois. Grasshopper Sparrows prefer grasslands of intermediate height (Vickery 1996). They use both native grasslands and tame pastures (Wilson and Belcher 1989) and have occasionally been found using cropland, but at much lower densities than within grasslands (Smith 1968, Ducey and Miller 1980, Best et al. 1997). The Grasshopper Sparrow has experienced rangewide population declines due to habitat fragmentation and incompatible land use practices (PIF 2000).

Bobolink: The Bobolink is a migratory bird that breeds in the grasslands of North America and winters in South America (Jaramillo and Burke 1999). Within the western United States, distribution is discontinuous and spotty with large areas lacking birds. Bobolinks rely on dense, tall grasslands for nesting. Bobolinks are found in native grasslands as well as non-native, tame pastures, hayfields, wet meadows and old fields that are characterized by relatively dense, tall grass (PIF 2000). Bobolinks are area-sensitive and prefer large grasslands (Helzer 1996).

Nested target: grassland/sagebrush-associated plant Species of Concern

At least two plant Species of Concern occur in native grassland/sagebrush communities in the Blackfoot Subbasin: Missoula phlox and Howell's gumweed (MTNHP 2009b). More information on these species is provided in Table 3.7.

Nested target: ungulate winter range

Critical habitat for sustaining elk populations in the Blackfoot Subbasin ranges from high elevation Wilderness areas to private valley lands and includes a mosaic of aspen stands, serviceberry and native bunchgrass prairies (Figure 3.29). Native grassland/sagebrush communities provide critical forage for ungulates during the winter months. The elk population

in the Blackfoot has increased over the last 15 years. MFWP estimates that there are approximately 6,000 elk in the Blackfoot Subbasin. The Blackfoot-Clearwater Wildlife Management Area currently provides winter range for 1,200 elk, 800 mule deer, and 800 white-tailed deer (J. Kolbe, pers. comm.).

Figure 3.29 Ungulate Winter Range.

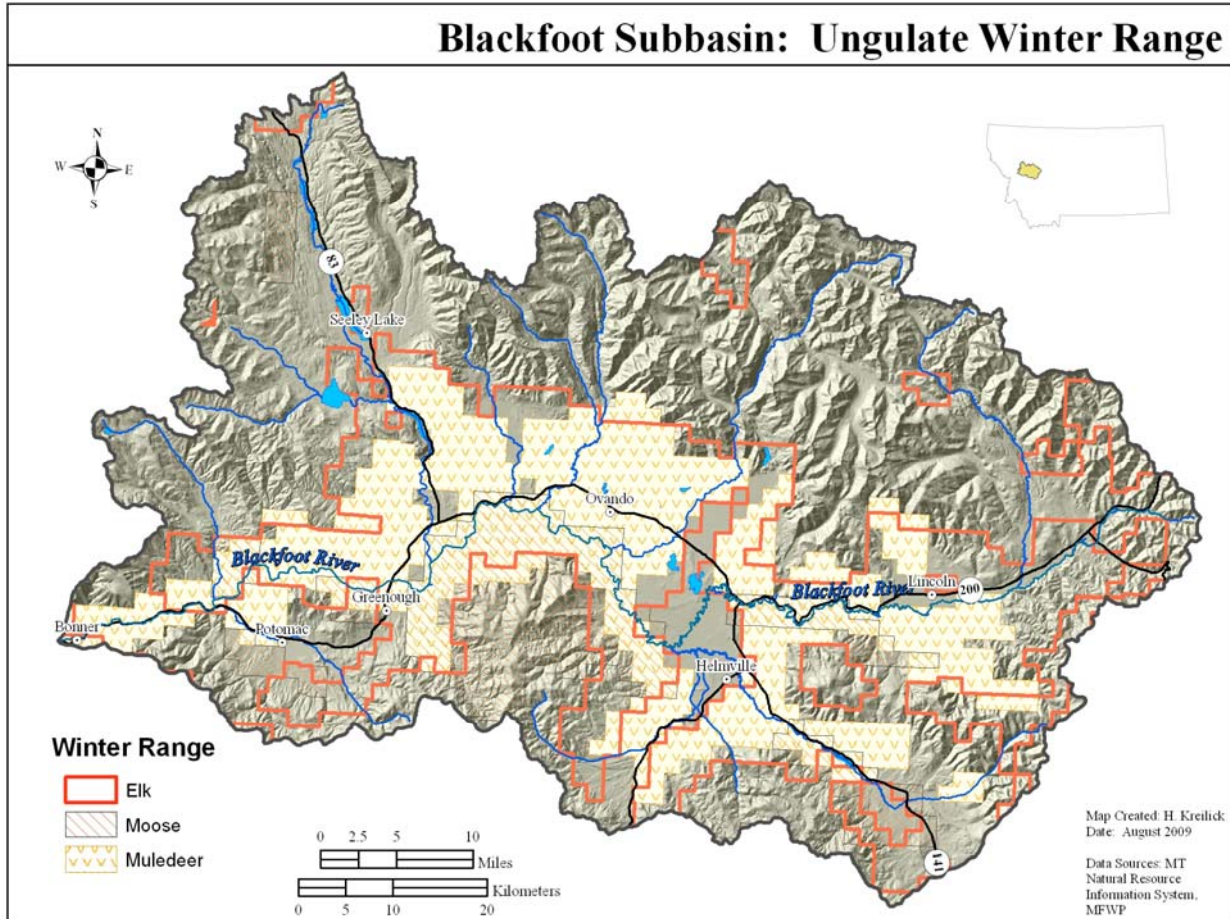


Table 3.17 Native Grassland/Sagebrush Communities Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context (<i>Functioning fire regime</i>)	Fire Return Interval (FRI)	FRI < 25% of HRV ¹	FRI at 25 to 50% of HRV	FRI at 51-75% of HRV	FRI at > 75% of HRV	poor	good	Historic FRI was 5-10 years in rough fescue grassland and > 25 years in sagebrush. Longer FRI and grazing practices have probably increased sagebrush cover in some places in the valley.
Condition (<i>Native vegetation community intactness</i>)	Composition and structure of native plant community	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair	good	HRV refers here to historic structure and composition.
Condition (<i>Native plant community not invaded by exotic plants</i>)	Extent and proportion of exotic invasive species	< 25% intact native plant community	25 to 50% intact	51 to 75% intact	> 75% intact	poor	good	Includes exotic pasture grasses and annual grasses. Use USFS Region 1 noxious weed risk assessment (Mantas 2003).
Size (<i>Areal Extent</i>): Area/size of grasslands/sagebrush by vegetation type	Acres of grassland/sagebrush habitats throughout the subbasin in historic locations	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair (?)	good (?)	HRV refers here to historic extent (acreage). Ratings take into account acreage lost due to conifer encroachment. Baseline inventory is needed to determine accuracy of these indicator ratings.

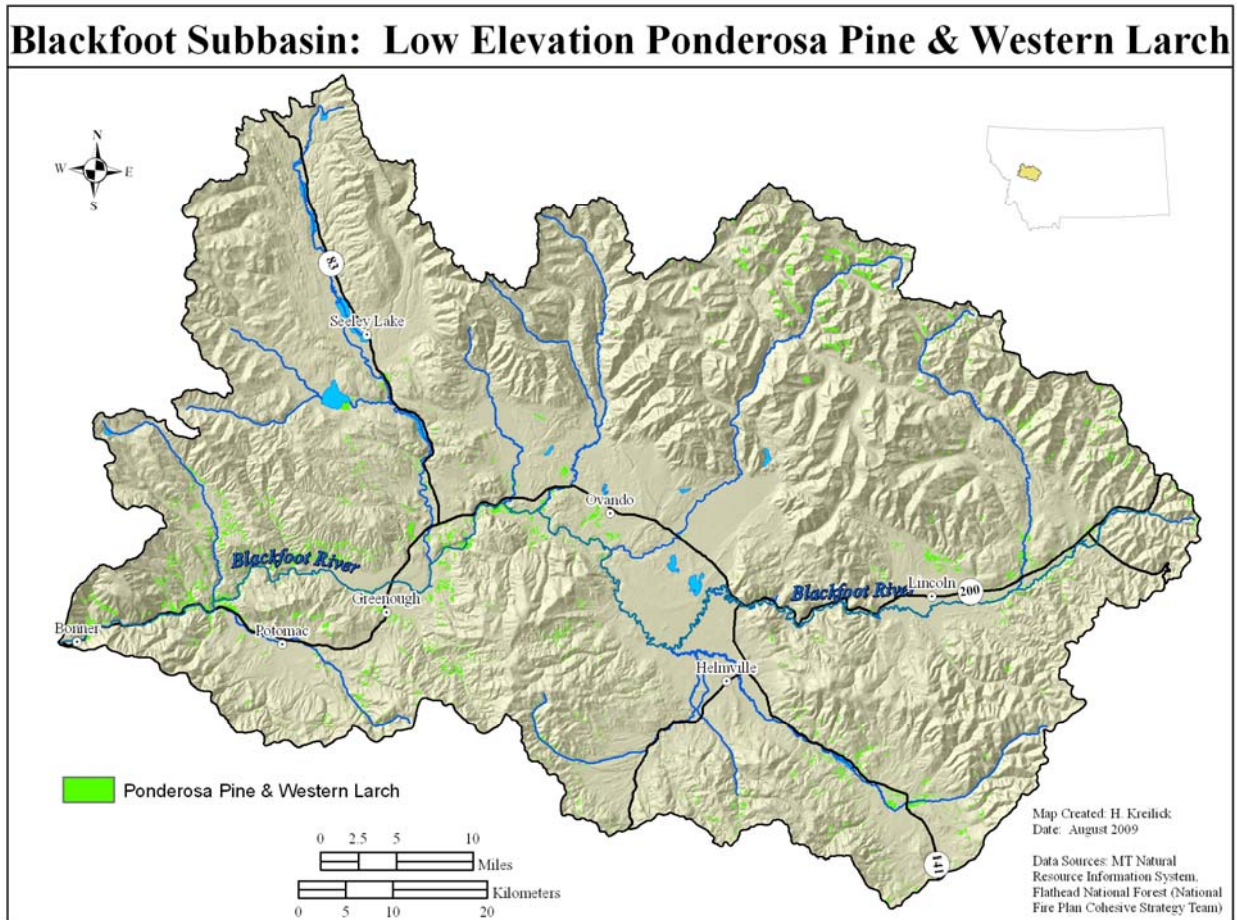
¹ HRV refers to “historic range of variability.” A definition of HRV is provided in Table 3.12.

3.3.3.5 Low Elevation Ponderosa Pine/Western Larch Forest

Nested targets: low elevation ponderosa pine/western larch forest-associated birds; ungulate winter range

Relatively dry and warm conditions prevail at low elevations and on gentle slopes in the Blackfoot Subbasin, giving rise to forest cover types dominated by ponderosa pine and western larch. The ponderosa pine forest type occurs on dry, forested sites within the Blackfoot Subbasin. The open-grown western larch forest type occurs on slightly more mesic. Low elevation ponderosa pine/western larch forests are distributed across many land ownerships in the subbasin, but are found primarily on USFS, DNRC, Plum Creek Timber Company and Nature Conservancy lands (Figure 3.30).

Figure 3.30 Low Elevation Ponderosa Pine/Western Larch Forest.



Historically, these forests were more open-grown than forests at mid to high elevations. This structure was created and perpetuated by frequent (5-25 year mean return interval), low to moderate severity fires that burned primarily in the understory (Morgan et al. 1998). In these open stands, fire-resistant ponderosa pine and western larch trees grew to very large diameters (up to and exceeding 36 inches). The forest understory was characterized by light fuel loads and native perennial grasses. This is especially true for mature, widely-spaced stands of ponderosa pine with relatively low stand densities (trees/acre). Downed woody fuels in such stands usually consisted of widely scattered, large trees (deadfalls) and concentrations of needles, twigs, branches, bark flakes and cones near the base of individual trees (Fisher and Bradley 1987). The western larch type also supported low densities of small-statured shrubs. Some researchers suggest that some low elevation ponderosa pine systems may be better characterized by mixed severity than by low severity fire regimes (Agee 1993, Shinneman and Baker 1997, Brown et al. 1999, Veblen 2000, Schoennagel et al. 2004, Baker et al. 2007, Hessburg et al. 2007). High severity fires were likely part of this mix (Hutto 2008).

Most low elevation ponderosa pine/western larch forests in the subbasin have been harvested over the past 125 years, and many of the large diameter trees have been removed. In addition, nearly 100 years of fire control has resulted in a dramatic shift in forest density, structure, composition and age class distribution away from the historic range of conditions. Due to this combination of harvest history and fire suppression, many low elevation forests in the Blackfoot Subbasin today are comprised of closely-spaced, small diameter ponderosa pine and Douglas-fir at stand densities higher than historic conditions. These current stand conditions make this forest type prone to drought stress, insects, disease and stand-replacing fires.

Nested target: low elevation ponderosa pine/western larch forest-associated birds

Species associated with low elevation ponderosa pine/western larch forests in the Blackfoot Subbasin include Flammulated Owl, Lewis's Woodpecker, Pygmy Nuthatch, and Solitary (Cassin's) Vireo. A brief description of two of these species, both Montana Species of Concern (MTNHP 2009b), follows.

Flammulated Owl: The Flammulated Owl, a Montana Partners in Flight Level I Priority Species (PIF 2000), breeds from southern British Columbia to southern Mexico (McCallum 1994). In Montana, the first Flammulated Owl nesting record was not documented until 1986 (Holt et al. 1987). Most Montana breeding records are from west of the Continental Divide. Breeding habitat for Flammulated Owls consists primarily of low to mid-elevation, open ponderosa pine and/or western larch forest (PIF 2000). Flammulated Owls nest primarily in cavities excavated by Pileated Woodpeckers and Northern Flickers in large trees and snags. Due to this affiliation, they are tied to the preferred nesting trees of these two species. In northwestern Montana, Pileated Woodpeckers in particular are strongly associated with mature to old-growth western larch and ponderosa pine forests, making these important habitats for Flammulated Owls as well (Holt and Hillis 1987, Reynolds and Linkhart 1992, McClelland and McClelland 1999).

Lewis's Woodpecker: The breeding range of the Lewis's Woodpecker extends from southwestern Canada south to southern New Mexico and Arizona, west to western California, and east to eastern Colorado, approximating the distribution of ponderosa pine in North America. The Lewis's Woodpecker generally winters in the southern portion of its

breeding range north to southwestern Oregon, central Utah and central Colorado (Tobalske 1997). Lewis's Woodpeckers have been recorded during the breeding season in all parts of Montana except the northeastern quarter (Lenard et al. 2003). The three primary breeding habitats of Lewis's Woodpeckers in Montana and elsewhere are open ponderosa pine forest, burned coniferous forests and open riparian woodland (particularly cottonwood) (Bock 1970, Linder 1994, Vierling 1997). Lewis's Woodpeckers are commonly associated with an open forest canopy that permits flycatching, dense understory shrub coverage to generate an abundance of insects and large snags for nesting (Bock 1970, Linder 1994). This species is considered a burn specialist due to its relatively high nesting success and high breeding densities in burned ponderosa pine forests (Saab and Vierling 2001, Gentry and Vierling 2007, Saab et al. 2007). In unburned forests, necessary snag and understory conditions are generally found in older, open stands that lack a dense layer of subcanopy trees. Lewis's Woodpecker populations in North America have declined in recent decades (PIF 2000).

Nested target: ungulate winter range

Low elevation forests in the Blackfoot Subbasin are a key component of ungulate winter range, providing thermal cover and lower snow depths. Maintaining connectivity between these low elevation forests and native grassland/sagebrush communities (see Section 3.3.3.4) is important for ensuring the functionality of winter range habitat in the subbasin. See Figure 3.29.

Table 3.18 Low Elevation Ponderosa Pine/Western Larch Forest Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context/Condition <i>(Functioning disturbance regime):</i> Fire	Appropriate species composition and structure in the understory and overstory relative to historic conditions	< 25% of HRV ¹	25-50% of HRV	51-75% of HRV	> 75% of HRV	poor	good (by year 2058)	HRV refers here to historic structure and composition. Indicator includes down and standing dead wood.
Landscape Context/Condition <i>(Patch Size and Distribution of Age Classes)</i>	Patch Dynamic Analysis: Departure from HRV for all cover types and age classes	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	poor	good (by year 2108)	HRV refers here to historic patch size and distribution of age classes.

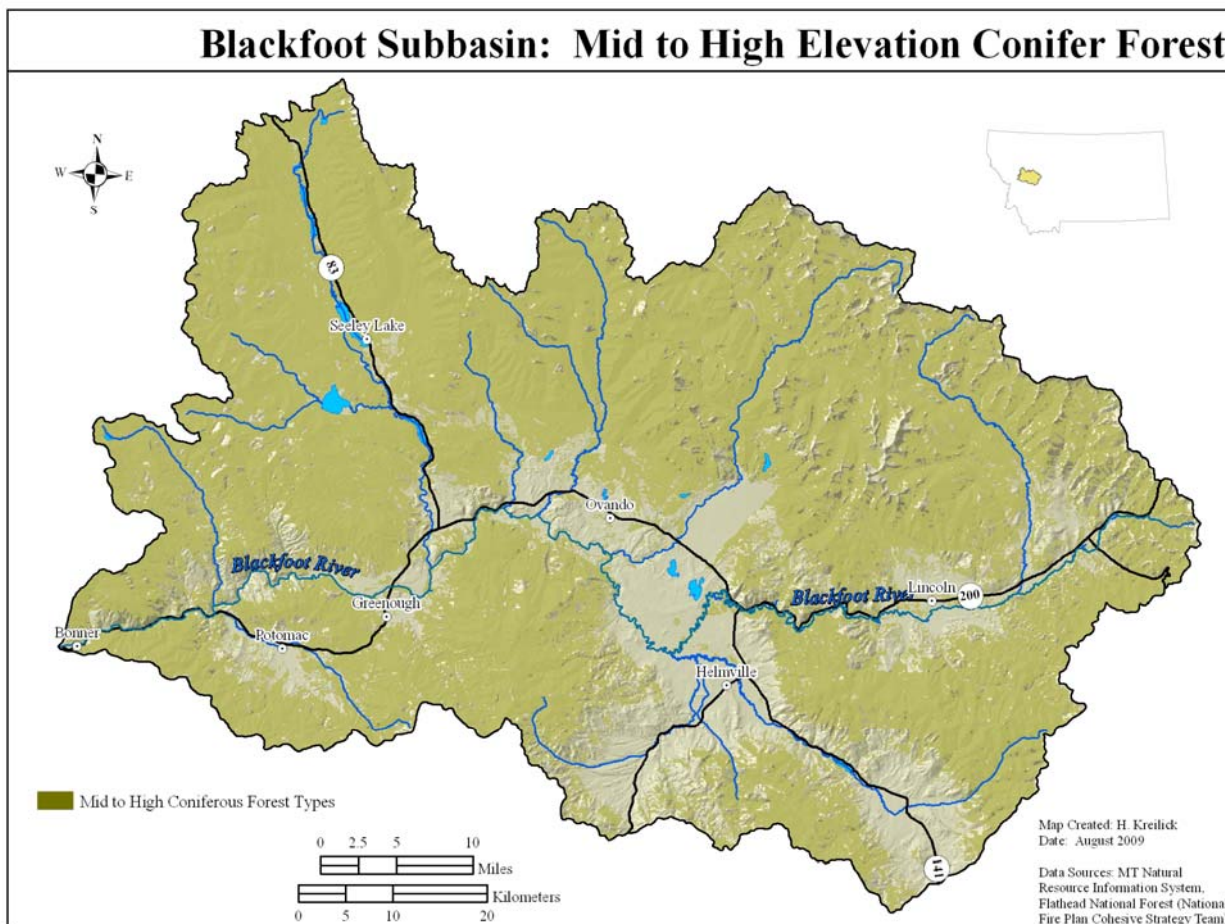
¹HRV refers to “historic range of variability.” A definition of HRV is provided in Table 3.12.

3.3.3.6 Mid to High Elevation Coniferous Forest

Nested Targets: mid to high elevation coniferous forest-associated birds; forest carnivores; whitebark pine

Mixed coniferous forest vegetation dominates at mid to upper elevations in the Blackfoot Subbasin (Figure 3.31). This forest type is found primarily on USFS and BLM lands, with smaller amounts on DNRC, Plum Creek Timber Company and Nature Conservancy lands. Depending on aspect, elevation and slope, various cover types occur including lodgepole pine, subalpine fir/Engelmann spruce and subalpine fir/whitebark pine. Western larch and Douglas-fir may also be significant components within these types. Whitebark pine is most common in subalpine areas. Forest structure, composition, and age class distribution varies with time since the most recent disturbance (timber harvest or fire). Older stands generally have continuous forest canopy cover. Down and standing dead wood is an important component of this forest type.

Figure 3.31 Mid to High Elevation Coniferous Forest.



Until recently, much of the mid-elevation forested land in the Blackfoot Subbasin was owned by corporate timber companies. Mid-elevation forests have been heavily roaded and harvested over the past 50 years and noxious weeds have invaded many of the disturbed sites. As a result of timber harvest and road building, species composition, structure, and age class distribution in mid-elevation forests have been significantly altered from historic conditions. In high elevation forests, white pine blister rust has also contributed to the departure from historic conditions.

Suppression of naturally occurring wildfires in the last 100 years has further affected composition, structure and age class distribution in both mid and high elevation forest types. The historic fire regime in mid and high elevation coniferous forests was characterized by mixed-fire frequency and severity, including either some infrequent severe fire events or patches of severe fire during fire events that occurred at intermediate frequencies (Schoennagel et al. 2004, Baker et al. 2007, Sherriff and Veblen 2007). Disturbed forest conditions are necessary for the maintenance of many plant and animal species (Hutto 2008). The Black-Backed Woodpecker, for example, is nearly restricted in its distribution to burned forest conditions (see below). There is a need, therefore, to manage for and maintain mixed and high severity fire in mid and high elevation forests in the Blackfoot Subbasin (D. Hutto, pers. comm.).

Nested target: mid to high elevation coniferous forest-associated birds

Black-backed Woodpecker: The Black-backed Woodpecker, a Montana Partners in Flight Level I Priority Species (PIF 2000) and Montana Species of Concern (MTNHP 2009b), occurs in mid to high elevation mixed conifer forests from New England and eastern Canada, across Canada to southern Alaska and south in the Rocky Mountains to Wyoming. It is a resident species in the forested habitats of Montana from the Rocky Mountain Front westward. The Black-backed Woodpecker is considered a sensitive, special concern, or management indicator species by most Montana agencies because of its strong association with burned forest conditions (Hutto 1995b, Dixon and Saab 2000, PIF 2000, Hutto and Young 2002, Hutto 2008). It is strongly associated with dying or dead trees infested with beetles. Mature and old-growth forests containing patches of beetle infested trees may provide habitat to support baseline populations of Black-backed Woodpeckers when burned areas are not available (Goggans et al. 1988).

Olive-sided Flycatcher: The Olive-sided Flycatcher, a Montana Partners in Flight Level I Priority Species (PIF 2000), generally occurs in mid to high elevation coniferous forests throughout the mountains of western North America (Altman 1997). It breeds throughout western Montana. Olive-sided Flycatchers have been found to be more abundant in disturbed than in undisturbed forests in the northern Rocky Mountains, including early postfire and logged (both partial cut and clearcut) habitats (Tobalske et al. 1991, Hutto and Young 1999). They appear to require large residual snags and/or live trees for foraging and singing perches (Altman 1997). Olive-sided Flycatcher populations appear to be in decline. In the northern Rocky Mountains, populations declined approximately 3% from 1966 to 1996, and approximately 5.8% within Montana over the same period (Sauer et al. 1997, PIF 2000).

Northern Goshawk: Northern Goshawks in western Montana and northern Idaho have been found to nest in mature to old-growth conifer forests (Hayward and Escano 1989). Douglas-

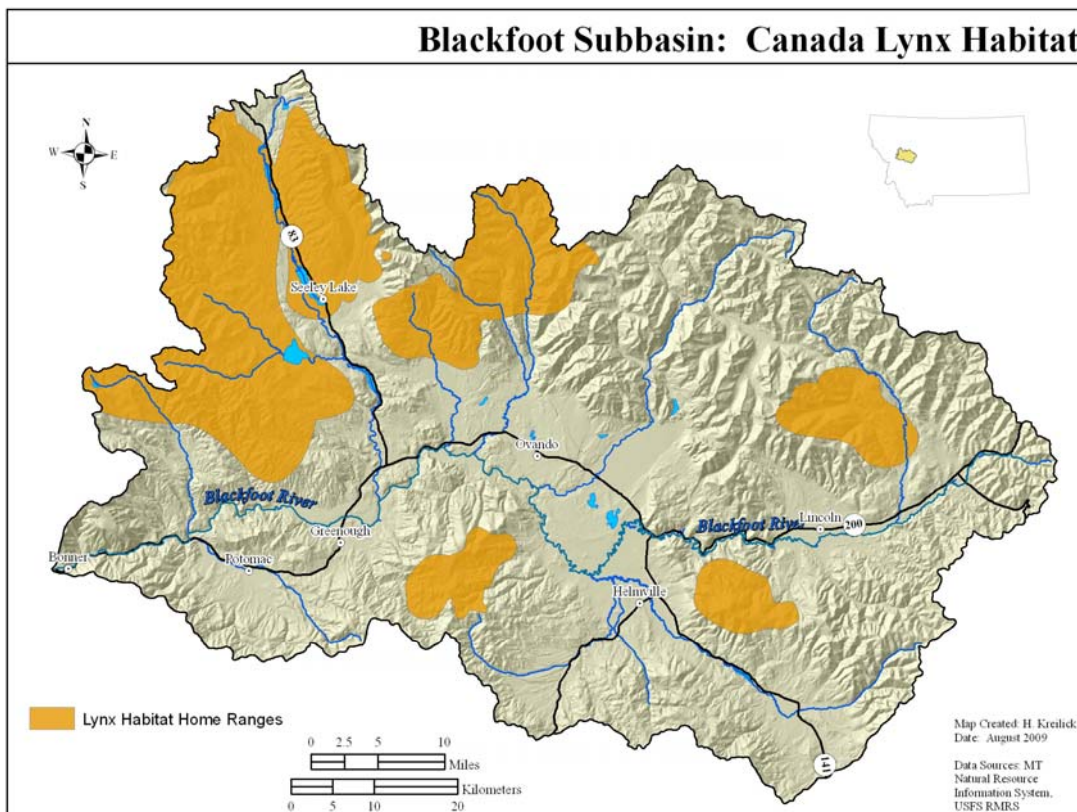
fir and western larch seem to be the preferred species for nesting in the northern Rockies (Hayward et al. 1990). A survey of 316 nests in northern Idaho, Montana, western North Dakota, and northwestern South Dakota indicated that 60% of nest sites were in the Douglas-fir forest type, followed in order of prevalence by lodgepole pine (16%), ponderosa pine (14%), hemlock/spruce (4%), and small percentages of hardwood and mixed conifer types (USFWS 1998, PIF 2000). The Northern Goshawk is a Species of Concern in Montana (MTNHP 2009b).

Nested target: forest carnivores

Wide-ranging forest carnivores such as Canada Lynx, wolverine, and fisher require large areas of intact mid to high elevation coniferous forest to fulfill their life history needs.

Canada lynx: The Blackfoot Subbasin is a stronghold for the federally threatened Canada lynx in the northern Rocky Mountains (Figure 3.32). Based on ongoing research in the Upper and Middle Blackfoot, lynx populations appear stable, although low reproductive rates are characteristic of this population. Since 1998, over 80 lynx have been monitored in the subbasin, providing information on habitat use, reproduction, mortality and movement. This research has shown that the Blackfoot Subbasin contains some of the most critical habitat for lynx in the continental United States. Large, intact spruce/subalpine fir forests above 4,000 feet in the subbasin provide high quality habitat for lynx and for snowshoe hares, the primary lynx food source. Regenerating forest stands are often used as foraging habitat during the snow-free months while older, multi-storied stands serve as denning and year-round habitat (BC 2005b, J. Kolbe pers. comm.).

Figure 3.32 Canada Lynx Habitat.



Wolverine: The wolverine, a Species of Concern in Montana (MTNHP 2009b), was nearly extinct in Montana during the early 1900s but has been increasing in numbers and range since then. Recovery originated in northwestern Montana and subsequently spread to its current range (Newby and Wright 1955, Newby and McDougal 1964). Wolverines are generally solitary, wide-ranging and occur at relatively low densities. In Montana, the mean annual wolverine home range is 163 square miles for males and 150 square miles for females (Hornocker and Hash 1981). Available evidence indicates that juveniles disperse usually around 20 to 60 miles from their natal range, though dispersal movements of more than 180 miles are known (Gardner et al. 1986). Wolverines are limited to alpine tundra and boreal and mountain forests (primarily coniferous) in the western mountains, particularly in large wilderness or other essentially roadless areas. Dispersing individuals, however, have been found far outside of usual habitats (MTNHP 2009b). Tracking data, sightings and trapper harvest indicate that wolverines are well distributed throughout suitable habitat in the Blackfoot Subbasin (J. Kolbe, pers. comm.).

Fisher: The fisher is also a Species of Concern in Montana (MTNHP 2009b). Although fisher were purportedly extirpated from the state by the 1930s, recent genetic research indicates that native remnant populations persisted in the Bitterroot and Blackfoot Watersheds (Vinkey et al. 2006). Efforts in 1959 and 1960 resulted in the establishment and augmentation of native populations in Lincoln, Granite, and Missoula counties. Within the Blackfoot Subbasin, fisher have been trapped in the Clearwater drainage, the Lincoln Valley, and the Garnet Mountains in recent decades. Recent genetic hair-snare surveys (USFS, unpublished data 2007) have confirmed fisher populations in the Clearwater drainage and Lincoln Valley portions of the Blackfoot as recently as 2007. A wide-ranging mammal, fisher home ranges have been estimated at 4 to 300 square miles. Fishers have been recorded moving up to 56 miles in three days (Ruggiero et al. 1994, J. Kolbe, pers. comm.).

Nested target: whitebark pine

Whitebark pine is a common component of subalpine forests and a dominant species of treeline and krummholtz habitats. It occurs in almost all major mountain ranges of western and central Montana. Whitebark pine occupies a critical niche in western ecosystems by producing large seeds that are extremely nutritious and important in food chains of an estimated 110 animals. Whitebark pine seeds are especially important components of grizzly bear, black bear, red squirrel, and Clark's Nutcracker diets (Kendall & Arno 1989, Schmidt 1992, Reinhart et al. 2001). Populations of whitebark pine in Montana and across most of western North America have been severely impacted by past mountain pine beetle outbreaks and by white pine blister rust, an introduced pathogen.²⁰ As a result, there have been major declines in whitebark pine populations across large areas of its range. Additionally, encroachment and increased competition from other trees (primarily subalpine fir) have occurred as a result of fire suppression in subalpine habitats.

²⁰ More information on white pine blister rust is provided in Section 3.4.4.3.

Table 3.19 Mid to High Elevation Coniferous Forest Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context/Condition <i>(Functioning disturbance regime):</i> Fire	Appropriate species composition and structure in the understory and overstory relative to HRV ¹	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair	Good	HRV refers here to historic species composition and structure. Age class distribution and condition have shifted in the Blackfoot. Indicator includes down and standing dead wood.
Condition <i>(Cone producing whitebark pine stand)</i>	Amount and distribution of cone producing whitebark pine stands	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	poor	fair/good	HRV refers here to historic amount and distribution of cone producing whitebark pine stands. Note that white pine blister rust is an introduced pathogen and not part of HRV. More ecological and status information is required to refine ratings.
Landscape Context/Condition <i>(Patch size and distribution of age classes)</i>	Patch dynamic analysis: departure from HRV	< 25% of HRV	25-50% of HRV	51-75% of HRV	> 75% of HRV	fair	good	HRV refers here to historic patch size and distribution of age classes.

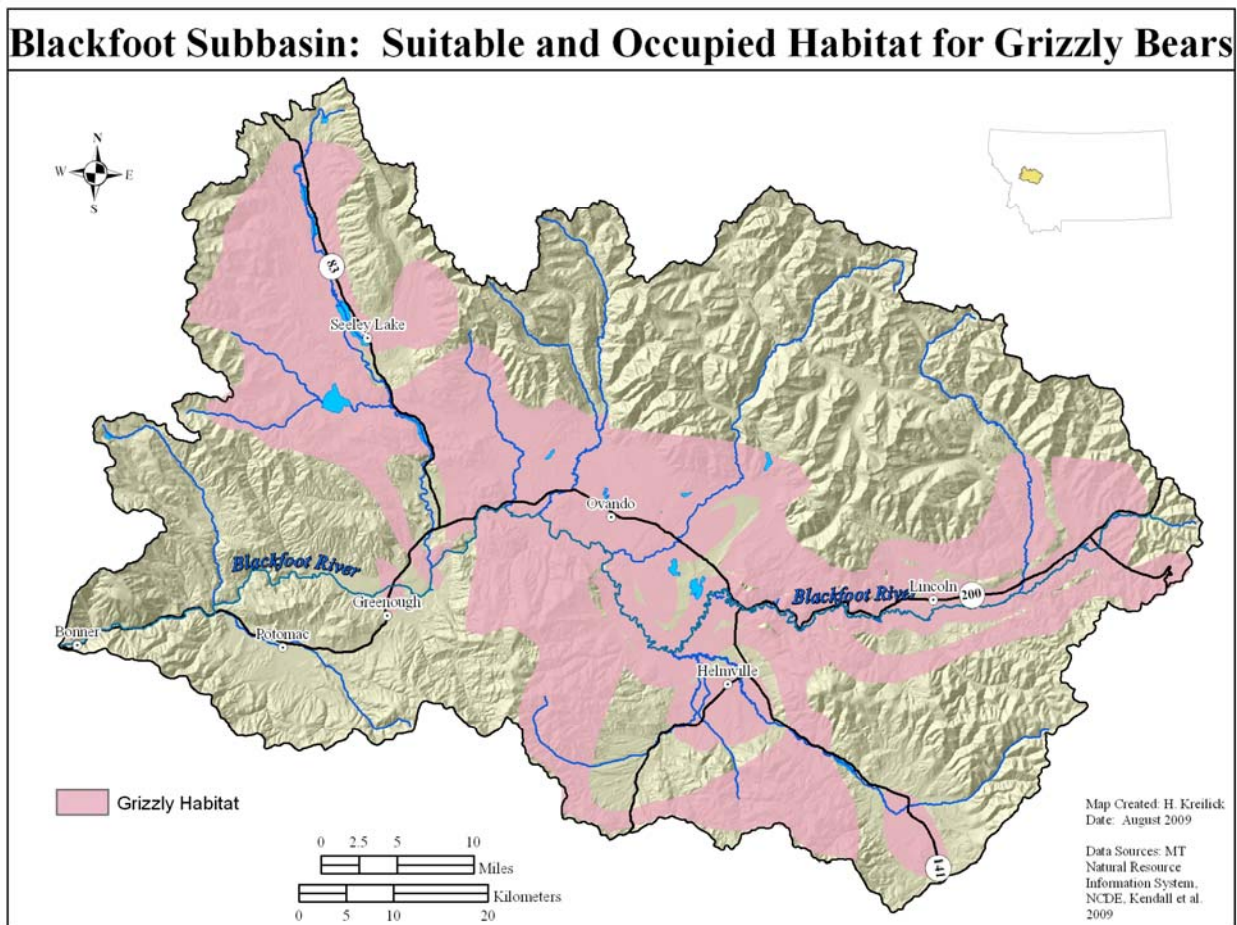
¹ HRV refers to “historic range of variability.” A definition of HRV is provided in Table 3.12.

3.3.3.7 Grizzly Bear

Nested Targets: habitat connectivity for wildlife

Grizzly bears are currently listed as a federally threatened species in the Northern Continental Divide Ecosystem (NCDE) (USFWS 2009b). The NCDE is an area of the northern Rocky Mountains with large blocks of protected public land containing some of the most pristine and intact environments found in the contiguous United States. The NCDE supports the largest population of grizzly bears in the lower 48 states. Despite dramatic losses of habitat throughout North America, the grizzly bear has maintained a presence in Montana and occurs in portions of the Blackfoot Subbasin. The Blackfoot Subbasin is the southern boundary for the NCDE grizzly bear recovery zone. The Grizzly Bear Recovery Plan (USFWS 1993) includes most of the Blackfoot Subbasin as suitable and/or occupied habitat (Figure 3.33).

Figure 3.33 Suitable and Occupied Habitat for Grizzly Bears.



The USGS Northern Divide Grizzly Bear Project, designed to estimate population size and distribution, confirmed the presence of 29 individual grizzly bears in the Blackfoot Subbasin in 2003 and 2004. The USGS estimates that at least 40 bears are present during all or part of the year in the subbasin. In recent years, grizzly bear activity has increased in the subbasin. This area appears to be an important habitat link for grizzlies that are re-colonizing historic ranges to the south of the subbasin. Maintaining habitat connectivity is critical to sustaining grizzly bear life histories and maintaining sustainable subpopulations within the southern portion of the NCDE.

Grizzlies breed, forage and migrate throughout the subbasin and den above 6,500 feet. They move from high mountain elevations to lower valley bottoms to forage seasonally for available food. Lakes, ponds, fens and spring-fed creeks, common in portions of the valley floor, provide excellent bear habitat. Additionally, the vegetation found along certain reaches of the Blackfoot River and its tributaries provide bears with cover, food and natural movement corridors. While grizzlies are taxonomically classified as carnivores, they are opportunistic and omnivorous in practice, eating a variety of forbs, roots, seeds, berries, insects, fish, birds and mammals. Important food sources found in the Blackfoot include chokecherries, serviceberries, hawthorns and rosehips.

As grizzly bears expand in population and spend more time on private agricultural lands in the Blackfoot, particular attention must continue to be focused on preventative management to reduce human-bear conflicts, protect human safety and reduce impacts to rural livelihoods. These efforts include securing bear attractants and installing electric fencing around agricultural food sources (beehives, sheep bedding grounds and calving areas) (J. Jonkel and S. Wilson, pers. comm.).

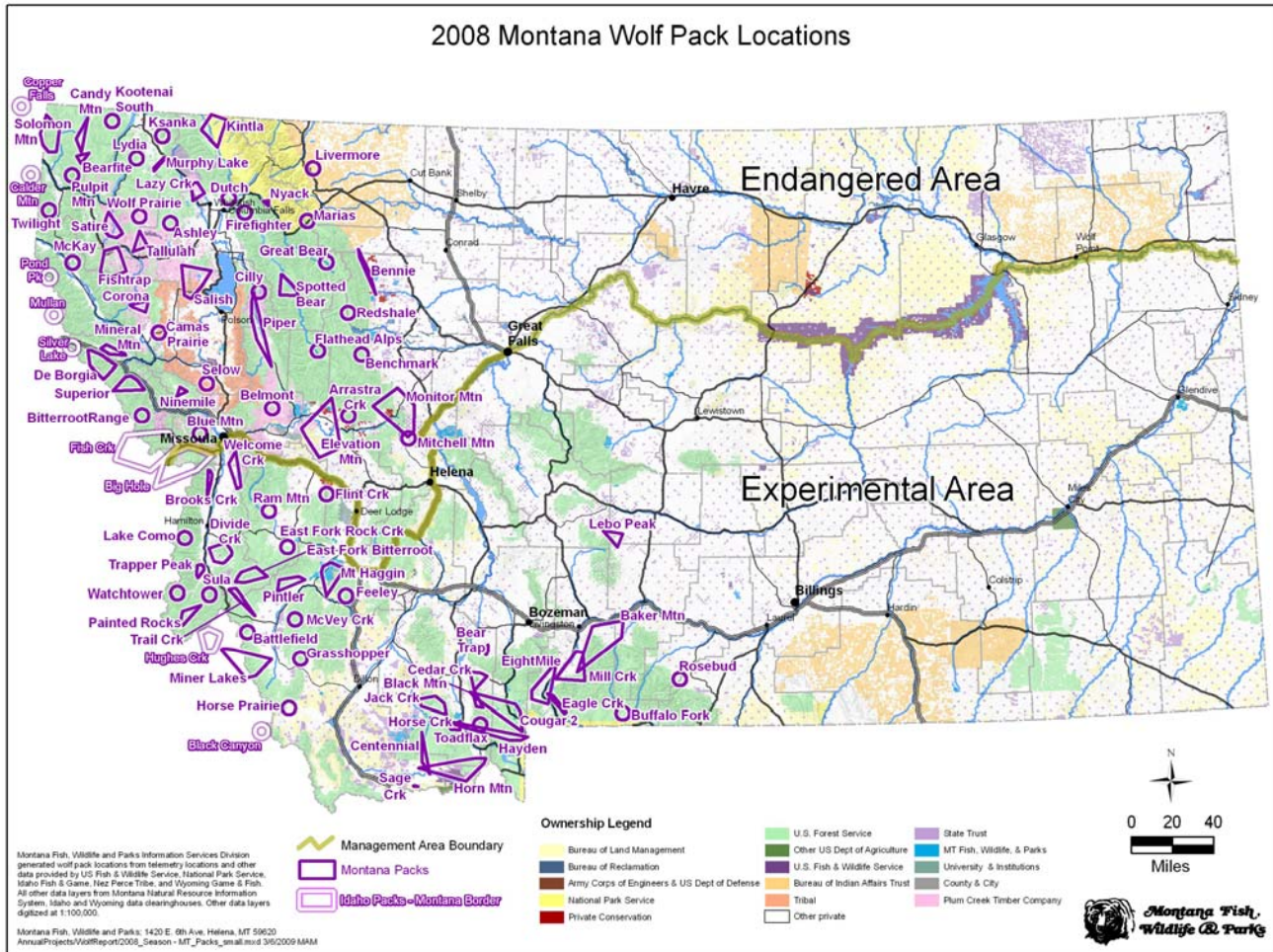
Nested target: habitat connectivity for wildlife

The Blackfoot Subbasin lies in a region which contains some of the best remaining habitat for many of North America's threatened or sensitive species including grizzly bear, gray wolf, wolverine, Canada lynx and native salmonid species. The location of the Blackfoot Subbasin in relation to larger ecosystems, such as the NCDE and the Yellowstone-to-Yukon region, adds to the importance of the area for maintaining large-scale connectivity for wildlife species. The subbasin provides crucial links for wildlife moving between the NCDE and other landscapes to the south. The Blackfoot River corridor and the entire subbasin serve as a complex network of linkage zones for wildlife moving in and out of the Bob Marshall/Scapegoat Wilderness Complex, the Mission Mountains Wilderness and between the lower Clark Fork drainage and the Garnet and Sapphire Ranges. Maintenance of the subbasin area as a linkage between large protected areas is important to many wildlife species including elk, moose, white-tailed and mule deer, fisher, Canada lynx, bobcat, pine marten, wolverine, mountain lion and wolf. Within the subbasin, maintaining connectivity at smaller scales, such as between elk summer and winter range, is also critical to preserving the diversity and abundance of wildlife species and overall ecosystem function.

The Blackfoot Subbasin lies at the confluence of three federally-designated gray wolf recovery areas: Northwestern Montana, Central Idaho and the Greater Yellowstone. Gray wolves in the Blackfoot are natural dispersers from wolf populations in Canada, moving southward from the Glacier National Park and Bob Marshall Wilderness Complex (Oakleaf et al. 2006). In 2007,

MFWP confirmed the first resident wolf pack (Elevation Mt. Pack) in the Blackfoot Subbasin. Subsequent livestock depredations by this pack ensued in April 2008 and resulted in three confirmed and one probable calf loss, and the subsequent removal of four wolves by wildlife management authorities. As of 2009, MFWP has confirmed the presence of four resident wolf packs and estimates that at least 25 to 35 wolves inhabit the subbasin, Arrastra Creek, Elevation Mountain, Belmont and more recently the Ovando Mountain Pack (Figure 3.34). The Blackfoot Valley also serves as an important wolf movement corridor between the NCDE and the Bitterroot Ecosystem to the south.

Figure 3.34 2008 Montana Wolf Pack Locations.



More information on elk, mule deer and white-tailed deer in the subbasin is provided in Section 3.3.3.4. More information on Canada lynx, wolverine, and fisher is provided in Section 3.3.3.6.

Table 3.20 Grizzly Bear Viability Assessment.

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Landscape Context <i>(Habitat Connectivity)</i>	Linkage zone intactness for wildlife movement	lose most	lose a lot, keep a little	lose some, keep some	maintained functionality of all wildlife linkage zones	very good	very good	Linkage zones or number of barriers should be defined so that this could be measured quantitatively for the subbasin. Indicators = highways and development.
Landscape Context <i>(Secure Available Habitat)</i>	“Available habitat”	< X % of available habitat is secure	X to X % of available habitat is secure	X to X % of available habitat is secure	> X % of available habitat is secure	very good	very good	Use USFS Cumulative Effects Model (CEM) to determine amount and distribution of available habitat and refine ratings.
Condition <i>(Population demographics):</i> Reproduction	Reproductive success of mothers and survivorship of cubs	0 verified females with young of the year	1 verified female with young of the year	2 verified females with young of the year	> 3 verified females with young of the year	good	very good	Number of females with young already tracked at NCDE scale. Animals to south of Highway 200 are not part of NCDE population estimate, but area still managed by MFWP.
Condition <i>(Population demographics):</i> Human-caused mortality	Number of human-caused breeding female deaths annually	> 3 breeding female deaths (this is a trend)	1-2 breeding female deaths	0 breeding female deaths in a year	0 breeding female deaths for 2 years in a row	fair	good	Referring to mortalities caused by hunters, highways, and malicious killing incidents. Mortality is good indicator of human presence/development.
Condition <i>(Human/grizzly bear conflicts)</i>	Incidence of human-grizzly conflicts with grizzlies	> 25 conflicts	10 to 25 conflicts	5 to 10 conflicts	up to 5 conflicts	good	very good	Includes incidents involving agricultural/residential attractants and recreation/hunter conflicts.

Table 3.20 (continued).

Key Attribute	Indicator	Indicator Ratings				Current Rating	Desired Rating	Comments
		Poor	Fair	Good	Very Good			
Size <i>(Population size and trend)</i>	Population trend monitoring and DNA studies	declining population	slight decline	stable trend	increasing population	very good	very good	Already tracked at NCDE scale. Population numbers should be tracked in the Blackfoot, but within the larger context of the NCDE population.

3.3.3.8 Rural Way of Life

Nested Targets: sustainable natural resource-based livelihoods; healthy/resilient communities

The Blackfoot Subbasin has provided critical ecological resources and functions to centuries of human communities from Native American Salish, Kootenai, Nez Perce, Shoshone, Blackfeet and Crow tribes to homesteaders and ranchers of European descent and present day residents. Recognizing the important interaction between natural resources and human communities, the subbasin planning team included *rural way of life* as an eighth conservation target. To define this target and its significance in the subbasin, it is necessary to examine the rural restructuring that is occurring across the Rocky Mountain West and the associated changes to communities that have historically been closely connected to natural resources and working landscapes.

The Rocky Mountain West is a region characterized by high alpine rugged mountains, large tracts of public land, clear running rivers and streams, large working ranches and a complex mosaic of habitats that support grizzly bear, gray wolf, Canada lynx and many other charismatic species. These regional characteristics are the substance behind many contentious political, economic and community debates related to natural resource preservation, conservation and sustainable use. Many argue that the controversies are a result of the shifting dynamics of the West—its history and value to old-timers versus newcomers. Terms like “the old west,” “the new west,” and “the next west;” “range-riding cowboy” and “web-surfing modern cowboy;” “working landscapes;” “amenity-based economy,” “resort communities,” and “recreation-based economy” all allude to the shift in culture and values (Brick et al. 2001, Wilkinson 1992, Decker 2001, Jungwirth 2001). Riebsame (2001) characterizes the new geography of the West as the “gentrified range of hobby ranchers and New West homesteaders.” From resource production—and, in some places, exploitation—to resource conservation, communities in the West are exploring tradeoffs between natural resource protection and community sustainability.

According to population census data, the Rocky Mountain West is undergoing some of the highest growth rates in the United States. According to demographers and economists, the factors contributing to this rapid growth include 1) businesses and jobs shifting away from cities due to information technology and a more mobile population, 2) the region’s newness as an economic development center and 3) the quality of life (Power 1996, Cromartie and Wardwell 1999, Riebsame et al. 1997). Stohlgren (1999), who examined population growth in several Rocky Mountain states and cities, found that the population of Jackson Hole, Wyoming increased by 260% between 1950 and 1990 and, closer to this study, the population of Missoula, Montana increased by 91% during the same time period.

In many places, shifting population dynamics, telecommunication, technology and global markets have created an “urban economy in a rural setting” (Rasker 2001). Both an influx of urban refugees and retirees means that the landscape is changing to a competitive, global and knowledge-based economy. Today, for example, over one-third of the personal income in the

Intermountain West is from nonlabor sources (e.g., investment and retirement and savings) (Rasker 2001).

The shift in demographics not only affects the land, as discussed later (see *Unplanned Residential and Resort Development*, Section 3.4.4.1), but also affects social and economic factors that are linked to natural resource-based communities, such as the loss of working farms and ranches, timber contracts, mills and infrastructure linked to these industries. In some areas, the use of zoning, county planning and conservation easements (a voluntary land protection tool employed by agencies and land trusts to conserve land) has reduced the opportunity for generational landowners to buy land or homes in the communities they were raised in due to larger parcel sizes. In other areas of the West, new and wealthy landowners have created quasi-nature preserves, keeping locals off their land with no trespassing signs. Numerous studies explore the relationships between property rights, value shifts and land use. Jackson-Smith and others (2005), for example, point out that landowners without farming and ranching backgrounds may depend less on their land for resource productivity than generational landowners, instead paying more attention to the cumulative impacts of aesthetic and environmental qualities across the landscape.

The Blackfoot Subbasin is experiencing many of the same changes as other rural communities across the West. New landowners are moving to the subbasin, bringing a range of values, skills and resources that provide potential benefits to the subbasin, including academic/professional knowledge, transfer or investment income and wealth and political sophistication. Many are welcomed, especially when they become active community members or leaders, participate in and organize local functions and fundraisers, serve on local community organization boards, spend time and money in local restaurants and businesses, and, most importantly, build long-lasting friendships and relationships with their neighbors. Others face barriers with generational landowners for a variety of reasons. Some new landowners, for example, have been quick to make decisions about land use and public access without fully understanding the impacts on natural resources and rural communities. Others take land out of production, “preserving” it for its amenity values. Some simply are not present, given that the ownerships are seasonal or absentee-based. Lastly, there is concern by rural residents over the fact that many of the seasonal or absentee landowners are not required to pay state income tax to benefit the local economy. Despite the mixed feelings, there is general recognition that the subbasin is changing and that efforts must be made to bridge old/new and rural/urban values.

In addition to changing demographics, it is important to highlight that the Blackfoot Subbasin is comprised of seven very distinct communities (Bonner, Greenough, Helmville, Lincoln, Ovando, Potomac and Seeley Lake) with different histories, landscapes and cultures. This diversity provides both challenges and opportunities to defining the rural way of life and associated indicators of community viability from a socioeconomic perspective. The proximity of the subbasin to the urban centers of Missoula and Helena (both approximately 60 miles away from the central portion of the valley) also influence the changing nature of the rural communities. The convenience of airports, hospitals/healthcare facilities and access to the internet will likely mean that many of the Blackfoot communities will not decrease in population.

The Blackfoot Challenge’s mission is to coordinate efforts that conserve and enhance the natural resources and rural way of life of the Blackfoot River Valley for present and future generations. The central question for partners practicing resource conservation and communities within the Blackfoot Subbasin is: can the communities retain their rural character in the midst of a changing west and a globally- and technologically-connected world? To address this question and assess the viability of the rural way of life in the Blackfoot Subbasin, representatives from the seven communities might complete a conservation target viability assessment (see Section 3.3.2) to 1) confirm or edit the following nested targets as key socioeconomic attributes of the subbasin rural way of life, 2) define indicators to measure each attribute, 3) rate the current status of each indicator, and 4) determine the desired status of each indicator.

Unlike key ecological attributes defined in Section 3.3.2, key *socioeconomic* attributes are factors that are critical for the long-term viability of societies (Belsky 2009). In the context of “rural” and “rural way of life,” this refers to areas with the following characteristics:

- relatively low population density
- located in relatively isolated or remote areas
- a large percentage of household income is from natural-resource based livelihoods (e.g., agriculture, ranching, forestry, hunting)
- the pace of life is slower than in cities
- strong ties exist between community members, social institutions (e.g., schools and other civic institutions) and the surrounding natural environment

It is important to note that the above definition of “rural” and “rural way of life” is highly generic. Differences will emerge within and across the seven distinct communities in the Blackfoot Subbasin, as discussed previously. The key to defining and choosing indicators related to the rural way of life is both resilience and sustainability (Belsky 2009).

The nested targets below have been identified based on current theory and models from the social scientific literature, available local social scientific data and/or comparative data from other areas and expert opinion.

Nested target: sustainable natural resource-based livelihoods

Although this nested target needs to be examined by community members with data collected from the subbasin, it can be loosely defined as the continued existence and support of industries such as agriculture, forestry, outfitting and recreation and the businesses that support these industries. In exploring indicators and opportunities to promote sustainable natural resource-based livelihoods, experts recommend that communities do not return to the old economy of resource production or seek large companies to move to small towns (Rasker, 2001). Instead, they advocate developing the physical and fiscal infrastructure to support local business and entrepreneurship, including seeking funds for education, infrastructure, and start-up capital. Possible indicators to measure progress in this area include:

- 1) Developing baseline and recent trend information that addresses how the different sectors are able to stay in business (and pass the business and knowledge on to the next generation);
- 2) Exploring the degree to which agriculture and forestry businesses are seeking economic diversification with value-added services and producing multiple products (e.g., animal processing, specialty meats, local marketing, utilization of small diameter wood products from restoration/fuel reduction treatment);
- 3) Defining the local benefit of these livelihoods in terms of product consumed or purchased and/or jobs in the subbasin;
- 4) Promoting businesses that:
 - a. Link resource use/natural amenities to the economy (e.g., recreation, guest-ranching, inns and restaurants, eco-tourism and/or the “restoration” economy)
 - b. Capitalize on global markets and public demand (e.g., wind energy development)
 - c. Develop new technologies to support a natural resource-based economy; and,
- 5) Exploring the relationship between conservation, local economy and community by creating new markets for the protection and stewardship of open space and healthy habitat and broadening the profit and income base versus complete reliance on government programs or philanthropy.

Nested target: healthy/resilient communities

The emphasis here is on the capacity of a community to continually create and improve its physical and social resources and environments and to be able to respond to new conditions. At the core is the concept of “social capital”, which is the ability of people and institutions within a community to come together and support each other to work through differences and define and accomplish common goals. The literature on the subject and ideas expressed in the Blackfoot Subbasin share many common themes and principals. Possible indicators of the viability of this nested target, as discussed by Edelman and Burke (2004) and Kenyon (2005), include:

- 1) A stable and/or increasing population;
- 2) Education (i.e., schools), keeping and attracting young people;
- 3) Accessible healthcare services and opportunities to care for the aging population;
- 4) Affordable housing;
- 5) Cultural “hubs” for community connection, conversation and relationships, e.g., restaurants, cafes, bars, churches, social organizations (Sew and So Club, Blackfoot Cattlewomen’s Association), community centers, events (4th of July Celebration, Births/Weddings/Funerals); and,
- 6) Low crime rates and public safety through rural fire departments and emergency response teams.

The Healthy Cities and Communities Coalition emphasizes the following seven pillars to a resilient and/or healthy community:

- 1) Practices ongoing dialogue
- 2) Generates leadership

- 3) Shapes its future
- 4) Embraces diversity
- 5) Knows itself
- 6) Connects people and resources
- 7) Creates a sense of community

Although rural way of life is not included in the threat assessments outlined in the following pages, conservation objectives and strategic actions undertaken in the subbasin will take into account the needs of local communities.

3.3.4 Summary of Viability

All conservation targets within the Blackfoot Subbasin were determined to have a current viability rating of *good*, *fair* or *poor*, suggesting that each conservation target will require some degree of human intervention in order to persist under current conditions (Table 3.21). In Section 3.4 (Threat Assessment), we analyze and describe the most important factors impacting conservation target viability in the subbasin. In Section 5.0 (Management Plan), we outline a set of conservation objectives and strategic actions to mitigate these threats and maintain or restore conservation target viability.

Table 3.21 Viability Summary for Blackfoot Subbasin Conservation Targets.¹

Conservation Targets	Landscape Context	Condition	Size	Viability Rank
	Grade			
Native Salmonids ²	Poor	Good	Fair	Fair
Herbaceous Wetlands	Good	Poor	Good	Fair
Moist Site and Riparian Vegetation	Fair	Fair	Fair	Fair
Native Grasslands/Sagebrush Communities	Poor	Poor	Fair	Poor
Mid to High Elevation Coniferous Forest ³	Fair	Fair	-	Fair
Low-Elevation Ponderosa Pine/Western Larch Forest ³	Poor	Poor	-	Poor
Grizzly Bear	Very Good	Fair	Very Good	Good
Subbasin Biodiversity Health Rank				Fair⁴

¹ The viability assessment for the rural way of life target has not yet been completed; depending on methods chosen for the assessment, different criteria other than landscape context, condition and size may be used.

² Viability ratings for native salmonids are subject to change pending review at 6th field HUC scale.

³ Forest work group did not consider size as a key attribute for forest targets.

⁴ Subbasin biodiversity health rank subject to change based on the variables noted above.

3.4 Threat Assessment

3.4.1 Overview

After identifying conservation targets and assessing target viability, technical work groups identified the most critical factors that currently impact or have the potential to impact target viability over the next ten years. The process entailed identifying and ranking *stresses* affecting each conservation target and *threats*, or the causes of each stress. The threat assessment process, including definitions of terms, is outlined below (adapted from Low 2003).²¹

Step 1: Identify Stresses

In the first step of the subbasin threat assessment, technical work groups identified stresses affecting each conservation target.²² Stresses destroy, degrade or impair a conservation target by impacting a key ecological attribute²³ relating to its size, condition or landscape context. Stresses are caused directly or indirectly by human activities. Technical work groups identified 19 stresses that negatively impact subbasin conservation targets (see Tables 3.22-3.28).

Step 2: Identify Threats (Sources of Stresses)

Threats represent the proximate cause of a stress. Most threats are rooted in incompatible human uses of land, water and natural resources. Many threats are driven by social, economic, or political underlying causes. Technical work groups identified 20 threats that represent the proximate cause(s) of each subbasin stress (see Tables 3.22-3.28).

Step 3: Rank Threats

After identifying the threats that affect each conservation target, technical work groups then ranked each one according to its *contribution* and *irreversibility* relative to each stress. *Contribution* refers to the expected contribution of the threat, acting alone, to the full expression of a stress under current circumstances. Contribution ratings indicate whether the threat is a very substantial, moderate or relatively insignificant cause of a stress. Contribution ratings are:

Very High (VH)	The source is a very large contributor to the particular stress.
High (H)	The source is a large contributor to the particular stress.
Medium (M)	The source is a moderate contributor to the particular stress.
Low (L)	The source is a low contributor to the particular stress.

²¹ For more information on the threat assessment process, see *Landscape-Scale Conservation: A Practitioner's Guide* (Low 2003).

²² *Stresses* are analogous to *limiting factors*, a term used by NPPC to describe the problems that impede the desired biological performance of a conservation target (NPPC 2001).

²³ *Key ecological attributes* are factors that are critical for the long-term viability of a conservation target. These are factors that, if degraded, would seriously jeopardize the target's ability to persist for a century or longer. Key ecological attributes for each conservation target are described in the Blackfoot Subbasin Viability Assessment, Section 3.3.2.

Irreversibility ratings indicate whether the threat produces a stress that is irreversible, reversible at extremely high cost, or reversible with moderate or little investment. Irreversibility ratings are:

<i>Very High (VH)</i>	Not reversible (e.g., wetlands converted to a shopping center).
<i>High (H)</i>	Reversible, but not practically affordable (e.g., wetland converted to agriculture).
<i>Medium (M)</i>	Reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).
<i>Low (L)</i>	Easily reversible at relatively low cost (e.g., off road vehicles trespassing in wetland).

3.4.2 Conservation Target Threat Assessments

Individual threat assessments for each subbasin conservation target illustrate the relationship between conservation targets, stresses, and threats in the subbasin (Tables 3.22-3.28). An understanding of both stresses and threats is necessary to develop effective conservation objectives and strategic actions that will maintain and/or improve the long-term viability of conservation targets in the subbasin. Narrative descriptions of each threat are provided in Section 3.4.4.

Table 3.22 Native Salmonids Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →					
		Water Quality Impairments	Habitat Access/ Connectivity Impairments	Physical Habitat Impairments	Altered Hydrologic Regime	Riparian Vegetation Impairments	Non-Natives, Exotics and/or Parasites Invasion
Mining	Contribution	M	L	M	L	L	n/a
	Irreversibility	H	H	H	H	H	n/a
Incompatible Grazing	Contribution	H	L	H	M	VH	M
	Irreversibility	M	M	M	M	M	H
Physical Road Issues	Contribution	VH	VH	H	M	M	M
	Irreversibility	M	M	M	M	M	H
Incompatible Forestry Practices	Contribution	M	L	H	H	H	M
	Irreversibility	H	M	M	M	M	H
Unplanned Residential and Resort Development	Contribution	M	L	L	M	L	M
	Irreversibility	H	H	H	H	M	H
Drainage and Diversion Systems	Contribution	H	H	M	H	M	M
	Irreversibility	M	M	M	M	M	M
Channel Alteration	Contribution	H	L	H	M	H	M
	Irreversibility	M	M	M	M	M	H
Non-Motorized Recreational Use	Contribution	L	M	L	L	L	H
	Irreversibility	L	M	L	L	L	H
Exotic/Invasive Species	Contribution	L	M	M	n/a	M	H
	Irreversibility	L	L	L	n/a	H	H
Climate Change	Contribution	H	M	M	VH	M	H
	Irreversibility	H	M	M	M	M	H

Table 3.23 Herbaceous Wetlands Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →					
		Altered hydrologic regime	Altered physical habitat condition	Altered native plant species, composition, and/or structure	Altered distribution, areal extent, patch size of community types	Degradation or loss of wildlife habitat	Reduced diversity of wetland types
Incompatible Grazing	Contribution	L	H	H	L	L	L
	Irreversibility	M	M	M	M	L	L
Drainage and diversion Systems	Contribution	VH	H	H	L	H	VH
	Irreversibility	M	M	M	L	L	M
Exotic/Invasive Species	Contribution	L	M	VH	L	M	H
	Irreversibility	M	M	M	L	M	M
Motorized Vehicle Use	Contribution	n/a	L	L	n/a	L	n/a
	Irreversibility	n/a	M	M	n/a	M	n/a
Conversion to Agriculture	Contribution	H	VH	VH	H	H	H
	Irreversibility	M	M	M	M	M	M
Filling of Wetlands	Contribution	H	H	H	M	M	H
	Irreversibility	H	H	M	M	H	M
Existing Crop Production	Contribution	H	VH	H	H	M	H
	Irreversibility	M	M	M	M	M	M
Incompatible Forestry Practices	Contribution	n/a	L	L	L	L	n/a
	Irreversibility	n/a	M	M	M	M	n/a
Climate Change	Contribution	H	L	H	H	H	H
	Irreversibility	VH	VH	VH	VH	VH	VH

Table 3.24 Moist Site and Riparian Vegetation Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →			
		Altered hydrologic regime	Altered disturbance regime (fire, grazing, browsing, flooding, beaver)	Altered native plant species, composition, and/or structure	Altered distribution, areal extent, patch size of community types
Channel Alteration	Contribution	M	H	M	L
	Irreversibility	M	M	M	M
Unplanned Residential and Resort Development	Contribution	M	H	H	M
	Irreversibility	H	H	VH	H
Conversion to Agriculture	Contribution	L	L	M	L
	Irreversibility	H	H	H	H
Lack of Fire	Contribution	n/a	VH	H	H
	Irreversibility	n/a	M	H	H
Incompatible Grazing	Contribution	M	H	H	H
	Irreversibility	M	M	M	M
Drainage and diversion Systems	Contribution	VH	L	L	L
	Irreversibility	M	M	M	M
Exotic/Invasive Species	Contribution	n/a	n/a	VH	M
	Irreversibility	n/a	n/a	H	M
Altered Wildlife Use Patterns	Contribution	n/a	M	H	M
	Irreversibility	n/a	M	M	M
Climate Change	Contribution	H	VH	H	VH
	Irreversibility	VH	VH	VH	VH

Table 3.25 Native Grasslands/Sagebrush Communities Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →			
		Altered fire regime	Altered Grazing Regime (domestic & wild)	Altered native plant species, composition, and/or structure	Altered distribution, areal extent, patch size of community types
Lack of Fire	Contribution	VH	M	H	H
	Irreversibility	M	M	M	M
Conversion to Agriculture	Contribution	M	H	H	H
	Irreversibility	M	H	H	M
Incompatible Grazing	Contribution	M	VH	H	H
	Irreversibility	M	M	M	M
Exotic/Invasive Species	Contribution	M	H	VH	H
	Irreversibility	M	M	H	H
Unplanned Residential and Resort Development	Contribution	H	M	M	H
	Irreversibility	H	VH	VH	H
Motorized Vehicle Use	Contribution	n/a	n/a	M	n/a
	Irreversibility	n/a	n/a	H	n/a
Altered Wildlife Use Patterns	Contribution	L	M	L	L
	Irreversibility	L	M	M	M
Climate Change	Contribution	VH	H	H	VH
	Irreversibility	VH	VH	VH	VH

Table 3.26 Low Elevation Ponderosa Pine/Western Larch Forest Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →			
		Altered fire regime	Degradation or loss of wildlife habitat (for forest carnivores)	Altered native plant species, composition, and/or structure (limited recruitment of ponderosa pine and larch)	Altered distribution, areal extent, patch size of community types
Incompatible Forestry Practices	Contribution	L	VH	VH	H
	Irreversibility	M	M	M	M
Lack of Fire	Contribution	VH	H	H	VH
	Irreversibility	M	M	M	M
Physical Road Issues	Contribution	M	n/a	L	H
	Irreversibility	M	n/a	M	M
Motorized Vehicle Use	Contribution	L	n/a	n/a	M
	Irreversibility	M	n/a	n/a	M
Unplanned Residential and Resort Development	Contribution	H	H	H	H
	Irreversibility	VH	VH	VH	VH
Climate Change	Contribution	VH	VH	n/a	n/a
	Irreversibility	VH	VH	n/a	n/a
Epidemic Levels of Native Insects and Pathogens	Contribution	L	M	M	n/a
	Irreversibility	H	H	H	n/a
Exotic/Invasive Species	Contribution	M	M	n/a	H
	Irreversibility	M	M	n/a	M

Table 3.27 Mid to High Elevation Coniferous Forest Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →				
		Altered fire regime	Non-functioning whitebark pine stands	Altered native plant species, composition, and/or structure	Altered distribution, areal extent, patch size of community types	Degradation or loss of wildlife habitat
Lack of Fire	Contribution	H	H	H	H	H
	Irreversibility	M	M	L	M	M
Incompatible Forestry Practices	Contribution	L	H	n/a	VH	H
	Irreversibility	M	M	n/a	M	M
Physical Road Issues	Contribution	L	n/a	n/a	L	H
	Irreversibility	M	n/a	n/a	M	M
Motorized Vehicle Use	Contribution	L	n/a	n/a	n/a	M
	Irreversibility	M	n/a	n/a	n/a	M
Exotic/Invasive Species	Contribution	L	L	VH	n/a	H
	Irreversibility	M	M	H	n/a	H
Unplanned Residential and Resort Development	Contribution	L	L	n/a	L	L
	Irreversibility	VH	VH	n/a	VH	VH
Climate Change	Contribution	VH	VH	H	n/a	n/a
	Irreversibility	VH	VH	H	n/a	n/a
Epidemic Levels of Native Insects and Pathogens	Contribution	L	M	L	L	L
	Irreversibility	H	M	H	H	H

Table 3.28 Grizzly Bear Threat Assessment.

Threats (Causes) ↓		Stresses (Effects) →					
		Loss of connectivity from the COCE to other historic ranges	Degradation or loss of wildlife habitat	Loss of habitat connectivity in the Blackfoot Subbasin	Decreasing reproduction (fitness)	Loss of genetic viability	Loss of population viability
Physical Road Issues	Contribution	VH	VH	VH	n/a	VH	VH
	Irreversibility	H	H	H	n/a	H	H
Incompatible Grazing	Contribution	M	M	M	n/a	M	M
	Irreversibility	L	L	L	n/a	L	L
Human-Caused Mortality	Contribution	n/a	n/a	n/a	VH	VH	VH
	Irreversibility	n/a	n/a	n/a	VH	VH	VH
Presence of Bear Attractants	Contribution	n/a	n/a	n/a	M	M	H
	Irreversibility	n/a	n/a	n/a	M	M	M
Motorized Vehicle Use	Contribution	VH	VH	H	H	H	VH
	Irreversibility	H	H	M	M	M	M
Mining	Contribution	M	M	M	M	M	M
	Irreversibility	VH	VH	VH	VH	VH	VH
Non-motorized Recreational Use	Contribution	M	M	M	M	M	M
	Irreversibility	M	M	M	M	M	M
Unplanned Residential and Resort Development	Contribution	VH	VH	VH	VH	VH	VH
	Irreversibility	VH	VH	VH	VH	VH	VH
Exotic/Invasive Species	Contribution	n/a	H	n/a	n/a	n/a	n/a
	Irreversibility	n/a	VH	n/a	n/a	n/a	n/a
Lack of Human Tolerance	Contribution	H	H	H	H	H	H
	Irreversibility	M	M	M	M	M	M
Climate Change	Contribution	M	M	H	H	M	H
	Irreversibility	VH	VH	VH	VH	VH	VH

3.4.3 Summary of Threats

Table 3.29 provides a synthesis of all 20 subbasin threats and illustrates the relative impact of each threat to individual targets and to the subbasin as a whole. The highest ranking threats are those that have the greatest impact on the greatest number of conservation targets in the subbasin. Although low ranking threats may not have a large impact on the subbasin as a whole, they can have a disproportionately large impact on a single conservation target (e.g., the threat of human-caused mortality to grizzly bears).

The cumulative impact of threats results in an overall subbasin threat rank of *very high*, indicating that all of the conservation targets face some threat of degradation or destruction across portions of the subbasin over the next ten years. A *very high* rating suggests that, without conservation action, the viability of conservation targets within the subbasin will decline. This synthesis provides the foundation for development of the Blackfoot Subbasin Management Plan (Section 5.0). Conservation objectives and strategic actions outlined in the Management Plan are designed to abate the critical threats in the subbasin, thereby ensuring the long-term viability of conservation targets.

Table 3.29 Summary of Threats to Blackfoot Subbasin Conservation Targets.

Targets → Threats ↓		Native Salmonids	Herbaceous Wetlands	Moist site and Riparian Vegetation	Native Grasslands and Sagebrush Communities	Mid to High-Elevation Coniferous Forest	Low-Elevation Ponderosa Pine and Larch Forest	Rural Way of Life	Grizzly Bear	Overall Threat Rank
		1	2	3	4	5	6	7	8	
1	Unplanned Residential and Resort Development	High		High	High	Medium	Very High	Very High	High	Very High
2	Climate Change	Very High	High	High	High	High	Very High	High	High	Very High
3	Exotic/Invasive Species	High	High	Medium	High	High	High	High	Medium	High
4	Lack of Fire			High	High	Medium	Very High	High		High
5	Incompatible Forestry Practices	High	Low			Medium	Very High			High
6	Physical Road Issues	High				Medium	High		High	High
7	Conversion to Agriculture		High	Medium	High					High
8	Mining	High							High	High
9	Motorized Vehicle Use			Medium	Medium	Medium	Medium		High	Medium
10	Incompatible Grazing	High	Medium	Medium	Medium				Low	Medium
11	Drainage and Diversion Systems	High	Medium	Medium						Medium
12	Channel Alteration	High		Medium						Medium
13	Epidemic Levels of Native Insects and Pathogens					Medium	High			Medium

Table 3.29 (continued).

Targets → Threats ↓		Native Salmonids	Herbaceous Wetlands	Moist site and Riparian Vegetation	Native Grasslands and Sagebrush Communities	Mid to High-Elevation Coniferous Forest	Low-Elevation Ponderosa Pine and Larch Forest	Rural Way of Life	Grizzly Bear	Overall Threat Rank
		1	2	3	4	5	6	7	8	
14	Non-motorized Recreational Use	High							Medium	Medium
15	Existing Crop Production		Medium							Low
16	Filling of Wetlands		Medium							Low
17	Lack of Human Tolerance								Medium	Low
18	Human-Caused Mortality								Medium	Low
19	Altered Wildlife Use Patterns				Low					Low
20	Presence of Bear Attractants								Low	Low
Threat Status for Targets and Subbasin		Very High	High	High	High	High	Very High	High	High	VERY HIGH

3.4.4 Description of Threats

In the following pages, we describe 20 subbasin threats and their impacts on subbasin conservation targets. Although these threats are considered obstacles to sustaining viable occurrences of native fish, wildlife and habitats in the subbasin, they also present excellent opportunities for collaboration and conservation action. In the Blackfoot Subbasin, these types of natural and community resource challenges have historically spurred cooperation and communication to better manage and protect natural resources and rural way of life. Many of the factors considered subbasin threats (e.g., incompatible forestry practices, incompatible grazing) can, in fact, be used as progressive management tools when practiced sustainably. By embracing these opportunities, partners in the subbasin will be better able to sustain a landscape that is ecologically and socioeconomically resilient and adaptive.

3.4.4.1 Unplanned Residential and Resort Development – Very High ²⁴

Targets Affected: native salmonids, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

Description: Community members and conservation partners recognize that development is not inherently detrimental. In fact, in portions of the subbasin, there is a critical need for sustainable development and affordable housing to support rural communities and the rural way of life. This threat refers to *unplanned* residential and resort development that is *dispersed*. Dispersed development refers to construction of structures and associated infrastructure, such as driveways and outbuildings, outside of existing towns and on lands that were previously unimpacted by permanent human habitation.

Implications: Disturbance from unplanned, dispersed development affects all conservation targets in the subbasin. Some of these impacts are highlighted below:

- Many new homes and resorts built in the subbasin are “view properties” situated in low and mid-elevation forests, native grassland/sagebrush communities, and riparian habitats along the Blackfoot River and its tributary streams. New construction in these areas results in direct habitat loss, fragmentation and degradation.
- When development occurs in close proximity to streams and rivers, riparian vegetation may be impaired and the natural flooding regime that helps to maintain riparian communities may be altered. Dispersed residential development can have multiple impacts on riparian communities, particularly in light of the fact that there is currently no stream setback zoning in any of the three Blackfoot Subbasin counties. Under Montana law, counties can adopt stream setback zoning ordinances, but the issue of stream setbacks is a politically charged one that invokes issues of property rights. Recent attempts to pass statewide legislation to require setbacks on certain streams failed in the

²⁴ Overall (subbasin-wide) threat ranks from Table 3.25 are provided next to each threat.

2009 legislature. While setbacks may be an effective way to reduce riparian encroachment, the issue is sufficiently contentious as to make this a highly uncertain remedy.

- Residential and resort development and associated human activity near streams, lakes, and rivers can also impact native salmonids. Increased water use can lead to reduced stream flows, elevated stream temperatures, and further constraints on rearing habitats and migratory corridors. In and downstream of Seeley Lake, for example, urbanization, septic systems and channel encroachment pose a direct threat to water quality and native salmonid habitat.²⁵ Throughout the USFWS-designated Upper Clark Fork Recovery Unit, growth and residential development are considered to be among the greatest threats to the recovery of bull trout. Impacts to spawning and rearing streams are of particular concern (USFWS 2002). Some of these impacts may be partially mitigated by an active program to acquire conservation easements to protect fragile lands in riparian zones. Missoula County subdivision regulations require developers to map areas with riparian vegetation and create a management plan for those areas (Missoula County 2008). This regulation is limited in its scope and extent in terms of protection for riparian areas and can be difficult to enforce. Missoula County Rural Initiatives is currently evaluating multiple regulatory and non-regulatory mechanisms for providing better riparian protection.²⁶
- Dispersed development leads to an increase in open road density and road use. Numerous studies have shown the negative effects of open road densities on wildlife, which include wildlife displacement and increased mortality due to wildlife-vehicle collisions (Trombulak and Frissell 2000).
- Resorts, homes and associated infrastructure and human activity create new sites and new opportunities for noxious and invasive weeds, especially new invaders.
- Dispersed development results in expansion of the wildland-urban interface (WUI), or the zone where structures and other human development are within the vicinity of forests and other wildlands. Expansion of the WUI increases the threat of wildfire to human life and property, thereby increasing the demand for fire suppression and raising the cost of infrastructure for fire fighting and emergency services. Continued fire suppression is a particular threat to subbasin forest targets (especially low elevation forests where the majority of development is located) that have been altered from their historic structure and composition after ~100 years of fire suppression and logging. Where residences are dispersed throughout forest habitats, efforts to allow the natural process of fire to return, even on a small scale, are problematic. Instead, the focus shifts to reducing the threat of wildfire via pre-commercial thinning and other fuels reduction projects. This type of forest management may not generate the revenue of a commercial timber sale, and it may reduce habitat for Canada lynx and other interior forest species.

²⁵ There are current efforts underway to upgrade the water treatment facility in the town of Seeley Lake and to fund a wastewater treatment facility.

²⁶ See <http://www.co.missoula.mt.us/rural/StreamProtection/index.htm> for more information.

- Dispersed development leads to degradation and loss of habitat for grizzly bears, Canada lynx, wolverine, fisher and other wildlife species, many of which are nested subbasin conservation targets.²⁷ Riparian zones, for example, provide excellent habitat and cover for bears moving throughout the subbasin, but they are also among the most desired locations for building (Lolo National Forest 2003). For wide-ranging species, unplanned development leads to loss of habitat connectivity within the subbasin and, on a larger scale, between the Crown of the Continent Ecosystem and other historic or potential ranges. An increase in development also leads to more frequent conflicts between bears and people due in large part to the increased presence of bear attractants. Human garbage, dog food and bird seed can condition and habituate bears, leading to more interactions and conflicts with people. These factors can lead to human-caused grizzly bear mortality, which in turn results in a decrease in grizzly bear reproduction and loss of population and genetic viability.

3.4.4.2 Climate Change – Very High

Targets Affected: native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

Description: Climate change is caused by the emission of heat-trapping gases – mostly carbon dioxide (CO₂) – from vehicles, industry, power plants, and deforestation. As these gases build up, they act like a thick blanket, heating the planet, changing the climate, and threatening human health, the economy, and the natural environment. The terms *global warming* and *climate change* are often used interchangeably, but the two phenomena are different. *Global warming* is the rise in global temperatures due to an increase of heat-trapping carbon emissions in the atmosphere. *Climate change*, on the other hand, is a more general term that refers to changes in many climatic factors (such as temperature and precipitation) around the world. These changes are happening at different rates and in different ways.²⁸

Implications: The potential impacts of climate change in the Blackfoot Subbasin are widespread. Throughout the region, warmer temperatures have already resulted in upward latitudinal and elevational movement for many insects, birds, trees and forbs. Species dependent on high-elevation habitats—species limiting the dispersal options for many plants and animals living there—are especially vulnerable in a warming climate. The pika, a small mammal of high elevation habitats, has been shown to stop feeding at temperature thresholds now common throughout Montana summers, with even short periods of exposure to temperatures of 88 °F being directly lethal (Smith 1974). As glaciers and alpine snow fields melt in Montana, so does the specialized habitat for bird species such as the White-tailed Ptarmigan and both Black and Gray-crowned Rosy Finches. Climate change in Montana is also diminishing habitat for forest

²⁷ Nested subbasin conservation targets are described in Section 3.3.3.

²⁸ Overview of climate change is from The Nature Conservancy's Climate Change Initiative website (<http://www.nature.org/initiatives/climatechange>).

carnivores, such as Canada lynx, whose hunting success is associated with snow conditions that are now changing with winter warming (Stenseth et al. 2004), and for high elevation forest plants such as whitebark pine, an important food source for grizzly bears and other birds and mammals throughout the Crown of the Continent and Greater Yellowstone Ecosystems (Kendall & Arno 1990). Whitebark pine is susceptible to increased mortality as the incidence of drought, high elevation wildfire, and mountain pine beetle attacks, all associated with a warming climate, increase (Hanna et al. 2009).

A warming climate also appears to be affecting species migrations on a large scale. Over the last 40 years, during which the United States has experienced an average January temperature rise of 5 °F, 60% of bird species wintering in North America have moved northward an average of 35 miles. Northward movement was documented for 19 bird species that occur in Montana, including movement of hundreds of miles for some species (Spruce Grouse: 316 miles; Cedar Waxwing: 190 miles; Northern Flicker: 192 miles; Northern Pintail: 90 miles; Red-tailed Hawk: 82 miles). According to researchers, global warming is the only explanation for why so many birds over such a broad area are wintering in more northern locales. Since warming has been most pronounced in the north, states such as Montana have recorded an influx of more southern species and could see some northern species retreat into Canada as ranges shift (Hanna et al. 2009).

While wildfire is natural within ecological systems and favors regeneration of many native species, the intensity and frequency of fires across the landscape will likely increase due to the combined effects of warming climate and increased tree densities from fire suppression. Wildfire frequency and intensity have already increased in the northwest United States, and nearly all climate projections predict that this fire trend will continue and increase. Insect infestations, such as those of the mountain pine bark beetle, will likely increase over time (ISAB 2007), which will kill more trees and increase combustible fuels.

Very little is known about how climate change will affect vegetation communities. New research in the western United States suggests that, in some cases, climate change may cause a shift in dominance toward invasive species while in other cases, climate change may lead to a retreat of some invasive species (Bradley et al. 2009).

Changes in hydrology and temperature may negatively affect stream habitats and aquatic species. This is especially true for salmonid species. Several projections of the potential impact of climate change on cool and cold water fishes have been completed. One of these analyses suggests that temperature increases alone will render 2% to 7% of current trout habitat in the Pacific Northwest unsuitable by 2030, 5% to 20% by 2060, and 8% to 33% by 2090 (Kinsella 2008, ISAB 2007). In the Columbia Basin, recent projections of the loss of suitable bull trout habitat as a result of climate warming range from 22% to 92% (ISAB 2007). Climate change has the potential to affect most freshwater life history stages of bull trout and other fall-spawning species. Increased frequency and severity of flood flows during winter can affect over-wintering juvenile fish and incubating eggs in the streambed. Eggs of fall-spawning fish such as bull trout suffer an increased risk of mortality from winter flooding and fry run the risk of premature emergence during warmer winters (ISAB 2007).

Although climate change ranks among the highest threats to subbasin conservation targets, the subbasin technical work groups elected not to focus specific strategic actions on abating this threat. Rather, through subbasin planning, our goal is to build resilience in ecological systems and communities throughout the subbasin so that, even as climate conditions change, the subbasin may support its full range of native biodiversity and ecological processes. Building resilience includes maintaining intact, interconnected landscapes and restoring fragmented or degraded habitats. For the most part, the threat of climate change originates outside of the subbasin and will therefore require large-scale (or landscape level) solutions that extend beyond subbasin boundaries (see *External Threats* in Section 3.4.5).

3.4.4.3 Exotic/Invasive Species – High

Targets Affected: native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

Description: Since European settlement, many non-native species have been introduced to the Blackfoot Subbasin. These exotic species represent a variety of life forms and affect multiple conservation targets. In their native habitats, plant and animal populations are kept in check by predators, food supply and other natural controls. However, when a species is introduced (accidentally or intentionally) into a new landscape, it has the potential to spread unchecked, displacing native species and causing ecological disruption. All habitats are vulnerable to these invasions, from grasslands and forests to lakes, rivers and wetlands. Invasive species damage the lands and waters that native plants and animals need to survive, as well as local economies. Worldwide, the estimated damage from invasive species totals more than \$1.4 trillion – five percent of the global economy.²⁹ In the Blackfoot, existing invasive species must be aggressively managed to limit impacts to conservation target species and communities. At the same time, the potential for new invaders in the subbasin must be mitigated through preemptive actions.

Implications: The implications of exotic and invasive species in the subbasin vary depending on the invader and the conservation target species or community affected. Significant invaders (and potential invaders) in the Blackfoot Subbasin are discussed below.

Non-native fish species

Introduction of non-native fish species in rivers, streams, and lakes in the Blackfoot Subbasin poses great concern for the viability of native salmonids and aquatic ecosystems. The tools available to mitigate this threat are limited and, in many cases, there is strong public opposition to controlling or eliminating fish (salmonids, in particular) that are considered valuable for sport fisheries. Still, this issue is a high priority: intact native fish ecosystems are increasingly rare and substantial resources must be allocated to protecting and restoring those that remain (USFWS

²⁹ Information on worldwide impacts of invasive species is from The Nature Conservancy's Invasive Species Initiative website: <http://www.nature.org/initiatives/invasivespecies>.

2002). Background information on non-native fish in the Blackfoot Subbasin is provided in Section 3.2.6.3. A brief discussion of the threats associated with each species is provided below.

Brook trout: Brook trout have vastly increased their distribution and abundance and now pose a threat to native cutthroat trout and bull trout. Brook trout have replaced populations of both species in certain waters (Rieman et al. 2006, Dunham et al. 2002, Leary et al. 1983).

Brown trout: Brown trout are suspected to adversely affect bull trout (Pratt and Huston 1993), although the nature of the negative interaction between bull trout and brown trout, which is thought to include elements of competition and predation, is not well understood. Recent work in Japan shows that brown trout can hybridize with chars closely related to bull trout (Kitano et al. 2009); a result that could lead to further erosion of reproductive potential in depressed bull trout populations. The influence of habitat improvement efforts in the Blackfoot Subbasin on the relative abundance of brown trout and bull trout is being investigated under the current MFWP monitoring program (Pierce et al. 2004, Pierce and Podner, 2006, Pierce et al. 2008). These investigations suggest that both westslope cutthroat trout and bull trout are expanding and brown trout are declining in certain streams where restoration actions have led to suitable habitat conditions for native fish. Angling regulations in the Blackfoot Subbasin have been liberalized to focus angler harvest on brown trout.

Rainbow trout: Hybridization with rainbow trout is believed to be the greatest threat across the range of native westslope cutthroat trout (Behnke 2002). Hybridization has occurred primarily in the lower Blackfoot Subbasin within the range of naturalized rainbow trout (Pierce et al. 2008). In a recent study, hybrid offspring of rainbow trout and westslope cutthroat trout were shown to have dramatically reduced reproductive success (Muhlfeld et al. 2009).

Asian carp: All four species of Asian carp (bighead, black, grass, and silver) listed as Priority Class 1 Aquatic Nuisance Species³⁰ in Montana grow quickly and feed voraciously on a variety of aquatic species including mollusks, aquatic insects, and plankton. The impacts of Asian carp in the United States vary by species, but are likely to include competition with native species for food resources, eliminating vegetation, increasing nutrients, eradicating habitat for native fishes and impacting native mussel and snail populations.

Other Fish: MFWP no longer stocks largemouth bass (or other warmwater fish) within the Blackfoot Subbasin and only plants arctic grayling and kokanee salmon on a very limited basis. Interactions between largemouth bass and native salmonids are unknown. Illegal stocking of northern pike, yellow perch and walleye has occurred in the Blackfoot Subbasin, and poses a significant risk to native species in some areas including the Clearwater lakes (MBTSG 1995, USFWS 2002).

³⁰ Priority Class 1 Aquatic Nuisance Species are currently not known to be present in Montana but have a high potential to invade. There are limited or no known management strategies for these species. Appropriate management for this class includes prevention of introductions and eradication of pioneering populations (see Section 3.2.6.3).

Non-native invertebrates³¹

Only one of the species listed in this section (New Zealand mudsnail) is currently found in Montana, and none of these species are currently found in the Blackfoot Subbasin. Although the likelihood of introduction varies by species, all have the potential to be introduced to the state and to the subbasin and therefore warrant attention as potential threats to the viability of native salmonids and aquatic systems in the subbasin.

New Zealand mudsnail: New Zealand mudsnails degrade habitat due to their high reproductive capacity and the subsequent impacts on invertebrate food sources. Abundant snail populations may outcompete other grazers and inhibit colonization by other macroinvertebrates. Effects of the New Zealand mudsnail on native aquatic invertebrates are being documented in the Madison River and in Darlington Ditch, a small stream along the lower Madison River (Montana ANS Technical Committee 2002).

Mud bithynia/faucet snail: The mud bithynia has been known to reduce species richness of mollusks in Oneida Lake, NY, although it also decreases in abundance after colonization by invasive zebra mussels. It has also been known to infest municipal water supplies.

Zebra and quagga mussel: In addition to their fouling impacts on human infrastructure (e.g., colonizing and restricting water flow in water supply pipes, engine cooling systems, irrigation systems and fishing gear), zebra and quagga mussels can have severe impacts on the ecosystems they invade by filtering substantial amounts of phytoplankton and suspended particulates from the water. Water clarity increases with filtration, causing an increase in light penetration and a proliferation of aquatic plants that can change species dominance and alter the entire ecosystem. Ecological effects radiate throughout the aquatic system, including impacts to macroinvertebrates and fish. Although zebra and quagga mussels are not currently present in Montana, they could easily survive overland transport to Montana while attached to boat hulls or in live wells, engine cooling systems or bait buckets. In the western United States, zebra and quagga mussels have significant potential to disrupt irrigation systems, fish passage facilities, and cause ecological and economic damage (Montana ANS Technical Committee 2002).

Non-native parasites/pathogens

Whirling disease is a current threat to aquatic systems in the Blackfoot Subbasin. Whirling disease affects fish in the trout and salmon family. By damaging cartilage, whirling disease can kill young fish directly, or cause diseased fish to swim in an uncontrolled whirling motion. This can make it impossible for them to escape predators or to effectively seek food. Habitat for the intermediate host worm (*Tubifex tubifex*) is associated with areas of fine sediment and warm water temperatures. Mainstem and lower tributary areas appear to be the most vulnerable sites, although the distribution of suitable habitat might expand through further habitat degradation and warming linked to reduced stream flows and climate change. Once established in a stream, the parasite cannot be eradicated, nor can its intermediate host, without significantly damaging the ecosystem (Pierce et al. 2008, Montana ANS Technical Committee 2002).

³¹ Information on non-native invertebrates, parasites, and pathogens is from the USGS Nonindigenous Aquatic Species fact sheets (<http://nas.er.usgs.gov>) and the Montana ANS website (<http://fwp.mt.gov/fishing/fishingmontana/ans>).

Other parasites and pathogens listed in Section 3.2.6.3 do not currently exist in Montana but warrant careful attention to avoid potential introduction. More information is available on the Nonindigenous Aquatic Species fact sheets (<http://nas.er.usgs.gov/>).

Non-native plants

Among the noxious weeds present in the Blackfoot Subbasin, some, such as spotted knapweed, infest tens of thousands of acres. Others, such as leafy spurge, are limited in their geographic distribution but are nearly impossible to eradicate due to their extensive root systems and herbicide resistance. A detailed discussion of non-native plants in the Blackfoot Subbasin is provided in Section 3.2.7.3. Appendix G provides a list of weeds classified by the State of Montana as “noxious.” Table 3.7 lists noxious weeds established in the Blackfoot Subbasin. Table 3.8 lists well-known weeds with high potential to become problem plants in the subbasin, and Table 3.9 includes an alert list for recently invading or less well-known weeds, along with risk ratings for Blackfoot Subbasin habitats.

Tame, naturalized pasture grasses fall into a category of “quasi-desirable” non-native plants. They are valuable for agriculture and are routinely planted for such purposes. Several of these species, however, such as Kentucky bluegrass and smooth brome, are sod-forming and spread aggressively into grassland and wetland communities where they compete for resources with native species. Another highly invasive species affecting wetlands is reed canarygrass, although authorities question whether reed canarygrass is native or non-native to this region.

Although not classified as a noxious weed in Montana, cheatgrass is a weed of concern in many parts of the state, including the Blackfoot Subbasin. In recent years, cheatgrass has established and spread on undisturbed, dry, scabby sites across low elevations in the subbasin. Cheatgrass is only palatable to livestock during a very short period in the spring. It is extremely flammable and therefore a significant fire hazard. In many situations, cheatgrass can impose significant economic costs, reducing crop yields and lowering weight gain of grazing livestock.

The spread of exotic plants into subbasin plant communities alters species composition and structure and, in many cases, degrades habitat for wildlife. Forest management activities such as timber harvest and road building can disturb soils, particularly at low elevations, and increase the spread and establishment of invasive species in these forests. Improper herbicide application may also impact native plant communities and water quality. Managing invasive species drains resources away from ranches and farms, impacting the rural way of life in the Blackfoot Subbasin.

The spread of non-native aquatic plants can also cause significant economic and ecological problems. Non-native plants that colonize aquatic communities compete with and often displace native species. Hydrilla and Eurasian watermilfoil, for example, are both well known for their ability to alter physical and biological functions of aquatic systems. Emergent species such as purple loosestrife reduce wildlife cover and habitat. Saltcedar degrades wetlands, completely drying up some lakes, ponds and river areas. Although none of these plants is currently present in the Blackfoot Subbasin, all have the potential to be introduced and therefore warrant attention as potential threats to the viability of native plants and plant communities in the subbasin. Pathways

for introduction of aquatic plant species include boats and trailers, the aquarium trade, nursery and garden centers, and mail order and internet suppliers (Montana ANS Technical Committee 2002).

White pine blister rust

White pine blister rust, a disease caused by the non-native fungus *Cronartium ribicola*, poses a major threat to high elevation whitebark pine stands and their ecosystems. The rust fungus was introduced in shipments of nursery stock from Europe to the United States and Canada in the late 1800s and early 1900s (Hoff & Hagel 1989, USDA Forest Service 1991). The fungus thrives in cool, wet environments and attacks whitebark pine and other five-needle pine species across their ranges, causing galls that eventually girdle branches and stems. Gooseberry and currant species serve as alternate hosts.

An estimated 80% to 90% of whitebark pines in Glacier National Park and the Bob Marshall Wilderness area, just north of the Blackfoot Subbasin, are infected with blister rust (Schmidt 1992). In the Blackfoot Subbasin, whitebark pine occupies only an estimated five percent of the total forest cover. This limited distribution makes it a high conservation priority. Whitebark pine seeds are an important dietary component for many species of birds and mammals (Kendall & Arno 1989, Schmidt 1992, Reinhart et al. 2001). For grizzly bears, seasonal variation in food supply can influence mortality. In Yellowstone National Park, variation in seasonal production of whitebark pine seed was correlated with grizzly bear mortality. Grizzly bear deaths nearly doubled during years when whitebark pine seed crops failed, causing bears to forage in lower elevations that are often dominated by human uses and contain attractants that can lead to an increased frequency of contact with humans, conflicts, and eventual mortality (Pease and Mattson 1999).

Different approaches have been used to address white pine blister rust, including breeding of rust-resistant seedlings (Neuenschwander et al. 1999, Sniezko et al. 2000, Hunt 2002) and gooseberry and current eradication programs in eastern forests (Tainter & Baker 1996). Because whitebark pine is not a commercially important species for timber, however, it has not received much attention in terms of resistance breeding (Campbell 2004).

3.4.4.4 Lack of Fire – High

Targets Affected: moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

Description: Federal and state land management agencies have been very successful at suppressing wildfires throughout the United States for over 100 years. In the Blackfoot Subbasin, the lack of fire has impacted a range of vegetation communities, from the prairie-dominated lowlands to high elevation coniferous forests. The lack of fire in these communities has contributed greatly to altered plant species composition and structure as well as altered and degraded wildlife habitat.

Implications: Fire suppression has affected vegetation target communities throughout the Blackfoot Subbasin. A discussion of the effects of fire exclusion on subbasin targets is provided in individual conservation target descriptions (Sections 3.3.3.4-3.3.3.6). To summarize, fire exclusion in low elevation ponderosa pine/western larch forests, in combination with timber harvest practices over the past century, has greatly altered forest species composition, age class distribution, and structure. In the absence of fire, many low elevation forests in the Blackfoot Subbasin are characterized by closely-spaced, small diameter trees. Increased tree density in forest stands leads to water stress, increased susceptibility to insects, diseases, and stand-replacing fires, and generally reduced resiliency of trees.

Because the historic fire return interval is longer in mid to high elevation coniferous forests than in low elevation ponderosa pine/western larch forests, lack of fire in this forest type has not had as drastic an effect on stand composition. Lack of fire (in combination with timber harvest) has, however, significantly altered the historic age class distribution, structure, patch size and distribution of mid to high elevation coniferous forest stands. Historically, fire created a mosaic of forest patches of various size and age classes across the landscape. Without this natural disturbance process, patches have become larger and more uniform.

Severe fire was likely a component of the historic fire regime in both low and mid to high elevation coniferous forests (Hutto 2008). Fire exclusion, however, has permitted a buildup of forest fuels (both downed woody debris and ladder fuels) so that much larger expanses of forest are susceptible to stand replacing fires. Some areas have also become more susceptible to insect infestations in the absence of fire. In high elevation coniferous forests, whitebark pine stands infected with white pine blister rust are more susceptible to wildfire.

Historic fire regimes in native grassland/sagebrush communities were also characterized by frequent, low to moderate severity fires (Morgan et al. 1998). In the absence of frequent wildfires, native grassland/sagebrush communities are lost to conifer encroachment. Some types of moist site and riparian vegetation, most notably quaking aspen stands, are rejuvenated or even established by fire. In the absence of periodic fires, these aspen stands grow decadent, exhibit poor clonal regeneration, and may eventually be encroached upon and replaced by other woody plant species, particularly conifers.

3.4.4.5 Incompatible Forestry Practices – High

Targets Affected: native salmonids, herbaceous wetlands, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

Description: Forestry has been a dominant land use in the Blackfoot Subbasin for over 100 years. Many drainages in the subbasin have been logged. Incompatible forestry practices with impacts on forest, riparian and aquatic habitats include road construction, log skidding, harvest in riparian areas, clear-cutting, terracing and log drives on the Blackfoot and Clearwater Rivers (MBTSG 1995, USFWS 2002). Although these activities occurred predominantly in the past, present activities occasionally exacerbate historical problems. For over 10 years, public land

management agencies and industrial timber companies have followed Forest Best Management Practices (BMPs) mitigating many of these resource impacts.

Implications: Over 100 years of logging in low elevation ponderosa pine/western larch forests and mid to high elevation coniferous forests has resulted in the removal of many large diameter trees and an overall shift in forest structure, composition and age class distribution away from the historic range of conditions. In aquatic communities, the impacts of past forestry practices include increased sediment in streams, increased peak flows, hydrograph and thermal modifications, loss of instream woody debris and channel stability, and increased accessibility for anglers and poachers (USFWS 2002). Impacts associated with past forestry practices are major contributing causes of bull trout decline. Silvicultural impairment to water quality has been noted in the following drainages (MDHES 1994, USFWS 2002):

Bear Creek	Belmont Creek	Black Bear Creek
Blanchard Creek	Blanchard Creek	Braziel Creek
Buffalo Gulch	Camas Creek	Chamberlain Creek
Cottonwood Creek	Deer Creek	Dunham Creek
East Fork Ashby	Elk Creek	Gallagher Creek
Jefferson Creek	Keno Creek	Marcum Creek
McElwain Creek	Monture Creek	Murray Creek
Poorman Creek	Richmond Creek	Rock Creek
Union Creek	Upper Nevada Creek	Wales Creek
Ward Creek	Warren Creek	Washington Creek
Washoe Creek	West Fork Ashby	Yourname Creek
North Fork Blackfoot	West Fork Clearwater	Blackfoot River (Landers Fork to Monture Creek)

Current forestry practices can also negatively impact terrestrial and aquatic habitats in the subbasin. Current forestry practices to reduce the risk of fire in the wildland-urban interface, for example, can negatively affect subbasin forest types if they do not follow an ecosystem restoration prescription. Impacts of current forestry practices on herbaceous wetlands include piling slash in wetlands, road building in and near wetlands, failure to maintain buffers around wetlands and driving through wetlands. These activities are prohibited by Forest BMPs; however some may still occur on private lands.

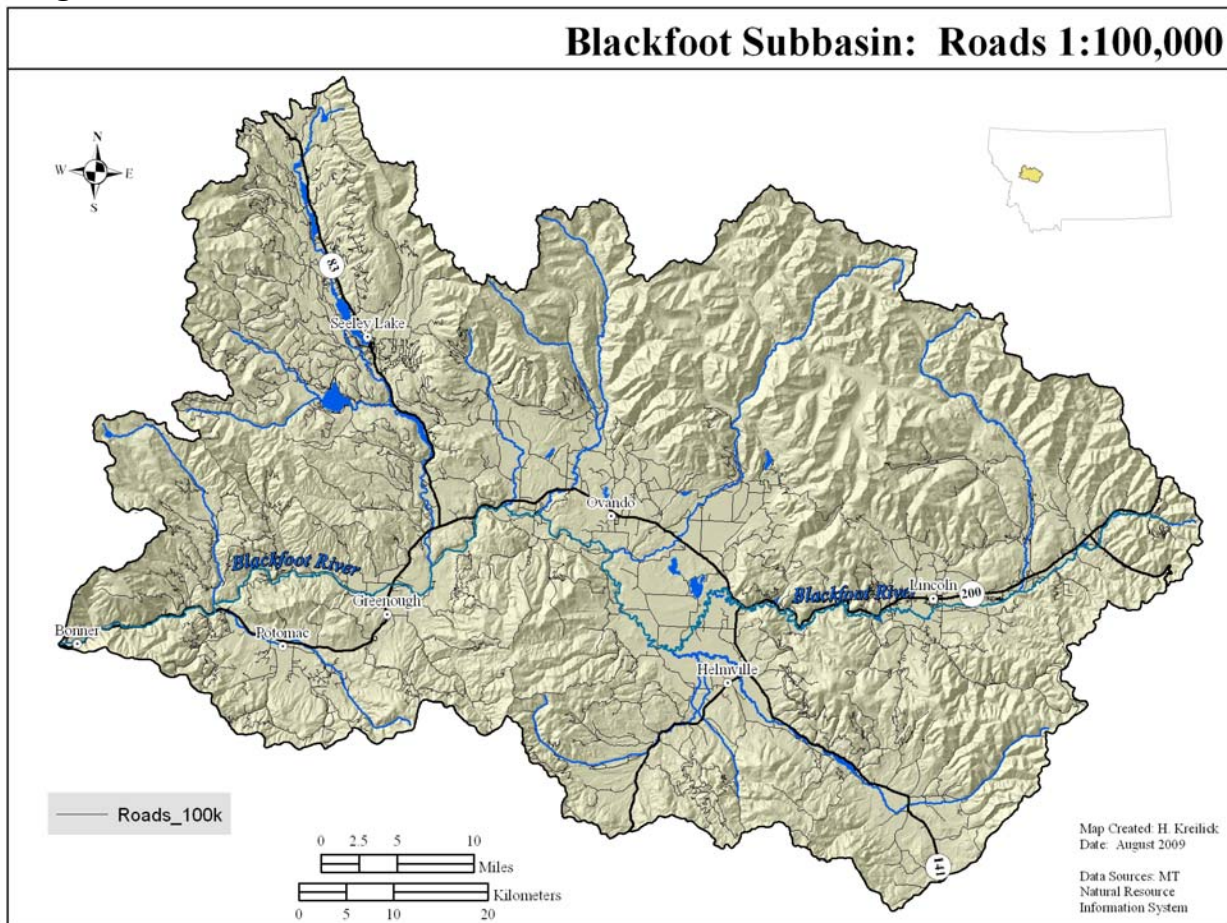
3.4.4.6 Physical Road Issues – High

Targets Affected: native salmonids, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

Description: Roads and road density are key factors affecting both terrestrial and aquatic systems in the Blackfoot Subbasin. Although the Blackfoot Subbasin includes substantial roadless areas, including parts of two federally-designated Wilderness areas, portions of the subbasin have extensive road networks associated mainly with past timber harvesting on national forest and

private timber company lands (Figure 3.35). The Highway 200 corridor along the mainstem Blackfoot River and the associated county road system are also key parts of the subbasin road network. As new homes are built away from the main highway corridor, the subbasin road network expands, impacting water quality, wildlife and weed management. For the purposes of the Blackfoot Subbasin Plan, this threat refers to the physical presence of roads. The impacts of road use on subbasin conservation targets are addressed in the *motorized vehicle use* threat.

Figure 3.35 Roads 1:100,000.



Implications: High road density is correlated with declines in aquatic habitat quality and native salmonids (USFS 1996). Road construction methods during the late 19th and early 20th centuries that involved stream/river channelization and straightening negatively affected aquatic habitat in the subbasin. Today, there are significant legacy effects of old roads including passage barriers, sediment production and unstable slopes (USFWS 2002). In addition, insufficient funding to maintain the existing road system has resulted in maintenance deficiencies, even on some well-designed roads, compounding the impacts of the existing road system (MDHES 1994, USFWS 2002).

Roads negatively affect water quality through chronic erosion of road surfaces and episodic failures of culverts at road-stream crossings that result in road sediments washing into streams (Lolo National Forest 2003). Improperly designed or installed culverts create barriers to the

movement of aquatic organisms and water and other natural materials, fragmenting and isolating populations, limiting access to spawning and rearing habitat, and altering the character of channels and associated habitats. Channel incisement associated with roads can also limit habitat access and impair habitat quality. Threats to native salmonids and aquatic habitat associated with Highway 200 and other heavily used roads in the subbasin include the risk of toxic spills and impacts associated with road grading, sanding, deicing and other road maintenance activities (USFWS 2002).

Roads and development are inextricably linked: roads facilitate new development and new development leads to expansion of the road network. The dispersed subbasin road network fragments forest habitat and facilitates the spread of noxious weeds. Habitat fragmentation by roads negatively impacts grizzly bears, bull trout, westslope cutthroat trout and other wide-ranging animals in the subbasin (e.g., Canada lynx, fisher, wolverine and gray wolf), leading to direct loss of habitat, loss of habitat connectivity within the subbasin and between the subbasin and adjacent habitats, and, ultimately, decreased population viability.

Impacts of roads on grizzly bears include: 1) direct mortality (collisions and human-caused death from encounters through an increase in the frequency and lethality of contact between people and bears), 2) displacement, 3) habituation and 4) habitat perforation and fragmentation. In the Blackfoot Subbasin, the presence of attractants for grizzly bears includes garbage at rest stops and homes, road-killed big game, tractor trailer food-cargo spills and roadside/highway-enhanced vegetation such as berries and grass. These food sources increase the susceptibility of grizzly bears to direct highway mortality. There have been three documented road-killed grizzlies in the Blackfoot Subbasin, one possible road-kill, several reports of collisions, and multiple reports of near misses (J. Jonkel, pers. comm.). The threat of vehicle mortality has widespread implications for grizzly bear reproduction, large-scale habitat connectivity and genetic viability.

3.4.4.7 Conversion to Agriculture – High

Targets Affected: herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities

Description: Agriculture is a critical component of the Blackfoot Subbasin economy. Ranchers play a vital role in conserving natural resources and the rural way of life in the subbasin. Roughly 14.5% of the total acreage in the Blackfoot is used for agriculture with livestock grazing characterizing the most common agricultural practice. This threat refers specifically to *new plowing and draining* in critical habitats within the Blackfoot Subbasin. Due to the conservation and restoration partnerships that started in the 1990s in the subbasin, new plowing and draining in critical habitats rarely occurs on private lands. The threat is listed as high to reinforce the implications listed below.

Implications: Conversion of ecologically critical habitats to agriculture results in habitat loss and degradation. In herbaceous wetlands, draining often occurs, altering the surface and groundwater

regimes that sustain these communities. Agricultural activity in or near riparian zones can result in bank destabilization, elevated water temperatures and increased sediment loads, among other problems (MBTSG 1995, USFWS 2002). Conversion to agriculture can also result in displacement of wildlife. The conversion of native grassland/sagebrush communities to agriculture, for example, is the primary factor responsible for the rangewide reduction in Columbian Sharp-tailed Grouse populations (Ulliman et al. 1998, PIF 2000).

3.4.4.8 Mining – High

Targets Affected: native salmonids, grizzly bears

Description: Numerous mines have been developed in the southern and eastern portions of the Blackfoot Subbasin. Mining in the headwaters of the Blackfoot River began in the mid-1800s. A variety of minerals including gold, silver, lead and copper were recovered from numerous small placer and hard rock mining operations (USFWS 2002). The Mike Horse Mine was the largest of several mines in the Heddleston District located between Lincoln and Rogers Pass. It produced gold, silver and lead during the first half of the 1900s. Continued exploration of the area after the Mike Horse Mine was closed in 1955 revealed a large deposit of copper and molybdenum. The Mike Horse tailings dam breached in 1975, resulting in acute and chronic contamination of the upper Blackfoot River (Stratus Consulting 2007), collapse of fisheries (Spence 1975, Peters and Spoon 1989, Pierce and Podner 2000, Pierce et al 2008), downstream movement of heavy metals, and biological uptake of toxins within the aquatic food web (Moore et al. 1991). The headwaters location of the mine and the toxic nature of existing contaminants continue to pose significant ecological risks to the mainstem Blackfoot River (Stratus Consulting 2007). The Heddleston Mining District has been the focus of some mine reclamation activity since 1993 (MDEQ 2003), although these have not addressed the ecological risks to the Blackfoot River (Stratus Consulting 2007).

The potential exists for new mining activity in the Blackfoot Subbasin. A large open-pit gold mine (the McDonald Gold Project) was proposed near Lincoln, but blocked by a 1999 state law resulting from a successful citizen-sponsored ballot initiative prohibiting new cyanide heap leach mining projects (USFWS 2002).

Implications: The legacy effect of past mining activities continues to impact aquatic habitat and fisheries in the subbasin. Impacts include the direct loss of aquatic habitat and, particularly in the upper portions of the drainage, chemical contamination. Mine drainage continues to contaminate waters in the Blackfoot Subbasin headwaters (Spence 1975, MBTSG 1995, Stratus Consulting 2007), although inflows of limestone groundwater below Lincoln enhance the river's buffering capacity against changes in pH and the effects of metals (Ingman et al. 1990). Impairment to water quality from mining activities has been noted in the following drainages (MDHES 1994, USFWS 2002, Pierce et al. 2008):

Blackfoot River (headwaters to Nevada Creek)	Beartrap Creek	Buffalo Gulch
Day Gulch	Douglas Creek	East Fork Ashby Creek
Elk Creek	Gleason Creek	Humbug Creek
Jefferson Creek	Keep Cool Creek	Mike Horse Creek
Moose Creek	Poorman Creek	Sandbar Creek
Sauerkraut Creek	Seven Up Pete Creek	Stonewall Creek
Union Creek	Upper Nevada Creek	Washington Creek
Washoe Creek	West Fork Ashby	Willow Creek

Any new mining activity in the Blackfoot Subbasin could pose a threat to native salmonids and aquatic habitat. New mining activity in the subbasin could also negatively affect grizzly bears. Depending on the size and type of mining operation, negative impacts could include: 1) direct habitat loss, 2) habitat degradation, 3) displacement of grizzly bears, 4) increased risk of habituation/food conditioning at the mine site (depending on how attractants are managed) and 5) cumulative negative impacts resulting from increased human population growth, development and recreation pressure in grizzly bear habitat.

3.4.4.9 Motorized Vehicle Use (On and/or Off Road) – Medium

Targets Affected: herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears

Description: Motorized vehicle use is one of many current uses in the subbasin. In particular, snowmobile, ATV and motorcycle use provide not only opportunities for recreation, but are also travel methods for private and public land managers and contractors accessing more remote areas. This threat primarily addresses motorized vehicle use on subbasin roads that have not been designated for public or administrative use as well as off-road motorized vehicle use. Impacts associated with the physical road network are described in Section 3.4.4.6.

Implications: Motorized vehicle use can directly impair vegetation communities, particularly off-road use in sensitive riparian areas, wetlands, grasslands and other plant communities. Use of motorized water craft in larger lakes and ponds may negatively impact Common Loons (a Species of Concern in Montana) and other wildlife. Motorized boats facilitate the spread of non-native species (invertebrates, plants and sometimes fish), cause erosion from their wake and can contribute to the petrochemical pollution of waters. Motorized vehicle use (both on and off-road) can also facilitate the spread of noxious weeds into native grasslands, forests and other plant communities and promote erosion and sedimentation in wetland and aquatic habitats.

Both on and off-road motorized vehicle use can result in disturbance to wildlife. Road density is usually higher at low elevations where grizzlies are concentrated in the spring. Road access management decisions, therefore, can impact grizzly bears (Lolo National Forest 2003). Roads

open to vehicle travel, especially during the spring, can displace grizzly bears, resulting in impairment of grizzly bear breeding and feeding. Road access can increase the frequency and lethality of contact between grizzlies and people. Hunting, ATV recreation and recreational road use by people who may be armed increases the probability that people will kill bears through: 1) self-defense killing from real or perceived risk of injury by bears, 2) malicious killing, and 3) mistaken identity killing of grizzly bears by black bears hunters. In some situations, private and public partners are employing increased human presence as a tool to deter grizzly and/or wolf-human conflicts.

Snowmobile trails are used by local clubs for recreation. Most large groups practice riding between communities and stay on the trails. In some areas, potential (and generally unintended) disturbance-related effects of snowmobile activity on grizzly bears include: 1) in-the-den disturbance, 2) disturbance at den emergence, 3) disturbance post emergence and 4) displacement from suitable denning habitat (Craighead and Craighead 1972). Potential impacts of snowmobile activity on Canada lynx include: 1) improved winter access and increased trapping mortality and 2) increased competition by bobcats and coyotes facilitated by compacted snowmobile trails (Ruediger et al. 2000). Potential impacts of snowmobile activity on wolverines include: 1) disturbance at the natal den and subsequent loss of recruitment and 2) improved access that facilitates increased take of legally trapped wolverines (Lolo National Forest 2000).

3.4.4.10 Incompatible Grazing – Medium

Targets Affected: native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, grizzly bears

Description: For centuries, grazing by ungulates (bison, deer, and elk) and livestock (cattle and sheep) has been a dominant land use and management tool in the Blackfoot Subbasin. Today, land managers recognize the important connections between grazing and vegetation management. Public and private landowners in the subbasin are experimenting with rest-rotation and temporary and permanent fencing practices to manage for healthy vegetation and reduce noxious weeds. One ranch has been using goats and sheep to reduce spotted knapweed for nearly 10 years. The threat of *incompatible* grazing includes such practices as overgrazing by both ungulates and livestock, locating cattle feed lots and calving yards along streams, and accessibility of calving yards to grizzly bears.

Implications: Historical cattle grazing in the Blackfoot Subbasin is a significant cause of bull trout decline. Although grazing impacts have decreased in recent years as a result of cooperative efforts between landowners and agencies, 65 streams or stream reaches in the Blackfoot Subbasin are still impacted by grazing practices or cattle feedlots (Pierce et al. 2008). Livestock grazing is of particular concern to native salmonids where allotments are located along spawning and rearing streams (USFWS 2002).

Loss of riparian vegetation due to excessive livestock grazing can result in reduced stream bank stability, increased erosion and sedimentation, and elevated water temperatures (Rieman and

McIntyre 1993, Ehrhart and Hansen 1998). Rieman and McIntyre (1993) concluded that temperature is a critical habitat characteristic for bull trout. Temperatures in excess of 59 °F are thought to limit bull trout distribution in many systems (Fraley and Shepard 1989). Excessive livestock grazing in riparian areas can also result in over-widened and unproductive stream habitat. Excessive livestock browsing of deciduous woody species in moist site and riparian vegetation communities can result in a lack of recruitment in young age classes and deviation from historic community composition and structure.

Incompatible grazing practices may also contribute to the spread of non-native species in native grassland/sagebrush communities, herbaceous wetlands, moist site and riparian communities, and other plant communities. Habitat degradation, including loss of native plant species diversity, can increase with season-long grazing or other incompatible grazing strategies. Overgrazing in uplands can result in reduced residual cover for nesting birds.

The major impact of incompatible livestock practices on grizzly bears is site conflicts resulting from access to calving yards, livestock feed and other livestock-related attractants (e.g., crystal licks, molasses licks, granaries). Such site conflicts often result in death to bears, particularly when repeated conflicts occur. Livestock operations that maintain large blocks of open rangeland can provide many benefits to the long-term conservation of grizzly bears, not the least of which is the maintenance of open space and habitats that support a wide variety of wildlife, including grizzlies. At the same time, livestock operators can suffer losses from bear depredation. These losses tend to be directed at sheep, calves and sometimes apiaries (MFWP 2006).

3.4.4.11 Drainage and Diversion Systems – Medium

Targets Affected: native salmonids, herbaceous wetlands, moist site and riparian vegetation

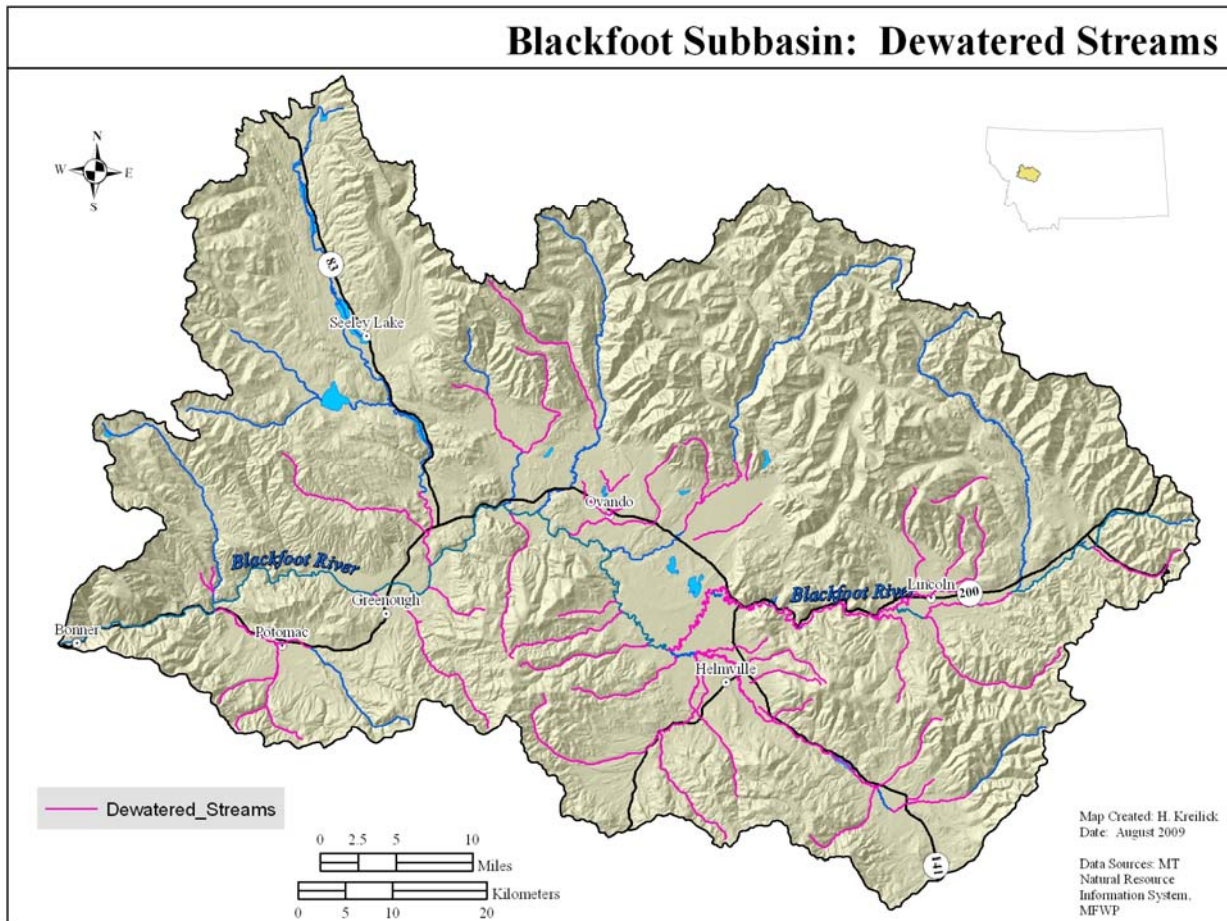
Description: Stream dewatering occurs naturally but is exacerbated in many cases by human activity. Drainage and diversion systems impact aquatic, wetland and riparian communities by altering the surface and groundwater flows that sustain them. Water is diverted from the Blackfoot River and its tributaries primarily for crop and livestock production. Coupled with the effects of an extended drought, stream dewatering is of great concern to both fisheries and water quality in the subbasin (BC 2005a).

Implications: Irrigation impacts and instream flow problems affect numerous streams and stream reaches in the Blackfoot Subbasin (Pierce et al. 2005).³² Diversions for irrigation can reduce flow, destabilize stream channels, interrupt migratory corridors (via blockages and dewatering) and entrain migrating fish (USFWS 2002). Lack of instream flows from dewatering and drought increases water temperature, limits fish passage, reduces survival and increases the spread of diseases among fish. In addition, lack of instream flows limits the transportation of sediment, nutrients and metals through the system leading to higher concentrations of these materials and impairments to water quality (MDEQ 2004, 2008a, 2008b).

³² A detailed discussion of water rights in the Blackfoot Subbasin is provided in Section 3.2.5.1.1.

Within the Blackfoot Subbasin, 194 river miles are periodically or chronically dewatered (Pierce et al. 2005) (Figure 3.36) (Appendix A). Natural dewatering occurs on 17 streams and 49 river miles. The upper Blackfoot River, for example, naturally becomes dewatered downstream of the Landers Fork. Human-caused dewatering occurs on about 45 streams and 165 river miles. The middle Blackfoot River, for example, includes 34 miles of human-related dewatering, most notably up and downstream of Nevada Creek. A combination of both natural and human-related dewatering occurs on eight streams (BC 2005a). In favorable flow years, the lower Blackfoot River from the North Fork to the mouth generally maintains flows sufficient to meet minimal aquatic needs and to satisfy relatively junior instream flow water rights. In low flow years, however, the lower Blackfoot may fall to less than 50% of minimum instream flow needs (BC 2005a).

Figure 3.36 Dewatered Streams.



Elevated water temperatures are common to streams that are heavily diverted and/or subject to receiving irrigation return flows (Pierce and Peters 1990, USFWS 2002). Water temperatures exceed the tolerance limits for bull trout in portions of many of these streams. Within the Blackfoot Subbasin, elevated water temperatures are found in Nevada, Douglas, Nevada Spring, Cottonwood, Willow, Union, and Elk Creeks and in the Clearwater River (MBTSG 1995, USFWS 2002, Pierce, 2004, 2006, 2008).

3.4.4.12 Channel Alteration – Medium

Targets Affected: native salmonids, moist site and riparian vegetation

Description: Channel alteration is associated with road corridors and levees that may constrain the channel migration zone. Stream banks have been armored in areas where natural bank erosion may threaten structures built too close to the channel, or where stream energy has been displaced by restrictions or channelization upstream. Channels have been intentionally straightened in areas where channel migration threatens property or structures and in an effort to gain access to or use of floodplain or stream migration zones. Some streams in the subbasin have been channelized for mining purposes or to drain wet meadows and increase hay production. Channel encroachment is caused mainly by development and land conversion for agricultural purposes.

Implications: Channel alteration and encroachment lead to riparian vegetation impairments, water quality impairments and physical habitat impairments (e.g., habitat elements and channel condition), all of which pose threats to native salmonid viability. Channel alteration also impacts the natural flood regime, which affects the viability of riparian vegetation communities. Forty streams in the Blackfoot Subbasin are currently identified with altered channels (Pierce et al. 2008).

Historically, the impact of channel encroachment was greatest in the valley-bottom agricultural lands. More recently, the impacts are associated with residential and resort development adjacent to streams. Landowners can exacerbate impacts by removing riparian vegetation or altering stream banks to gain stream access, improve views or protect vulnerable property within the flood plain and active channel migration zone.

3.4.4.13 Epidemic Levels of Native Insects and Pathogens – Medium

Targets Affected: low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

Description: Significant insect threats in the Blackfoot Subbasin include the mountain pine beetle in lodgepole, ponderosa, and whitebark pine, the Douglas-fir bark beetle in Douglas-fir, and the western pine beetle in ponderosa pine.

Implications: The abovementioned beetles are at epidemic proportions in subbasin forests, largely as a result of drought conditions since 2000. Insect infestations in subbasin forests have resulted in significant mortality of coniferous tree species. Impacts of extensive tree mortality

include increased risk of severe wildfires and, in the case of whitebark pine, reduced seed production and loss of this food source for grizzly bears and other subbasin wildlife.

3.4.4.14 Non-Motorized Recreational Use - Medium

Targets Affected: native salmonids, grizzly bears

Description: Outdoor recreation and tourism is a major component of the Blackfoot Subbasin economy. The area is renowned for its high quality fishing, hunting, camping, hiking, river floating, wildlife viewing, and sightseeing opportunities. Many of these outdoor activities are made possible by public ownership of large tracts of mountainous habitat and additional access provided by many private landowners (MFWP 2006). There are, however, a range of impacts associated with non-motorized recreational use.

Implications: For salmonids, angler pressure and poaching are the two primary threats associated with recreational use in the Blackfoot. The Blackfoot River is one of the most popular fisheries in the Upper Clark Fork region. The average number of angling days/year between 2001 and 2007 was 36,489 (MFWP 2008). Illegal stocking of non-native fish, such as northern pike, largemouth bass and walleye, is another side-effect of recreational angling that threatens native species in the subbasin. The mainstem of the Blackfoot River is also extremely popular for non-angling recreation (e.g., picnicking, sunbathing, boating), particularly in the lower reaches closer to Missoula. Both angling and non-angling river recreation have impacts on aquatic and riparian habitat in the subbasin (MFWP 2008). Fish stocking, boating and angling can all contribute to the spread of whirling disease, an exotic parasite that affects fish in the trout and salmon family (Montana Water Center 2009). MFWP is in the process of drafting a recreation management plan for the Blackfoot River and the North Fork of the Blackfoot River that will guide recreation management now and into the future (MFWP 2009). The proposed plan is based on the recommendations of the River Recreation Advisory for Tomorrow (RRAFT) Citizen Advisory Committee.

For grizzly bears, negative bear-human interactions are the primary threat associated with non-motorized recreational use. Recreationists have largely unhindered access to millions of acres of undeveloped land in the Blackfoot Subbasin, much of which is currently occupied by grizzly bears. As numbers of bears and outdoor recreationists increases, contact between bears and people is likely to increase as well. These encounters could lead to injuries or death for both humans and bears (MFWP 2006). Backcountry camps used by hikers and hunters may be sources of bear attractants. Because habituation to humans often results in bear removals or death, high levels of human use in certain areas may eventually preclude bear use.

3.4.4.15 Existing Crop Production – Low

Targets Affected: herbaceous wetlands

Description: There are over 44,000 irrigated acres in the subbasin (CFTF 2004). Most of the existing cropland in the subbasin is located on the valley floor. This threat is again primarily of historic interest. In fact, in the recent past there has been more conversion of traditional agricultural land (grazing or hay production) back to herbaceous wetland communities than conversion of wetlands to cropland production.

Implications: In the past, crop production resulted in the loss and/or degradation of herbaceous wetland communities across the Blackfoot Valley floor. Crop production practices that can negatively impact herbaceous wetlands include draining and plowing, result in hydrologic alteration and water quality impairment in wetlands through increased nutrient inputs.

3.4.4.16 Filling of Wetlands - Low

Targets Affected: herbaceous wetlands

Description: It is estimated that about one-fourth of Montana's wetlands have been lost because of agriculture and urbanization. As mentioned above, this threat is primarily of historic interest as there has been recent conversion of traditional agricultural land (grazing or hay production) back to herbaceous wetland communities.

Implications: Filling of herbaceous wetlands reduces the number, size, distribution and diversity of this important habitat, resulting in degradation and/or loss of many important wetland functions, such as (McCarthy 2001):

- Holding and gradually releasing water into the soil and into adjacent streams or water bodies during low flow periods of the year (maintaining late summer stream flows is critical for irrigating crops, watering livestock, sustaining fisheries and recharging aquifers).
- Enhancing water quality by absorbing and holding toxins and nutrients before they enter nearby lakes, streams or groundwater. Wetlands also filter sediments, which protects water quality and prolongs the life of irrigation pumps, and reduces siltation of ponds and irrigation ditches.
- Supporting rare plants and vegetation that stabilizes shorelines and acts as a flood buffer.
- Decomposing organic matter and incorporating nutrients back into the food chain.
- Providing habitat for birds, mammals, reptiles and amphibians.
- Providing shallow water for freshwater fish to spawn, shelter and feed.

3.4.4.17 Lack of Human Tolerance – Low

Targets Affected: grizzly bears

Description: Some residents of the Blackfoot Subbasin are ideologically opposed to having grizzly bears reoccupy private lands and therefore do not feel it necessary to accommodate bears. Intolerance of grizzly bears results from such factors as:

- Fear for personal safety and safety of children/family
- Perceived or real threat of loss of personal property (e.g., livestock, beehives)
- Perceived loss of recreational opportunity (e.g., loss of favorite fishing hole due to fear of encountering grizzlies in river/creek bottoms)
- Perceived loss of intergenerational equity (some parents do not allow their children to roam freely).
- Negative perceptions and intolerance of grizzly bears that can result in refusal to adopt coexistence practices.

Implications: A lack of public and political support can result in human practices and behaviors that lead to human-bear conflicts, which in turn can lead to grizzly bear deaths. In some situations, residents believe that bear management is the sole responsibility of state wildlife management entities. Unfortunately, this shifts the burden to engage in bear-friendly behavior away from the public. The willingness of humans to coexist with grizzly bears is critical to the recovery and long-term viability of this threatened species.

Because lack of human tolerance is a threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and their partners have worked hard in recent years to mitigate this threat. The subbasin grizzly bear work group assigned lack of human tolerance a threat rank of “medium” based on their experiences with community members throughout the basin. Hundreds of community members take part in a variety of programs that have reduced grizzly bear-human conflicts by 84% since 2003 to the present. While the grizzly bear work has not directly measured human tolerance for grizzly bears in the subbasin, the number of complaints, concerns or discussions regarding grizzly bears is virtually nonexistent. Because this threat only affects one conservation target, the overall threat rank to the subbasin is “low.”

3.4.4.18 Human-Caused Mortality – Low

Targets Affected: grizzly bears

Description: Humans kill grizzly bears for a variety of reasons including self defense, mistaken identity killing during legal black bear hunting season, management removal of bears from conflicts, collision with vehicles, or killing for malicious purposes (poaching) (MFWP 2006). In the NCDE, between 2000 and 2004, roughly one-third of known mortality was from illegal killing. Certain locations seem to have greater densities of illegal killing, suggesting localized

poaching activity. This type of poaching is not for the bear parts trade, but is likely the work of an individual or individuals that engage in vandal-type killing of bears for a variety of unknown reasons (S. Wilson, pers. comm.).

Implications: Human-caused mortality is a major limiting factor for long-term grizzly bear recovery. The decline of grizzly bear populations in the United States and the southern Canadian Rockies is clearly linked to human causes, as human-grizzly bear conflicts are often a precursor to mortality (Mattson et al. 1996). A synthesis of long-term grizzly bear radio collar studies in the United States and southern Canada showed that between 1974 and 1996, approximately 85% of known bear mortality was attributed to humans (Mattson et al. 1996). McLellan et al. (1999) found that undetected grizzly bear deaths were typically due to non-hunting human causes and that between 1975 and 1997, malicious killing was the major cause of grizzly bear death in Montana. Moreover, these same researchers determined that for every known human-caused mortality, it is likely that another undetected mortality occurs (McLellan et al. 1999).

Grizzly bear mortality in the United States tends to be spatially concentrated on the periphery of core habitats, particularly in portions of Montana like the Blackfoot Subbasin (USFWS 2003). Core habitats refer to lands that contain self-sustaining populations of grizzly bears. There are generally a mix of multiple use national forest lands, national parks, and designated Wilderness areas. Lands on the periphery of core areas are less secure, low elevation habitats. They are typically privately owned agricultural lands that contain a variety of unnatural bear foods (S. Wilson pers. com.). Upon emergence from the den, bears move considerable distances from high, snow covered elevations to lower elevations to reach palatable, emerging vegetation on avalanche chutes or to feed on winter-killed or weakened ungulates on foothill winter ranges. Similar movement patterns often occur in the fall due to ripening of fruit and berries at lower elevations. These movement patterns often bring bears near areas of human habitation, increasing the incidence of human/bear conflicts and human-caused grizzly bear mortality (MFWP 2006).

Because human-caused mortality is a serious and long-term threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and their partners have worked directly on mitigating this threat. Since 2004 there have been no grizzly bears mortalities resulting from management related incidents or conflicts. For this reason, the subbasin grizzly bear work group assigned human-caused mortality a threat rank of “medium.” Because this threat only affects one conservation target, the overall threat rank to the subbasin is “low.”

3.4.4.19 Altered Wildlife Use Patterns - Low

Targets Affected: moist site and riparian vegetation, native grassland/sagebrush communities

Description: Historic patterns of wildlife use in native plant communities have been altered due to a variety of human land use activities in the subbasin. These changes have occurred largely since European settlement when a variety of relatively high impact land uses began, including logging, mining and agriculture.

Implications: Wildlife use patterns in vegetation communities change when degradation occurs such as plowing of native prairie, excessive livestock grazing, non-native plant invasion, draining of wetlands or disturbance next to wetlands such as roads. If degradation of vegetation communities occurs on a small scale (i.e., < 20% of a landscape), the impact to wildlife is generally minimal. If degradation occurs on a larger scale, certain species of wildlife may no longer be able to use that landscape. If historic wildlife use patterns are altered significantly enough, species (both plants and animals) composition and structure in native vegetation communities can shift.

3.4.4.20 Presence of Bear Attractants – Low

Targets Affected: grizzly bears

Description: Attractants like garbage, livestock feed, bird seed, beehives, calving areas and other bear food sources associated with humans and human settlements are a major cause of repeated human-grizzly bear conflicts in the subbasin (J. Jonkel, pers. com., Mattson 1990). Under certain conditions, grizzly bears can kill significant numbers of cattle and sheep (Murie 1948, Johnson and Griffel 1982, Knight and Judd 1983, Jorgensen 1983, Brown 1985). Grizzly bears apparently prefer to kill livestock in the following approximate order: swine, ewes, lambs, calves and yearling cattle, cows, horses, and bulls (Mattson 1990) but site specific situations also influence the type of livestock grizzlies prefer. Forestry operations also provide opportunities for grizzly bears to be attracted to food and garbage and to become food conditioned (Lolo National Forest 2003).

Implications: Attractants located in high quality bear habitat result in human-grizzly bear conflicts on private land (Wilson et al. 2005; Wilson et al. 2006). Chronic conflict situations from attractants lead to bears being trapped and relocated or removed from the ecosystem. In the NCDE, 49% of known, human-caused grizzly bear mortality results from human foods or livestock (USFWS 2006). Excessive human-caused mortality can result in a decrease in grizzly bear genetic and population viability.

Removing or securing attractants is a simple yet critical step in fostering human-bear coexistence. In Montana, researchers have called for a reduction in the availability of anthropogenic food sources and attractants on privately owned lands to reduce conflicts and mortalities, particularly for female grizzly bears (Mace and Waller 1998). Action item #1 in the Grizzly Bear Recovery Plan (USFWS 1993) is to “reduce human-bear conflicts,” most of which occur on private lands. The Blackfoot Challenge is currently working with ranchers and other private landowners to reduce conflicts by removing livestock carcasses in the spring and fencing calving areas and bee yards. These efforts have successfully reduced grizzly bear/human conflicts in the subbasin in the last six years by 84% (S. Wilson, pers. com.). One individual failing to secure bear attractants, however, can precipitate a chain of events that leads to a bear becoming more familiar with people and their dwellings. Also, as time goes by without conflict, people can become complacent. It is through awareness of the risk, and by responding

accordingly, that risks can be minimized and support for grizzlies in Montana can increase (MFWP 2006).

Because the presence of bear attractants is a serious, dynamic and long-term threat to grizzly bear viability in the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge and partners have focused directly on securing or removing attractants throughout the subbasin. Nearly all high risk calving areas in the subbasin have electric fences (41,000 feet of fencing have been installed) and on average, 225 livestock carcasses are removed annually from ranches in the subbasin. All ranches located in core grizzly bear habitat in the subbasin remove livestock carcasses. Ninety-five percent of all beehives in the subbasin are protected with electric fences. All road killed deer and livestock composting facilities are protected with electric fences, and plans are underway to protect two of the three transfer stations in the subbasin with electric fences. A network of 120 residents monitor both grizzly and wolf activity and the Blackfoot Challenge has dozens of trash resistant garbage cans that are loaned out to residents each year. For these reasons, the subbasin grizzly bear work group assigned presence of bear attractants a threat rank of “low.” Because this threat only affects one conservation target, the overall threat rank to the subbasin is also “low.”

3.4.5 External Threats

Threats to Blackfoot Subbasin conservation targets originate both within and outside of the subbasin. The preceding discussion of 20 key threats identified by subbasin work groups focuses on within-subbasin impacts. In this section, we note the significance of external factors that pose a threat to subbasin targets. External impacts to fish and wildlife in the Blackfoot Subbasin include climate change, fish migration barriers, habitat conditions, land use in adjacent subbasins and human population growth at a regional scale. Of the Blackfoot Subbasin conservation targets, bull trout, westslope cutthroat trout and grizzly bears are all wide-ranging species that are particularly vulnerable to threats originating outside of the subbasin.

External threats to bull trout and westslope cutthroat trout include:

- Climate change, as described in Section 3.4.4.2, has specific impacts on the life histories of both westslope cutthroat trout and bull trout.
- The removal of Milltown Dam just downstream of the mouth of the Blackfoot River, while generally considered to a positive change for migratory native fish, may have the ancillary effect of allowing the in-migration of non-native species, which could intensify competition and hybridization.
- The spread of invasive, aquatic species not yet established in the Blackfoot Subbasin (e.g., New Zealand mud snail, zebra mussel) in areas outside of the subbasin may increase the likelihood of their future import into the subbasin.

External threats to grizzlies include:

- Future coal mining north of the Canadian border in the British Columbia portion of the Flathead Subbasin could impact grizzly populations in the NCDE.
- High grizzly bear mortality in southwest Alberta could act as a ‘sink’ to grizzlies that disperse there from the NCDE, potentially reducing the NCDE population over time.
- The impacts of climate change on grizzlies is unknown, but drier and hotter conditions throughout the NCDE could pose additional threats to grizzly bears through habitat change and reduced abundance in naturally occurring bears foods.
- Large-scale wind development along the Rocky Mountain Front could impact grizzlies throughout habitat loss, displacement, and increased human-caused mortality depending on how site development, maintenance, and road access is managed.
- High-speed rail and highway improvements throughout the NCDE are potential future threats to grizzly populations in the NCDE.

Climate change is the most significant external threat affecting all conservation targets to varying degrees. In addition to conservation and restoration actions at the subbasin scale, addressing the threat of climate change will require large-scale solutions that extend beyond the subbasin boundaries.

4.0 Inventory of Existing Programs and Activities

4.1 Background

The Blackfoot Subbasin Inventory summarizes current fish, wildlife, and habitat protection and restoration activities within the subbasin. The Inventory includes a description of 1) protected areas in the subbasin, 2) management plans, including endangered species recovery plans, 3) management and funding programs and 4) on-the-ground restoration and conservation projects that target fish, wildlife and habitat in the subbasin. Following this review of existing protections and current management strategies, we evaluated and identified gaps in conservation and restoration activities in the Blackfoot Subbasin, particularly in relation to the stresses and threats identified in Section 3.4 of the Blackfoot Subbasin Assessment. The results of this gap assessment are outlined in Section 4.4. To complete the Subbasin Inventory, we surveyed a large number of agencies, organizations and individuals involved directly or indirectly in fish and wildlife activities in the subbasin.

In the Blackfoot Subbasin, a history of landowner-led cooperation has resulted in an emphasis on voluntary, incentive-based conservation and restoration in contrast to top-down regulation and enforcement. The lack of courtroom-settled disputes indicates the success of this collaborative approach. In the following pages, we outline the wide variety of programs and tools used by public and private partners in the subbasin to achieve on-the-ground conservation and restoration.

4.2 Current Management Activities

Protection for fish, wildlife and habitat in the Blackfoot Subbasin comes in many forms, including state and federal laws and regulations, federal wilderness designations, wildlife management and conservation areas, natural areas, and various special fisheries or wildlife designations. In the following sections (4.2.1.1 - 4.2.1.3), we provide brief descriptions of major regulations, protected areas and special designations within the Blackfoot Subbasin.

4.2.1 Existing Protection

4.2.1.1 Federal Protection

Federal laws and regulations: Federal laws and regulations that protect westslope cutthroat trout and bull trout habitat in the Blackfoot Subbasin include:

- The Clean Water Act (CWA), including Sections 401 and 404 permits, which regulate discharge or placement of dredged or fill material into waters of the United States.
- The Federal Land Management Protection Act (FLPMA).
- National Forest Management Plans and other internal agency management guidelines and policies.
- The Endangered Species Act (ESA), which compels review of actions that may affect habitat of threatened and endangered species or species proposed for listing.

- The National Environmental Protection Act (NEPA), which compels review of all activities that may affect westslope cutthroat trout and bull trout on federal and tribal lands and may thus modify those activities, when necessary, to minimize adverse effects on these species.

Federal protected areas:

- *Scapegoat and Mission Mountains Wilderness Areas (USFS):* The Scapegoat Wilderness, designated by the U.S. Congress in 1972, encompasses 239,936 acres along the northern edge of the Blackfoot Subbasin and includes within its boundaries the headwaters of Monture Creek, the North Fork of the Blackfoot and the Landers Fork. It is managed by the Rocky Mountain, Lincoln, and Seeley Lake Ranger Districts. A small portion of the Mission Mountains Wilderness Area extends into the western portion of the Blackfoot Subbasin. The Mission Mountains Wilderness was officially classified as Wilderness in 1975. In total, there are 164,413 acres of wilderness in the Blackfoot Subbasin that are managed in accordance with the Wilderness Act of 1964. If passed, the proposed Blackfoot-Clearwater Cooperative Stewardship Project will result in an additional 83,478 acres of wilderness designated in the Blackfoot watershed (71,378 acres as part of the North Fork Blackfoot Monture Creek Addition to the Bob Marshall and Scapegoat Wilderness Areas; 7,599 acres as part of the Grizzly Basin Swan Range Wilderness Addition to the Bob Marshall Wilderness Area; and, 4,501 acres as part of the West Fork Clearwater Wilderness Addition to the Mission Wilderness Area).
- *Waterfowl Productions Areas (USFWS):* Waterfowl Production Areas (WPAs) are purchased and managed by the USFWS. All WPAs are tracts of wetlands and uplands purchased with funds from the sale of Federal Duck Stamps under the Small Wetlands Acquisition Program. Units that contain habitat for waterfowl are purchased from willing sellers when money and acreage are available. Units are sometimes expanded as opportunities arise. The USFWS owns three Waterfowl Production Areas (WPAs) within the Blackfoot Subbasin that are managed as part of the National Wildlife Refuge System. The three properties total 4,452 acres and are locally known as the Blackfoot WPA, the H2-O WPA and the Kleinschmidt Lake WPA.
- *Conservation easements (USFWS):* The USFWS manages over 43,277 acres of perpetual conservation easements on private lands in Powell and Lewis and Clark Counties.

4.2.1.2 State Protection

State laws and regulations: Montana has several laws and regulations directed toward protection of aquatic habitats that, if properly applied and enforced, reduce threats to native salmonids throughout the state. Before permits allowing activities covered under these regulations are issued, applications are reviewed by MFWP, MDNRC, and MDEQ. Recommendations to limit impacts to westslope cutthroat trout and bull trout and their habitat are mandated through the permitting process.

- The *Montana Natural Streambed and Land Preservation Act* requires private, non-governmental entities to obtain a permit for any activity that physically alters or modifies the bed or banks of a perennially flowing stream.

- The *Montana Stream Protection Act* requires a permit for any project that may affect the natural and existing shape and form of any stream or its banks or tributaries.
- The *Montana Pollutant Discharge Elimination System* requires permits for all discharges to surface water or groundwater, including discharges related to construction, dewatering, suction dredges and placer mining.
- The *Streamside Management Zone Law* permits only selective logging and prohibits clear cutting and heavy equipment operation within 50 feet of any lake, stream or other body of water.

State protected areas:

- *Montana Department of Natural Resources and Conservation lands:* While the MDNRC manages school trust lands in the Blackfoot Subbasin, none of those lands have received designation as “protected,” for purposes other than fire protection, under any state program or statute. The total number of MDRNC lands in the subbasin is 73,200 acres and is expected to increase in the future, as part of the Montana Legacy Project (see Section 4.2.1.3).
- *Montana Fish, Wildlife and Parks lands:* MFWP owns and manages 25,000 acres of key wildlife habitat in the Blackfoot Subbasin consisting of four Wildlife Management Areas (WMAs) (the Blackfoot-Clearwater, Ovando Mountain, Aunt Molly, and Nevada Lake) and more than 20 Fishing Access Sites. In addition, MFWP is actively pursuing fee purchase of an additional 24,000-acre parcel in the Clearwater drainage of the Blackfoot which will also be managed as a WMA. The Department currently holds 12 conservation easements in the valley totaling more than 22,000 acres and expects to acquire an additional 26,000 acres of conservation easements within the next two years. MFWP land management, and the conservation easements that it holds, emphasize the maintenance and improvement of wildlife habitat and the provision of public recreational access.

4.2.1.3 Other Special Designations and Projects

The Blackfoot Community Conservation Area (BCCA): In 2003, the Blackfoot Challenge and The Nature Conservancy initiated the Blackfoot Community Project, involving the purchase and re-sale of 89,215 acres of Plum Creek Timber Company (PCTC) lands based on a community-driven disposition plan. The lands encompassed all PCTC lands from the headwaters near Rogers Pass to the Clearwater drainage and are in the process of being resold to both public agencies and private individuals. Approximately 70% of the lands will be transferred into federal or state ownership with the remaining 30% into private ownership. As part of the project, partners established the 41,000-acre Blackfoot Community Conservation Area at the base of Ovando Mountain. The BCCA involves 5,609 acres of community forest ownership and cooperative ecosystem management of surrounding USFS-Lolo National Forest, MFWP, MDNRC, and private lands.

Bull Trout Critical Habitat (USFWS): The final bull trout critical habitat rule was published in the federal register on September 26, 2005. It designated 1,058 stream miles in Montana as critical habitat. Of those miles, approximately 146 miles are in the Blackfoot Subbasin. Included in the designation are the mainstem Blackfoot, Monture Creek, the Clearwater River, Morrell

Creek, Cottonwood Creek, the North Fork of the Blackfoot, and Landers Fork. Also receiving critical habitat designation are Seeley Lake, Placid Lake, Lake Alva, Lake Inez, and Salmon Lake, Rainy Lake, and Clearwater Lake. In 2010, the USFWS proposed a new critical habitat designation that would expand the description of critical habitat within the Blackfoot sub-basin.

Montana Legacy Project: In 2008, The Nature Conservancy and The Trust for Public Land entered into an agreement with Plum Creek Timber Company to purchase 312,500 acres of timberland in western Montana. A total of 71,754 acres in the Clearwater and Potomac valleys of the Blackfoot Subbasin will be purchased and resold to public agencies and/or private buyers. A majority of the lands that are part of this project in the Blackfoot Subbasin are intended to be resold to the USFS or MDNRC. For more information, please visit <http://www.themontanalegacyproject.org/>.

Powell County Agricultural District 3: Powell County development regulations divide the county into five "Agricultural Districts." Each of these districts has minimum lot sizes and allowable uses, creating what is essentially county-wide zoning. Agricultural District 3, which encompasses Powell County in the Blackfoot Subbasin, has minimum lot sizes of 160 acres. This District was established out of concern from the community over the rate at which family farms were being sold and converted to second homes.

4.2.2 Existing Management Plans

This section provides brief descriptions of federal, state, county and other management plans that affect fish and wildlife in the Blackfoot Subbasin.

4.2.2.1 Federal Plans

Bull Trout Draft Recovery Plan (Chapter 3: Clark Fork, which includes the Blackfoot Subbasin) (USFWS 2002): This draft federal recovery plan was required under the Endangered Species Act. It is currently under revision. It includes recovery criteria, recovery tasks, estimated costs, and an implementation schedule. When the final plan is approved, it will become the official guidance document for federal bull trout recovery efforts.

Canada Lynx Conservation Assessment and Strategy, Second Edition (Ruediger et al. 2000): The Lynx Conservation Assessment and Strategy was developed to provide a consistent and effective approach to conserve Canada lynx on federal lands in the conterminous United States. The USFS, BLM and USFWS initiated the Lynx Conservation Strategy Action Plan in spring of 1998. The conservation measures presented in this document were developed to be used as a tool for conferencing and consultation, as a basis for evaluating the adequacy of current programmatic plans, and for analyzing effects of planned and on-going projects on lynx and lynx habitat.

Canada Lynx Conservation Agreement (USFS and USFWS 2005): This agreement is an interim measure to guide lynx management on federal lands within forests pending the amendment of forest plans to incorporate the provisions of the Lynx Conservation and Assessment Strategy.

Grizzly Bear Recovery Plan (USFWS 1993): This federal recovery plan, required under the Endangered Species Act, includes a description of the current status, habitat requirements and limiting factors, recovery objectives, recovery priorities, recovery criteria, and actions needed.

Habitat Conservation Plans (HCP): Organized under the ESA, HCPs provide a framework for people to complete projects while conserving at-risk species of plants and animals. Congress envisioned Habitat Conservation Plans as integrating development and land-use activities with conservation in a climate of cooperation. The ESA protects endangered and threatened species of wildlife and plants. Without a permit, it is unlawful to “take” (i.e., harm, kill) listed wildlife species. Under the ESA, the USFWS is authorized to issue incidental take permits to landowners who develop HCPs. HCPs provide a framework for creative partnerships with the goal of reducing conflicts between listed species and economic development. Habitat Conservation Plans can help communities plan for economic development while ensuring the future of endangered and threatened species. Through large-scale HCPs, stakeholders chart landscape-level strategies and conserve biological diversity. HCPs for MDNRC lands and Plum Creek Timber lands are described below in Sections 4.2.2.3 and 4.2.2.5.

Hatchery and Genetic Management Plan for the Creston National Fish Hatchery (USFWS 2000): This document describes the hatchery program including: funding, purpose, justification, performance standards and indicators, relationship of hatchery to other program objectives, ecological interactions, facilities water source, broodstock origin and identity, incubation, rearing, and release.

Helena National Forest Plan (Helena National Forest, USFS, updated 2004 to include Amendments 1 through 23): The Forest Plan guides all natural resource management activities and establishes management standards for the Helena National Forest. It describes resource management practices, levels of resource production and management, and the availability and suitability of lands for resource management. The purpose of the Forest Plan is to provide long-term (10-15 year) direction for managing the Helena National Forest. The plan provides two levels of direction: general forest-wide management direction and specific direction for each management area. Direction is described in terms of management goals, objectives, and forest-wide and Management Area Standards. This update incorporates Amendments 1 through 23. The forest also has a management plan for the Lincoln Scapegoat Wilderness.

The Inland Native Fish Strategy (INFISH): INFISH was adopted by the USFS in 1995, amended National Forest Plans and Regional Guides to include interim direction for riparian management objectives, standards and guidelines, and monitoring in the Columbia River basin. Among other provisions, INFISH requires that 300-foot buffers be maintained along all streams. INFISH standards, which can only be modified following a watershed analysis or site-specific evaluation, are being implemented on USFS lands to minimize or eliminate present or potential destruction of westslope cutthroat trout and bull trout habitat and other aquatic resources. The June 10, 1998 listing of bull trout in the Columbia River basin as a threatened species under the Endangered Species Act (63 FR 31647) has further strengthened protections for focal species habitat.

Lolo National Forest Plan (Lolo National Forest, USFS, 1986): The Forest Plan follows the same format and serves the same purpose as the Helena National Forest Plan described above. It

was also amended by the 1995 INFISH as describe above. The Lolo National Forest also has management plans for the Wilderness areas within its boundaries. The Forest Plan also has management areas that designate areas as proposed Wilderness (MA 12) and roadless areas (MA 11). Proposed Wilderness areas include the Bob Marshall Extension which consists of lands in the headwaters of North Fork Blackfoot, Monture Creek, North Fork Cottonwood, and Morrell Creeks. Designated roadless areas include headwater portions of Monture Creek, Clearwater River, Morrell Creek, North Fork Placid, and Cottonwood Creek. The Lolo National Forest is currently revising its land management plans to reflect new scientific information as well as natural and social changes that have accumulated since the original plan was prepared in the 1980s. For more information, please visit <http://www.fs.fed.us/r1/wmpz/>.

Montana Bald Eagle Management Plan (USDI 1994): This plan is a revision of the 1986 Montana Bald Eagle Management Plan. It is intended to provide landowners and resource managers with information on the biology of Bald Eagles to facilitate informed decisions about land use and to promote the conservation of the species and its habitat. It includes information on biology and management guidelines.

Northern Rocky Mountain Wolf Recovery Plan (USFWS 1987): The Northern Rocky Mountain Wolf Recovery Plan outlines steps for the recovery of the gray wolf populations in portions of their former range in the Northern Rocky Mountains of the United States. The recovery plan is intended to provide direction and coordination for recovery efforts. State responsibility for many plan items is proposed because the Endangered Species Act of 1973, as amended, provides for State participation and responsibility in endangered species recovery. The plan is a guidance document that presents conservation strategies for the Northern Rocky Mountain wolf.

4.2.2.2 Tribal Plans

While the Confederated Salish and Kootenai Tribes of the Flathead Nation do not have any specific management initiatives in the Blackfoot Subbasin, they do have a strong management interest in the area because it is encompassed within the aboriginal territory of the Tribes and consists largely of lands ceded to the United States government under the provisions of the Hellgate Treaty of 1855. Tribal members of the Kootenai Tribe lived in northwestern Montana. Under the provisions of the Treaty, the Tribes maintained the right to continued use of resources in the area. Today, tribal members continue to utilize those resources for subsistence, cultural, and spiritual needs. As a result, the Confederated Salish and Kootenai Tribes value this area and take an active interest and role in ongoing management activities that affect fish, wildlife, and habitat resources (L. Ducharme, pers. comm.).

4.2.2.3 State Plans

Blackfoot River Recreation Management Plan (MFWP 2009): This plan seeks to guide recreation management now and in the future on the Blackfoot River. The plan identifies the desirable social and resource conditions for different reaches (sections) of the river, management actions that can be implemented on a routine basis to manage recreation on the Blackfoot River, and indicators and standards to guide the implementation of future management actions that can be used to maintain desired conditions or to improve undesirable conditions. The plan is based on

the recommendations of the River Recreation Advisory for Tomorrow (RRAFT) Citizen Advisory Committee. For more information, see <http://fwp.mt.gov>.

Columbian Sharp-tailed Grouse Mitigation Implementation Plan for Western Montana (MFWP 1991): This plan outlines management objectives to accomplish the goal of improving the current status of Columbian Sharp-tailed Grouse in western Montana by protecting existing populations and habitats and by establishing additional populations in areas of suitable habitat.

Deer Population Objectives and Hunting Regulation Strategies (MFWP 1998): This plan outlines objectives and strategies designed to manage for the long-term welfare of Montana's deer resource and provide recreational opportunities that reflect the dynamic nature of deer populations.

Final Bull Trout Restoration Plan (MFWP 2000): In 1993, the Governor of Montana appointed the Bull Trout Restoration Team (MBTRT) to produce a plan that maintains, protects, and increases bull trout populations. The team appointed a scientific group, the Montana Bull Trout Scientific Group (MBTSG), to provide the restoration planning effort with technical expertise. The scientific group wrote 11 basin-specific status reports and three technical, peer-reviewed papers about the role of hatcheries, the suppression of non-native fish species, and land management. A draft restoration plan that defined and identified strategies for ensuring the long-term persistence of bull trout in Montana was released for public comments in September 1998. In June 2000, the final restoration plan was issued (MBTRT 2000). The plan synthesizes the scientific reports and provides recommendations for achieving bull trout restoration in western Montana. It focuses activities on 12 restoration/conservation areas and was designed to complement and be consistent with this recovery plan. The Montana Restoration Plan relies on voluntary actions, promoted by watershed groups, but has no legislative or legal authority beyond existing state law. Implementation of the Montana Restoration Plan has not officially begun; it is expected to mesh with implementation of the USFWS Bull Trout Recovery Plan.

Five-Year Update of the Programmatic Environmental Impact Statement, the Grizzly Bear in Northwestern Montana (MFWP 1993): This document outlines MFWP's goals to manage for a recovered grizzly bear population, to maintain distribution in defined management areas, and to maintain the habitat in a condition suitable to sustain the population at an average density of one grizzly bear per 15-30 square miles outside of Glacier National Park.

Garnet Resource Management Plan (BLM): In 1986, the BLM adopted the Garnet Resource Management Plan for much of its holdings in Montana west of the continental divide, including the Blackfoot Subbasin. The plan sets out the prescription for managing the 145,660 surface acres of public lands and 213,385 sub-surface acres in the Garnet Resource area. The plan prescribes management options for road construction, grazing, logging, mineral leasing, and range improvement, among others. In addition it sets specific limitations for logging in sensitive areas such as riparian zones and key elk habitat.

Grizzly Bear Management Plan for Western Montana (MFWP 2006): This is the Draft Programmatic Environmental Impact Statement 2006-2016 that will guide MFWP's approach to grizzly bear management should the state assume control of grizzly bear management. This

document outlines goals and objectives for a recovered grizzly bear population and envisions effective connections of grizzly bear populations among the Cabinet-Yaak, Northern Continental Divide Ecosystem, Greater Yellowstone Area and Canada. The plan outlines management strategies that include an overall approach to grizzly bear management that allows bears to re-colonize former habitats where it is “biologically suitable and socially acceptable.”

Management of Black Bears in Montana (MFWP 1994): This plan defines a statewide management strategy for managing black bear populations and their harvest in Montana.

Management of Mountain Lions in Montana (MFWP 1996): This plan defines a statewide management strategy for mountain lions including objectives for determining carrying capacities for mountain lions and their prey; monitoring populations; regulating harvest; improving public understanding of lion biology, habitat requirements and management and public policies that deal with mountain lion conflicts with people and livestock.

Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout in Montana (MFWP): This Memorandum of Understanding and Conservation Agreement was developed to expedite implementation of conservation measures for westslope cutthroat trout in Montana as a collaborative and cooperative effort among resource agencies, conservation and industry organizations, resource users, and private land owners. Threats that warrant consideration of westslope cutthroat trout as a Species of Concern by the State of Montana, a Sensitive Species by the USFS, a Species of Special Concern by the BLM, and as Species of Special Management Concern by the USFWS should be significantly reduced or eliminated through implementation of this Agreement.

Montana’s Comprehensive Fish and Wildlife Strategy (MFWP 2005): Montana’s Comprehensive Fish and Wildlife Strategy describes both the vertebrate species in Montana and their related habitats “in greatest conservation need.” It is intended to provide a guide for the expenditure of federal funds under the State Wildlife Grants Program. The Strategy identifies the Blackfoot River as an aquatic conservation focus area in greatest need, and identifies both the bull trout and the westslope cutthroat as aquatic species of greatest conservation need. In addition, it lists riparian and wetland communities and mountain streams as community types of greatest conservation need. Among birds and mammals, it lists Trumpeter Swan, Bald Eagle, Columbian Sharp-tailed Grouse, gray wolf, grizzly bear, and Canada lynx, all species found within the Blackfoot drainage, as among species of greatest conservation need.

An integrated Stream Restoration and Native Fish Conservation Strategy for the Blackfoot River Basin (MFWP, 2005): This strategy outlines a restoration strategy for native salmonids in the Blackfoot sub-basin, identifying key areas within the Blackfoot, fisheries impairments on both the Mainstem and in tributaries, describes a prioritization strategy for restoration, summarizes high, medium, and low priority streams, and describes monitoring protocols. This strategy was updated in 2008 to expand the number of streams and modify the prioritization strategy (Pierce, 2008; Appendix J).

Montana Gray Wolf Conservation and Management Plan (MFWP 2004a): This plan outlines a balanced approach to sustain wolves as a native species in Montana, while balancing their

presence with the costs and impacts on those people most directly affected by the presence of wolves.

Montana State Trust Lands Habitat Conservation Plan (MDNRC and USFWS): Habitat Conservation Plans (HCPs) are complex, long-term management plans authorized under the Endangered Species Act. MDNRC developed a draft HCP under which it intends to conduct forest management activities while conserving habitat for three species, which are currently listed as threatened under the ESA (grizzly bear, Canada lynx, bull trout), and for two species that are not listed (westslope cutthroat trout, Columbia redband trout). MDNRC's HCP outlines the commitments it has made to minimize or mitigate impacts on the HCP species from forest management activities for the next 50 years within the HCP project area. The lands covered by the HCP include approximately 548,500 acres of state trust lands within three DNRC land offices in western Montana – Northwestern, Southwestern, and Central Land Offices.

MDNRC forest management activities that are covered in the HCP and associated permit application include timber harvest, road construction and maintenance, removal and replacement of stream crossing structures and issuance of grazing licenses on state trust lands classified as “forest” lands. The plan would benefit HCP aquatic species by managing for and maintaining suitable stream temperature regimes, instream sedimentation levels, instream habitat complexity, and stream channel stability and channel form and function within the HCP project area as well as improving connectivity among sub-populations of the covered species where appropriate on HCP project area lands.

The benefits of the HCP for grizzly bears include provisions for important seasonal habitat and limitations on activities affecting bears within those habitats. This is primarily accomplished by applying grizzly bear commitments across a greater geographic area within MDNRC's forested trust lands than are applied now, and increasing the level of commitments based on the importance of that habitat for bears (i.e., lands within federally designated recovery zones received the greatest level of commitments), and designing timber sales and applying silvicultural prescriptions to maintain important habitat features, including den sites, avalanche chutes, lush riparian zones, and locations that produce high volumes of forage.

The Canada lynx commitments would support federal lynx conservation efforts by maintaining important habitat elements for lynx and their prey at both the landscape and site specific scale, particularly in key locations for resident populations. This is primarily achieved by maintaining set ratios of suitable lynx habitat in the HCP project area and managing for vegetation structure and habitat elements important for lynx and their prey. Additional information on the HCP is available at: www.dnrc.mt.gov/HCP.

Statewide Elk Management Plan (Montana Fish, Wildlife & Parks 2004b): This plan provides guidance to wildlife managers, land managers and other parties responsible for planning and policy decisions that affect wildlife resources and wildlife-related recreation in Montana.

TMDL Plans for the Blackfoot Subbasin (MDEQ): In 1997, the Montana Legislature passed House Bill 546, which strengthened the state's authority to develop Total Maximum Daily Loads (TMDLs) for Montana waters. Under this legislation, MDEQ must identify impaired water

bodies, identify the causes of impairment, and develop corrective actions. MDEQ's goal is to correct all impairments within the next 10 years. Such corrective actions will improve water quality in many streams and should result in enhancement of habitat for focal species. TMDLs are discussed further in Section 3.2.5.2. TMDLs for the Blackfoot Subbasin include:

- *Blackfoot Headwaters Planning Area Water Quality and Habitat Restoration Plan and TMDL for Sediment (MDEQ 2004)*: This document identifies causes and sources of sediment and habitat related water quality impairments for eight 303(d)-listed water bodies in the Blackfoot Headwaters Planning Area. Targets for restoring water quality and achieving full beneficial use support in impaired water bodies are established in this document. Strategies for the restoration of water quality and monitoring needs in the Blackfoot Headwaters are also outlined. Available at: <http://www.deq.mt.gov/wqinfo/TMDL/finalReports.asp>.
- *Water Quality Restoration Plan for Metals in the Blackfoot Headwaters TMDL Planning Area (MDEQ 2003)*: This document identifies causes and sources of metals related water quality impairments for six 303(d)-listed water bodies in the Blackfoot Headwaters Planning Area. Targets for restoring water quality and achieving full beneficial use support in impaired water bodies are established in this document. Strategies for the restoration of water quality and monitoring needs in the Blackfoot Headwaters are also outlined. Available at: <http://www.deq.mt.gov/wqinfo/TMDL/finalReports.asp>.
- *Middle Blackfoot-Nevada Creek Total Maximum Daily Loads and Water Quality Improvement Plan: Sediment, Nutrient, Trace Metal and Temperature TMDLs (MDEQ 2008a)*: This document identifies causes and sources of sediment, habitat, nutrient, temperature, and metals related water quality impairments for 37 water bodies on the 303(d) list in the Middle Blackfoot and Nevada Creek Planning Areas. Targets for restoring water quality and achieving full beneficial use support in impaired water bodies are established in this document. Strategies for the restoration of water quality and monitoring needs in these planning areas are also outlined. A draft of this document was released in December 2007 with EPA approval anticipated in 2008. Available at: <http://deq.mt.gov/wqinfo/TMDL/tmdlPublicComments.asp#MiddleBlackfootNevada>.
- *Lower Blackfoot Total Maximum Daily Loads and Water Quality Improvement Plan: Sediment, Trace Metal and Temperature TMDLs. Public Review Draft (MDEQ 2008b)*: Development of TMDLs and water quality restoration plans for 12 streams or stream segments on the 303(d) list in the Lower Blackfoot Planning Area began in 2006. The plan, completed in 2009, is currently under review by EPA.
- *Blackfoot River TMDL Implementation Plan (Bureau of Land Management)*: This plan describes BLM's proposed implementation of TMDLs on BLM lands in the Blackfoot Subbasin. It describes proposed management actions on BLM lands to reduce non-point pollution in water bodies on the 303(d) list in the Blackfoot Subbasin.

4.2.2.4 County Plans

Lewis and Clark County: In 2004, Lewis and Clark County adopted a county growth policy to replace the comprehensive plan that it had adopted in 1983. The growth policy is intended to be a long-range, non-regulatory planning document for Lewis and Clark County. The growth policy establishes a broad framework for how to proceed with more detailed shorter-range planning. While the policy is county-wide, it focuses heavily on the Helena Valley and the county east of the Continental Divide, and makes only scant reference to the portion the county in the Blackfoot Subbasin.

Missoula County: In 2002, Missoula County adopted a growth policy that replaced the 1975 Missoula County Comprehensive Plan. It was updated in 2005. The overarching goals are: 1) manage growth in a proactive rather than reactive way, considering both immediate and cumulative impacts; and 2) create a truly healthy community by protecting critical lands and natural resources, such as wildlife habitat, riparian resources, hillsides, air and water quality and open spaces and by enhancing the community's resources in the areas of health and safety, social, educational, recreational, and cultural services, employment, housing and the valued characteristics of communities. The growth policy is not a regulatory document. It provides a framework for articulating goals and policies and establishes the legal and philosophical foundation upon which future plans and regulations will be based. While the growth policy gives guidance for the entire county, regional or issue plans provide specific guidance through land use designations, design and development guidelines, and recommendations for specific action steps. A portion of the Blackfoot Subbasin is covered by the 1989 Seeley Lake Regional Plan. This plan is currently being updated through a community process. The remainder of the Blackfoot Subbasin in Missoula County has recommended land use policies and designations carried forward from the 1975 Plan into the 2002 Regional Land Use Guide.

Powell County: In 1996, Powell County adopted a comprehensive plan and a set of development regulations. The comprehensive plan was transformed into a growth policy in 2004 and then revised in 2006. The growth policy is intended to be a long-range, non-regulatory planning document for Powell County. The growth policy establishes a broad framework for how to proceed with more detailed, shorter-range planning. The original set of development regulations has been amended/revised five times since 1996. They are currently titled "Powell County Zoning & Development Regulations" and dated January 7, 2009. Powell County has had discussions with the Missoula County/Seeley Lake community regarding coordination of planning across county lines.

4.2.2.5 Other Plans

A Basin-Wide Restoration Action Plan for the Blackfoot Watershed (The Blackfoot Challenge in partnership with BBCTU, MFWP, Hydrometrics, Inc., and other partners 2005): The goal of the Restoration Action Plan is to define strategies for prioritization, planning, and implementation of restoration projects for impaired and dewatered streams in the Blackfoot Watershed. This complements and slightly expands the Native Fish Conservation Strategy described in section 4.2.2.3. A description of the plan is provided in Section 2.3.2. To access the complete plan, please visit www.blackfootchallenge.org.

Blackfoot Community Conservation Area-Management Plan for the Core (BCCA Council, 2006): The purpose of this plan is to guide land management decisions on the BCCA core—the 5,609 acres located in the heart of the conservation area (see Section 4.2.1.3). This document defines the community’s vision for the property, characterizes the natural and cultural landscape, documents the public involvement process and administration of the property, and establishes management goals, objectives and issues requiring future study to guide conservation, restoration, and stewardship activities.

Blackfoot River Valley Conservation Area Draft Plan (The Nature Conservancy and the Blackfoot Challenge 2007): The purpose of this planning effort was to develop a framework of conservation strategies that can be implemented to conserve, and perhaps even further enhance, the viability of significant ecological and social/economic components of the Blackfoot Subbasin. A description of the plan is provided in Section 2.3.2.

Blackfoot Watershed Cooperative Conservation Agreement (2009): Fifteen public and private partners signed this agreement in 2009. This agreement was established to document the commitment to cooperation between the partners for the enhancement, conservation, and protection of the natural resources and rural way of life in the Blackfoot watershed for present and future generations. The area encompassed by the agreement consists of all lands within the Blackfoot watershed in western Montana. The agreement will help partners to coordinate on issues such as unplanned residential development, noxious weeds, and other issues that transcend county and other jurisdictional boundaries.

Plum Creek Native Fish Habitat Conservation Plan for Montana (Plum Creek Timber Company/USFWS 2000): The Montana Native Fish Habitat Conservation Plan (HCP) was approved in 2000. This 30-year HCP applies to 1.3 million acres of Plum Creek Timber Company land in Montana. Under this plan, habitat for eight species of native trout and salmon are protected in over 1,300 miles of fish-bearing streams on Plum Creek property. The HCP contains 56 conservation commitments covering a wide range of activities including timber harvest, road construction, stream habitat enhancement and livestock grazing.

4.2.3 Management and Funding Programs

This section provides brief descriptions of federal, state, county, and other management programs and funding sources that affect fish, wildlife, and habitat in the Blackfoot Subbasin.

4.2.3.1 Federal Programs

Bonneville Power Administration: The BPA funds watershed protection and restoration projects, reconnection of fish migration routes, eradication of hybridized or non-native fish populations, reduction of sedimentation to protection of spawning areas, reduction of phosphorous, and protection and restoration of wetland and riparian habitat. In the Blackfoot Subbasin, BPA has supported a number of streamflow restoration projects (see Table 4.1).

Culvert inventory program (USFS): The USFS conducted a culvert inventory program in 2002 and 2003 in order to determine the magnitude of fish passage barriers on USFS road systems. Approximately 80% of the inventoried culverts were at least partial barriers to upstream fish

migration and approximately 20% were considered total barriers. In addition, it was noted that approximately 95% of the culverts constrict the stream channel to some degree and 50% constrict the stream channel by more than 50%, suggesting a high concern of culvert failure during normal bankful flows.

Federal Migratory Bird Hunting and Conservation Stamps: Commonly known as “Duck Stamps,” these are pictorial stamps produced by the U.S. Postal Service for the USFWS. They are not valid for postage. Originally created in 1934 as the federal licenses required for hunting migratory waterfowl, today Federal Duck Stamps are a vital tool for wetland conservation. Ninety-eight cents out of every dollar generated by the sales of Federal Duck Stamps goes directly to purchase or lease wetland habitat for protection in the National Wildlife Refuge System.

Land and Water Conservation Fund (LWCF): The LWCF was established by Congress in 1965. A portion of receipts from offshore oil and gas leases are placed into this fund annually for federal, state and local conservation. LWCF is authorized at \$900 million annually, a level that has been met only twice during the program's 40-year history. The program is divided into two distinct funding pots: state grants and federal acquisition funds. In FY 2005, the federal acquisition pot received \$166 million and the state grants program received \$92.5 million for a total of \$258.5 million. In FY 2006 the federal pot received \$114.5 and the state grants received \$30 million. FY 2007 was similar to the year before receiving \$113 million for federal acquisition and \$30 million for state grants.

The state side of LWCF provides for all 50 states, the District of Columbia, and the territories by a formula based on population and other factors. State grant funds can be used for park development and for acquisition of lands and easements. State park directors solicit communities to apply for projects and distribute funds to those worthy projects based on a scoring process. The federal side provides for national park, forest, and wildlife refuge and Bureau of Land Management area fee and easement acquisitions. Each year, based on project demands from communities as well as input from the federal land management agencies (NPS, USFS, USFWS, BLM), the President makes recommendations to Congress regarding funding for specific LWCF projects. Once in Congress, these projects go through a rigorous Appropriations Committee review process with much input from Members representing project areas. Given the intense competition among projects, funding is generally only provided for those projects with universal support.

Natural Resources Conservation Service (NRCS) in Powell, Missoula, and Lewis and Clark Counties: Federal programs active through NRCS and county conservation districts provide financial incentives, cost sharing, leases and conservation agreements to landowners (especially the farming community) to improve the use of natural resources. Efforts target improvement of irrigation methods, reduction of sediment runoff and sustainable management and/or exclusion of cattle from riparian areas to reduce impacts on water quality. The four key programs that have funded substantial investments in conservation and restoration work in the Blackfoot Subbasin include:

- **Environmental Quality Incentives Program (EQIP):** This program was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. EQIP applications are ranked and compete for county funding based on a set of local environmental benefits criteria. EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions. Local conservation districts approve plans and determine annual priorities for projects.

NRCS provided \$1.3 million through two rounds of the Cutthroat and Bull Trout EQIP Special Initiative during 2005 and 2006. The projects primarily focused on in-stream channel restoration and, to a lesser degree, off-stream grazing management. The Late Forestry EQIP Special Initiative was implemented in 2007 to address forest health issues by providing cost share dollars for forest thinning on private lands in the Blackfoot Subbasin and beyond. NRCS also provided significant financial assistance (cost-share) to numerous private landowners in the subbasin through county EQIP allocations. Primary categories included weed management, forest thinning, and grazing management.

- **Conservation Innovation Grant (CIG):** In 2005, a two-year Conservation Innovation Grant was granted to the Blackfoot Challenge to leverage NRCS investment in the conservation of the threatened grizzly bear while sustaining agricultural livelihoods. The Challenge used a scientific approach to map, prioritize, and implement conflict abatement projects with EQIP-eligible producers throughout the Blackfoot Subbasin. Following this innovation for wildlife and agriculture, the Challenge received a two-year national Conservation Innovation Grant in 2009 to leverage NRCS investment in fire management and the conservation of forested lands while sustaining economic and rural values. This project used a community-based approach for EQIP delivery of innovative Forest Health Practices in the Blackfoot Subbasin.
- **Grazing Lands Conservation Initiative (GLCI):** The Powell County Weed District and the Blackfoot Watershed received \$122,500 from this fund in 2006 as part of a national effort to enhance 40 million acres, primarily on grazing lands, with technical assistance at a grassroots level using a voluntary approach. The grant provided three years of funding to promote integrated weed management, Weed Management Area enhancement and organizational efforts in Missoula, Powell, and Lewis and Clark Counties, and cost share with landowners for weed control activities.

Other NRCS programs that provide funding opportunities include:

- *The Conservation Reserve Program (CRP)* provides technical 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 in complying with federal, state, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning. The Conservation Reserve Program reduces soil erosion, protects the nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.
- *The Grassland Reserve Program (GRP)* is a voluntary program that helps landowners protect, restore and enhance grassland, rangeland, pastureland, shrubland and certain other lands on their property. Section 2401 of the Farm Security For the Grassland Reserve and Rural Investment Act of 2002 (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize this program. The Natural Resources Conservation Service, Farm Service Agency and Forest Service are coordinating implementation of GRP. The program prevents conversion of vulnerable grasslands to cropland or other uses and conserves valuable grasslands by helping to maintain viable ranching operations.
- *The Wetlands Reserve Program (WRP)* is a voluntary program that provides technical and financial assistance to eligible landowners to restore, enhance, and protect wetlands. Landowners have the option of enrolling eligible lands through permanent easements, 30-year easements, or restoration, cost-share agreements. The program is offered on a continuous sign-up basis and is available nationwide. Landowners can establish at minimal cost long-term conservation and wildlife habitat enhancement practices. WRP has an acreage enrollment limitation rather than a funding limit. Congress determines how many acres can be enrolled in the program and funding is somewhat flexible.
- *The Wildlife Habitat Incentives Program (WHIP)* is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP, the NRCS provides both technical assistance and up to 75% cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from five to 10 years from the date the agreement is signed. WHIP has proven to be a highly effective and widely accepted program across the country. By targeting wildlife habitat projects on all lands and aquatic areas, WHIP provides assistance to conservation-minded landowners who are unable to meet the specific eligibility requirements of other USDA conservation programs. The Farm

Security and Rural Investment Act of 2002 reauthorized WHIP as a voluntary approach to improving wildlife habitat in the United States.

U.S. Fish and Wildlife Service: USFWS management and funding programs applicable to the Blackfoot Subbasin include:

- *Cooperative Conservation Initiative:* This program supports efforts that restore natural resources and establish or expand wildlife habitat.
- *Cooperative Endangered Species Conservation Fund (Section 6):* This program funds a wide array of voluntary conservation projects for candidate, proposed and listed endangered species.
- *Dingell-Johnson Federal Aid in Sport Fish Restoration Act (DJ):* This program supports activities designed to restore, conserve, manage or enhance sport fish populations and the public use benefits from these resources and to support activities that provide boating access to public waters. Projects supported include fish habitat improvement, research on fishery problems, surveys and inventories of fish populations, provision for public use of fishery resource and lake and stream rehabilitation.
- *Fisheries Restoration and Irrigation Mitigation Act (FRIMA):* The program authorized by this act funds voluntary design, construction and installation of fish screens, fish ladders or other fish passage devices associated with water diversions. Projects may also include modifications to water diversion structures that are required for effective functioning of fish passage devices.
- *Fish & Habitat Conservation -Fish Passage:* Project funding is for fish passage restoration by removing or bypassing barriers to fish movement such as dam removal, culvert renovation, designing and installing fish ways, installing fish screens and barrier inventories to identify additional fish passage impediments.
- *Landowner Incentive:* These grants are available for conservation efforts to be carried out on private lands and to provide technical or financial assistance to private landowners for the purpose of benefiting federally listed, proposed or candidate species.
- *North American Wetlands Conservation Act (NAWCA):* NAWCA's Standard Grants Program is a competitive, matching grants program that supports public-private partnerships carrying out projects in Canada, the United States, and Mexico. These projects must involve long-term protection, restoration, and/or enhancement of wetlands and associated uplands habitats. The Standard Grants Program began supporting projects in all three countries in 1990, shortly after the North American Wetlands Conservation Act of 1989 was passed. The USFWS Division of Bird Habitat Conservation is responsible for facilitating and administering the Act's Standard Grants Program. The Blackfoot Watershed has received \$2 million in NAWCA funding since 2002 to promote wetland conservation and restoration.

- *Partners for Fish and Wildlife Program*: This program works with private landowners and numerous partners in an effort to restore wetlands, riparian areas, instream habitats, and upland habitats for the benefit Federal Trust Species including threatened and endangered species, migratory birds, and native fish. The USFWS has established several staff positions in western Montana under the Partners for Fish and Wildlife Program, and these new employees have focused on developing funding opportunities and directing USFWS funds toward cooperative habitat restoration, management, and protection of key habitats for the benefit of Federal Trust Species including native salmonids.
- *Pittman-Robertson Wildlife Restoration Act (PR)*: The Federal Aid in Wildlife Restoration Act is commonly called the Pittman-Robertson Act. It has been amended several times, and provides federal aid to states for management and restoration of wildlife. Funds from an 11% excise tax on sporting arms and ammunition are appropriated to the Secretary of the Interior and apportioned to states on a formula basis for paying up to 75% of the cost of approved projects. Project activities include acquisition and improvement of wildlife habitat, introduction of wildlife into suitable habitat, research into wildlife problems, surveys and inventories of wildlife problems, acquisition and development of access facilities for public use, and hunter education programs, including construction and operation of public target ranges.
- *Private Stewardship Grants Program*: This program provides grants and other assistance to individuals and groups engaged in private, voluntary conservation efforts that benefit species listed or proposed as endangered or threatened under the ESA. Eligible projects include those by landowners and their partners who need technical and financial assistance to improve habitat or implement other activities on private lands.
- *State Wildlife Grants (SWG)*: The Interior and Related Agencies Appropriations Act, 2002, created the State Wildlife Grants program. As indicated within this legislation, these grants were established, "...for the development and implementation of programs for the benefit of wildlife and their habitat, including species that are not hunted or fished..." Since its creation, the SWG program has received annual Congressional appropriations that are administered by the USFWS. The USFWS apportions these funds, using a legislated formula based on human population and geographic area, to fish and wildlife agencies within the states, territories and the District of Columbia. Each state fish and wildlife agency wishing to participate in the SWG program must develop a Comprehensive Wildlife Conservation Strategy.

U.S. Forest Service: USFS management and funding programs applicable to the Blackfoot Subbasin include:

- *Forest Legacy Program (FLP)*: The USFS administers the FLP in cooperation with state partners. Designed to encourage the protection of privately owned forest lands, FLP is an entirely voluntary program. To maximize the public benefits it achieves, the program focuses on the acquisition of partial interests in privately owned forest lands. FLP helps the states develop and carry out their forest conservation plans. It encourages and

supports acquisition of conservation easements without removing the property from private ownership. Most FLP conservation easements restrict development, require sustainable forestry practices and protect other values. Participation in the FLP is limited to private forest landowners. To qualify, landowners are required to prepare a multiple resource management plan as part of the conservation easement acquisition. The federal government may fund up to 75% of project costs, with at least 25% coming from private, state, or local sources. In addition to gains associated with the sale or donation of property rights, many landowners also benefit from reduced taxes associated with limits placed on land use.

- *Section 7, Blackfoot Watershed, Bull Trout Baseline:* As part of the listing requirement of bull trout, all federal land management agencies were required to develop baseline conditions of bull trout habitat for each 6th field HUC within their ownership. This was completed in 2000 and reported to the USFWS in the Section 7, Blackfoot Watershed, Bull Trout Baseline produced by the Lolo National Forest, Helena National Forest and Bureau of Land Management. The end product documented the bull trout and habitat condition for each federally owned 6th field HUC within the Blackfoot Watershed and determined that the overall habitat condition within the Blackfoot Section 7 Watershed is “Functioning at Risk” for bull trout. Since the completion of the plan in 2000, additional information has supplemented the information in this plan. (Note the baseline also applies to the Bureau of Land Management).
- *State and Private Forestry (S&PF) Program:* The S&PF program provides financial and technical forest management assistance and expertise to a diversity of landowners, including small woodlot, tribal, state, and federal, through cost-effective, non-regulatory partnerships. The staffs play a key role, along with others within the USFS and the Department of the Interior, in implementing the National Fire Plan to manage the impacts of wildland fires on communities and the environment.
- *Tri-County Resource Advisory Council:* Projects must be located within one of the three counties covered by the Tri-County RAC (Deer Lodge, Granite or Powell). Funds must be spent on projects that benefit federal land, although projects do not have to be located on federal land. Eligible projects include watershed restoration and maintenance; restoration, maintenance, and improvement of wildlife and fish habitat; or reestablishment of native species.

4.2.3.2 State Programs

Montana Department of Natural Resources and Conservation: MDNRC management and funding programs applicable to the Blackfoot Subbasin include:

- *MDNRC Trust Lands:* MDNRC Trust Lands Division manages activities on state trust lands throughout the Blackfoot Subbasin. Use of state trust lands includes agricultural use, harvest of forest products, mineral activities, and a number of other commercial uses. In addition the Trust Lands Division sponsors a variety of restoration activities ranging from fire and range rehabilitation to fisheries and stream restoration projects, including a number of projects in the Blackfoot (e.g., Blanchard Creek stream restoration project).

MDNRC has also participated in the acquisition of Plum Creek Timber Company property in partnership with the Blackfoot Challenge and others. On Montana State Forests, forestry Best Management Practices (BMPs) are implemented to maintain water quality and reduce sediment input. Audits of forestry practices indicate a high degree of compliance. Grazing BMPs have also been developed and are being implemented on state grazing lands.

- *MDNRC Private Grants:* These funds are for projects relating to water where the quantifiable benefits exceed the costs.
- *MDNRC RDGP:* This program funds projects that reclaim lands damaged by mining. Projects must provide benefits in one or more of the following: reclamation, mitigation, and research related to mining and exploration; identification and repair of hazardous waste sites, or research to assess existing or potential environmental damage.
- *MDNRC RRGL Planning Grant:* These grants fund the conservation, management, development, or protection of renewable resources in Montana. A 50% cash match is required unless the project is sponsored by a non-revenue producing entity.

Montana Department of Environmental Quality 319 Program: This program is for protection, improvement, or planning. Four categories of applications include: 1) Watershed TMDL Planning, 2) Watershed Restoration, 3) Groundwater, and 4) Information/Education.

Montana Fish, Wildlife and Parks (MFWP): MFWP programs focus on monitoring, research, and protection of habitat for threatened and endangered species and other wildlife of special interest to the public. Species of interest in the Blackfoot Subbasin include wolves, white-tailed deer, grizzly bears, elk, native fish (bull trout and westslope cutthroat trout) Bald Eagles, waterfowl and other birds of special interest. Public education is emphasized to avoid human/wildlife conflicts. Many efforts by MFWP to protect and restore native fish also incorporate protection of water quality in streams, rivers, and lakes critical to native fish. Projects involve stream bank restoration, removal of culverts, reduction of sediment runoff, and land acquisition. Mitigation funds are used to recover lost wildlife habitat. The *River Restoration Program*, for example, funds stream corridor improvements, including fencing and bank stabilization. Other MFWP programs include:

- *Access Montana Program:* The goal of Access Montana is to improve hunting access to public lands and resolve public land access conflicts. MFWP works with landowners, hunters, and land management agencies to attempt to resolve public land access conflicts. FWP also works with willing landowners to develop public land access agreements, which may include incentives such as fencing, cattle guards, culverts, gates, signing or maps to identify land ownership boundaries, increased MFWP enforcement, and in some cases, compensation.
- *Future Fisheries Improvement Program:* This program was passed by the 1995 Montana Legislature to restore essential habitats for the growth and propagation of wild fish populations in lakes, rivers, and streams. Funds used to implement the program originate

from the sale of Montana fishing licenses. Nearly a million dollars per year are presently allocated to the program. Program funding may be provided for costs of design, administration, construction, maintenance and monitoring of projects that restore or enhance habitat for wild fishes. Preference is given to projects that restore habitats for native fishes. In addition to restoring habitat, projects must eliminate or significantly reduce the original cause of the habitat degradation.

- *Habitat Montana Program:* The goal of Habitat Montana is to preserve and restore important habitat for fish and wildlife. Under the program, landowners interested in using a conservation easement to protect traditional farm and ranch land and to preserve natural resources such as wildlife habitat, may partner with MFWP. A variety of funding sources enable MFWP to protect seriously threatened habitats and provide recreational opportunities through purchased or donated conservation easements and purchases of land. Annually, about \$4 million from several sources goes to fund projects selected by the MFWP Commission from among those recommended by the MFWP staff. In addition to monetary compensation, landowners may: realize tax benefits from a conservation easement; gain help in pursuing habitat-friendly agricultural practices; and ensure the protection of scenic and open spaces.

Montana Natural Heritage Program (MTNHP): MTNHP is Montana's clearinghouse for information on Montana's native species and habitats, emphasizing those of conservation concern. The program collects, validates and distributes this information and assists natural resource managers and others in applying it effectively. Established by the Montana State Legislature in 1983, the program is located in the Montana State Library, where it is part of the Natural Resource Information System.

4.2.3.3 County Programs

Missoula, Powell, and Lewis and Clark County Conservation Districts: County Conservation Districts (located in NRCS field offices) provide handouts to the general public with information and management recommendations for water, riparian and wetlands protection and restoration. All conservation district boards are made up of local landowners who work closely with their respective NRCS field offices to implement conservation programs. Conservation districts also work with NRCS to determine annual priorities (e.g., grazing, forestry, multiple use) for county projects. All three districts conduct weed control programs and administer 310 permits in cooperation with MFWP. The North Powell Conservation District has taken a proactive role by contracting a full-time Land Steward who works closely with private landowners and watershed partners to plan and develop grassroots resource conservation projects aimed at improving water quality and fisheries, grazing resources, forest health, and irrigation use. The North Powell Conservation District has a number of watershed restoration efforts in the Nevada Creek drainage, including stream/riparian restoration, grazing management, forest thinning, and irrigation improvement efforts.

Missoula, Powell, and Lewis and Clark County Extension Offices: Extension offices in each county offer a wide variety of programs and services that support resource management and landowners in the subbasin, including education and assistance for topics such as nutrition, agriculture, livestock and 4-H. Weed Districts run through the Extension Offices assist

in mapping and inventory of weeds, leadership in identifying and controlling noxious weeds, and facilitation of grant programs in Weed Management Areas.

Missoula, Powell, and Lewis and Clark County Planning Offices and Health Departments: The county planning offices and health departments are responsible for applying zoning regulations, conducting growth planning, regulating air quality and providing permits for land subdivision and new septic systems.

Missoula County Open Space Program: Missoula County voters approved a \$10 million dollar bond in November 2006 for the purpose of preserving open space in Missoula County, with half allocated to Missoula County and half allocated to the City of Missoula for use in the urban area. The County's Open Lands Citizen Advisory Committee (OLC), in addition to its other responsibilities, reviews and makes recommendations to the Board of County Commissioners (BCC) about projects in its jurisdictional area. The OLC, appointed by the BCC, includes 13 members and 4 alternates from across the County. It bases its recommendations on project evaluation criteria established by BCC resolution. To date, the County portion of the bond money has been used to help purchase seven conservation easements throughout the county, including three in the Blackfoot Subbasin that protect a combined 4,041 acres.

Lewis and Clark County Open Space Program: Lewis and Clark County voters approved a \$10 million dollar bond in November 2008 for the purpose of preserving open-space lands in the County, including working lands and land for protecting water and wildlife, by providing funds to acquire conservation easements or other property interests from willing sellers and to pay costs associated with the sale and issuance of bonds, for any one or more of the following reasons: protecting drinking water sources and ground water quality; protecting water quality in and along rivers and streams; conserving working farm, ranch and forest lands; protecting wildlife areas; preserving open lands and natural areas; providing for recreation; and managing growth and development. The County is in the process of developing a proposal process and evaluation criteria for potential projects.

4.2.3.4 Institutions, Non-Profit Organizations, and Private Funding

The Big Blackfoot Chapter of Trout Unlimited (BBCTU): The mission of BBCTU is to restore and protect the coldwater fishery of the Blackfoot Subbasin. It embarked upon this effort in partnership with state, federal and local agencies and private entities and individuals in the late-1980s. Since that time it has been heavily involved in a growing watershed-wide restoration effort that has included a wide variety of stream and riparian restoration projects. It currently employs a full-time restoration biologist to oversee its restoration project work.

The Blackfoot Challenge: The Blackfoot Challenge is a landowner-based group that coordinates management of the Blackfoot River, its tributaries and adjacent lands. The mission of the Blackfoot Challenge is to coordinate efforts that will enhance and conserve the natural resources and rural way of life of the Blackfoot River Valley for present and future generations. The Challenge works with over 500 partners and has secured funding for restoration and conservation projects through cooperative agreements and leveraging of public/private funds. See www.blackfootchallenge.org for a comprehensive list of all partners engaged in conservation and restoration activities and a complete overview of funding partners.

The Clearwater Resources Council (CRC): The mission of the CRC is to initiate and coordinate efforts that will enhance, conserve and protect the natural ecosystems and rural lifestyle of the Clearwater River region for present and future generations. Among its accomplishments, the CRC has conducted a landscape assessment of the Clearwater Valley Planning area (CRC 2008). In addition, it has been key in the development of a Fuel Mitigation Task Force consisting of the CRC, local fire and land management agencies, and the Bitterroot Resource Conservation and Development program. The goal of the Task Force is to provide professional consultation to landowners when they embark on fuel thinning efforts.

Five Valleys Land Trust (FVLT): Five Valleys Land Trust is a community-supported non-profit conservation organization with a mission to “preserve and protect western Montana’s natural legacy—our river corridors, wildlife habitat, agricultural lands, and scenic open spaces.” FVLT works with landowners and other partners to craft unique, collaborative solutions to conservation challenges and opportunities. FVLT currently holds 19 conservation easements on 11,469 acres throughout the Blackfoot Subbasin and played a key role in the collaborative effort to protect the Blackfoot Clearwater Wildlife Management Area. In the months and years ahead, FVLT will be working with several landowners and with The Nature Conservancy to permanently protect thousands of additional acres in the Blackfoot.

The Montana Land Reliance (MLR): The MLR mission is to "provide permanent protection for private lands that are ecologically significant for agricultural production, fish and wildlife habitat, and scenic open space. MLR’s goal is to affirm the positive relationship between well-managed, productive lands and the integrity of wildlife habitat, watersheds, and open space in a way that benefits both the landowner and the community." MLR’s goal is to protect 1 million acres of private lands through conservation easements in all of Montana by 2010. To date, MLR has acquired conservation easements on 16,463 acres in the Blackfoot Subbasin.

The Montana Nature Conservancy (TNC): The Montana Nature Conservancy’s goal is to protect unique habitat, areas rich in biodiversity, and areas critical for rare, threatened or endangered species. TNC has a number of land holdings in the Blackfoot Subbasin and has been actively engaged in a variety of conservation efforts within the subbasin for many years. The Blackfoot is a key component of its 10 million-acre effort known as the “Crown of the Continent” initiative that spans from the Blackfoot in Montana to the Elk River Valley in southern British Columbia. Most recently TNC’s efforts have included both its collaboration with the Blackfoot Challenge and private and public partners on the 89,215-acre Blackfoot Community Project and the designation of the Blackfoot Community Conservation Area (see Section 4.2.1.3). In 2008, The Nature Conservancy and The Trust for Public Land entered into an agreement with Plum Creek Timber Company to purchase 312,500 acres of timberland in western Montana called the Montana Legacy Project. As part of this project, a total of 71,754 acres in the Clearwater and Potomac valleys of the Blackfoot Subbasin will be purchased and resold to public agencies and/or private buyers. A majority of the lands that are part of this project in the Blackfoot Subbasin are intended to be re-sold to the USFS or MDNRC.

Rocky Mountain Elk Foundation (RMEF): RMEF and its partners have contributed more than \$4.6 million to protecting the Blackfoot-Clearwater Wildlife Management Area through a

combination of land acquisition and trades. These efforts have resulted in over 5,500 acres that have been protected as elk and mule deer habitat.

Tri-State Water Quality Council: In response to water quality concerns expressed by citizens within the Clark Fork-Pend Oreille watershed, the U.S. Congress added a section to the 1987 Clean Water Act (Section 525), which directed the EPA to conduct a comprehensive water quality study across the three-state watershed (Montana, Idaho, and Washington). That study was completed and a watershed management plan was developed by the study's steering committee (comprised of two EPA regions and the state water quality agencies of the three states). The first priority in the management plan was to create a Tri-State Council to carry out the various action items in the plan. The Council first met in October of 1993. The Tri-State Water Quality Council is a partnership of diverse community interests—including citizens, business, industry, tribes, government, and environmental groups—working together to improve and protect water quality throughout the 26,000 square mile watershed.

Private Foundations and Individuals: Private foundation grants and individual contributions have played a critical role in funding conservation and restoration in the Blackfoot Subbasin. These private sources of funds have provided not only project funding but often the difficult to obtain capacity for partners (e.g., personnel, travel, etc.). This capacity is central to project implementation and securing project funding. These private partners and their funding provide incredible support in terms of leveraging funds, resources, and expertise. In addition, many private landowners have donated conservation easements where the appraised value of the donated private right is used as matching funds to secure public sources of funding for additional conservation outcomes for public benefit.

4.3 Restoration and Conservation Projects

As described below, since 1988 the effort to restore and conserve aquatic resources—particularly native fisheries—has been underway in the Blackfoot sub-basin. Underlying that long term effort has been a long-term data-gathering effort that targets both pre-restoration baseline information, and post-restoration effectiveness monitoring. This data collection effort covers fish population estimates, stream temperatures, stream habitat surveys (e.g. pool width, depth, frequency, large wood, pebble counts, stream discharge, streambank stability, stream degradation, overhead canopy, understory vegetation, Rosgen channel type), whirling disease severity, and westslope cutthroat genetic investigations.(Pierce, 2008). As of the date of this plan, habitat and fisheries inventories have been performed on 182 tributaries and mainstem reaches within the sub-basin (Pierce, 2008). This data is used to help target restoration efforts (Appendix M). In addition, ongoing monitoring is an important tool for measuring the success of the restoration efforts.

4.3.1 BPA-Funded Restoration Projects in the Blackfoot Subbasin

To date, the only BPA funding source in the Blackfoot Subbasin has been the Columbia Basin Water Transaction Program (CBWTP). The CBWTP came into being in 2002 specifically to support innovative voluntary grassroots water transactions to improve tributary flows in the

Columbia Basin. Table 4.1 lists completed BPA-funded CBWTP projects in the Blackfoot Subbasin.

4.3.2 Non-BPA-Funded Restoration Projects in the Blackfoot Subbasin

Table 4.2 lists restoration projects that were supported by a variety of non-BPA funding sources, including private donors, foundations, private landowners, conservation groups, license dollars, D-J funds, Future Fisheries, various NRCS funds and cooperative agreements with other state and federal agencies. The status of projects completed, projects pending and projects planned is constantly changing as pending projects reach completion and new projects are begun. The projects described in this section represent only those that were completed as of December 31, 2008.

4.3.3 Ongoing and Potential Restoration Projects on TMDL Streams

Numerous potential restoration projects have been identified to address TMDLs in the Blackfoot Subbasin. These projects are listed in Table 4.3.

Table 4.1 Completed BPA-Funded CBWTP Projects in the Blackfoot Subbasin.

Project Name	Project Description
1. Poorman Creek Riparian Habitat and Stream Flow Restoration	This project entailed removal of culverts, a grazing management plan and associated riparian restoration, and irrigation improvements to reconnect lower Poorman Creek with the Blackfoot River near Lincoln. The goal of this project is to improve conditions for migration of spawning bull trout and westslope cutthroat trout into Poorman Creek. CBWTP contributed \$10,000 to the total project cost of \$110,000.
2. North Fork Blackfoot Water Rights Lease (Weavers)	This water conservation project involved an instream flow lease of 18.4 cfs of water from the Weaver Ranch on the North Fork of the Blackfoot, a key bull trout spawning and rearing stream in the Blackfoot Subbasin. This project entailed the change in point of diversion from a ditch in a losing reach of the North Fork to a point of diversion in a gaining reach and conversion from a gravity system to a pump and pipeline, reducing the irrigator's diversion from as much as 20.5 cfs to 2.0 cfs.
3. Rock Creek (Hoxworth) single-season diversion-reduction agreement	This agreement was a single-season agreement by an irrigator on Rock Creek to refrain from diverting water from Rock Creek for one irrigation season, in 2003. CBWTP contributed \$2950 to secure the agreement. This agreement was a pre-cursor to a long-term lease of an instream flow water right from the irrigator.
4. Rock Creek (Hoxworth) water conservation project	This project involved a change from a flood irrigation operation to a pump, pipe, and center pivot, leading to an instream water lease of 1.5 cfs in Rock Creek, a tributary to the North Fork of the Blackfoot in order to enhance the migration of westslope cutthroat trout to the upper reaches of Rock Creek. The agreement leases 1.5 cfs for 25 years. This project is part of a much larger habitat restoration project on Rock Creek which entailed channel restoration, riparian habitat restoration, and reconnection of the stream with its floodplain from its headwaters to the mouth. CBWTP contributed \$10,000 to the \$64,000 cost of this project.
5. Rock Creek/North Fork (Talan, Inc.) single-season diversion reduction agreement	This agreement was a precursor of a long-term agreement (30 years) for a lease of water rights on the North Fork of the Blackfoot. The approval of that long-term agreement is pending before the Montana MDNRC. The long-term agreement is part of efforts to improved streamflows in the North Fork of the Blackfoot. CBWTP contributed \$3,500 to securing of this agreement.
6. Murphy Spring Creek single-season, split-season diversion-reduction agreements	These agreements (2004-2007) between three irrigators who divert water from Murphy Spring Creek, a tributary to the North Fork of the Blackfoot for 2.2 cfs minimum flow in the creek, are designed to maintain minimum passages flows and rearing habitat for both westslope and bull trout. These single-season agreements are pending a longer-term lease. Water lease for 2.2 cfs. CBWTP, over the life of these agreements, has contributed \$20,240.
7. Wasson Creek (Mannix Brothers Ranch) single-season diversion-reduction agreements	These agreements with the Mannix Brothers Ranch were designed to keep at least 0.5 cfs water flowing in lower Wasson Creek pending a long-term lease, which was completed in 2006. The purpose of these agreements is to keep a minimum flow in the lower two miles of Wasson Creek during the irrigation season to allow the migration a pure-strain population of west slope cutthroat from upper Wasson Creek into a newly restored spring creek into which Wasson Creek flows. CBWTP contributed \$15,000 to secure these agreements.
8. Wasson Creek (Mannix Brothers Ranch) long-term lease	See item 7 above. This ten-year lease secures a minimum flow of 0.75 cfs in Wasson Creek. CBWTP contributed \$45,000 to the \$75,000 price for this lease.

Table 4.2 Completed Restoration Projects in the Blackfoot Subbasin.

Stream Name	Number of Projects	Number of Landowners	Projects ^{1, 2, 3}
Arrastra Creek	1	2	Fish passage improvements(a)
Ashby Creek	10	2	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water Conservation(b;d); Improve wetlands; Improve range/riparian habitat; Upgrade diversion structure; Fish passage improvements(a;b); Prevent fish entrainment (fish screen); Conservation easement
Basin Spring Creek	12	2	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water Conservation(d); Improve wetlands; Improve range/riparian habitat; Improve irrigation(b); Remove streamside feedlots; Conservation easement
Bear Creek (RM 12.2)	11	3	Fish passage improvements(a;c); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water Conservation(b;d); Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Beaver Creek	17	2	Fish passage improvements(b;e); Water Conservation(b); Channel restoration; Improve wetlands; Conservation easement
Belmont Creek	3	1	Fish passage improvements(a); Spawning habitat protection; Improve range/riparian habitat
Blackfoot River (Clearwater to mouth)	7	5	Water Conservation(a;b;c); Conservation easement
Blackfoot River (North Fork to Clearwater)	13	11	Improve instream flows; Improve wetlands; Improve range/riparian habitat; Conservation easement
Blackfoot River (Lincoln to North Fork)	50	24	Channel restoration; Riparian vegetation improvements; Water Conservation(a;b); Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots; Prevent fish entrainment; Improve diversion structure(a); Conservation easement
Blanchard Creek	4	1	Fish passage improvements(a;b;d;e); Riparian vegetation improvements; Improve range/riparian habitat; Water Conservation(a;b)
Chamberlain Creek	22	4	Fish passage improvements(a;b;c;d;e); Water Conservation(a;b;c;d); Improve diversion structures(a;b); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots; Conservation easement
Chamberlain Creek (West Fork)	1	1	Improve range/riparian habitat
Clearwater River	6	2	Water Conservation(a;b;c); Improve range/riparian habitat; Conservation easement
Cottonwood Creek (RM 43)	24	5	Fish passage improvements(a;b;d;e); Water Conservation(a;b;c); Improve irrigation structure(a); Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots; Conservation easement

Table 4.2 (continued).

Stream Name	Number of Projects	Number of Landowners	Projects^{1, 2, 3}
Cottonwood Creek (Nevada)	6	1	Fish passage improvements(b;e); Channel restoration; Riparian vegetation improvements; Improve range/riparian habitat; Improve diversion structure(a); Remove streamside feedlots
Dick Creek	34	10	Fish passage improvements(a;b;c;d;e); Water Conservation(b); Improve diversion structure(a;c); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Prevent fish entrainment; Remove streamside feedlots; Conservation easement
Douglas Creek	6	2	Fish passage improvements(d;e); Riparian vegetation improvements; Improve range/riparian habitat; Conservation easement
Dry Creek	4	1	Riparian vegetation improvements; Improve range/riparian habitat; Remove streamside feedlots; Conservation easement
Dunham Creek	11	4	Fish passage improvements(a;b;c); Water Conservation(d); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Improve diversion structure(a)
Elk Creek	4	1	Channel restoration; Fish habitat improvement; Improve wetlands; Improve range/riparian habitat
East Twin Creek	1	1	Fish passage improvements(a)
Enders Spring Creek	8	2	Fish passage improvements(c;d); Water Conservation(c;d); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat;
Gold Creek	2	2	Fish habitat improvement
Grantier Spring Creek	11	1	Fish passage improvements(c); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat
Hoyt Creek	19	4	Fish passage improvements(a;b;c;d); Water Conservation(b;d); Improve diversion structures(a;b;c); Channel Restoration; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Fish habitat improvement; Conservation easement
Jacobsen Spring Creek	16	2	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water Conservation(d); Improve range/riparian habitat; Improve diversion structures(b); Fish passage improvements(a;c;d); Remove streamside feedlots; Conservation easement
Johnson Creek	1	1	Fish passage improvements(a)
Keep Cool Creek	6	1	Riparian vegetation improvements; Improve range/riparian habitat; Improve wetlands; Remove streamside feedlot; Conservation easement
Kleinschmidt Creek	26	6	Fish passage improvements(a;c); Water Conservation(a;d); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots; Conservation easement

Table 4.2 (continued).

Stream Name	Number of Projects	Number of Landowners	Projects ^{1, 2, 3}
Lincoln Spring Creek	13	1	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Fish passage improvements(a,b,c,d); Water Conservation(b,c,d); Improve diversion structure(a;c).
Lodgepole Creek	1	1	Fish passage improvements(a)
McElwain Creek	2	1	Improve range/riparian habitat; Remove streamside feedlots; Water Conservation(b)
McCabe Creek	15	2	Fish passage improvements(a;b;c;d); Water Conservation(a;b;c;d); Improve diversion structures(a;b;c); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Prevent fish entrainment; Conservation easement
Monture Creek	27	6	Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water Conservation(b;c); Improve wetlands; Improve range/riparian habitat; Improve diversion structures(a); Remove streamside feedlots
Moose Creek	2	1	Fish passage improvements(a)
Morrell Creek	10	4	Fish passage improvements(b;c;d); Fish habitat improvement; Water Conservation(a;c); Channel restoration; Fish habitat improvement; Improve diversion structures(a); Prevent fish entrainment
Nevada Creek	20	5	Fish passage improvements(b;e); Channel restoration; Improve diversion structures(a); Conservation easement
Nevada Spring Creek	24	3	Fish passage improvements(a;b;c;d;e); Water Conservation(a;b;d); Improve diversion structures(a;b); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots; Conservation easement
North Fork Blackfoot River	31	14	Fish passage improvements(b;d); Fish habitat improvement; Water Conservation(a;b;c); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Improve diversion structures(a); Prevent fish entrainment; Conservation easement
Pearson Creek	20	2	Fish passage improvements(b;c;d;e); Water Conservation(d); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve diversion structure(a); Remove streamside feedlots; Conservation easement
Poorman Creek	11	4	Fish passage improvements(a;b;c;d); Channel restoration; Water Conservation(a;b;c;d); Riparian vegetation improvements; Improve diversion structure(a;); Improve range/riparian habitat

Table 4.2 (continued).

Stream Name	Number of Projects	Number of Landowners	Projects ^{1, 2, 3}
Rock Creek	50	12	Fish passage improvements(a;b;c;d); Water Conservation(a;b;c;d); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve diversion structures(a;b;c); Remove streamside feedlots; Conservation easement
Salmon Creek	21	4	Fish passage improvements(a;b;c;d;e); Water Conservation(b;c;d); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve diversion structures(a;c); Remove streamside feedlots; Conservation easement
Shanely Creek	6	2	Water Conservation(b); Riparian vegetation improvements; Improve range/riparian habitat; Improve diversion structures(a); Fish passage improvements(b); Conservation easement
Spring Creek (North Fork)	8	6	Fish passage improvements(a;b;d;e); Water conservation(a;b); Improve diversion structure(a); Improve wetlands; Prevent fish entrainment; Conservation easement
South Fork Rock Creek	5	1	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Water conservation(d); Improve range/riparian habitat
Ward Creek	17	8	Improve range/riparian habitat; Remove streamside feedlots; Channel restoration; Riparian vegetation improvements; Improve diversion structures(a); Conservation easement
Warren Creek	39	9	Fish passage improvements(a;b;c;d;e); Water Conservation(d); Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve diversion structures(a;b); Remove streamside feedlots; Conservation easement
Wasson Creek	17	2	Fish passage improvements(b;c;d;e); Water Conservation(a;b;d); Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Improve diversion structures(a); Remove streamside feedlots; Prevent fish entrainment; Conservation easement
West Twin Creek	1	1	Fish passage improvements(a)

Total project streams: 53

Total projects: 676

Total landowners: 193

¹ **Fish passage improvement codes:**

a = rd crossing upgrade
b = upgrade diversion
c = restoration
d = instream flows
e = fish ladder

² **Water conservation codes:**

a = water lease; conversion; single season agreement
b = conveyance
c = conversion
d = restoration

³ **Improve diversion structure codes:**

a = replace headgate
b = remove headgate
c = install headgate

Table 4.3 Potential Restoration Projects on TMDL Streams in the Blackfoot Subbasin.

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>BLACKFOOT HEADWATERS PLANNING AREA</i>						
Blackfoot River from Headwaters to Landers Fork	Mine waste removal from floodplain	From the Anaconda/Beartrap Creeks confluence downstream 1 mile	Reduce metals loading; Improve habitat	Mixed private/public	Scheduled to be completed as part of Mike Horse Mine cleanup	Yes - High
Blackfoot River from Landers Fork to Nevada Ck	None identified at this time				Water quality restoration measures identified in TMDL	Yes – High/Moderate
Arrastra Creek	Culvert Replacement	Approximately 3 miles upstream of confluence with the Blackfoot River	Improve fish passage and flow/sediment conveyance	Public	Completed in 2005	Yes-Moderate
	Bridge installation	Approx 1 mi upstream of above culvert replacement		Private	Preliminary	
Beartrap Creek from Mike Horse Creek to mouth	Mine waste removal from floodplain	Beartrap Creek from Mike Horse Creek to mouth	Reduce metals loading; Improve habitat	Mixed private/public	Scheduled to be completed as part of Mike Horse Mine cleanup	No
Mike Horse Creek	Mine waste removal from floodplain	From Mike Horse Mine to confluence with Beartrap Ck	Reduce metals loading; Improve habitat	Mixed private/public	Private land work completed in 2006/2007. Public land work scheduled to be completed as part of Mike Horse Mine cleanup	No

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>BLACKFOOT HEADWATERS PLANNING AREA (CONT.)</i>						
Poorman Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes-High
Sandbar Creek	None identified at this time				Water quality restoration measures identified in TMDL	No
Willow Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes – High
<i>NEVADA CREEK PLANNING AREA</i>						
Washington Creek (upper)	None identified at this time.				Water quality restoration measures identified in TMDL	Yes – Low
Washington Creek (lower)	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Low
Jefferson Creek (upper)	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Low

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>NEVADA CREEK PLANNING AREA (CONT.)</i>						
Jefferson Creek (lower)	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Low
Gallagher Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Low
Buffalo Gulch	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Low
Braziel Creek	Stream channel reconstruction, grazing management, riparian area protection, irrigation diversion improvement	About ½ mile from mouth	Restore instream and riparian habitat	Private	Scheduled to be completed in 2009/2010	No
Nevada Creek (headwaters to Nevada Lake)	Stream channel reconstruction/stabilization, grazing management, riparian plantings	At confluence with Halfway Ck	Restore instream and riparian habitat. Reduce sediment from bank erosion	Private	Completed in 2007	Yes - Moderate
	Grazing management, irrigation diversion structure	Just upstream of USGS gage station	Sediment reduction, Instream flows	Private	Completed in 2007	Yes - Moderate
Nevada Creek (Nevada Lake to Blackfoot River)	Stream restoration and grazing management	Approx 1 mile downstream of reservoir	Prevent avulsion, reduce sediment from bank erosion, improve riparian area and uplands	Private	Scheduled for implementation in 2009	Yes – Low

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
NEVADA CREEK PLANNING AREA (CONT.)						
Nevada Creek (Nevada Lake to Blackfoot River) (cont)	Streambank stabilization where encroaching on Helmville ditch berm, grazing management	Approx 3 miles downstream of reservoir	Prevent Creek from undercutting berm toe, reduce sediment from bank erosion, improve riparian area and uplands	Private	Scheduled for implementation in 2009	Yes – Low
	Channel restoration, grazing management, riparian area protection, irrigation conveyance improvement	Immediately below reservoir	Demonstration project	Private	Under development	Yes - Low
Nevada Spring Creek	Fencing and off-site water development		Habitat enhancement; Sediment/temperature reduction	Private	Completed in 2006	Yes - Moderate
Black Bear Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Moderate
Murray Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Low
Douglas Creek (upper)	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Moderate
Douglas Creek (lower)	Grazing Management: off-stream water development, fencing	Approx 2 miles upstream of NV Ck	Habitat enhancement; Sediment/temperature nutrient reduction	Private	Completed by landowner 2006	Yes - Moderate
	Irrigation diversion improvement	Downstream end of previous project	Reduce sediment loading; remove fish barrier	Private	Unknown	Yes - Moderate

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>NEVADA CREEK PLANNING AREA (CONT.)</i>						
Cottonwood Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Low
McElwain Creek	Channel maintenance, spring development for livestock	Approx 1 mile above mouth	Mitigate gorging of channel, conserve instream flows	Private	Completed in 2007/2008	Yes - High
<i>MIDDLE BLACKFOOT PLANNING AREA</i>						
Yourname Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Moderate
Frazier Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Low
Wales Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes -Moderate
Ward Creek	Riparian enhancement, grazing management, offsite watering, fencing, revegetation	Approx ¼ mile above Dead Man’s Lake	Improve habitat; Sediment/temperature reduction/, increase instream flow	Private	Completed in 2005	Yes - Low
Rock Creek	Riparian revegetation	South Fork Rock Creek, middle and lower reaches	Temperature reduction, bank stability, cover, habitat improvements	Private	Completed in 2008	Yes - High

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>MIDDLE BLACKFOOT PLANNING AREA (CONT.)</i>						
Rock Creek (cont)	Riparian revegetation	Upper reach from Salmon and Dry Creek confluence to State lands	Re-establish riparian willow and shrub communities	Private	Completed in 2008	Yes - High
Kleinschmidt Creek	Channel reconstruction, grazing management, off-site watering, fencing	Above final Highway 200 crossing	Reduce sediment, nutrients and temperature	Private	Completed in 2006	Yes – High
	Grazing management, off-site water development, fencing	Below final Highway 200 crossing	Reduce sediment, nutrients and temperature	Private	Scheduled for completion in 2010	
Warren Creek	Riparian enhancement, grazing management, offsite watering	Above Highway 200	Improve habitat; Sediment/temperature reduction/increase instream flow	Private	Completed in 2005	Yes - High
Monture Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - High
Cottonwood Creek	Culvert replacement		Improve fish passage, improve sediment/flow conveyance	USFS	Completed in 2007	
Blanchard Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - High
Buck Creek	None identified at this time				Water quality restoration measures identified in TMDL	No

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
MIDDLE BLACKFOOT PLANNING AREA (CONT.)						
Deer Creek	None identified at this time				Water quality restoration measures identified in TMDL	No
West Fork Clearwater River	None identified at this time				Water quality restoration measures identified in TMDL	No
Richmond Creek	None identified at this time				Water quality restoration measures identified in TMDL	No
Blackfoot River (Nevada Creek to Monture Creek)	None identified at this time				Water quality restoration measures identified in TMDL	Yes – High/Moderate
Blackfoot River (Monture Creek to Clearwater River)	None identified at this time				Water quality restoration measures identified in TMDL	Yes – Moderate
LOWER BLACKFOOT PLANNING AREA						
Belmont Creek	None identified at this time				Water quality restoration measures identified in TMDL	

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>LOWER BLACKFOOT PLANNING AREA (CONT.)</i>						
Blackfoot River (Clearwater River to Belmont Cr)	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Moderate
Blackfoot River (Belmont Cr to mouth)	Grazing management	Between Roundup Bridge and Elk Creek confluence	Protect stream banks and riparian area	Private	Under development	Yes – Moderate
Camas Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Low
Day Gulch	None identified at this time				Water quality restoration measures identified in TMDL	No
East Fork Ashby Creek	None identified at this time				Water quality restoration measures identified in TMDL	No
Elk Creek (headwaters to Stinkwater Cr)	None identified at this time				Water quality restoration measures identified in TMDL	Yes-High
Elk Creek (Stinkwater Cr to mouth)	Grazing Management, some channel reconstruction/stabilization	Lower 4 to 5 miles	Improve riparian area, protect past stream restoration	Private	Completed in 2008	Yes - High

Table 4.3 (continued).

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Prioritization List?
<i>LOWER BLACKFOOT PLANNING AREA (CONT.)</i>						
Keno Creek	None identified at this time				Water quality restoration measures identified in TMDL	No
Union Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Moderate
Washoe Creek	None identified at this time				Water quality restoration measures identified in TMDL	Yes - Low
West Fork Ashby Creek	None identified at this time				Water quality restoration measures identified in TMDL	No

4.4 Gap Assessment

As illustrated in the Blackfoot Subbasin Assessment and Inventory, the Blackfoot Subbasin has been and continues to be the focal point of much conservation and restoration work. This has been especially true during the last two decades, when emphasis has been placed on the restoration and protection of native aquatic and terrestrial species. Most of the factors threatening the viability of subbasin conservation targets and associated nested targets (Sections 3.3 and 3.4) have received some level of attention in an effort to abate them, but the extent of actions varies widely. While conservation accomplishments have been significant, the Blackfoot Subbasin threat assessment (Section 3.4) illustrates that much work remains to be done. The purpose of this section is to review the areas of accomplishment for each conservation target, to provide some assessment of the relative success of the ongoing restoration efforts, and to identify the areas of remaining need in terms of resource conservation and restoration in the subbasin.

Native Salmonids: At the inception of the current restoration effort in the late 1980s, various conservation partners made a decision to focus their efforts in the lower subbasin, from the North Fork of the Blackfoot downstream. These early efforts did not focus heavily on the Clearwater drainage. Part of this early emphasis was driven by the fact that fisheries investigations identified critically important bull trout and westslope cutthroat trout habitats within the Monture, North Fork, and nearby drainages. Willingness of many landowners to address fisheries problems in these areas was also an important factor. While native fish habitat continues to improve in the lower Blackfoot subbasin, the focus of native fish restoration work has begun to shift toward the upper subbasin and the Clearwater drainage (Pierce et al. 2008).

Historic mining activity and abandoned mine discharge has resulted in extensive water quality impairment in the subbasin. While there has been a long-term effort to address abandoned mine discharge in the headwaters of the subbasin, that effort is incomplete. To address nonpoint source impairments resulting from roads, unplanned residential and resort development, and incompatible forestry, irrigation, and livestock practices, the entire subbasin has undergone the TMDL designation process and primary pollutants have been identified for each reach of the river. Some of the causes of nonpoint-source pollution, such as nutrient enrichment and thermal and sediment pollution, are being addressed by ongoing habitat restoration projects. Significant nonpoint sources remain unaddressed, however, including those in the upper subbasin in and near the town of Lincoln and in the lower Nevada Creek drainage. Restoration projects are proceeding in both the lower Nevada Creek and upper Blackfoot areas that will improve water quality through partnerships with private landowners, government agencies, and conservation groups.

Access to and from important native fish habitats has been impaired by roads and drainage/diversion systems across the Blackfoot Subbasin. Projects to restore biological connectivity in tributaries and to restore native fish habitat have been completed throughout much of the lower and middle subbasin. There has been an extensive effort throughout the subbasin to remove culverts and other road crossings that have blocked migration into tributaries. A number of irrigation diversions have been modified or retrofitted to allow for fish passage. In a related effort, a substantial number of fish screens have been installed on irrigation diversions in key tributaries throughout much of the subbasin. Despite this work,

there are still a number of tributaries in the lower Nevada Creek drainage which continue to have access and connectivity impairments resulting from road crossings and drainage/diversion systems.

Channel alteration has caused water quality and physical habitat impairments in the subbasin. Restoration of physical habitat throughout much of the subbasin has been completed, especially in the lower and middle subbasin. The restoration efforts have focused on channel reconfiguration and reconnection of channels with their floodplains. Nonetheless, because many of the impairments occur on private land, the pace at which restoration can occur is uneven. This is especially true in parts of the lower Nevada Creek drainage. In the past few years, the pace of restoration here and in the upper subbasin, including the Copper Creek drainage, has increased.

Incompatible forestry practices, drainage and diversion systems, and, most recently, extended drought and climate change have all contributed to an altered hydrologic regime in the subbasin. The long-term restoration effort has been reasonably successful at addressing dewatering on many tributaries though a combination of both habitat and flow restoration strategies. Experience indicates that a coordinated, comprehensive approach that addresses not only physical water diversions but also the restoration of channel and floodplain integrity is the most effective way to address hydrologic alteration. Despite the success with restoration on many streams throughout the subbasin, much remains to be done to restore hydrologic function, especially in the middle Blackfoot and in the Nevada Creek drainage.

The historic introduction of non-native fish species (e.g., rainbow trout, brook trout and brown trout), along with the more recent illegal introduction of unwanted fish such as northern pike and yellow perch, is a high-ranked threat to native salmonids in certain waters of the Blackfoot Subbasin. Tools to eradicate or control some of these fish species are often not feasible. Habitat restoration that reduces water temperature and/or sediment and nutrient loading within moving waters may help control of some species. Public interest in maintaining a sport fishery in the Blackfoot precludes the eradication of recreationally important species, such as brown and rainbow trout.

Whirling disease, caused by the exotic parasite *Myxobolus cerebralis*, has been documented to varying degrees of severity throughout the low elevations the Blackfoot Subbasin. Although there remains a great deal to learn regarding the ecology of the parasite and effects of the disease, it is evident that degraded habitats with elevated levels of fine sediments and warm temperatures and/or nutrient enrichment can contribute to the severity of infection in certain waters. Recent research shows that riparian restoration and habitat enhancement with emphasis on migratory native fish within and upstream of the whirling disease pathogen may buffer fish from the effects of the disease (Pierce et al. 2009).

While the restoration effort has significantly improved conditions required for native fish in the Blackfoot sub-basin, certain conservation strategies have been more productive than others. For example, the installation of 24 fish screens has improved migration corridors while reducing the entrainment of fish into irrigation ditches in five bull trout spawning streams (the North Fork, Dunham, Cottonwood Creek, Morrell and Snowbank Creeks).

These improvements have been most dramatic on the North Fork of the Blackfoot when undertaken in concert with other needed strategies. Following a change in regulation to prevent the harvest of bull trout in 1990, the restoration partners installed fish screens on all five ditches in the North Fork in the mid-1990s. Prior to these actions, populations remained suppressed. After the installations were completed, populations of full trout showed dramatic improvement. See figure 3.20. Conversely, the restoration of riparian vegetation through the management of grazing in sensitive riparian areas continue to be particularly challenging and underscores the need to develop grazing criteria and better monitor streambank conditions and vegetative response particularly in native fish (i.e., bull trout) habitat.

Continuous long-term monitoring is critical to evaluating fisheries to restoration strategies. This monitoring from pre-treatment through post-treatment periods has enabled the restoration partners to identify specific restoration efforts that have not accomplished their intended goals. For example, on Nevada Spring Creek, a restoration effort in 2003 produced initial dramatic drops (in excess of 10 degrees F) in temperature at its mouth. In ensuing years, temperatures began to climb. This prompted a close examination of the restoration which found a partial failure of the work. The problems were corrected and in 2010 temperature data again showed dramatic cooling (FWP unpublished data). The repair of that restoration is now underway. That example nonetheless illustrates the importance of ongoing monitoring efforts and a willingness to apply adaptive management.

Monitoring and project evaluation have allowed MFWP to measure the relative response of salmonids to restoration actions. Overall, the response of wild trout, including native trout, has been positive, across several spawning and rearing tributaries and within the mainstem lower Blackfoot. River (Figures 3.21 and 3.22; Pierce, 2008).

Herbaceous Wetlands/Native Grassland/Sagebrush Communities/ Moist Site and Riparian Vegetation: Conservation and restoration accomplishments pertaining to these vegetation targets include a variety of public and private programs, projects and protections. Land protection has been the primary strategy used to conserve these targets. Numerous conservation easements on private land and fee title acquisition resulting in public land ownership, such as the designation of Waterfowl Production Areas, Wildlife Management Areas and the Blackfoot Community Conservation Area, have resulted in protection of wetlands, riparian areas, grasslands, and other vegetation communities. In 2002, the Blackfoot Challenge initiated a three-phase landscape-level effort to protect, restore, and enhance 37,000 acres of biologically significant wetlands (5,310 acres) and associated uplands (31,690 acres) for migratory birds and other wildlife species by 2015. The Blackfoot Watershed I, Montana Project was completed in 2007, resulting in protection, restoration and enhancement of a total of 16,794 acres (3,027 acres of wetland and 13,767 acres of associated upland). The Blackfoot Watershed II, Montana Project is in process.

Restoration activities implemented by the BBCTU targeted at native salmonids and aquatic habitat have also played a critical role in conservation of moist site and riparian vegetation communities. Revegetation projects in the riparian zone range from the simple cessation or reduction of grazing to replanting of native riparian vegetation associated with grazing

management. These revegetation efforts nearly always include grazing management agreements with the riparian landowners. While there are some notable successes, partners have identified the need to tighten provisions in agreements with private landowners and enhance compliance monitoring.

Cooperative weed management efforts by public and private partners have contributed to healthy grassland/rangeland and riparian areas. Partners in cooperative weed management seek to manage for a diversity of species and to prevent dense monocultures of noxious weeds using a combination of chemical, biological, and cultural controls. In recent years, conservation partners have initiated restoration projects focused on reducing Douglas-fir encroachment into native grassland/sagebrush communities.

Despite these efforts, much work remains to be done to conserve/restore these vegetation types in the subbasin. Significant information gaps exist for each vegetation target, making it difficult to develop quantifiable conservation objectives. To this end, many of the strategic actions outlined for subbasin vegetation targets in the Subbasin Management Plan (Section 5.0) focus on filling these information gaps. To ensure the effectiveness of future conservation and restoration work, baseline information on the historic extent and condition of each vegetation target is needed. This baseline information will be used to analyze the degree of departure from historic conditions in each vegetation type and to prioritize restoration and conservation action. Once sites are identified for conservation and/or restoration, it will be necessary to determine conservation goals and tools and to establish monitoring protocol that will permit adaptive management over time.

Low Elevation Ponderosa Pine/Western Larch Forest/Mid to High Elevation Coniferous Forest: Conservation and restoration accomplishments pertaining to subbasin forest conservation targets also include a variety of public and private programs, projects and protections. Forest protection strategies are diverse, ranging from Wilderness areas, where no forest management occurs, to conservation easements on working forest lands. In 2003, the Blackfoot Challenge and The Nature Conservancy purchased 89,215 acres of land from Plum Creek Timber Company. Known as the Blackfoot Community Project, this transaction protected that land from future inappropriate development. It also led to the establishment of the Blackfoot Community Conservation Area, a cooperatively-managed working forest. These types of conservation accomplishments reflect the important connections between working forests and forest protection in the Blackfoot Subbasin.

Commercial logging has been an economic mainstay in the Blackfoot Valley since 1885. For the first 100 years, the emphasis was on producing logs for the area mills and not necessarily on the environmental consequences of timber stand treatments, logging systems, and forest road construction. As a result, there are countless restoration opportunities on previously harvested lands within the subbasin. Recently, forest restoration, both on USFS land and across ownerships, has been the focus of several collaborative efforts. The Lolo Restoration Committee, a multi-interest advisory group, is working with the USFS on two restoration projects on the Seeley Lake Ranger District. A similar effort is underway on the Lincoln Ranger District. Forest restoration is a major component of recent federal legislation introduced by Montana Senator Jon Tester. The USFS, two state agencies, private

landowners and the Blackfoot Challenge have signed a Memorandum of Understanding for cooperative restoration projects across property lines on the 43,000-acre Blackfoot Community Conservation Area. The unintended negative impacts of historic logging activity will be mitigated in these cooperative efforts.

Climate change, the lack of natural fire on the landscape, and the worst bark beetle infestation on record have combined to present the largest threat to forested land within the subbasin. The current world-wide recession has exacerbated the problem by severely limiting market opportunities for the dead and dying timber. However, land management agencies, lumber mills, and private landowners are again working collaboratively with experienced loggers to help mitigate the potential extreme threat of uncontrolled wildfire to rural communities. Programs are in place to identify major wildfire threats to the individual communities, identify cross-boundary treatment areas and establish local task forces to lead the mitigation effort in each community. Federal funding is being provided through programs such as Jump Start, Western Forestry Initiative and the Redesign Competitive Grant. Many of these programs support ecologically sustainable forest stand treatments on low elevation ponderosa pine stands. The cooperators are also establishing new markets for forest thinning and dead trees that will enable the required treatments to continue on a sustained basis.

Although motorized vehicle use on public lands has been a contentious issue that impacts subbasin forest targets, various interest groups are finding solutions through collaboration versus litigation. For example, the Montana Wilderness Association and local snowmobile clubs agreed on a common set of recommendations for motorized use in the revision to the Lolo National Forest Plan. The progressive user groups realize that continued effective collaboration is the only way to successfully address inappropriate motorized vehicle use on public lands.

Grizzly Bears: A variety of regulatory documents (e.g., USFWS 1993, MFWP 1993, MFWP 2006) guide grizzly bear recovery in the NCDE. Because the major threats to grizzly bears in the Blackfoot Subbasin are related to human-bear conflicts that occur primarily on privately owned and leased lands, however, voluntary actions have been instrumental in abating threats to grizzly bears. In the Blackfoot Subbasin, wildlife managers, the Blackfoot Challenge, landowners and others have worked hard in recent years to mitigate these threats. Hundreds of community members take part in a variety of programs that have reduced grizzly bear-human conflicts by 84% between 2003 and 2008. No grizzly bears have been killed by wildlife management authorities since 2004 and no grizzlies have been trapped/relocated since 2005 for management related purposes in the core project area in the subbasin. This portion of the NCDE is likely serving as important stepping stone habitat facilitating grizzly bear dispersal to the south. Programmatic efforts here are laying the groundwork for population-level connectivity for grizzlies to the Greater Yellowstone Ecosystem and Central Idaho.

The Blackfoot Challenge's Wildlife Committee (WC) has been a leader in the subbasin to help improve management of human-wildlife interactions. The WC has focused on grizzly bear conservation and management since its inception in 2003. The WC has three official work groups: the Landowner Advisory Group, the Neighbor Network Group, and the Waste

Management and Sanitation Work Group. The WC has developed an extensive programmatic effort to reduce human-grizzly bear conflicts and improve grizzly bear conservation and management. Maintaining this official committee of the Blackfoot Challenge is an important mechanism for furthering grizzly bear conservation in the watershed. Future actions will continue to focus on working cooperatively with livestock producers, managers, landowners, agencies, and other partners on a variety of conflict mitigation strategies to reduce grizzly bear mortality in the Blackfoot Subbasin.

A major focus of WC work with the USFWS, MFWP, landowners and all partners has been on changing specific land use practices and human behaviors that lead to conflicts with bears. Rather than trying to change the way people think about bears, the WC has focused on trying to change the way people live, work and recreate around bears. When subbasin residents can learn to live with bears, attitudes and or perceptions of bears may improve. WC coordinator Seth Wilson documented the attitudes of more than 30 ranchers throughout the subbasin in 2003 as a baseline to measure future changes in attitudes.

The efforts of MFWP, USFWS, the WC and all partners over the past six years have focused squarely on “attractant security” or making artificial food sources off limits to grizzly bears. MFWP and the WC’s Neighbor Network program play a critical role in helping to make attractants such as household garbage, livestock feed, birdfeed and other artificial food sources secure from grizzly bears. New Neighbor Networks are being developed in Lincoln, Woodworth and in the Avon-Helmville area to address attractants and other sanitation issues. Nearly all high-risk calving areas in the subbasin have electric fences (41,000 feet of fencing have been installed) and, on average, 225 livestock carcasses are removed annually from ranches in the subbasin. All ranches located in core grizzly bear habitat in the subbasin participate in the livestock carcass removal effort. Ninety-five percent of all beehives in the subbasin are protected with electric fences. All road killed deer and livestock composting facilities are protected with electric fences, and plans are underway to protect two of the three transfer stations in the subbasin with electric fences. The Blackfoot Challenge has dozens of trash resistant garbage cans to loan to residents each year. A network of 120 residents monitors both grizzly and wolf activity in the subbasin.

The WC has taken an indirect approach to reduce illegal or poaching related mortality of grizzly bears through widespread education and outreach efforts. These actions may help account for the relatively few, if any instances of malicious killing activity. Over the past six years there have no known instances of malicious killing of grizzly bears in the core project area of the subbasin. MFWP and USFWS law enforcement are the lead agencies that address malicious or vandal killing. If poaching or malicious killing activities increase in the subbasin, the WC could devise an appropriate response for improving the situation. The WC has also played an indirect role in reducing mistaken identity killings of grizzly bears (the killing of grizzly bears by black bear hunters or hunters in general). Typically these types of incidents occur in remote, backcountry settings and managing hunter behavior is a challenging task. If MFWP and the USFWS were interested in working in partnership to address this cause of grizzly bear mortality, the WC could assist with education and outreach efforts.

Since self-defense related mortality is a relatively small proportion of overall annual grizzly bear mortality in the NCDE, this has not been a high priority for the WC. However, early season elk hunters have fairly regular encounters with grizzly bears. In some situations these encounters can be problematic for both hunters and grizzlies. There are a variety of activities that MFWP, USFWS and the WC could collectively work on including improving access to hunter-safety education in the Blackfoot Subbasin, providing workshops to improve hunter knowledge of bear behavior and targeting education efforts during poor food years to prevent conflicts resulting from increased probability of hunter-grizzly encounters.

Improving habitat connectivity for grizzly bears in the Blackfoot Subbasin is largely a function of reducing the lethality of the landscape. Large portions of the Blackfoot Subbasin are currently available or potentially available habitat for grizzlies. However, road densities, road access, and habitat alteration, loss and degradation are important cumulative factors that impair functional habitat connectivity.

To reduce physical road and highway impact mortality to grizzly bears and other wildlife, the WC can assist the Montana Department of Transportation in wildlife mitigation measures as future highway improvements are planned. The WC has begun this process with the ITEEM planning effort for Highway 83 and will assist where needed as the planning process unfolds. Additionally, the WC has assisted recently in the development of a set of wildlife movement areas maps that can help plan for potential crossing structures and other wildlife mitigation should those actions be useful in the future. Additional work can be done to address road densities, access and travel management through the USFS, BLM and DNRC public planning processes and public involvement through the NEPA and MEPA processes. The WC will also continue to work on reducing the presence of bear attractants along roads and in other areas that impede migration and movement.

Motorized vehicle use and impacts to grizzly bears and bear habitat on public lands found in the subbasin are best addressed through public land management agency public involvement processes. The WC could facilitate communication and facilitate discussion among stakeholders should motorized vehicle use become a major factor for grizzly bears. While non-motorized recreational use-conflicts with grizzly bears in the watershed have been relatively few, MFWP and the WC could play a positive role should this become a more pressing issue. Education and outreach efforts and improved knowledge about grizzly bear behavior could help river recreationists, hikers, bikers, fishers, hunters, mushroom pickers and others learn how to safely recreate and work in bear country. This may become a more serious issue in the future as growth, development, and human population pressures increase levels of recreation in grizzly bear habitat.

Unplanned residential and resort development could present significant risk to grizzly bears in the subbasin. However, the Blackfoot Challenge has historically helped to mitigate this threat through a proactive approach to land conservation through its Conservation Strategies Committee and intensive work by partners. Future growth and development are important issues that the Blackfoot Challenge will continue to grapple with in the future.

New mining activity in the subbasin poses a potential threat to grizzly bears. The Blackfoot Challenge can serve as the forum in the watershed to foster civil and productive dialogue about existing or potential resource extraction and impacts to grizzly bears. The Blackfoot Challenge does not advocate a specified position on such issues such as mine site development etc, but can serve as a forum for thoughtful dialogue among all invested stakeholders.

Loss of whitebark pine due to the exotic pathogen white pine blister rust and to climate change jeopardizes an important grizzly bear food source in the Blackfoot Subbasin and throughout the NCDE. There have been significant declines in white bark pine mast throughout portions of the NCDE. No direct action has been taken to mitigate this threat, although grizzly bears may be successfully adapting to these changes in food availability

The Blackfoot Subbasin Gap Assessment illustrates the range of conservation/restoration accomplishments in the subbasin and the scope of work that lies ahead. Private and public partners in the subbasin will continue to address threats to fish, wildlife and habitats through proactive conservation and restoration strategies. New/emerging opportunities include: 1) further development of land planning tools to minimize habitat fragmentation (e.g., county zoning, transferable development rights, and cluster development), 2) human-predator conflict abatement focused on wolves, 3) prevention of new exotic species invasions, 4) expansion of aquatic habitat restoration in the Clearwater and upper portions of the Blackfoot Subbasin, 5) efforts to address climate change and 6) efforts to mitigate the impacts of fire exclusion on subbasin vegetation communities.

5.0 Management Plan

5.1 Background

The Management Plan is the heart of the Blackfoot Subbasin Plan. It consists of five elements: 1) a vision for the subbasin, 2) conservation objectives, 3) strategic actions, 4) research, monitoring and evaluation and 5) consistency with the Endangered Species Act and Clean Water Act. The Blackfoot Subbasin Management Plan is a living document that is based on a 10-15 year planning horizon. It reflects current understanding of conditions in the Blackfoot Subbasin and will be updated through an adaptive management process as knowledge of ecological processes and socioeconomic conditions in the subbasin grows. It is designed to serve as an iterative, community-based and science-driven document and we anticipate that additional objectives and strategies will emerge over time.

The Blackfoot Subbasin Management Plan will serve as a guide for partners working to sustain ecological, economic and cultural values and resources in the Blackfoot Subbasin. This document was developed collaboratively by the subbasin technical work groups which are comprised of a wide range of stakeholders including private landowners, public agencies, and non-profit organizations. Consensus among this diverse group will promote effective and collaborative implementation of the strategic actions outlined in Section 5.3.

5.2 Subbasin Vision

The vision for the Northwest Power and Conservation Council's Fish and Wildlife Program is a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife, mitigating across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydrosystem and providing the benefits from fish and wildlife valued by the people of the region (NPCC 2009). The vision for the Blackfoot Subbasin is based on this overarching vision for the entire Columbia River Basin. It describes the desired future condition of the subbasin and incorporates the values and priorities of a wide spectrum of stakeholders:

The vision for the Blackfoot Subbasin is for a place characterized by dynamic natural processes that create and sustain diverse and resilient communities of native fish and wildlife and the aquatic and terrestrial habitats on which they depend, thereby assuring substantial ecological, economic and cultural benefits. The efforts to conserve and enhance those natural resources will be implemented through a cooperative partnership between public and private interests that will seek to sustain not only those natural resources, but the rural way of life of the Blackfoot River Valley for present and future generations.

The Blackfoot Subbasin Assessment illustrates, both quantitatively and qualitatively, that ecological conditions in the subbasin are generally very good. At the subbasin scale, there are large, intact landscapes comprised of wilderness, natural areas and other federal or state-owned lands linked to protected and/or sustainably managed private working lands typically located in

the valley bottom. Due to a legacy of conservation and restoration partnerships led by private landowners since the 1970s, residential, resort and commercial development is limited to certain areas and native biodiversity, from wide-ranging mammals to localized rare plant populations, is largely intact. These characteristics, coupled with continued strong public-private partnerships, have resulted in identification of the Blackfoot Subbasin as a high priority site for conservation action by international, national and local partners. The Blackfoot Subbasin Vision will guide prioritization and implementation of conservation objectives and strategic actions to ensure the continued viability of ecological and human communities in the subbasin.

5.3 Conservation Objectives and Strategic Actions

The core of the Blackfoot Subbasin Management Plan consists of a comprehensive set of conservation objectives and strategic actions.³³ Conservation objectives and strategic actions were developed based on the results of the Blackfoot Subbasin threat assessment (Section 3.4). In most cases, the critical subbasin threats stem from incompatible human uses of land, water or natural resources. The conceptual framework for conservation objectives and strategic actions assumes that abating the critical threats in the subbasin will alleviate current or future stresses, resulting in healthy, viable conservation targets.³⁴ However, in many instances, a target has been degraded by historical threats that require some form of active restoration. In these situations, restoration strategies that directly enhance or restore the viability of the target are considered.

Conservation objectives and strategic actions were developed based on the following criteria: 1) economic, social and ecological feasibility, 2) existing partnerships or future cooperative opportunities to implement actions, 3) benefits to multiple targets and 4) the scope of threat abatement. Table 5.1 outlines the relationship between conservation targets, threats and conservation objectives in the subbasin.

³³ Conservation objectives are distinct from what BPA refers to as “biological objectives.” Conservation objectives are general guiding principles that provide a framework for specific and measurable strategic actions. Quantitative “biological objectives” for each conservation target are presented in the subbasin viability assessments (Section 3.3.3).

³⁴ A detailed discussion of Blackfoot Subbasin conservation targets and conservation target viability is provided in Section 3.3.3. Information on stresses and threats is provided in Section 3.4.

Table 5.1 Strategy Development Reference Table.

Threat ¹	Conservation Targets Affected ²	Objective Number
Unplanned Residential and Resort Development (VH)	native salmonids (H) moist site and riparian vegetation (H) native grassland/sagebrush communities (H) low elevation ponderosa pine/western larch forest (VH) mid to high elevation coniferous forest (M) grizzly bears (H) rural way of life (VH)	1, 2a, 2b, 2c, 3, 5, 6, 7, 8, 9a, 9b, 9c, 10
Climate Change (VH)	native salmonids (VH) herbaceous wetlands (H) moist site and riparian vegetation (H) native grassland/sagebrush communities (H) low elevation ponderosa pine/western larch forest (VH) mid to high elevation coniferous forest (H) grizzly bears (H) rural way of life (H)	1, 2a, 2b, 2c, 4, 5, 6, 7, 8, 9a, 9b, 9c, 10
Exotic/Invasive Species (H)	native salmonids (H) herbaceous wetlands (H) moist site and riparian vegetation (M) native grassland/sagebrush communities (H) low elevation ponderosa pine/western larch forest (H) mid to high elevation coniferous forest (H) grizzly bears (M) rural way of life (H)	1, 2a, 2b, 2c, 3, 4, 5, 6, 7, 8, 9a, 10
Lack of Fire (H)	moist site and riparian vegetation (H) native grassland/sagebrush communities (H) low elevation ponderosa pine/western larch forest (VH) mid to high elevation coniferous forest (M) rural way of life (H)	5, 6, 7, 8, 10
Incompatible Forestry Practices (H)	native salmonids (H) herbaceous wetlands (L) low elevation ponderosa pine/western larch forest (VH) mid to high elevation coniferous forest (M)	2a, 2b, 2c, 4, 7, 8, 10
Physical Road Issues (H)	native salmonids (H) low elevation ponderosa pine/western larch forest (H) mid to high elevation coniferous forest (M) grizzly bears (H)	1, 2a, 2b, 2c, 7, 8, 9a, 9b, 10
Conversion to Agriculture (H)	herbaceous wetlands (H) moist site and riparian vegetation (M) native grassland/sagebrush communities (H)	1, 4, 5, 6, 10
Mining (H)	native salmonids (H) grizzly bears (H)	2a, 2b, 2c, 9a, 10
Motorized Vehicle Use (M)	moist site and riparian vegetation (M) native grassland/sagebrush communities (M) low elevation ponderosa pine/western larch forest (M) mid to high elevation coniferous forest (M) grizzly bears (H)	5, 6, 7, 8, 9a, 9b, 10

Table 5.1 (continued).

Threat ¹	Conservation Targets Affected ²	Objective Number
Incompatible Grazing (M)	native salmonids (H) herbaceous wetlands (M) moist site and riparian vegetation (M) native grassland/sagebrush communities (M) grizzly bears (L)	2a, 2b, 2c, 4, 5, 6, 9a, 9b, 9c, 10
Drainage and diversion Systems (M)	native salmonids (H) herbaceous wetlands (M) moist site and riparian vegetation (M)	2a, 2b, 2c, 4, 5, 10
Channel Alteration (M)	native salmonids (H) moist site and riparian vegetation (M)	2a, 2b, 2c, 5, 10
Epidemic Levels of Native Insects and Pathogens (M)	low elevation ponderosa pine/western larch forest (H) mid to high elevation coniferous forest (M)	7, 8, 10
Non-motorized Recreational Use (M)	native salmonids (H) grizzly bears (M)	2a, 2b, 2c, 9a, 9b, 9c, 10
Existing Crop Production (L)	herbaceous wetlands (M)	4, 10
Filling of Wetlands (L)	herbaceous wetlands (M)	1, 4, 10
Lack of Human Tolerance (L)	grizzly bears (M)	9a, 9b, 9c, 10
Human-Caused Mortality (L)	grizzly bears (M)	9a, 9b, 9c, 10
Altered Wildlife Use Patterns (L)	native grassland/sagebrush communities (L)	1, 5, 10
Presence of Bear Attractants (L)	grizzly bears (L)	9a, 9b, 9c, 10

¹ Abbreviations in parentheses indicate the threat rank: VH = Very High; H = High; M = Medium; L = Low.

² Abbreviations in parenthesis indicate threat ranks by target.

For each conservation objective outlined in the following pages, we list the conservation targets affected and the set of strategic actions that will be employed by conservation and restoration partners in the subbasin to achieve the objective. Strategic actions consist of new actions that will enhance conservation and restoration in the subbasin as well as programs and projects already being implemented by agencies and private organizations. A number of strategies currently implemented by the Blackfoot Challenge, for example, are already addressing some of the key threats identified in the Blackfoot Subbasin Plan. Coordinated implementation and regular updating of this set of conservation objectives and strategic actions, as well as monitoring measures proposed in Section 5.4, will ensure that the most effective fish, wildlife and habitat conservation in the Blackfoot Subbasin will be achieved.

Conservation Objective 1 – Maintain the large, intact working landscapes that sustain the natural resources and rural way of life in the Blackfoot Subbasin through support to local communities, counties and land conservation partners.

Conservation Targets Affected: All eight conservation targets: native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

Strategic Actions:

1. Through the Conservation Strategies Committee (CSC), maintain the Blackfoot Challenge Conservation Resource Database, watershed map and other GIS-based resources to prioritize areas and pool resources for conservation, stewardship and land-use planning efforts.
 - a. Integrate baseline data, objectives and strategic actions for vegetation targets and other data associated with the subbasin plan into future conservation and stewardship activities.
 - b. Provide these resources as requested to Missoula, Powell, and Lewis and Clark Counties and local communities and/or host community forums pertaining to land-use planning efforts.
2. Through the Blackfoot Challenge’s CSC and Conservation Easement Work Group, continue coordinating conservation easements to address conservation targets, adaptive management and coordinated monitoring; utilize the conservation easement brochure as a clearinghouse for information.
3. Continue coordinating with partners working at the regional level on conservation and stewardship projects (e.g., Cooperative Conservation Agreement for the Blackfoot Watershed, Montana Legacy Project, Missoula County Practical Landscape Assessment for Conservation and Enhancement (PLACE) Project, Seeley-Swan-Blackfoot Stewardship Summit, Crown of the Continent, Partners for Conservation).
4. Research and explore innovative conservation tools, such as the transfer of development rights and other incentives that reward sustainable residential development, and their compatibility with the communities, practices and resources in the Blackfoot Subbasin.
5. Explore/identify the qualities that define the rural way of life for communities across the subbasin and connections to public-private conservation, restoration and stewardship practices. Explore/identify community-benefit indicators to monitor effectiveness of programs for the long-term.

Conservation Objective 2a – Maintain and/or restore viable populations of bull trout within the three major population groups³⁵ in the Blackfoot Subbasin.³⁶

Conservation Objective 2b – Maintain and/or restore viable populations of migratory (fluvial and adfluvial) westslope cutthroat trout within each of the three major population groups³⁷ within the Blackfoot Subbasin.

Conservation Objective 2c – Maintain and/or restore viable populations of resident westslope cutthroat trout within each of the three major population groups within the Blackfoot Subbasin.³⁸

Conservation Targets Affected: Native salmonids (bull trout; westslope cutthroat trout). These species are widely distributed and represent the broad range of aquatic environments found in the Blackfoot. Conservation and restoration of these target species and their habitats will also provide benefits for other native fishes, aquatic organisms and riparian plant communities found throughout the subbasin.

The strategic actions described in this section incorporate the guidance found in the current prioritization strategy (Table 3.12), the Table of Potential Restoration Projects (Appendix M), the 2002 USFWS bull trout recovery strategy (Appendix K), and by future refinements to the strategy as the salmonid working group begins to assess the native fisheries to the 6th field HUC. The existing native salmonid recovery strategy, and the data on which it is based, will heavily inform the assessment of fisheries to the 6th field HUC.

³⁵ The three major bull trout population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek, 2) Clearwater River Basin, and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek.

³⁶ The Bull Trout Draft Recovery Plan (USFWS 2002) lists four recovery objectives for the Clark Fork Recovery Unit. The Blackfoot Subbasin Plan is consistent with those objectives which are as follows: (1) maintain current distribution of bull trout and restore distribution in previously occupied areas within the Clark Fork Recovery Unit; (2) maintain stable or increasing trends in abundance of bull trout in each subunit of the Clark Fork Recovery Unit; (3) restore and maintain suitable habitat conditions for all bull trout life history stages and strategies; and (4) conserve genetic diversity and provide opportunity for genetic exchange.

³⁷ The three major westslope cutthroat population groups in the Blackfoot Subbasin are 1) Upper Blackfoot Basin upstream of Nevada Creek, 2) Clearwater River Basin, and 3) Lower Blackfoot Basin (outside of the Clearwater) below Nevada Creek.

³⁸ Implicit in this objective is to protect and enhance resident, spawning and rearing habitats for isolated populations of genetically pure westslope cutthroat trout and to protect these populations from genetic introgression by non-native species.

Strategic Actions:

1. Continue to restore physical instream habitat suitable to native salmonids.
 - a. Continue to restore instream habitat connectivity by removing barriers (e.g., diversion barriers, culverts, temperature and pollution barriers) except where maintaining barriers is desirable to maintain physical and genetic isolation.
 - b. Continue to implement instream restoration projects that restore proper pattern, profile and dimensions to impacted channels.
 - c. Continue to implement water conservation/instream flow projects, particularly those that retain or enhance perennial flows over the long term or during low flow periods, and conserve cold waters necessary for native salmonids.
 - d. Continue to implement water quality improvement projects, particularly those that reduce water temperatures, instream sediment levels and other pollutants that are deemed harmful to native salmonids.
 - e. Continue to protect and restore riparian vegetation.
 - f. Continue to implement grazing and livestock management projects that benefit riparian and instream habitat. This includes developing grazing criteria consistent with bull trout habitat protection.
 - g. .
2. Continue work to reduce the threat of non-native fish interactions.
 - a. Promote restoration and/or maintenance of natural habitat and stream flow conditions that may provide native fish with an advantage over non-native species.
 - b. Promote and support public policy that favors native species and their habitats.
 - c. Coordinate efforts to identify the distribution of non-native fish, invertebrates and plants in aquatic habitats and how these species affect native salmonids.
 - d. Monitor the status of new invasive species in the area surrounding the Blackfoot Subbasin and promote the use of the state's response strategy for non-native species.
 - e. Continue to monitor, educate and devise strategies to prevent the introduction of non-native and/or invasive aquatic species to the subbasin.
 - f. Conduct public education/outreach about non-native species that threaten native salmonid populations in the subbasin.
3. Use existing climate models to assess how a climate change will affect the subbasin hydrologic regime.
 - a. Adapt or extend existing climate-hydrology models (e.g., Crozier et al. 2008, Issak et al. *in review*) to scale at the subbasin level and, if possible, to the three major fish population areas within the Blackfoot Subbasin. Use this information to inform stakeholders of potential changes in hydrology, water availability and water temperature and to guide and prioritize conservation and restoration efforts.
 - b. Exploit any long-term data sets that exist in the subbasin to refine and validate the "downsized" climate projections.

4. Promote the continuation and expansion of long-term data sets with a repository accessible to the public and research partners.
 - a. Reestablish and expand significant long-term data sets in the Blackfoot Subbasin that have been truncated due to lack of dedicated funding (e.g., stream discharge, water temperature, air temperature, and fisheries population data).
 - b. Continue historic data sets and create new data sets necessary for tracking impacts of climate change in river, tributary and lake habitats. Support long-term data collection efforts by public agencies (e.g., MFWP, USFS, BLM, DEQ, USGS). These long-term data sets are essential to adaptive management and conservation efforts.
 - c. Augment citizen based monitoring with Blackfoot Challenge coordinating consistent data gathering on private lands to complete data sets and improve management.
5. Develop a viability assessment based on the sixth code HUC level. Complete the aquatic species viability assessment (Section 3.3.3.1) for each bull trout and westslope cutthroat trout population described above based on a more complete sixth code HUC level data set that incorporates data from all public agencies and private organizations.
6. Coordinate implementation of native salmonid conservation objectives/strategic actions with terrestrial species and upland/wetland objectives/strategic actions. Integrity of terrestrial ecosystems influences and constrains aquatic systems. Integrated implementation of the Blackfoot Subbasin Plan will advance management and allow leveraging of limited resources by recognizing and resolving convergent and potentially conflicting objectives.
 - a. Conduct a spatially explicit assessment of terrestrial and aquatic resources and management conditions that will support development of integrated goals, objectives and opportunities for collaboration in conservation activities and recognition of joint restoration priorities.
 - b. Develop a water budget that acknowledges the interaction between surface water and groundwater. Subbasin wetland, stream and lake habitats are closely linked. An integrated hydrologic assessment is needed to manage any of these habitats effectively. This assessment would:
 - i. catalog existing information on groundwater-surface water interactions
 - ii. support development of a water budget
 - iii. include potential changes in water volume and temperature predictions based on climate change models

Conservation Objective 3 – Control existing noxious and invasive³⁹ plant species abundance and distribution and prevent establishment of all new noxious and invasive species in the Blackfoot Subbasin. Emphasis should be placed on protecting the highest quality habitats, which should be identified and prioritized by 2012.⁴⁰

Conservation Targets Affected: herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest

Strategic Actions:

1. Expand current noxious and invasive weed management efforts by coordinating and cooperating with partners on an ecologically and economically sustainable approach to integrated weed management through the Blackfoot Challenge Weed Steering Committee.
 - a. Continue organization and facilitation of landowner-led Cooperative Weed Management Areas.
 - b. Emphasize prevention of new invaders and develop strategies for early detection and eradication.
 - c. Dedicate resources to education, awareness and outreach through one-on-one contact with landowners, resource users and the general public.
 - d. Coordinate efforts to eradicate, contain or control noxious weeds with conservation of rare plant species that occur in the subbasin (i.e., avoid or minimize impacts to known rare plant populations).
 - e. Monitor and evaluate effectiveness of weed program.
 - f. Continue building private and public partnerships for a sustainable approach to integrated weed management.
2. Develop a Blackfoot Watershed Weed Management Plan (utilize USFS-Region 1 Noxious Weed Risk Assessment and coordinate with other land management planning efforts).
 - a. Utilize baseline data for vegetation targets associated with the subbasin plan to inform the plan.
 - b. Coordinate efforts to work in the highest quality native plant habitats, contain existing invasive species to their present extent and attempt to restore native communities.

³⁹ May include pasture grasses in some areas, e.g., wetlands, riparian areas, and native grasslands/sagebrush communities. Definitions of “noxious” and “invasive” plants are provided in Section 3.2.7.3.

⁴⁰ The Blackfoot Challenge will be instrumental in accomplishing this objective at the subbasin scale.

3. Through the Blackfoot Challenge Weed Steering Committee, develop an Invasive Species Strike Team that will be collectively funded and organized. The team will provide coordinated integrated weed identification, management and control and will emphasize long-term biological control. However, the team will initially emphasize the use of all integrated pest management tools (chemical, biological, mechanical, vegetation management, etc.).
 - a. Estimate costs of assembling a strike team.
 - b. Determine how to share the costs (e.g., fee per acre that needs treatment) and obtain sources of outside funding to support/subsidize the effort.
 - c. Engage participation by as many private and public landowners as possible.
4. Address non-native pasture grasses on a site specific basis, where they are invasive and threatening native plant communities.
5. Incorporate weed management practices in forestry activities (e.g., use of minimal soil disturbing methods and equipment, reseeding with non-invasive and/or native mixes, equipment washing).
6. Increase emphasis on biological control of weeds by making more bio-control agents available and increasing funding for bio-control development and implementation.
7. Increase awareness among small acreage landowners about the importance of controlling noxious and invasive species on their property. (See conservation objective 10 for more information on how this strategic action will be implemented).
8. Use the Blackfoot Community Conservation Area and other sites to establish demonstration plots to explore, practice and transfer invasive species abatement strategies.
9. Partner with universities and other public and private entities interested in noxious weed research.
10. Use stewardship outreach with conservation easement holders to explore, practice, and export invasive species abatement strategies to other landscapes (e.g., the Centennial Valley and Rocky Mountain Front).
11. Integrate the Blackfoot Challenge weed program and Conservation Easement Work Group to develop a consistent, watershed-wide approach to monitoring and managing invasive plants on lands with conservation easements.

Conservation Objective 4 – Maintain or restore the viability of priority⁴¹ herbaceous wetlands based on historic conditions across the Blackfoot Subbasin.

Conservation Targets Affected: herbaceous wetlands

Strategic Actions:

1. Develop a baseline of historic and current vegetation communities.
 - a. Request proposals for baseline development.
 - b. Assemble team of experts to determine best methodology for developing a baseline (e.g., interpretation of historic aerial photographs; analysis stratified by vegetation type, temperature/moisture regimes).
 - c. Determine the acceptable level of departure from historic conditions (see parameters outlined in viability assessment, Table 3.12).
 - d. Conduct field inventory to classify existing and potential vegetation condition and to identify high-quality existing sites.
2. Analyze the degree of departure from historical conditions overlain with a baseline of developed, converted or otherwise altered areas where it is not feasible to restore and/or maintain those plant communities.
3. Develop a priority map for protection of intact areas and restoration of disturbed areas in critical native plant community areas. Coordinate this effort with actions/needs for other conservation targets, such as grizzly bears/wildlife linkage zones.
4. Determine a wetland community conservation goal (total area conserved) and timeline for achieving the goal.
5. Develop tools for maintaining healthy sites identified in the inventory and planning process, outlined above, and restore high priority degraded sites.⁴²
 - a. Address water manipulation and management in wetlands: timing, depth (draining wetlands or using as irrigation water storage devices).
 - b. Work with willing landowners of prioritized wetlands on water management plans.
 - c. Use the Blackfoot Community Conservation Area and other project sites to test and demonstrate restoration techniques.

⁴¹ “Priority” sites will be determined based on HRV analysis outlined in strategic actions. Significant information gaps exist for each of the Blackfoot Subbasin vegetation/forest targets, making it difficult to develop quantifiable objectives. Thus, many of the strategic actions in conservation objectives 4-8 are focused on filling these information gaps.

⁴² The 2008 USFS Restoration Policy (USFS 2008) defines *ecological restoration* as the process of assisting the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed. Restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to make terrestrial and aquatic ecosystems sustainable, resilient, and healthy under current and future conditions.

6. Encourage sustainable development near priority herbaceous wetlands.
7. Monitor for viability of nested targets (herbaceous wetland-associated bird, plant, amphibian, and invertebrate Species of Concern). Develop action items if necessary for nested target protection. See Section 3.3.3.2 for more information on nested targets.
8. Coordinate with other land management planning efforts (e.g., the USFS National Forest Plans and BLM, DNRC, USFWS and MFWP planning updates).
9. Incorporate incentives for restoration and protection in private, public and interagency land management plans.
10. Evaluate, monitor and plan in an iterative way (adaptive management). Through ongoing monitoring and data gathering, refine viability indicator ratings (Table 3.12) necessary to maintain or restore the viability of priority wetland communities.

Conservation Objective 5 – Maintain or restore the viability of priority moist site and riparian vegetation based on historic conditions across the Blackfoot Subbasin.

Conservation Targets Affected: moist site and riparian vegetation

Strategic Actions:

1. Develop a baseline of historic and current vegetation communities.
 - a. Request proposals for baseline development.
 - b. Assemble team of experts to determine best methodology for developing a baseline (e.g., interpretation of historic aerial photographs; analysis stratified by vegetation type, temperature/moisture regimes).
 - c. Determine the acceptable level of departure from historic conditions (see parameters outlined in viability assessment, Table 3.13).
 - d. Conduct field inventory to classify existing and potential vegetation condition and to identify high-quality existing sites.
2. Analyze degree of departure from historical conditions overlain with a baseline of developed, converted or otherwise altered areas where it is not feasible to restore and/or maintain those plant communities.
3. Develop a priority map for protection of intact areas and restoration of disturbed areas in critical native plant community areas. Coordinate this effort with actions/needs for other conservation targets, such as grizzly bears/wildlife linkage zones.
4. Determine a moist site and riparian community conservation goal (total area conserved) and timeline for achieving the goal.
5. Develop tools for maintaining healthy sites identified in the inventory and planning process, outlined above, and restore high priority degraded sites.
 - a. Maintain sites closest to historic condition using fire or other vegetation management tools.
 - b. Use such tools as: NRCS Riparian Forest Buffers⁴³ and Riparian Proper Functioning Condition.⁴⁴

⁴³ A riparian forest buffer is an area of trees and shrubs located adjacent to streams, lakes, ponds and wetlands. Riparian forest buffers of sufficient width intercept sediment, nutrients, pesticides and other materials in surface runoff and reduce nutrients and other pollutants in shallow subsurface water flow. Woody vegetation in buffers provides food and cover for wildlife, helps lower water temperatures by shading waterbody and slows out-of-bank flood flows. In addition, the vegetation closest to the stream or waterbody provides litter fall and large woody debris important to aquatic organisms. Also, the woody roots increase the resistance of streambanks and shorelines to erosion caused by high water flows or waves (NRCS).

⁴⁴ Riparian Proper Functioning Condition (PFC) is a qualitative assessment of riparian conditions. A qualitative assessment is defined as “the process of estimating or judging the value or functional status of ecological processes (e.g., ecosystem health) in a location during a moment in time” (Pellant et al. 2005). A standard checklist of riparian attributes (amount, function etc.) is assessed by an interdisciplinary team along a selected reach (for lotic

- c. Use BBCTU's priority list, the Basin-Wide Restoration Action Plan for the Blackfoot Watershed, and other key plans.
 - d. Use the Blackfoot Community Conservation Area and other project sites to test and demonstrate moist site and riparian community restoration techniques.
6. Encourage sustainable development near priority moist site and riparian vegetation areas.
7. Monitor for viability of nested targets (riparian dependent birds). Develop action items if necessary for nested target protection. See Section 3.3.3.3 for more information on nested targets.
8. Increase awareness about the important role of fire and other ecological processes in the maintenance of moist site and riparian systems.
9. Coordinate with other land management planning efforts (e.g., the USFS National Forest Plans and BLM, DNRC, USFWS, and MFWP planning updates).
10. Incorporate incentives for restoration and protection in private, public and interagency land management plans.
11. Evaluate, monitor and plan in an iterative way (adaptive management). Through ongoing monitoring and data gathering, refine viability indicator ratings (Table 3.13) necessary to maintain or restore the viability of priority moist site and riparian communities.

assessments) or wetland (for lentic assessments). Although PFC is not a monitoring or inventory tool, it can be used to diagnose function and determine whether additional, quantitative data need to be collected. The assessment results in designating the system as one of the following: Proper Functioning Condition, Functioning-at-Risk, or Non-Functioning.

Conservation Objective 6 - Maintain or restore the viability of priority native grassland and sagebrush communities based on historic conditions across the Blackfoot Subbasin.

Conservation Targets Affected: native grassland/sagebrush communities

Strategic Actions:

1. Develop a baseline of historic and current vegetation communities.
 - a. Request proposals for baseline development.
 - b. Assemble team of experts to determine best methodology for developing a baseline (e.g., interpretation of historic aerial photographs; analysis stratified by vegetation type, temperature/moisture regimes).
 - c. Determine the acceptable level of departure from historic conditions (see parameters outlined in viability assessment, Table 3.14).
 - d. Conduct field inventory to classify existing and potential vegetation condition and to identify high-quality existing sites.
2. Analyze the degree of departure from historical conditions overlain with a baseline of developed, converted or otherwise altered areas where it is not feasible to restore and/or maintain those plant communities. Include an assessment of the extent of tree encroachment into native grasslands/sagebrush communities due to fire suppression.
3. Develop a priority map for protection of intact areas and restoration of disturbed areas in critical native plant community areas. Coordinate this effort with actions/needs for other conservation targets.
4. Determine a native grassland/sagebrush community conservation goal (total area conserved) and timeline for achieving the goal.
5. Develop tools for maintaining healthy sites identified in the inventory and planning process, outlined above and restore high priority degraded sites.
 - a. Maintain sites closest to historic condition using fire or other vegetation management tools.
 - b. Develop specific tools for maintaining the Three-tip Sagebrush–Rough Fescue Association.
 - c. Use the Bandy Ranch and Blackfoot Community Conservation Area to test and demonstrate grassland restoration techniques.
6. Encourage sustainable development in priority native plant community areas.
7. Monitor for viability of nested targets (grassland/sagebrush-associated bird and plant Species of Concern; ungulate winter range). Develop action items if necessary for nested target protection. See Section 3.3.3.4 for more information on nested targets.

8. Capitalize on wildland-urban interface funding and the need to restore grasslands and/or sagebrush communities within the forest/grassland-shrubland interface to historic condition.
9. Increase awareness about the important role of fire and other ecological processes in the maintenance of native grassland/sagebrush communities.
10. Coordinate with other land management planning efforts (e.g., the USFS National Forest Plans and BLM, DNRC, USFWS, and MFWP planning updates).
11. Incorporate grassland/sagebrush protection and restoration, including prescribed fire burn plans and incentives for the use of managed fire, into private, public and interagency land management plans.
12. Evaluate, monitor and plan in an iterative way (adaptive management). Through ongoing monitoring and data gathering, refine viability indicator ratings (Table 3.14) necessary to maintain or restore the viability of priority native grassland and sagebrush communities.

Conservation Objective 7 - Maintain or restore the viability of low severity fire regime ponderosa pine/western larch forest communities⁴⁵ based on historic stand conditions across the Blackfoot Subbasin.

Conservation Targets Affected: low elevation ponderosa pine/western larch forest

Strategic Actions:

1. Develop a baseline of historic and current vegetation communities.
 - a. Request proposals for baseline development.
 - b. Assemble team of experts to determine best methodology for developing a baseline (e.g., interpretation of historic aerial photographs; analysis stratified by vegetation type, temperature/moisture regimes).
 - c. Include analysis of wildlife linkage areas and forest carnivore (Canada lynx, fisher) needs.⁴⁶
 - d. Determine the acceptable level of departure from historic conditions (see parameters outlined in viability assessment, Table 3.15).
 - e. Conduct field inventory to classify existing and potential vegetation condition, including understory vegetation, and to identify high-quality existing sites.
2. Analyze the degree of departure from historical conditions overlain with a baseline of developed, converted or otherwise altered areas where it is not feasible to restore and/or maintain those plant communities. In HRV analysis, emphasize the low elevation forest types if resources are limited.
3. Develop a priority map for protection of intact areas and restoration of disturbed areas in critical native plant community areas. Coordinate this effort with actions/needs for other conservation targets, such as grizzly bears/wildlife linkage zones.
4. Determine a low elevation ponderosa pine/western larch forest community conservation goal (total area conserved) and timeline for achieving the goal.
5. Develop tools for maintaining healthy sites identified in the inventory and planning process, outlined above, and restore high priority degraded sites using appropriate vegetation management tools (e.g., fire, mechanical treatments).
 - a. Maintain sites closest to historic condition using fire or other vegetation management tools.
 - b. Seek opportunities to restore forest stands to historic conditions where it overlaps with the needs of public safety within the wildland-urban interface.

⁴⁵ This includes mostly low-elevation, dry forest types, but may include more mesic stands, particularly larch-dominated stands in Clearwater drainage.

⁴⁶ The Blackfoot Subbasin planning team intends to focus future attention on wildlife habitat linkage and connectivity across and between nonfederal and federal lands, including strategies for coordinated management.

- c. Use Lubrecht Experimental Forest, the Blackfoot Community Conservation Area, and other project sites to test and demonstrate low elevation forest restoration techniques.
- 6. Promote forestry practices (e.g., thinning) that enhance resilient and sustainable stand conditions.
 - a. Consider effects of forest roads on hydrology, wildlife security, weed introductions, etc.
 - b. Through the Blackfoot Challenge Forestry Committee, coordinate fuels mitigation work in the wildland-urban interface to enhance sustainable stand conditions in conjunction with creating fire safety zones.
- 7. Maintain the viability of the local wood products industry through increased local production of wood products generated from restoration treatments. For example, support:
 - a. Construction and use of small co-gen plants for local energy production (burning chips, pellets)
 - b. Locally-produced pine/fir furniture
 - c. Small-diameter fir/larch flooring
- 8. Monitor for viability of nested targets (low elevation ponderosa pine/western larch forest-associated birds; ungulate winter range). Develop action items if necessary for nested target protection. See Section 3.3.3.5 for more information on nested targets.
- 9. Increase awareness about the important role of fire and other ecological processes in the maintenance of forest systems.
- 10. Coordinate with other land management planning efforts (e.g., the USFS National Forest Plans and BLM, DNRC, USFWS and MFWP planning updates).
- 11. Coordinate with Montana Forest Stewardship Steering Committee, UM Applied Forest Management Program and others to gain support for projects and funding on private lands.
- 12. Incorporate prescribed fire burn plans and incentives for the use of managed fire, as well as forest protection and restoration, into private, public and interagency land management plans.
- 13. Coordinate with Montana Forest Restoration Committee to gain support for projects and funding on USFS lands.
- 14. Evaluate, monitor and plan in an iterative way (adaptive management). Through ongoing monitoring and data gathering, refine viability indicator ratings (Table 3.15) necessary to maintain or restore the viability of priority low elevation ponderosa pine/western larch forest communities.

Conservation Objective 8 - Maintain or restore the viability of mid to high elevation coniferous forest communities based on historic stand conditions across the Blackfoot Subbasin.

Conservation Targets Affected: mid to high elevation coniferous forest

Strategic Actions:

1. Develop a baseline of historic and current vegetation communities.
 - a. Request proposals for baseline development.
 - b. Assemble team of experts to determine best methodology for developing a baseline (e.g., interpretation of historic aerial photographs; analysis stratified by vegetation type, temperature/moisture regimes).
 - c. Include analysis of wildlife linkage areas and forest carnivore (Canada lynx, fisher) needs.
 - d. Determine the acceptable level of departure from historic conditions (see parameters outlined in viability assessment, Table 3.16).
 - e. Conduct field inventory to classify existing and potential vegetation condition, including understory vegetation, and to identify high-quality existing sites.
2. Analyze the degree of departure from historical conditions overlain with a baseline of developed, converted or otherwise altered areas where it is not feasible to restore and/or maintain those plant communities. In HRV analysis, emphasize the low elevation forest types if resources are limited (see Conservation Objective 7).
3. Develop a priority map for protection of intact areas and restoration of disturbed areas in critical native plant community areas. Coordinate this effort with actions/needs for other conservation targets, such as wildlife linkage zones and critical Canada lynx habitat.
4. Determine a mid to high elevation coniferous forest community conservation goal (total area conserved) and timeline for achieving the goal.
5. Develop tools for maintaining healthy sites identified in the inventory and planning process, as outlined above, and restore high priority degraded sites using appropriate vegetation management tools (e.g., fire, mechanical treatments).
 - a. Maintain sites closest to historic condition using fire or other vegetation management tools.
 - b. Seek opportunities to restore forest stands to historic conditions where it overlaps with the needs of public safety within the wildland-urban interface.
 - c. Use Lubrecht Experimental Forest, Blackfoot Community Conservation Area and other project sites to test and demonstrate mid to high elevation forest restoration techniques.
 - d. Support the federal and state agency partners in their whitebark pine restoration efforts.
6. Promote forestry practices that enhance resilient sustainable stand conditions.

- a. Consider effects of forest roads on hydrology, wildlife security, weed introductions, etc.
 - b. Use the Blackfoot Challenge Forestry Committee to coordinate fuels mitigation work in the wildland-urban interface to enhance sustainable stand conditions in conjunction with creating fire safety zones.
7. Maintain the viability of the local wood products industry through increased local production of wood products generated from restoration treatments.
 - a. Pursue construction and use of small co-gen plants for local energy production (burning chips, pellets)
 - b. Locally-produced pine/fir furniture
 - c. Small-diameter fir/larch flooring
8. Monitor for viability of nested targets (mid to high elevation coniferous forest-associated birds; forest carnivores; whitebark pine). Develop action items if necessary for nested target protection. See Section 3.3.3.6 for more information on nested targets.
9. Increase awareness about the important role of fire and other ecological processes in the maintenance of forest systems.
10. Coordinate with other land management planning efforts (e.g., the National Forest plan revisions and BLM, DNRC, USFWS and MFWP planning updates).
11. Coordinate with Montana Forest Stewardship Steering Committee, UM Applied Forest Management Program and others to gain support for projects and funding on private lands.
12. Incorporate prescribed fire burn plans & incentives for the use of managed fire, as well as forest protection and restoration, into private, public and interagency land management plans.
13. Coordinate with Montana Forest Restoration Committee to gain support for projects and funding on USFS lands.
14. Evaluate, monitor and plan in an iterative way (adaptive management). Through ongoing monitoring and data gathering, refine viability indicator ratings (Table 3.16) necessary to maintain or restore the viability of priority mid to high elevation coniferous forest communities.

Conservation Objective 9a – Maintain functional connectivity for grizzly bears across biologically suitable habitats in the Blackfoot Subbasin.⁴⁷

Conservation Targets Affected: grizzly bears

Strategic Actions:⁴⁸

1. Address physical road issues (e.g., migration barriers, mortality) and recreational road use impacts through county planning efforts, private landowner stewardship projects, cooperative demonstration projects like the BCCA and travel management processes on public lands (NEPA and MEPA).
2. Address wildlife movement across Highway 200 and Highway 83.
 - a. Assist Montana Department of Transportation (MDT) in wildlife mitigation measures (Integrated Transportation and Ecosystem Enhancements for Montana (ITEEM) process, etc.).
 - b. Plan for potential road crossing structures and other wildlife mitigation using wildlife movement areas maps developed in January 2009.
3. Reduce presence of attractants. In partnership with MFWP, USFWS, USFS, other public land management agencies and the Blackfoot Challenge’s Wildlife Committee, continue work on “attractant security,” or making artificial food sources (e.g., household garbage, backcountry camps, livestock feed, birdfeed) unavailable to grizzly bears. Continue the Blackfoot Challenge’s “Neighbor Network” phone tree program and expand the program to Lincoln, Woodworth and the Avon-Helmville area to address attractants and other sanitation issues on private lands.
4. Address impacts of motorized recreational use on grizzly bears through USFS, BLM and DNRC public planning and public involvement in the NEPA and MEPA processes.⁴⁹
5. Address impacts of non-motorized recreation on grizzly bears through education and outreach efforts. Use new knowledge about grizzly bear behavior to help river

⁴⁷ It should be noted that while certain habitat types are preferred by grizzly bears and are seasonally influenced by food availability, improving habitat level connectivity for grizzly bears in a place like the Blackfoot Subbasin is largely a function of reducing the risk of mortality in the portions of this landscape that support grizzly bear life history needs. Large portions of the Blackfoot Subbasin are currently available or potentially available habitat for grizzlies. However, road densities, road access, and habitat alteration, loss and degradation are important cumulative factors that can impair functional habitat connectivity, largely through human-caused mortality.

⁴⁸ The Blackfoot Challenge’s Wildlife Committee has been and will continue to be pivotal in implementing strategic actions designed to improve management of human-wildlife interactions in the Blackfoot Subbasin.

⁴⁹ The BCCA Council has developed a motorized recreation use plan that addresses potential impacts to wildlife including grizzly bears.

recreationists, hikers, bikers, fishers, hunters, mushroom pickers, etc. learn how to safely live, recreate and work in bear country.⁵⁰

6. Address impacts of resource extraction on grizzly bears. The Blackfoot Challenge can serve as a forum for thoughtful dialogue among all invested stakeholders on mine site development and other resource extraction issues.
7. Use USFS Cumulative Effects Model (CEM) to determine amount and distribution of available grizzly bear habitat in the Blackfoot Subbasin.
8. Coordinate with public land management agencies (e.g., USFS, BLM, DNRC, MFWP) to identify public and non-federal lands that may be important wildlife linkage habitat necessary to sustain life history needs of species like grizzly bears. Emphasis should be placed on identifying potential acres of habitat that serve as important linkage zones and securing attractants that may be present in these same areas. This ensures that there is stable habitat and that the habitat is permeable or less lethal to species like grizzly bears.

⁵⁰ While non-motorized recreational use conflicts with grizzly bears in the watershed have been relatively few, this may become a more serious issue in the future as growth, development, and human population pressures increase levels of recreation in grizzly bear habitat.

Conservation Objective 9b – Reduce human-caused grizzly bear mortality in the Blackfoot Subbasin.

Conservation Targets Affected: grizzly bears

Strategic Actions:

1. Maintain and/or establish partnerships between the Blackfoot Challenge’s Wildlife Committee, livestock producers, managers, landowners, USFWS, MFWP, NRCS, DNRC and other partners throughout the subbasin to improve livestock production practices and reduce the risk of domestic livestock depredation and property damage by grizzlies.
2. Continue to systematically prioritize high risk areas (conflict hotspots) using GIS spatial analysis and expert opinion of MFWP to focus conflict abatement in geographically targeted areas in the most cost effective manner possible.
3. Continue to implement proven non-lethal deterrent practices to remove or secure attractants, e.g., electric fencing of calving areas, beehives, garbage; livestock carcass removal; and sanitation at the household and municipal levels.
4. Continue to work collaboratively with the community on a variety of education/outreach efforts through the Neighbor Network to better understand how to live, work and recreate safely in grizzly bear country.
5. Reduce direct mortality of grizzly bears.
 - a. Reduce illegal (including poaching) killing of grizzly bears through education and outreach efforts. MFWP and USFWS law enforcement are the lead agencies that address malicious or vandal killing.
 - b. Assist MFWP and the USFWS as requested to address mistaken identity killing of grizzly bears by black bear hunters.
 - c. Reduce self defense-related mortality of grizzly bears.
 - i. Improve access to hunter-safety education in the Blackfoot
 - ii. Provide workshops to improve hunter knowledge of bear behavior
 - iii. Target specific education efforts during poor bear food years to prevent hunter-grizzly conflicts resulting from more widely dispersed grizzly bear foraging activity.
 - d. Work with MDT to reduce direct highway mortality of grizzly bears related to vehicle collisions and highway attractants (e.g., garbage at rest stops, road-killed animals, tractor-trailer cargo spills, and roadside enhanced vegetation such as berries and grass).
 - i. Work with MDT to reduce/mitigate highway attractants.
 - ii. Work with MDT to improve wildlife passage across highways.

- iii. Work with MDT to mitigate the effects of potential highway improvements (e.g., construction of four-lane highways) on wildlife in the Blackfoot Subbasin.
- e. Reduce management action-related mortality of grizzly bears.⁵¹
- f. Reduce research and management (e.g., trapping)-related mortality of grizzly bears (MFWP/USFWS are primarily responsible for this).

⁵¹ The efforts of MFWP, USFWS, the WC, landowners and all partners over the past six years have helped to reduce reported and verified human-grizzly bear conflicts that can lead to “management removals” or grizzly mortality.

Conservation Objective 9c – Improve human acceptance of grizzly bears and wolves by building a community-supported conservation and management process that reflects the interests and values of residents and landowners throughout the Blackfoot Subbasin.

Conservation Targets Affected: grizzly bears

Strategic Actions:

1. Continue to maintain regular communication with community members and all stakeholders through inclusive decision making process⁵² using the Blackfoot Challenge’s Wildlife Committee and associated work groups and forums, e.g., Landowner Advisory Work Group, Sanitation and Waste Management Work Group, Neighbor Network training, and one-on-one visits with landowners.
2. Continue to engage with landowners and ranchers on participatory projects
 - a. Continue to use on-the-ground projects (e.g., electric fencing) as a positive way to improve tolerance for grizzly bears by reducing livestock depredation risk (also applies to wolves).
 - b. Select specific fencing projects to showcase during field tours to increase awareness of how this technology can deter grizzly bears in a non-lethal manner.
3. Conduct a survey on Blackfoot area rancher tolerance for grizzly bears (baseline data was collected in 2003 through a survey. If needed, a follow up survey could document possible changes or improvements in human tolerance for grizzly bears).
4. Continue community wolf monitoring/surveys
 - a. Document presence/absence of wolves and estimate distribution and relative abundance in subbasin.
 - b. Maintain annual surveys (begun in 2008-2009) into future
5. Use range riders to monitor livestock and wolves and reduce risk of livestock losses
 - a. Use human presence as a deterrent to wolves
 - b. Increase human vigilance of livestock to reduce depredation risk, implement non-lethal deterrent practices, confirm predation events and predator type, remove carcasses when detected and reduce the need for compensation to ranchers
6. Explore applied research opportunities
 - a. Improve husbandry practices to make cattle herds more robust to wolves
 - b. Test effectiveness of non-lethal deterrent strategies
 - c. Examine indirect economic costs of wolf presence on ranches and improve compensation policies

⁵² A major focus of WC work with USFWS, MFWP, landowners, and partners has been on changing specific land use practices and human behaviors that lead to conflicts with bears. Rather than trying to change the way people think about bears, the focus has instead been on trying to change the way people live, work and recreate around bears. When we as a community learn to live with bears, then attitudes and or perceptions of bears may improve.

Conservation Objective 10 – Increase public awareness and education about conserving and enhancing the natural resources and rural way of life in the Blackfoot Subbasin.

Conservation Targets Affected: All eight conservation targets: native salmonids, herbaceous wetlands, moist site and riparian vegetation, native grassland/sagebrush communities, low elevation ponderosa pine/western larch forest, mid to high elevation coniferous forest, grizzly bears, rural way of life

Strategic Actions:

1. Promote opportunities to engage private and public partners in implementation of the subbasin plan and future resource stewardship. Increase public awareness related to:
 - a. The important role of fire and other processes in the maintenance of forest systems and other vegetation communities.
 - b. The importance of controlling non-native and invasive species and each landowner's responsibility in managing noxious weeds on his/her property.
 - c. The top-ranked threats in the Blackfoot Subbasin Plan (unplanned residential and resort development; climate change; exotic/invasive species; lack of fire; incompatible forestry practices, physical road issues, conversion to agriculture, mining).
2. Promote the Rural Living Institute (RLI) to the all residents of the Blackfoot Subbasin. The RLI is a venue for providing information to new and current landowners through the Challenge by providing online informational resources, workshops and courses for aspects related to living in the Blackfoot Subbasin and being a good land steward.
3. Through the Blackfoot Challenge Education Committee and its partners, prepare and distribute new and progressive materials and engage partners in learning more about resource stewardship. Examples include video, website, field-based tours, targeted education brochures/magazines (for small acreage landowners, realtors, etc.), community meetings, etc.
4. Promote conservation measures and/or sustainable practices that strengthen rural economic sectors of the Blackfoot.
 - a. Promote energy efficiency particularly in the agricultural irrigation sector and assist landowners in implementing energy conservation projects.
 - b. Provide education on practices such as irrigation scheduling or sustainable timber harvesting that can provide economic benefits while conserving natural resources.
 - c. Provide education on links between economic stability and land stewardship.
 - d. Encourage exploration of alternative markets and other opportunities to diversify economic base of rural communities.

5.4 Monitoring, Evaluation, and Research Plan

While the Blackfoot Subbasin Monitoring and Evaluation Plan, as envisioned by the subbasin planning process, has not been fully developed as of the completion of Blackfoot Subbasin Plan, there is a substantial, monitoring, evaluation, and research effort as to the restoration of aquatic habitat that has been evolving and operational since 1990. This effort has largely been led by DFWP and has been characterized by annual data-gathering across a variety of monitoring values. There are currently 10 annual or biennial publication of reports that describe the and analyze the monitoring results (e.g. Peters, 1995; Pierce, 1997; Pierce 1999; Pierce, 2000; Pierce, 2004).

Since 1990, the research effort has included sport fishery harvest surveys, mark-and-recapture population surveys, redd counts, telemetry studies of both bull trout and westslope cutthroat trout, other life history surveys, disease and invasive species, genetics, temperature monitoring, water quality monitoring for a variety of chemical and physical parameters, and site specific habitat monitoring on 182 streams (Pierce, 2008). All of this existing data has provided insight into how angling behavior and habitat changes have affected native fish populations. As the restoration effort has progressed, the research, monitoring and evaluation effort has provided valuable information as to the status of those restoration efforts. This has allowed the restoration partners in the sub-basin to evaluate restoration projects and make adjustments suggested by the monitoring data. This experience is fully consistent with the iterative character of the overall restoration and management effort in the Blackfoot.

Restoration Effectiveness Monitoring Protocol for the Blackfoot Watershed (BC 2005)

In 2005, DFWP codified its years of monitoring and data-collection experience with a summation of potential restoration-based monitoring protocols (Pierce et al, 2005). This document was further refined and included in the Basin-wide Restoration Action Plan for the Blackfoot Watershed (Blackfoot Challenge, 2005; Appendix J; See Appendix L). The purpose of this document is to provide a common reference for restoration planners to determine appropriate monitoring parameters/activities and protocol to utilize on a given restoration project, and contemplates the use of the protocol both pre- and post-project. Specific objectives of this document include:

- Promoting inclusion of appropriate pre- and post-restoration monitoring in all stream and riparian area restoration projects within the watershed;
- Establishing monitoring protocol and procedures to be employed for restoration monitoring to ensure consistency in data collection efforts between projects and between various organizations/agencies involved with stream and riparian area restoration; and
- Providing a tool for use in the planning and design phase of restoration projects throughout the watershed.

These protocols include a specific description of the monitoring metrics applicable to a variety of restoration objectives (Table 5.2). The metrics include biological, physical, and chemical measurements. Table 5.2 organizes the metrics by objectives and impairments and notes the specific methodologies for each metric. The protocol also describes the specific methodologies

to be used in greater detail and how those methodologies are to be applied (Appendix L). The protocol is careful to note that the list of monitoring methods that it describes is by no means exhaustive but rather provides a reasonable spectrum of monitoring options, while acknowledging that other options are not precluded by this list.

TABLE 5.2 RESTORATION EFFECTIVENESS MONITORING METRICS APPLICABLE TO VARIOUS RESTORATION OBJECTIVES/SOURCES

METRICS	RESTORATION PROJECT OBJECTIVES/IMPAIRMENT CAUSES							
	In-Stream Flow Maintenance	Habitat Restoration	Reduce Substrate Siltation	Reduce Thermal Modification	Reduce Ag Runoff	Riparian Area Restoration	Reduce Elevated Metals	Reduce Elevated Nutrients
BIOLOGICAL METRICS								
Fish Population Surveys	X	X	X	X	X	X		
Redd Counts	X	X	X	X	X	X		
Macroinvertebrate Sampling	X	X	X	X	X	X	X	X
Periphyton Sampling	X	X	X	X	X			X
Chlorophyll-a					X			X
PHYSICAL PARAMETERS								
Habitat Assessments	X	X				X		
Riparian Assessment		X	X	X	X	X		
Water Temperature	X	X	X	X	X	X		
Flow Monitoring	X			X			X	X
Photo Points	X	X	X	X	X	X	X	X
WATER CHEMISTRY								
TSS Samples			X		X		X	X
Nutrient Sampling					X			X
Metals Sampling							X	
STREAM SUBSTRATE COMPOSITION								
McNeil Core Samples		X	X			X		
Percent Fine Sediment Content		X	X			X		

X – Metrics marked in bold should be given primary consideration for monitoring
TSS- Total Suspended Sediment

Current long-term water quality monitoring efforts in the Blackfoot Subbasin

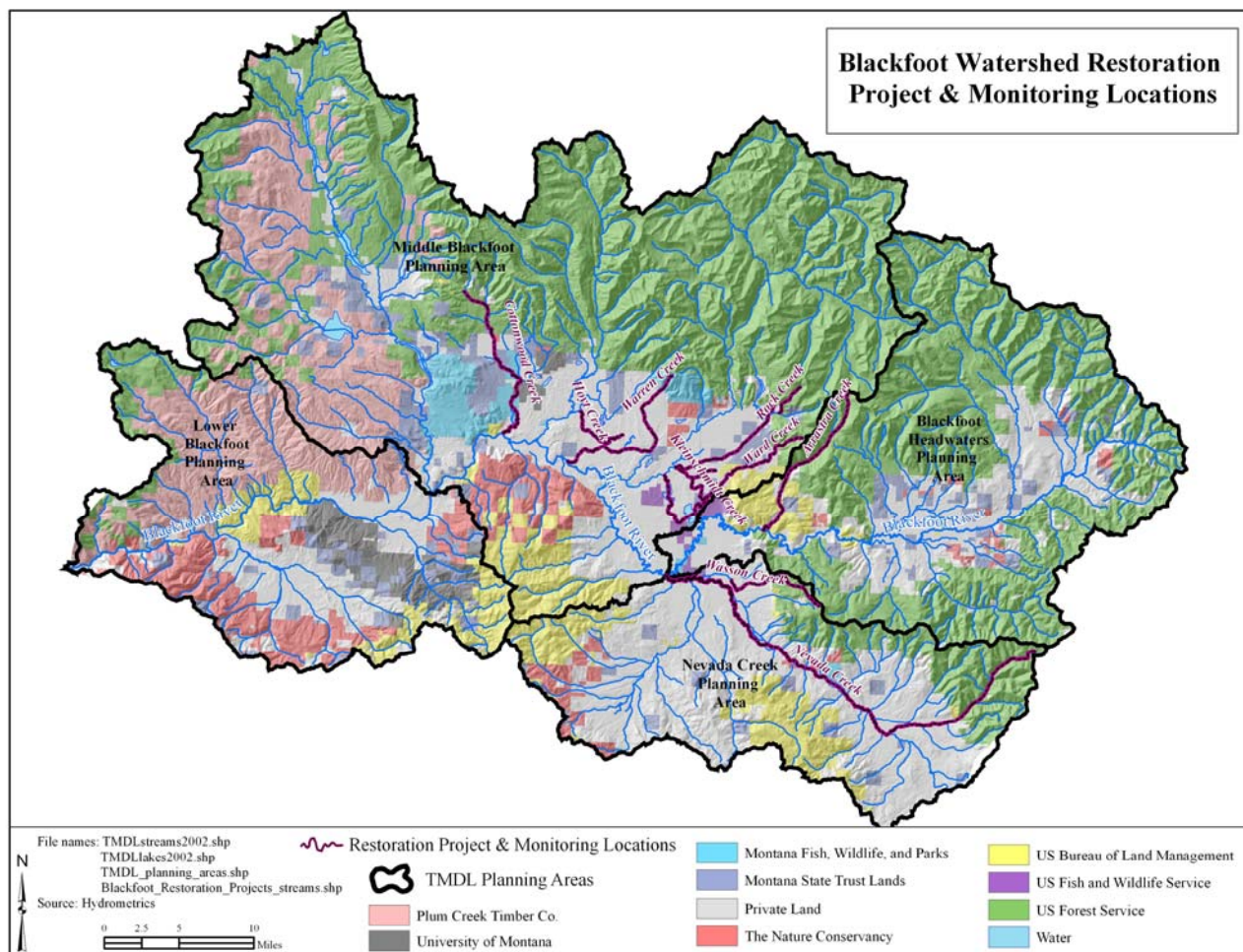
In addition to the restoration monitoring and protocol described above, the Blackfoot Subbasin hosts an ongoing, long-term water quality monitoring program (see Blackfoot Watershed Restoration Project and Monitoring Locations map below).

There are three major water quality monitoring programs in the Blackfoot: water quality assessment, restoration effectiveness, and status and trends.

The monitoring programs are complementary but are implemented for different reasons. Water quality assessment monitoring gives a basic understanding of streams and what water quality concerns are present. For example, assessment monitoring might identify stream bank erosion as a major source of sediment or illustrate that the highest nutrient concentrations in a certain stream are found in the valley bottom. Assessment monitoring also opens the door to restoration as the data are reviewed to identify potential solutions to these concerns.

If a restoration project occurs, it is important to understand how that project changed water quality conditions, if project goals were met, whether restoration practices need to be adjusted, and what else could be done. Restoration effectiveness monitoring does that as well as giving insight into expectations of future restoration efforts.

Figure 3.37 Blackfoot Watershed Restoration Project & Monitoring Locations



When multiple restoration efforts have occurred on a stream or in a specific area, status and trends monitoring helps to understand the cumulative effects of restoration work on water quality in the Blackfoot River and its tributaries (see Blackfoot Watershed Status and Trends Monitoring Network Map below).

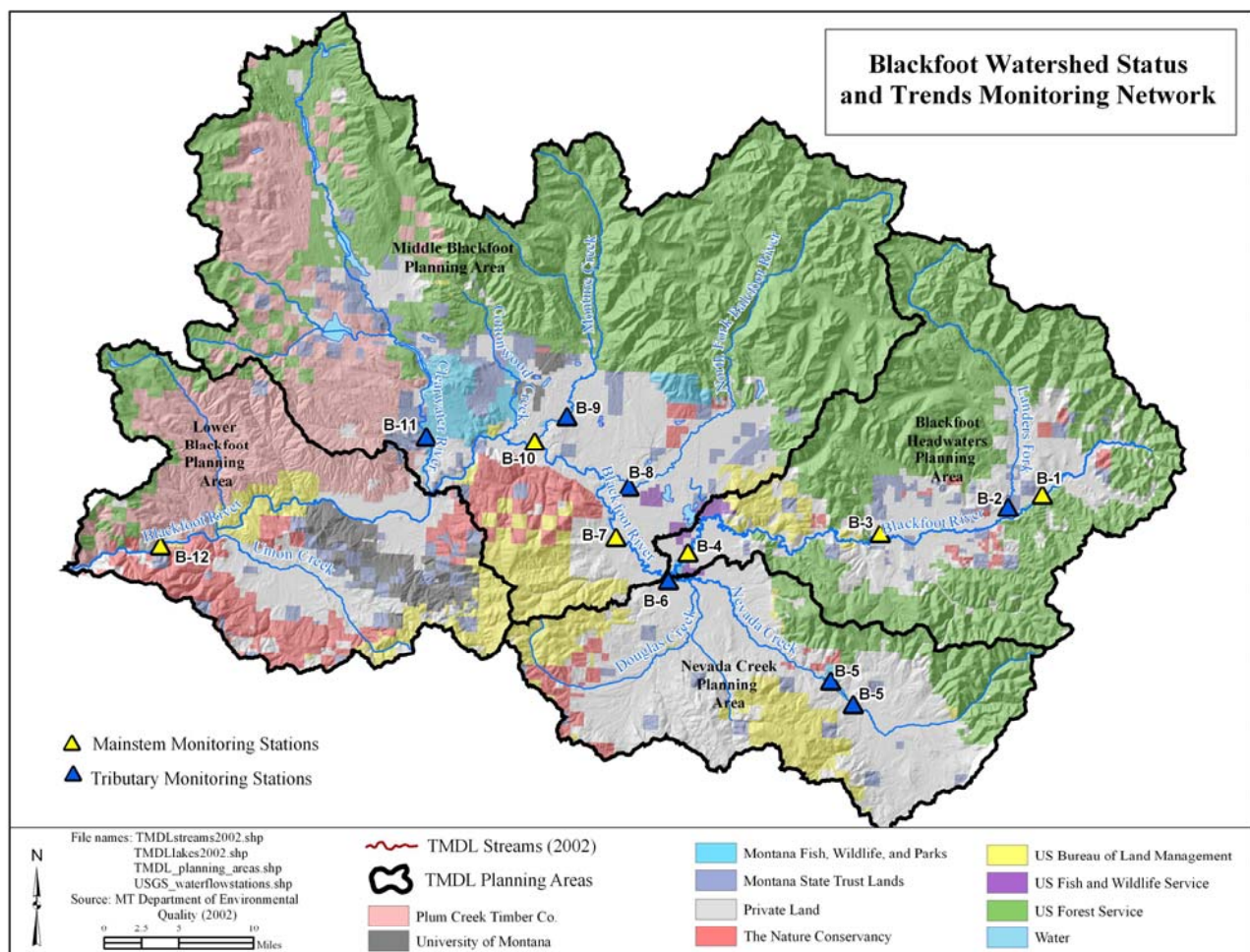
The Blackfoot River Valley Conservation Area Draft Plan (TNC and BC 2007)

Monitoring protocol for terrestrial and wetland species and habitats is not as fully developed as for aquatic habitats and populations. But The Nature Conservancy included a draft monitoring plan as part of its Blackfoot River Valley Conservation Area Draft Plan that, while incomplete, provides a useful point of departure for a terrestrial and wetland monitoring evaluation, and research plan (Appendix H). While the plan in Appendix H has overlap with the monitoring protocol described in Appendix L, that overlap can be easily resolved. The results of the Blackfoot Subbasin viability assessments that describe the current and desired viability ratings for a variety of indicators for each conservation target (Section 3.3) will complement the Conservation Area Plan efforts by providing valuable baseline and restoration target information.

These measures will provide a framework for expanded monitoring and evaluation of progress toward achieving conservation objectives in the subbasin.

Completion of the Blackfoot Subbasin Monitoring and Evaluation Plan will: 1) provide a framework for measuring conservation target viability over time, 2) ensure that strategic actions are abating the critical threats to conservation targets, and 3) verify that the stresses and threats identified in the Subbasin Assessment are, in fact, the factors that are limiting the viability of each conservation target. Through this process, existing strategies will be modified and new strategies will be developed. The process will also generate a cooperative research agenda to address management uncertainties and fill information gaps related to subbasin objectives and strategies.

Figure 3.38 Blackfoot Watershed Status and Trends Monitoring Network.



Ongoing Research Needs

The identification and planning of applied research applied has been an iterative process driven in part, by the accumulated information that has emerged from the continuing monitoring and

evaluation effort. In addition, the restoration effort itself has been instrumental in identifying research needs. The accumulated restoration and progress reports are replete with specific research projects initiated to inform the restoration efforts beyond what the annual and biennial efforts can do. To date, these efforts have included: telemetry studies of fluvial bull trout (Swanberg, 1997; Benson 2009) and fluvial westslope cutthroat trout (Schmetterling, 2001; Pierce, 2007); and mountain whitefish (Pierce, pending); whirling disease causes, distribution, and effects on rainbow trout (Pierce et al, 2008 and 2009); riparian conditions (Marler, 1997; Fitzgerald, 1997); mainstem and tributary temperatures (Pierce, 2000); research into the efficacy of certain fish screens and fish ladders (Schmetterling et al Pierce et al 2001); assessment of the geomorphic and temperature variables associated with bull trout spawning areas (Pierce, 2006); status review of mountain whitefish (Pierce, 2008).

As restoration projects unfold and as the ongoing fish population, streamflow, and temperature and other parameters continue, applied research needs will be identified. The biggest challenge to that continuation will be funding necessary to continue existing monitoring programs, including the continuation of long-term fisheries studies associated with restoration. Currently funding of monitoring and applied research has no dedicated funding source among any of the restoration partners. The Blackfoot Challenge and BBCTU have undertaken an effort to create a secure source of funding for future monitoring.

5.5 Endangered Species Act and Clean Water Act Requirements

For a subbasin plan to be adopted by the NPCC, the plan must conform to existing federal guidelines of the Endangered Species Act (ESA) and Clean Water Act (CWA).

ESA: The relationship of the Blackfoot Subbasin to ESA Planning Units and the status of threatened and endangered species in the subbasin are discussed in the Section 3.2.6.2 of the Subbasin Assessment. Nine of the Blackfoot Subbasin conservation objectives directly or indirectly address threatened and endangered species (grizzly bear, Canada lynx, bull trout) in the subbasin. Many of the strategic actions listed under these objectives directly support goals and objectives in relevant ESA recovery plans. Each of the conservation objectives will also support conservation of one or more Montana Species of Concern, which are listed in Tables 3.5 and 3.6.

CWA: Water quality conditions in the Blackfoot Subbasin are discussed in the Section 3.2.5 of the Subbasin Assessment. Many of the Blackfoot Subbasin conservation objectives incorporate strategic actions that will help to satisfy CWA objectives in the subbasin. The salmonid objectives and many of the vegetation-related objectives, in particular, address the CWA by including strategic actions that address forestry practices, road issues, livestock management, riparian vegetation, channel alteration, drainage systems and other factors that impact water quality in the subbasin.

Table 5.3 illustrates how the Blackfoot Subbasin conservation objectives are reflective of and integrated with recovery goals of ESA recovery plans and where they are supportive of and consistent with the CWA.

Table 5.3 Relationship of Blackfoot Subbasin Conservation Objectives to the ESA and CWA.

Conservation Objective	Addresses ESA	Addresses CWA
Conservation Objective 1 – Maintain the large, intact working landscapes that sustain the natural resources and rural way of life in the Blackfoot Subbasin through support to local communities, counties and land conservation partners.	√	√
Conservation Objective 2a – Maintain and/or restore viable populations of bull trout within the three major population groups in the Blackfoot Subbasin.	√	√
Conservation Objective 2b – Maintain and/or restore viable populations of migratory (fluvial and adfluvial) westslope cutthroat trout within each of the three major population groups within the Blackfoot Subbasin.		√
Conservation Objective 2c – Maintain and/or restore viable populations of resident westslope cutthroat trout within each of the three major population groups within the Blackfoot Subbasin.		√
Conservation Objective 3 – Control existing noxious and invasive plant species abundance and distribution, and prevent establishment of all new noxious and invasive species in the Blackfoot Subbasin. Emphasis should be placed on protecting the highest quality habitats, which should be identified and prioritized by 2012.		√
Conservation Objective 4 – Maintain or restore the viability of priority herbaceous wetlands based on historic conditions across the Blackfoot Subbasin.		√
Conservation Objective 5 - Maintain or restore the viability of priority moist site and riparian vegetation based on historic conditions across the Blackfoot Subbasin.		√
Conservation Objective 6 – Maintain or restore the viability of priority native grassland and sagebrush communities based on historic conditions across the Blackfoot Subbasin.	√	√
Conservation Objective 7 – Maintain or restore the viability of low severity fire regime ponderosa pine/western larch forest communities based on historic stand conditions across the Blackfoot Subbasin.	√	√
Conservation Objective 8 - Maintain or restore the viability of mid to high elevation coniferous forest communities based on historic stand conditions across the Blackfoot Subbasin.	√	√

Table 5.3 (continued).

Conservation Objective	Addresses ESA	Addresses CWA
Conservation Objective 9a - Maintain functional connectivity for grizzly bears across biologically suitable habitats in the Blackfoot Subbasin.	√	
Conservation Objective 9b – Reduce human-caused grizzly bear mortality in the Blackfoot Subbasin.	√	
Conservation Objective 9c –Improve human acceptance of grizzly bears and wolves by building a community-supported conservation and management process that reflects the interests and values of residents and landowners throughout the Blackfoot Subbasin.	√	
Conservation Objective 10 – Increase public awareness of the Blackfoot Watershed and the subbasin/conservation planning process, emphasizing the need to conserve the rural life, values and natural resources of the Blackfoot Subbasin.	√	√

6.0 References

- Agee, J. K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Covelo, California, USA.
- Allendorf, F.W. and C. Servheen. 1986. Genetics and the conservation of grizzly bears. *Trends in Ecology and Evolution* 1: 88-89.
- Alt, D. and D.W. Hyndman. 1986. *Roadside Geology of Montana*. Mountain Press Publishing Company, Missoula, MT.
- Altman, B. 1997. Olive-sided Flycatcher in western North America: Status review. U.S. Fish and Wildlife Service, Portland, Oregon. 59 p.
- Baker, W. L., T. T. Veblen, and R. L. Sherriff. 2007. Fire, fuels and restoration of ponderosa pine-Douglas fir forests in the Rocky Mountains, USA. *Journal of Biogeography* 34: 251–269.
- Baty, R. 1995. Resource Partitioning and Browse Use by Sympatric Elk, Mule Deer, and White-tailed Deer on a Winter Range in Western Montana. M.S. Thesis, University of Montana, Missoula.
- Baxter, C.V., K. D. Fausch, M. Murakami, and P. L. Chapman. 2004. Fish invasion restructures stream and forest food webs by interrupting reciprocal prey subsidies. *Ecology* 85(10): 2656-2663.
- Baxter, C.V., K. D. Fausch, M. Murakami, and P. L. Chapman. 2007. Invading rainbow trout usurp a terrestrial prey subsidy from native charr and reduce their growth and abundance. *Oecologia* 153: 461-470.
- Baxter, C.V., K.D. Fausch, and W.C. Saunders. 2005. Tangled webs: reciprocal flows of invertebrate prey link streams and riparian zones. *Freshwater Biology* 50: 201-220.
- Benson, Aubrey. 2009. Effects of Barriers on Migratory Bull Trout and Application of a Conceptual Framework to Evaluate Tradeoffs Associated With Dam Removal in the Clearwater River Drainage, Montana. M.S. Thesis, University of Montana, Missoula. .
- Blackfoot Challenge (BC). 2005a. A Basin-Wide Restoration Action Plan for the Blackfoot Watershed. Prepared for: Montana Department of Natural Resources and Conservation Renewable Resource Grant & Loan Program and The Blackfoot Watershed Restoration and Monitoring Partners. Prepared by: The Blackfoot Challenge in partnership with the Big Blackfoot Chapter of Trout Unlimited, Montana Fish, Wildlife and Parks, Hydrometrics Inc., and other partners.
- BC. 2005b. The Blackfoot Watershed: State of the Basin Report. Understanding Our Natural Resources and Rural Lifestyle. Blackfoot Challenge, Ovando, MT.

- BC. 2005c. Water Quality Status and Trends in the Big Blackfoot Watershed: 2004 Summary Report and Technical Appendices (draft December 2005). Blackfoot Challenge, Ovando, MT.
- Blackfoot Community Conservation Area (BCCA) Council and BC. 2008. Blackfoot Community Conservation Area: Management Plan for the Core. Blackfoot Community Conservation Area Council and Blackfoot Challenge, Ovando, MT.
- Behnke, R. 1992. Native trout of western North America. American Fisheries Society monograph 6. American Fisheries Society. Bethesda, MD.
- Behnke, R. 2002. Trout and salmon of North America. Chanticleer Press, New York.
- Belsky, J. 2009. Presentation at Seeley-Swan-Blackfoot Summit , April 15-16, 2009.
- Best, L. B., H. Campa, III, K. E. Kemp, R. J. Robel, M. R. Ryan, J. A. Savidge, H. P. Weeks, Jr., and S. R. Winterstein, 1997. Bird abundance and nesting in CRP fields and cropland in the Midwest: a regional approach. *Wildlife Society Bulletin* 25: 864-877.
- Bicak, T.K., R.L. Raymond, and D.A. Jenni. 1982. Effects of grazing on Long-billed Curlew (*Numenius americanus*) breeding behavior and ecology in southwestern Idaho. In J.M. Peck and R. D. Dalke (eds), *Wildlife Livestock Management: Proceedings 10*. University of Idaho, Forest Wildlife and Range Experiment Station, Moscow, ID pp.74-85.
- Bisson, P.A., B.E. Rieman, C. Luce, P.F. Hessburg, D.C. Lee, J.L. Kershner, G.H. Reeves, and R.E. Gresswell 2003 . Fire and aquatic ecosystems of the western USA: Current knowledge and key questions. *Forest Ecology and Management* 178 (1-2): 213-229.
- Bock, C.E. 1970. The ecology and behavior of the Lewis's Woodpecker (*Asyndesmus lewis*). *University of California Zoological Publications* 92: 1100.
- Bradley, B.A., M. Oppenheimer, and D.S. Wilcove. 2009. Climate Change and Plant Invasion: Restoration Opportunities Ahead? *Global Change Biology* 15: 1511-1521.
- Brown, D.E. 1985. The grizzly bear in the Southwest. University of Oklahoma Press, Norman , Oklahoma, USA.
- Brown, P. M., M. R. Kaufmann, and W. D. Shepperd. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. *Landscape Ecology* 14: 513-532.
- Burcham, M.G., C.L. Marcum, D. McCleery, M. Thompson. 2000. Final Report: Study of Sympatric Moose and Elk in the Garnet Range of Western Montana.
- Burcham, M.G., C.L. Marcum, L.J. Lyon, K.T. Weber, and W.D. Edge. 1998. Final Report: Chamberlain Creek Elk Studies 1977-1983 and 1993-1996. School of Forestry, University of Montana. 260 pp.

- Campbell, E.M., and J.A. Antos. 2000. Distribution and severity of white pine blister rust and mountain pine beetle on whitebark pine in British Columbia. *Can. J. For. Res.* 30: 1051-1059.
- Campbell, F. 2004. White pine blister rust. From: Gallery of Pests: Pests and Pathogens that are Widespread. The Nature Conservancy's Global Invasive Species Team. Website available at: www.invasive.org/gist/products/gallery/crori1.html.
- Caprio, J.M. and P. Farnes (unknown date). Montana Interagency Plant Materials Handbook, Chapter One – Climate of Montana. Montana State University Animal and Range Science Extension Services. Website available at: www.animalrangeextension.montana.edu/Articles/Forage/MIPMH-chptr-1.htm.
- CFTF (Clark Fork Task Force). 2004. Clark Fork River Basin Watershed Management Plan. Montana Department of Natural Resources and Conservation: Water Resources Division.
- CFC (Clark Fork Coalition). 2009. Clark Fork Coalition website available at: www.clarkfork.org.
- Clark, T.W., A.H. Harvey, R.D. Dorn, D.L. Genter, and C. Groves, eds. 1989. Rare, sensitive, and threatened species of the Greater Yellowstone Ecosystem. Northern Rockies Conservation Cooperative, Montana Natural Heritage Program, The Nature Conservancy, and Mountain West Environmental Services. 153 p.
- Cox, B., T. Gignoux and R. McCulloch. 1998. Economic Geology in the Western Montana Portion of the Blackfoot River Region: Discussion and Field Trip Guide. Abstract. *Northwest Geology*, v.28, p 101-109.
- Craighead, F.C. and J.J. Craighead. 1972. Data on grizzly bear denning activities and behavior obtained by using wildlife telemetry. *Bears and their Biology: International Conference On Bear Research and Management* 2: 84-106.
- CRC (Clearwater Resource Council). 2008. Landscape Assessment for the Clearwater Valley of Montana. CSeeley Lake, MT.
- Cromartie, J.B. and J.N. Wardwell. 1999. Migrants settling far and wide in the rural West. *Rural Development Perspectives* 14(2): 2-8.
- Crozier, L.G., R.W. Zabel, and A.F. Hamlet. 2008. Predicting differential effects of climate change at the population level with life-cycle models of spring Chinook salmon. *Global Change Biology* 14: 1-14.
- Curtis, S. 2005. Meeting the challenge head-on: how a nationally recognized, landowner-led conservation group is protecting both the natural resources and rural lifestyle of the Blackfoot Valley. *Montana Outdoors* March–April.
- Decker, P.R. 2001. “The Death of John Wayne and the Rebirth of a Code of the West.” In *Across the Great Divide: Explorations in Collaborative Conservation and the American West*, edited by Philip Brick, D. Snow, and S. Van De Wetering. Washington, D.C. : Island Press, 2001.

- Dixon, R. D., and V. A. Saab. 2000. Black-backed Woodpecker (*Picoides arcticus*). Pages 1–20 in A. Poole and F. Gill, editors. *Birds of North America*. Birds of North America, Inc., Philadelphia, Pennsylvania, USA.
- Dood, A. R., S.J. Atkinson, and V.J. Boccadori. 2006. Grizzly Bear Management Plan for Western Montana: Final Programmatic Environmental Impact Statement 2006-2016. Montana Fish, Wildlife and Parks, Helena, 163 pp.
- Ducey, J. and L. Miller. 1980. Birds of an agricultural community. *Nebraska Bird Review* 48: 5868.
- Dunham, J. B., and B.E. Rieman. 1999. Metapopulation structure of bull trout: influences of physical, biotic, and geometrical landscape characteristics. *Ecological Applications* 9(2): 642-655.
- Dunham, J.B., S.B. Adams, R.E. Schroeter, and D.C. Novinger. 2002. Alien invasions in aquatic ecosystems: toward an understanding of brook trout invasions and potential impacts on inland cutthroat trout in western North America. *Reviews in Fish Biology and Fisheries* 12: 373-391.
- Dunham, J.B., B.E. Rieman, and J.T. Peterson. 2002. Patch-based models to predict species occurrence: lessons from salmonid fishes in streams. Pages 327-334 in J.M. Scott, P.J. Heglund, M. Morrison, M. Raphael, J. Haufler, and B. Wall, editors. *Predicting Species Occurrences: Issues of Scale and Accuracy*. Island Press. Covelo, CA
- Edelman, M.A. and S.C. Burke. 2004. Iowa Communities of Distinction: A Summary Analysis of Lessons Learned, Best Practices, and Community Vitality Indicators from In-Depth Studies of Selected Iowa Communities. Report prepared for Community Vitality Center, Ames, Iowa.
- Ehrhart, R.C. and P.L. Hansen. 1998. Successful Strategies for Grazing Cattle in Riparian Zones. Montana BLM Riparian Technical Manual No. 4. USDI Bureau of Land Management.
- Fausch, K.D., Y. Taniguchi, S. Nakano, G.D. Grossman, and C.R. Townsend. 2001. Flood disturbance regimes influence rainbow trout invasion success. *Ecological Applications* 11(5): 1438-1455.
- Fausch, K. D., B. E. Rieman, M. K. Young, and J. B. Dunham. 2006. Strategies for conserving native salmonid populations at risk from nonnative fish invasions: tradeoffs in using barriers to upstream movement. USDA Forest Service, General Technical Report RMRS-GTR-174. Rocky Mountain Research Station, Fort Collins, Colorado.
- Fischer, W.C. and A.F. Bradley. 1987. Fire Ecology of Western Montana Forest Habitat Types. USDA Forest Service, Intermountain Research Station. General Technical Report INT-223.
- Fitzgerald G. 1997. Analysis and inventory of riparian vegetation along Nevada and Monture Creeks using ADAR imagery. M.S. Thesis, University of Montana, Missoula.

- Fraley, J. J. and B. B. Shepard. 1989. Life History, Ecology, and Population Status of Migratory Bull Trout (*Salvelinus confluentus*) in the Flathead Lake River System, Montana. *Northwest Science* 63(4): 133-143.
- Gardner, C.L, W. Ballard, and R.H. Jessup. 1986. Long distance movement by an adult wolverine. *J. Mammal* 67: 603.
- Gentry D.J., and K.T. Vierling. 2007. Old burns as source habitats for Lewis's woodpeckers breeding in the Black Hills of South Dakota. *Condor* 109: 122-131.
- Goggans, R., R.D. Dixon, C. Seminara. 1988. Habitat use by three-toed and Black-backed Woodpeckers, Deschutes National Forest, Oregon. Nongame Rep. 87302. Oregon Department of Fish and Wildlife; Deschutes National Forest.
- Griffin, P.C. 2004. Landscape ecology of snowshoe hares in Montana. PhD Dissertation, University of Montana. Missoula, Montana.
- Griffin, P.C., and L.S. Mills. 2007. Precommercial thinning reduces snowshoe hare abundance in the short term. *Journal of Wildlife Management* 71: 559-564.
- Hammond, C. 2009. Conservation Plan for Common Loons in Montana. Common Loon Working Group of Montana.
- Hanna, D., L. Bay, and E. Bergman. 2009. Proposed Climate Change Case Statement for The Nature Conservancy in Montana.
- Harris, N.C. 2007. Monitoring Survival of Young in Ungulates: A Case Study with Rocky Mountain Elk. M.S. Thesis, University of Montana
- Hayward, G.D. and R.E. Escano. 1989. Goshawk nest site characteristics in western Montana and northern Idaho. *Condor* 91: 476-479.
- Hayward, G.D., T. Holland and R.E. Escano. 1990. Goshawk habitat relationships. In: N.M. Warren (ed.). *Old growth habitats and associated wildlife species in the northern Rocky Mountains*. Report R19042. USDA Forest Service, Wildlife Habitat Relationships Program, Northern Region, Missoula, Montana. 47 p.
- Helzer, C.J. 1996. The effects of wet meadow fragmentation on grassland birds. M.S. Thesis. University of Nebraska, Lincoln. 65p.
- Herkert, J.R. 1994. The effects of habitat fragmentation on midwestern grassland bird communities. *Ecological Applications* 4: 461-471.
- Hessburg, P. F., K. M. Reynolds, R. E. Keane, K. M. James, and R. Salter. 2007. Re-examining fire severity relations in pre-management era mixed conifer forests: inferences from landscape patterns of forest structure. *Landscape Ecology* 22: 5-24.

- Hilborn, R., T.P. Quinn, D.E. Schindler, and D.E. Rogers. 2003. Biocomplexity and fisheries sustainability. *Proceedings of the National Academy of Science* 100(11): 6564-6568.
- Hoff, R. and S. Hagle. 1989. Diseases of whitebark pine with special emphasis on white pine blister rust. In: Schmidt, W.C. and K. J. McDonald, Compilers. *Proceedings - Symposium on Whitebark Pine Ecosystems: Ecology and Management of a High-Mountain Resource*. Bozeman, MT. March 29-31, 1989. pp. 179-190.
- Holt, D.W. and J.M. Hillis. 1987. Current status and habitat associations of forest owls in western Montana. Pages 281-288 in R.W. Nero, R.J. Clark, R.J. Knapton, and R.H. Hamre (eds.), *Biology and conservation of northern forest owls: symposium proceedings*, Feb. 37, Winnipeg, Manitoba. General Technical Report RM142. USDA, Forest Service; Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 309 p.
- Holt, D.W., J.A. Hoy, and P.L. Wright. 1987. Occurrence and first nest record of Flammulated Owls in Montana. *J. Raptor Res.* 21 (3): 121-124.
- Hornocker, M.G., and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. *Can. J. Zool.* 59: 1286-1301.
- Hunt, R.S. 2002. Relationship between early family-selection traits and natural blister rust cankering in western white pine families. *Can. J. Plant Path.* 24: 200-204.
- Hurley, M.A. 1994. Summer-Fall Ecology of the Blackfoot-Clearwater Elk Herd of Western Montana. M.S. Thesis, University of Montana, Missoula.
- Hutto, R.L. 1995a. USFS Northern Region songbird monitoring program: Distribution and habitat relationships. USFS Contract #R19505, Second report. 120 p.
- Hutto, R.L. 1995b. Composition of bird communities following stand-replacement fires in Northern Rocky Mountain (U.S.A.) conifer forests. *Conserv. Biol.* 9(5): 1041-1058.
- Hutto, R.L. 2008. The ecological importance of severe wildfires: some like it hot. *Ecological Applications* 18(8): 1827-1834.
- Hutto, R.L., and J.S. Young. 1999. Habitat relationships of landbirds in the Northern Region, USDA Forest Service. General Technical Report RMRS GTR32. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT.
- Hutto, R. L., and J. S. Young. 2002. Regional landbird monitoring: perspectives from the northern Rocky Mountains. *Wildlife Society Bulletin* 30: 738-750.
- IGBC (Interagency Grizzly Bear Committee). 1986. *Interagency Grizzly Bear Guidelines*.
- IGBC. 1994. *Interagency Grizzly Bear Committee Taskforce Report*.
- IGBC. 1998. *Interagency Grizzly Bear Committee Taskforce Report*.

- Ingman, G.L., M.A. Kerr, and D.L. McGuire. 1990. Water quality investigations in the Blackfoot River drainage, Montana. A report to the Big Blackfoot River and Oakbrook, Illinois, chapters of Trout Unlimited. Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena.
- Isaak, D.J., C.H. Luce, B.E. Rieman, D.E. Nagel, E.E. Peterson, D.L. Horan, S. Parkes, and G.L. Chancler (submitted). Effects of climate change and wildfire on stream temperature and thermal habitat for two salmonids in a mountain river network. Submitted to Ecological Monographs.
- ISAB (Independent Scientific Advisory Board). 2007. Climate Change Impacts on Columbia Basin River Fish and Wildlife.
- Jackson-Smith, J., U. Kreuter and R.S. Krannich. 2005. Understanding the multidimensionality of property rights orientations: Evidence from Utah and Texas rancher. *Society and Natural Resources* 18:587-610.
- Jaramillo, A., and P. Burke. 1999. New World Blackbirds. The Icterids. Princeton, NJ: Princeton University Press; 413 p.
- Johnson, S.J., and D.E. Griffel. 1982. Sheep losses on grizzly bear range. *Journal of Wildlife Management*. 46: 786-790.
- Jonkel, J.J. 2006. Preliminary overview of grizzly bear management and mortality 1998-2005. Living with Predators Project Working Paper 0004. Montana Fish, Wildlife and Parks Region 2 Preliminary Report.
- Jorgensen, C.J. 1983. Bear-sheep interactions, Targhee National Forest. International Conference on Bear Research and Management. 5: 191-200.
- Karr, J.R., and I.J. Schlosser. 1978. Water resources and the land-water interface. *Science* 201: 229-234.
- Kendall, K.C. and S.F. Arno. 1989. Whitebark pine - an important but endangered wildlife species. In Schmidt, W. C. and K. J. McDonald (compilers). Proceedings - Symposium on Whitebark Pine Ecosystem: Ecology and Management of a High-Mountain Resource. Bozeman, MT. March 29-31, 1989. pp. 264-273.
- Kendall, K.C., J.B. Stetz, J. Boulanger, A.C. Macleod, D. Paetkau, and G.C. White. 2009. Demography and Genetic Structure of a Recovering Grizzly Bear Population. *Journal of Wildlife Management* 73(1): 3-17.
- Kenyon, P. 2005. Building Rural Communities Through Innovation. Presentation available at: <http://www.torc.on.ca/documents/BuildingRuralCommunitiesThroughInnovation-PKenyon.pdf>

- Kinsella, S. 2008. Trout In Trouble: The Impacts of Global Warming on Trout in the Interior West, citing S. Saunders, et al., Hotter and Drier: The West's Changed Climate, The Rocky Mountain Climate Organization/Natural Resources Defense Council.
- Kitano, S., K. Hasegawa, and K. Maekawa. 2009. Evidence for interspecific hybridization between native white-spotted charr *Salvelinus leucomaenis* and non-native brown trout on Hokkaido Island Japan. *Journal of Fish Biology* 74: 467-473.
- Knight, R.R., and S.J. Judd. 1983. Grizzly bears that kill livestock. *International Conference on Bear Research and Management*. 5: 186-190.
- Knotek, L. 2005. Middle Clark River and Missoula Area 2004 Fisheries Status Report. Montana Department of Fish, Wildlife, and Parks. Missoula, Montana.
- Kolbe, J.A., and J.R. Squires. 2007. Circadian activity patterns of Canada lynx in western Montana. *Journal of Wildlife Management* 71: 1607-1611.
- Kolbe, J.A., J.R. Squires, D.H. Pletscher, and L.F. Ruggiero. 2007. The effect of snowmobile trails on coyote movements within lynx home ranges. *Journal of Wildlife Management* 71: 1409-1418.
- Leary, R.F., F.W. Allendorf, and K.L. Knudsen. 1983. Consistently high meristic counts in natural hybrids between brook trout and bull trout. *Systematic Zoology*. 32: 369-376.
- Lenard, S., J. Carlson, J. Ellis, C. Jones, and C. Tilly. 2003. P. D. Skaar's Montana Bird Distribution, 6th Edition. Montana Audubon, Helena, Montana. 144 pp.
- Lesica, P. 1994. The distribution of plant community diversity associated with glacial wetlands in the Ovando Valley, Montana. Unpublished report on file with The Nature Conservancy, 32 S. Ewing, Helena, Montana. 26 pp.
- Lewis, M. 1805. Lewis and Clark Expedition Journal entry 13 June.
- Lewis R.S. 1998. Geologic Map of the Butte 1o X 2o Quadrangle, Southwestern Montana.
- Liknes, G.A. 1984. The present status and distribution of the westslope cutthroat trout (*Salmo clarki lewisi*) east and west of the Continental Divide in Montana. Final Report to the Montana Fish, Wildlife and Parks, Helena.
- Liknes, G.A. and P.J. Graham. 1988. Westslope cutthroat trout in Montana: life history, status, and management. *American Fisheries Society Symposium* 4: 53-60.
- Lindenmayer, D., R.J. Hobbs, and R. Montague-Drake. 2008. A checklist for ecological management of landscapes for conservation. *Ecology Letters* 11: 78-91.
- Linder, K.A. 1994. Habitat utilization and behavior of nesting Lewis's Woodpeckers (*Melanerpes lewis*) in the Laramie range, southeast Wyoming. M.S. Thesis, University of Wyoming, Laramie.

- Lolo National Forest. 2000. Proposed Designated Backcountry Snowmobile Areas Biological Assessment (draft). Seeley Lake Ranger District, May 26.
- Lolo National Forest. 2003. Biological Assessment for Grizzly Bears: Clearwater Roads Project (draft). Seeley Lake Ranger District, August 26.
- Low, Greg. 2003. Landscape-Scale Conservation: A Practitioner's Guide (Fourth Edition). Efroymson Fellowship Program, The Nature Conservancy, Arlington, VA.
- Mace, R.D. and T.L. Manley. 1992. South Fork Flathead River Grizzly Bear Project: Progress Report for 1992. Montana Fish, Wildlife and Parks.
- Mace, R.D. and J.S. Waller. 1998. Demography and population trend of grizzly bears in the Swan Mountains, Montana. *Conservation Biology*. 12(5): 1005-1016.
- Mace, R.D., J.S. Waller, T.L. Manley, L.J. Lyon, and H. Zuuring. 1996. Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana. *J. Apl. Ecol.* 33:1395-1404.
- Mantas, M. 2003. Evaluating Risk to Native Plant Communities from Selected Exotic Species. The Nature Conservancy of Montana, and U.S. Forest Service Cohesive Strategy Team, Kalispell, Montana.
- Marler, M. 1997. Riparian health and inventory of the Blackfoot River between Nevada Creek and the North Fork Confluence: A GIS mapping project. Report to Montana Fish, Wildlife and Parks, Missoula, MT.
- Marlow, C.B. and T.M. Pogacnik. 1985. Time of grazing and cattle-induced damage to streambanks. In: *Riparian ecosystems, and their management: reconciling conflicting uses*. R. Roy Johnson, Charles D. Ziebell, David R. Patton, Peter F. Folliott, and R. H. Hamre (technical coordinators). First North American riparian conference, April 16-18, Tucson, AZ. USDA Forest Service General Technical Report RM-120. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
- Mattson, D.J. 1990. Human impacts on bear habitat use. *International Conference on Bear Research and Management*. 8: 33-56.
- Mattson, D.J., S. Herrero, R.G. Wright, and C.M. Pease. 1996. Designing and managing protected areas for grizzly bears: How much is enough? In: R.G. Wright (ed). *National parks and protected areas: Their role in environmental protection*. Cambridge, MA : Blackwell Science.
- MBEWG (Montana Bald Eagle Working Group). 1991. Habitat management guide for Bald Eagles in northwestern Montana. Montana Bald Eagle Working Group: 29 p.
- MBTRT (Montana Bull Trout Restoration Team). 2000. Restoration plan for bull trout in the Clark Fork River Basin and Kootenai River Basin Montana. A report to Governor Marc Racicot from the Montana Bull Trout Restoration Team, c/o Montana Fish, Wildlife and Parks, Helena, Montana.

- MBTSG (Montana Bull Trout Scientific Group). 1995. Blackfoot River drainage bull trout status report. Prepared by the Montana Bull Trout Scientific Group for the Montana Bull Trout Restoration Team, Montana Fish, Wildlife and Parks, Helena.
- McCallum, D.A. 1994. Flammulated Owl (*Otus flammeolus*). In: A. Poole and F. Gill (eds). *The Birds of North America*, No. 93. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.
- McCarthy, J. 2001. A landowners' guide to Montana wetlands: revised 2001 edition. Montana Watercourse, Bozeman, MT.
- McClelland, B.R., and P. T. McClelland. 1999. Pileated woodpecker nest and roost trees in Montana : links with old growth and forest "health." *Wildlife Society Bulletin* 27:846-857.
- McIntyre, J.D., and B.E. Reiman. 1995. Westslope WSCT. Pages 1-15 in M.K. Young, editor. Conservation assessment for inland WSCT. U.S. Forest Service General Technical Report. RM-256.
- McLellan, B.N, F.W. Hovey, R.D. Mace, J.G. Woods, D.W. Carney, M.L. Gibeau, W.L. Wakkinen, and W.F. Kasworm. 1999. Rates and causes of grizzly bear mortality in the interior mountains of BC, AB, MT, WA, and ID. *Journal of Wildlife Management*. 63(3): 911-920.
- MDEQ (MT Department of Environmental Quality). 2003. Water Quality Restoration Plan for Metals in the Blackfoot Headwaters TMDL Planning Area. Montana Department of Environmental Quality, Helena, MT. Available online at: <http://www.deq.state.mt.us/wqinfo/TMDL/finalReports.asp>.
- MDEQ. 2004. Blackfoot Headwaters Planning Area Water Quality and Habitat Restoration Plan and TMDL for Sediment. Montana Department of Environmental Quality, Helena, MT. Available online at: <http://www.deq.state.mt.us/wqinfo/TMDL/finalReports.asp>.
- MDEQ. 2008a. Middle Blackfoot-Nevada Creek Total Maximum Daily Loads and Water Quality Improvement Plan: Sediment, Nutrient, Trace Metal and Temperature TMDLs. Montana Department of Environmental Quality, Helena, MT. Available online at: <http://www.deq.state.mt.us/wqinfo/TMDL/finalReports.asp>.
- MDEQ. 2008b. Lower Blackfoot Total Maximum Daily Loads and Water Quality Improvement Plan: Sediment, Nutrient, Trace Metal and Temperature TMDLs. Public Review Draft, December 2008. Montana Department of Environmental Quality, Helena, MT.
- MDHES (Montana Department of Health and Environmental Sciences). 1994. Montana water quality 1994. The Montana 305(b) Report. Montana Department of Health and Environmental Sciences, Water Quality Division. Helena, MT.
- Meehan, W. R. (editor). 1991. Influence of forest and rangeland management on salmonid fishes and their habitats. *American Fisheries Society Special Publication* 19.

- MFIS (Montana Fisheries Information System). 2009. Montana Fish, Wildlife and Parks. Helena. Website available at: fwp.mt.gov/fishing/mfish/.
- MFWP (MT Fish, Wildlife and Parks). 1993. Five year update of the programmatic environmental impact statement: The grizzly bear in northwestern Montana 1986-1990. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 1994. Management of Black Bears in Montana. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 1996. Management of Mountain Lions in Montana – Final Environmental Impact Statement. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 2004a. Montana Gray Wolf Conservation and Management Plan. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 2004b. Montana Statewide Elk Management Plan. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 2005a. Montana’s Comprehensive Fish and Wildlife Conservation Strategy. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 2006. Grizzly Bear Management Plan for Western Montana: Final Programmatic Environmental Impact Statement 2006-2016. Montana Fish, Wildlife and Parks, Helena.
- MFWP. 2008. Blackfoot River Recreation Management Annual Report. Montana Fish, Wildlife and Parks, Missoula.
- MFWP. 2009. Blackfoot River Recreation Management Plan (preliminary draft). Montana Fish, Wildlife and Parks, Missoula.
- Missoula County. 2008. Missoula County Subdivision Regulations, as amended Nov 1, 2008 by Resolution 2008-125.
- Mitchell, C.D. 1994. Trumpeter Swan (*Cygnus buccinator*). In: Poole, A. and F. Gill (eds). The Birds of North America No. 105. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.
- MTNHP (Montana Natural Heritage Program). 2009a. Natural Resource Information System search results for the Blackfoot Subbasin. Montana Natural Heritage Program, Helena, MT.
- MTNHP. 2009b. Montana Field Guide, available at: www.nhp.nris.mt.gov. Montana Natural Heritage Program, Helena, MT.
- Montana ANS Technical Committee. 2002. Montana aquatic nuisance species (ANS) management plan (final). Produced by the Montana ANS Steering Committee.

- Montana Summit Steering Committee and Weed Management Task Force. 2005. Montana Weed Management Plan. Compiled by C.A. Duncan. Helena, MT.
- Montana Water Center. 2009. Whirling disease initiative. Montana State University, Bozeman. Website available at: whirlingdisease.montana.edu.
- Moore, J.N., S.N. Luoma, and D. Peters. 1991. Downstream effects of mine effluent on an intermontane riparian system. *Canadian Journal of Fisheries and Aquatic Sciences* 48: 222-232.
- Morgan, P., S. Bunting, A. Black, T. Merrill, and S. W. Barrett. 1998. Fire regimes in the Interior Columbia River Basin: Past and Present. Pp. 77-82 In Proc. Fire mgt. under fire (adapting to change); 1994 Interior West Fire Council Meeting, Internatl. Assoc. Wildland Fire, Fairfield, WA.
- Mosconi, S.L., and R.L. Hutto. 1982. The effects of grazing on land birds of a western Montana riparian habitat. In: *Wildlife-Livestock Relationships Symposium*. Forest, Wildlife and Range Experiment Station, Moscow, ID: University of Idaho: 221-233.
- Moskoff, W. 1995. Veery (*Catharus fuscescens*). In: A. Poole and F. Gill (eds). *The Birds of North America*, No. 142. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C.
- Mudge M.R., R.L. Earhart, J.W. Whipple, and J.E. Harrison. 1982. *Geologic and Structure Map of the Choteau 1° x 2° Quadrangle, Western Montana*. Reston, VA: Montana Bureau of Mines and Geology, Department of the Interior, U.S. Geological Survey.
- Muhlfeld, Clint C., Steven T. Kalinowski, Thomas E. McMahon, Mark L. Taper, Sally Painter, Robb F. Leary, and Fred W. Allendorf. 2009. Hybridization rapidly reduces reproductive success of a native trout in the wild. *Biology Letters*.
- Murie, A. 1948. Cattle on grizzly bear range. *Journal of Wildlife Management* 12: 57-72.
- Naiman, R.J., and M.G. Turner. 2000. A future perspective on north America's freshwater ecosystems. *Ecological Applications* 10(4): 958-970.
- National Audubon Society. 2007. Audubon Watch List. Available at: <http://web1.audubon.org/science/species/watchlist/>.
- NCDE (Northern Continental Divide Ecosystem) Access Taskforce. 1995. *Interim Motorized Access Management Direction: Northern Continental Divide Recovery Zone*.
- Neuenschwander, L.F., J.W. Byler, A.E. Harvey, G.I. McDonald, D.S. Ortiz, H.L. Osborne, G.C. Snyder, and A. Zack. 1999. White pine in the American West: a vanishing species - can we save it? Gen. Tech. Rep. RMRS-GTR-35. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 20 p.

- Newby, F.E., and J.J. McDougal. 1964. Range extension of the wolverine in Montana. *J. Mammal* 45: 485-487.
- Newby, F.E., and P.L. Wright. 1955. Distribution and status of the wolverine in Montana. *J. Mammal* 36: 248-253.
- NPPC (Northwest Power Planning Council). 2000. Columbia River Basin Fish and Wildlife Program. Council document 2000-19. Northwest Power Planning Council, Fish and Wildlife Program. Portland, OR.
- NPPC. 2001. Technical Guide for Subbasin Planners. Council Document 2001-20. Northwest Power Planning Council, Fish and Wildlife Program. Portland, OR.
- NPPC. 2009. Northwest Power and Conservation Council website. Available at: www.nwccouncil.org.
- Oakleaf, J.K., D.L. Murray, J.R. Oakleaf, E.E. Bangs, C.M. Mack, D.W. Smith, J.A. Fontaine, M.D. Jimenez, T.J. Meier, and C.C. Niemeyer. 2006. Habitat selection by recolonizing wolves in the Northern Rocky Mountains of the United States. *Journal of Wildlife Management* 70(2): 554-563.
- Olson, B.E. 1999. Impacts of Noxious Weeds on Ecologic and Economic Systems. Pages 4-18 *in* R.L. Sheley and J.K. Petroff, Eds. *Biology and Management of Noxious Rangeland Weeds*. Oregon State University Press, Corvallis, OR.
- Pampush, G.L. and R.G. Anthony. 1993. Nest success, habitat utilization and nest site selection of Long-billed Curlews in the Columbia Basin, Oregon. *Condor* 95: 954-967.
- Pease, C.M. and D.J. Mattson. 1999. Demography of the Yellowstone grizzly bears. *Ecology*. 80(3): 957-975.
- Pellant, M., P. Shaver, D.A. Pyke, and J.E. Herrick. 2005. Interpreting indicators of rangeland health, version 4. Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. 122 pp.
- Peters, D. J. 1990. Inventory of fishery resources in the Blackfoot River and major tributaries of the Blackfoot River. *Montana Fish Wildlife and Parks*, Missoula.
- Peters, D. and R. Pierce. 1995. Aquatic Restoration in the Blackfoot River and Rock Creek Drainages. *Montana Fish, Wildlife and Parks*, Missoula.
- Peters, D. J. and R. Spoon. 1989. Preliminary inventory of the Big Blackfoot River. *Montana Fish, Wildlife and Parks*, Missoula.
- Peterson, K.L., and L.B. Best. 1985. Brewer's Sparrow nest site characteristics in a sagebrush community. *Journal of Field Ornithology* 56: 2327.

- Petersen-Perlman, J. and D. Shively. 2009. Assessment of Municipal Water Rights in the Upper Clark Fork River Basin, University of Montana, Missoula.
- Pierce, R. 1991. A stream habitat and fisheries analysis for six tributaries to the Blackfoot River. Montana Fish, Wildlife and Parks, Missoula.
- Pierce, R., and D. Peters. 1990. Aquatic studies in the middle Blackfoot River, Nevada Creek, and Nevada Spring Creek corridors. Montana Fish, Wildlife and Parks, Missoula.
- Pierce R. and D. J. Peters. 1991. Aquatic investigation in the middle Blackfoot River, Nevada Creek and Nevada Spring Creek corridor. Montana Fish, Wildlife and Parks, Bozeman.
- Pierce, R. and C. Podner. 2000. Blackfoot River fisheries inventory, monitoring and restoration report. Montana Fish, Wildlife and Parks, Missoula.
- Pierce, R., C. Podner, and J. McFee. 2001. Blackfoot River Fisheries Inventory, Monitoring, and Restoration Report 2001. Montana Fish, Wildlife and Parks, Missoula.
- Pierce, R. and C. Podner. 2006. The Big Blackfoot River Fisheries Restoration Report for 2004 and 2005. Montana Fish, Wildlife and Parks, Missoula.
- Pierce, R. and D. Schmetterling. 1999. Blackfoot River Restoration Project: Progress and Monitoring Report 1997-1999. Montana Fish, Wildlife and Parks, Missoula.
- Pierce, R., R. Aasheim and C. Podner. 2005. An integrated stream restoration and native fish conservation strategy for the Big Blackfoot River basin. Montana Fish Wildlife and Parks, Missoula, Montana.
- Pierce, R., R. Aasheim and C. Podner. 2007. Fluvial westslope cutthroat trout movements and restoration relationships in the upper Blackfoot Basin, Montana. *Intermountain Journal of Sciences* Vol. 13(2).
- Pierce, R., R. Anderson and C. Podner. 2004. The Big Blackfoot River Restoration Progress Report for 2002 and 2003. Montana Fish, Wildlife and Parks, Missoula. 108pp.
- Pierce, R., D. Peters and T. Swanberg. 1997. Blackfoot River restoration progress report. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R., C. Podner, and M. Davidson. 2009. Correlation of fluvial rainbow trout spawning life history with severity of infection by *Myxobolus cerebralis* in the Blackfoot River Basin, Montana. *Transactions of the American Fisheries Society* 138: 251-263.
- Pierce R., C. Podner, M. Davidson, L. Knotek, and J. Thabes. 2008. The Big Blackfoot River Fisheries and Restoration Investigations for 2006 and 2007. Montana Department of Fish, Wildlife and Parks, Missoula.
- PIF (Partners In Flight). 2000. Partners in Flight Bird Conservation Plan Montana. Version 1.1.

- Platts, W.S. 1979. Livestock grazing and riparian/stream ecosystems. p. 39-45. In: Proceedings, Forum-Grazing and Riparian/Stream Ecosystems. Trout Unlimited, Inc., Vienna, VA.
- Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River. Draft. Prepared for Avista Corporation, Spokane, Washington.
- Power, T. 1996. Lost Landscapes and Failed Economies: The Search for a Value of Place. Washington, D.C. : Island Press.
- Rasker, R. 2001. "Your Next Job Will Be In Services. Should You Be Worried?" In Across the Great Divide: Explorations in Collaborative Conservation and the American West, edited by Philip Brick, D. Snow, and S. Van De Wetering. Washington , D.C.: Island Press, 2001.
- Reinhart, D.P., M.A. Haroldson, D.J. Mattson, and K.A. Gunther. 2001. Effects of exotic species on Yellowstone's grizzly bears. Western N. Amer. Naturalist 61: 277-288.
- Reynolds, R.T. and B.D. Linkhart. 1992. Flammulated owls in ponderosa pine: evidence of preference for old growth. In: Kaufmann, M.R., W.H. Moir, and R.L. Bassett, tech. coords. Old-growth forests in the Southwest and Rocky Mountain regions: Proceedings of a workshop. USDA For. Serv. General Technical Report RM213. Pp. 166-169
- Rice, P.M. 1997. INVADERS Database System (*invader.dbs.umt.edu*). Division of Biological Sciences, University of Montana, Missoula.
- Rice, P.M., Toney, C., and Saco, R. 1997. Potential Exotic Plant Species Invading the Blackfoot Drainage: An Analysis. University of Montana, Missoula.
- Riebsame, W.E. 2001. "Geographies of the New West." In Across the Great Divide: Explorations in Collaborative Conservation and the American West, edited by Philip Brick, D. Snow, and S. Van De Wetering. Washington , D.C. : Island Press, 2001.
- Rieman, B.E. and F.W. Allendorf. 2001. Effective population size and genetic conservation criteria for bull trout. North American Journal of Fisheries Management 21: 330-338.
- Rieman, B.E. and M. Birzell. 2008. Adopt-A-Lake Monitoring Program Progress Report 2008. Clearwater Resource Council.
- Rieman, B. E. and J.B. Dunham. 2000. Metapopulation and salmonids: a synthesis of life history patterns and empirical observations. Ecology of Freshwater Fish 9: 51-64.
- Rieman, B.E. and J.D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. Gen. Tech. Rep. INT-302. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Boise, ID. 38p.
- Rieman, B.E., J.T. Peterson and D.L. Myers. 2006. Have brook trout (*Salvelinus fontinalis*) displaced bull trout (*Salvelinus confluentus*) along longitudinal gradients in central Idaho stream? Canadian Journal of Aquatic Sciences 63: 63-78.

- Ruediger, Bill, Jim Claar, Steve Gniadek, Bryon Holt, Lyle Lewis, Steve Mighton, Bob Naney, Gary Patton, Tony Rinaldi, Joel Trick, Anne Vandehey, Fred Wahl, Nancy Warren, Dick Wenger, and Al Williamson. 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Forest Service Publication #R1-00-53, Missoula, MT. 142 pp.
- Ruggiero, L. F., K. B. Aubry, S. W. Buskirk, L. J. Lyon, and W. J. Zielinski (eds). 1994. The Scientific basis for conserving forest carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States. USDA Forest Service Gen. Tech. Rep. RM-254. Fort Collins, CO. 184 pp.
- Saab, V.A., and J.S. Marks. 1992. Summer habitat use by Columbian Sharp-tailed Grouse in western Idaho. *Great Basin Nat.* 52: 166-173.
- Saab, V.A., and K.T. Vierling. 2001. Reproductive success of Lewis's woodpecker in burned pine and cottonwood riparian forests. *Condor* 103: 491-501.
- Saab, V.A., R. Russell, and J.G. Dudley. 2007. Nest densities of cavity-nesting birds in relation to post-fire salvage logging and time since wildfire. *Condor* 109: 97-108.
- Sauer, J.R., J.E. Hines, G.Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey: results and analysis. Version 96.3. Patuxent Wildlife Research Center, Laurel, MD.
- Schmetterling, D.A. 2000. Redd characteristics of fluvial westslope cutthroat trout in four tributaries to the Blackfoot River, Montana. *North American Journal of Fisheries Management* 20: 776-783.
- Schmetterling, D.A. 2001. Seasonal movements of fluvial westslope cutthroat trout in the Blackfoot River drainage, Montana. *North American Journal of Fisheries Management* 21: 507-520.
- Schmetterling, D.A. 2001. 2000 Northern Pike Investigations in Milltown Reservoir. Unpublished Report, Montana Department of Fish, Wildlife, and Parks. Missoula, Montana.
- Schmetterling, D.A. 2003. Reconnecting a fragmented river: movements of westslope cutthroat trout and bull trout after transport upstream of Milltown Dam, Montana. *North American Journal of Fisheries Management* 23: 721-731.
- Schmidt, W.C. 1992. Effects of White Pine Blister Rust on Western Wilderness. In *Society of American Foresters 1992 Annual Meeting, Proceedings*. SAF Publication 92-01.
- Schoennagel, T., T. T. Veblen, and W. H. Romme. 2004. The interaction of fire, fuels, and climate across Rocky Mountain forests. *BioScience* 54: 661-676.
- Servheen, C. and R. Klaver. 1983. Grizzly bear dens and denning activity in the Mission and Rattlesnake Mountains, Montana. *International Conference on Bear Research and Management* 5: 201-207.

- Servheen, C. and P. Sandstrom. 1993. Ecosystem management and linkage zones for grizzly bears and other large carnivores in the northern Rocky Mountains in Montana and Idaho. *Endangered Species Technical Bull* 18:10-13.
- Sheley, R., J. Petroff, M. Borman. 1999. *Introduction to Biology and Management of Noxious Rangeland Weeds*, Corvallis, OR.
- Shepard, B.B., B.E May and W. Urie. 2003. Status of westslope cutthroat trout (*Onchorhynchus clarki lewisi*) in the United States: 2002. A report to the Westslope Cutthroat Interagency Conservation Team.
- Shepard, B. B., B. E May and W. Urie. 2005. Status and conservation of westslope cutthroat trout within the Western United States. *North American Journal of Fisheries Management* 25: 1426-1440.
- Sherriff, R.L. and T.T. Veblen. 2007. A spatially-explicit reconstruction of fire regime types in ponderosa pine forests of the Colorado Front Range. *Ecosystems* 10: 311-323.
- Shinneman, D. J., and W. L. Baker. 1997. Nonequilibrium dynamics between catastrophic disturbances and old-growth forests in ponderosa pine landscapes of the Black Hills. *Conservation Biology* 11: 1276–1288.
- Skaar, D. 1990. Montana Common Loon management plan. Prep. by Montana Loon Society for USDA Forest Service. 27p.
- Smith, A.T. 1974. The distribution and dispersal of pikas: influences of behavior and climate. *Ecology*, 55: 1368-1376.
- Smith, R.L. 1968. Grasshopper Sparrow. Pages 725-745 in O. L. Austin, Jr., editor. *Life histories of North American cardinals, grosbeaks, buntings, towhees, finches, sparrows, and allies*, Part 2. Dover Publications, Inc., New York.
- Sniezko, R.A., A. Bower, and J. Danielson. 2000. A comparison of early field results of white pine blister rust resistance of sugar pine and western white pine. *Hort. Technology* 10: 519-522.
- Spence, L. 1975. Upper Blackfoot River Study: A premining inventory of aquatic and wildlife resources. Montana Department of Fish and Game in cooperation with The Anaconda Company.
- Squires, J.R. and L.F. Ruggiero. 2007. Winter prey selection of Canada lynx in northwestern Montana. *Journal of Wildlife Management* 71: 310-315.
- Squires, J.S., N.J. DeCesare, J.A. Kolbe, and L.F. Ruggiero. 2008. Hierarchical Den Selection of Canada Lynx in Western Montana. *Journal of Wildlife Management* 72(7): 1497–1506.

- Squires, J.R., N.J. DeCesare, J.A. Kolbe, and L.F. Ruggiero. In Prep. Seasonal Changes in Resource Use of Canada Lynx in Managed Southern Boreal Forests in the North-Central Rocky Mountains.
- Stenseth, N. 2004. Snow conditions may create an invisible barrier for lynx. *Proceedings of the National Academy of Science* 101(29): 10632–10634.
- Stohlgren, T.J., T.T. Veblen, K.C. Kendall, W.L. Baker, C.D. Allen, J.A. Logan, and K.C. Ryan. 2005. The heart of the Rockies: montane and subalpine ecosystems. In *Rocky Mountain Futures: An Ecological Perspective*, ed. J.S. Baron, 203-218. Washington, D.C.: Island Press.
- Stratus Consulting. 2007. Preliminary evaluation of injuries and damages: Upper Blackfoot Mining Complex, Lewis and Clark County, Montana, A report to the Natural Resources Damage Claim, Montana Department of Justice, Helena, MT.
- Swanberg, T.R. 1997. Movement of and Habitat Use by Fluvial Bull Trout in the Blackfoot River, Montana. *Transactions of the American Fisheries Society* 126:735-746. Thomas G, T. 1992. Status Report: Bull trout in Montana. A report to the Montana Department of Fish, Wildlife and Parks.
- Tainter, F.H., and F.A. Baker. 1996. *Principals of Forest Pathology*. John Wiley & Sons, Inc., New York. 805 pp.
- Tetra-tech. 2004. Final Geology and Mineral Potential Report for Blackfoot River Proposed Acquisition, Plum Creek Timber Lands, Phase I. Unpublished report on file with The Nature Conservancy, 32 S. Ewing, Helena, Montana. 29pp.
- Thomas, G. 1992. Status report: bull trout in Montana. Report prepared for Montana Department of Fish, Wildlife and Parks, Helena, Montana.
- TNC (The Nature Conservancy). 2003. *The Five-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success*. Volume I, Third Edition. The Nature Conservancy, Arlington, VA.
- TNC. 2006. *Conservation by Design, A Strategic Framework for Mission Success*. The Nature Conservancy, Arlington, VA.
- TNC and BC. 2007. *Blackfoot River Valley Conservation Area Draft Plan. The Blackfoot Challenge and The Nature Conservancy of Montana*.
- Tobalske, B.W., R.C. Shearer, and R.L. Hutto. 1991. Bird populations in logged and unlogged western larch/Douglas-fir forest in northwestern Montana. *USDA Forest Service, Int. Res. Sta., Research Paper INT442*. 12 p.
- Trombulak, S.C. and C.A. Frissell. 2000. Review of ecological effects of roads on terrestrial and aquatic communities. *Conservation Biology*. 14: 18-30.

- Ulliman, M.J., A. Sands, and T. Hemker. 1998. Draft conservation plan for Columbian Sharp-tailed Grouse and its habitats in Idaho. Idaho Department of Fish and Game, Boise. 36 pp.
- UM Watershed Health Clinic and U.S. Fish and Wildlife Service. 2005. Trumpeter Swan Habitat Suitability Study in the Blackfoot River Watershed of Montana.
- USDI (US Department of the Interior). 1994. Montana Bald Eagle Management Plan. U.S. Department of the Interior, Bureau of Reclamation. Billings, MT.
- USGS (US Geological Survey). 2009. U.S. Geological Survey National Water Information System website available at: <http://waterdata.usgs.gov>.
- USFS (US Forest Service). 1991. Pest Risk Assessment of the Importation of Larch from Siberia and the Soviet Far East. U.S. Department of Agriculture, Forest Service Miscellaneous Publication No. 1495.
- USFS. 1996. Status of the Interior Columbia Basin: Summary of Scientific Findings. U.S. Department of Agriculture, Forest Service PNW-GTR-385: 144 p.
- USFS. 2008. Forest Service Manual, Chapter 2020, Interim Directive 2020-2008-1: Ecological Restoration and Resilience. U.S. Department of Agriculture, Forest Service, Washington, DC. 12 pp.
- USFWS (US Fish and Wildlife Service). 1987. Northern Rocky Mountain Wolf Recovery Plan. Prepared by the U.S. Fish and Wildlife Service in cooperation with the Northern Rocky Mountain Wolf Recovery Team.
- USFWS. 1982. Grizzly Bear Recovery Plan. U. S. Fish and Wildlife Service, Denver, CO.
- USFWS. 1993. Grizzly Bear Recovery Plan. U. S. Fish and Wildlife Service, Missoula, MT.
- USFWS. 1995. Migratory nongame birds of management concern in the United States: the 1995 list. U.S. Fish and Wildlife Service Office of Migratory Bird Management. U.S. Government Printing Office: 1996-404-911/44014. 22 pp.
- USFWS. 1996. Statement of Incidental Take. U. S. Fish and Wildlife Service.
- USFWS. 1998. Twelve month Administrative finding on petition to list the Northern Goshawk in the contiguous western United States under the Endangered Species Act. U.S. Fish and Wildlife Service, Portland, Oregon. 129 p.
- USFWS. 1999. Using resource selection functions to model cumulative effects in the Northern Continental Divide Ecosystem. U. S. Fish and Wildlife Service, Grizzly Bear Recovery Coordinator's Office, University of Montana, Missoula.
- USFWS. 2002. Draft Recovery Plan for Three of the Five Distinct Population Segments of Bull Trout (*Salvelinus confluentus*). Chapter 3 – Clark Fork Recovery Unit. U.S. Fish and Wildlife Service Region 1, Portland, OR.

- USFWS. 2003. Grizzly bear mortalities 1992-2003. Dataset provided by U.S. Fish and Wildlife Service Grizzly Bear Recovery Coordinator. Missoula, Montana.
- USFWS. 2006. NCDE human-caused mortality issues. Data from U.S. Fish and Wildlife Service Grizzly Bear Recovery Coordinator. Missoula, Montana.
- USFWS. 2009a. Montana Partners for Wildlife-Blackfoot River Watershed Focus Area. Website available at: www.fws.gov/mountain-prairie/pfw/montana/mt5b.htm.
- USFWS. 2009b. Endangered Species Program, U.S. Fish and Wildlife Service. Website available at: www.fws.gov/endangered/.
- USFWS. 2010a. Proposed Critical Habitat for Bull Trout in The Clark Fork River Basin Unit 31. Website available at: <http://www.fws.gov/pacific/bulltrout/crithab/index.cfm?unit=31>.
- USFWS. 2010b. Comment of Wade Fredenberg, Bull Trout Coordinator, Montana ES Field Office, USFWS on Proposed Sub-Basin Plan, February 6, 2010.
- Veblen, T. T. 2000. Disturbance patterns in southern Rocky Mountain forests. Pages 31–54 in R. L. Knight, F. W. Smith, S. W. Buskirk, W. H. Romme, and W. L. Baker, editors. Forest fragmentation in the southern Rocky Mountains. University Press of Colorado, Boulder, Colorado, USA.
- Verner, J. 1994. Current management situation of Flammulated Owls. In: Hayward, G.D., (ed). Flammulated, boreal, and Great Gray Owls in the United States: A technical conservation assessment. U.S. For. Serv. General Technical Report 253.
- Vickery, P.D. 1996. Grasshopper Sparrow (*Ammodramus savannarum*). In: A. Poole and F. Gill, editors. The Birds of North America, 239. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Ornithologists' Union, Washington, D.C. 24 p.
- Vierling, K.T. 1997. Habitat selection of Lewis's Woodpeckers in southeastern Colorado. *Wilson Bulletin* 109: 121-130.
- Vinkey, R.S., Schwartz, M.K., McKelvey, K.S., Foresman, K.R., Pilgrim, K.L., Giddings, B.J., and Lofroth, E.C. 2006. When reintroductions are augmentations: the genetic legacy of fishers (*Martes pennanti*) in Montana. *Journal of Mammalogy* 87(2): 265-271.
- Whiteley, A.R., P. Spruell, and F.W. Allendorf. 2004. Ecological and life history characteristics predict population genetic divergence of two salmonids in the same landscape. *Molecular Genetics* 13(12): 3675-3688.
- Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2002. Weeds of the West, 9th Edition. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities Cooperative Extension Services and University of Wyoming, Jackson, Wyoming.

- Wittinger, W.T., J.S. Waller, A. Vandehey, A.M. Soukkala, R.D. Mace, R. B. Harris, D. Godtel, P. Dolan, and K. Ake. 1999. Managing Motorized Access to Grizzly Bear Habitat on Multiple-Use Lands. Draft for NCDE Access proposed guidelines. NCDE Access Task Group.
- Ward, R. L. 1999. The Occurance of Two Arboreal Lichens and Their Utilization by Deer and Elk on Selected Winter Ranges in West-Central Montana. M. S. Thesis, University of Montana, Missoula.
- Western Regional Climate Center. 2009. Website available at: www.wrcc.dri.edu/Climsum.html.
- Whipple, J.W., M.R. Mudge and R.L. Earhart. 1987. Geologic Map of the Rogers Pass Area, Lewis & Clark County, Montana. USGS Miscellaneous Investigation Series: Map I-1642.
- Whitson, T.D., L.C. Burrill, S.A. Dewey, D.W. Cudney, B.E. Nelson, R.D. Lee, and R. Parker. 2002. Weeds of the West, 9th Edition. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities Cooperative Extension Services and University of Wyoming, Jackson, Wyoming.
- Wiens, J.A., and J.T. Rotenberry. 1985. Response of breeding passerine birds to rangeland alteration in a North American shrub steppe locality. *Journal of Applied Ecology* 22: 655-668.
- Wilkinson, C.F. 1993. *Crossing the Next Meridian : Land, Water and the Future of the West*. Washington , D.C. : Island Press.
- Wilson, S.D., and J.W. Belcher. 1989. Plant and bird communities of native prairie and introduced Eurasian vegetation in Manitoba, Canada. *Conservation Biology* 3: 39-44.
- Wilson, S.M., J.A. Graham., D.J. Mattson, and M.J. Madel. 2006. Landscape conditions predisposing grizzly bears to conflict on private agricultural lands in the western U.S.A. *Biological Conservation* 130: 47-59.
- Wilson, S.M., M.J. Madel, D.J. Mattson, J.M. Graham., J.M. Belsky, and J.A. Burchfield. 2005. Landscape features, attractants, and conflict hotspots: A spatial analysis of human-grizzly bear conflicts. *Ursus* 16(1): 117-129
- Witkind, I.J. and W.M. Weber. 1982. Reconnaissance Geologic Map of the Bigfork-Avon Enviromnetal Study Areas, Flathead, Lake, Lewis & Clark, Missoula and Powell Counties, Montana. U.S. Geological Survey Miscellaneous Investigations Map I-1380.

Appendix A. Dewatered Stream List for the Blackfoot Subbasin.

Stream Name	Affected Length	Natural	Human	Both
Arkansas Creek	2		2	
Ashby Creek	2		2	
Arrastra Creek (sm 4.5-2.0)	2.5	2.5		
Bear Creek (North Fork)	1	1	1	x
Blackfoot River (Seven-Up Pete-Poorman Creek)	11	11	3	x
Blackfoot River (54.1 - 84.9)	30.8		30.8	
Blanchard Creek	1.2		1.2	
Burnt Bridge Creek	1		1	
Chamberlain Creek	1		1	
Chimney Creek (Nevada Creek)	0.5		0.5	
Chimney Creek (Douglas Creek)	3.5		3.5	
Clearwater River	3.5		3.5	
Copper Creek	1	1		
Cottonwood Creek rm 43.0 (sm 10.0-4.4)	5.6	2.8	2.8	x
Cottonwood Creek (Douglas Creek)	5		5	
Dick Creek (sm 3.5-6.0)	2.5	2.5	2.5	x
Douglas Creek	14		14	
Dry Creek (trib to Rock Creek)	0.5	0.5		
Dry Fork (trib to North Fork)	2	2		
Dunham Creek	5	4	1	x
Elk Creek	3		3	
Fish Creek	0.3		0.3	
Frazier Creek	1.5		1.5	
Frazier Creek, North Fork	0.5		0.5	
Gallagher Creek	3		3	
Hoyt Creek	1		1	
Humbug Creek	1	1		
Jefferson Creek	1		1	
Keep Cool	2		2	
Landers Fork (3.6-4.5)	1	1		
McCabe Creek	2		2	
McElwain Creek	1		1	
Monture Creek (12.0-15.0)	3	3		
Murray Creek	3	3		
Nevada Creek (sm 31.7-6.4)	25.3		25.3	
Nevada Creek (sm 40.0-34)	6		6	
North Fork of Blackfoot River (rm 12.0-6.2)	5.8	5.8	5.8	x
Pearson Creek	2	2		
Poorman Creek	2	2	2	x
Rock Creek (1.4-7.0)	5.6	5.6	5.6	x
Shanley Creek	1.6		1.6	
Spring Creek (trib to Cottonwood Creek)	1		1	
Spring Creek (trib to North Fork)	2.5		2.5	
Snowbank Creek	0.4		0.4	

Appendix A (continued).

Stream Name	Affected Length	Natural	Human	Both
Stonewall Creek	2	1	1	x
Sucker Creek	1		1	
Union Creek (sm 7.0-0.5)	6.5		6.5	
Wales Creek	1.9		1.9	
Warm Springs Creek	1		1	
Warren Creek	6		6	
Washington Creek (Section 24 and 26)	1		1	
Wasson Creek	2		2	
Willow Creek (lower)	2		2	
Wilson Creek	0.8		0.8	
Yourname Creek	1		1	
Totals	196.3	51.7	164.5	

Appendix B. List of Wildlife Species.

The following list of wildlife species found in the Blackfoot Subbasin is based on records compiled by the Montana Natural Heritage Program (2009).

Common Name	Scientific Name
MAMMALS	
Masked Shrew	<i>Sorex cinereus</i>
Preble's Shrew	<i>Sorex preblei</i>
Vagrant Shrew	<i>Sorex vagrans</i>
Dusky or Montane Shrew	<i>Sorex monticolus</i>
Water Shrew	<i>Sorex palustris</i>
Pygmy Shrew	<i>Sorex hoyi</i>
Little Brown Myotis	<i>Myotis lucifugus</i>
Long-eared Myotis	<i>Myotis evotis</i>
Fringed Myotis	<i>Myotis thysanodes</i>
Long-legged Myotis	<i>Myotis volans</i>
Western Small-footed Myotis	<i>Myotis ciliolabrum</i>
Silver-haired Bat	<i>Lasiorycteris noctivagans</i>
Big Brown Bat	<i>Eptesicus fuscus</i>
Hoary Bat	<i>Lasiurus cinereus</i>
Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>
Pika	<i>Ochotona princeps</i>
Mountain Cottontail	<i>Sylvilagus nuttallii</i>
Snowshoe Hare	<i>Lepus americanus</i>
White-tailed Jack Rabbit	<i>Lepus townsendii</i>
Least Chipmunk	<i>Tamias minimus</i>
Yellow-pine Chipmunk	<i>Tamias amoenus</i>
Red-tailed Chipmunk	<i>Tamias ruficaudus</i>
Yellow-bellied Marmot	<i>Marmota flaviventris</i>
Hoary Marmot	<i>Marmota caligata</i>
Columbian Ground Squirrel	<i>Spermophilus columbianus</i>
Golden-mantled Ground Squirrel	<i>Spermophilus lateralis</i>
Red Squirrel	<i>Tamiasciurus hudsonicus</i>
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>
Northern Pocket Gopher	<i>Thomomys talpoides</i>
Beaver	<i>Castor canadensis</i>
Deer Mouse	<i>Peromyscus maniculatus</i>
Bushy-tailed Woodrat	<i>Neotoma cinerea</i>
Southern Red-backed Vole	<i>Clethrionomys gapperi</i>
Heather Vole	<i>Phenacomys intermedius</i>
Meadow Vole	<i>Microtus pennsylvanicus</i>
Montane Vole	<i>Microtus montanus</i>
Long-tailed Vole	<i>Microtus longicaudus</i>
Muskrat	<i>Ondatra zibethicus</i>
Northern Bog Lemming	<i>Synaptomys borealis</i>
Western Jumping Mouse	<i>Zapus princeps</i>
Porcupine	<i>Erethizon dorsatum</i>

Common Name**Scientific Name****MAMMALS (CONT.)**

Coyote	<i>Canis latrans</i>
Gray Wolf	<i>Canis lupus</i>
Red Fox	<i>Vulpes vulpes</i>
Black Bear	<i>Ursus americanus</i>
Grizzly Bear	<i>Ursus arctos</i>
Raccoon	<i>Procyon lotor</i>
Marten	<i>Martes americana</i>
Fisher	<i>Martes pennanti</i>
Short-tailed Weasel	<i>Mustela erminea</i>
Long-tailed Weasel	<i>Mustela frenata</i>
Mink	<i>Mustela vison</i>
Wolverine	<i>Gulo gulo</i>
Badger	<i>Taxidea taxus</i>
Striped Skunk	<i>Mephitis mephitis</i>
Northern River Otter	<i>Lontra canadensis</i>
Canada Lynx	<i>Lynx canadensis</i>
Bobcat	<i>Lynx rufus</i>
Mountain Lion	<i>Puma concolor</i>
Elk or Wapiti	<i>Cervus canadensis</i>
Mule Deer	<i>Odocoileus hemionus</i>
White-tailed Deer	<i>Odocoileus virginianus</i>
Moose	<i>Alces alces</i>

BIRDS

Common Loon	<i>Gavia immer</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Horned Grebe	<i>Podiceps auritus</i>
Red-necked Grebe	<i>Podiceps grisegena</i>
Eared Grebe	<i>Podiceps nigricollis</i>
Western Grebe	<i>Aechmophorus occidentalis</i>
Clark's Grebe	<i>Aechmophorus clarkii</i>
American White Pelican	<i>Pelecanus erythrorhynchos</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
American Bittern	<i>Botaurus lentiginosus</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Ardea alba</i>
White-faced Ibis	<i>Plegadis chihi</i>
Tundra Swan	<i>Cygnus columbianus</i>
Trumpeter Swan	<i>Cygnus buccinator</i>
Snow Goose	<i>Chen caerulescens</i>
Ross's Goose	<i>Chen rossii</i>
Canada Goose	<i>Branta canadensis</i>
Wood Duck	<i>Aix sponsa</i>
Green-winged Teal	<i>Anas crecca</i>
Mallard	<i>Anas platyrhynchos</i>
Northern Pintail	<i>Anas acuta</i>
Blue-winged Teal	<i>Anas discors</i>

Common Name**Scientific Name****BIRDS (CONT.)**

Cinnamon Teal	<i>Anas cyanoptera</i>
Northern Shoveler	<i>Anas clypeata</i>
Gadwall	<i>Anas strepera</i>
Eurasian Wigeon	<i>Anas penelope</i>
American Wigeon	<i>Anas americana</i>
Redhead	<i>Aythya americana</i>
Ring-necked Duck	<i>Aythya collaris</i>
Lesser Scaup	<i>Aythya affinis</i>
Harlequin Duck	<i>Histrionicus histrionicus</i>
Surf Scoter	<i>Melanitta perspicillata</i>
White-winged Scoter	<i>Melanitta fusca</i>
Common Goldeneye	<i>Bucephala clangula</i>
Barrow's Goldeneye	<i>Bucephala islandica</i>
Bufflehead	<i>Bucephala albeola</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Common Merganser	<i>Mergus merganser</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Ruddy Duck	<i>Oxyura jamaicensis</i>
Turkey Vulture	<i>Cathartes aura</i>
Osprey	<i>Pandion haliaetus</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Northern Harrier	<i>Circus cyaneus</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Northern Goshawk	<i>Accipiter gentilis</i>
Swainson's Hawk	<i>Buteo swainsoni</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Ferruginous Hawk	<i>Buteo regalis</i>
Rough-legged Hawk	<i>Buteo lagopus</i>
Golden Eagle	<i>Aquila chrysaetos</i>
American Kestrel	<i>Falco sparverius</i>
Merlin	<i>Falco columbarius</i>
Peregrine Falcon	<i>Falco peregrinus</i>
Prairie Falcon	<i>Falco mexicanus</i>
Gray Partridge	<i>Perdix perdix</i>
Ring-necked Pheasant	<i>Phasianus colchicus</i>
Spruce Grouse	<i>Falcapennis canadensis</i>
Dusky Grouse	<i>Dendragapus obscurus</i>
White-tailed Ptarmigan	<i>Lagopus leucura</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Greater Sage-Grouse	<i>Centrocercus urophasianus</i>
Sharp-tailed Grouse (Columbian)	<i>Tympanuchus phasianellus columbianus</i>
Wild Turkey	<i>Meleagris gallopavo</i>
Virginia Rail	<i>Rallus limicola</i>
Sora	<i>Porzana carolina</i>
Common Moorhen	<i>Gallinula chloropus</i>
American Coot	<i>Fulica americana</i>

Common Name**Scientific Name****BIRDS (CONT.)**

Sandhill Crane	<i>Grus canadensis</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>
Killdeer	<i>Charadrius vociferus</i>
Black-necked Stilt	<i>Himantopus mexicanus</i>
American Avocet	<i>Recurvirostra americana</i>
Greater Yellowlegs	<i>Tringa melanoleuca</i>
Lesser Yellowlegs	<i>Tringa flavipes</i>
Solitary Sandpiper	<i>Tringa solitaria</i>
Willet	<i>Tringa semipalmata</i>
Spotted Sandpiper	<i>Actitis macularius</i>
Long-billed Curlew	<i>Numenius americanus</i>
Marbled Godwit	<i>Limosa fedoa</i>
Least Sandpiper	<i>Calidris minutilla</i>
Long-billed Dowitcher	<i>Limnodromus scolopaceus</i>
Wilson's Snipe	<i>Gallinago delicata</i>
Wilson's Phalarope	<i>Phalaropus tricolor</i>
Red-necked Phalarope	<i>Phalaropus lobatus</i>
Franklin's Gull	<i>Leucophaeus pipixcan</i>
Ring-billed Gull	<i>Larus delawarensis</i>
California Gull	<i>Larus californicus</i>
Sabine's Gull	<i>Xema sabini</i>
Caspian Tern	<i>Hydroprogne caspia</i>
Common Tern	<i>Sterna hirundo</i>
Forster's Tern	<i>Sterna forsteri</i>
Black Tern	<i>Chlidonias niger</i>
Long-billed Murrelet	<i>Brachyramphus perdix</i>
Ancient Murrelet	<i>Synthliboramphus antiquus</i>
Rock Pigeon	<i>Columba livia</i>
Band-tailed Pigeon	<i>Patagioenas fasciata</i>
Mourning Dove	<i>Zenaida macroura</i>
Flammulated Owl	<i>Otus flammeolus</i>
Great Horned Owl	<i>Bubo virginianus</i>
Snowy Owl	<i>Bubo scandiacus</i>
Northern Hawk Owl	<i>Surnia ulula</i>
Northern Pygmy-Owl	<i>Glaucidium gnoma</i>
Barred Owl	<i>Strix varia</i>
Great Gray Owl	<i>Strix nebulosa</i>
Long-eared Owl	<i>Asio otus</i>
Short-eared Owl	<i>Asio flammeus</i>
Boreal Owl	<i>Aegolius funereus</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Common Nighthawk	<i>Chordeiles minor</i>
Common Poorwill	<i>Phalaenoptilus nuttallii</i>
Black Swift	<i>Cypseloides niger</i>
Vaux's Swift	<i>Chaetura vauxi</i>
White-throated Swift	<i>Aeronautes saxatalis</i>
Black-chinned Hummingbird	<i>Archilochus alexandri</i>

Common Name**Scientific Name****BIRDS (CONT.)**

Calliope Hummingbird	<i>Stellula calliope</i>
Rufous Hummingbird	<i>Selasphorus rufus</i>
Belted Kingfisher	<i>Megasceryle alcyon</i>
Lewis's Woodpecker	<i>Melanerpes lewis</i>
Lewis's Woodpecker	<i>Melanerpes lewis</i>
Lewis's Woodpecker	<i>Melanerpes lewis</i>
Lewis's Woodpecker	<i>Melanerpes lewis</i>
Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>
Downy Woodpecker	<i>Picoides pubescens</i>
Hairy Woodpecker	<i>Picoides villosus</i>
Black-backed Woodpecker	<i>Picoides arcticus</i>
American Three-toed Woodpecker	<i>Picoides dorsalis</i>
Northern Flicker	<i>Colaptes auratus</i>
Northern Flicker (Red-shafted)	<i>Colaptes auratus cafer</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Olive-sided Flycatcher	<i>Contopus cooperi</i>
Western Wood-Pewee	<i>Contopus sordidulus</i>
Willow Flycatcher	<i>Empidonax traillii</i>
Least Flycatcher	<i>Empidonax minimus</i>
Hammond's Flycatcher	<i>Empidonax hammondii</i>
Dusky Flycatcher	<i>Empidonax oberholseri</i>
Cordilleran Flycatcher	<i>Empidonax occidentalis</i>
Say's Phoebe	<i>Sayornis saya</i>
Western Kingbird	<i>Tyrannus verticalis</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Scissor-tailed Flycatcher	<i>Tyrannus forficatus</i>
Horned Lark	<i>Eremophila alpestris</i>
Tree Swallow	<i>Tachycineta bicolor</i>
Violet-green Swallow	<i>Tachycineta thalassina</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Bank Swallow	<i>Riparia riparia</i>
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>
Barn Swallow	<i>Hirundo rustica</i>
Gray Jay	<i>Perisoreus canadensis</i>
Steller's Jay	<i>Cyanocitta stelleri</i>
Blue Jay	<i>Cyanocitta cristata</i>
Clark's Nutcracker	<i>Nucifraga columbiana</i>
Black-billed Magpie	<i>Pica hudsonia</i>
American Crow	<i>Corvus brachyrhynchos</i>
Common Raven	<i>Corvus corax</i>
Black-capped Chickadee	<i>Poecile atricapillus</i>
Mountain Chickadee	<i>Poecile gambeli</i>
Boreal Chickadee	<i>Poecile hudsonica</i>
Chestnut-backed Chickadee	<i>Poecile rufescens</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>

Common Name**Scientific Name****BIRDS (CONT.)**

Pygmy Nuthatch	<i>Sitta pygmaea</i>
Brown Creeper	<i>Certhia americana</i>
Rock Wren	<i>Salpinctes obsoletus</i>
Canyon Wren	<i>Catherpes mexicanus</i>
House Wren	<i>Troglodytes aedon</i>
Winter Wren	<i>Troglodytes troglodytes</i>
Marsh Wren	<i>Cistothorus palustris</i>
American Dipper	<i>Cinclus mexicanus</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Western Bluebird	<i>Sialia mexicana</i>
Mountain Bluebird	<i>Sialia currucoides</i>
Townsend's Solitaire	<i>Myadestes townsendi</i>
Veery	<i>Catharus fuscescens</i>
Swainson's Thrush	<i>Catharus ustulatus</i>
Hermit Thrush	<i>Catharus guttatus</i>
American Robin	<i>Turdus migratorius</i>
Varied Thrush	<i>Ixoreus naevius</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Brown Thrasher	<i>Toxostoma rufum</i>
American Pipit	<i>Anthus rubescens</i>
Bohemian Waxwing	<i>Bombycilla garrulus</i>
Cedar Waxwing	<i>Bombycilla cedrorum</i>
Northern Shrike	<i>Lanius excubitor</i>
Loggerhead Shrike	<i>Lanius ludovicianus</i>
European Starling	<i>Sturnus vulgaris</i>
Warbling Vireo	<i>Vireo gilvus</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Cassin's Vireo	<i>Vireo cassinii</i>
Solitary Vireo	<i>Vireo solitarius</i>
Tennessee Warbler	<i>Vermivora peregrina</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Nashville Warbler	<i>Vermivora ruficapilla</i>
Yellow Warbler	<i>Dendroica petechia</i>
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Audubon's Warbler	<i>Dendroica coronata auduboni</i>
Black-throated Gray Warbler	<i>Dendroica nigrescens</i>
Townsend's Warbler	<i>Dendroica townsendi</i>
American Redstart	<i>Setophaga ruticilla</i>
Ovenbird	<i>Seiurus aurocapilla</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
MacGillivray's Warbler	<i>Oporornis tolmiei</i>
Common Yellowthroat	<i>Geothlypis trichas</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>
Western Tanager	<i>Piranga ludoviciana</i>
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>

Common Name**Scientific Name****BIRDS (CONT.)**

Black-headed Grosbeak	<i>Pheucticus melanocephalus</i>
Lazuli Bunting	<i>Passerina amoena</i>
Green-tailed Towhee	<i>Pipilo chlorurus</i>
Spotted Towhee	<i>Pipilo maculatus</i>
American Tree Sparrow	<i>Spizella arborea</i>
Chipping Sparrow	<i>Spizella passerina</i>
Clay-colored Sparrow	<i>Spizella pallida</i>
Brewer's Sparrow	<i>Spizella breweri</i>
Vesper Sparrow	<i>Pooecetes gramineus</i>
Lark Sparrow	<i>Chondestes grammacus</i>
Lark Bunting	<i>Calamospiza melanocorys</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Fox Sparrow	<i>Passerella iliaca</i>
Song Sparrow	<i>Melospiza melodia</i>
Lincoln's Sparrow	<i>Melospiza lincolni</i>
White-throated Sparrow	<i>Zonotrichia albicollis</i>
Golden-crowned Sparrow	<i>Zonotrichia atricapilla</i>
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>
Harris's Sparrow	<i>Zonotrichia querula</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Dark-eyed Junco (Gray-headed)	<i>Junco hyemalis caniceps</i>
Dark-eyed Junco (Oregon)	<i>Junco hyemalis oregonus</i>
Dark-eyed Junco (Pink-sided)	<i>Junco hyemalis mearnsi</i>
Snow Bunting	<i>Plectrophenax nivalis</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Red-winged Blackbird	<i>Agelaius phoeniceus</i>
Western Meadowlark	<i>Sturnella neglecta</i>
Yellow-headed Blackbird	<i>Xanthocephalus xanthocephalus</i>
Brewer's Blackbird	<i>Euphagus cyanocephalus</i>
Common Grackle	<i>Quiscalus quiscula</i>
Brown-headed Cowbird	<i>Molothrus ater</i>
Bullock's Oriole	<i>Icterus bullockii</i>
Gray-crowned Rosy-Finch	<i>Leucosticte tephrocotis</i>
Pine Grosbeak	<i>Pinicola enucleator</i>
Cassin's Finch	<i>Carpodacus cassinii</i>
House Finch	<i>Carpodacus mexicanus</i>
Red Crossbill	<i>Loxia curvirostra</i>
White-winged Crossbill	<i>Loxia leucoptera</i>
Pine Siskin	<i>Carduelis pinus</i>
American Goldfinch	<i>Carduelis tristis</i>
Evening Grosbeak	<i>Coccothraustes vespertinus</i>
House Sparrow	<i>Passer domesticus</i>

FISH

Mottled Sculpin	<i>Cottus bairdi</i>
Slimy Sculpin	<i>Cottus cognatus</i>

Common Name**Scientific Name****FISH (CONT.)**

Westslope Cutthroat Trout	<i>Oncorhynchus clarkii lewisi</i>
Yellowstone Cutthroat Trout*	<i>Oncorhynchus clarkii bouvieri</i>
Rainbow Trout*	<i>Oncorhynchus mykiss</i>
Mountain Whitefish	<i>Prosopium williamsoni</i>
pygmy Whitefish	<i>Prosopium coulteri</i>
Brown Trout*	<i>Salmo trutta</i>
Bull Trout	<i>Salvelinus confluentus</i>
Brook Trout*	<i>Salvelinus fontinalis</i>
Northern Pikeminnow	<i>Ptychocheilus oregonensis</i>
Longnose Dace	<i>Rhinichthys cataractae</i>
Redside Shiner	<i>Richardsonius balteatus</i>
Longnose Sucker	<i>Catostomus catostomus</i>
Largescale Sucker	<i>Catostomus macrocheilus</i>
White Sucker*	<i>Catostomus commersoni</i>
Peamouth	<i>Mylocheilus caurinus</i>
Kokanee*	<i>Oncorhynchus nerka</i>
Coho Salmon*	<i>Oncorhynchus kisutch</i>
Arctic Grayling*	<i>Thymallus arcticus</i>
Fathead Minnow*	<i>Pimephales promelas</i>
Northern Pike*	<i>Esox lucius</i>
Brook Stickleback*	<i>Culaea inconstans</i>
Pumpkinseed*	<i>Lepomis gibbosus</i>
Largemouth Bass*	<i>Micropterus salmoides</i>
Yellow Perch*	<i>Perca flavescens</i>

AMPHIBIANS AND REPTILES

Long-toed Salamander	<i>Ambystoma macrodactylum</i>
Rocky Mountain Tailed Frog	<i>Ascaphus montanus</i>
Western Toad	<i>Bufo boreas</i>
Pacific Treefrog	<i>Pseudacris regilla</i>
Columbia Spotted Frog	<i>Rana luteiventris</i>
Painted Turtle	<i>Chrysemys picta</i>
Rubber Boa	<i>Charina bottae</i>
Terrestrial Gartersnake	<i>Thamnophis elegans</i>
Common Gartersnake	<i>Thamnophis sirtalis</i>
Prairie Rattlesnake	<i>Crotalus viridis</i>
Eastern Racer	<i>Coluber constrictor</i>

INVERTEBRATES

A Leech	<i>Helobdella stagnalis</i>
Virile Crayfish	<i>Orconectes virilis</i>
An Amphipod	<i>Hyaella azteca</i>
Signal Crayfish	<i>Pacifastacus leniusculus</i>
A Riffle Beetle	<i>Zaitzevia parvula</i>
A Riffle Beetle	<i>Heterlimnius corpulentus</i>
A Riffle Beetle	<i>Cleptelmis addenda</i>

Common Name**Scientific Name****INVERTEBRATES (CONT.)**

A Riffle Beetle	<i>Lara avara</i>
A Riffle Beetle	<i>Narpus concolor</i>
A Riffle Beetle	<i>Optioservus quadrimaculatus</i>
A Riffle Beetle	<i>Ordobrevia nubifera</i>
A Eukiefferiellan Chironomid	<i>Eukiefferiella brehmi</i>
A Mayfly	<i>Serratella tibialis</i>
A Mayfly	<i>Ephemerella excrucians</i>
A Mayfly	<i>Baetis bicaudatus</i>
A Mayfly	<i>Epeorus longimanus</i>
A Mayfly	<i>Drunella coloradensis</i>
A Mayfly	<i>Drunella doddsi</i>
A Mayfly	<i>Drunella grandis</i>
A Mayfly	<i>Drunella spinifera</i>
A Mayfly	<i>Acentrella turbida</i>
Hagen's Small Minnow Mayfly	<i>Dipheter hageni</i>
A Mayfly	<i>Timpanoga hecuba</i>
A Mayfly	<i>Plauditus punctiventris</i>
Northern Rocky Mountains Refugium Mayfly	<i>Caudatella edmundsi</i>
A Mayfly	<i>Caudatella hystrix</i>
Large Marble	<i>Euchloe ausonides</i>
Gillette's Checkerspot	<i>Euphydrys gillettii</i>
Hayden's Ringlet	<i>Coenonympha haydenii</i>
Pacific Spiketail	<i>Cordulegaster dorsalis</i>
Blue-eyed Darner	<i>Rhionaeschna multicolor</i>
Mountain Emerald	<i>Somatochlora semicircularis</i>
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>
Last Best Place Damselfly	<i>Enallagma optimolocus</i>
A Stonefly	<i>Despaxia augusta</i>
A Stonefly	<i>Amphinemura banksi</i>
A Stonefly	<i>Zapada cinctipes</i>
A Stonefly	<i>Zapada columbiana</i>
A Stonefly	<i>Zapada oregonensis</i>
A Stonefly	<i>Yoraperla brevis</i>
A Stonefly	<i>Doroneuria theodora</i>
A Stonefly	<i>Hesperoperla pacifica</i>
A Stonefly	<i>Claassenia sabulosa</i>
A Stonefly	<i>Setvena bradleyi</i>
A Caddisfly	<i>Rhyacophila betteni</i>
A Rhyacophilan Caddisfly	<i>Rhyacophila brunnea</i>
An Agapetus Caddisfly	<i>Agapetus montanus</i>
A Caddisfly	<i>Hydropsyche confusa</i>
A Caddisfly	<i>Parapsyche elsis</i>
A Caddisfly	<i>Lepidostoma cascadenense</i>
A Caddisfly	<i>Lepidostoma unicolor</i>
A Caddisfly	<i>Chyrandra centralis</i>
A Caddisfly	<i>Dicosmoecus atripes</i>
A Caddisfly	<i>Dicosmoecus gilvipes</i>

Common Name**Scientific Name****INVERTEBRATES (CONT.)**

A Rhyacophilan Caddisfly	<i>Rhyacophila alberta</i>
A Caddisfly	<i>Anagapetus debilis</i>
A Caddisfly	<i>Arctopsyche grandis</i>
A Rhyacophilan Caddisfly	<i>Rhyacophila narvae</i>
A Rhyacophilan Caddisfly	<i>Rhyacophila verrula</i>
A Caddisfly	<i>Neophylax splendens</i>
A Caddisfly	<i>Neothremma alicia</i>
A Caddisfly	<i>Micrasema bacro</i>
A Limnephilid Caddisfly	<i>Nemotaulius hostilis</i>
A Caddisfly	<i>Hesperophylax designatus</i>
A Caddisfly	<i>Onocosmoecus unicolor</i>
A Caddisfly	<i>Brachycentrus americanus</i>
A Caddisfly	<i>Brachycentrus occidentalis</i>
Western Pearlshell	<i>Margaritifera falcata</i>
Grooved Fingernailclam	<i>Sphaerium simile</i>
Forest Disc	<i>Discus whitneyi</i>
Magnum Mantleslug	<i>Magnipelta mycophaga</i>
Smoky Taildropper	<i>Prophysaon humile</i>
Brown Hive	<i>Euconulus fulvus</i>
Quick Gloss	<i>Zonitoides arboreus</i>
Meadow Slug	<i>Deroceras laeve</i>
Spruce Snail	<i>Microphysula ingersolli</i>
Alpine Mountainsnail	<i>Oreohelix alpina</i>
Carinate Mountainsnail	<i>Oreohelix elrodi</i>
Rocky Mountainsnail	<i>Oreohelix strigosa</i>
Subalpine Mountainsnail	<i>Oreohelix subrudis</i>
Lyre Mantleslug	<i>Udosarx lyrata</i>
Wrinkled Marshsnail	<i>Stagnicola caperata</i>
Two-ridge Rams-horn	<i>Helisoma anceps</i>
A Millipede	<i>Corypus cochlearis</i>
A Millipede	<i>Ergodesmus compactus</i>
A Millipede	<i>Lophomus laxus</i>
A Millipede	<i>Endopus parvipes</i>
A Freshwater Sponge	<i>Ephydatia cooperensis</i>

* non-native species

Appendix C. Explanation of Montana Natural Heritage Program Ranks.

The Montana Natural Heritage Program employs a standardized ranking system to denote global (G) and state (S) status. Species are assigned numeric ranks ranging from 1 (critically imperiled) to 5 (demonstrably secure), reflecting the relative degree to which they are "at-risk." Rank definitions are given below. A number of factors are considered in assigning ranks - the number, size and distribution of known "occurrences" or populations, population trends (if known), habitat sensitivity, life history traits and threats.

G1 S1

At high risk because of extremely limited and potentially declining numbers, extent and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.

G2 S2

At risk because of very limited and potentially declining numbers, extent and/or habitat, making it vulnerable to global extinction or extirpation in the state.

G3 S3

Potentially at risk because of limited and potentially declining numbers, extent and/or habitat, even though it may be abundant in some areas.

G4 S4

Uncommon but not rare (although it may be rare in parts of its range), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern.

G5 S5

Common, widespread and abundant (although it may be rare in parts of its range). Not vulnerable in most of its range.

GX SX

Presumed Extinct or Extirpated - Species is believed to be extinct throughout its range or extirpated in Montana. Not located despite intensive searches of historical sites and other appropriate habitat, and small likelihood that it will ever be rediscovered.

GH SH

Possibly Extinct or Extirpated - Species is known only from historical records, but may nevertheless still be extant; additional surveys are needed.

GNR SNR

Not yet ranked.

GU SU

Unrankable - Species currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

GNA SNA

A conservation status rank is not applicable for one of the following reasons:
The taxa is of Hybrid Origin; is Exotic or Introduced; is Accidental or is Not Confidently Present in the state. (see other codes below)

Other Codes and Modifiers:

HYB

Hybrid-Entity not ranked because it represents an interspecific hybrid and not a species.

T

Intraspecific Taxon (trinomial) - The status of intraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.

?

Inexact Numeric Rank - Denotes inexact numeric rank.

Q

Questionable taxonomy that may reduce conservation priority-Distinctiveness of this entity as a taxon at the current level is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority (numerically higher) conservation status rank.

C

Captive or Cultivated Only - Species at present is extant only in captivity or cultivation, or as a reintroduced population not yet established.

A

Accidental - Species is accidental or casual in Montana, in other words, infrequent and outside usual range. Includes species (usually birds or butterflies) recorded once or only a few times at a location. A few of these species may have bred on the one or two occasions they were recorded.

SYN

Synonym - Species reported as occurring in Montana, but the Montana Natural Heritage Program does not recognize the taxon; therefore the species is not assigned a rank.

B

Breeding - Rank refers to the breeding population of the species in Montana.

N

Nonbreeding - Rank refers to the non-breeding population of the species in Montana.

M

Migratory - Species occurs in Montana only during migration.

Appendix D. Vascular Plant Species Associated with Glacial Wetlands in the Ovando Valley (Lesica 1994).

Alismataceae

Alisma gramineum
Alisma plantago-aquatica
Sagittaria cuneata

Amaranthaceae

Amaranthus californicus

Apiaceae

Cicuta bulbifera
Cicuta douglasii
Sium suave

Asteraceae

Antennaria microphylla
Artemisia biennis
Artemisia ludoviciana
Aster brachyactis
Aster occidentalis
Aster pansus
Bidens cernua
*Cirsium arvense**
*Cirsium vulgare**
Conyza canadensis
Coreopsis atkinsoniana
Crepis runcinata
Erigeron lonchophyllus
Gnaphalium palustre
Grindellia howellii
Grindelia squarrosa
Haplopappus integrifolius
Helenium autumnale
Petasites sagittatus
Senecio debilis
Senecio foetidus
Senecio indecorus
Solidago canadensis
Solidago nana
*Sonchus uliginosus**
*Taraxacum officinale**

Betulaceae

Alnus incana
Betula glandulosa

Boraginaceae

Plagiobothrys scouleri

Brassicaceae

Hutchinsia procumbens
Rorippa curvisiliqua
Rorippa islandica

Rorippa obtusa

Callitrichaceae

Callitriche hermaphroditica
Callitriche heterophylla

Chenopodiaceae

Atriplex truncata
Chenopodium glaucum
Chenopodium rubrum
Salicornia rubra

Cyperaceae

Carex atherodes
Carex athrostachya
Carex aurea
Carex buxbaumii
Carex canescens
Carex chordorhiza
Carex cusickii
Carex diandra
Carex disperma
Carex flava
Carex interior
Carex lasiocarpa
Carex lanuginosa
Carex limosa
Carex microptera
Carex nebrascensis
Carex parryana
Carex praegracilis
Carex sartwellii
Carex scirpoidea
Carex stipata
Carex vesicaria
Eleocharis acicularis
Eleocharis palustris
Eriophorum viridicarinatum
Scirpus acutus
Scirpus americanus
Scirpus maritimus
Scirpus microcarpus

Droseraceae

Drosera anglica

Equisetaceae

Equisetum fluviatile
Equisetum variegatum

Fabaceae

Astragalus tenellus
*Medicago lupulina**

Trifolium longipes

Gentianaceae

Swertia perennis

Haloragaceae

Myriophyllum spicatum

Hippuridaceae

Hippuris vulgaris

Iridaceae

Iris missouriensis
Sisyrinchium angustifolium

Juncaceae

Juncus alpinus
Juncus balticus
Juncus bufonius
Juncus ensifolius
Juncus longistylis
Juncus tenuis

Juncaginaceae

Triglochin maritima

Lamiaceae

Mentha arvensis
Prunella vulgaris
Scutellaria galericulata
Stachys palustris

Lemnaceae

Lemna minor
Lemna trisulca

Lentibulariaceae

Utricularia intermedia
Utricularia minor
Utricularia vulgaris

Liliaceae

Zigadenus elegans

Menyanthaceae

Menyanthes trifoliata

Najadaceae

Najas flexilis

Nymphaeaceae

Nuphar polysepalum

Onagraceae

Epilobium glaberrimum
Epilobium palustre

Orchidaceae

Habenaria dilatata
Habenaria hyperborea
Spiranthes romanzoffiana

Plantaginaceae

Plantago major*

Poaceae

Agrostis alba
Agrostis scabra
Alopecurus aequalis
Alopecurus pratensis*
Beckmannia syzigachne
Calamagrostis canadensis
Calamagrostis inexpansa
Calamagrostis neglecta
Deschampsia cespitosa
Distichlis stricta
Festuca pratensis*
Festuca rubra
Glyceria borealis
Glyceria grandis
Glyceria striata
Hierocloe odorata
Hordeum brachyantherum
Hordeum jubatum
Muhlenbergia asperifolia
Muhlenbergia richardsonis
Panicum capillare
Phalaris arundinacea*

Phleum pratense*
Poa nevadensis
Poa palustris*
Poa pratensis*
Polypogon monspeliensis
Puccinellia distans
Sphenopholis obtusata

Polygonaceae

Polygonum amphibium
Rumex crispus*
Rumex maritimus
Rumex occidentalis
Rumex salicifolius
Potamogetonaceae
Potamogeton crispus*
Potamogeton friesii
Potamogeton foliosus
Potamogeton gramineus
Potamogeton natans
Potamogeton pectinatus
Potamogeton pusillus
Potamogeton richardsonii
Potamogeton zosteriformis

Ranunculaceae

Ranunculus acriformis
Ranunculus aquatilis
Ranunculus cymbalaria
Ranunculus flammula
Ranunculus gmelinii
Ranunculus macounii
Ranunculus sceleratus

Rosaceae

Geum macrophyllum

Potentilla biennis
Potentilla gracilis
Potentilla palustris

Rubiaceae

Galium trifidum

Ruppiaceae

Ruppia maritima

Salicaceae

Salix bebbiana
Salix boothii
Salix candida
Salix drummondiana
Salix exigua
Salix planifolia

Scrophulariaceae

Mimulus guttatus
Mimulus moschatus
Pedicularis groenlandica
Veronica americana
Veronica catenata
Veronica peregrina

Sparganiaceae

Sparganium emersum
Sparganium minimum

Typhaceae

Typha latifolia

(* exotic species)

Appendix E. Native Salmonid Viability: Definitions of Key Attributes.

Notes excerpted from Native Salmonid Work Group Meetings.

Condition

(The following four elements of condition are bull trout population demographic characteristics influencing the risk of local extinction).

Abundance:

Very Good: Spawning adults consistently abundant (average more than 100).

Good: Spawning adults common. (average more than 10 but less than 100)

Fair: Spawning adults low or highly variable (average less than 10 or vary substantially between less than and more than 10; but are consistently present)

Poor: Spawning adults occur only occasionally, or adult numbers are unknown

Note: The number includes the adults in the local population associated with or including this 6th code. The extent of the local population may extend beyond a single 6th field or may be contained entirely within it. Suitable spawning habitats that are discontinuous but within a few kilometers could be expected to exchange adults through dispersal (e.g., Whiteley et al. 2004). The numbers are based on the 50:500 rules of thumb from conservation biology and the approximation of effective population size given demographic characteristics of typical bull trout populations (Rieman and Allendorf 2003). Specifically a consistent average of effective spawners higher than 50 is believed important to minimize the effects of inbreeding depression and 500 is important to maintain long-term genetic diversity. Few populations will exceed 500 adults so this number must be maintained through dispersal, gene flow and the demographic linkage among populations at a broader level. This should be a contextual variable considered later when we roll up the major population groups. The number is an average (strictly the harmonic mean) of the adults spawning over an extended period of time. Because of generation times, reproductive and other demographic characteristics a conservative estimate of the effective population size is approximately twice the average number of adults spawning per year (See Rieman and Allendorf 2001 for details). If the population reaches these numbers but varies a lot and is commonly lower, the effective population size is lower. The number of adults should include both migratory and resident fish, males and females. The number might be approximated through regular or periodic redd counts, but that will require some assumption or observation of the number of adults per redd count (some estimates range from 2 to 3 total adults for observed redd). If there is no information to judge abundance, the estimates should be conservative. If bull trout are known to occur at numbers that exceed a threshold, but no long term perspective is possible, the next lower class should be selected, e.g., Morrell Creek and West Fork Clearwater have supported redd counts or adult population estimates that would represent more than 50 adults and conceivably more than 100, but long term averages are not available and the populations are also known to fluctuate dramatically from year to year. They would be classified as either fair or good depending on the interpretation of existing data. Estimates of abundance in tributaries could be extrapolated to approximate adult numbers based on typical age structure information. For example the number of adults in any population might be assumed to be approximately 10% of the fish \geq age 1. So an extrapolation of at least 1,000 resident fish

could equate to an adult population of approximately 100. Generally populations with average to high abundance and roughly 10 km of available habitat would be close.

Life History Expression

Very Good: All potential migratory life histories are abundant or dominant

Good: Migratory life histories occurs, but access through corridors or to rearing areas occasionally limited

Fair: Migratory life history occurs, but relative abundance is low or adult access is blocked or limited during typical migration periods

Poor: No migratory life histories. Local population is isolated by permanent impassible barrier; OR life history expression unknown

Note: The full expression of life history is believed to represent important biological diversity in bull trout populations. Migratory life histories also contribute to the resilience of populations because they tend to be more fecund, may resist hybridization with brook trout or competition with other species. If migratory adults occur resident life histories probably occur as well, but may be restricted in abundance or distribution by the presence of the migratory form. Thus the occurrence of the migratory life history should really reflect the full expression and diversity of the population. Life history diversity may be an important hedge against habitat loss or degradation, non-native invasion, and climate change (Fausch et al. 2006; Hilborn et al. 2003) and a primary mechanism facilitating gene flow and dispersal among local populations (Rieman and Dunham 2000).

Genetic Integrity

Not Applicable for bull trout

Note: available information indicates hybridization is primarily limited to F1. When post F1 hybridization does occur, it does not appear to progress to full introgression.

Resilience

Very good- Population is stable and moderate to high abundance, or when reduced has the capacity to grow back quickly. Habitat is in excellent condition and expected to stay that way. Nonnative salmonids are not important.

Good- Population is stable at moderate abundance or growing slowly. When reduced in abundance, population does slowly rebuild. Habitat is in good condition and nonnatives are not present or rare.

Fair- Population is stable at low to moderate abundance and or habitat is degraded, but not destroyed. Non-natives may be relatively abundant, but not dominant.

Poor- Population is declining and or habitat is in poor condition and nonnatives are abundant or dominate the community. OR nothing is known about resilience.

Size

Extent of habitat network within the 6th code

Very Good- the length of the interconnected stream network supporting spawning and rearing is > 20 km.

Good- the length of the interconnected stream network supporting spawning and rearing habitat is between 10 and 20 km in length.

Fair- the length is between 3 and 10 km.
Poor- the length is less than 3 km.

Note: The persistence of bull trout has been strongly associated with the size of the spawning and rearing habitat network or patch (Dunham and Rieman 1999, Dunham et al. 2002). The reasons may include the size of the population and the mitigation of small population effects and the diversity and extent of habitat minimizing the threat of catastrophic disturbances. This metric can be estimated from the extent of fish distribution identified in the existing MFWP inventories. Likely will require a GIS analysis, but might be done with a quick approximation using a mapped hydrography in each 6th code, the fish distribution maps, a map of existing barriers and a scale that can be placed on the mapped stream network.

Landscape Context

Water quality: Temperature, Sediment, and Chemical Contaminants

Very Good- all three elements are considered functioning acceptably
Good- two elements are functioning acceptably, one is functioning at risk
Fair- two or more elements are functioning at risk, none at unacceptable risk
Poor- one or more elements is functioning at unacceptable risk

Note: this would be based on the Forest Service Assessment for the encompassing 6th field (subwatershed). It might be modified with additional information if available, i.e., streams that are 303 d listed would be considered poor.

Habitat Structure: Large wood, width-depth, floodplain connectivity, stream bank condition

Very Good- all four elements are considered functioning acceptably
Good- three elements are functioning acceptably, one is functioning at risk
Fair- two or more elements are functioning at risk, none at unacceptable risk
Poor- one or more elements is functioning at unacceptable risk

Note: this would be based on the Forest Service Assessment for the encompassing 6th field (subwatershed). I've included only some of the elements in habitat and channel condition. Substrate, pools and off channel habitat were dropped because presumably they are correlated or represented by those selected.

Hydrology: Flow and Hydrology

Very Good- both elements are considered functioning acceptably
Good- One is functioning acceptable and one is functioning at risk
Fair- Two or more elements are functioning at risk,
Poor- One or more elements is functioning at unacceptable risk

Note: this would be based on the Forest Service Assessment for change in peak/base flows and drainage network increase for the encompassing 6th field (subwatershed). Additional data on water diversion might be used to consider condition.

Connectivity: Physical barriers

Very good- there are no barriers or impediments to fish migration from the 6th field to the lake or river environment where migratory life histories could be expected to rear or stage.

Good- Temporary or partial impediments or barriers may exist for juvenile movement, but only occasionally. There are no barriers to adult movements, or they exclude less than 25% of the 6th field spawning habitat

Fair- Temporary or partial impediments or barriers may exist for juvenile and adult movements; or permanent barriers may exist that exclude adult migrants from 25% to 75% of the 6th field spawning habitat

Poor-Permanent barriers exclude adult movement to spawning habitat in more than 75% of the 6th code.

Note: presumably this would be based on Forest Service inventory of fish passage barriers.

Appendix F. Invertebrate Species of Concern and Potential Species of Concern Associated with Herbaceous Wetlands West of the Continental Divide.¹

Group	Common Name	Scientific Name	MT Status ²	Global Rank ³	MT Rank	Habitat	Blackfoot	Seeley
Snails	Mountain Marshsnail	<i>Stagnicola montanensis</i>	SOC	G3	S1S3	wetlands/marshes	?	X
Butterflies	Eyed Brown	<i>Satyrodes eurydice</i>	SOC	G4	S2S3	wetlands/marshes	?	?
Butterflies	Frigga Fritillary	<i>Boloria frigga</i>	SOC	G5	S1S3	mountain wetlands	?	?
Butterflies	Gillett's Checkerspot	<i>Euphydryas gillettii</i>	SOC	G2G3	S2S3	wet meadows	X	X
Dragonflies	Boreal Whiteface	<i>Leucorrhinia borealis</i>	SOC	G5	S1	Wetlands	?	?
Dragonflies	Brush-tipped Emerald	<i>Somatochlora walshii</i>	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	Subarctic Darner	<i>Aeshna subarctica</i>	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	Western Pondhawk	<i>Erythemis collocata</i>	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	California Darner	<i>Aeshna californica</i>	PSOC	G5 S3S5		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Chalk-fronted Corporal	<i>Ladona julia</i>	PSOC	G5 S3S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Crimson-ringed Whiteface	<i>Leucorrhinia glacialis</i>	PSOC	G5 S3		wetland/lake w/ emergent vegetation	X	X
Dragonflies	Lake Darner	<i>Aeshna eremita</i>	PSOC	G5 S3S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Lance-tipped Darner	<i>Aeshna constricta</i>	PSOC	G5 S1S3		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Hudsonian Emerald	<i>Somatochlora hudsonica</i>	PSOC	G5 S2S4		wetland/lake w/ emergent vegetation	X	X
Dragonflies	Mountain Emerald	<i>Somatochlora semicircularis</i>	PSOC	G5 S3S5		Wetlands	X	X
Dragonflies	Ocellated Emerald	<i>Somatochlora minor</i>	PSOC	G5 S2S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Red-veined Meadowhawk	<i>Sympetrum madidum</i>	PSOC	G4 S2S3		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Ringed Emerald	<i>Somatochlora albicincta</i>	PSOC	G5 S1S3		wetlands	?	?
Dragonflies	Sedge Darner	<i>Aeshna juncea</i>	PSOC	G5 S3S5		Wetlands	?	?
Dragonflies	Spiny Baskettail	<i>Epitheca spinigera</i>	PSOC	G5 S3S5		wetland/lake w/ emergent vegetation	?	?

¹ Source: Dave Stagliano, Montana Natural Heritage Program

² SOC: Species of Concern/Conservation Need; PSOC: Potential Species of Concern/Conservation Need

³ Global (G) and state (S) ranks are explained in Appendix C.

Appendix G. Montana State Noxious Weed List (3/27/08).

Category 1.

Category 1 noxious weeds are weeds that are currently established and generally widespread in many counties of the state. Management criteria include awareness and education, containment and suppression of existing infestations and prevention of new infestations. These weeds are capable of rapid spread and render land unfit or greatly limit beneficial uses.

- (a) Canada thistle (*Cirsium arvense*)
- (b) Field bindweed (*Convolvulus arvensis*)
- (c) Whitetop or Hoary cress (*Cardaria draba*)
- (d) Leafy spurge (*Euphorbia esula*)
- (e) Russian knapweed (*Centaurea repens*)
- (f) Spotted knapweed (*Centaurea maculosa*)
- (g) Diffuse knapweed (*Centaurea diffusa*)
- (h) Dalmatian toadflax (*Linaria dalmatica*)
- (i) St. Johnswort (*Hypericum perforatum*)
- (j) Sulfur (Erect) cinquefoil (*Potentilla recta*)
- (k) Common tansy (*Tanacetum vulgare*)
- (l) Oxeye-daisy (*Chrysanthemum leucanthemum* L.)
- (m) Houndstongue (*Cynoglossum officinale* L.)
- (n) Yellow toadflax (*Linaria vulgaris*)
- (o) Hoary alyssum (*Berteroa incana*)

Category 2.

Category 2 noxious weeds have recently been introduced into the state or are rapidly spreading from their current infestation sites. These weeds are capable of rapid spread and invasion of lands, rendering lands unfit for beneficial uses. Management criteria include awareness and education, monitoring and containment of known infestations and eradication where possible.

- (a) Purple loosestrife or lythrum (*Lythrum salicaria*, *L. virgatum*, and any hybrid crosses thereof).
- (b) Tansy ragwort (*Senecio jacobea* L.)
- (c) Meadow hawkweed complex (*Hieracium pratense*, *H. floribundum*, *H. piloselloides*)
- (d) Orange hawkweed (*Hieracium aurantiacum* L.)
- (e) Tall buttercup (*Ranunculus acris* L.)
- (f) Tamarisk [Saltcedar] (*Tamarix* spp.)
- (g) Perennial pepperweed (*Lepidium latifolium*)
- (h) Rush skeletonweed (*Chondrilla juncea*)
- (i) Yellowflag iris (*Iris pseudacorus*)
- (j) Blueweed (*Echium vulgare*)

Category 3.

Category 3 noxious weeds have not been detected in the state or may be found only in small, scattered, localized infestations. Management criteria include awareness and education, early detection and immediate action to eradicate infestations. These weeds are known pests in nearby states and are capable of rapid spread and render land unfit for beneficial uses.

- (a) Yellow starthistle (*Centaurea solstitialis*)
- (b) Common crupina (*Crupina vulgaris*)
- (c) Eurasian watermilfoil (*Myriophyllum spicatum*)
- (d) Dyer's woad (*Isatis tinctoria*)
- (e) Flowering rush (*Butomus umbellatus*)
- (f) Japanese knotweed complex (*Polygonum cuspidatum*, *sachalinense* & *polystachyum*)

Category 4.

Category 4 noxious weeds are invasive plants and may cause significant economic or environmental impacts if allowed to become established in Montana. Management criteria include prohibition from sale by the nursery trade. Research and monitoring may result in the plant being listed in a different category.

- (a) Scotch broom (*Cytisus scoparius*)

Appendix H. Blackfoot River Valley Conservation Area Monitoring Plan (DRAFT 2007).

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Fish Population Measures						
Connectivity of fluvial trout populations	native salmonids	Connectivity within tributaries and to the Blackfoot River	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Roads – stream crossings • Milltown Dam 	Refer to FWP methods to obtain fisheries data	High	MT DFWP gathers fish data. Obtain data and summarize from their reports
Distribution of fluvial trout populations	native salmonids	Distribution of pure-strain westslope cutthroat and bull trout populations	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Grazing Practices • Roads – stream crossings • Invasive/ Alien Species • Milltown dam 	Assess the current distribution of native salmonid species to an historic one. Need to develop measures that place percent of unoccupied habitat into appropriate category. Work with FWP.	High	Data gathered by MT DFWP. Summarized by TNC
Trout redd and juvenile counts	native salmonids	Reproduction Success	<ul style="list-style-type: none"> • (none – viability measure) 	This is a count of reproductive measures (redds/ juveniles) that is related to a baseline condition. Measures need to be developed. Work with FWP to see how we can use their data.	High	MT DFWP gathers data, TNC summarize

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Grizzly Bear Habitat Measures						
Grizzly bear use of available habitat	grizzly bear	Secure Available Habitat	<ul style="list-style-type: none"> • Road development/use • Livestock production • Residential development • Second home resort development • Recreational use • Parasites/pathogens 	Use CEM Model to determine	High	USFS, FWP CEM Model will provide data
Grizzly Bear Population Measures						
Grizzly bear linkage zone intactness and/or number of barriers to g bear movement	grizzly bear	Habitat Connectivity	<ul style="list-style-type: none"> • Road development/use • Livestock production • Residential development • Second home resort development • Recreational use 	Need to identify linkage zones and barriers to movement, then determine method to measure. Can use CEM model to help determine these.	High	USFS, FWP CEM Model will provide data
Grizzly bear population demography: Reproductive success/ mortality	grizzly bear	Viable population	<ul style="list-style-type: none"> • Viability measure • Poaching 	Use FWP observation and population trend monitoring data. Consult the annual reports.	High	FWP
Grizzly bear population and population trend	grizzly bear	Population size and trend	<ul style="list-style-type: none"> • Viability measure 	Population Trend monitoring Study and DNA Study	High	NPS, FWP, USFWS

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Grizzly bear incidences or conflicts with livestock/ residences	grizzly bear	Bear/ Human Harmony	<ul style="list-style-type: none"> • Livestock production • Residential development • Second home resort development • Recreational use 	Use FWP annual conflict data reports	High	FWP
Bird Nesting Measures						
Nesting and fledgling success of loons and trumpeter swans	herbaceous wetlands	Quality of bird nesting (and rearing) habitat	<ul style="list-style-type: none"> • (none – viability measure) 	Loons are monitored and likely USFWS monitors Trumpeter Swans, refer to USFWS reports for the information on nesting and fledgling success	Medium	FWP? USFWS?
Blackfoot River Measures (Water Quality/Quantity)						
Seasonal surface river flow volumes	native salmonids	Functioning Hydrologic Regime- sufficient instream flows	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. 	Obtain USGS water flow data for Blackfoot River Gauge near Bonner MT (available on-line). Obtain an annual low flow (CFS) average for the months of June, July, August for the last 7 years. Average these low flows for the 7 year period. Place in appropriate category.	High	Data collected by USGS, to be summarized by TNC

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Water temperature and particulate level (TMDL)	native salmonids	Water quality	<ul style="list-style-type: none"> • Grazing/ livestock production practices • Mining practices • Milltown dam • Roads – stream crossings 	Obtain TMDL plans and data. Still need to develop indicator ratings and methods	High	Data gathered by Blackfoot Challenge Contractors? Summarized by TNC
Vegetation Community Measures – Invasive Species						
Amount of aggressive exotic species	herbaceous wetlands native grasslands/ sagebrush communities aspen and riparian woody vegetation	Native Vegetation Community	<ul style="list-style-type: none"> • Invasive/ alien species • Construction and operation of drainage or diversion systems, dikes and ditches. • Crop production Practices • Recreational Use • Residential development • Grazing Practices 	No methods developed yet. Would need to see if anyone is monitoring weeds at this scale. If not would need to develop sampling protocol to estimate area affected by aggressive exotic species. This probably will involve sampling	High	?
Vegetation Community Measures – Wetlands Condition						
Amount of filled, altered, or drained or otherwise disturbed herbaceous wetlands	herbaceous wetlands	Functional Hydrologic Regime: Intactness of wetland	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Crop production Practices • Conversion to agriculture • Filling 	Try to obtain information through aerial photo interp. If not possible a field sample may be required. Develop standards for what constitutes a drained, filled or altered wetland. This is simply a count of how many have been impaired.	Medium	?

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Number, distribution, and size of wetlands	herbaceous wetlands	Number, distribution and size of wetlands	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Crop production Practices • Conversion to agriculture • Filling 	Aerial Photo interp or NWI assessment of wetland area	Medium	?
Age class distribution of aspen, and riparian woody vegetation types	aspen and riparian woody vegetation	Functioning disturbance regime (fire, browsing, beaver)	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Channelization of rivers and streams • Residential development • Conversion to agriculture • Fire suppression • Grazing practices 	None developed yet. Need to field measure condition of woody riparian and aspen stands.	Medium	?
Miles/acres of aspen and riparian woody vegetation	aspen and riparian woody vegetation	Number, Size, or Area of aspen and riparian woody vegetation	<ul style="list-style-type: none"> • Construction and operation of drainage or diversion systems, dikes and ditches. • Channelization of rivers and streams • Residential development • Conversion to agriculture • Grazing practices 	Methods not developed. May be able to complete with aerial photo interpretation.	Medium	?

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Vegetation Community Measures – Grasslands/ Sagebrush Condition						
Fire Return Interval of grassland/ sagebrush communities	native grasslands/ sagebrush communities	Functioning fire regime	<ul style="list-style-type: none"> • Fire suppression 	Not developed	Medium	?
Areal extent of grasslands/ sagebrush communities	native grasslands/ sagebrush communities	Area/ Size of grasslands/ sagebrush communities	<ul style="list-style-type: none"> • Fire suppression • Conversion to agriculture • Grazing practices • Invasive/ alien species • Residential development 	Need to calculate HRV and compare current coverage. Need to determine resolution of veg mapping (community level) and method of sampling (remote sensing? aerial photos?). Not sure how HRV is determined in open country (consult with EMRI)	Medium	?
Vegetation Community Measures – Forest Condition						
Amount and distribution of cone producing whitebark pine stands	mid to high elevation coniferous forest	Areal extent of cone producing white bark pine stands	<ul style="list-style-type: none"> • Fire suppression • Parasites/ pathogens 	Use USFS vegetation surveys to determine covertype/ PNV type distribution in conjunction with cone production surveys (they may be on a different monitoring interval)	Medium	USFS inventory for data?

Indicator	Target (s)	Key Attribute	Threats Reference	Methods	Priority	Who monitors
Fire Regime Condition of forest types	mid to high elevation coniferous forest	Functioning disturbance regime - fire	<ul style="list-style-type: none"> • Fire suppression • Forestry practices 	Utilize USFS FRCC models	Medium	USFS has models that can be summarized
Departure from Historic Range of Variability of forest types	mid to high elevation coniferous forest low-elevation ponderosa pine/western larch	Patch size and distribution of forest cover types and age classes	<ul style="list-style-type: none"> • Fire suppression • Forestry practices 	Use patch dynamic analyses, HRV, veg mapping and Fragstats etc. need to explore these methods and if they are available. Emphasize the presence of large diameter trees/stands in the low-elevation forest targets	Medium	?
Percent of ponderosa pine/larch stands that have fire/fire surrogate treatment	low-elevation ponderosa pine/western larch	Functioning disturbance regime - fire	<ul style="list-style-type: none"> • none (viability measure) 	Not sure: Aerial photo interp, USFS Models, FRCC, field sampling?	High	USFS has models that can be summarized

Appendix I. Acronyms and Abbreviations.

BBCTU	Big Blackfoot Chapter, Trout Unlimited
BBS	Breeding Bird Survey
BC	Blackfoot Challenge
BCCA	Blackfoot Community Conservation Area
BFS	Basin fill sediment unit
BLM	U.S. Bureau of Land Management
BLM	U.S. Bureau of Land Management
BMP	best management practice
BPA	Bonneville Power Administration
CBWTP	Columbia Basin Water Transaction Program
COCE	Crown of the Continent Ecosystem
CRC	Clearwater Resource Council
CRP	Conservation Reserve Program
CWA	Clean Water Act
EPA	Environmental Protection Agency
EQIP	Environmental Quality Incentives Program
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land and Policy Management Act
FRI	fire-return interval
FVLT	Five Valleys Land Trust
GRP	Grasslands Reserve Program
GLCI	Grazing Lands Conservation Initiative
HCP	Habitat Conservation Plan
INFISH	Inland Native Fish Strategy
ITEEM	Integrated Transportation and Ecosystem Enhancements for Montana
LWCF	Land and Water Conservation Fund
MBTRT	Montana Bull Trout Restoration Team
MBTSG	Montana Bull Trout Scientific Group
MCA	Montana Code Annotated
MDEQ	Montana Department of Environmental Quality
MDNRC	Montana Department of Natural Resource Conservation
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFWP	Montana Department of Fish, Wildlife and Parks
MLR	Montana Land Reliance
MTNHP	Montana Natural Heritage Program
NCDE	Northern Continental Divide Ecosystem
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration

Appendix I (continued)

NPCC	Northwest Power and Conservation Council
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PCTC	Plum Creek Timber Company
RLI	Rural Living Institute
RMEF	Rocky Mountain Elk Foundation
RRAFT	River Recreation Advisory for Tomorrow
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
TMDL	total maximum daily load
TNC	The Nature Conservancy
TU	Trout Unlimited
USFS	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
WHIP	Wildlife Habitat Incentives Program
WMA	Wildlife Management Area
WRP	Wetlands Reserve Program
WUI	wildland-urban interface

An integrated stream restoration and native fish conservation strategy for 182 streams in the Blackfoot Basin, Montana

Introduction

The Blackfoot River Fisheries Initiative continues to expand with restoration and conservation becoming more inclusive of native fish, water quality, instream flows and landscape protection. As such, the need for an inclusive clearly defined native fish conservation strategy for Blackfoot Basin has emerged. This need originates from 1) an expanded number (and scope) of watershed interest groups, 2) a cadre of federal, state and regional fisheries management directives, and 3) the recent development of drought, sub-basin and TMDL plans, NRCS fisheries-related EQIP projects and the recent development of Native Fish Habitat Conservation Plan (HCP) strategies.

To foster fisheries-related conservation endeavors, FWP recently developed an integrated stream restoration and native fish conservation strategy for 108 waterbodies of the Blackfoot Basin (Pierce et al. 2005). Although valuable to the broader restoration program, this planning document was also deficient because it failed to include large areas of the Blackfoot Basin where fisheries data was lacking. These areas include the Clearwater River Basin, the “backcountry” and heavily damaged streams in the upper Blackfoot Mining complex. With the recent initiation of native fish telemetry studies and the completion of fisheries data collections in these areas (Clearwater Basin (49 streams), the backcountry (19 streams), and mining areas (6 streams)), we are now able to generate a prioritization strategy for the entire Blackfoot River Basin.

The guiding purpose of this planning document is to develop a cohesive restoration and conservation strategy that directs stakeholder involvement to common priorities involving the needs of native fish. Native fisheries are indicators of ecosystem health, and their recovery has become an FWP Fisheries Division priority. To this end, this plan provides a basin-wide, native fisheries-based, priority-driven template for restoration projects and expands upon the gains of the existing Blackfoot River Restoration Program. Our rationale for generating this report was that by integrating all fisheries-related restoration programs into a single guiding strategy, the Blackfoot Cooperators could better meet a common suite of conservation goals. For detailed review of restoration prioritization, we refer the reader to the original strategy (Pierce, Aasheim and Podner 2005).

Specific objectives of this report are to:

1. Provide a planning strategy to guide restoration activities of the Montana Fish, Wildlife and Parks (FWP), U.S. Fish and Wildlife Service, Blackfoot Challenge, The Nature Conservancy, Big Blackfoot Chapter of Trout Unlimited and other restoration partners.
2. Expand on an existing fisheries-based stream restoration prioritization ranking system (Pierce, Aasheim and Podner 2005) to include all inventories waters of the Blackfoot Basin
3. Re-prioritize all FWP currently inventoried streams to a hierarchical strategy that includes the Clearwater Basin.

Procedures

We incorporated 74 additional tributaries inventoried since 2005 into the original matrix of 108 streams (Appendix K). The new matrix includes five reaches of the Clearwater River 1) mouth to the Salmon Lake outlet, 2) Salmon lake to Seeley Lake outlet, 3) Seeley lake to the outlet of Lake Inez (fish barrier), 4) Lake Inez to outlet of Rainy Lake (fish barrier), and, 4) Rainy lake to the headwaters. We then re-prioritized and ranked all inventoried waterbodies on a hierarchical point system that includes 1) native fish values (70 points), 2) total fisheries values (90 points), 3) total biological values (150 points), and finally 4) total values (200 possible points).

FWP fisheries personnel were given the job of assigning data input and corresponding point values to the matrix. Scoring of some criteria (primarily social and financial considerations) necessarily relied on past landowner interviews, direct knowledge of tributaries, along with professional expertise and judgment for inventoried non-project streams.

For the biological benefits section of the matrix, streams with documented bull trout use received scores of 10, 20, 30 or 40 points, depending on whether the stream supported spawning (20 points), rearing (10 points) or is a designated bull trout “core area” stream (10 points). Compared with other criteria, streams supporting bull trout received more points due to their: 1) “threatened” status under ESA along with State and Federal priorities for the recovery of this species; 2) high potential for improvement in the Blackfoot watershed; and 3) downstream and sympatric benefits to other species resulting from bull trout recovery efforts.

For streams supporting WSCT, an additional zero, 10 or 20 points were possible, depending on whether a stream supported no WSCT (zero points), resident WSCT (10 points) or fluvial WSCT use (20 points). Fluvial WSCT streams received a higher score than streams supporting resident fish due to 1) the precarious status of the fluvial life-history, 2) high sport fish value to the Blackfoot River, and 3) downstream and sympatric benefits to other species resulting from WSCT recovery efforts. Streams with fluvial WSCT status (20 points) were those identified through 1) telemetry studies, 2) direct observations of fluvial-sized fish by FWP fisheries personnel, or 3) direct tributaries to the Blackfoot River and biologically connected during high flows periods.

Streams received an additional zero, 10 or 20 points based on sport fishery value to the Blackfoot River. Streams with no sport fishery value (disjunct from the Blackfoot River) received zero points, single species sport fishery value (non-disjunct usually with WSCT) received 10 points, while non-disjunct streams that provide recruitment of multiple species (bull trout, WSCT, rainbow and brown trout) to the Blackfoot River received 20 points. We assumed connected streams supporting rainbow trout, brown trout and bull trout provided sport fishery value to the Blackfoot River. We assumed small non-direct and non-fluvial headwater tributaries to support primarily resident WSCT, and as such, these were not considered as providing sport fishery value to the Blackfoot River. We did not consider brook trout in this ranking due to their limited use of the Blackfoot River and adverse biological impacts to native species.

Stream restoration technical feasibility was also considered with zero points for not feasible and 20 points for streams considered technically feasible to restore. Large instream reservoirs (e.g. upper Nevada Creek, Frazier Creek, and Wales Creek), over-appropriated water rights (e.g. lower Nevada Creek), major highway problems (eg. Chimney Creek), and fully restored (e.g. Grantier Spring Creek) were considered not technically feasible to restore for the purposes of this report.

In addition to fisheries and feasibility criteria, streams with potential to increase instream flows (e.g. irrigation salvage potential) in the Blackfoot River were allotted 20 points. Finally, under the biological ranking section, streams with potential to improve downstream water quality by reducing 1) instream sediment (10 points), 2) water temperature (10 points), and 3) nutrient loading (10 points) could earn up to an additional 30 points. This water quality point

system is based on FWP assessments and judgment based on field observations

For social and financial considerations, we used three criteria: 1) landowner and land manager cooperation (5, 10, 15 or 20 points) - a measure of perceived landowner cooperation; 2) cost-effectiveness (5, 10 or 20 points) – an estimate of project cost/mile; and 3) demonstration/educational value of potential projects (5 or 10 points) - a measure of project uniqueness, judgments of landowner interest and project access.

We transferred matrix values of all 182 streams to an EXCEL spreadsheet and then spatially converted the matrix to an Arcview GIS shape-file where priorities were classified and displayed. Streams were classified hierarchically first by: 1) native species score, 2) then by total fisheries score, 3) biological score, and finally 4) total score. All native species scores (7 classes) and total fisheries scores (9 classes) are presented. Biological scores and total scores were grouped by class values that approximated the 0-33, 34-66, and 67-100 cumulative percentiles, and these were assigned a respective *high*, *moderate* and *low* priority values.

Prioritization shortcomings

It is important to note that our ranking criteria does not consider many complex restoration-related issues, such as: 1) fisheries potential of sites, 2) potential contribution to connected systems, 3) severity of impacts, 4) population size, 5) native and non-native species interactions, 6) WSCT genetic composition, 6) numerical water quality standards and criteria, or 7) industrial-scale timber harvesting practices, public land or hard-rock mine drainage issues, or 8) other specific agency programs geared toward fisheries and water quality improvements. Rather, these issues should be considered at the project development phases. Our prioritization scheme attempts to guide the limited resources of the Blackfoot Cooperators to biologically important tributaries located primarily on private land. Although the prioritization is intended to guide restoration activities, as new information becomes available and as additional limiting factors are identified low priorities may be elevated potentially triggering restoration action. We recognize unique restoration opportunities may be presented, and that continued input from landowners and managers will help guide the Blackfoot River restoration initiative.

Restoration Priorities

The hierarchy of the matrix is summarized below first by native fish priorities (Figure 1, Table 1) followed by total fisheries priorities (Figure 2, Table2) and biological score (Figure 3, Table 3) and finally by total restoration priority groupings (Figure 4, Table 4).

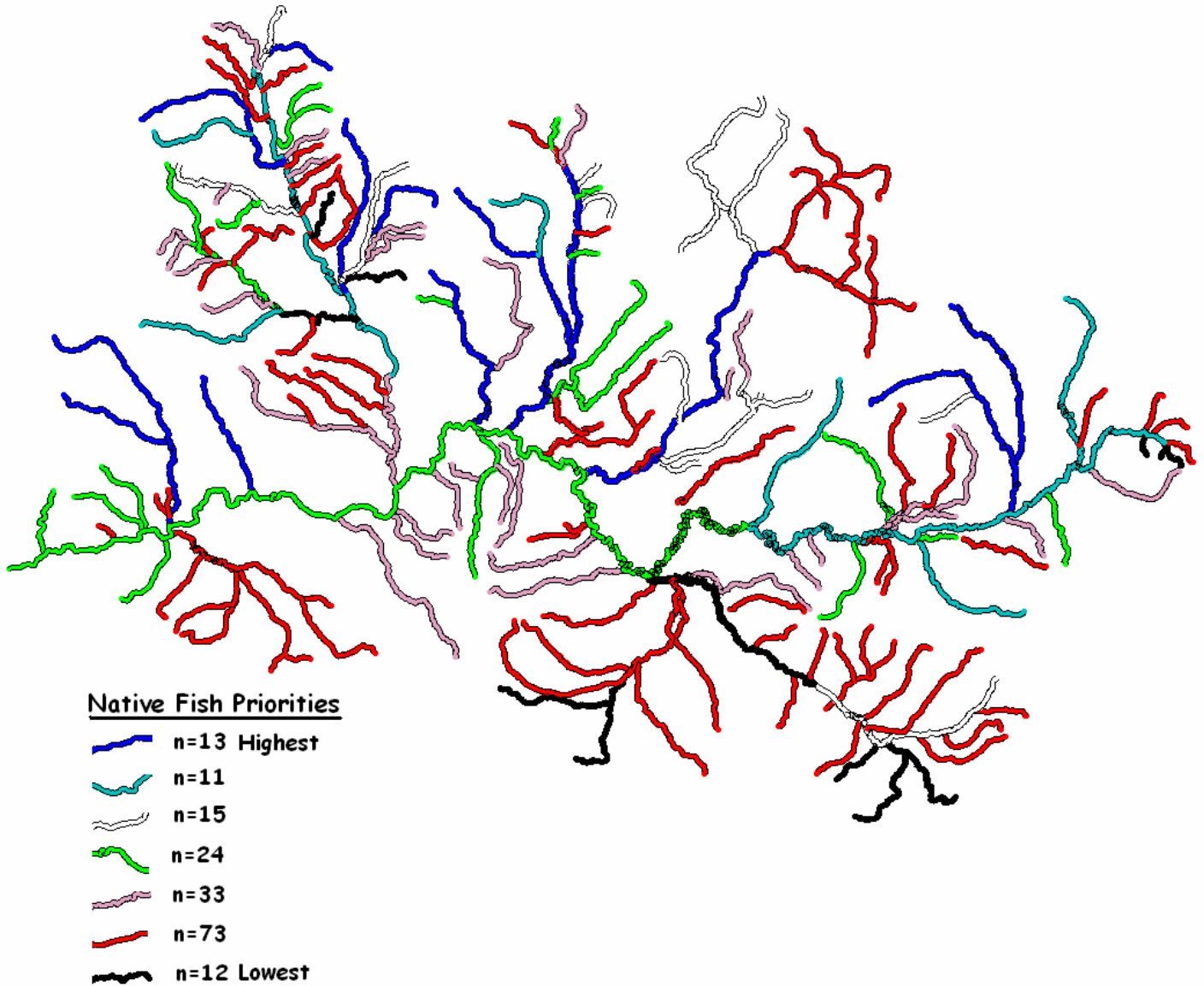


Figure 1. Native fish restoration priorities for the Blackfoot River Basin. Classes show the number of individual streams by priority grouping (Table 1). The highest scores are migratory bull trout and WSCT streams and the lowest scores possess little or no migratory native fish value to the Blackfoot River.

Stream Name	Native Species Total Score	Stream Name	Native Species Total Score	Stream Name	Native Species Total Score	Stream Name	Native Species Total Score
Belmont Creek	60	East Twin Creek	30	Bear Gulch	10	Seeley Creek	10
Clearwater Section 2	60	Ender's Spring Creek	30	Bertha Creek	10	Shaue Gulch	10
Clearwater Section 3	60	Grantier Spring Cr.	30	Blanchard NF	10	Sheep Creek	10
Clearwater Section 4	60	Hogum Creek	30	Braziel Creek	10	Shingle Mill Creek	10
Copper Creek	60	Inez Creek	30	Broadus Creek	10	Smith Creek	10
Cottonwood Cr. (R.M.43)	60	Johnson Creek	30	Buffalo Gulch	10	Sourdough Creek	10
Dunham Creek	60	McCabe Creek	30	Burnt Bridge Creek	10	Stonewall Creek	10
E.F. Clearwater	60	Saurekraut Creek	30	California Gulch	10	Sucker Creek	10
Gold Creek	60	Spring Cr.(Cottonwood)	30	Camas Creek	10	Swamp Creek	10
Gold Creek, W,F	60	Trail Creek	30	Chicken Creek	10	Tamarack Creek	10
Landers Fork	60	Unnamed tributary	30	Chimney Cr. (Douglas)	10	Theodore Creek	10
Monture Creek below the Falls	60	West Twin Creek	30	Chimney Cr. (Nevada)	10	Uhler Creek	10
Morrell Creek	60	Yellowjacket Creek	30	Clear Creek	10	Union Creek	10
North Fork Blackfoot River below the Falls	60	Basin Spring Creek	20	Cold Brook Creek	10	Vaughn Creek	10
W.F. Clearwater	60	Bear Creek trib. to N.F.	20	Colt Creek	10	Warm Springs Cr.	10
Alice Creek	50	Bear Creek (R.M.37.5)	20	Cooney Creek	10	Warren Creek	10
Arrastra Creek	50	Benedict Creek	20	Cottonwood Cr. (Nev.)	10	Warren Creek, Doney Lake trib	10
Blackfoot River 1	50	Blanchard Creek	20	Dobrota Creek	10	Washington Creek	10
Blackfoot River 2	50	Chamberlain EF	20	Douglas Creek	10	Washoe Creek	10
Blind Canyon Creek	50	Chamberlain WF	20	East Fork of North Fork	10	Wedge Creek	10
Boles Creek	50	Clearwater Section 1	20	Finley Creek	10	Willow Cr. (lower)	10
Lodgepole Creek	50	Elk Creek	20	First Creek	10	Wilson Creek	10
Poorman Creek	50	Fawn Creek	20	Frazier Creek	10	Auggie Creek	0
Cabin Creek	40	Findell Creek	20	Frazier Creek, NF	10	Bear Trap Creek	0
Canyon Creek	40	Fish Creek	20	Gallagher Creek	10	Black Bear Creek	0
Clearwater Section 5	40	Keep Cool Creek	20	Game Creek	10	Buck Creek	0
Dry Creek	40	Lincoln Spring Cr.	20	Gleason Creek	10	Drew Creek	0
Dry Fork of the North Fork	40	Little Fish Creek	20	Grouse Creek	10	Finn Creek	0
East Fork of Monture	40	Little Moose Creek	20	Hoyt Creek	10	Halfway Creek	0
Hayden Creek	40	McDermott Creek	20	Humbug Creek	10	Horn Creek	0
Kleinschmidt Cr.	40	Middle Fork of Monture Creek	20	Indian Creek	10	Mike Horse Creek	0
Marshall Creek	40	Moose Creek	20	Jacobsen Spring Creek	10	Nevada Cr. (lower)	0
Nevada Cr.(upper)	40	N.F. Placid Creek	20	Jefferson Creek	10	Owl Creek	0
Rock Creek	40	Nevada Spring Cr.	20	Lost Horse Creek	10	Paymaster Creek	0
Salmon Creek	40	Pearson Creek	20	Lost Pony Creek	10	Sheep Creek	0
Snowbank Creek	40	Placid Creek	20	Lost Prairie Creek	10	Slippery John Creek	0
Spring Creek (N.F.)	40	Seven up Pete Cr.	20	McElwain Creek	10	Strickland Creek	0
Bear Creek (R.M.12.2)	30	Shanley Creek	20	Mitchell Creek	10	Sturgeon Creek	0
Beaver Creek	30	Wales Creek	20	Mountain Creek	10	Ward Creek	0
Blackfoot River 3	30	Wales Spring Creek	20	Murphy Creek	10		
Blackfoot River 4	30	Wasson Creek	20	Murray Creek	10		
Blackfoot River 5	30	Willow Cr. (upper)	20	North Fork above the Falls	10		
Blackfoot River 6	30	Yourname Creek	20	Pass Creek	10		
Burnt Cabin Creek	30	Anaconda Creek	10	Rice Creek	10		
Camp Creek	30	Archibald Creek	10	Richmond Creek	10		
Chamberlain Creek	30	Arkansas Creek	10	Sawyer Creek	10		
Deer Creek	30	Ashby Creek	10	Scotty Creek	10		
Dick Creek	30	Bartlett Creek	10	Second Creek	10		

Table 1. Native fish restoration priority stream sorted alphabetically from high to low priority.

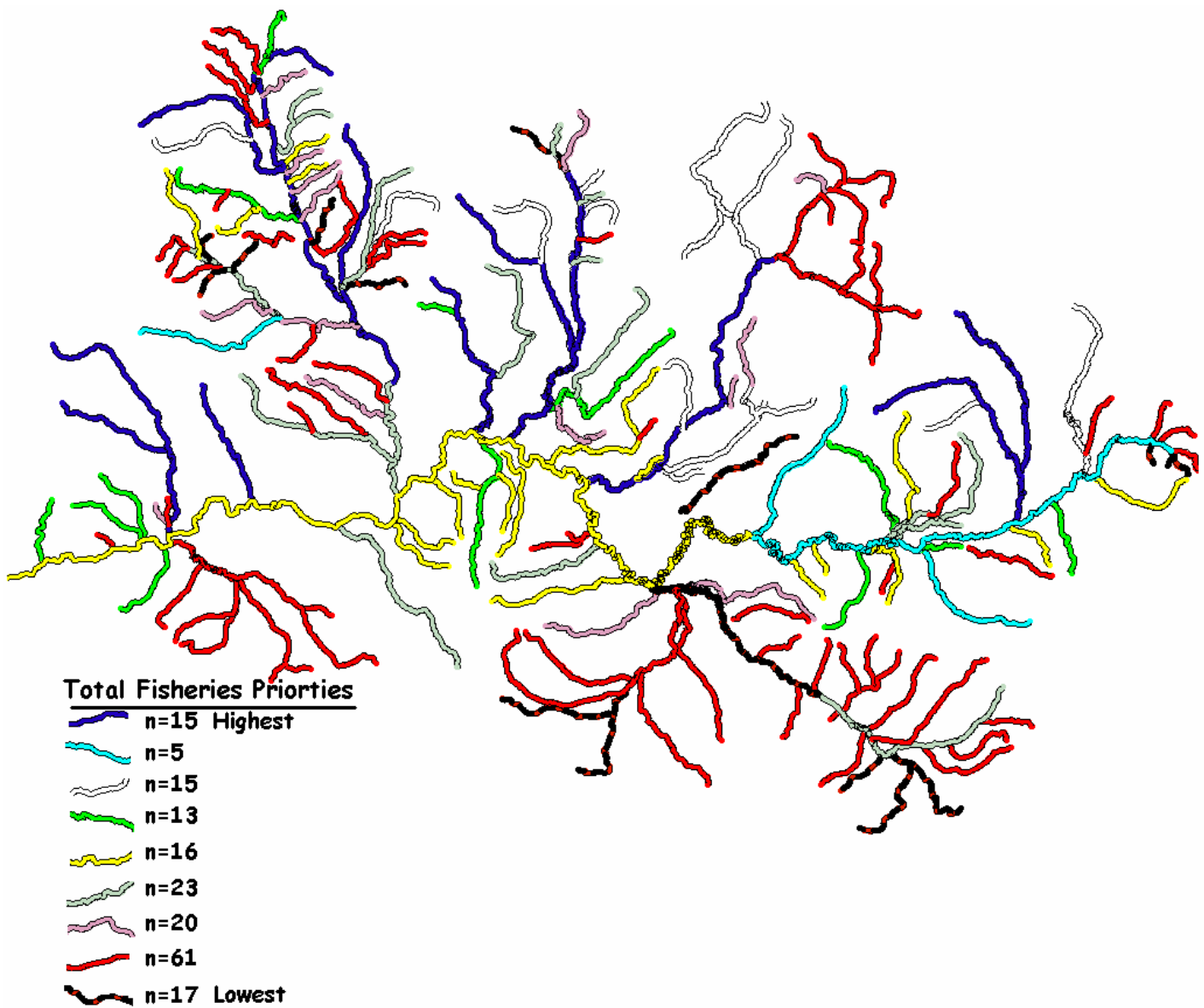


Figure 2. Total fisheries restoration priorities for the Blackfoot River Basin. High priority stream currently support migratory bull trout, WSCT and may recruit of game fish (rainbow and brown trout) to the Blackfoot River (Table 2). Streams near the bottom of the priority list provide very little or no native or recreational (recruitment) value to the Blackfoot River.

Stream Name	Total fisheries score	Stream Name	Total fisheries score	Stream Name	Total fisheries score	Stream Name	Total fisheries score
Belmont Creek	80	Blanchard Creek	40	Murphy Creek	20	Scotty Creek	10
Clearwater Section 2	80	Burnt Cabin Creek	40	Nevada Spring Cr.	20	Second Creek	10
Clearwater Section 3	80	Camp Creek	40	Owl Creek	20	Seeley Creek	10
Clearwater Section 4	80	Clearwater Section 1	40	Rice Creek	20	Shaue Gulch	10
Copper Creek	80	Elk Creek	40	Richmond Creek	20	Sheep Creek	10
Cottonwood Cr. (R.M.43)	80	Inez Creek	40	Sawyer Creek	20	Shingle Mill Creek	10
Dunham Creek	80	Keep Cool Creek	40	Warm Springs Cr.	20	Smith Creek	10
E.F. Clearwater	80	Lincoln Spring Cr.	40	Wasson Creek	20	Sourdough Creek	10
Gold Creek	80	McCabe Creek	40	Anaconda Creek	10	Sucker Creek	10
Gold Creek, W,F	80	Nevada Cr.(upper)	40	Archibald Creek	10	Swamp Creek	10
Landers Fork	80	Placid Creek	40	Arkansas Creek	10	Tamarack Creek	10
Monture Creek below the Falls	80	Shanley Creek	40	Ashby Creek	10	Theodore Creek	10
Morrell Creek	80	Trail Creek	40	Bartlett Creek	10	Uhler Creek	10
North Fork below the Falls	80	Unnamed tributary	40	Bear Gulch	10	Union Creek	10
W.F. Clearwater	80	Wales Creek	40	Bertha Creek	10	Vaughn Creek	10
Arrastra Creek	70	Wales Spring Creek	40	Blanchard NF	10	Warren Creek, Doney Lak	10
Blackfoot River 1	70	Yellowjacket Creek	40	Braziel Creek	10	Washington Creek	10
Blackfoot River 2	70	Basin Spring Creek	30	Buffalo Gulch	10	Washoe Creek	10
Boles Creek	70	Bear Creek (R.M.37.5)	30	Burnt Bridge Creek	10	Wedge Creek	10
Poorman Creek	70	Benedict Creek	30	California Gulch	10	Wilson Creek	10
Alice Creek	60	Blackfoot River 3	30	Camas Creek	10	Auggie Creek	0
Blind Canyon Creek	60	Blackfoot River 4	30	Chicken Creek	10	Bear Trap Creek	0
Cabin Creek	60	Blackfoot River 5	30	Chimney Cr. (Douglas)	10	Black Bear Creek	0
Canyon Creek	60	Blackfoot River 6	30	Chimney Cr. (Nevada)	10	Buck Creek	0
Dry Creek	60	Chamberlain EF	30	Clear Creek	10	Drew Creek	0
Dry Fork of the North Fork	60	Chamberlain WF	30	Cold Brook Creek	10	Finn Creek	0
East Fork of Monture	60	Fawn Creek	30	Colt Creek	10	Halfway Creek	0
Hayden Creek	60	Findell Creek	30	Cooney Creek	10	Horn Creek	0
Kleinschmidt Cr.	60	Fish Creek	30	Cottonwood Cr. (Nev.)	10	Mike Horse Creek	0
Lodgepole Creek	60	Jacobsen Spring Creek	30	Dobrota Creek	10	Nevada Cr. (lower)	0
Marshall Creek	60	Little Fish Creek	30	Douglas Creek	10	Paymaster Creek	0
Rock Creek	60	Little Moose Creek	30	East Fork of North Fork	10	Sheep Creek	0
Salmon Creek	60	Moose Creek	30	First Creek	10	Slippery John Creek	0
Snowbank Creek	60	N.F. Placid Creek	30	Frazier Creek	10	Strickland Creek	0
Spring Creek (N.F.)	60	Pearson Creek	30	Frazier Creek, NF	10	Sturgeon Creek	0
Bear Creek (R.M.12.2)	50	Seven up Pete Cr.	30	Gallagher Creek	10	Ward Creek	0
Beaver Creek	50	Stonewall Creek	30	Game Creek	10		
Chamberlain Creek	50	Warren Creek	30	Gleason Creek	10		
Clearwater Section 5	50	Willow Cr. (lower)	30	Grouse Creek	10		
Deer Creek	50	Willow Cr. (upper)	30	Humbug Creek	10		
Dick Creek	50	Yourname Creek	30	Indian Creek	10		
East Twin Creek	50	Bear Creek trib. to N.F.	20	Jefferson Creek	10		
Ender's Spring Creek	50	Broadus Creek	20	Lost Pony Creek	10		
Grantier Spring Cr.	50	Finley Creek	20	Lost Prairie Creek	10		
Hogum Creek	50	Hoyt Creek	20	Mitchell Creek	10		
Johnson Creek	50	Lost Horse Creek	20	Mountain Creek	10		
Saurekraut Creek	50	McDermott Creek	20	Murray Creek	10		
Spring Cr.(Cottonwood)	50	McElwain Creek	20	North Fork above the Falls	10		
West Twin Creek	50	Middle Fork of Monture Creek	20	Pass Creek	10		

Table 2. Total fisheries scores for the Blackfoot River Basin. Streams are sorted alphabetically from high fisheries value to no current fisheries value to the Blackfoot River.

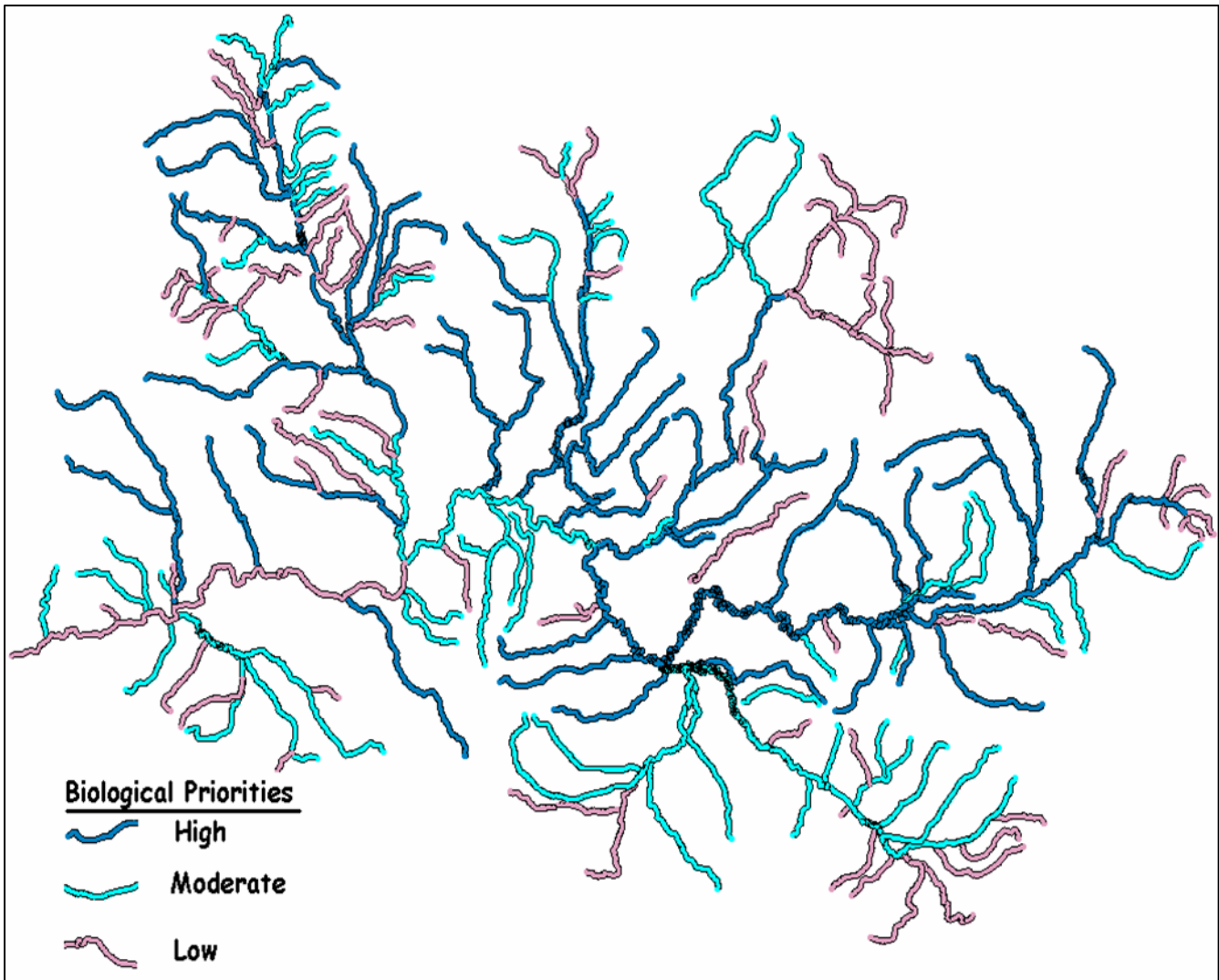


Figure 3. Biologically scores ranked by high, moderate and low values. High priority streams support native and sport fish and most possess high restoration (i.e., flow and water quality) potential. Moderate priority streams possess often possess less valuable fish but high restoration potential (Table 3). Low values may possess restoration potential but provide little current fisheries value to the Blackfoot River.

Stream Name	Bio score	Stream Name	Bio score	Stream Name	Bio score	Stream Name	Bio score
Alice Creek	High	Stonewall Creek	High	Pearson Creek	Moderate	McDermott Creek	Low
Arrastra Creek	High	Wales Creek	High	Placid Creek	Moderate	Middle Fork of Monture Creek	Low
Beaver Creek	High	Wales Spring Creek	High	Richmond Creek	Moderate	Mike Horse Creek	Low
Belmont Creek	High	Wasson Creek	High	Seven up Pete Cr.	Moderate	Mitchell Creek	Low
Blackfoot River 1	High	Bear Creek (R.M.12.2)	Moderate	Sucker Creek	Moderate	North Fork above the Falls	Low
Blackfoot River 2	High	Ashby Creek	Moderate	Union Creek	Moderate	Pass Creek	Low
Blackfoot River 3	High	Basin Spring Creek	Moderate	Unnamed tributary	Moderate	Paymaster Creek	Low
Blackfoot River 4	High	Bear Gulch	Moderate	Warm Springs Cr.	Moderate	Rice Creek	Low
Blanchard Creek	High	Benedict Creek	Moderate	Washington Creek	Moderate	Sawyer Creek	Low
Blind Canyon Creek	High	Bertha Creek	Moderate	West Twin Creek	Moderate	Scotty Creek	Low
Boles Creek	High	Blackfoot River 5	Moderate	Willow Cr. (upper)	Moderate	Second Creek	Low
Clearwater Section 2	High	Braziel Creek	Moderate	Wilson Creek	Moderate	Seeley Creek	Low
Clearwater Section 3	High	Buffalo Gulch	Moderate	Yellowjacket Creek	Moderate	Shaue Gulch	Low
Clearwater Section 4	High	Burnt Cabin Creek	Moderate	Anaconda Creek	Low	Sheep Creek	Low
Copper Creek	High	Cabin Creek	Moderate	Archibald Creek	Low	Sheep Creek	Low
Cottonwood Cr. (R.M.43)	High	California Gulch	Moderate	Arkansas Creek	Low	Shingle Mill Creek	Low
Deer Creek	High	Camas Creek	Moderate	Auggie Creek	Low	Slippery John Creek	Low
Dick Creek	High	Camp Creek	Moderate	Bartlett Creek	Low	Smith Creek	Low
Dry Creek	High	Canyon Creek	Moderate	Bear Creek trib. to N.F.	Low	Sourdough Creek	Low
Dunham Creek	High	Chamberlain Creek	Moderate	Bear Creek (R.M.37.5)	Low	Strickland Creek	Low
E.F. Clearwater	High	Chamberlain EF	Moderate	Bear Trap Creek	Low	Sturgeon Creek	Low
Elk Creek	High	Chamberlain WF	Moderate	Black Bear Creek	Low	Swamp Creek	Low
Ender's Spring Creek	High	Chicken Creek	Moderate	Blackfoot River 6	Low	Tamarack Creek	Low
Gold Creek	High	Chimney Cr. (Douglas)	Moderate	Blanchard NF	Low	Theodore Creek	Low
Gold Creek, W,F	High	Clearwater Section 1	Moderate	Broadus Creek	Low	Uhler Creek	Low
Hoyt Creek	High	Clearwater Section 5	Moderate	Buck Creek	Low	Vaughn Creek	Low
Kleinschmidt Cr.	High	Cottonwood Cr. (Nev.)	Moderate	Burnt Bridge Creek	Low	Ward Creek	Low
Landers Fork	High	Douglas Creek	Moderate	Chimney Cr. (Nevada)	Low	Warren Creek, Doney Lake trib	Low
Lincoln Spring Cr.	High	Dry Fork of the North Fork	Moderate	Clear Creek	Low	Washoe Creek	Low
Marshall Creek	High	East Fork of Monture	Moderate	Cold Brook Creek	Low	Wedge Creek	Low
McCabe Creek	High	East Twin Creek	Moderate	Colt Creek	Low		
McElwain Creek	High	Fawn Creek	Moderate	Cooney Creek	Low		
Monture Creek below the Falls	High	Findell Creek	Moderate	Dobrota Creek	Low		
Morrell Creek	High	Finley Creek	Moderate	Drew Creek	Low		
N.F. Placid Creek	High	Fish Creek	Moderate	East Fork of North Fork	Low		
Nevada Spring Cr.	High	Hayden Creek	Moderate	Finn Creek	Low		
North Fork below the Falls	High	Hogum Creek	Moderate	First Creek	Low		
Owl Creek	High	Inez Creek	Moderate	Frazier Creek	Low		
Poorman Creek	High	Jacobsen Spring Creek	Moderate	Frazier Creek, NF	Low		
Rock Creek	High	Jefferson Creek	Moderate	Gallagher Creek	Low		
Salmon Creek	High	Johnson Creek	Moderate	Game Creek	Low		
Saurekraut Creek	High	Keep Cool Creek	Moderate	Gleason Creek	Low		
Shanley Creek	High	Little Fish Creek	Moderate	Grantier Spring Cr.	Low		
Snowbank Creek	High	Lodgepole Creek	Moderate	Grouse Creek	Low		
Spring Cr.(Cottonwood)	High	Lost Horse Creek	Moderate	Halfway Creek	Low		
Spring Creek (N.F.)	High	Moose Creek	Moderate	Horn Creek	Low		
Trail Creek	High	Mountain Creek	Moderate	Humbug Creek	Low		
W.F. Clearwater	High	Murphy Creek	Moderate	Indian Creek	Low		
Warren Creek	High	Murray Creek	Moderate	Little Moose Creek	Low		
Willow Cr. (lower)	High	Nevada Cr. (lower)	Moderate	Lost Pony Creek	Low		
Yourname Creek	High	Nevada Cr.(upper)	Moderate	Lost Prairie Creek	Low		

Table 3. Streams arranged alphabetically and sorted by biological (high, moderate and low) classification groupings.

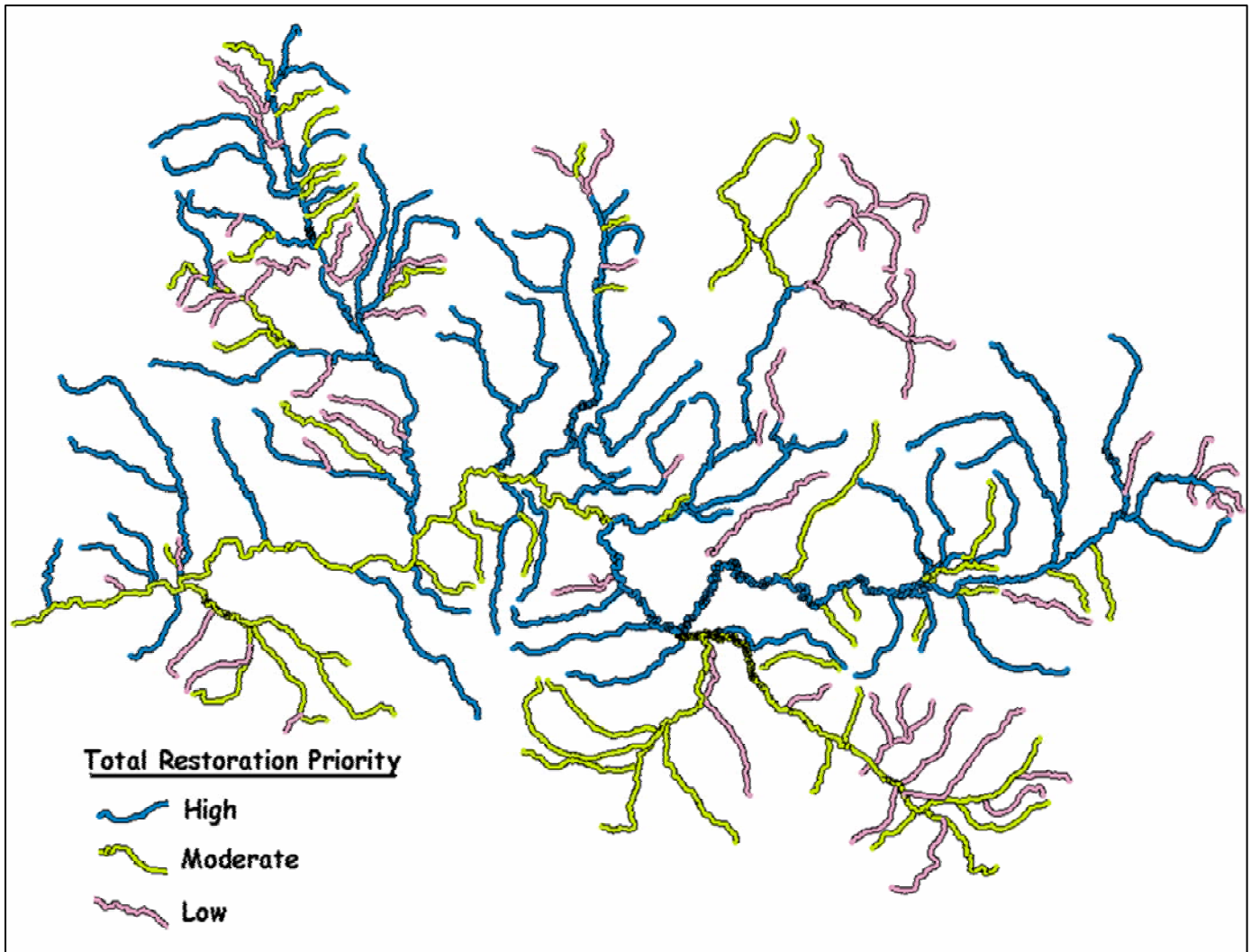


Figure 4. Total restoration priorities. This map is classified by high, moderate and low scores. In addition to the biological scores, the social scores influence this classification (Table 4).

**APPENDIX K: U.S. FISH AND WILDLIFE SERVICE, 2002. BULL TROUT
DRAFT RECOVERY PLAN, CLARK FORK RIVER RECOVERY UNIT**

STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout, including for both spawning and rearing, as well as for foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting a core habitat) constitutes the basic core area unit on which to gauge recovery within a recovery unit.

In the Clark Fork Recovery Unit (Table 2), core areas were most easily delineated for adfluvial populations (*e.g.*, typically the lake where adults reside and interconnected watershed upstream). For fluvial or anadromous populations, delineating core areas requires that some judgment calls be made in determining the extent of historical and current connectivity of migratory habitat, while considering natural and manmade barriers, survey and movement data, and genetic analysis. For resident populations, we must consider whether local populations are remnants from previously existing migratory bull trout and whether reconnecting fragmented habitat would restore a migratory core area. Overall, the hierarchy of population units was mutually exclusive both within a level (*e.g.*, core areas did not overlap) and among levels (*e.g.*, a core area did not occur within portions of more than one recovery unit or subunit).

Table 2. List of local populations (in bold) by core area, in the Clark Fork Recovery Unit. Streams designated by (mc) are migratory corridors only and are not considered to host their own local population.

RECOVERY UNIT AND SUBUNIT	CORE AREA	LOCAL POPULATION
Clark Fork RU Upper Clark Fork RSU	Clark Fork River Section 1 (Upstream of Milltown Dam)	Clark Fork River Warm Springs Creek Racetrack Creek Little Blackfoot River Flint Creek Boulder Creek Harvey Creek
	Rock Creek	Rock Creek Middle Fork Rock Creek East Fork Rock Creek West Fork Rock Creek Ross Fork Rock Creek Upper Willow Creek Stony Creek Wyman Creek Hogback Creek Cougar Creek Wahlquist Creek Butte Cabin Creek Welcome Creek Ranch Creek Brewster Creek Gilbert Creek
	Blackfoot River	Blackfoot River Landers Fork North Fork Blackfoot River Monture Creek Cottonwood Creek Belmont Creek Gold Creek
	Clearwater River and Clearwater lake chain	Clearwater River (upstream of Salmon Lake) West Fork Clearwater River Deer Creek Morrell Creek Owl Creek (mc) Placid Creek

RECOVERY UNIT AND SUBUNIT	CORE AREA	LOCAL POPULATION
	Clark Fork River Section 2 (Milltown Dam to Flathead River)	Clark Fork River (mc) Rattlesnake Creek Petty Creek Fish Creek Trout Creek Cedar Creek St. Regis River
	West Fork Bitterroot River	All tributaries upstream of Painted Rocks Dam
	Bitterroot River	West Fork Bitterroot River (downstream of Painted Rocks) East Fork Bitterroot River Warm Springs Creek Bitterroot River Sleeping Child Creek Skalkaho Creek Blodgett Creek Fred Burr Creek Burnt Fork Creek
Clark Fork RU Lower Clark Fork RSU	Lower Flathead River	Mission Creek (mc) Post Creek (trib. to McDonald Lake) Mission Creek (trib. to Mission Reservoir) Dry Creek (trib. to Tabor (St. Marys) Res.) Jocko River South Fork Jocko River Middle Fork Jocko River North Fork Jocko River
	Clark Fork River Section 3 (Flathead River to Thompson Falls Dam)	Clark Fork River (mc) Thompson River (mc) Fishtrap Creek West Fork Thompson River
	Noxon Rapids Reservoir	Prospect Creek Graves Creek Vermillion River
	Cabinet Gorge Reservoir	Rock Creek Bull River

RECOVERY UNIT AND SUBUNIT	CORE AREA	LOCAL POPULATION
	Lake Pend Oreille (LPO)	<p>Clark Fork River</p> <p>Twin Creek</p> <p>Lightning Creek</p> <p>Rattle Creek</p> <p>Wellington Creek</p> <p>Porcupine Creek</p> <p>East Fork Lightning Creek</p> <p>Johnson Creek (trib. to LPO)</p> <p>Gold Creek (trib. to LPO)</p> <p>North Gold Creek (trib. to LPO)</p> <p>Granite Creek (trib. to LPO)</p> <p>Trestle Creek (trib. to LPO)</p> <p>Pack River (trib. to LPO)</p> <p>Grouse Creek</p> <p>Priest River</p> <p>East River (mc)</p> <p>Middle Fork East River (mc)</p> <p>Uleda Creek</p> <p>Tarlac Creek</p>
Clark Fork RU Flathead RSU	Frozen Lake	Unnamed headwater tributary (and stream flowing out of Frozen Lake)
	Upper Kintla Lake	Kintla Creek (trib. to Upper Kintla Lake)
	Kintla Lake	Kintla Creek (trib. to Kintla Lake)
	Akokala Lake	Akokala Creek (trib. to Akokala Lake)
	Bowman Lake	Bowman Creek (trib. to Bowman Lake)
	Cerulean Lake Quartz Lake Middle Quartz Lake	Quartz Creek (trib. to Middle Quartz Lake)
	Lower Quartz Lake	Quartz Creek (trib. to Lower Quartz Lake)
	Cyclone Lake	Cyclone Creek (entire drainage)
	Logging Lake	Logging Creek (trib. to Logging Lake)
	Trout Lake	Camas Creek (trib. to Trout Lake)
	Arrow Lake	Camas Creek (trib. to Arrow Lake)
	Isabel Lake(s)	Park Creek (trib. to Lower Isabel Lake)
	Harrison Lake	Harrison Creek (trib. to Harrison Lake)
Lincoln Lake	Lincoln Creek (trib. to Lincoln Lake)	

RECOVERY UNIT AND SUBUNIT	CORE AREA	LOCAL POPULATION
	Lake McDonald	McDonald Creek (trib. to Lake McDonald)
	Doctor Lake	Doctor Creek (trib. to Doctor Lake)
	Big Salmon Lake	Big Salmon Creek (trib. to Big Salmon Lake)
	Hungry Horse Reservoir	South Fork Flathead River (mc) Danaher Creek Youngs Creek Gordon Creek White River Little Salmon Creek Bunker Creek Spotted Bear River Sullivan Creek (trib. Hungry Horse Res.) Wheeler Creek (trib. H. Horse Res.) Wounded Buck Creek (trib. H. Horse Res.)
	Upper Stillwater Lake	Stillwater River (trib. to Upper Stillwater Lake)
	Whitefish Lake	Swift Creek (trib. to Whitefish Lake)
	Upper Whitefish Lake	East Fork Swift Creek (trib. and downstream)
	Lindbergh Lake	Swan River (trib. to Lindbergh Lake)
	Holland Lake	Holland Creek (trib. to Holland Lake)
	Swan Lake	Swan River (mc) Elk Creek Cold Creek Jim Creek Piper Creek Lion Creek Goat Creek Woodward Creek Soup Creek Lost Creek

RECOVERY UNIT AND SUBUNIT	CORE AREA	LOCAL POPULATION
	Flathead Lake	<p>Flathead River (mc)</p> <p>North Fork Flathead River (U.S. / B.C.)</p> <p>Howell Creek (B. C.)</p> <p>Kishinehn Creek (B. C.)</p> <p>Trail Creek</p> <p>Whale Creek</p> <p>Red Meadow Creek</p> <p>Coal Creek</p> <p>Big Creek</p> <p>Middle Fork Flathead River (mc)</p> <p>Strawberry Creek (includes Trail)</p> <p>Bowl Creek</p> <p>Clack Creek</p> <p>Schafer Creek (includes Dolly Varden)</p> <p>Morrison Creek (Includes Lodgepole)</p> <p>Granite Creek</p> <p>Long Creek</p> <p>Bear Creek</p> <p>Ole Creek</p> <p>Park Creek</p> <p>Nyack Creek</p>
Clark Fork RU Priest RSU	Priest Lakes	<p>Upper Priest River</p> <p>Hughes Fork</p> <p>Gold Creek</p> <p>Trapper Creek (trib. to Upper Priest Lake)</p> <p>Lion Creek (trib. to Priest Lake)</p> <p>Two Mouth Creek (trib. to Priest Lake)</p> <p>Granite Creek (trib. to Priest Lake)</p> <p>North Fork Granite Creek</p> <p>South Fork Granite Creek</p> <p>Indian Creek (trib. to Priest Lake)</p> <p>Kalispell Creek (trib. to Priest Lake)</p> <p>Soldier Creek (trib. to Priest Lake)</p>

Recovery Goals and Objectives

The specific goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted.** Specifically, the recovery subunit teams for the four Clark Fork River subunits (Upper Clark Fork, Lower Clark Fork, Flathead, and Priest) adopted the goal of **a sustained net increase in bull trout abundance, and increased distribution of some local populations, within existing core areas in this recovery unit (as measured by standards accepted by the recovery subunit teams, often referred to collectively as the Clark Fork Recovery Unit Teams).**

- ▶ Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Clark Fork Recovery Unit.
- ▶ Maintain stable or increasing trends in abundance of bull trout in each subunit of the Clark Fork Recovery Unit.
- ▶ Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.
- ▶ Conserve genetic diversity and provide opportunity for genetic exchange.

Within that general guidance, the Clark Fork Recovery Unit Teams developed specific recovery criteria for the Clark Fork Recovery Unit. Bull trout are distributed among about 150 local populations within 38 core areas of the recovery unit (see Table 2). As more information on fish distribution and genetics is collected and analyzed, the number of local populations identified will probably increase. In this recovery unit, the historical distribution of bull trout is relatively intact, and no vacant core habitat is recommended at this time for reestablishment of extirpated local populations. Instead, emphasis is placed on securing the existing distribution within core areas and increasing the abundance and connectivity of local populations.

The Upper Clark Fork, Lower Clark Fork, Flathead, and Priest Subunit Recovery Teams adopted the following objective for the Clark Fork Recovery Unit:

A sustained net increase in bull trout abundance, and increased distribution of some local populations, within existing core areas in this recovery unit (as measured by standards that the Clark Fork Recovery Unit Teams develop).

To assess progress toward this objective, each recovery subunit team adopted recovery criteria for its respective subunit. Relevant numerical standards are presented in Table 3. The standards for adult abundance, presented in Table 3, are based in part on recent historical information about the size of the adult population, as well as its potential, given the extent of the interconnected watershed.

Inherent stochastic, as well as genetic, risks are broadly acknowledged to be associated with low population levels of any species, but, to date, there has been a great deal of uncertainty about the proper application of theoretical population standards to bull trout. Rieman and Allendorf (2001) proposed that 1,000 spawning adults is a cautious management goal for long-term maintenance of genetic variation in a core area population of bull trout. The Clark Fork Recovery Unit Teams estimate that, of the 38 core areas identified in the Clark Fork Recovery Unit, only about 10 core areas have the potential to support 1,000 or more adult bull trout, even under recovered conditions.

Based in part on the analysis of Rieman and Allendorf (2001), the Clark Fork Recovery Unit Teams also assumed that a core area cannot maintain genetic viability for even the short term with spawning populations of fewer than roughly 100 adults. Rieman and Allendorf (2001) concluded that a cautious interpretation would be that approximately 100 adult bull trout, spawning each year, would be required to minimize the risk of inbreeding in a population. For some of the isolated core areas in the Clark Fork Recovery Unit, even this level of population abundance will be difficult to attain.

Table 3. Numeric standards necessary to achieve recovered abundance of bull trout in primary and secondary core areas of the Clark Fork Recovery Unit of the Columbia River drainage

CORE AREAS	Existing Number (Estimated) Local Populations	Existing Number (Estimated) Local Populations with > 100	Recovered Minimum Number Local Populations with > 100	Recovered Minimum Number Core Area Total Adult Abundance
<u>PRIMARY</u>				
Upper Clark Fork River Complex (Sections 1 and 2 combined)	13	0	5	1,000
Rock Creek	14	2	5	1,000
Blackfoot River	7	3	5	1,000
Bitterroot River	9	2	5	1,000
Lower Clark Fork River Complex (Clark Fork River Section 3, Lower Flathead River, Noxon Reservoir, and Cabinet Gorge Reservoir)	16	0	5	1,000
Lake Pend Oreille	14	3	6	2,500
Flathead Lake	19	9	10	2,500
Swan Lake	9	7	5	2,500
Hungry Horse Reservoir	10	5	5	1,000
Priest Lakes	12	0	5	1,000
TOTAL - PRIMARY CORES	123	31	56	14,500
<u>SECONDARY</u> - Clearwater River	5	0	1	Maximize with goal of > 100 in each
West Fork Bitterroot	1	1	1	
Flathead Disjuncts (22 separate adfluvial cores)	22 (1 each)	1	22 (1 each)	
TOTAL - SECONDARY CORES	28	2	24	2,400

The numerical criteria proposed by the Clark Fork Recovery Unit Teams to ensure replication of populations and to function as minimum recovery standards for adult abundance of bull trout in the Clark Fork Recovery Unit (Table 3) are based in part upon Rieman and Allendorf's (2001) estimates of the minimum population levels required for maintaining long-term genetic variability (1,000 adults) and genetic viability (100 adults). However, the Clark Fork Recovery Unit Teams also used the best professional scientific judgment of their members in setting those standards. At this time, the proposed recovery standards are based primarily on genetic concerns. Over time, protection of other ecological and biological attributes that contribute to population viability and long-term population stability will also need to be considered. Rieman and Allendorf (2001) cautioned that the guidelines they presented represent conservative minimum standards for the conservation of genetic variability and not "goals that will assure the viability of any population." They also noted that mitigation of extinction threats associated with demographic processes may require larger population sizes regardless of the genetic issues. They concluded that maintaining genetic diversity is essential, but not necessarily sufficient, for effective conservation.

It must be noted, however, that many of the small isolated populations in the Clark Fork Recovery Unit (defined below as secondary core areas) are essentially stranded local populations that have apparently persisted for a very long time, even thousands of years, at population levels very similar to current levels. Most such populations will continue to exist at a high degree of genetic risk and will be subject to high risk of extirpation from stochastic events. As more numerical data are collected and as trends are more clearly documented, the abundance standards should be further refined in their application as recovery criteria.

For purposes of recovery in this unit, the Clark Fork Recovery Unit Teams divided the entire unit into primary and secondary core areas, based mostly on the size, connectedness, and complexity of the watershed. The distinction between primary and secondary core areas indicates that a different set of standards are needed for recovery criteria, particularly for addressing abundance. The distinction does not infer a different level of importance for recovery purposes.

Primary Core Areas: Primary core areas in the Clark Fork Recovery Unit are typically located in watersheds of major river systems, often contain large lakes or reservoirs, and have migratory corridors that usually extend 50 to 100 kilometers (30 to 60 miles) or more. Each primary core area includes 7 to 19 identified local populations of bull trout. In recovered condition, a primary core area is expected to support at least 5 local populations with 100 or more adults each and to contain 1,000 or more adult bull trout in total.

The following areas have been designated as primary core areas in the Clark Fork Recovery Unit:

1. **Upper Clark Fork River** (includes two currently fragmented population segments, upstream and downstream of Milltown Dam, that are currently treated as separate core areas). Note that these core areas were historically connected and must be functionally rejoined under recovered conditions.
2. **Rock Creek**
3. **Blackfoot River**
4. **Bitterroot River**
5. **Lower Clark Fork River** (includes four currently fragmented population segments: Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir; these segments are currently treated as separate core areas). Note that these core areas were historically connected and must be functionally rejoined under recovered conditions.
6. **Lake Pend Oreille**
7. **Priest Lakes and Priest River**

8. **Flathead Lake**

9. **Swan Lake**

10. **Hungry Horse Reservoir**

Secondary Core Areas: Secondary core areas are based in smaller watersheds and typically contain adfluvial populations of bull trout that have become naturally isolated, with restricted upstream spawning and rearing habitat extending less than 50 kilometers (30 miles). Each secondary core areas includes one identified local population of bull trout (the Clearwater River is an exception, with as many as five local populations) and is not believed to contain sufficient size and complexity to accommodate 5 or more local populations with 100 or more adults to meet the abundance criteria defined above for primary core areas. Most secondary core areas have the potential to support fewer than a few hundred adult bull trout, even in a recovered condition. In extreme cases, secondary core areas may include small isolated lakes that occupy as little as 10 surface hectares (25 acres) and that are connected to 100 meters (about 100 yards) or less of accessible spawning and rearing habitat. In most cases, these conditions are natural, and, in some situations, these bull trout have probably existed for thousands of years with populations that seldom exceed 100 adults.

Collectively, the 24 secondary core areas may support a broad range of the genetic and phenotypic diversity that is representative of bull trout in the Clark Fork Recovery Unit.

The following areas have been designated as secondary core areas for the Clark Fork Recovery Unit:

1. **Clearwater River** and associated chain of lakes
2. **West Fork Bitterroot River** upstream of Painted Rocks Dam
- 3.–24. **22 lakes in the Flathead Recovery Subunit** (see Table 2)

It is noted that, for the portions of these watersheds in Montana, the primary core areas are functionally equivalent to the Restoration/Conservation Areas (also known as RCAs) designated by the Montana Bull Trout Restoration Team 2000. The secondary core areas generally represent the waters referred to as “disjunct” by the Montana Scientific Group.

Recovery Criteria

Listed below are the proposed recovery criteria for the Clark Fork Recovery Unit. As for the objectives identified in Chapter 1, the intent of recovery criteria within this recovery unit is to maximize the likelihood of persistence. Such persistence will be achieved, in part, by seeking to perpetuate the current distribution and by maintaining or increasing abundance of all local bull trout populations that are currently identified in the Clark Fork Recovery Unit (Table 2). Numerical summary of the recovery criteria is presented in Table 3.

Achieving the recovery criteria, including increasing monitoring and evaluation, will require the cooperative efforts of State, Federal, and Tribal resource management agencies; government and private landowners and water users; conservation organizations; and other interested parties. Criteria will only be achieved through reducing threats to bull trout, in part as a result of implementing tasks identified in the Recovery Measures Narrative section of this recovery plan, as well as by taking advantage of other new conservation and recovery opportunities as they arise.

1. **Distribution criteria will be met when the total number of identified local populations (currently numbering about 150) has been maintained or increased and when local populations remain broadly distributed in all existing core areas (Table 2).** This criteria must be applied with enough flexibility to allow for adaptive changes in the list of local populations (both additions and subtractions), based on best available science, as the body of knowledge concerning population and genetic inventory grows. It is also accepted that some secondary core areas may be at high risk of, or are currently undergoing, extirpation.

The distribution criteria cannot be met if major gaps develop in the current distribution of bull trout in the primary core areas of the Clark Fork Recovery Unit. Reconnecting fragmented habitat, as well as documenting new or previously undescribed local populations, should allow the documented distribution of bull trout to increase as recovery progresses. An exception to such an increase may occur in the Flathead Recovery Subunit where historical distribution is nearly intact.

The intention of the Clark Fork Recovery Unit Teams is also to maintain the existing bull trout distribution within all secondary core areas, but the teams recognize that stochastic events or deterministic processes already occurring are likely to cause a loss of distribution in some cases. The significance of such losses in the ultimate determination of whether or not distribution criteria have been met need to be judged on a case-by-case basis.

2. **Abundance criteria will be met when, in all 10 primary core areas, each of at least 5 local populations contain more than 100 adult bull trout. In the Lake Pend Oreille Core Area, each of at least 6 local populations must contain more than 100 adult bull trout. In the Flathead Lake Core Area, each of at least 10 local populations must contain more than 100 adult bull trout. In each of the 10 primary core areas, the total adult bull trout abundance, distributed among local populations, must exceed 1,000 fish; total abundance must exceed 2,500 adult bull trout in Lake Pend Oreille, Flathead Lake, and Swan Lake.**

Lake Pend Oreille, Flathead Lake, Swan Lake. These three core areas represent the largest natural adfluvial populations of bull trout in the Clark Fork Recovery Unit and perhaps the largest within the species' range in the United States. Each of these lakes has consistently supported spawning populations of adfluvial bull trout that produce over 500 redds annually in the currently connected portions of its watershed. Higher standards established for these three core areas reflect their higher biological potential, as well as their significance in maintaining high population levels, to conserve genetic variability within this recovery unit. These higher standards are based, in part, upon professional scientific judgment after evaluation of the existing 20 years of data for these waters.

In Lake Pend Oreille, 13 relatively complete basinwide redd counts were conducted between 1983 and 2000. These counts found an average of 657 redds in 18 streams (range 412 to 881). The 2000 redd count located 740 redds. Five drainages (Grouse, Gold, Granite, Trestle, and Lightning Creeks) consistently support over 25 redds, with the strongest (Gold and Trestle Creeks) normally exceeding 100 redds each. Johnson Creek also exceeded the 25 redd level in two of the 4 years between 1997 and 2000.

In Flathead Lake, 7 basinwide bull trout redd counts, conducted in 30 streams across 24 drainages between 1980 and 2000, found an average of 628 redds (range 236 to 1,156). The most recent basinwide count in 2000 found 555 bull trout redds, reflecting a rebounding trend from lows of the 1990's. Nine drainages (Big, Coal, Whale, Trail, and Howell [British Columbia] Creeks in the North Fork Flathead watershed and Ole, Morrison, Schafer, and Strawberry Creeks in the Middle Fork Flathead watershed) averaged 25 redds or more during the 21-year survey period, and several more drainages approached that level.

In the Swan Lake Core Area, basinwide redd counts were conducted annually between 1995 and 2000 and found an average of 752 bull trout redds in 10 streams across 8 drainages. Redd counts ranged from 703 to 861 during that period, and 717 redds were counted in 2000. Five drainages (Woodward, Goat, Lion, Jim, and Elk Creeks) consistently produced redd counts of 50 to 250 redds each, and 2 additional streams (Lost and Cold Creeks) produce about 20 to 30 redds.

Conversion of redd counts or other indices to adult numbers should be developed on a case-by-case basis, using the best available science and conversion factors that may be unique to each population. In many adfluvial populations, alternate-year spawning appears to be the norm. On the other hand, when Carnefix *et al.* (2001) used radio telemetry to track movements of 96 bull trout in the Rock Creek core area over a 3-year period, they concluded that nearly all of the fish they followed spawned annually.

Remaining Seven Primary Core Areas. In the other seven primary core areas, there are generally insufficient data over too short a period of record to provide a statistical analysis of abundance. Flathead, Pend Oreille, and Swan Lakes are thought to

represent unique situations because of the high number of extant local populations of adfluvial origin, and these lakes may not reflect the norm for the other seven primary core areas in the Clark Fork Recovery Unit. The standard criteria we have adopted for the remaining core areas are 5 local populations with 100 or more adults each and 1,000 or more adults in total.

The default abundance criteria for primary core areas—five local populations with 100 or more adults and 1,000 or more adult fish in total—is designed to protect genetic integrity and to reduce chances of stochastic extirpation by replicating local populations in these core areas. As more information becomes available, the default criteria for each primary core area should be evaluated and may be adjusted to reflect that new information. The recovery unit teams emphasize that these criteria must be adaptive if we are to fully protect and restore bull trout in this recovery unit.

The abundance criteria for 24 secondary core areas will be met when each of these core areas with the habitat capacity to do so supports at least 1 local population containing more than 100 adult bull trout and when total adult abundance in the secondary core areas collectively exceeds 2,400 fish. Some of the weakest and smallest secondary core areas do not have sufficient habitat available to meet this criteria, even in a recovered condition, and these cases must be factored into the evaluation of whether or not these criteria have been attained.

Extirpation of bull trout in as many as one-fourth of the secondary core areas (6 or fewer) is expected to occur over the next 25 years, or is already in process, based upon the evaluation of existing trend and status information. This eventuality should not prevent overall abundance criteria from being attained if each of the primary core areas and the remaining secondary core areas (75 percent) meet their individual criteria. Reasonable recovery efforts must continue in all primary and secondary core areas to minimize the chance of local extirpations. Consideration must be given to using whatever means necessary to maintain or restore at-risk populations to protect the genetic and phenotypic diversity that these core areas represent in the Clark Fork Recovery Unit.

3. **Trend criteria will be met when the overall bull trout population in the Clark Fork Recovery Unit is accepted, under contemporary standards of the time, to be stable or increasing, based on at least 10 years of monitoring data.**

4. **Connectivity criteria will be met when functional fish passage is restored or determined to be unnecessary to support bull trout recovery at Milltown, Thompson Falls, Noxon Rapids, Cabinet Gorge, and Priest Lake Dams and when dam operational issues are satisfactorily addressed at Hungry Horse, Bigfork, Kerr, and Albeni Falls Dams (as identified through license conditions of the Federal Energy Regulatory Commission and the Biological Opinion of the U.S. Fish and Wildlife Service).** Restoring connectivity so that the abundance and distribution requirements above can be met will probably require remedying additional passage barriers identified as inhibiting bull trout migration on smaller streams within the Clark Fork Recovery Unit. Restored connectivity of the mainstem Clark Fork River will consolidate six existing core areas, a result of fragmentation caused by the dams, into two (recovered) core areas in the upper and lower Clark Fork River.
 - a) In the Upper Clark Fork Recovery Subunit, fish passage must be provided at Milltown Dam, or the dam must be removed and the migratory corridor restored (Federal Energy Regulatory Commission relicensing process).

 - b) In the Lower Clark Fork Recovery Subunit, fish passage needs must be fully evaluated at Thompson Falls, Noxon, and Cabinet Gorge Dams and be provided where determined biologically feasible and necessary (Federal Energy Regulatory Commission license conditions). Additional concerns relating to water level manipulation and flow regulation through the operations of Kerr Dam (Federal Energy Regulatory Commission license conditions) and Albeni Falls Dam (USFWS 2000) must also be evaluated and mitigative or restorative actions implemented.

 - c) In the Flathead Recovery Subunit, no major barriers currently require passage. Concerns related to water level manipulation and flow regulation

through the operations of Kerr (Federal Energy Regulatory Commission license conditions) and Hungry Horse (USFWS Biological Opinion) Dams must be resolved, and conditions established by Federal Energy Regulatory Commission relicensing of Bigfork Dam must be met.

d) In the Priest Recovery Subunit, fish passage needs must be fully evaluated at Priest Lake Dam (Federal Energy Regulatory Commission license), and year-round fish passage must be provided if determined biologically necessary.

In all recovery subunits, substantial gains in reconnecting fragmented habitat may be achieved by restoring passage over and around many of the barriers that are typically located on smaller streams, including water diversions, road crossings, and culverts. Such barriers on small streams are not listed individually in the recovery criteria. In fact, many have not been identified. But, they are collectively important to recovery, and some are highlighted in the recovery narrative portion of this plan. A list of all such barriers should be prepared in the first five years of implementation. Substantial progress must be made in providing passage over at least half of these sites, consistent with the protection of upstream populations of westslope cutthroat trout and other native fishes, to meet the bull trout recovery criteria for connectivity.

ACTIONS NEEDED

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follows a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. Second-tier tasks that do not include specific third-tier actions are usually programmatic activities that are applicable across the species' range; they appear in *italic type*. These tasks may or may not have third-tier tasks associated with them; see Chapter 1 for more explanation. Some second-tier tasks may not be sufficiently developed to apply to the recovery unit at this time; they appear in *a shaded italic type (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period when additional tasks may be developed. Third-tier entries are tasks specific to the Clark Fork Recovery Unit. They appear in the Implementation Schedule that follows this section and are identified by three numerals separated by periods.

The Clark Fork Recovery Unit chapter should be updated as recovery tasks are accomplished or revised as environmental conditions change and as monitoring results or additional information become available. The Clark Fork Recovery Unit Teams should meet annually to review annual monitoring reports and summaries and to make recommendations to the U.S. Fish and Wildlife Service.

UPPER CLARK FORK RECOVERY SUBUNIT

- 1 Protect, restore, and maintain suitable habitat conditions for bull trout.
 - 1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

- 1.1.1 Reduce general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery. Implement Watershed Improvement Needs activities throughout the Bitterroot River watershed and sediment source reduction activities identified by comprehensive U.S. Forest Service survey(s) elsewhere. Priority watersheds include **Bitterroot River:** Cameron, Camper, Fred Burr, Lolo (Highway 12), Martin, Meadow, Moose, Overwhich, Piquett, and Warm Springs Creeks and the Nez Perce Fork, East Fork, and mainstem Bitterroot Rivers; **Blackfoot River:** Arrastra, Belmont, Dick, Elk, Hogum, McElwain. Moose, Murray, Nevada, Poorman, Rock, Sauerkraut, Seven Up Pete, Warm Springs, and Wilson Creeks; **Clark Fork River:** Boulder, Cedar, Dry, Fish, Flint, Racetrack, Rattlesnake, Tamarack, and Warm Springs Creeks and the St. Regis and mainstem Clark Fork Rivers; **Little Blackfoot River:** Dog, Ontario, and Telegraph Creeks and numerous sites identified in survey; **Rock Creek:** Stony and Upper Willow Creeks and Middle Fork, Ross Fork, West Fork, and mainstem Rock Creek.
- 1.1.2 Upgrade problem roads. Increase maintenance of extensive secondary road systems of the U.S. Forest Service, Plum Creek Timber Company, and State lands by increasing application of best management practices, with emphasis on remediation of sediment-producing hotspots and maintenance of bridges, culverts, and crossings in drainages supporting bull trout spawning and rearing. Decommission surplus forest roads, especially those that are chronic sources of sediment and/or those located in areas of highly erodible geological formations. Remove culverts and/or bridges on closed roads that are no longer maintained. Paving or graveling portions of major roads that encroach on riparian zones to reduce sediment delivery may be appropriate, but such resurfacing must be considered on a case-by-case basis along with other factors, such as the impacts of easier accessibility for anglers. Priority watersheds include

Bitterroot River: Nez Perce Fork Road (improve), Meadow and Moose Creek roads in the East Fork, roads along the mainstem and Slate Creek in the West Fork Bitterroot River, and Skalkaho Highway; **Blackfoot River:** Poorman Creek (pave portions of Stemple Pass Road to reduce sediment delivery to the creek) and South Fork Poorman Creek (reroute a portion of the county road up the creek to the hillside to eliminate one culvert and three fords within a 0.4-kilometer [0.25-mile] stream reach); **Clark Fork River:** Fish Creek Road, State Highway 1 along Flint Creek, I-90 corridor, Upper Warm Springs Creek Road, Foster Creek, Storm Lake Road, and South Boulder Creek Road; **Rock Creek:** Skalkaho Highway (State Highway 38) along the West Fork, mainstem Rock Creek Road (needs management plan), Copper Creek, and Upper Willow Creek.

1.1.3 Clean up mine waste. Control mining runoff by removing or stabilizing mine tailings and waste rock deposited in the stream channel and floodplains and by restoring stream channel function. Priority watersheds include **Bitterroot River:** Hughes Creek in the West Fork Bitterroot, Stansbury Vermiculite Mine; **Blackfoot River:** Beartrap, Day Gulch, Douglas, Elk, Jefferson, Poorman, Sandbar (tributary to Willow), Sauerkraut, Seven Up Pete, Washington, Washoe, West Fork Ashby, and Willow Creeks and the mainstem Blackfoot River (downstream of the Mike Horse Dam that partially washed out in 1975); **Clark Fork River:** Dunkleberg (Forest Rose), Douglas (Wasa), Boulder (Nonpariel site), Cedar, Ninemile, Quartz, and Trout Creeks and the St. Regis River; **Little Blackfoot River:** Charter Oak, Golden Anchor, Ontario, and numerous other mine sites; **Rock Creek:** Frog Pond basin and sites in Middle Fork Rock Creek and Stony Creek drainages.

1.1.4 Implement Atlantic Richfield Corporation mitigation. Implement mitigation activities resulting from the Atlantic Richfield

Corporation settlement for heavy metals contamination of at least 562 kilometers (349 miles) of streams and 5,000 hectares (13,000 acres) of the Clark Fork River floodplain between Warm Springs Creek and Milltown Reservoir from past mining and ore-processing activities in the Butte and Anaconda areas. Impacts to surface water, streambed sediments, benthic macroinvertebrates, trout populations, riparian wildlife, and vegetation have been documented in the Clark Fork and Blackfoot River watersheds, and a mitigation plan is being developed through an advisory board process.

- 1.1.5 Monitor McDonald Gold Mine. Monitor the application status of the former McDonald Gold Mine near Lincoln and, if mine operations move forward, implement mitigation actions to reduce the potential negative effects on water quality and quantity.
- 1.1.6 Restore fish passage at Milltown Dam. Monitor and participate (representing bull trout concerns) in Superfund processes designed to decide the fate of Milltown Dam and the heavy metal deposits stored behind it. Fully restoring fish passage and eliminating the threat of toxic sediment discharge during runoff events are important elements for reducing fragmentation and supporting bull trout recovery.
- 1.1.7 Assess and mitigate nonpoint thermal pollution. Assess and attempt to mitigate effects on bull trout from thermal increases (nonpoint sources) that negatively impact receiving waters and migratory corridors downstream. Priority watersheds include **Bitterroot River:** Blodgett, Fred Burr, Kootenai, Roaring Lion, Lolo, Sawtooth, Skalkaho, Sleeping Child, and Tin Cup Creeks and the mainstem and East Forks of the Bitterroot River; **Blackfoot River:** Cottonwood (near Helmville), Douglas, Elk, Nevada, Nevada Spring, Union, and Willow (near Sauerkraut) Creeks and the Clearwater River; **Clark Fork River:** Fish, Flint,

Ninemile, Petty Creeks and the entire mainstem of the Clark Fork River; **Little Blackfoot River:** throughout the drainage; **Rock Creek:** Upper Willow Creek.

- 1.1.8 Reduce nutrient input. Reduce nutrient delivery throughout the Bitterroot and Clark Fork River watersheds by improving sewage disposal, agricultural practices, and silvicultural practices.
 - 1.1.9 Implement water quality regulations. Enforce water quality standards and implement a total maximum daily load program.
 - 1.1.10 Minimize recreational development in bull trout spawning and rearing habitat. Minimize impacts from expansion or development of new golf courses, ski areas, campgrounds, fishing access sites, and second home or other recreational developments in the corridors of bull trout spawning and rearing streams.
- 1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.
- 1.2.1 Eliminate entrainment in diversions. Screen both water diversions and irrigation ditches to reduce entrainment losses or eliminate unneeded diversions. Priority watersheds include **Bitterroot River:** Bass, Blodgett, Burnt Fork, Chaffin, Fred Burr, Hughes, Kootenai, Lolo, Mill, Roaring Lion, Sawtooth, Skalkaho, Sleeping Child, Sweathouse, Tin Cup, and Tolan Creeks and the East Fork, Nez Perce Fork, and West Fork Bitterroot Rivers; **Blackfoot River:** Poorman Creek and mainstem Blackfoot River between Landers Fork and Poorman Creeks and between Lincoln and Nevada Creeks; **Clark Fork River:** Twin Lakes Creek in the Warm Springs Creek drainage, Flint Creek watershed, the mainstem Clark Fork River (five Missoula Valley diversions); **Little Blackfoot River:** Dog Creek and other creeks not yet evaluated; **Rock Creek:** East Fork Rock

Creek (Flint Creek Diversion), Ross Fork Rock Creek (diversions), and Upper Willow Creek (diversions).

- 1.2.2 Provide fish passage around diversions. Install appropriate fish passage structures around diversions and/or remove related migration barriers to facilitate bull trout movement. Priority watersheds include **Bitterroot River:** Burnt Fork, Fred Burr, Lolo, Skalkaho (Republican Ditch and others), Sleeping Child, and Warm Springs (Highway 93 crossing) Creeks; **Clark Fork River:** Dry and Lower Willow Creeks in Flint Creek drainage and Rattlesnake, Storm Lake, and Twin Lakes Creeks in Warm Springs Creek drainage; **Little Blackfoot River:** throughout drainage (survey is needed).
- 1.2.3 Eliminate culvert barriers. Monitor road crossings for blockages to upstream passage and, where beneficial to native fish, replace or improve existing culverts that impede passage. Priority watersheds include **Bitterroot River:** Bugle, Hughes, Lolo, Moose, Upper Mine, and Warm Springs Creeks and the upper West Fork and Nez Perce Fork of the Bitterroot River; **Blackfoot River:** Arrastra (Section 24), Cotter (tributary to Copper Creek), Cottonwood, Hogum, Moose, Poorman, Sauerkraut, and Spring Creeks; **Clark Fork River:** Fish Creek, Tamarack Creek, and St. Regis River; **Little Blackfoot River:** Hat Creek; **Rock Creek:** Skalkaho Highway crossings on West Fork Rock Creek (Duncie Creek, Fuse Creek, and others).
- 1.2.4 Restore connectivity over other manmade barriers. Investigate manmade barriers that were installed to eliminate upstream fish movement through Rainy, Alva, and Inez Lakes in the Clearwater River drainage, in Harvey Creek (Upper Clark Fork River), and in any other streams. Assess advisability and feasibility of restoring passage.

- 1.2.5 Improve instream flows. Restore connectivity and opportunities for migration by securing or improving instream flows and/or acquiring water rights. Priority streams identified to date (see also Montana Fish, Wildlife and Parks dewatered streams list) include **Bitterroot River:** Bass, Big, Blodgett, Chaffin, Fred Burr, Kootenai, Lolo, Lost Horse, Mill, North Bear, O'Brien, Roaring Lion, Rock, Sawtooth, Skalkaho, Sleeping Child, South Bear, South Fork Lolo, Sweathouse, Sweeney, Tin Cup, Tolan, and Warm Springs Creeks and the East Fork, Burnt Fork, and mainstem of the Bitterroot River from Corvallis to Stevensville; **Blackfoot River:** Cottonwood (stream miles 9 to 11) and Poorman Creeks and the mainstem Blackfoot River between Landers Fork and Poorman Creek; **Clark Fork River:** Cedar, Dry, Grant, Petty, and Twin Lakes Creeks and the Flint Creek drainage (including Douglas and Lower Willow Creeks); **Rock Creek:** Beaver Creek (tributary to Upper Willow).
- 1.2.6 Consider fish salvage, as needed. Consider implementing fish salvage programs, as needed, as an interim measure to address stranding while long-term solutions are developed (*e.g.*, Blackfoot River between Landers Fork and Poorman Creeks, East Fork Rock Creek at Flint Creek diversion).
- 1.2.7 Consider passage around natural barriers. Evaluate and make recommendations concerning potential benefits of fish passage around, or establishment of resident bull trout populations upstream of, natural barriers as a way to conserve genetic diversity in existing bull trout populations in the following areas: **Bitterroot River:** Bass, Daly, North Lost Horse, Overwhich, and Sweathouse Creeks upstream of falls; **Blackfoot River:** Arrastra Creek (section 24), Landers Fork (Silver King Falls), and North Fork Blackfoot River above North Fork Falls.

- 1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.
- 1.3.1 Conduct watershed problem assessments. Identify site-specific threats (problem assessment) that may be limiting bull trout in watersheds that have not already been evaluated, including the Bitterroot River, Little Blackfoot River, middle portions of the Clark Fork River, and Rock Creek drainages.
- 1.3.2 Prioritize actions on waters with restoration potential. As recovery progresses, identify highest-priority actions—ones that will contribute most to recovery—on streams in the Bitterroot River drainage where bull trout occurrence is incidental (or on contributing waters with no bull trout). Areas include Bass, Bear, Big, Cameron, Camp, Chaffin, Gird, Hayes, Lost Horse, Miller, One Horse, Patte, Rye, St. Clair, Sweeney, and Willow Creeks and the West Fork Bitterroot River downstream of Painted Rocks.
- 1.3.3 Revegetate denuded riparian areas. Revegetate to restore shade and canopy, riparian cover, and native vegetation. Priority watersheds include **Bitterroot River:** Blodgett, Fred Burr, Hughes, Meadow, Mill, Skalkaho, Sleeping Child, and Sweathouse Creeks and the East Fork, West Fork, Burnt Fork, and mainstem of the Bitterroot River; **Blackfoot River:** the mainstem Blackfoot River between the North Fork Blackfoot River and Arrastra Creek, Dunham Creek, Landers Fork, Nevada Creek, and other sites throughout the drainage; **Clark Fork:** Cedar, Dry, Fish, Ninemile, South Fork Lower Willow, and Petty Creeks and the St. Regis and mainstem Clark Fork Rivers; **Little Blackfoot River:** throughout the drainage; **Rock Creek:** the East Fork, Middle Fork, and Ross Fork of Rock Creek.
- 1.3.4 Improve grazing practices. Reduce negative effects of grazing by improving management practices and/or fencing riparian areas.

Priority watersheds include **Bitterroot River:** Bugle, Camp (west fork), Fred Burr, Gird, Lolo, Meadow, Mill, Skalkaho, Sleeping Child, and Tolan Creeks and the Burnt Fork, East Fork, and mainstem Bitterroot River; **Blackfoot River:** the mainstem Blackfoot River (from Lincoln to mouth) and Beaver, Blanchard, Belmont, Cottonwood, Dick, Douglas, Elk, Frazier, Hogum, Humbug, Keep Cool, Kleinschmidt, McElwain, Monture, Murray, Nevada, Nevada Spring, Poorman, Rock, Sauerkraut, Shanley, Warren, Wasson, Willow, and Yourname Creeks; **Clark Fork River:** Cedar, Petty, Racetrack, Tamarack, and Twin (St. Regis River drainage) Creeks and other sites (largely private lands) throughout the upper Clark Fork River drainage; **Little Blackfoot River:** Dog, Elliston, and Hat Creeks and the mainstem Little Blackfoot River; **Rock Creek:** the entire upper drainage, especially the upper mainstem Rock Creek, Middle Fork Rock Creek, Meadow Creek, Beaver Creek, Ross Fork, Sand Basin, Stoney Creek, and U.S. Forest Service allotments on Upper Willow Creek.

- 1.3.5 Restore stream channels. Conduct stream channel restoration activities where such activities are likely to benefit native fish and only where similar results cannot be achieved by other, less costly and less intrusive means. Priority watersheds include **Bitterroot River:** Blodgett, Burnt Fork, Fred Burr, Hughes, Lolo, Mill, O'Brien, Overwhich, Skalkaho, Sleeping Child, and Sweathouse Creeks and the East Fork (Highway 93 reconstruction) and Nez Perce Fork Bitterroot Rivers; **Blackfoot River:** Cottonwood, Dunham, Kleinschmidt, Landers Fork, Moose, Rock, Sauerkraut, and Warren Creeks; **Clark Fork River:** South Fork Lower Willow Creek in the Flint Creek drainage; **Rock Creek:** Stony Creek (Moose Gulch, Shively Gulch), Upper Willow Creek (Shylo Gulch, Miners Gulch), and the East Fork and West Fork of Rock Creek (Coal Gulch).

- 1.3.6 Improve instream habitat. Increase or improve instream habitat by restoring recruitment of large woody debris, restoring pool development, or by initiating other appropriate activities, wherever the need is identified. Priority watersheds include **Blackfoot River:** Chamberlain and Gold Creeks, the mainstem Blackfoot River upstream of Lincoln, and the Landers Fork; **Bitterroot River:** Burnt Fork, Lolo, and Moose Creeks and the East Fork Bitterroot River downstream of Camp Creek; **Clark Fork River:** Ninemile Creek; **Little Blackfoot River:** portions of the Little Blackfoot River that have been channelized by railroad and highway development.
- 1.3.7 Minimize potential stream channel degradation. Ensure that negative effects on bull trout of ongoing flood control activities are minimized (*e.g.*, dredging, channel clearing, and bank stabilization on the Clark Fork, Blackfoot, and Bitterroot Rivers).
- 1.3.8 Manage beaver to function naturally in maintaining wetlands. Manage beaver populations to maintain wetland complexes that provide important biological filters (*e.g.*, Mike Renig Gulch in the Little Blackfoot River drainage).
- 1.3.9 Reduce riparian firewood harvest. Implement campaigns, such as with signs, to improve public awareness or implement regulatory actions to eliminate firewood cutting in riparian areas, especially in the Rock Creek and Skalkaho Creek drainages.
- 1.3.10 Reduce impacts from campsite use. Identify and mitigate impacts from concentrated use of campsites on the Burnt Fork and Skalkaho Creeks in the Bitterroot River drainage; on the North Fork and mainstem Blackfoot Rivers and Monture, Copper, and Gold Creeks; on Middle Fork and mainstem Rock Creeks; and on Racetrack Creek in the upper Clark Fork River drainage.

1.3.11 Mitigate for transportation corridor encroachment on streams. Mitigate for impacts from the legacy effects of highway and railroad encroachment, channel straightening, channel relocation, and undersized bridges on the Bitterroot River (U.S. 93), Blackfoot River (Montana 200), Clark Fork River (I-90), Lolo Creek (U.S. 12), and St. Regis River (I-90).

1.3.12 Reduce impacts to Foster Creek. Identify and mitigate potential impacts (from sediment, water use, use of riparian areas) of the Anaconda Job Corps Center development on Foster Creek in the Warm Springs Creek drainage of the upper Clark Fork River drainage.

1.4 Operate dams to minimize negative effects on bull trout.

1.4.1 Reduce reservoir operational impacts. Review reservoir operational concerns (*e.g.*, water level manipulation, minimum pool elevation) and provide operating recommendations for East Fork Reservoir (East Fork Rock Creek), Georgetown Lake (Flint Creek), Nevada Reservoir (Nevada Creek in Blackfoot River drainage), and Painted Rocks Reservoir (West Fork Bitterroot River).

1.4.2 Provide instream flow downstream of dams. Maintain or exceed established instream flows downstream of Painted Rocks Reservoir (West Fork Bitterroot River), East Fork Reservoir (East Fork Rock Creek), and Georgetown Lake (Flint Creek). Establish instream flows from high-elevation reservoirs in the Bitterroot National Forest on Bass, Big, Blodgett, Burnt Fork, Fred Burr, and Tin Cup Creeks.

1.4.3 Operate Milltown Dam to minimize impact on native fish. If the dam is not removed, operate to minimize potential for downstream discharge of heavy metal deposits in Milltown

Reservoir. Operate the dam to minimize northern pike reproduction and maximize survival and downstream passage of bull trout juveniles and adults. Restore upstream fish passage.

1.4.4 Evaluate fish passage at Painted Rocks Dam. Evaluate advisability and need for upstream fish passage at Painted Rocks Dam (West Fork Bitterroot River).

1.5 Identify upland conditions that negatively affect bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 Mitigate for legacy effects of mining-related timber management practices. Continue to mitigate for legacy effects of mining-related timber harvest and for other impairment from poor silvicultural practices in the last century in the following areas: **Blackfoot River:** Bear, Belmont, Chamberlain, Deer, Keno, Marcum, McElwain, and Richmond Creeks and the North Fork Blackfoot and West Fork Clearwater Rivers; **Clark Fork River:** Fish, Rattlesnake, and Trout Creeks and the St. Regis River.

1.5.2 Monitor fire effects and mitigate effects where necessary. Monitor effects from wild fires and pursue habitat restoration actions where warranted, especially in the upper portions of the Bitterroot River drainage (where there were fires in 2000).

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and evaluate enforcement of public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

- 2.1.1 Review fish stocking programs. Review annual fish stocking programs to minimize potential conflict with this bull trout recovery plan.
- 2.1.2 Regulate private fish ponds. Reduce the risk of inadvertent introduction of nonnative fish from private fish ponds by closely regulating existing permits to ensure that only permitted species are stocked and that fish barriers are maintained and by attaching conditions to future permits.
- 2.1.3 Encourage development of commercial sources of westslope cutthroat trout. Develop and maintain an approved and available source of genetically diverse native westslope cutthroat trout for private pond stocking. Follow stocking guidelines developed by the Montana Westslope Cutthroat Trout Technical Committee.
- 2.2 *Evaluate policies for preventing illegal transport and introduction of nonnative fishes.*
- 2.3 Inform the public about ecosystem concerns of illegal introductions of nonnative fishes.
 - 2.3.1 Discourage unauthorized fish introductions. Implement educational efforts about the problems and consequences of unauthorized fish introductions.
 - 2.3.2 Develop bull trout education program. Develop a public information program with a broad emphasis on bull trout ecology and life history requirements and with a more specific focus on regionally or locally important recovery issues.
- 2.4 *Evaluate biological, economic, and social effects of control of nonnative fishes.*

- 2.5 Implement control of nonnative fishes where found to be feasible and appropriate.
- 2.5.1 Experimentally remove established brook trout populations. Evaluate opportunities for experimentally removing brook trout from selected streams and lakes. Priority watersheds include **Bitterroot River:** Blodgett, Boulder, Fred Burr, Hughes, Kootenai, Lolo, Martin, Meadow, Mill, O'Brien, Overwhich, Piquett, Roaring Lion, Sawtooth, Skalkaho, Slate, Sleeping Child, Springer, Tin Cup, Trapper, and Warm Springs Creeks and the East Fork, Burnt Fork, and Nez Perce Fork Bitterroot Rivers; **Blackfoot River:** Cottonwood, Hogum, Nevada (upstream of Shingle Mill), Poorman, Sauerkraut, and South Fork Poorman Creeks and the North Fork Blackfoot River upstream of the falls; **Clark Fork River:** Lower Twin Lake and Storm Lake Creek in the Warm Springs Creek drainage; **Little Blackfoot River:** Bison, Hat, Elliston, and Ontario Creeks; **Rock Creek:** East Fork Reservoir and upstream waters.
- 2.5.2 Suppress northern pike in Clearwater Lakes chain. Continue assessment of predator–prey interactions in Clearwater Chain of Lakes, with emphasis on the northern pike threat and suppression of those populations.
- 2.5.3 Reduce brown trout numbers in portions of mainstem rivers. Continue to encourage harvest of brown trout in the mainstem Blackfoot, Clark Fork, and Bitterroot Rivers and in Rock Creek by maintaining liberal angling regulations.
- 2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.
- 2.6.1 Evaluate bull trout–brown trout interaction. Evaluate the interaction between bull trout and brown trout populations in the

Blackfoot River drainage, including the potential threat of brown trout redds superimposed on bull trout redds.

- 3 Establish fisheries management goals and objectives compatible with bull trout recovery and implement practices to achieve goals.
 - 3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.
 - 3.1.1 Implement adaptive management of native fish management plans. Develop and implement native fish management plans that emphasize integration of research results into management programs.
 - 3.1.2 Aggressively protect remaining native species complexes. Protect integrity of all intact native species assemblages, such as in Harvey Creek (upper Clark Fork River), Belmont and Copper Creeks, and the Landers Fork of the Blackfoot River, by aggressively removing any nonnative invaders.
 - 3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.
 - 3.2.1 Minimize unintentional mortality of bull trout. Continue to develop and implement sport angling regulations and fisheries management plans, guidelines, and policies that minimize incidental mortality of bull trout in all waters, especially the most heavily fished reaches of Rock Creek and the Bitterroot, Blackfoot, upper Clark Fork, and Clearwater Rivers.
 - 3.2.2 Evaluate enforcement of angling regulations and oversee scientific research. Ensure compliance with angling regulations and scientific collection policies and target bull trout spawning and staging areas for enforcement.

- 3.2.3 Implement angler education efforts. Inform anglers about special regulations and about how to identify bull trout and reduce hooking mortality of bull trout caught incidentally, especially in the most heavily fished migratory habitat of mainstem rivers.
- 3.2.4 Solicit information from commercial guides. Develop a reporting system to collect information on bull trout caught and released by commercial fishing guides on the Bitterroot River, Blackfoot River, and Rock Creek.
- 3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.
 - 3.3.1 Evaluate site-specific conflicts with introduced sport fish. Determine site-specific level of predation, competition, and hybridization of bull trout with introduced sport fish and assess effects of those interactions, especially with brook trout, brown trout, and northern pike in the Blackfoot, Bitterroot, and Clark Fork Rivers.
- 3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.
 - 3.4.1 Evaluate effects of existing and proposed angling regulations on bull trout in heavily fished waters. Rapidly increasing angler pressure has led to increasing concerns about angling regulations, species complexes, unintentional mortality, and other angler-related issues affecting bull trout on the most heavily fished waters of Rock Creek and the Blackfoot, Bitterroot, and Clark Fork Rivers. An investigation of these issues should be made, and recommendations on how to reduce impacts to bull trout recovery should be developed and adaptively implemented.

- 4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
 - 4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.
 - 4.1.1 Conduct genetic inventory. Continue coordinated genetic inventory throughout recovery subunit, with emphasis on upper Clark Fork and Clearwater River drainages, to contribute to establishing a program to understand the genetic baseline and to monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).
 - 4.2 *Maintain existing opportunities for gene flow among bull trout populations.*
 - 4.3 *Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.*
- 5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.
 - 5.1 *Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.*
 - 5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.
 - 5.2.1 Identify suitable unoccupied habitat. Identify suitable bull trout habitat that is unoccupied, if any. Within five years, complete a comprehensive list of all known passage barriers that prevent upstream-migrating bull trout from accessing suitable habitat.

- 5.2.2 Investigate bull trout movement and distribution. Investigate movement, distribution, and status of bull trout in the Bitterroot, middle Clark Fork, Clearwater, Little Blackfoot, and St. Regis River drainages and make recovery recommendations.
- 5.2.3 Evaluate importance of contributing waters. Evaluate the importance and contribution to bull trout recovery of streams with only incidental bull trout presence.
- 5.2.4 Map spawning habitat. Develop a comprehensive map of primary bull trout spawning reaches in tributaries for the purpose of focusing protection and recovery efforts.
- 5.2.5 Coordinate monitoring of fish movement. Develop a coordinated fish marking and tracking strategy (*e.g.*, standardized PIT tags and radio implant frequencies) throughout the Clark Fork River basin so that marked fish are recognized and reported when captured in other States or different project jurisdictions (*e.g.*, Lake Pend Oreille, Avista, Milltown).
- 5.2.6 Evaluate water temperature as a limiting factor. Evaluate water temperature as a limiting factor and/or migration barrier in the mainstem of the Bitterroot, Blackfoot, Clearwater, and Clark Fork Rivers.
- 5.3 Evaluate the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery.
 - 5.3.1 Develop and implement best management practices for managing water diversions. Establish best management practices for constructing, maintaining, and operating water diversion structures.

- 5.3.2 Implement best management practices for grazing in riparian zones. Establish best management practices for grazing management and establish a monitoring program in riparian zones.
- 5.3.3 Expand monitoring of forestry best management practices. Continue and expand monitoring of compliance and effectiveness of Montana Forestry best management practices and recommend adjustments to best management practices to correct any documented deficiencies.
- 5.3.4 Protect groundwater inflow sources. Inventory and protect important stream reaches with groundwater inflow.
- 5.4 Evaluate effects of diseases and parasites on bull trout and develop and implement strategies to minimize negative effects.
 - 5.4.1 Monitor fish health in private hatcheries. Closely regulate fish health in private hatcheries that supply fish for private ponds (State and Federal hatcheries are already closely monitored).
 - 5.4.2 Prevent spread of fish pathogens. Survey and evaluate fish health before implementing major fish passage projects.
 - 5.4.3 Evaluate effects of whirling disease on bull trout. Continue experimental evaluation (and limited field survey) of the potential effects of whirling disease on bull trout.
- 5.5 *Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.*
- 5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

- 5.6.1 Investigate status of migratory and resident life history forms.
Investigate the genetic and/or behavioral basis of resident and migratory bull trout in the Bitterroot River basin.
 - 5.6.2 Research origin of migratory bull trout at Milltown Dam.
Continue to investigate life history and spawning habitat of bull trout congregating below Milltown Dam.
- 6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
- 6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.
 - 6.1.1 Support watershed group restoration efforts. Support collaborative efforts by local watershed groups already established in Montana, such as the Bitterroot Water Forum, Blackfoot Challenge, Trout Unlimited Chapters, and Clark Fork Coalition, to accomplish site-specific protection and restoration activities consistent with this recovery plan.
 - 6.1.2 Protect habitat. Provide long-term habitat protection through purchase, conservation easements, watershed restoration, management plans, land exchanges, and other methods. Opportunities have been identified on the Blackfoot River and the Little Blackfoot River upstream of Hwy. 12 crossing; Hughes Creek in the West Fork Bitterroot River drainage; and Fish Creek, the mainstem Clark Fork River, and Rock Creek.
 - 6.1.3 Integrate watershed restoration efforts on public and private lands. Integrate watershed analyses and restoration activities on public lands in the headwaters and on private lands lower in the watersheds to ensure activities are complementary for bull trout

restoration (*e.g.*, Bitterroot River, Dunham Creek, Fish Creek, Landers Fork of the Blackfoot River, Rattlesnake Creek, Rock Creek, and Warm Springs Creek).

6.1.4 Develop strategy for implementation participation. Develop participation plans to support implementation or recovery actions in the Upper Clark Fork Recovery Subunit.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.2.3 Complete Federal Energy Regulatory Commission licensing of Milltown Dam. Complete Federal Energy Regulatory Commission licensing or decommissioning of Milltown Dam (beyond current license expiration date of December 31, 2006) and implement mitigation plan and/or dam removal.

6.2.4 Implement Plum Creek Habitat Conservation Plan. Carry out compliance monitoring and U.S. Fish and Wildlife Service commitment to adaptive management planning under the Plum Creek Native Fish Habitat Conservation Plan, primarily applicable to waters of the Blackfoot River and upper Clark Fork River watersheds.

6.3 Evaluate enforcement of existing Federal and State habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

6.3.1 Fully implement State habitat protection laws. Fully implement the Montana Streamside Management Zone Law (1993), Montana Stream Protection Act (1965), and Montana Natural Streambed and Land Preservation Act (1975) to maximize legal protection of bull trout habitat under State law and evaluate the effectiveness of these laws in conserving bull trout habitat.

6.3.2 Encourage floodplain protection. Encourage local governments to develop, implement, and promote restrictive regulations for floodplains to mitigate extensive habitat loss and stream encroachment from rural residential development throughout the Bitterroot, Blackfoot, and upper Clark Fork River drainages because these and other effects of development exacerbate temperature problems, increase nutrient loads, decrease bank stability, alter instream and riparian habitat, and change hydrologic response of affected watersheds.

7 *Assess the implementation of bull trout recovery by recovery units and revise recovery unit plans based on evaluations.*

LOWER CLARK FORK RECOVERY SUBUNIT

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery. Priority watersheds include **Idaho:** Gold, Granite, Grouse, Lightning, North Gold, and Trestle Creeks and the Middle Fork East River and Pack River; **Montana:** Elk, Fish Trap (Thompson River tributary), Marten, Pilgrim, Prospect, Rock, Snake Swamp, West Fork Elk (Bull River tributary) Creeks and the Bull, South Fork Bull, South Fork Jocko, Thompson, Vermilion, and West Fork Thompson Rivers.

1.1.2 Upgrade problem roads. Increase maintenance of extensive secondary road systems—U.S. Forest Service, Plum Creek Timber Company, and State lands—by increased application of best management practices, with emphasis on remediating sediment-producing hotspots and on maintaining bridges,

APPENDIX L

**RESTORATION EFFECTIVENESS MONITORING
PROTOCOL FOR THE BLACKFOOT WATERSHED**

RESTORATION EFFECTIVENESS MONITORING PROTOCOL FOR THE BLACKFOOT WATERSHED

1.0 INTRODUCTION

The Blackfoot River watershed has been the focus of extensive stream restoration activities over the past several years, with the scope of restoration activities increasing in recent years. Restoration activities undertaken by various entities, including but not limited to, Montana Department of Fish Wildlife and Parks (FWP), the Blackfoot Challenge, and the Big Blackfoot Chapter of Trout Unlimited (BBCTU) have focused on fisheries restoration, water conservation, and mitigation of impaired streams as identified on the State of Montana 303(d) list. Due to the increasing scope of restoration activities in the watershed, and specific needs tied to certain restoration project funding sources, the restoration partners have identified a growing need for an established restoration monitoring program and protocol designed to document the effectiveness of restoration activities in the watershed in terms of immediate and long-term attainment of restoration goals.

This document presents a conceptual plan for restoration effectiveness monitoring in the Blackfoot Watershed. The purpose of this Restoration Effectiveness Monitoring Plan is to provide a common reference for restoration planners to determine appropriate monitoring parameters/activities and protocol to utilize on a given restoration project. Specific objectives of this document include:

- Promoting inclusion of appropriate pre- and post-restoration monitoring in ALL stream and riparian area restoration projects within the watershed;
- Establishing monitoring protocol and procedures to be employed for restoration monitoring to ensure consistency in data collection efforts between projects and between various organizations/agencies involved with stream and riparian area restoration; and
- Providing a tool for use in the planning and design phase of restoration projects throughout the watershed.

Attainment of these objectives will not only assist project planners in the design and implementation of appropriate restoration effectiveness monitoring on their projects, but should also result in a greater degree of consistency in the scope of monitoring, and monitoring methodologies employed, both from project to project and through time. This in turn will lead to development of a comprehensive database of restoration-related data and information collected under consistent methods, thus facilitating informational sharing among projects and, potentially, reduced monitoring costs in the long-term.

This Restoration Effectiveness Monitoring Plan is intended to serve as a guide to restoration project monitoring. The plan outlines various monitoring activities that should be considered for inclusion on restoration projects, depending on the restoration project objectives and/or

impairment conditions associated with the project. The specific scope of monitoring to be applied for a given project should be determined by the individuals and agencies involved in the project, with the scope of monitoring dependent on specific project needs as well as possible budget constraints. However, it is hoped that through consultation of this plan, all restoration projects will be monitored to the extent necessary to allow determination of the effectiveness of the restoration action, with a level of consistency in monitoring methodology so that data may be used by other restoration and land use planners in the watershed.

This document is designed to be a quick reference for restoration planners evaluating potential monitoring needs for their projects. Section 2 outlines monitoring parameters/activities, such as stream substrate characterization or water temperature monitoring, that may be applicable to restoration projects based on project objectives and goals, and stream impairment conditions. Section 3 summarizes actual protocol, or methodologies, to be employed for specific parameter measurement (i.e., streamflow measurement by USGS protocol).

2.0 RESTORATION EFFECTIVENESS MONITORING METRICS

Appropriate measures of restoration effectiveness will vary depending on the particular goals and objectives of the restoration project, be they restoration of aquatic habitat, maintenance of in-stream flow, or irrigation efficiency improvements. The various types of metrics used to assess the status of a water body generally include biological, physical, and chemical measurements. Table 2-1 shows suggested metrics to be used for restoration projects depending on the restoration goals and/or the particular water body impairment.

Biological metrics are particularly appropriate for many types of restoration effectiveness monitoring, due to their capacity to provide information on overall stream health by integrating the effects of many potential sources of impairment. For example, fish populations and macroinvertebrate community structure and abundance both will respond favorably to improvements in aquatic habitat and riparian conditions, as well as reductions in loads of specific pollutants such as nutrients or metals. Measurements of pollutant concentrations through water quality sampling should, if possible, be supplemented by one or more biological metrics to provide a more comprehensive representation of stream status and response to restoration activities. Note that biological metrics are typically more labor-intensive and expensive to conduct than water quality sampling; therefore, careful planning is important for conducting biological surveys.

As shown in Table 2-1, each restoration project category has multiple monitoring metrics identified as potentially applicable with some categories, such as “Excess Siltation in Stream Substrate”, showing the majority of metrics as applicable. This does not mean that all of the identified monitoring metrics need be, or should be, included. Instead, a suitable suite of parameters should be selected by project planners based on the specific project scope and needs, as well as availability of funding. It should also be noted that the list of monitoring metrics in Table 2-1 is by no means exhaustive. For instance, the methods included for quantifying stream substrate composition (percent fine content measurements and McNeil core sampling), represent only two of numerous methods available for stream substrate characterization. Other common methods, such as Wohlman Pebble Counts and Riffle Stability Index, may be equally as applicable. However, the list of metrics included in this document are intended to provide a reasonable spectrum of measurement options, from relatively simple semi-qualitative methods to more intensive methods, to fit most project needs and budgets. The number of methods has intentionally been kept short in order to promote consistency in the data collection methodology throughout the watershed. Specific monitoring protocols are summarized in Section 3.

TABLE 2-1. RESTORATION EFFECTIVENESS MONITORING METRICS APPLICABLE TO VARIOUS RESTORATION OBJECTIVES/IMPAIRMENT SOURCES

METRICS	RESTORATION PROJECT OBJECTIVES/IMPAIRMENT CAUSES							
	In-Stream Flow Maintenance	Habitat Restoration	Reduce Substrate Siltation	Reduce Thermal Modification	Reduce Ag Runoff	Riparian Area Restoration	Reduce Elevated Metals	Reduce Elevated Nutrients
BIOLOGICAL METRICS								
Fish Population Surveys	X	X	X	X	X	X		
Redd Counts	X	X	X	X	X	X		
Macroinvertebrate Sampling	X	X	X	X	X	X	X	X
Periphyton Sampling	X	X	X	X	X			X
Chlorophyll-a					X			X
PHYSICAL PARAMETERS								
Habitat Assessments	X	X				X		
Riparian Assessment		X	X	X	X	X		
Water Temperature	X	X	X	X	X	X		
Flow Monitoring	X			X			X	X
Photo Points	X	X	X	X	X	X	X	X
WATER CHEMISTRY								
TSS Samples			X		X		X	X
Nutrient Sampling					X			X
Metals Sampling							X	
STREAM SUBSTRATE COMPOSITION								
McNeil Core Samples		X	X			X		
Percent Fine Sediment Content		X	X			X		

X – Metrics marked in bold should be given primary consideration for monitoring

TSS- Total Suspended Sediment

3.0 RESTORATION MONITORING PROTOCOL

The following monitoring protocols represent methodologies and practices generally accepted and commonly used for biological, physical and chemical characterization of aquatic and riparian systems. These protocols have been compiled by the Blackfoot Challenge, with input from various restoration partners. For instance, the Department of Fish, Wildlife and Parks provided methodologies for fish population surveys, redd counts, habitat assessments, and water temperature monitoring. FWP has been the primary entity performing these monitoring activities in the past, and should be consulted when these monitoring activities are being considered for restoration projects.

3.1 BIOLOGICAL MONITORING

3.1.1 Fish Population Surveys

Depending on the survey objectives, fish population surveys take many different forms. Methods generally involve fish collections using traps, seines, electrofishing or other methods. In some cases, population surveys may involve direct observations of fish (eg. Snorkeling) or of spawning activity (redds). Restoration-related fish population surveys often involve electrofishing means. These methods usually involve some quantification of densities or biomass using single-pass, mark-recapture, or multiple pass-depletion methods. Other information typically collected includes age/length structure, species identification

3.1.2 Redd Counts

Counting spawning sites (redds) is a standard method of assessing the numbers of adult spawning fish within a spawning area or for a given population. Redd counts are not considered a useful method for certain spring spawning fish in environments where high water and turbidity confounds the identification of redds. Redd counts work best for fall spawning fish (brown trout and bull trout) or in spring creeks. Counts were made by walking the spawning areas shortly after the spawning period. Redd areas were identified by a cleaned, oval shape (pit), and a mound of unconsolidated gravel (tailspill) left by the females digging activities. Only redds where a definite pit and tailspill were discernable are counted. Redd counts are often made in index reaches where surveys are completed annually in order to assess population trends.

3.1.3 Macroinvertebrate Sampling

In instances where restoration project objectives include fisheries restoration, pre- and post-restoration macroinvertebrate sampling should be considered. Besides serving as an indicator for general water quality and substrate conditions, macroinvertebrate populations represent an integral component of a functioning biological system and will therefore help in determining restoration project success and/or beneficial use support associated with aquatic life. Careful consideration should be given to the need for and utility of macroinvertebrate sampling due to the considerable expense.

Procedure:

When conducting macroinvertebrate sampling, two general methods can be used; the quantitative and qualitative methods. The quantitative sampling method uses a Hess or Surber sampler, and is the preferred sampling method. When sampling by the quantitative method, sampling should include collection of multiple samples (replicates) at each site to allow for statistical analysis of the data. Typically, between 3 and 8 replicate samples are recommended depending on the suspected site variability, level of analysis required, and budgetary constraints. In most cases, 4 replicate samples per site should suffice for evaluating restoration effectiveness. The qualitative method uses a kick net for sample collection. The qualitative method is quicker and generally less expensive than the quantitative method, but yields less reliable results.

Macroinvertebrate sampling should be performed by experienced personnel following MDEQ's Rapid Bioassessment Protocols, Standard Operating Procedures 12.1.3.1 (Quantitative Method) or 12.3.1.2 (Qualitative Method). The MDEQ protocols are available upon request from the Blackfoot Challenge, or at:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/12-1-3.pdf>

If preferred, comparable procedures, such as the EPA Rapid Bioassessment Protocol, can be used provided they are consistent with substantive portions of the MDEQ protocol. When quantitative macroinvertebrate sampling is performed, it should also be performed in a manner consistent with the Status and Trends macroinvertebrate sampling to allow for comparison to the basin-wide Status and Trends data.

Monitoring Sites/Schedule:

Due to the considerable cost associated with macroinvertebrate sample analyses, careful consideration should be afforded to selection of sampling locations and schedules. Ideally, a minimum of two sampling sites should be established within and/or downstream of the restored stream segment. However, if budget constraints dictate, one sampling site properly located within the restored segment may suffice (see MDEQ SOPs for sample site selection). Once established, sampling sites should be photographed, and described using the Rapid Bioassessment Protocol Physical Evaluation Form and Contractor Evaluation Form provided with the MDEQ SOPs.

Macroinvertebrate sampling should occur at least once prior to and once after restoration. Sampling should occur after runoff, preferably in August/September, although samples can be collected later in the year if necessary. Sampling should not be conducted immediately after large storm-related runoff events.

3.1.4 Periphyton/Chlorophyll a Sampling

Periphyton refers to the assemblage of algae living attached to or in close proximity to the stream substrate. These assemblages represent the principle source of primary productivity in most Montana streams. In general, excessive crops of periphyton are indicators of poor

water quality, particularly elevated nutrient concentrations. In addition, species composition, diversity and abundance can be used as a measure of overall stream ecological health, since different species show variable sensitivity to potential impairment causes such as temperature, nutrients, and toxic constituents. Periphyton analyses may include quantification of chlorophyll a, and/or taxonomic identification to varying levels of precision. The methods chosen will depend on the specific project objectives.

Procedure:

MDEQ protocol divides periphyton sampling into three tasks of increasing complexity:

- Field observations;
- Standing crop/chlorophyll a sampling; and
- Community composition and structure sampling.

Field observations include completion of an Aquatic Plant Field Sheet, which records information on general composition, amount, color, and condition of aquatic plants and is equivalent to a Level I Rapid Bioassessment Protocol for plants (similar to the RBP for macroinvertebrates). Semi-quantitative assessments of biomass and taxonomy may also be conducted using a field-based rapid periphyton survey technique, which involves use of a gridded viewing bucket and a biomass scoring system.

Collection of samples for chlorophyll a analysis can include targeted sampling (sampling of heaviest accumulations of attached algae in a sampling transect), or more random sampling and direct extraction of chlorophyll a from streambed rocks. In both cases an estimate of amount of chlorophyll a per unit area of streambed is generated. Finally, collection of samples for laboratory identification of community composition and structure basically involves scraping rock surfaces, lifting algal film from nearshore sediments, and scraping several submerged branches.

Standard Operating Procedures for periphyton and chlorophyll a sampling have been developed by MDEQ, and are available at the following web address (comparable procedures may also be used):

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/12-1-2-0.pdf>

Monitoring Sites/Schedule:

Similar to macroinvertebrate analysis, periphyton analysis (identification of community structure and composition) is a time-consuming, labor-intensive, and thus relatively expensive endeavor. Thus, the objectives of sampling and the potential data uses should be thoroughly assessed prior to collecting samples for periphyton. Ideally, a reference site should be established to evaluate baseline conditions, in addition to 1 or 2 monitoring locations within and/or downstream of the restored stream section. For high-gradient streams, one periphyton sampling site should cover a single riffle, while in low-gradient streams, the sampling site should consist of at least one meander length (about 20 bankful channel widths).

The recommended time for periphyton sampling is summer (late June through September). During this period, stream flow is relatively stable, and most streams exhibit peaks of both periphyton standing crop (biomass) and community diversity. If temporal trends are to be assessed by repeated sampling over a number of years, the time of sampling should remain consistent from year to year to minimize seasonal variance.

3.2 PHYSICAL PARAMETERS

3.2.1 Habitat Assessments

Methods of assessing aquatic habitat vary greatly depending on the scale of the project and the specific survey objectives. An excellent reference for determining scale and objectives is found in *Aquatic Habitat Assessment: common methods* (Bain and Stevenson, 1999). At a restoration project level, habitat survey methods should focus on survey precision and repeatability necessary for post-project evaluation. Habitat surveys almost always involve a longitudinal and areal description of channel bed forms including pools, riffles and channel complexity. Habitat survey methods often involve geomorphic assessments, stream bank condition and riparian health, measurements of flow, water temperature and water quality, substrate compositions and instream wood counts.

3.2.2 Riparian Assessment

Assessment and monitoring of riparian areas is a critical step in assessing riparian system health. Initial stream reach inventories can be used as indicators of problem areas and identification of potential solutions to unstable stream situations. These same assessment techniques can also be used to observe changes over time, especially to gauge progress in restoring health and vigor to riparian systems functioning at levels below their potential.

Vegetation in stream zones is the best terrestrial indicator of stream health and function. Healthy vegetation within the watershed, especially within the riparian corridor, is the best indicator of a proper functioning stream system from a biological and hydrological perspective. Vegetation is also the component of a watershed over which a land manager has the most influence.

Consequently, when riparian vegetation is not in a healthy state, management changes may be warranted. Riparian areas are complex systems and thus present numerous options to the land manager to make positive changes in management, especially when dealing with grazing animals. If management of these areas is part of an unhealthy stream system, management changes must then be part of any solution to enhance riparian health. Downward trends in vegetation health can be reversed relatively quickly with positive changes in management of grazing animals.

Physical and biological processes occurring in riparian areas are sustainable in a healthy stream system. These processes are complex but need to be in balance to maintain a proper functioning, stable system. Inventory, assessment techniques used to gauge the health of these systems therefore need to account for this complexity.

Two riparian assessment techniques are recommended for use in the Blackfoot Watershed, as described below. Both techniques account for the complexity of riparian systems, yet are relatively user friendly to those familiar with inventory techniques, and also provide repeatable, quantifiable data. Whatever process is used for an initial inventory of the riparian system, it should quantify current condition, assess problems, and be repeatable. The first method was developed by the NRCS and is a relatively quick means of assessing riparian conditions. The second method is the USFS Green Line method, which is slightly more complex, yet should be readily implementable on most restoration projects. The appropriate method to use for specific restoration projects should be based on the project scope and budget, and importance of riparian conditions to the project goals and objectives.

The first riparian evaluation recommended for use in the Blackfoot Watershed is the Riparian Assessment procedure and field form developed by the USDA NRCS (USDA, 2004). This evaluation gives the user a good overview of a particular stream reaches status of the ecological and physical processes interacting at a site. This assessment will indicate problem areas within a stream system and yields a numeric rating which can be used to indicate trends through time. This evaluation technique is a relatively quick method for trained observers to utilize and will indicate specific physical or biological problems for more detailed inventory/analysis. The NRCS protocol document and filed forms are available at the following website, or from the Blackfoot Challenge upon request:

<http://www.mt.nrcs.usda.gov/technical/>

The stream reach evaluated should be well identified and documented (e.g. gps points, aerial photography, photo points) so that future evaluators can locate the same site. All pertinent observations should be recorded on the enclosed forms to enable future reference. The more notes/observations recorded during an assessment, the easier it will be for future evaluators to visualize the current conditions.

The second riparian evaluation method recommended for use is Monitoring the Vegetation Resources in Riparian Areas, USDA Forest Service, Technical Report RMRS-GTR-47 (USDA, 2000). Since vegetation is a key component in evaluating riparian health, this method zeroes in on one of the key monitoring tools for streams. This monitoring technique does require some technical knowledge of riparian vegetation, and thus should only be used when a more quantitative analysis of the riparian situation is desired. For example, when a grazing management problem is identified, a more detailed evaluation of the current vegetation condition may be warranted to enhance management changes. This monitoring technique also provides a more quantitative measure of vegetation trends through time. Sites where this technique is employed should again be accurately documented to ensure that assessment reaches can be relocated in the future.

The publication RMRS-GTR-47 is available from the Blackfoot Challenge upon request. The document can also be ordered from the USDA Forest Service Rocky Mountain Research Station at phone number (970) 498-1392, or downloaded from:

<http://www.fs.fed.us/rm>

3.2.3 Water Temperature

Water temperature measures now include programmable miniature temperature loggers. These loggers collect time and temperatures at user-defined intervals. Loggers can be record for several years if needed. Loggers can be downloaded in a manner that provide maximum, min and mean temperature values or as continuous data. Data can be easily manipulated in computer programs like EXCEL or can be statistically manipulated.

3.2.4 Flow Monitoring

Streamflow measurements should be recorded anywhere that restoration goals include maintenance of in-stream flow. In addition, accurate flow measurements are necessary for calculating loads of chemical constituents (e.g., nutrients, metals) within a water body. Streamflow measurements should be collected using one of three general methods, depending on the channel geometry and stream or seep discharge rate:

- Velocity-area method;
- Portable trapezoidal flume; or
- Volumetric method.

The velocity-area method is used to measure streamflow in larger, wadeable streams. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths. Streamflow measurement data should be recorded on specially prepared forms available from the Blackfoot Challenge.

Streamflow measurements on smaller streams or seeps are obtained using a portable flume such as a 90° v-notch cutthroat flume. This flow measurement method is based on equations developed by Skogerboe et al (1967). To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the upstream (H_a) and downstream (H_b) sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow based on the water depth.

Collection of volumetric flow measurements consists of directing the flow into a container of known volume (such as a five-gallon bucket), and recording the time required to fill the known volume. Volumetric flow measurements are typically limited to monitoring points with small seepage flows (which can be diverted into a container) and discrete discharge points such as culverts and pipes.

3.2.5 Photo Point Monitoring

Photo points should be established for all restoration projects to assure collection of adequate pre- and post-restoration photographs. Pre- and post-restoration photos are invaluable for visually portraying large scale changes in response to restoration activities and in presenting such information to the general public. Following are a few simple rules that should be applied when establishing photo points to ensure that Pre- and post- project photos capture the level of information desired.

- Photo points should be selected and established in the earliest stages of the project. This will allow pre-restoration photos to be taken for all seasons.
- Photo points should be permanently marked to facilitate future relocation and identification. Once selected, photo points should be marked in the field with a steel or wood stake and GPS coordinates recorded. Photo points should be assigned a unique site code name and the marker stake inscribed with the site code.
- Long view photos representative of the entire or large portion of the project area should have a distinct permanent landmark in the background such as a mountain peak, rock outcrop, etc. Other considerations when choosing photo point locations include:
 - Locations should be easily relocatable and accessible;
 - Make sure that future plant growth will not obscure view; and
 - Select sites that will portray the level and depth of information applicable to the project.
- Information on project photos should be recorded on special project photo forms for systematic documentation into a project photolog. Forms should include information such as: Project name and location; Photo point number and location; Direction of photo; Photograph date, time, and weather conditions; Photographers name; Dates of previous photos, if known; and any comments/notes by the photographer.

3.3 WATER QUALITY MONITORING

Water quality monitoring needs for specific projects will depend on the restoration project objectives and the specific causes of impairment. In most cases, water quality monitoring needs will include nutrients, sediment, and/or metals. Monitoring for each of these general parameter groups is described below.

3.3.1 General Water Sampling Procedures

Procedure

The USGS has published water quality monitoring protocol for sampling of metals, nutrient, and suspended sediment concentrations. These methods are widely accepted and used for water quality monitoring across Montana. Restoration effectiveness water quality monitoring conducted within the Blackfoot River drainage should be completed in

accordance with USGS protocol, or in accordance with comparable methods such as MDEQ protocol. USGS procedures are available at the following web address:

<http://water.usgs.gov/owq/FieldManual/>

Current MDEQ procedures are available at:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/sop.asp>

Streamflow rates should be measured in conjunction with all water quality monitoring events to allow parameter loads (mass/time) to be calculated from parameter concentrations (mass/volume) determined through sampling. Comparison of parameter loads at multiple locations along a stream can be used to determine where load increases occur, and thus where sources of contaminant loading are located. Streamflow measurement should be performed as described in Section 3.2.

Monitoring Sites and Schedule

When water quality sampling is performed to assess restoration effectiveness, samples should be collected upstream of the restoration area in addition to sampling within and downstream of the restored stream reach. Sampling upstream of the restoration project will document the quality of surface water entering the restoration stream reach, allowing variations in upstream water quality to be taken into account when evaluating restoration project effectiveness. For restoration projects encompassing relatively short segments of stream (1,000 feet or less), one monitoring site near the upstream boundary and a second site near the downstream boundary will generally be sufficient. For stream restoration projects encompassing longer stream segments, one or more internal monitoring sites should be added to document water quality trends through the project area.

A minimum of one pre-restoration and one post-restoration monitoring event is required to assess restoration effectiveness from a water quality improvement perspective. However, due to intrinsic variability in surface water quality due to streamflow and climatic conditions, multiple pre- and post-restoration monitoring events should be conducted over a number of years. Ideally, water quality data should be collected from various portions of the streamflow hydrograph, with the specific sampling schedule dependent on the water quality parameters of interest. For instance, sampling for metals concentrations should be performed during the rising limb and falling limb of the spring runoff peak and during baseflow conditions since different metals loading sources will predominate under differing flow conditions (see discussion below). Conversely, nutrient sampling should focus on summer and early fall baseflow conditions when nutrient-related water quality problems are generally most severe. Pre- and post-restoration data used for evaluating restoration effectiveness should be collected under similar climatic conditions since runoff from heavy precipitation events can greatly affect short-term water quality. In general, a minimum of three pre- and post-restoration monitoring events should be performed under appropriate flow and climatic conditions to allow restoration effectiveness to be evaluated with a reasonable level of

confidence. Following is additional detail on monitoring protocol for specific water quality parameters.

3.3.2 Nutrient Sampling

Although nutrient pollution can result from a wide variety of sources, nutrient-related impacts to streams in the Blackfoot watershed will most likely be associated with agricultural runoff. Therefore, water quality monitoring for nutrients should be conducted for restoration projects associated with agricultural sources, and/or where the stream has been identified as impaired due to nutrients. In these cases, pre- and post-restoration water samples should be collected at the upstream and the downstream ends of the restoration project.

Table 3-1 includes a list of typical nutrient parameters for restoration projects, including total phosphorus, orthophosphate, nitrate plus nitrite (as nitrogen), ammonia (as nitrogen) and total kjeldahl nitrogen. This list will allow discrimination of the primary organic and inorganic forms of nitrogen and phosphorus. Samples for all parameters (except total phosphorus) should be filtered through a 0.45-micrometer filter in the field prior to placement in the sample container to remove particulate matter from the water sample that could affect analytical results.

When conducting nutrient sampling, the pre- and post-restoration sampling should be conducted during the same time of the year to prevent seasonal variations in nutrient concentrations from affecting the pre- and post-restoration comparison. Nutrient sampling should be performed during the summer months when water quality impacts from nutrients are expected to be greatest. Precipitation trends during and prior to sampling should be noted since runoff from intense precipitation events can greatly affect nutrient concentrations in streams through agricultural runoff.

**TABLE 3-1. ANALYTICAL PARAMETERS, SAMPLE REQUIREMENTS
FOR NUTRIENT SAMPLING**

Parameter	Detection Limit	Container	Preservation	Holding Time
Total Phosphorus	0.01 mg/l	250 ml polyethylene	Add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Orthophosphate	0.01 mg/L	250 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Nitrate+Nitrite as N	0.05 mg/L	50 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Ammonia as N	0.1 mg/L	50 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Total Kjeldahl Nitrogen (TKN)	0.5 mg/L	500 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days

3.3.3 Suspended Sediment Sampling

Total suspended sediment (TSS) monitoring will serve as the primary indicator of the effectiveness of restoration projects on water column sediment concentrations. Although other measures of water column sediment conditions (such as turbidity) are available, TSS monitoring represents the most direct measure of sediment levels within the water column available. Table 3-2 includes details on sample collection and handling for TSS.

Suspended sediment (or water column sediment) sampling will be applicable to many projects in the Blackfoot watershed due to the widespread nature of sediment-related impairment in the drainage. Excessive suspended sediment is not only detrimental to fish and other aquatic life, but also interferes with other beneficial uses such as irrigation water and drinking water supplies. Elevated suspended sediment concentrations also are indicative of or related to a myriad of other water quality problems and impairment causes, such as riparian degradation, agricultural runoff, substrate siltation, and elevated metals and nutrient concentrations. Therefore, documenting changes in suspended sediment concentrations through proper monitoring will be applicable to the majority of restoration projects in the Blackfoot watershed.

Pre- and post-restoration sampling for TSS must be performed under similar conditions to reduce the effects of natural variability in TSS concentrations. For instance, pre- and post-restoration samples should be collected from similar points on the annual hydrograph (rising limb, falling limb, baseflow) and during similar climatic conditions (extended dry periods, during or shortly after significant precipitation events), to exclude flow and weather-induced variations in TSS concentrations from the restoration effectiveness assessment. A minimum of three pre- and post-restoration TSS monitoring events should be performed under various

hydrologic and climatic conditions to adequately document restoration success. Monitoring should occur at the upstream and downstream boundary for smaller restoration projects (on the order of 1,000 feet in length), with one or more internal sites added for longer restoration projects.

TABLE 3-2. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR TOTAL SUSPENDED SOLIDS SAMPLING

Parameter	Detection Limit	Container	Preservation	Holding Time
Total Suspended Solids	10 mg/L	1000 ml glass or plastic	Cool to 4°C	7 days

3.3.4 Metals Sampling

Monitoring of metals concentrations in surface water should be performed on all restoration/reclamation projects designed to reduce metals loading to surface waters. This may include abandoned mine reclamation projects or mitigation of other metals loading sources. When monitoring metals concentrations in stream restoration projects, the objectives are to determine how restoration activities affect in-stream metals concentrations, and to determine how post-restoration concentrations compare to applicable water quality standards presented in Circular WQB-7, the official list of Montana Numeric Water Quality Standards published by MDEQ.

Table 3-3 includes sample collection and handling requirements for metals analyses. Typically, metals of interest in assessing surface water quality may include aluminum, arsenic, cadmium, copper, iron, lead, manganese, zinc, or numerous other metals. Actual metals to be analyzed for a project should be based on specific metals impairments or loading sources. On projects where information on specific metals of concern is lacking, the above list of metals should be sufficient for documentation of metals impairment and restoration effectiveness.

With the exception of aluminum, all metals should be analyzed for total recoverable concentrations for comparability to the water quality standards. If applicable, aluminum should be tested for dissolved concentrations (sample should be filtered through 0.45 micron filter prior to acidification) since the aluminum standard is based on the dissolve concentration. Although not typically considered a pollutant, the metals calcium and magnesium should be included in metals sample analyses to determine the water hardness. Because water quality standards for certain metals are dependent on the water hardness,

calcium and magnesium concentrations should be used to determine the water hardness by the following equation:

$$H = [Ca^{2+} \times 2.497] + [Mg^{2+} \times 4.117]$$

Where: H= water hardness (as CaCO₃) in mg/L

Ca²⁺ = dissolved calcium concentration

Mg²⁺=dissolved magnesium concentration.

Similar to other water sampling protocol, pre- and post-restoration sampling for metals should be performed during similar hydrologic and climatic conditions to reduce the effects of natural variability in metals concentrations. A minimum of two pre- and post-restoration metals monitoring events should be performed under various hydrologic and climatic conditions to adequately document restoration success. Monitoring should occur at the upstream and downstream boundary for smaller restoration projects (on the order of 1,000 feet in length), with one or more internal sites added for longer restoration projects.

TABLE 3-3. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR METALS SAMPLING

Parameter	Detection Limit	Container	Preservation	Holding Time
TRC Metals	*	250 ml polyethylene	Add HNO ₃ to pH<2, cool to 4°C	6 mos
Dissolved Calcium, Magnesium	1.0 mg/L	50 ml polyethylene	Filter to 0.45 micron, add HNO ₃ to pH<2, cool to 4°C	6 mos
Dissolved Aluminum (if applicable)	0.05 mg/L	50 ml polyethylene	Filter to 0.45 micron, add HNO ₃ to pH<2, cool to 4°C	6 mos

TRC-total recoverable. Specific list of metals to be analyzed dependent on project needs but may include arsenic, copper, cadmium, iron, lead, manganese, zinc, or other metals of interest.

*Varies with metal. Detection limits for individual metals should be less than applicable water quality standard in WQB-7.

3.4 STREAM SUBSTRATE COMPOSITION

Stream substrate composition, or the distribution of sediment particle sizes in streambed sediments, can be an important measure of success and effectiveness for many stream restoration projects. Excessive fine sediment content, typically taken to be any sediment particles less than approximately 6 mm in size, can be detrimental to aquatic life and other beneficial uses. Changes in the fine sediment content of the stream substrate are also a useful measure of the effectiveness of specific restoration measures and objectives, such as reducing sediment runoff from roads or unstable streambanks. Following are two methods for documenting stream substrate composition before and after restoration actions. The Percent Fines Content method is a relatively simple measurement yielding semi-quantitative information on substrate composition, while the McNeil Core Sampling method provides more quantitative information. The specific method used on a project should depend on the scope of the project, importance of streambed siltation to the stream health and project objectives, and available funding. Other methods, such as Wohlman pebble counts, riffle

stability index, etc., may also be considered as long as standard methodologies are employed. Whichever method is chosen, the same method must be applied for the pre- and post-restoration monitoring to allow for direct comparison of the results.

3.4.1 Percent Fine Content

Procedure

Percent fines content is calculated using a five-gallon bucket fitted with a clear plastic bottom. The bottom is marked with a grid of one-inch spaced lines, with a 6 mm wide space demarcated at each intersection. The bucket is then placed in the water, and the streambed viewed through the bucket. At each grid intersection (a total of 45), the size of the sediment particle below the intersection (greater than or less than 6 mm), is recorded. The percent fines content is then calculated from the percentage of intersection points with sediment particles less than 6mm. The procedure is described in MDEQ Standard Operating Procedure 11.8.6, Percent Fines Calculation at the following website:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/11-8-6.pdf>

Monitoring Sites/Schedule

Percent fine sediment measurements should be taken in pool tails and riffles, with the distribution of measurements dependent on the relative abundance of each. For instance, if the reach contains 70% riffles and 30% pools, 70% of the measurements should be taken from riffles and 30% from pools. The total number of measurements to be taken depends of the size and variability of the stream in the restoration area, and importance of stream substrate composition to the project. A sufficient number of measurements should be made to adequately characterize the percent fines content of the stream substrate for the project purposes.

3.4.2 McNeil Core Samples

McNeil core sampling provides more quantitative information on stream substrate composition than does the Percent Fine Content method, but is also more labor and equipment intensive. McNeil core sampling also requires that sediment samples be analyzed for grain size distribution, adding additional costs. However, collection of McNeil core samples should be considered where documentation of the percent fine sediment content in stream substrate before and after restoration is critical to project objectives.

The Helena National Forest has been conducting McNeil core sampling in the Blackfoot watershed for the past several years, resulting in an existing database of McNeil core data from the drainage. In order to ensure comparability of future restoration project sampling results with the existing database, McNeil core sampling performed for restoration projects should be conducted in a manner consistent with the HNF methodology. The following protocol was provided by the Helena National Forest. The general procedure is as follows:

Required Equipment:

- GPS Unit
- McNeil core sampler
- 1000 ml Imhoff cone
- 500 ml plastic bottle
- 5 gallon bucket with plastic bag liner

Field Data to be Recorded:

- Stream Name /Date /Location
- Observer Name
- Depth of core (6” for bull trout spawning gravel and 4” for cutthroat spawning areas)
- Site # and Core # with a description of the start point and the distance between points.
- Number of redds located at the site.
- GPS location
- Suspended sediment measure (ss) – The measurement of the depth of the water taken within the core sampler after the sample has been pulled into the reservoir, but the sampler is still in the stream.
- Imhoff cone measure (Imh) – Let the sample settle for approximately 20 minutes. If using a 500 ml bottle – double the total sediment reading in the cone (1000 ml) and multiply by 0.4. This will account for how much it would actually settle overnight.

Field Procedure:

- Locate a spawning site or a potential spawning site. (All successive sites will be located upstream from the first site.)
- Set up 5-gallon bucket with a plastic bag inside.
- Set up Imhoff cone.
- Write two identification tags on the flagging for each sample using a waterproof marker. One tag is short and will be placed inside the plastic bag with the sample and the other is long and will be used to tie the sample bag when finished. The tags contain the following information: Stream Name, Site #, and Core #.
- Place core sampler next to the existing redd, but not where it would be affected in any way by the coring (remember your feet). If the site is a potential site, place the core sampler where you would expect a redd.
- In a bull trout stream, take 6” of core, or 4” from the top of the inner rim on the McNeil sampler. (The inner cylinder is 10”.)
- In a cutthroat stream take 4” of core, or 6” from the top of the inner rim on the McNeil sampler.
- When drilling the core into streambed, try not to let it walk over the stream bottom. If it hangs up on a large rock go ahead and re-core. If a piece of rubble is too big to fit through the 10” cylinder leave it out of the sample.
- Once the core sampler is down to the appropriate depth, remove the material from the inner 10” cylinder and place into the inner reservoir. You are finished when you feel the top of the teeth at the bottom of the sampler.
- Use the ruler to measure the depth of the water from the bottom of the core sampler.

- Quickly fill the 500 ml bottle to capture the suspended sediments and pour it into the Imhoff cone.
- Slowly pull up the core sampler and place it on the 5 gallon bucket with the bag around the 10” cylinder.
- Empty the sample from the reservoir into the plastic bag through the 10” cylinder. Use extra wash water to carefully wash the extra sediment from inside the core sampler. Pick up the sampler and drain the rest of the water into the bag.
- Remove the bag from the plastic bucket and pour any remaining sediment and water into the bag.
- Place the short tag inside the bag.
- Twist the bag and tie it with many wraps of the long flagging.
- Record the GPS reading, the ss depth in inches and the Imhoff cone reading. Empty the water from the cone using the cap at the bottom and then replace it tightly! (Easy to lose.)

Sample Analysis:

- Samples are processed by passing the sample through a set of soil sieves and recording the weight of soil passing through each sieve. The percent passing each sieve is then plotted against the sieve sizes on a semi-log plot to provide the grain size distribution of the sample. Samples should be passed through a stack of sieves consisting of the following sieve sizes:

Sieve Number	Opening Size (mm)
200	0.074
20	0.85
8	2.38
4	4.76
3	6.3
0.5”	12.7
1.0”	25.4
2.0”	50.8
3.0”	76.1

From the resulting data, the percent fine sediment can be determined. Other useful metrics, such as the Fredel Index and sorting coefficient, can also be calculated.

4.0 REFERENCES

- Bain, M, B., and N. J. Stevenson, 1999. Aquatic Habitat Assessment: Common Methods. American Fisheries Society, Bethesda, Maryland.
- Skogerboe et al., 1967. Design and Calibration of Submerged Open Channel Flow Measurement Structures: Part 3, Cutthroat Flumes. Utah Water Research Laboratory, Utah State University, April 1967.
- U.S. Dept. of Agriculture, 2004. Using the NRCS Riparian Assessment Method. Natural Resource Conservation Service. September 2004.
- U.S. Geological Survey, 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, 1977 (with subsequent revisions through 1983).
- U.S. Dept. of Agriculture, 2000. Monitoring the Vegetation Resources in Riparian Areas. US Forest Service Rocky Mountain Research Station, General Technical Report RMRS-GTR-47. April 2000.

APPENDIX M

Table of Potential Restoration Projects

Blackfoot River Basin												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
Alice Creek				X	X				X			
Arkansas Creek							X	X				
Arrastra Creek	X						X		X	X		
Ashby Creek	X	X	X	X	X	X	X	X				
Bartlett Creek					X				X			
Basin Spring Creek												
Bear Creek (Blackfoot trib. at R.M. 12.2)					X		X					
Bear Creek (Blackfoot trib. at R.M. 37.5)	X											
Bear Creek (North Fork drainage)		X				X						
Bear Gulch	X	X	X	X	X	X	X	X				
Beaver Creek		X			X	X		X		X		
Belmont Creek							X		X	X		
Black Bear Creek	X					X		X				
Blackfoot River (mouth to Clearwater)			X	X			X	X	X	X		
Blackfoot River (Clearwater to N.F)			X		X			X	X	X		
Blackfoot River (N.F. to Nevada Creek)						X		X		X		
Blackfoot River (Nevada Cr. to Arrastra Cr.)		X		X	X	X		X		X		
Blackfoot River (Arrastra Cr. to Lincoln, MT)		X	X	X	X	X		X	X	X		
Blackfoot River (Lincoln to Headwaters)		X	X	X	X	X			X	X	X	
Braziel Creek	X		X	X	X	X	X	X				
Buffalo Gulch	X			X	X			X			X	
Burnt Bridge Creek	X	X	X		X	X	X					
California Gulch	X			X	X			X				
Camas Creek			X	X				X				
Chamberlain Creek				X	X		X			X		
Chamberlain Creek, East Fork							X					
Chamberlain Creek, West Fork							X					
Chicken Creek	X		X	X	X			X				
Chimney Creek (Douglas Cr tributary)		X	X	X	X			X				
Chimney Creek (Nevada Cr tributary)	X	X	X			X		X				
Clear Creek	X		X		X			X				X
Copper Creek	X								X			
Cottonwood Creek (Blackfoot trib. at R.M. 43)	X		X	X	X	X	X	X		X		
Cottonwood Creek (Nevada Cr tributary)	X	X	X	X	X	X		X				X

Table of Potential Restoration Projects (cont'd).

Blackfoot River Basin (cont'd)												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
Dick Creek	X	X	X	X	X	X		X				
Douglas Creek		X	X	X	X	X	X	X				
Dry Creek				X	X			X				
Dunham Creek					X	X						
East Twin Creek												
Elk Creek	X	X	X	X	X	X	X	X		X	X	
Enders Spring Creek				X	X							
Finn Creek		X		X		X		X				
Fish Creek		X	X									
Frazier Creek	X	X	X	X	X	X	X	X				
Frazier Creek, North fork		X	X		X	X		X				
Gallagher Creek	X							X				
Game Creek	X							X				
Gleason Creek	X										X	
Gold Creek									X	X		
Gold Creek, West Fork												
Grantier Spring Creek												
Halfway Creek				X	X			X				
Hogum Creek	X				X			X				
Hoyt Creek		X	X	X	X	X		X		X		
Humbug Creek		X	X		X	X		X			X	
Indian Creek				X								
Jacobsen Spring Creek										X		
Jefferson Creek	X		X	X		X					X	
Johnson Creek												
Keep Cool Creek	X	X	X		X	X		X			X	
Kleinschmidt Creek								X		X		
Landers Fork			X	X	X	X			X			
Lincoln Spring Creek	X	X	X	X	X			X		X		X
Little Fish Creek	X				X		X	X				
Little Moose Creek												
Lodgepole Creek												
McCabe Creek	X				X							

Table of Potential Restoration Projects (cont'd).

Blackfoot River Basin (cont'd)												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
McDermott Creek												
McElwain Creek	X	X			X	X	X	X				
Mitchell Creek	X			X				X				
Monture Creek	X		X	X	X			X	X	X		X
Moose Creek	X										X	
Murphys Spring Creek		X				X						
Murray Creek	X	X		X	X	X	X	X				
Nevada Creek (lower)		X	X	X	X	X		X				
Nevada Creek (upper)	X	X			X		X	X			X	
Nevada Spring Creek			X							X		
North Fork Blackfoot River			X	X	X	X			X	X		
Pearson Creek					X		X					
Poorman Creek	X		X	X	X		X	X			X	
Rock Creek	X	X		X	X	X				X		X
Salmon Creek		X		X		X						
Sauerkraut Creek	X		X	X	X	X	X	X			X	
Seven up Pete Creek	X								X		X	
Shanley Creek		X		X	X	X		X		X		
Sheep Creek						X		X				
Shingle Mill Creek		X						X				
Smith Creek	X				X			X				
Snowbank Creek	X	X	X									
Spring Creek (Cottonwood Cr tributary)		X	X		X	X						
Stonewall Creek	X	X	X			X		X			X	
Strickland Creek				X	X			X				
Sturgeon Creek			X		X	X		X				
Sucker Creek	X	X	X	X	X	X		X				
Tamarack Creek	X	X	X	X	X	X	X					X
Union Creek	X	X		X	X	X		X				
Wales Creek		X	X		X	X		X				
Wales Spring Creek			X		X			X				
Ward Creek	X	X	X	X	X	X		X				
Warm Springs Creek	X	X				X	X					


Table of Potential Restoration Projects (cont'd).

Blackfoot River Basin (cont'd)												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
Warren Creek	X	X	X	X	X	X		X		X		
Warren Creek (Doney Lake trib.)												
Washington Creek	X	X	X	X				X			X	
Washoe Creek				X				X				
Wasson Creek					X	X		X				
West Twin Creek												
Willow Creek (above Lincoln)					X			X				
Willow Creek (below Lincoln)	X	X	X	X	X	X	X	X			X	
Wilson Creek	X	X				X						
Yourname Creek		X	X	X	X	X		X				
Clearwater River Basin												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
Auggie Creek	X					X	X					
Benedict Creek	X				X							
Bertha Creek												
Blanchard Creek	X	X	X	X	X	X	X	X				
Blanchard Creek, North Fork												
Blind Canyon Creek							X					
Boles Creek					X		X					
Buck Creek	X				X	X						
Camp Creek	X				X	X	X					
Clearwater River Section 1		X	X		X	X			X			X
Clearwater River Section 2			X		X	X			X			X
Clearwater River Section 3					X	X		X				
Clearwater River Section 4			X			X			X			
Clearwater RiverSection 5	X											
Clearwater River, East Fork							X					
Clearwater River, West Fork					X	X	X					
Cold Brook Creek												
Colt Creek	X		X		X	X	X					
Deer Creek	X				X		X					
Drew Creek	X	X	X	X	X		X					X

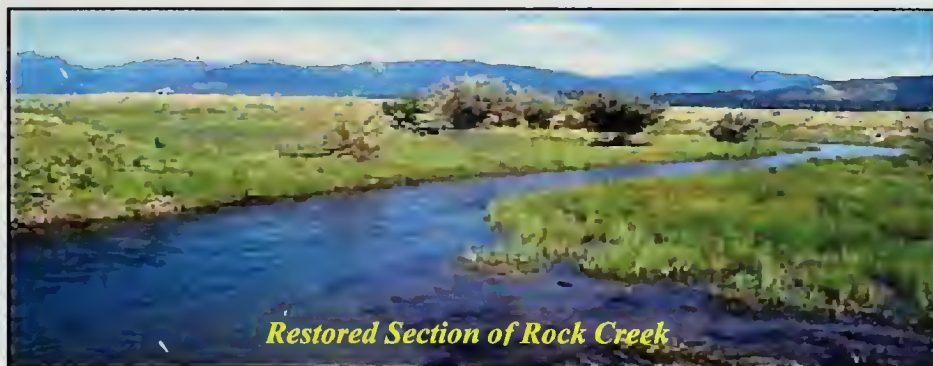
Table of Potential Restoration Projects (cont'd).

Clearwater River Basin (cont'd)												
Stream Name	Road Crossings	Irrigation Impacts	Channel Alterations	Lacks Complexity	Riparian Vegetation	Instream Flow	Road Drainage	Feedlots, Grazing	Recreation Impacts	Whirling Disease	Mining	Residential
Fawn Creek	X					X	X					
Findell Creek	X				X		X					
Finley Creek	X				X		X					
First Creek	X				X		X					
Grouse Creek	X						X					
Horn Creek						X	X					
Inez Creek	X				X		X					
Lost Horse Creek	X			X	X		X					
Lost Prairie Creek						X	X					
Marshall Creek					X		X					
Morrell Creek		X	X	X	X	X	X		X			X
Mountain Creek	X	X			X	X	X					X
Murphy Creek	X				X		X					
Owl Creek				X	X	X	X		X			
Placid Creek	X			X			X					
Placid Creek, North Fork	X	X					X					
Rice Creek		X					X					
Richmond Creek	X				X		X					
Sawyer Creek	X						X					
Second Creek							X					
Seeley Creek		X					X					X
Sheep Creek	X					X	X					
Slippery John Creek	X					X						
Swamp Creek	X		X	X	X	X	X					X
Trail Creek	X	X	X	X	X		X					X
Uhler Creek	X				X	X	X					
Vaughn Creek							X					

S
333.73
N7BWR
2005

Montana State Library

3 0864 1003 5145 4

A BASIN-WIDE RESTORATION ACTION PLAN FOR THE BLACKFOOT WATERSHED



STATE DOCUMENTS COLLECTION

Prepared for:

Montana Department of Natural Resources and Conservation
Renewable Resource Grant & Loan Program
and
The Blackfoot Watershed Restoration and Monitoring Partners

JUN 15 2005
MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620

Prepared by:

The Blackfoot Challenge in partnership with the Big Blackfoot Chapter of Trout Unlimited,
Montana Fish, Wildlife and Parks, Hydrometrics Inc., and other partners

August 2005

S
333.73
N7BWR
2005

Montana State Library
3 0864 1003 5145 4

A BASIN-WIDE RESTORATION ACTION PLAN FOR THE BLACKFOOT WATERSHED



STATE DOCUMENTS COLLECTION

JUN 10 2005

Prepared for:

Montana Department of Natural Resources and Conservation
Renewable Resource Grant & Loan Program
and
The Blackfoot Watershed Restoration and Monitoring Partners

MONTANA STATE LIBRARY
1515 E. 2ND AVE.
MONTANA 59620

Prepared by:

The Blackfoot Challenge in partnership with the Big Blackfoot Chapter of Trout Unlimited,
Montana Fish, Wildlife and Parks, Hydrometrics Inc., and other partners

August 2005

TABLE OF CONTENTS

LIST OF FIGURES	iv
LIST OF TABLES	v
LIST OF APPENDICES	v
EXECUTIVE SUMMARY	vi
1.0 INTRODUCTION	1
1.1 GOALS AND OBJECTIVES	2
1.2 REPORT SCOPE AND FORMAT	2
1.3 WATERSHED CHARACTERISTICS	3
1.3.1 Impairment Issues	4
1.4 RESULTS AND CONCLUSIONS.....	5
2.0 ACTION PLAN IMPLEMENTATION PROCESS.....	12
2.1 ACTION PLAN IMPLEMENTATION APPROACH.....	12
2.1.1 Tributary Focus.....	12
2.1.2 Partnership Building	12
2.1.3 Landowner Cooperation.....	13
2.2 IMPLEMENTATION PROCESS	13
2.3 PARTICIPATING PARTNERS	14
2.4 ROLE OF PARTNERS	14
2.5 FUNDING PROGRAMS.....	15
3.0 TOTAL MAXIMUM DAILY LOAD (TMDL)-RELATED RESTORATION PLANNING	21
3.1 THE TMDL PROCESS AND IMPLICATIONS FOR RESTORATION PLANNING	21
3.2 TMDL DEVELOPMENT IN THE BLACKFOOT WATERSHED.....	22
3.3 303(D) LISTED WATER BODIES.....	22
3.4 TMDL-RELATED RESTORATION PROJECTS.....	23
4.0 FISHERIES RESORATION PLANNING.....	31
4.1 RESTORATION CONCEPTS	31

4.2 FISHES OF THE BLACKFOOT WATERSHED.....	33
4.2.1 Nonnative Salmonids of the Blackfoot Watershed.....	33
4.3 NATIVE TROUT OF THE BLACKFOOT RIVER: INTRODUCTION, MANAGEMENT, AND RECOVERY GUIDELINES.....	35
4.3.1 Bull Trout Recovery Areas - Core Areas and Proposed Critical Habitat.....	35
4.3.2 Bull Trout Recovery - Recreational Conflict Areas	36
4.3.3 Westslope Cutthroat Trout.....	36
4.3.4 Native Species Management Areas	37
4.3.5 Native Species Conservation Areas.....	37
4.3.6 Native Species Maintenance Areas.....	38
4.4 GENERAL FISHERIES HEALTH	38
4.4.1 Fisheries Impairments of the Blackfoot River	38
4.4.2 Tributary Impairments	41
4.4.3 Whirling Disease.....	42
5.0 FISHERIES RESTORATION PRIORITIZATION	51
5.1 FISHERIES PRIORITIZATION STRATEGY.....	51
5.2 DEWATERED STREAMS PRIORITIZATION	53
5.3 OTHER CONSIDERATIONS	53
5.4 PRIORITIZATION RESULTS	54
5.4.1 High Priority Streams	54
5.4.2 Moderate Priority Streams	55
5.4.3 Low Priority Streams	55

LIST OF FIGURES

FIGURE 1-1. STUDY AREA: THE BLACKFOOT RIVER WATERSHED AND LAND OWNERSHIP	7
FIGURE 1-2. FISHERY RESTORATION PRIORITY, 303(D), AND DEWATERING STREAMS IN THE BLACKFOOT DRAINAGE.....	8
FIGURE 3-1. BLACKFOOT WATERSHED 303(D) LISTED STREAMS	25
FIGURE 4-1. DISTRIBUTION MAP OF FIVE SALMONIDS SPECIES IN THE BLACKFOOT RIVER BASIN.....	43
FIGURE 4-2. BULL TROUT CORE AREA WATERSHEDS (EXCLUDING THE CLEARWATER DRAINAGE) AND PROPOSED CRITICAL BULL TROUT HABITAT.....	44
FIGURE 4-3. BULL TROUT RECOVERY/RECREATIONAL CONFLICT AREAS FOR THE BLACKFOOT WATERSHED	45
FIGURE 4-4. WESTSLOPE CUTTHROAT TROUT GENETICS MAP WITH SAMPLE LOCATIONS AND PERCENT WSCT COMPOSITION	46
FIGURE 4-5. REGION 2 NATIVE SPECIES MANAGEMENT AREAS FOR THE BLACKFOOT RIVER WATERSHED.....	47
FIGURE 4-6. PERCENT TROUT SPECIES COMPOSITION FOR FIVE REACHES OF THE BLACKFOOT RIVER	48
FIGURE 4-7. GENERALIZED WHIRLING DISEASE DISTRIBUTION MAP FOR THE BLACKFOOT WATERSHED	49
FIGURE 5-1. HISTOGRAMS AND CUMULATIVE PERCENTAGE CURVES USED TO DEVELOP PRIORITIZATION CATEGORIES.....	57
FIGURE 5-2. DEWATERED STREAMS OF THE BLACKFOOT WATERSHED: HUMAN INDUCED AND NATURAL DEWATERING	58
FIGURE 5-3. HIGH PRIORITY STREAMS OF THE BLACKFOOT RIVER WATERSHED.....	59
FIGURE 5-4. MODERATE PRIORITY STREAMS OF THE BLACKFOOT RIVER WATERSHED.....	60

FIGURE 5-5. LOW PRIORITY STREAMS OF THE BLACKFOOT RIVER WATERSHED.....	61
---	----

LIST OF TABLES

TABLE 1-1. CORRELATION BETWEEN 127 FISHERIES, TMDL, AND DEWATERED STREAMS IN THE BLACKFOOT WATERSHED.....	9
TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES.....	16
TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED.....	26
TABLE 4-1. ANTHROPOGENIC FISHERIES IMPAIRMENT ON 108 INVENTORIED STREAMS OF THE BLACKFOOT WATERSHED .	50
TABLE 5-1. DEWATERED STREAM LIST IN THE BLACKFOOT WATERSHED.....	62

LIST OF APPENDICES

APPENDIX A	COMPLETED RESTORATION PROJECTS IN THE BLACKFOOT WATERSHED
APPENDIX B	ONGOING AND POTENTIAL RESTORATION PROJECTS ON TMDL STREAMS
APPENDIX C	DESCRIPTION OF NEAR TERM RESTORATION PROJECTS
APPENDIX D	108 FISHERIES PRIORITY STREAM SUMMARIES
APPENDIX E	FISHERIES PRIORITIZATION MATRIX
APPENDIX F	RESTORATION EFFECTIVENESS MONITORING PROTOCOL FOR THE BLACKFOOT WATERSHED
APPENDIX G	GUIDING DOCUMENTS FOR THE RESTORATION ACTION PLAN

EXECUTIVE SUMMARY

The Blackfoot River Watershed has been the focus of a rapidly expanding stream restoration program over the past several years, with a growing number of organizations and entities involved in restoration planning and implementation in the Watershed. These restoration activities are being implemented under a number of regulatory programs and mandates, and restoration program objectives. This growth in restoration activities in the Blackfoot Watershed has prompted the need for a guiding document to strengthen restoration partnerships and programs through pooling of resources, greater information sharing, and the creation of a restoration network. This Restoration Action Plan has been developed through a collaborative effort by the Blackfoot River restoration partners to meet these needs for restoration activities throughout the Blackfoot Watershed.

The goal of this Action Plan is to define strategies for prioritization, planning and implementation of restoration projects for impaired and dewatered streams in the Blackfoot Watershed. The Plan is also intended to assist project planners in selection and implementation of appropriate monitoring strategies for assessing the effectiveness of restoration projects regarding attainment of restoration goals. This Action Plan serves as a restoration guide for partners by identifying opportunities for cooperative restoration and monitoring efforts, promoting implementation of restoration strategies identified in various programs and directives, promoting restoration monitoring to assess effectiveness; and creating a tracking system for completed restoration projects and associated monitoring.

This Action Plan encompasses three established restoration programs currently operating in the Blackfoot Watershed, including: 1) Native fish species management and recovery led by MT FWP and Big Blackfoot Chapter of Trout Unlimited (BBCTU); 2) The TMDL Program led by MDEQ and the Blackfoot Challenge; and 3) Water conservation and instream flow management led by BBCTU and the Blackfoot Challenge. A total of 127 streams were examined during the development of this Action Plan. The results show overlap as well as differences between the restoration program areas. About half (64) of the streams identified in this Action Plan as being in need of restoration fall within multiple program areas and represent excellent opportunities for collaborative restoration projects (Table 1-1). The Action Plan is a flexible document that allows for the integration of other restoration programs and directives. While the three existing restoration programs will likely address the majority of restoration needs in the Blackfoot, it is recognized that there may be other considerations and restoration needs beyond those outlined in this plan, such as restoration opportunities related to NRCS agricultural programs.

Strong partnerships between landowners (private and corporate), state and federal agencies, and private entities (like the Blackfoot Challenge and BBCTU) are a primary reason for the success of restoration efforts to date in the Blackfoot Watershed. Implementation of this Action Plan will help solidify these partnerships and strengthen the collaborative approach to restoration that has flourished in the Watershed. This Action Plan is intended to foster these partnerships through the identification and implementation of cooperative restoration projects that meet multiple programmatic goals and objectives.

Implementation of this Action Plan will include annual meetings of the restoration partners, beginning in 2005. The primary purpose of the annual meetings will be to review ongoing restoration projects and associated monitoring activities in the Watershed, and plan upcoming restoration-related activities. The Action Plan will be modified as necessary, including updating the inventory of completed and upcoming restoration projects, updating the restoration project priority list, and incorporating other modifications deemed appropriate by the Blackfoot Watershed restoration partners.

A BASIN-WIDE RESTORATION ACTION PLAN FOR THE BLACKFOOT WATERSHED

1.0 INTRODUCTION

The Blackfoot watershed encompasses 2,320 square miles of biologically rich and diverse lands in western Montana (Figure 1-1). The Blackfoot River drainage system provides critical fish and wildlife habitat, irrigation water for agricultural lands, domestic water use, and high quality recreational opportunities for the public -- all beneficial uses dependent upon clean water.

Since 1990, restoration partners in the Blackfoot watershed have undertaken cooperative habitat restoration tied to fisheries with over 200 projects completed to date involving more than 100 individual landowners (Appendix A). However, as the number of habitat and water quality programs and projects has grown over time, the need has emerged for a more clearly defined comprehensive watershed-wide restoration program. Much of this need is brought on by opportunities and requirements associated with a variety of local, state, and federal programs, plans, and directives involving fisheries management and recovery, long-term water conservation and drought management, and the State of Montana Total Maximum Daily Load (TMDL) program. Through restoration planning and implementation under these various programs, it has become apparent that better coordination between the various entities performing restoration in the watershed is needed. As a result, this restoration action plan has been developed to help partners work more closely together, pool resources, and meet common goals.

This Action Plan is intended to serve as a guidance document for restoration planning, implementation and monitoring in the Blackfoot Watershed. It serves as a planning tool for identifying, prioritizing and coordinating restoration activities in the Blackfoot watershed. The plan provides a comprehensive resource-based, priority-driven strategy for project planning and expands upon the experience and success of existing restoration programs in the watershed. Restoration planning in this document is organized by the three primary restoration programs currently operating within the watershed, including:

1. The Fisheries Management and Recovery Program overseen primarily by FWP;
2. The Blackfoot Water Conservation and Drought Management Program; and
3. The State of Montana Total Maximum Daily Load (TMDL) program.

This Action Plan has been prepared as a collaborative effort between the Blackfoot Challenge and its partners with major contribution from the Montana Fish, Wildlife and Parks and Hydrometrics Inc. Grant support has been provided by the Montana Department of Natural Resources and Conservation's Renewal Resource Grant and Loan Program (RRGL) and the Chutney Foundation. In-kind support has been provided by all the partners identified in Section 2.3. The Action Plan will be used to guide selection of priority

collaborative projects and will be updated as needed to provide a mechanism for obtaining a more consistent and higher level of funding for on-the-ground restoration projects.

1.1 GOALS AND OBJECTIVES

The goal of this Restoration Action Plan is to define the strategies for prioritization, development, implementation, and monitoring of water quality, habitat and fisheries restoration projects for impaired and dewatered streams of the Blackfoot Watershed. The Action Plan addresses restoration needs or causes of water quality impairment in three primary categories: 1) Fisheries and stream restoration needs; 2) Stream dewatering affecting fisheries and other beneficial uses; and 3) restoration needs/opportunities identified through the Montana Department of Environmental Quality (MDEQ) Total Maximum Daily Load (TMDL) program. These strategies in turn will be used to direct restoration efforts, secure implementation funding, and coordinate stakeholder involvement.

To ensure that this overall goal is met, Action Plan Objectives have been developed and include:

- Identify opportunities for collaborative restoration project and monitoring efforts;
- Promote implementation of restoration strategies identified through native species management/recovery plans, the TMDL program, and the Blackfoot water conservation and in-stream flow plans within the framework of the Action Plan;
- Outline restoration monitoring strategies, including monitoring protocols, to promote consistent and adequate monitoring for assessing restoration project effectiveness; and
- Create a tracking system for completed and planned restoration projects as well as the monitoring associated with these projects.

1.2 REPORT SCOPE AND FORMAT

The Restoration Action Plan incorporates the plan objectives as well as the various restoration programs currently operating within the watershed. The primary components of the Action Plan include the action plan implementation process, the TMDL-related restoration strategies, and the fisheries/dewatering-related restoration strategies, with each component described in a separate section of the Action Plan. The report is organized as follows:

- Section 1 contains report objectives, a general description of the Blackfoot watershed characteristics, an overview of impairment issues, and results and conclusions;
- Section 2 describes the action plan implementation process, participating partners, role of partners, and potential funding sources for projects and monitoring;
- Section 3 contains a summary of TMDL issues and 303(d)-listed streams in the watershed, and discussion of potential TMDL-related restoration projects;
- Section 4 covers fisheries and stream dewatering issues including a summary of the existing fishery, which is a driving factor in most of the restoration planning in the drainage; and

- Section 5 contains a prioritization scheme for watershed-wide fisheries-related restoration needs based on several ranking criteria including drought-related impairment conditions and the results of the prioritization.

In addition to the sections described above, the following appendices provide further support for the three program areas of the Action Plan:

- Appendix A provides a table and map of restoration projects completed since 1990;
- Appendix B provides a list of ongoing and potential TMDL-Related Restoration Projects in the Blackfoot;
- Appendix C contains descriptions of near-term restoration projects in the Blackfoot watershed;
- Appendix D provides a summary of 108 streams identified in the fisheries prioritization process including, for each stream, a description, the TMDL issues and 303(d) status, dewatering issues, native species issues, restoration activities, and monitoring activities;
- Appendix E is the Fisheries Prioritization Matrix;
- Appendix F contains a strategy for monitoring restoration effectiveness using the Restoration Monitoring Protocols; and
- Appendix G provides a bibliography of relevant guiding documents for the Restoration Action plan and document references.

1.3 WATERSHED CHARACTERISTICS

The following watershed characterization is intended to provide readers unfamiliar with the Blackfoot Watershed with a general understanding of the watershed setting and physical characteristics necessary for assessing restoration needs and priorities in the watershed.

The Blackfoot Watershed, situated in western-central Montana, encompasses 1.5 million acres of diverse lands. The headwaters to the Blackfoot River originate atop the continental divide at Rogers Pass at the junction of Beartrap and Anaconda Creeks. The river flows westerly 132 miles to its confluence with the Clark Fork River at Bonner, east of Missoula, MT. The northern portion of the watershed is dominated by the Clearwater River and the North Fork of the Blackfoot subdrainages, while the southern watershed is dominated by Nevada Creek and Poorman Creek subdrainages (Figure 1-1).

This river system drains a 2,320 square mile watershed through a 3,700-mile stream network of which 1,900 miles are perennial streams capable of supporting fishes. Mean annual discharge is 1,607 cubic feet per second (cfs). The physical geography of the watershed ranges from high-elevation glaciated alpine meadows, timbered forests at the mid-elevations to prairie pothole topography on the valley floor. Glacial deposits, mainly glacial till, outwash and glacial lake sediments, cover much of the Blackfoot River valley floor and exert a controlling influence on the geomorphology of the Blackfoot River and the lower reaches of most tributaries. The Blackfoot River is a free flowing river to its confluence with the Clark Fork River where Milltown dam, a run-of-the-river hydroelectric facility, creates Milltown Reservoir. Milltown dam has blocked upstream fish passage on the Clark Fork

River, affecting natural migrations between the Clark Fork River and Blackfoot River since 1907. The dam is scheduled for removal in 2006.

Land ownership in the Blackfoot watershed is 60% public, 20% corporate timber, and 20% privately owned ranches. In general, public lands and large tracts of corporate timber properties comprise large forested tracts in mountainous areas of the watershed while private lands occupy the foothills and lower valley areas (Figure 1-1). About 1/3 of the corporate timber lands are being resold to public agencies and adjacent private land-owners as part of the Blackfoot Community Project that aims to maintain traditional uses such as recreation, timber management, grazing and wildlife habitat. Traditional land-use in the basin includes mining, timber harvest, agriculture and recreation activities, all of which provide the economic base of the Blackfoot Valley. Unfortunately to various degrees, these activities have also contributed to water quality and habitat degradation or fish population declines.

1.3.1 Impairment Issues

The Blackfoot River and its tributaries provide critical fish and wildlife habitat, water for domestic consumptive use and agriculture (crops and livestock), and countless recreational opportunities. Maintaining and improving water quality is essential to continuing these beneficial water uses. The major water quality impairment issues identified in the Blackfoot Watershed include excess sediment and siltation, habitat alterations, flow alterations, elevated water temperature, and elevated nutrients and metals concentrations. Siltation and aquatic habitat alterations are the most common causes of water quality impairment on the 36 303(d) listed streams in the Blackfoot. Water quality impairment results from a wide array of land use practices such as mining, excessive riparian timber harvest, riparian grazing management, poorly designed roads, non-point source agricultural runoff, stream dewatering, and channel alterations. The natural complexity of the Blackfoot River system also contributes to impairments. Naturally high sediment production, low stream flows and drought prone areas, and other natural factors account for some impairment issues and compound problems when combined with human influences. The impacts of poor water quality are most often reflected in the health of fisheries as they are the most immediately impacted resource and provide a measure of overall watershed health. To a lesser extent water quality can affect recreational uses, crop yield, wildlife health, and livestock survival. In severe cases, poor water quality can limit drinking water availability. Regardless of impacts, the goal of this Action Plan is to maintain and improve water quality so that all beneficial uses are supported.

Within the Blackfoot Watershed, the great majority of inventoried streams exhibit some level of physical and biological impairment. The level of impairment varies significantly within and among streams. Fisheries related impairments represent the majority of restoration needs in the Blackfoot watershed. Functional tributaries play essential roles in the life stages (migration, spawning and rearing) of all fluvial Blackfoot River fish. Altered and degraded tributaries generally inhibit movement and reduce spawning and rearing success, which contributes to suppressed populations and inadequate recruitment of multiple species over large areas of the river. The sum of natural and human variables produces a diverse array of

wild fish communities that vary in species composition and overall population densities among river reaches.

Stream dewatering occurs naturally but is primarily caused by human activity. Agriculture plays a large role in the economy and lifestyle of the Blackfoot basin. Water is diverted from the Blackfoot River and its tributaries for crop and livestock production. Coupled with the effects of an extended drought, stream dewatering is of great concern to both fisheries and water quality. Lack of instream flows from dewatering and drought increases water temperature, limits fish passage, reduces survival, and increases the spread of diseases among fish. In addition, lack of instream flows limits the transportation of sediment, nutrients, and metals through the system leading to higher concentrations of these materials and impairments to water quality. By improving water use efficiency, especially during drought years, issues related to stream dewatering can be minimized while maintaining water uses for agriculture.

Although the Action Plan identifies a significant number of impaired streams, it should not be considered a complete list of restoration needs in the Blackfoot basin. For this reason, the Action Plan will undergo periodical updating and represents an adaptive approach to restoration planning that incorporates changing conditions and current information to ensure continued success in restoration efforts in the Blackfoot watershed.

1.4 RESULTS AND CONCLUSIONS

A total of 127 water bodies (streams, stream segments, river reaches, and lakes) were examined in this Action Plan (Figure 1-2). There is overlap and noticeable differences between the three program areas as shown in Table 1-1. The 108 “fisheries restoration priority” streams represent the majority of the list (85%). Fifty-four streams are included on the dewatered stream list (43%) and 36 streams are identified as impaired on the 303(d) list (28%). Forty-four of the streams fall exclusively under the fisheries restoration program (35%) and sixty-four streams (50%) are found in multiple program categories. The following analysis of the programs offers numerous considerations and opportunities for cooperative restoration projects.

Of the 127 total streams, 22 streams (17%) are included in all three restoration programs (fisheries priority, TMDL and dewatered streams). Eight of these streams ranked high on the fisheries prioritization while another eight ranked as moderate. The remaining six streams ranked low (Table 1-1).

There is a strong correlation between the TMDL and fisheries restoration program. Of the 36 streams or stream segments identified on the TMDL list, 33 streams (92%) are also included in the fisheries restoration program. Twelve of the TMDL streams ranked high, twelve ranked moderate, and nine streams ranked low on the fisheries prioritization list. The three 303(d) listed streams not included on the fisheries prioritization list include Beartrap Creek, Braziel Creek, and Sandbar Creek. Although 78 streams listed in the fisheries program are not included in the TMDL program, it should be noted that many of these streams are

tributaries to 303(d) listed water bodies and can be considered for restoration under the TMDL program as part of a comprehensive approach to water quality restoration.

Approximately 61% (22 of 36) of the TMDL streams are also found on the dewatered streams list (Table 1-1). None of the total streams fall exclusively in these two program areas. These 22 streams are the same streams that are common to all three program areas.

All but one of the dewatered streams were also listed under the fisheries restoration program (Dry Fork). Of these streams 23 ranked high on the fisheries prioritization while 15 streams ranked moderate and 15 ranked low.

Several collaborative restoration opportunities and possibilities for program integration are presented in this Action Plan. Sixty four of the streams listed in this Action Plan are found in multiple program areas and could be considered as good opportunities to address more than one impairment issue. Table 1-1 also shows that 25 restoration projects involving various partners will be implemented in 2005 and 2006. These projects address restoration needs identified in all three program areas. Appendix C contains more detailed descriptions of these projects that have been provided by partners. Once these projects are completed, they will be included in the inventory of completed projects. In the future, Appendix C will serve as an inventory of developed projects that will be implemented or are in need of funding.

Using this information for collaborative restoration projects will require commitment and coordination from the partners. This Action Plan is an initial step towards a watershed wide restoration program. As new programs and directives emerge, the Action Plan and partners will need to evolve to facilitate growing restoration needs.

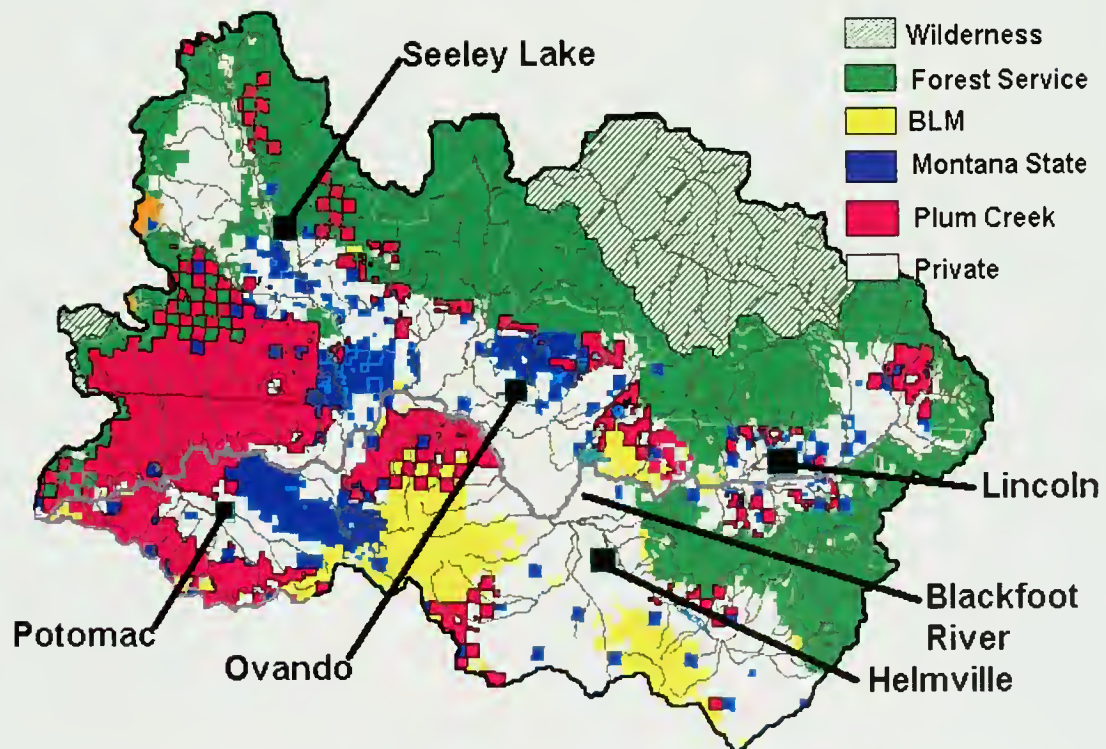
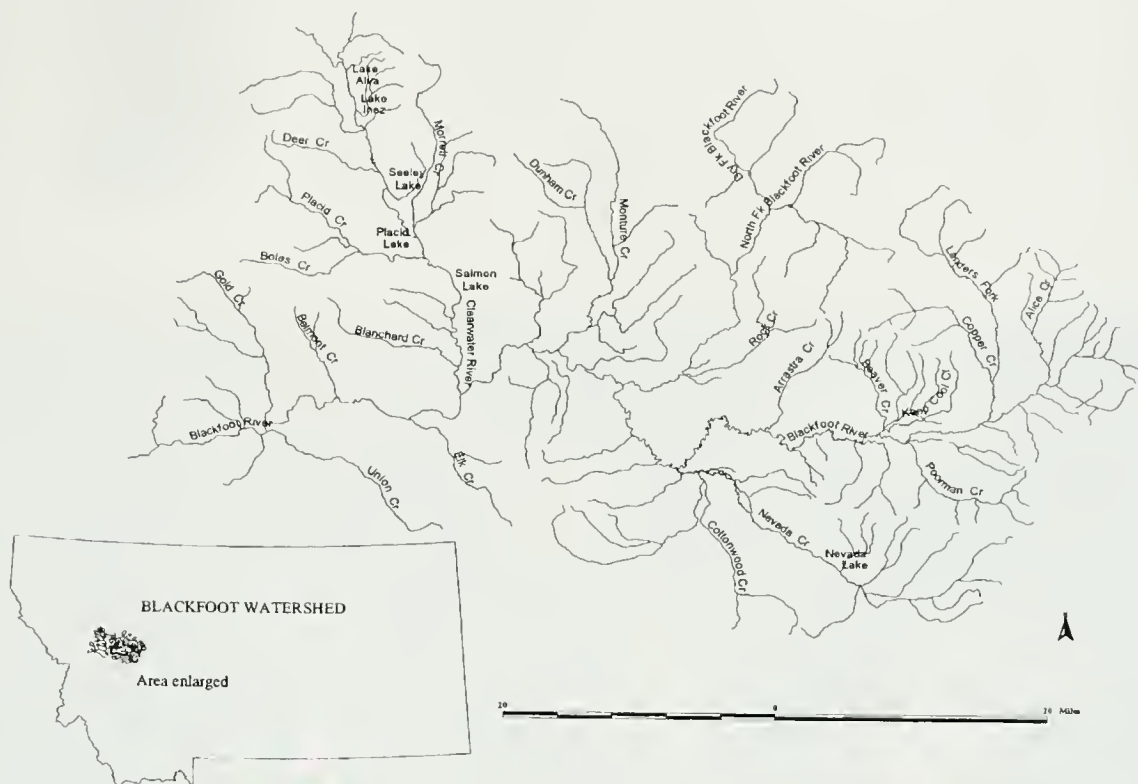


FIGURE 1-1. THE BLACKFOOT RIVER WATERSHED (ABOVE) AND LAND OWNERSHIP (BELOW).



Legend

- Blackfoot River Watershed
- TMDL Planning Area Boundary
- County Boundary
- Highway
- Land Ownership**
 - USFS
 - US BLM
 - State Land
 - Flathead Tribal Land
 - Plum Creek
 - Nature Conservancy
- 2004 303(d) Stream
- Fishery Priority Stream
- Dewatered Stream
- 2004 303(d) Stream/Fishery Priority Stream
- Fishery Priority Stream/Dewatered Stream
- 2004 303(d) Stream/Fishery Priority Stream/Dewatered Stream

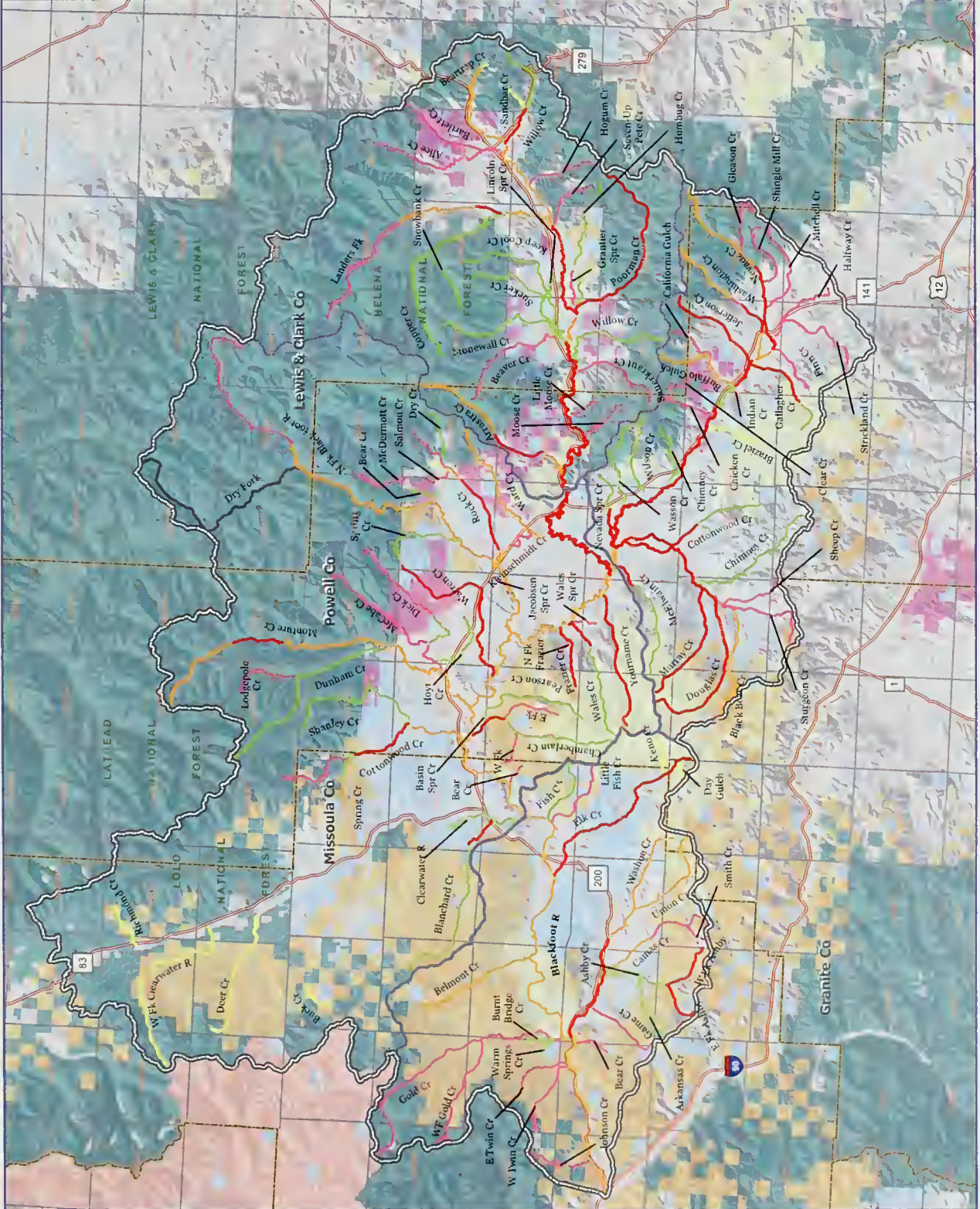


Figure 1-2
Fishery Restoration Priority, 303(d),
and Dewatered Streams in the
Blackfoot Drainage

TABLE I-1. CORRELATION BETWEEN 127 FISHERIES, TMDL, AND DEWATERED STREAMS IN THE BLACKFOOT WATERSHED

Stream Name	TMDL Planning Area	Fisheries Stream	Dewatered Streams	303(d) Listed Streams	Fisheries Priority Ranking	Completed Projects	2005 - 2006 Projects
Alice Creek	BFH	x			H-10		
Arkansas Creek	LBF	x	x		L-19		
Arrastra Creek	BFH	x	x	x	M-13		BBCTU/BC/FWP/DEQ
Ashby Creek	LBF	x	x		L-17		LO/FVLT/BBCTU/NRCS
Bartlett Creek	BFH	x			L-20		
Basin Creek	MBF	x			M-16		
Bear Creek (RM 12.2)	LBF	x			M-11	x	
Bear Creek (RM 37.5)	MBF	x			L-17		
Bear Creek (trib to NF)	MBF	x	x		L-21		
Beartrap Creek	BFH			x	NR		Asarco
Beaver Creek	BFH	x			H-4	x	
Belmont Creek	LBF	x		x	H-4	x	
Black Bear Creek	NC	x		x	M-16		
Blackfoot River - 1	BFH	x	x	x	H-9		Asarco
Blackfoot River - 2	BFH	x		x	H-9	x	
Blackfoot River - 3	BFH	x		x	M-11	x	
Blackfoot River - 4	MBF	x	x	x	H-9		
Blackfoot River - 5	MBF	x		x	M-13		
Blackfoot River - 6	LBF	x		x	M-16	x	
Blanchard Creek	MBF	x	x	x	H-7	xxx	
Braziel Creek	NC			x	NR		
Buck Creek	MBF			LSCD	NR		
Buffalo Gulch	NC	x		x	L-19		
Burnt Bridge Creek	LBF	x	x		L-23		
California Gulch	NC	x			L-19		
Camas Creek	LBF	x		LSCD	L-17		
Chamberlain Creek	MBF	x	x	FS	H-10	x	LO/BBCTU/DNRC
Chamberlain Creek (EF)	MBF	x			M-15		
Chamberlain Creek (WF)	MBF	x			L-17		
Chicken Creek	NC	x			L-17		
Chimney Creek (Douglas)	NC	x	x		L-17	x	
Chimney Creek (Nev)	NC	x	x		L-24		
Clear Creek	NC	x			L-23		
Clearwater River	MBF	x	x		M-13	x	LO/BBCTU/FWP/USFWS
Copper Creek	BFH	x	x		H-7		
Cottonwood Creek (RM 43)	MBF	x	x	FS	H-3	xxxxxx	USFS/BBCTU
Cottonwood Creek (Nev)	NC	x		x	L-19	x	
Day Gulch	LBF			LSCD	NR		
Deer Creek	MBF			FS	NR		
Dick Creek	MBF	x	x		H-3	x	LO/NRCS/BBCTU
Douglas Creek (Upper)	NC	x	x	x	M-13	x	
Douglas Creek (Lower)	NC	x	x	x	M-13		LO
Dry Creek	MBF	x	x		M-11	xx	LO/FVLT
Dry Fork	MBF		x		NR		
Dunham Creek	MBF	x	x		H-6	xx	
East Fork Ashby	LBF			LSCD	NR		
East Twin Creek	LBF	x			M-12	x	
Elk Creek (Upper)	LBF	x	x	x	H-8	x	
Elk Creek (Lower)	LBF	x	x	x	H-8	x	

TABLE 1-1. CORRELATION BETWEEN 127 FISHERIES, TMDL, AND DEWATERED STREAMS IN THE BLACKFOOT WATERSHED

Stream Name	TMDL Planning Area	Fisheries Stream	Dewatered Streams	303(d) Listed Streams	Fisheries Priority Ranking	Completed Projects	2005 - 2006 Projects
Finn Creek	NC	x			L-18		
Fish Creek	LBF	x	x		M-13		
Frazier Creek	MBF	x	x	x	L-20		
Frazier Creek (NF)	MBF	x	x		L-23		
Gallagher Creek	NC	x	x	x	L-20		
Game Creek	LBF	x			L-20		
Gleason Creek	NC	x			L-23		
Gold Creek (WF)	LBF	x			H-5		
Gold Creek	LBF	x			H-6	x	
Grantier Spring Creek	BFH	x			M-16	x	
Halfway Creek	NC	x			L-18		
Hogum Creek	BFH	x			M-15		
Hoyt Creek	MBF	x	x		H-8	x	LO/BBCTU/BC/NRCS
Humbug Creek	BFH	x	x		L-20		LO/BBCTU
Indian Creek	NC	x			L-22		
Jacobsen Spring Creek	MBF	x			M-14		LO/NRCS/BBCTU
Jefferson Creek (Upper)	NC	x	x	LSCD	L-19		
Jefferson Creek (Lower)	NC	x	x	x	L-19		
Johnson Creek	LBF	x			M-12	x	
Keep Cool Creek	BFH	x	x		M-12		
Keno Creek	LBF				NR		
Kleinschmidt Creek	MBF	x		x	H-5	xx	(2) LO/NRCS/BBCTU
Landers Fork	BFH	x	x	FS	H-2		
Lincoln Spring Creek	BFH	x			M-13		
Little Fish Creek	LBF	x			M-11		
Little Moose Creek	BFH	x			L-17		
Lodgepole Creek	MBF	x			M-11		
McCabe Creek	MBF	x	x		H-9	xx	
McDermott Creek	MBF	x			L-23		
McElwain Creek	NC	x	x	LSCD	H-10		
Mitchell Creek	NC	x			L-18		
Monture Creek	MBF	x	x	x	H-1	xxx	LO/NRCS
Moose Creek	BFH	x			M-15		USFS/BBCTU
Murray Creek	NC	x	x	LSCD	L-17		
Nevada Creek (Upper)	NC	x	x	x	M-14	x	LO/NRCS/BC/DEQ
Nevada Creek (Lower)	NC	x	x	x	L-19	x	LO
Nevada Spring Creek	NC	x	x	x	M-11	xxxx	LO/NRCS
Nevada Lake	NC			LSCD	NR		
North Fork Blackfoot River	MBF	x		FS	H-1	xxxxxx	
Pearson Creek	MBF	x	x		M-12	x	LO/NRCS
Poorman Creek	BFH	x	x	x	H-2	xxxxxx	
Richmond Creek	MBF			FS	NR		
Rock Creek	MBF	x	x	x	H-4	xxxx	LO/NRCS/FVLT
Salmon Creek	MBF	x			H-10	xx	
Salmon Lake	MBF			FS	NR		
Sandbar Creek	BFH			x	NR		
Sauerkraut Creek	BFH	x			M-12		
Seeley Lake	MBF			FS	NR		
Seven Up Pete Creek	BFH	x			M-16		

TABLE 1-1. CORRELATION BETWEEN 127 FISHERIES, TMDL, AND DEWATERED STREAMS IN THE BLACKFOOT WATERSHED

Stream Name	TMDL Planning Area	Fisheries Stream	Dewatered Streams	303(d) Listed Streams	Fisheries Priority Ranking	Completed Projects	2005 - 2006 Projects
Shanley Creek	MBF	x	x		H-10	x	
Sheep Creek	NC	x			L-17		
Shingle Mill Creek	NC	x			L-20		
Smith Creek	LBF	x			L-24		
Spring Creek (Cottonwood)	MBF	x	x		H-10		
Spring Creek (NF)	MBF	x	x		H-8	x	LO/BBCTU/NRCS
Snowbank Creek	BFH	x	x		H-6		
Strickland Creek	NC	x			L-21		
Stonewall Creek	BFH	x	x		H-10		
Sturgeon Creek	NC	x			L-18		LO
Sucker Creek	BFH	x	x		M-14		
Union Creek	LBF	x	x	x	M-14	x	
Wales Creek	MBF	x	x	LSCD	M-12		
Wales Spring Creek	MBF	x			H-10		
Ward Creek	MBF	x		x	L-21		LO/BC/BBCTU/EPA
Warm Springs Creek	LBF	x	x		L-17		
Warren Creek	MBF	x	x	x	H-7	xx	LO/BC/BBCTU/NRCS/EPA
Warren Creek (Doney Lake)	MBF	x			L-22		
Washington Creek (Upper)	NC	x	x	x	L-19		
Washington Creek (Lower)	NC	x	x	x	L-19		
Washoe Creek	LBF	x		LSCD	L-18		
Wasson Creek	NC	x	x		H-10	x	LO/BBCTU/BC/NRCS/FWP/EPA
West Fork Ashby Creek	LBF			LSCD	NR		
West Fork Clearwater River	MBF			FS	NR		
West Twin Creek	LBF	x			M-12	x	
Willow Creek (Upper)	BFH	x		x	M-14		
Willow Creek (Lower)	BFH	x	x		H-7		
Wilson Creek	NC	x	x		M-14		
Yourname Creek	MBF	x	x	x	M-11		

Totals

108

54

56 - Total

35 - High

36 - Listed

35 - Moderate

11 - LSCD

42 - Low

9 - FS

15 - Not ranked

127 Water Bodies (streams, stream segments, river reaches, and lakes)

108 streams and stream segments on the fisheries priority list (85%). 34 streams rank high, 34 moderate, and 40 low.

54 streams and stream segments on the dewatered list (43%). 23 streams rank high, 15 moderate, 15 low, and 1 unranked

Dry Fork is the only dewatered stream not ranked

36 water bodies on the TMDL list. An additional 11 streams LSCD and 9 streams are fully supporting (28%). Of the 36 listed

TMDL streams 12 rank high, 12 moderate, 9 low, and 3 are unranked (Beartrap, Braziel, and Sandbar Creeks).

44 streams fall exclusively under the fisheries category (35%)

64 streams fall under multiple categories (50%)

22 streams and stream segment fall under all three categories (17%). 8 rank high, 8 moderate, and 6 low

53 of the 54 (98%) dewatered streams are also on the fisheries list. 23 rank high, 15 moderate, and 15 low.

33 of the 36 listed TMDL streams (92%) are found on the fisheries list. 12 rank high, 12 moderate, and 9 low

22 of the 36 TMDL streams (61%) are also found on the dewatered list. 8 rank high, 8 moderate, and 6 low

2.0 ACTION PLAN IMPLEMENTATION PROCESS

Interagency cooperation, fostering of partnerships, and adoption of a watershed approach have helped stakeholders in the Blackfoot Watershed address natural resources issues such as weed infestation, wildlife management, drought management, and growth and development. It is this collaborative approach that has led to the development of this Action Plan. The Action Plan will be implemented through this environment of cooperation and partnerships in order to effectively address fisheries, TMDL, and stream dewatering restoration needs on both private and public lands. Implementation of this Action Plan will help strengthen and expand the partnership and its restoration programs.

2.1 ACTION PLAN IMPLEMENTATION APPROACH

Approaches to stream restoration under this current version of the Action Plan are a result of the Action Plan goals and objectives as well as restoration approaches inherent to the current restoration programs operating in the watershed (i.e., native fish conservation, water conservation, and the TMDL program). These programmatic approaches are a driving force in restoration planning in the watershed, dictating such key restoration elements as project identification, selection, prioritization and design. Following is a summary of the general approaches to restoration planning and implementation covered by this Action Plan. These approaches are based on current restoration priorities and program needs, but may change in the future as these priorities and needs change in response to future restoration successes, other restoration programs, or as other relevant information becomes available within the watershed.

2.1.1 Tributary Focus

Problems in mainstem Blackfoot River fisheries generally result from tributary impairments. As a result, stream restoration activities in the Blackfoot Watershed have focused on fisheries-sensitive tributaries rather than the Blackfoot River mainstem. Because tributaries are critical to native fish spawning and survival and the impaired tributaries act as a source of impairment to the Blackfoot River, this tributary approach to watershed restoration has proven to be successful at meeting the watershed restoration goals and objectives including improvements to native fish populations. Therefore, the current focus of tributary restoration in the three primary restoration programs operating in the drainage are expected to continue. As more tributaries are successfully restored, restoration needs and opportunities on the mainstem Blackfoot River may be considered where relevant. Likewise, future restoration activities may focus on lakes and wetlands within the watershed.

2.1.2 Partnership Building

Strong partnerships are a primary reason for the success of restoration in the Blackfoot and continuing these partnerships is crucial to future efforts. Through this Action Plan, partnerships are strengthened by integration of the three primary restoration programs currently operating in the watershed, more systematic sharing of information, and increased opportunities for cooperative projects. It is fully recognized that participating partners will

continue to pursue individual projects based on their priorities, mission, and directives. This Action Plan is not intended to supersede individual organization's restoration priorities and activities, but to create a "restoration network" that provides assistance to partners, limits duplicative efforts and associated inefficiencies, and helps multiple partners operating within the watershed meet their restoration goals and objectives through cooperative project planning, development, implementation, and monitoring.

2.1.3 Landowner Cooperation

Due to the fact that significant levels of watershed impairment issues occur on private land, cooperation with private landowners is critical to the continued success of restoration programs in the Blackfoot. Over 200 private landowners have completed restoration projects in the Blackfoot and much of the restoration still needing to be undertaken is on private lands. Given the strong stewardship history and ethic, the Action Plan relies on the sustained private-public partnership that has been built since the 1970's in the Blackfoot Watershed.

2.2 IMPLEMENTATION PROCESS

In order to facilitate and coordinate activities under this Action Plan, a partners committee will be formed. The Blackfoot Watershed Restoration Partners will meet yearly to review and update the Action Plan and to coordinate known projects. The Partnership will meet more often if needed and as funding opportunities arise. The partners will be requested to:

- Update the summary of fisheries priority streams, TMDL projects, and dewatered streams;
- Maintain the consolidated list of assessed streams and short-term and mid-term proposed projects;
- Review projects initiated and/or completed during each year ;
- Identify candidate projects for design development, fund raising, and implementation over next 2-5 years;
- Update the inventory of completed projects and completed monitoring; and
- Review and update the monitoring restoration protocol.

The following factors will be used by the Restoration Partners in reviewing and selecting cooperative projects:

- Timeliness of Project – Is project ready to be implemented, has a design been prepared, are landowner agreement in place, are permits approved?
- Funding Appropriateness – Is the project eligible for funding?
- Design – Is the project design adequate to meet intended restoration objectives?
- Partners – Are there multiple partners willing to seek/fund project?
- Restoration Goals and Objectives – Does the proposed project have clearly defined goals and objectives? Can goals and objectives be reasonably met, and does the project address the identified source of the problem rather than a symptom?
- Monitoring – Has a monitoring plan been developed, do partners agree on appropriateness of monitoring?

2.3 PARTICIPATING PARTNERS

As noted above, development and maintenance of strong partnerships is a key element to the Action Plan restoration approach. Past restoration successes in the Blackfoot Watershed have been possible through the efforts of several public and private entities, exemplifying the cooperative nature of land use planning over the past several years. Partners involved in past restoration planning and implementation include: the Blackfoot Challenge and its Habitat and Water Quality Restoration Committee; Big Blackfoot Chapter of Trout Unlimited (BBCTU); Montana Fish, Wildlife and Parks (FWP); US Fish and Wildlife Service Partners for Fish and Wildlife Program (USFWS); Natural Resource Conservation Service (NRCS); US Forest Service (USFS); Bureau of Land Management (BLM); Lewis and Clark, Powell, and Missoula County Conservation Districts; Montana Department of Natural Resources (DNRC); Montana Department of Transportation (MDT); Plum Creek Timber Company (PCTC); Five Valleys Land Trust (FVLT); and others. These partnerships have also played significant roles in stream restoration planning and implementation in the watershed.

In addition to the partners listed above, the following partners have contributed substantially to the development of monitoring protocols and programs: Montana Fish, Wildlife and Parks; US Geological Survey (USGS); Montana Department of Environmental Quality (DEQ); US Environmental Protection Agency (EPA); Hydrometrics, Inc.; Land Water Consulting, Inc.; McNeal Resources; and the Blackfoot Challenge Monitoring Work Group.

2.4 ROLE OF PARTNERS

The Blackfoot Challenge will be responsible for organizing and coordinating the annual Blackfoot Watershed Restoration Partners Committee meeting as well as periodic Restoration Partners and Land Stewards meetings. The Challenge will also coordinate updates to the Restoration Action Plan Report, and through its Habitat and Water Quality Restoration Committee, will involve restoration partners in the TMDL planning and implementation grant requests. The Challenge, through its Monitoring Work Group, will assist in review and provide input on pre- and post-project monitoring protocols, and will assist partners in obtaining funding for restoration projects through grant writing assistance or other means.

The Big Blackfoot Chapter of Trout Unlimited (BBCTU) will co-host annual Restoration Action Plan meetings and will participate in other cooperative restoration meetings. BBCTU will take a lead in maintaining the database and inventory of completed restoration projects, proposed restoration projects, and priority streams list. BBCTU will host monthly Fisheries and Habitat Committee meetings and take a lead in landowner contacts, project identification, contracting for design of restoration projects, as well as oversee project implementation, and project monitoring in the watershed. BBCTU will also take the lead on coordinating grant writing.

Montana Fish, Wildlife and Parks (FWP) will participate in Restoration Action Plan meetings and take the lead on maintaining the Summary of Priority Streams portion of the

Action Plan and periodic updates to stream prioritization, report on monitoring activities, and advise on fisheries monitoring protocols. FWP will develop projects and grant proposals, and oversee projects funded through FWP.

Given the history of this partnership, it is expected that the other partners listed in Section 2.2 will continue to contribute to restoration efforts and the implementation of this Action Plan. These contributions are expected to include: participation in Restoration Partnership meetings; providing technical assistance for the identification, development, and prioritization of restoration projects; providing technical assistance to project designs and monitoring plans; developing and overseeing projects funded by their respective agencies or organizations; assist with private landowner contacts as necessary; advise on grant funds available and assist with grant writing proposals for restoration and monitoring; and provide funding for primary field staff as necessary to help meet restoration program demands.

2.5 FUNDING PROGRAMS

Most restoration projects undertaken in the Blackfoot are cost-shared by multiple partners. The Restoration Partners agree to meet periodically to coordinate grant applications with the goal of a higher level of funding for on-the-ground conservation projects. The Restoration Partners will communicate and coordinate regarding funding from the sources listed in Table 2-1. New funding sources will be added to Table 2-1 as they are identified. Currently identified grants and funding sources are subject to change.

TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES

Agency/Grant Program	Contact	Amount	Limits Per Application	Source	Funding Cycle	Application Due Dates	Who Can Apply	Description
DEQ 319 Program	Rob Rung rrung@mt.gov	1.5 million annually	Not specified	Federal	Annual	Draft 10/1 Final 12/1	Government Entities and Non-profit Organizations	protection, improvement, or planning; 4 categories of applications - Watershed TMDL Planning, Watershed Restoration, Groundwater, and Information/Education
MT FWP Future Fisheries	Mark Lere 406-444-2432	~\$750,00 annually	Not specified	State	6 months	Jan 1 and July 1	Anyone, but coordination with local fisheries biologist recommended	Projects that restore or enhance habitat for naturally reproducing populations of wild fish.
DNRC RRGL Planning Grant	Pam Smith pamsmith@mt.gov	\$300,000 this biennium	\$10,000	State	Biannual	Open cycle	Government Entities	Must be for the conservation, management, development, or protection of a renewable resources in Montana. 50% cash match required unless sponsored by a non-revenue producing entity such as a CD
DNRC RRGL Grant	Pam Smith pamsmith@mt.gov	4 million biennial	\$100,000	State	Biennial	May 15th even numbered years	Government Entities	Must be for the conservation, management, development, or protection of a renewable resources in Montana.
DNRC RDGP	Greg Mills gmills@mt.gov	4 million biennial	\$300,000	State	Biennial	May 15th even numbered years	Government Entities	Projects that reclaim lands damaged by mining; activities that address crucial state needs. Projects must provide benefits in one or more of the following: reclamation, mitigation, and research related to mining and exploration; identification and repair of hazardous waste sites, research to assess existing or potential environmental damage.
DNRC Private Grants	Larry Bloxom lbloxom@mt.gov	\$100,000 biennial	\$5,000 or 25% of the total estimated project cost	State	Biennial	Open cycle	An individual association, for-profit corporation or non-profit corporation	Projects relating to water where the quantifiable benefits exceed the costs
NRDP - Large Grants	Kathy Coleman kcoleman@mt.gov	6.5 - 8.5 million annually	Not specified	State	Annual	Open cycle	Government Entities, Privates, Non-profits	Projects must restore, replace, or acquire the equivalent of injury natural resources and/or lost services covered in Montana v. ARCO lawsuit
NRDP - Project Development Grants or Small Projects	Kathy Coleman kcoleman@mt.gov	\$200,000 annually	\$25,000	State	Annual	Open cycle	Government Entities, Privates, Non-profits	Projects must restore, replace, or acquire the equivalent of injury natural resources and/or lost services covered in Montana v. ARCO lawsuit

TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES

Agency/Grant Program	Contact	Amount	Limits Per Application	Source	Funding Cycle	Application Due Dates	Who Can Apply	Description
USFWS Fish & Habitat Conservation - Fish Passage	Chris Lowie Chris_Lowie@fws.gov	Nationally 3.6 million in 2005	None although under \$50,000 are most attractive	Federal	Annual	Open cycle	Unrestricted	Project funding is for fish passage restoration by removing or bypassing barriers to fish movement such as dam removal, culvert renovation, desinging and installing fishways, installing fish screens, and barrier inventories to identify additional fish passage impediments.
USFWS Partners for Fish & Wildlife Program	Sally Valdes Sally_Valdes@fws.gov	Nationally 16.8 million in 2005	\$25,000	Federal	Annual	Open cycle	Some restrictions	This program provides technical and financial assistance to private landowners for habitat restoration on their lands. A variety of habitats can be restored to benefit federal trust species (for example migratory birds and fish and threatened and endangered species).
USFWS Private Stewardship Grants Program	Louise Clemency louise_clemency@fws.gov	Nationally 6.5 million in 2005	Not specified	Federal	Annual	Set by regional offices	Some restrictions	This program provides grants and other assistance to individuals and groups engaged in private, voluntary conservation efforts that benefit species listed or proposed as endangered or threatened under the ESA. Eligible projects include those by landowners and their partners who need technical and financial assistance to improve habitat or implement other activities on private lands.
USFWS Cooperative Endangered Species Conservation Fund (Section 6)	Louise Clemency louise_clemency@fws.gov	Not specified	Not specified	Federal	Annual	Set by regional offices	State governments that have a current cooperative agreement with the Secretary of the Interior	This program funds a wide array of voluntary conservation projects for candidate, proposed, and listed endangered species.
USFWS Cooperative Conservation Initiative	Regional or local office	Not specified	Not specified	Federal	Annual	Set by regional offices	Not specified	Support efforts that restore natural resources and establish or expand wildlife habitat

TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES

Agency/Grant Program	Contact	Amount	Limits Per Application	Source	Funding Cycle	Application Due Dates	Who Can Apply	Description
USFWS Fisheries Restoration & Irrigation Mitigation Act (FRIMA)	Morgan McCosh Elmer morgan_elmer@fws.gov	Not specified	Not specified	Federal	Annual	Set by regional offices	Local and state governments, partnerships, and Conservation Districts. Landowner is often a co-applicant	Design, construction, and installation of fish screens, fish ladders, or other fish passage devices associated with water diversions. Projects may also include modifications to water diversion structures that are required for effective functioning of fish passage devices.
USFWS Dingell-Johnson Sport Fish Restoration	Regional or local office. Website: http://fa.r9.fws.gov	Nationally ~293 million in 2005 & 2006	Not specified	Federal	Annual	Set by regional offices	State fish & wildlife agencies	Support activities designed to restore, conserve, manage, or enhance sport fish populations and the public use benefits from these resources; and to support activities that provide boating access to public waters. Projects supported include fish habitat improvement, reasearch on fishery problems, surveys and inventories of fish populations, provision for public use of fishery resource, and lake and stream rehabilitation.
USFWS Landowner Incentive	Regional or local office. Website: http://international.fws.gov	Nationally 18 million in 2005; 34 million in 2006	Awards range from \$165,000 to 1.7 million	Federal	Annual	Set by regional offices	State fish & wildlife agencies	These grants are available for conservation efforts to be carried out on private lands, to provide technical or financial assistance to private landowners for the purpose of benefiting Federally listed, proposed or candidate species.
USFWS North American Wetlands Conservation Fund (NAWCA)	Regional or local office. Website: http://birdhabit at.fws.gov/NA WCA/grants.htm	61 million in 2005; 75 million in 2006	Awards range from less than \$50,000 to \$710,000	Federal	Annual	March, July, and December	Public and private organizations or individuals who have developed partnerships to carry out wetland conservation projects	Funds may be used to restore, manage, and/or enhance wetland ecosystems and other habitat for migratory birds and other fish and wildlife. Lands and waters must have as their primary purpose long-term water conservation for the benefit of migratory birds and other wildlife.
NRCS Environmental Quality Incentives Program	Local USDA Service Center	Not specified - varies from national to state level	Up to \$450,000 per project	Federal	Annual	Varies - deadlines set each year	Private landowners that are agricultural producers (can be assisted by conservation groups, consultants, etc.)	Provides voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals.

TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES

Agency/Grant Program	Contact	Amount	Limits Per Application	Source	Funding Cycle	Application Due Dates	Who Can Apply	Description
NRCS Wildlife Habitat Incentives Program	Local USDA Service Center	Not specified - varies from national to state level	Not specified	Federal	Annual	Varies - deadlines set each year	Private landowners (can be assisted by conservation groups, consultants, etc.)	Voluntary program for people who want to develop and improve wildlife habitat primarily of private lands. This program provides both technical and cost share assistance to establish and improve fish and wildlife habitat.
FSA Conservation Reserve Program	Local USDA Service Center	Acreage capped program - currently 39.2 million acres nationally	\$50,000 annual CRP income per producer	Federal	Annual	Continuous sign up for buffer practices; periodic one-month signups for General CRP	Private landowners that are agricultural producers (can be assisted by conservation groups, consultants, etc.)	Programs offers annual rental payments, incentive payments, and cost-share for establishment of grasslands, riparian habitat, and wetlands on marginal cropland and pastureland.
NRCS Wetlands Reserve Program	Local USDA Service Center	Not specified - varies from national to state level	Not specified	Federal	Annual	Open cycle	Private landowners (can be assisted by conservation groups, consultants, etc.)	Voluntary wetland conservation program that offers perpetual easements, 30-year easements, and 10-year restoration cost-share agreements. NRCS holds CEs, private landowner controls access and performs management.
BOR Water Conservation Field Services Program	Area or local Bureau of Reclamation office	\$450,000	\$25,000	Federal	Annual	June	Unrestricted	Financial assistance for demonstration programs and pilot projects to promote and implement improved water management and conservation. Also for planning, designing, and construction improvements that will conserve water, increase water use efficiency, or enhance water management through measurement or automation, at existing water supply projects within the 17 western states.
Columbia Basin Water Transaction	Stan Bradshaw Sbradshaw@t u.org	Not specified	Not specified	Private	Not specified	Not specified	Qualified Local Entities (Trout Unlimited)	Improve flows to streams and rivers in the Columbia Basin through water acquisitions, boosting efficiency, conserving habitat, rethinking the source, pools, and banks.

TABLE 2-1. RESTORATION PLANNING, PROJECTS AND MONITORING FUNDING SOURCES

Agency/Grant Program	Contact	Amount	Limits Per Application	Source	Funding Cycle	Application Due Dates	Who Can Apply	Description
Tri-County Resource Advisory Council	Jack deGolia jdegolia@ts.fe d.us	Varies - designated by counties each fiscal year. \$100,000 was available for the 2005 fiscal year	In 2005, approved project amounts ranged from \$1,000 to \$16,000	Federal	Annual - The SRSCSDA expires on September 30, 2006. Congress will need to reapprove this Act for funding past this date	Varies - applications are reviewed during RAC meetings	Unrestricted - preference is for projects with several partners	Projects must be located within one of the three counties covered by the Tri-County RAC (Deer Lodge, Granite, or Powell). Funds must be spent on project that benefit federal land, although projects do not have to be located on federal land. Eligible projects include watershed restoration and maintenance; restoration, maintenance, and improvement of wildlife and fish habitat; or reestablishment of native species.

3.0 TOTAL MAXIMUM DAILY LOAD (TMDL)-RELATED RESTORATION PLANNING

As described in Section 1, the restoration Action Plan addresses three restoration programs currently operating within the watershed: the Native Fisheries Management Program; Water Conservation and Drought Management Program; and the TMDL Program. This section of the Action Plan addresses Total Maximum Daily Load (TMDL)-related restoration priorities and opportunities. The TMDL-related restoration program is presented separate from the fisheries-related and water conservation restoration programs due to differences in program strategies, priorities, and potential funding mechanisms. Unlike the other widely evaluated programs (fisheries and drought management), the TMDL program only covers a portion of the impaired streams in the Blackfoot watershed. Although the TMDL listed streams are clearly in need of improvement, the TMDL list as a whole is not considered comprehensive of all water quality impaired streams.

Following is a brief description of the TMDL process and implications for restoration planning, a summary of water bodies within the Blackfoot Watershed identified through the TMDL program as impaired, and potential TMDL-related restoration projects as currently identified. It is the intent that this information, updated yearly to incorporate new TMDL implementation strategies and opportunities, will provide the basis for identification, selection, prioritization, funding, and implementation of future TMDL-related restoration activities.

3.1 THE TMDL PROCESS AND IMPLICATIONS FOR RESTORATION PLANNING

Section 303(d) of the federal Clean Water Act (and related regulations) requires states to assess the condition of surface waters within their borders to identify water bodies that are impaired, or do not fully meet water quality standards. The resulting list of water quality impaired water bodies is known as the 303(d) list. Section 303(d) also requires states to develop water quality improvement plans and strategies, also referred to as TMDLs, for water bodies on their 303(d) list.

In Montana, the Department of Environmental Quality (DEQ) is tasked with development of TMDLs. Montana's approach is to develop TMDLs in the context of comprehensive water quality restoration plans. The goal of a TMDL and water quality restoration plan is to identify sources of water quality impairment, and the level of water quality improvement necessary for a water body to fully support all intended beneficial uses for that water body. Water quality restoration plans typically include a restoration strategy or generalized plan for restoring water quality and associated beneficial uses. In this way, the TMDL program represents an initial step in restoration planning for 303(d)-listed streams.

To encourage water quality restoration efforts in 303(d)-listed streams, various state and federal agencies offer funding in the form of grants and other programs to implement TMDL-identified restoration projects. Therefore, TMDL development is tied to restoration planning

in the Blackfoot Watershed by helping identify restoration needs and priorities, and by providing a potential source of funding for restoration projects.

3.2 TMDL DEVELOPMENT IN THE BLACKFOOT WATERSHED

The Blackfoot Watershed has been divided into four distinct planning areas for purposes of TMDL development (Figure 3-1). The four planning areas include:

- The Blackfoot Headwaters Planning Area, extending from the Blackfoot Headwaters to the confluence with Nevada Creek;
- The Middle Blackfoot, including the Blackfoot River Drainage from Nevada Creek to the confluence with Blanchard Creek;
- The Nevada Creek Planning Area covering the Nevada Creek drainage from its headwaters to the confluence with the Blackfoot River; and
- The Lower Blackfoot Planning area, extending from Blanchard Creek downstream to the confluence with the Clark Fork River.

In 2000, the Montana Department of Environmental Quality approached the Blackfoot Challenge and requested its participation in the development of TMDL plans in the Blackfoot watershed. The Challenge accepted this leadership role since TMDL development fit with their mission and goals for the Blackfoot Watershed, and because locally led efforts will produce a more practicable TMDL plan. TMDL development began in the Headwaters Planning Area in 2001 with development of a Water Quality Restoration Plan and TMDLs for sediment and habitat-related impairments, and a second Water Quality Restoration Plan and TMDLs for metals-related impairment. These documents identified sources of pollution in the 303(d) listed water bodies, as well as conceptual strategies for addressing the identified sources of pollution. TMDL development is currently in progress in the Middle Blackfoot and Nevada Creek Planning areas with TMDL completion scheduled for 2006. TMDL development for the Lower Blackfoot Planning Area is in the initial planning stages with completion scheduled for 2007. As with the Headwaters Water Quality Restoration Plan and TMDLs, the Nevada Creek, Middle and Lower Blackfoot Plans will include restoration strategies to help guide future restoration planning.

3.3 303(d) LISTED WATER BODIES

Since 1996, a total of 56 water bodies (streams, stream segments, river reaches, and lakes) have been identified as impaired on the biannual 303(d) lists (Table 3-1). Since 1996, nine previously listed water bodies have been found to be “Fully Supporting” beneficial uses and are no longer considered to be impaired for TMDL planning purposes. An additional 11 water bodies are included on the list as lacking sufficient credible data (SCD) for determination of impairment conditions at this time. The nine delisted streams and 11 streams lacking SCD are not addressed in this restoration Action Plan. The 11 streams lacking SCD will be incorporated into the Plan if future assessment by MDEQ shows these streams to be impaired. Also, the 20 streams either delisted or lacking SCD may be included under the fisheries or water conservation-related restoration planning portions of this Plan as discussed in subsequent sections. As of March 2005, 36 water bodies are identified as

impaired under the TMDL program. These streams are the focus of the TMDL-related restoration planning in this Action Plan. A history of 303(d) listings for the Blackfoot Watershed dating back to 1996 is included in Table 3-1, and the 2004 303(d) listed streams are shown on Figure 3-1.

Several different causes of water quality impairment are specified in the 2004 303(d) list, with the most common including siltation, habitat alterations and flow alteration. Other less frequently listed causes of impairment include metals, nutrients, thermal modification, and riparian degradation. In TMDL-related restoration planning, the restoration objectives will address the specific listed causes of impairment for the water body. The goal of restoration is to assure that all water quality standards are met and all beneficial uses attained in these streams.

The 36 303(d)-listed water bodies span the Blackfoot Watershed, with the distribution by TMDL planning area as follows:

- Blackfoot Headwaters (7): Two sections of the Blackfoot River and Sandbar Creek, Willow Creek, Beartrap Creek, Poorman Creek, and Arrastra Creek;
- Middle Blackfoot (10): Two sections of the Blackfoot River and Blanchard Creek, Frazier Creek, Kleinschmidt Creek, Monture Creek, Rock Creek, Ward Creek, Warren Creek, and Yourname Creek;
- Nevada Creek (13): Two sections of Douglas Creek, Nevada Creek, and Washington Creek; Lower Jefferson Creek, Black Bear Creek, Braziel Creek, Buffalo Gulch, Cottonwood Creek, Gallagher Creek, and Nevada Spring Creek; and
- Lower Blackfoot (6): Two segments of the Blackfoot River and Elk Creek; Belmont Creek and Union Creek.

3.4 TMDL-RELATED RESTORATION PROJECTS

Appendix B contains a list of ongoing and potential restoration projects on some of the 36 water bodies listed as impaired on the 2004 303(d) list. The primary objective of these projects, as currently defined, is to address the causes of impairment identified on the 303(d) list (as well as other potential causes of impairment) to the point that all intended beneficial uses of the waters are supported, and the streams can ultimately be removed from the 303(d) list. A number of these projects may also meet the restoration objectives and strategies of the fisheries-related or water conservation-related portions of this Action Plan.

The restoration projects listed in Appendix B range from abandoned mine reclamation projects designed to reduce metals loading to streams, to grazing management projects designed to, among other things, improve aquatic habitat and reduce nutrient and sediment loading, to stream reconstruction projects. Most of the projects are preliminary and represent restoration “ideas” and opportunities at this time. Others include restoration strategies outlined in the completed Blackfoot Headwaters TMDLs or projects identified or being developed by partners. These projects must go through initial planning stages, including landowner negotiations and peer review, prior to advancing to the conceptual design and implementation phase. Other projects are in the more advanced stages having already gone

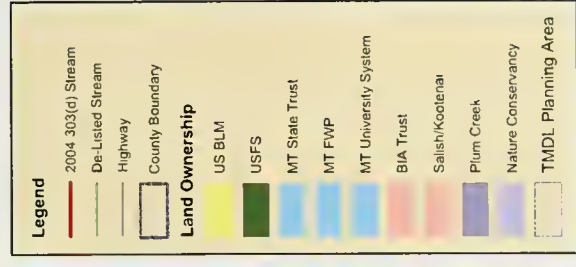
through landowner negotiations and conceptual planning and design, and in some cases are partially funded. These projects are considered to be higher priority for implementation purposes at this time due to their potential for near-term implementation. Projects currently identified as “preliminary,” or other potential projects not yet identified, may be elevated to near-term depending on the progress of project planning and landowner negotiations, availability of funding sources, or potential synergies with fisheries or water conservation-related projects. The Action Plan will be updated at least yearly to maintain a list of projects suitable for near-term implementation (within one to two years) should funding or other implementation opportunities arise.

Of the potential projects listed in Appendix B, some are considered to be near-term projects based on the level of planning completed for the project, as well as the severity of impairment conditions and potential benefits associated with the proposed project. The majority of projects fall within the Blackfoot Headwaters, Middle Blackfoot, and Nevada Creek TMDL Planning Areas, since TMDLs have either been completed or are in progress in these areas. Descriptions of these near-term restoration projects on TMDL streams are included in Appendix C. It is assumed that more priority projects will be identified in the Lower Blackfoot Planning Area once TMDL development begins for this portion of the watershed.

In addition to the potential projects identified above as near to mid-term restoration opportunities for the Blackfoot restoration partners, a number of other restoration opportunities and needs are listed in Appendix B. Some of these projects, such as Elk Creek in the Lower Blackfoot Planning Area and Poorman Creek in the Headwaters Planning Area, are very conceptual in nature at this time, with most not yet in the landowner negotiation stage. The projects may develop into near-term restoration projects if future opportunities arise. Other projects, such as mine waste removal from the Blackfoot River floodplain at the Upper Blackfoot Mining Complex, are mandated under other restoration programs and are listed for watershed-wide restoration planning and coordination purposes only.

Appendix B also shows potential or planned projects for certain non-303(d) listed streams. These streams are included since they are tributaries to impaired streams and should be acknowledged as part of the watershed approach to water quality restoration. All of these projects are scheduled for restoration under the fisheries program.

As previously discussed, this list of TMDL-related restoration projects will be updated annually or more frequently if warranted. TMDLs yet to be completed for the Middle Blackfoot, Nevada Creek and the Lower Blackfoot Planning Areas will include restoration strategy sections to help identify specific restoration opportunities and needs for inclusion in future revisions to this Action Plan.



NOTE: All map layers obtained from Montana Natural Resources Information System (NRS)

Figure 3-1.
Blackfoot Watershed
303(d) Listed Streams

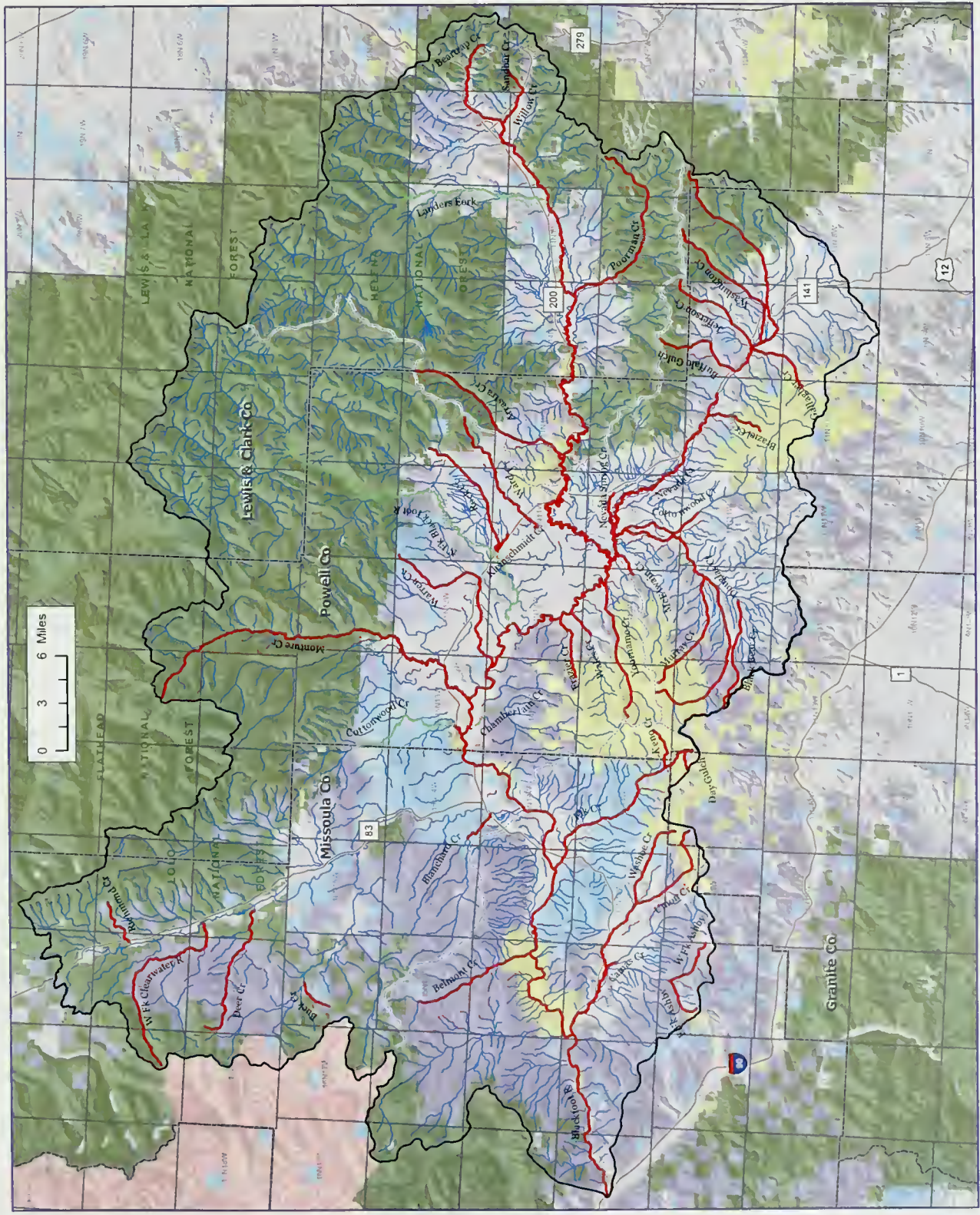


TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED

<i>Listed Water</i>	<i>Probable Causes (1996 List)</i>	<i>Probable Causes (2002 List)</i>	<i>Probable Causes (2004 List)</i>	<i>Probable Sources (2004 List)</i>
BLACKFOOT HEADWATERS PLANNING AREA				
Artrastra Creek	Not assessed	Other habitat alterations, Siltation	Other habitat alterations, Siltation	Agriculture, Habitat alteration, Highway maintenance and runoff
Beartrap Creek from Mike Horse Creek to mouth	Metals	Metals	Metals	Resource extraction, Mill tailings
Blackfoot River from Headwaters to Landers Fork	Metals, Other habitat alterations	Metals, Other habitat alterations	Metals, Other habitat alterations	Silviculture, Resource extraction (abandoned mining, acid mine drainage), Habitat modification (other than hydromodification), Bank and shoreline modification/destabilization
Blackfoot River from Landers Fork to Nevada Ck	Other habitat alterations, Siltation	Other habitat alterations, Siltation	Other habitat alterations, Siltation	Agriculture, Silviculture
Poorman Creek	Dewatering, Flow alterations, Metals, Other habitat alterations, Riparian degradation, Siltation	Dewatering, Flow alterations, Metals, Other habitat alterations, Riparian degradation, Siltation	Dewatering, Flow alterations, Metals, Other habitat alterations, Riparian degradation, Siltation	Silviculture (logging road construction/maintenance), Construction, Resource extraction (abandoned mines)
Sandbar Creek	Not assessed	Copper, Metals, Other habitat alterations, pH, Siltation	Copper, Metals, Other habitat alterations, pH, Siltation	Resource extraction (abandoned mining, acid mine drainage), Highway maintenance and runoff
Willow Creek	Bank erosion, Other habitat alterations,	Bank erosion, Other habitat alterations, Siltation	Bank erosion, Other habitat alterations, Siltation	Agriculture (grazing related sources), Habitat alteration (other than hydromodification), Bank and shoreline modification/destabilization, Highway maintenance and runoff
NEVADA CREEK PLANNING AREA				
Black Bear Creek	Siltation, Other Habitat Alterations	Habitat	Habitat	Agriculture, Grazing related sources, Habitat modification-other than hydromodification, Bank or shoreline modification/destabilization
Buffalo Gulch	NOT LISTED	Siltation, Other Habitat Alterations	Siltation, Other Habitat Alterations	Agriculture, Grazing related sources, Silviculture, Logging road construction/maintenance
Braziel Creek	Siltation, Other Habitat Alterations	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD

TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED (continued)

<i>Listed Water</i>	<i>Probable Causes (1996 List)</i>	<i>Probable Causes (2002 List)</i>	<i>Probable Causes (2004 List)</i>	<i>Probable Sources (2004 List)</i>
Cottonwood Creek	Flow Alteration, Nutrients, Salinity/TDS/Chlorides, Siltation, Thermal Modifications	Flow Alteration	Flow Alteration	Agriculture
Douglas Creek (lower)	Thermal Modifications, Other Habitat Alterations, Siltation, Nutrients, Salinity/TDS/Chlorides, Flow Alteration	Habitat; Thermal modifications	Habitat; Thermal modifications	Agriculture, Grazing related sources, Hydromodification
Douglas Creek (upper)	Thermal Modifications, Other Habitat Alterations, Siltation, Nutrients, Salinity/TDS/Chlorides, Flow Alteration	Habitat; Thermal	Habitat; Thermal modifications	Agriculture, Grazing related sources, Hydromodification
Gallagher Creek	Flow Alteration	Other Habitat Alterations	Other Habitat Alterations	Agriculture, Crop-related sources
Jefferson Creek (lower)	Flow Alteration, Other Habitat Alterations, Siltation	Flow Alteration, Other Habitat Alterations	Flow Alteration, Other Habitat Alterations	Resource extraction, Dredge mining, Agriculture, Grazing related sources, Crop-related sources
Jefferson Creek (upper)	Flow Alteration, Other Habitat Alterations, Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
McElwain Creek	Siltation, Flow Alteration, Pathogens	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Murray Creek	Flow Alteration, Thermal Modification, Other Habitat Alterations, Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Nevada Creek (headwaters to Nevada Lake)	Flow Alteration, Nutrients, Other Habitat Alterations, Siltation, Thermal Modifications	Metals, Nitrogen, Nutrients, Habitat, Suspended Solids	Metals, Nitrogen, Nutrients, Habitat, Suspended Solids	Agriculture, Grazing related sources, Resource extraction, Placer mining
Nevada Creek (Nevada Lake to Blackfoot River)	Flow Alteration, Nutrients, Other Habitat Alterations, Siltation, Thermal Modifications	Metals, Nitrogen, Suspended Solids, Other Habitat Alterations, Nutrients	Flow Alteration, Siltation, Other Habitat Alterations, Nutrients	Agriculture, Habitat modification-other than hydromodification, Bank or shoreline modification/destabilization

TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED (continued)

<i>Listed Water</i>	<i>Probable Causes (1996 List)</i>	<i>Probable Causes (2002 List)</i>	<i>Probable Causes (2004 List)</i>	<i>Probable Sources (2004 List)</i>
Nevada Lake	Nutrients, Organic Enrichment/DO, Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Nevada Spring Creek	Siltation, Other Habitat Alterations	Habitat; Siltation	Habitat; Siltation	Agriculture, Grazing related sources, Pasture grazing – riparian, Hydromodification, Flow regulation/modification
Washington Creek (lower)	Flow Alteration, Siltation, Other Habitat Alterations	Flow Alteration, Siltation	Flow Alteration, Siltation	Agriculture, Grazing related sources; Resource extraction; Abandoned mining
Washington Creek (upper)	NOT LISTED	Flow Alteration, Habitat	Flow Alteration, Habitat	Resource extraction, Dredge mining, Abandoned mining
MIDDLE BLACKFOOT PLANNING AREA				
Blackfoot River (Monture Creek to Clearwater River)	Nutrients Siltation	Nutrients; Thermal Mods	Nutrients; Thermal Modification	Agriculture, Silviculture, Flow Regulation/Modification, Hydromodification
Blackfoot River (Nevada Creek to Monture Creek)	Nutrients Siltation	Nutrients; Thermal Mods	Nutrients; Thermal Modification	Agriculture, Crop-related Sources,
Blanchard Creek	Habitat Alterations; Siltation	Habitat alterations; siltation	Other Habitat Alterations, Siltation, Flow Alteration	Agriculture, Grazing related Sources, Hydromodification, Flow Regulation/Modification, Highway Maintenance and Runoff
Buck Creek	Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Cottonwood Creek	Flow Alteration; Habitat Alterations; Siltation	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING
Chamberlain Creek	Flow Alteration; Habitat Alterations; Susp solids	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING
Deer Creek*	Non-Priority Organics; Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Frazier Creek	Flow Alteration	Habitat Alterations	Other Habitat Alterations	Agriculture, Grazing related sources
Kleinschmidt Creek	NOT PREVIOUSLY LISTED	Copper, fish habitat degradation, metals, other habitat alterations, riparian degradation, thermal modification	Riparian Degradation, Fish Habitat Degradation, Thermal Modifications, Other Habitat Alterations, Arsenic	Agriculture, Grazing related Sources, Hydromodification, Dam Construction, Habitat Modification (other than Hydromodification), Bank or Shoreline Modification/ Destabilization
Monture Creek	Habitat Alterations; Siltation	Habitat Alterations	Habitat Alterations	Agriculture, Grazing Related Sources

TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED (continued)

<i>Listed Water</i>	<i>Probable Causes (1996 List)</i>	<i>Probable Causes (2002 List)</i>	<i>Probable Causes (2004 List)</i>	<i>Probable Sources (2004 List)</i>
North Fork Blackfoot River	Habitat Alterations; Siltation	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING
Richmond Creek*	Non-Priority Organics; Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Rock Creek	Flow Alteration; Habitat Alterations Siltation	Flow Alteration; Habitat Alterations	Flow Alteration; Habitat Alterations	Agriculture, Flow Reg/Modification, Grazing related Sources, Hydromodification,
Salmon Lake*	Siltation, Nutrients/Organic Enrichment/DO	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Seeley Lake	Organic Enrichment/DO	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING	NONE--FULLY SUPPORTING
Wales Creek	Flow Alteration; Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Ward Creek	Flow Alteration	Siltation, Other Habitat Alterations	Siltation, Other Habitat Alterations	Agriculture, Silviculture, Highway Maintenance and Runoff, Unpaved Road Runoff
Warren Creek	Flow Alteration	Flow Alteration; Habitat Alterations	Flow Alteration; Habitat Alterations	Agriculture, Crop-related Sources, Grazing related Sources, Hydromodification, Channelization
West Fork Clearwater River*	Non-Priority Organics; Siltation	DID NOT MEET SCD	DID NOT MEET SCD	DID NOT MEET SCD
Yourname Creek	Flow Alteration	Flow Alteration	Flow Alteration	Agriculture
LOWER BLACKFOOT PLANNING AREA				
Belmont Creek	Other Habitat Alterations, Siltation	Siltation	Siltation	Agriculture, Grazing-related Sources, Silviculture, Logging Road Construction/Maintenance
Blackfoot River (Belmont Cr to mouth)		Metals, Total Toxics	Unionized Ammonia	Source Unknown
Blackfoot River (Mouture Cr to Belmont Cr)	Nutrients, Siltation (segments combined in 1996 303(d) list)	Nutrients, Thermal Modifications	Nutrients, Thermal Modifications	Agriculture, Silviculture, Hydromodification, Flow Regulation/Modification
Camas Creek	Flow Alteration, Siltation, Thermal Modifications	Uses Assessed are Fully Supported; Other Uses Not Assessed	Uses Assessed are Fully Supported; Other Uses Not Assessed	Agriculture, Highway/Road/Bridge Construction, Irrigated Crop Production, Natural Sources, Range Land, Streambank Modification/ Destabilization

TABLE 3-1. 303(D) LISTING HISTORY FOR LAKES, STREAMS, AND STREAM SEGMENTS IN THE BLACKFOOT WATERSHED (continued)

<i>Listed Water</i>	<i>Probable Causes (1996 List)</i>	<i>Probable Causes (2002 List)</i>	<i>Probable Causes (2004 List)</i>	<i>Probable Sources (2004 List)</i>
Day Gulch	Flow Alteration, Other Habitat Alterations, Siltation	Insufficient Data To Assess Any Use	Insufficient Data To Assess Any Use	Placer Mining
East Fork Ashby Creek	Siltation	Uses Assessed are Fully Supported; Other Uses Not Assessed	Uses Assessed are Fully Supported; Other Uses Not Assessed	Agriculture, Highway/Road/Bridge Construction, Range Land, Silviculture
Elk Creek (headwaters to Stinkwater Cr)	Flow Alteration, Siltation (segments combined in 1996 303(d) list)	Cadmium, Metals, Nitrate, Nutrients, Other Habitat Alterations, Siltation	Cadmium, Metals, Nitrate, Nutrients, Other Habitat Alterations, Siltation	Silviculture, Logging Road Construction/Maintenance, Resource Extraction, Placer Mining
Elk Creek (Stinkwater Cr to mouth)		Other Habitat Alterations, Siltation, Thermal Modifications	Other Habitat Alterations, Siltation, Thermal Modifications	Agriculture, Grazing-related Sources
Keno Creek	Flow Alteration, Other Habitat Alterations, Siltation, Thermal Modifications	Uses Assessed are Fully Supported; Other Uses Not Assessed	Uses Assessed are Fully Supported; Other Uses Not Assessed	Harvesting, Restoration, Residue Management, Logging Road Construction/Maintenance, Silviculture
Union Creek	Flow Alteration, Other Habitat Alterations, Siltation, Thermal Modifications	Arsenic, Copper, Metals, Nutrients, Other Habitat Alterations, Phosphorus, Suspended Solids, Thermal Modifications	Arsenic, Copper, Metals, Nutrients, Other Habitat Alterations, Phosphorus, Suspended Solids, Thermal Modifications	Agriculture, Grazing-related Sources, Intensive Animal Feeding Operations, Resource Extraction, Abandoned Mining, Hydromodification, Flow Regulation/Modification
Washoe Creek	Flow Alteration, Other Habitat Alterations, Siltation	Uses Assessed are Fully Supported; Other Uses Not Assessed	Uses Assessed are Fully Supported; Other Uses Not Assessed	Resource Extraction, Subsurface Mining, Surface Mining
West Fork Ashby Creek	Other Habitat Alterations, Siltation	Uses Assessed are Fully Supported; Other Uses Not Assessed	Uses Assessed are Fully Supported; Other Uses Not Assessed	Logging Road Construction/Maintenance, Resource Extraction

* These streams have been found to be fully supporting beneficial uses by MDEQ after publication of the 2004 303(d) list

4.0 FISHERIES RESTORATION PLANNING

The Blackfoot River watershed possesses a variety of wild trout, as well as cool-and warm-water fishes. Within the watershed, fish communities and distribution of individual species is longitudinal, a pattern in which species richness increases in the downstream direction and with increasing stream size. In contrast to this general distribution, *imperiled native fish* (bull trout and fluvial westslope cutthroat trout) occupy large areas of the watershed. These fish spawn often in discrete areas and rear in small streams high in the watershed before moving down to the larger, more productive streams where they grow to maturity. These broad areas of native fish use overlap at the low elevations with over 20 other species, including important non-native sport fish such as rainbow trout and brown trout.

With few exceptions, the life histories of wild trout of the Blackfoot River involve tributaries. Based on these mainstem/tributary relationships, community richness and population densities of fishes in the mainstem Blackfoot River closely reflect the number and quality of nearby tributaries. Because habitat degradation is extensive in tributaries, restoration of tributaries has become the primary method of restoring river populations. Biotic relationships between the Blackfoot River and tributary system also vary by river reach. Some reaches of the Blackfoot River possess few (functional) tributaries and/or support a harsh natural environment. Native fish and the subtle adaptations they possess (including whirling disease resistance) make them well-suited to the environmental extremes of the Blackfoot watershed. As such, native fish appear to provide much of the potential to improve currently suppressed river populations. With an emphasis on improving tributary conditions, native trout of Blackfoot River have shown consistent population size increases since the advent of the native fish recovery efforts in 1990.

Since hatchery stocking of rainbow trout ceased in 1979, Montana Fish, Wildlife and Parks (MFWP) has managed stream-dwelling salmonids of the Blackfoot River under the *wild trout* philosophy – a management philosophy that relies upon natural reproduction of wild fish. Attaining *quality habitat* and stream connectivity provide the basis of this management philosophy. Quality stream habitat is defined as a stream possessing water of sufficient quantity and quality where an arrangement of physical channel features provides food, cover (security) and space in an environment that allows a population to thrive. Stream connectivity provides the mechanism for fish to move among streams or stream reaches and to complete their life cycle and use a variety of habitats. When attempting to correct fisheries-impairment on streams, properly identifying and correcting habitat-related *limiting factors* is essential to successfully restoring stream-dwelling wild trout. Limiting factors are defined as any factor that inhibits or limits the population below its full potential. This concept of managing for wild trout, focusing on native fish, restoring and connecting habitats, and correcting other human-induced limiting factors forms the general foundation of the Blackfoot River fisheries restoration initiative.

4.1 RESTORATION CONCEPTS

Fisheries restoration planning, at a basic level, involves the biogeography of fishes, an understanding of fisheries (i.e., habitat) impairment and the role that stakeholders (e.g.

private landowners and the angling public) play in restoration outcomes. At a secondary level, the methods and outcomes of restoration must further consider 1) stream potential, 2) the relationships of project scale (i.e., stream-reach, stream and watershed) to the problem, 3) a recognition of tradeoffs, 4) indirect and/or downstream benefits of restoration actions, and 5) uncertainty (i.e., risk) of restoration outcomes.

Reducing uncertainty of outcomes, above all, requires firm commitment of cooperating parties to success. Generating sufficient project information on which to base restoration decisions is also essential. Project information involves recognizing not only the sources of impairment, but also reasonable assessments of biological/fisheries outcomes. Obtaining this information usually involves: 1) establishing a thorough pre-project (habitat and fish populations) baseline; 2) understanding life-history, habitat associations and limiting factors related to target and, in some cases, non-target species; 3) identifying clear and attainable goals and objectives; 4) developing realistic time-frames necessary for project and species recovery; 5) recognizing an ability to correct up-and downstream limiting factors; and 6) developing post-project monitoring protocols through recovery phases to ensure the projects meet their objectives. Restoration practices must also conform to the 'trust' responsibilities of several local, state and federal natural resource and permitting agencies. A willingness to modify restoration methods based on monitoring results is important. Considerations of off-site concerns are often important to restoration outcomes and may involve downstream beneficial uses including improved water quality and quantity, and/or recruitment of recreational species to the Blackfoot River. Less predictable outcomes may result from the influences of exotic fishes, diseases and perhaps climate change on some projects.

As a final outcome, restoration projects must be consistent with ecologically sound and sustainable practices, contribute to conservation of high quality aquatic habitat and protect native aquatic species. Several restoration-related plans can help guide restoration practices and the recovery of native fishes, including:

- *Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin Montana* (MBTRT 2000);
- *Draft Recovery Plan for the Bull Trout and Proposed Critical Habitat* (USFWS 2002);
- *A Hierarchical Strategy for Prioritizing the Restoration of 83 Impaired Tributaries of the Big Blackfoot River* (Pierce et al 2002b);
- *Westslope Cutthroat Trout Status Review* (Shepard et al. 2003); and
- *Region 2 Native Salmonid Management Guidelines*, Montana Fish, Wildlife and Parks, Missoula

Several additional research projects and FWP restoration-related studies completed in the Blackfoot River watershed (Appendix A and Appendix G) also provide relevant information. The intent of these plans has been integrated into the framework of this strategy.

4.2 FISHES OF THE BLACKFOOT WATERSHED

There are currently 12 native fish species and 13 non-native fish species in the Blackfoot Watershed, as well as several hybrid salmonids. Native species of the Blackfoot Watershed are bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), mountain whitefish (*Prosopium williamsi*), pigmy whitefish (*P. coulteri*), longnose sucker (*Catostomus catostomus*), largescale sucker (*C. macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus camrinus*), redbside shiner (*Richardsonius balteatus*), longnose dace (*Rhinichthys cataractae*) slimy sculpin (*Cottus cognatus*) and mottled sculpin (*C. bairdi*). Non-native species include rainbow trout (*O. mykiss*), kokanee (*O. nerka*), Yellowstone cutthroat trout (*O. clarki bouvieri*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*), arctic grayling (*Thymallus arcticus*), white sucker (*C. commersoni*), fathead minnow (*Pimephales promelas*), northern pike (*Esox lucius*), brook stickleback (*Culaea inconstans*), pumpkinseed (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides*) and yellow perch (*Perca flavescens*).

Compared to other families of fishes, stream-dwelling salmonids of the Blackfoot River receive management emphasis. Emphasis on salmonids relates to their 'sensitive' status and popular sport fisheries value. As a family of fishes, salmonids (and native trout specifically) can also be compared to the "canary in the coal mine," meaning they are very sensitive to changes in water quality, especially increases in sediment and water temperature. As indicators of cold and clean water, measures to restore natural conditions suitable to salmonids also provide benefits to sympatric species (non-salmonids) that require natural environments but receive less management emphasis.

Most salmonids in the Blackfoot River (rainbow trout, brown trout, westslope cutthroat trout, bull trout and mountain whitefish) exhibit *fluvial* (or migratory) life-histories, whereas tributaries support both *migratory* and *stream-resident* populations. Migratory fish are hatched in tributaries where they rear before migrating to a river where they grow to maturity before returning to natal tributaries to spawn. Migratory fish require connectivity. Stream resident fish exhibit less movement and spent their entire life in small streams. Enhancing or maintaining migratory forms are desirable because more and variable habitats are needed, thus allowing more fish in a population and greater resistance and resilience to stochastic events. Connectivity and migratory forms also increase the likelihood for, and provide a source of, naturally refounding extirpated populations. This increases the probability of long-term species survival.

4.2.1 Nonnative Salmonids of the Blackfoot Watershed

Several introduced fishes (brown trout, rainbow trout and brook trout) of the Blackfoot River are managed as sport fisheries and offer harvest opportunities.

Brown trout

European brown trout, introduced to North America in the 1880s, include a diversity of life-history forms. The mixing of various European stocks brought the basis of genetic diversity and potential for rapid naturalization of self-sustaining populations of brown trout across the

continent. Brown trout rapidly became established and quickly replaced native trout in large rivers of the West. Brown trout now support popular sport fisheries in many rivers including the Blackfoot River. In the Blackfoot watershed, brown trout tend to dominate medium-sized, low-elevation tributaries that provide undercut banks and abundant cover. Brown trout co-exist with other salmonids in the larger river reaches where sufficient habitat complexity creates a diversity of niches. Brown trout inhabit ~15% of the perennial stream system with a distribution that extends from the Landers Fork down the length of the Blackfoot River and into the lower foothills of the tributary system tributaries (*see* distribution map on Figure 4-1). As a species, European brown trout co-evolved with the parasite *myxobolus cerebralis* and possess a higher level of natural resistant to whirling disease than other salmonids.

Rainbow trout

Rainbow trout, a renowned sportfish, has been introduced into cold-water habitats worldwide. In western Montana, rainbow trout were brought inland from coastal and other areas of western North America beginning in the late 1800s. Since the implementation of wild trout management, the distribution of rainbow trout in the Blackfoot watershed has diminished, with the species no longer present in the upper Blackfoot River. Stream-dwelling rainbow trout currently inhabit the lower mainstem Blackfoot River and reproduce in the lower portions of the larger tributaries. Rainbow trout occupy ~10-15% of the perennial streams at the lower elevation of the Blackfoot watershed (*see* distribution map on Figure 4-1). They dominate the lower river reaches but also are also established in lakes, reservoirs and private ponds. Rainbow trout are highly susceptible to whirling disease, which is expanding within the range of stream-dwelling rainbow trout in the Blackfoot Watershed. This escalation of whirling disease corresponds with a trend of declining densities for wild rainbow trout in the mainstem Blackfoot River.

Brook trout

Brook trout, like all charr in the genus *Salvelinus* (including bull trout), are known for its adaptation to cold water. But unlike other charr, brook trout are also tolerant of warmer waters. Unlike bull trout, brook trout are also more tolerant of higher sediment levels and are thus better able to reproduce in streams of impaired condition. Brook trout were brought to the inland American West from northeastern North America for sportfishing and subsistence between 1920 and 1950. Brook trout have vastly increased their distribution and abundance and now pose a threat to native cutthroat trout and bull trout and have replaced populations of both species in certain waters. Resident brook trout are widely distributed in tributaries of the Blackfoot Watershed, but are rare in the mainstem Blackfoot River below the Landers Fork tributaries (*see* distribution map on Figure 4-1). Brook trout are considered vulnerable to whirling disease.

4.3 NATIVE TROUT OF THE BLACKFOOT RIVER: INTRODUCTION, MANAGEMENT, AND RECOVERY GUIDELINES

4.3.1 Bull Trout Recovery Areas – Core Areas and Proposed Critical Habitat

Bull trout is a Montana *species of special concern* and *threatened* under the Endangered Species Act. The recovery of bull trout is a fisheries priority under both State FWP and Federal USFWS programs in the Blackfoot Watershed. Bull trout inhabit ~125 miles of the Blackfoot River main stem. Bull trout are especially vulnerable to increased water temperatures and sediment loads, changes in flow regimes, blocked migration routes and non-native trout like brook trout. Densities of bull trout are very low in the upper Blackfoot River, but increase downstream of the North Fork at river mile 54. Outside of the Clearwater River drainage, bull trout occupy ~25% of the drainage or ~355 miles of stream (*see* distribution map on Figure 4-1). Most bull trout spawning streams (Gold Creek, Dunham Creek, Monture Creek, Copper Creek, and the North Fork of the Blackfoot River) support fluvial fish, although some streams (Poorman, Cottonwood and Belmont Creeks) seem to support predominately resident bull trout. Adult migratory bull trout distribution is generally tied to the larger, colder streams north of the Blackfoot River and larger, more productive river reaches. Fluvial bull trout reproduce in only a few discrete groundwater-fed spawning sites and seek cold-water refugia during periods when the river is warm (>60 °F). Juvenile bull trout also seek small and cold, non-spawning tributaries, some of which are located in the Garnet Mountains presumably for cold water refugia, foraging and predator avoidance.

Bull trout recovery focuses on primarily *core area* watershed and *proposed critical habitat* (Figure 4-2) (MBTRT, 2000; USFWS, 2002, Appendix G). To assist with bull trout recovery in the Blackfoot Watershed, the Montana Bull Trout Recovery Plan (MBTRT, 2000) established the following recovery goals: 1) maintain self-reproducing migratory fish in the Blackfoot River with access to tributary streams and spawning in all *core area* watersheds; 2) maintain the population genetic structure throughout the watershed; 3) maintain and increase the connectivity between the Blackfoot River and its tributaries; 4) establish a baseline of redd counts in all drainages that presently support spawning migratory bull trout; and 5) maintain a count of a least 100 redds or 2,000 individuals in the Blackfoot drainage with an increasing trend thereafter (MBTRT, 2000). In 2002, the USFWS designated *proposed critical habitat* and developed a draft recovery plan. The proposed critical habitat designation included the mainstem Blackfoot River and all mainstem tributaries of all core area watersheds. The draft recovery plan outlined measures needed to help remove bull trout from the ESA list, similar to the Montana Bull Trout Recovery Team (USFWS, 2002).

In addition to State and Federal recovery plans, several research and restoration-related reports further contribute to bull trout recovery planning in the Blackfoot River Watershed (Appendix G). These plans generally outline: 1) the relationships of bull trout to *clean, cold, connected* and *complex* habitats; 2) life-history relationships with spawning and non-spawning tributaries and river reaches; and 3) ecological risks related to adverse land use practices, as well as interactions of non-native fishes. For restoration activities in bull trout habitat, recovery plans should be considered on a stream specific basis, in conjunction with pertinent recovery plans, and in consultation with FWP or other qualified agency biologists during initial project planning phases.

4.3.2 Bull Trout Recovery - Recreational Conflict Areas

Based on fisheries management-related risks to bull trout recovery, FWP recently identified *bull trout recovery - recreational conflict areas* (Figure 4-3). These *conflict areas* refer to biologically critical sites (key spawning, rearing and staging areas, important migration corridors and areas of thermal refugia) that overlap with recreational developments, areas of increased angler pressure and where illegal bull trout harvest is a concern. Concern over *conflict areas* also relate to: 1) large increases in angling pressure in bull trout recovery areas; 2) the documented inability of most anglers to identify bull trout; 3) continued illegal harvest of bull trout; and 4) expanded recreational developments in critical recovery areas. Recent declines in adult bull trout densities and population size compound these concerns. Integrating recreational conflict areas into this action plan would lead to a more programmatic and conservation-based management philosophy by resource management agencies. Additional special fishing regulations may also be necessary to protect native salmonids in these areas.

4.3.3 Westslope Cutthroat Trout (WSCT)

Westslope cutthroat trout, a *species of special concern* in Montana, has declined over much of their historic range within the last century. These declines are more pronounced in the Missouri River drainage than the upper Columbia River drainages (Shepard et al., 2003). Reasons for the decline include habitat loss and degradation, genetic introgression with introduced rainbow trout and Yellowstone cutthroat trout, over-harvest, and competition with introduced brook trout and brown trout. In the Blackfoot Watershed, WSCT occupy ~93% of historical range, compared with ~39% of occupied historical range statewide. The Blackfoot River also supports one of the larger fluvial meta-populations of WSCT (upper drainage) in Montana, but at population abundance well below habitat capacity (Shepard et al., 2003, Appendix G).

The Blackfoot River watershed (outside of the Clearwater Drainage) supports a nearly basin-wide distribution of WSCT with 86% (85 of 98) of surveyed fish-bearing tributaries containing WSCT (Figure 4-1). Streams lacking WSCT are either impaired headwater streams or degraded spring creeks. The densities of WSCT usually decrease in the downstream direction. These longitudinal decreases typically relate to adverse habitat changes, losses to irrigation ditches, barriers to movement, natural dewatering and the interactions with non-native fishes.

WSCT stocks include migratory (fluvial) and stream resident fish. Fluvial fish have a sympatric resident component. Both stream resident and fluvial WSCT rely on high quality tributary habitats for spawning, rearing and over-wintering. Stream resident fish can also maintain populations in isolation, occupying less than one mile of perennial stream in some cases. Stream connectivity and access to the Blackfoot River is also necessary for fluvial fish to complete their life-cycle. Fluvial WSCT spend early life stages in smaller streams and migrate to the river to mature where they grow too much larger size than resident fish, before returning to natal tributaries to spawn.

WSCT genetic tests in the Blackfoot Watershed show a high degree of genetic 'purity' over large areas, particularly in the upper watershed upstream of the confluence of the North Fork (Figure 4-4). Within this setting, a primary conservation strategy identified in the upper Blackfoot Watershed involves managing for metapopulation function and multiple life-history strategies (Shepard et al. 2003). This conservation strategy involves managing both stream resident and fluvial WSCT. Managing metapopulations of fluvial fish not only involves maintaining main stem connectivity of the Blackfoot River with spawning areas, but also: 1) reducing or eliminating *controllable* sources of anthropogenic mortality; 2) maintaining and restoring existing spawning and rearing habitats; and 3) managing lakes and private fish ponds with appropriate species. Although stream connectivity allows spawning migrations, season movements and complex life history strategies to persist, WSCT restoration strategies must also consider genetic integrity as well as other ecological risks such as invasive species and diseases when considering restoring connectivity to isolated populations. Conservative strategies should also entail maintaining an array of existing isolated populations of genetically 'pure' WSCT as a measure against known and unknown ecological risks.

Ecological risks to WSCT conservation are generally complex and should be considered on a stream or reach specific basis. From a restoration perspective, planning should consider life-history expression, habitat capacity and availability, genetic composition, risks related to land use, potential interactions of non-native species (e.g. brook trout and rainbow trout), as well as public expectations of recruitment to recreational fisheries. As with bull trout, the range of biological interactions and concerns for WSCT should be established in consultation with State agency fisheries biologist during the initial restoration planning process. This particularly applies where barriers, genetically pure islet populations and potential for invasive species are involved.

4.3.4 Native Species Management Areas

Native species management areas are general FWP designations representing a regional (R-2) approach to native fish management in the Clark Fork watershed. In the Blackfoot sub-basin, the classification contains two major categories: 1) native species conservation areas; and 2) native species maintenance areas (Figure 4-5). Within each category, the following management implications are considered: 1) stocking and transplant policy; 2) fishing regulations; 3) watershed restoration activities; 4) land acquisitions by other agencies or conservation groups; 5) stream alterations and fish ponds; and 6) fishing access.

4.3.5 Native Species Conservation Areas

In most cases, these are bull trout critical habitat and areas close in proximity to the headwaters, including spawning areas for fluvial fish. Conservation areas include: 1) streams that support native species, 2) a stable detectable bull trout population, 3) areas that tend to have genetically pure WSCT populations, or 4) if genetic composition can be improved by management. Conservation areas are critical to the long-term persistence of native species. Where native species will be the management emphasis, suppression or

removal of introduced species will be considered to maintain populations in conservation areas. Guidelines and management strategies include:

1. Stocking of non-native species will not occur. The impacts of stocking on amphibians, reptiles and invertebrates if detrimental to native populations will be considered;
2. Fishing regulations will be tailored to encourage native species and discourage introduced species;
3. These areas would be the highest priority for watershed restoration activities
4. These areas would be a priority for land acquisition and protection (i.e., easements) by federal and state agencies;
5. Stream alteration permitting would strongly encourage the use of native material and natural stream function;
6. Fish species and strains permitted in private fishponds will only include those that are genetically compatible with the populations in source and receiving waters; and
7. The biological consequences of additional fishing access sites on native populations would be heavily considered.

4.3.6 Native Species Maintenance Areas

Maintenance areas of the main stem have retained populations of fluvial WSCT or bull trout, but are predominately composed of non-native species (salmonids). Maintenance areas are also low elevation tributaries dominated by non-natives with only relic populations of native trout. These are areas where native species will be the management emphasis, but no active effort will be taken to remove or discourage introduced species. Guidelines and management strategies include:

1. Stocking of introduced species may occur if compatible with existing populations;
2. Fishing regulations will encourage native species. They will not necessarily discourage introduced species;
3. These areas are high priority for watershed restoration activities;
4. Land acquisition would be encouraged, but not as high a priority as native species conservation areas;
5. Non-native will be stocked in ponds if already present in the wild. Normal precautions will be taken to keep fish stocked in private ponds from contacting wild populations; and
6. Fishing access would be prioritized based on angling opportunity and social need.

4.4 GENERAL FISHERIES HEALTH

4.4.1 Fisheries Impairments of the Blackfoot River

The mainstem Blackfoot River is one of the most diverse and biologically complex rivers in western Montana. Unfortunately, large sections of the river support low densities of trout due to an array of natural and human-related factors. The natural complexity and limitations of the mainstem involve severe icing of the channel, low stream flows and drought prone

areas, fine sediment accumulation and areas of limited secondary productivity. Human influences involve metals contamination, dewatering, barriers to movement (e.g. Milltown dam and many sub-standard road crossings) and areas of impaired water quality and extensive alteration of the tributary system and essential habitat components it provides. Functional tributaries play essential roles in the life stages (migration, spawning and rearing) of all fluvial Blackfoot River fish. Altered and degraded tributaries generally inhibit movement and reduce spawning and rearing success, which contributes to suppressed populations and inadequate recruitment of multiple species over large areas of the river. The sum of these natural and human variables produces a diverse array of wild fish communities that vary in species composition and overall population densities among river reaches. Because of this variability, we consider mainstem on a reach-by-reach basis. Each reach has its own set of natural problems and human-induced limiting factors that need to be addressed if populations are to substantially improve.

Reach 1: Headwaters to Lincoln. This reach has been evaluated since the 1970's, both before and after the collapse of the Mike Horse mine tailings dam. This ecological disaster sent contaminated mine tailings into the upper mainstem Blackfoot River. The acute and chronic effects of this contamination coincide with the collapse of WSCT in headwater areas. The tailings were partially contained by a series of wetlands, preventing more serious contamination of the lower Blackfoot River. During the 1990s, a voluntary reclamation of patented mining claims was undertaken on ASARCO properties. Cleanup plans on the Helena National Forest are being developed.

Below this area of contamination, the Blackfoot River supports WSCT, brown trout, brook trout and bull trout in low densities. In addition to mining contamination in the headwater, this reach lacks complexity in portions of the mainstem, naturally becomes dewatered downstream of Landers Fork and has localized tributary problems. Natural gas exploration is now occurring in tributaries of this reach. A low level infection of whirling disease is also present in this reach.

FWP fish surveys in the early 1970s, before the collapse of the tailing dam, showed healthy WSCT numbers in the upper mainstem. After the dam collapse, cutthroat numbers declined drastically. And the impacts of contamination linger today. In one sampling section (Pop's Place section) the point estimate for age 1+ WSCT declined from 101 fish/1,000' in 1971 to zero in 1999. In a downstream monitoring section (Flescher Pass section) age 1+ WSCT densities have declined approximately 75%. The percent trout species composition for Flescher Pass section for 1999 is located in Figure 4-6.

Reach 2: Lincoln to Arrastra Creek. The upper portion of this alluvial reach gains most of its base flow from groundwater and spring creeks. Water quality and complexity improve substantially compared to the upper reach. Mainstem brown trout spawning is concentrated in the upper portion of this reach and in the spring creeks near Lincoln. Several tributaries enter the river, the majority of which have been identified with some level of fisheries impairment. Several tributaries are at various stages of restoration. Fish populations consist primarily of resident brown trout, fluvial WSCT in low, but increasing, densities and very low densities of fluvial bull trout. Telemetry studies indicate several tributaries in this reach

and upstream of Lincoln provide native fish recruitment. Copper Creek is the primary fluvial bull trout spawning site. Recent whirling disease monitoring reveals a gradual increase in infection level in this section of the Blackfoot River. When last surveyed in 1999, total trout densities (fish >6.0") in the Canyon Section of reach 2 were 55 fish/1000'. The percent trout species composition for this survey is located in Figure 4-6.

Reach 3: Arrastra Creek to Nevada Creek. This reach of river is low gradient, highly sinuous and subject to 1) active stream bank erosion, 2) deposition of fine sediment, and 3) winter anchor ice formation beginning in the lower portion of this reach and extending down the remaining length of the Blackfoot River. Fine sediment limits instream production of food organisms. Although limited, mainstem brown trout spawning has been observed. Juvenile surveys indicate very low recruitment. There are no tributaries entering this reach of river, which further limits recruitment. Irrigation reduces instream flows resulting in late-summer and early-fall low flow conditions. Evaluation of irrigation ditch entrainment is ongoing. Initial ditch evaluations indicate juvenile entrainment in some ditches, further hindering recruitment. Although a population survey section does not exist in this reach, other fisheries investigations suggest low densities in the upper portion of this reach, decreasing to very low in the downstream portion of this reach.

Reach 4: Nevada Creek to the North Fork. In this reach, channel gradient increases and the river becomes laterally confined by glacial moraine. This reach is subject to chronic water quality problems originating from Nevada Creek, which enters at the upper boundary of this reach. This reach exhibits elevated nutrients levels, low summer flows, high summer water temperatures, anchor-ice formation in the winter and high levels of fine sediment in substrates. All tributaries entering this reach are fisheries impaired due largely to irrigation and riparian degradation. Tributaries support salmonids in the headwaters but not in lower reaches. Poor recruitment limits river salmonid populations and fish densities are very low for all species. These combined influences result in the lowest population densities for the mainstem Blackfoot River downstream of Lincoln. Fish population survey completed in 2004 recorded total trout densities (fish >6.0") in the Wales Creek Section of reach 4 at 9 fish/1000'. The percent trout species composition for this survey is located in Figure 4-6.

Reach 5: North Fork to the Clearwater River. The North Fork Blackfoot River approximately doubles the base flow of the Blackfoot River, bringing a much-needed influx of cold water to the main stem during summer. The influx of groundwater to the lower North Fork during base flow periods may also moderate severe winter conditions in a portion of the mainstem below the North Fork mouth. Below this junction, population densities of all salmonids increase due to the improved mainstem conditions and increased recruitment from more functional tributaries. Many tributaries of this reach are the focus of ongoing restoration practices. In this river section, bull trout densities increase due to recruitment from the two largest tributaries (Monture Creek and the North Fork) of this reach, angler restrictions and restoration. Likewise, WSCT have improved with densities increasing. Brown and rainbow trout are common throughout this reach and the lower portions of most tributaries. Unfortunately, whirling disease has recently escalated to lethal levels in most rainbow trout spawning and rearing sites within this reach. This disease escalation coincides with the declining trend in rainbow trout densities in recent years. Fish population survey

completed in 2004 recorded total trout densities (fish >6.0") in the Scotty Brown Bridge Section of reach 5 were 49 fish/1000'. The percent trout species composition for this survey is located in Figure 4-6.

Reach 6: Clearwater River to the mouth. Downstream of the Clearwater River mouth, the Blackfoot River becomes laterally contained over the remainder of its length by bouldery terraces and steep canyon walls. Milltown Dam, located at the mouth of the Blackfoot River has blocked the upstream movement of all species since 1907. Several tributaries enter this reach and those to the north originate primarily from industrial forestlands. Southern tributaries flow from mountains through primarily agricultural foothills before entering the mainstem. With few exceptions, the lower reaches of all southern tributaries are severely impaired. Conversely, streams to the north appear to support the majority of Blackfoot River fish spawning. With increased recruitment of primarily rainbow trout, Blackfoot River fish populations increase substantially in the downriver direction. Unfortunately, like reach 5, rainbow trout are declining. Whirling disease is present near lethal levels in the mainstem but currently at sub-lethal levels in primary rainbow trout spawning streams. Brown trout and WSCT are stable to increasing in this river reach. Bull trout, originating primarily in the Monture and North Fork Watersheds have declined to very low densities. Fish population surveys completed in 2004 recorded total trout densities (fish >6.0") in the Johnsrud Section of reach 6 were 128 fish/1000'. The percent trout species composition for this survey is located in Figure 4-6.

4.4.2 Tributary Impairments

Within the Blackfoot Watershed, the great majority of inventoried streams exhibit some level of physical and biological impairment (Table 4-1). The level of impairment varies significantly within and among streams. The concentration and diversity of tributary fisheries problems also increases longitudinally, with the most serious problems found in lower stream reaches on private land. However, significant impairment occurs on State and Federal lands as well. Fisheries impairments result from a wide array of land use practices, such as mining pollution, excessive riparian timber harvest, riparian grazing management, poorly designed roads, non-point agricultural runoff, stream dewatering, channel alterations, fish losses to irrigation ditches and artificial barriers to fish movements, etc. These impairments have diminished fisheries resources, and in some cases, have led to the loss of salmonids from entire stream reaches. In general, correcting habitat problems in tributaries focuses in areas where native fish are expected to improve. Native fish remain the focus of restoration in part due to their status as sensitive species as well as the sympatric benefits to other species, including downstream nonnative salmonids.

Correcting fisheries impairments at a watershed scale will involve: 1) protection of existing high quality tributary habitats, 2) restoring areas that are compromised, and 3) and a higher level of commitment to proper riparian management than currently exists in many areas of the Blackfoot Watershed. Correcting impairments must also be considered within the context of established native species recovery and conservation plans. Bringing technical expertise, educational programs, landowner incentives and additional monitoring

commitment to willing cooperators are necessary components to reversing fisheries impairments.

4.4.3 Whirling Disease

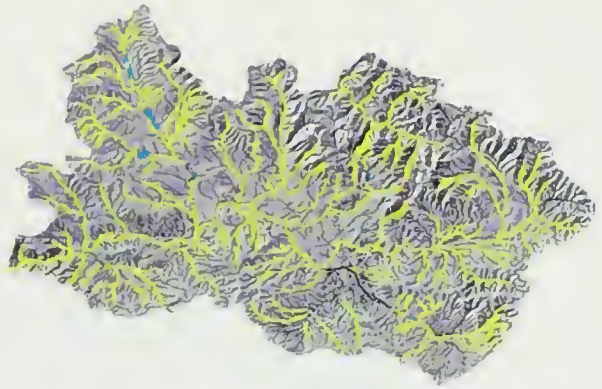
At this time, restoration planning in many stream reaches requires consideration of whirling disease, which is now firmly established at the low elevations of the watershed. Whirling disease, caused by the myxosporean parasite *Myxobolus cerebralis*, was first detected in the Blackfoot River in 1995 near Ovando. Since then, the disease has increased in distribution and intensity. It now infects the lower 122 miles of the mainstem Blackfoot River and continues to expand in the lower reaches of some tributaries (Figure 4-7). FWP is attempting to determine the extent of whirling disease containment at the low elevations of the watershed. The current distribution of whirling disease overlaps with the distribution of rainbow trout and brown trout reproduction and occurs at levels harmful to rainbow trout populations in many streams.

Blackfoot River native WSCT and bull trout appear to have a diminished risk of contracting whirling disease, due in part, to habitat use and life history strategies that entail spawning and rearing in upper tributaries. Whirling disease severity typically increases in the downstream direction in Blackfoot River tributaries. This inverse relationship between elevation and infection may be a result of the parasite's lack of time in the area, low numbers of myxospores in the environment, or a lack of suitable habitat supporting *T. tubifex*.

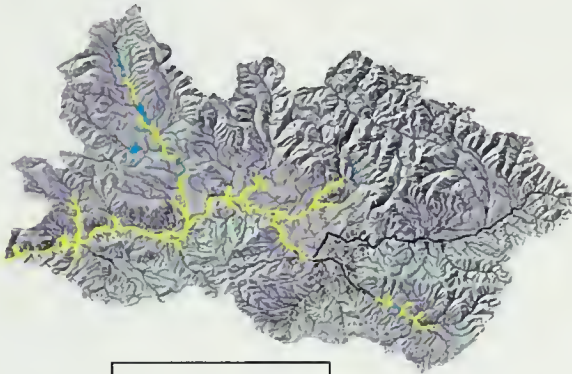
Strategies to help moderate impacts of whirling disease are incorporated into this action plan. These include: 1) improving migration corridors and rearing areas between headwater spawning streams and the Blackfoot River; 2) targeting restoration of native populations of WSCT and bull trout, whose life history could help reduce risk of infection by allowing the continual recruitment of these species to downstream river reaches; 3) habitat restoration - developing compatible streamside grazing practices, removing streamside feedlots and other methods of lowering sediment and nutrient input to streams; and 4) reducing other stress or mortality factors on trout populations such as ditch entrainment, low flows, poor habitat, etc.



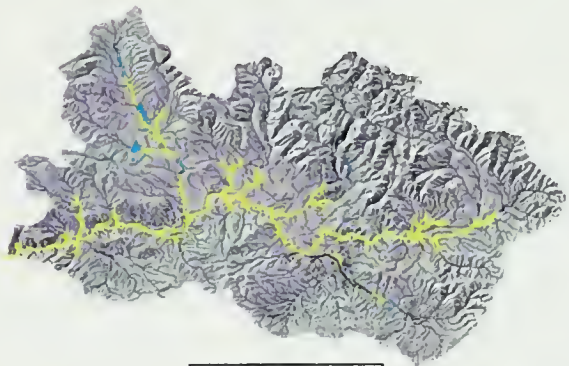
BULL TROUT



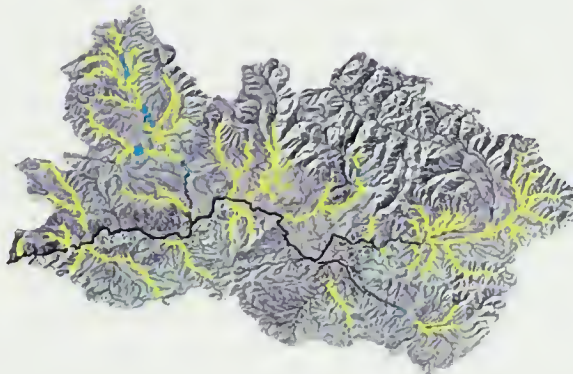
WESTSLOPE CUTTHROAT
TROUT



RAINBOW TROUT



BROWN TROUT



BROOK TROUT

Figure 4-1. Distribution Map of Five Salmonid Species in the Blackfoot River Basin.

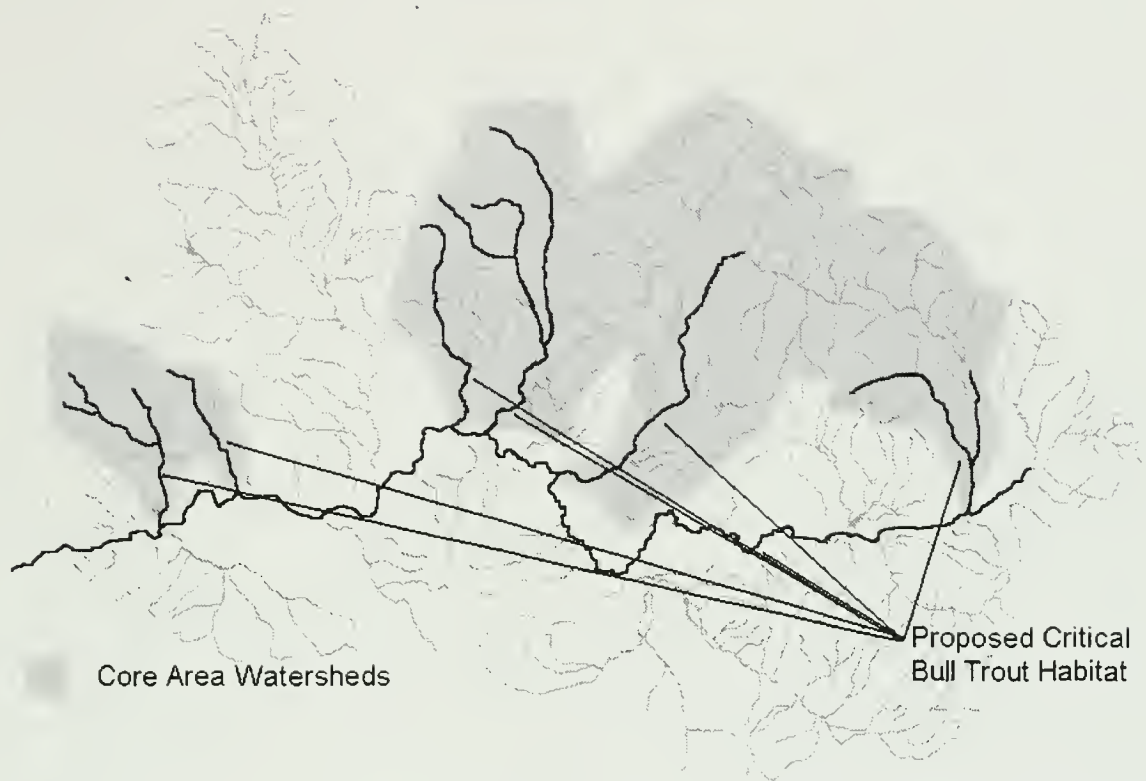
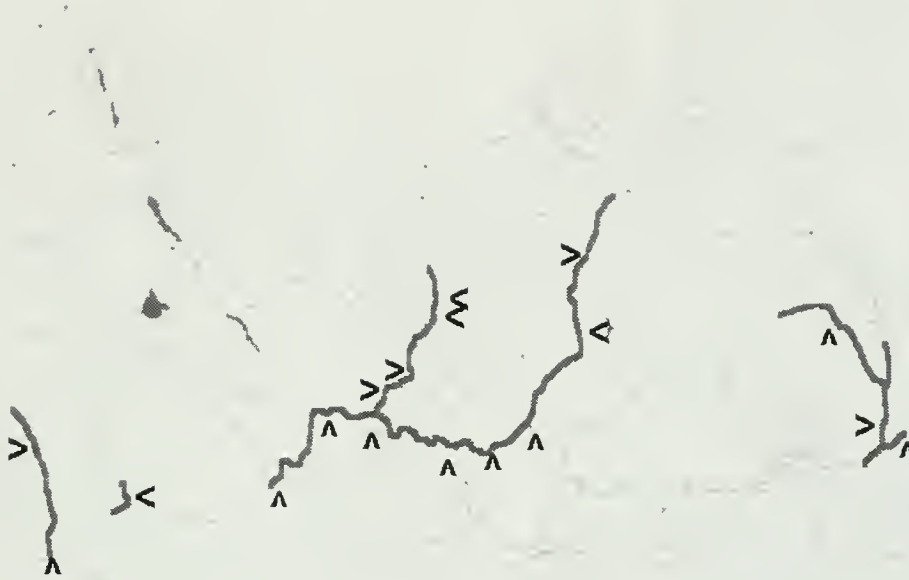


Figure 4-2. Bull trout core area watersheds (excluding the Clearwater River drainage) and proposed critical bull trout habitat.



> Public access sites

Figure 4-3. Bull trout recovery/recreational conflict areas for the Blackfoot Watershed.

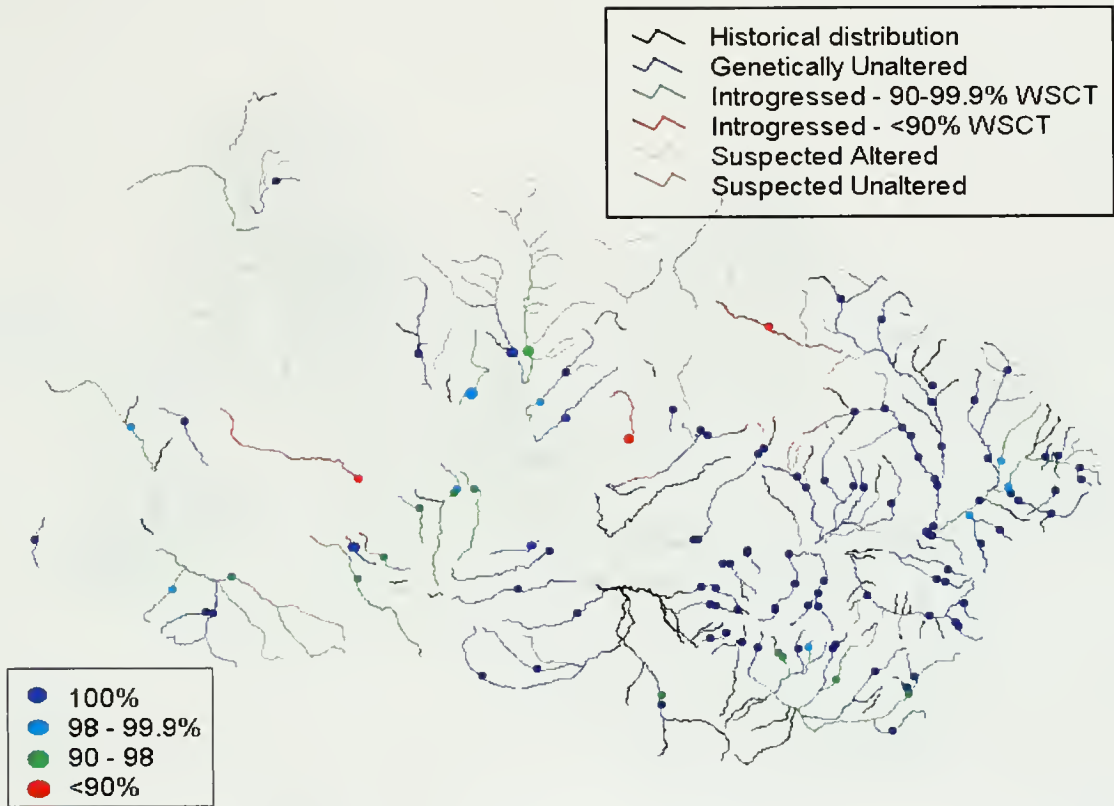


Figure 4-4. Westslope Cutthroat Trout Genetics Map with Sample Locations and Percent WSCT Composition.

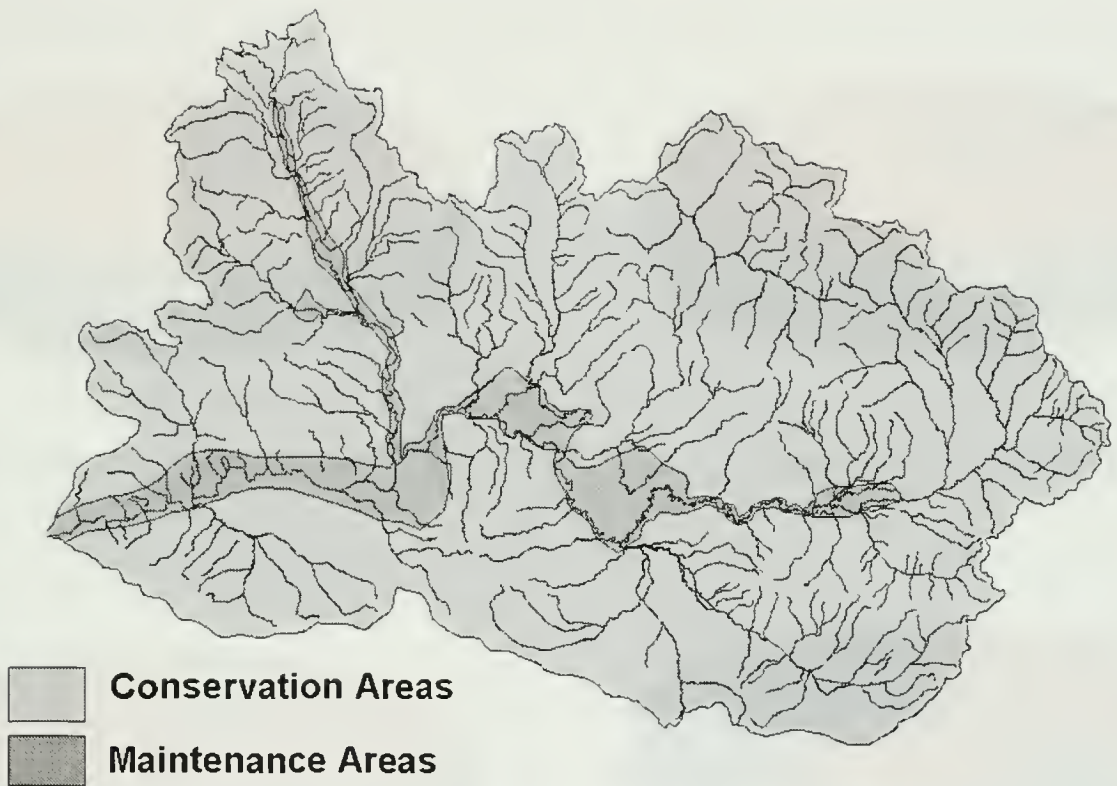
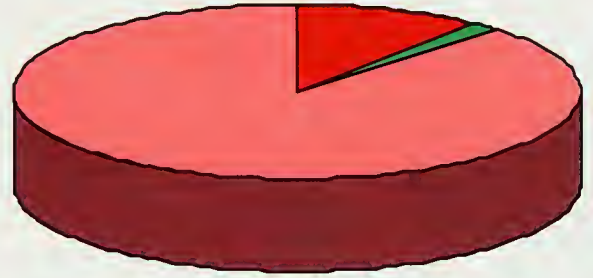


Figure 4-5. Region 2 Native Species Management Areas for the Blackfoot River Watershed.

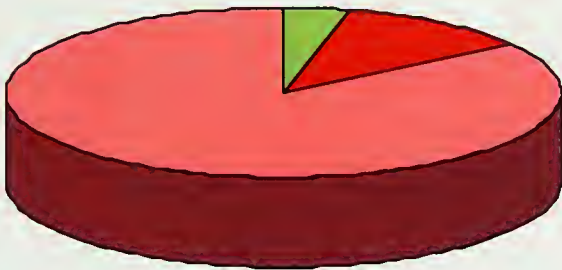
Figure 4-6. Percent Trout Species Composition for Five Reaches of the Blackfoot River



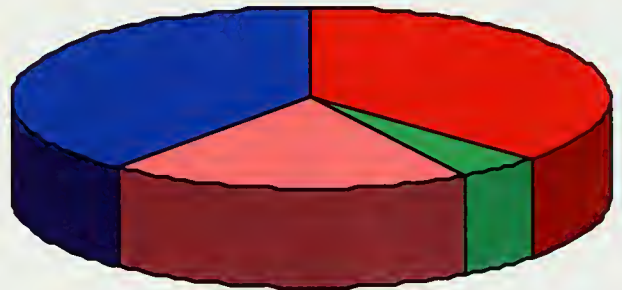
Reach 1: Flescher pass Section 1999



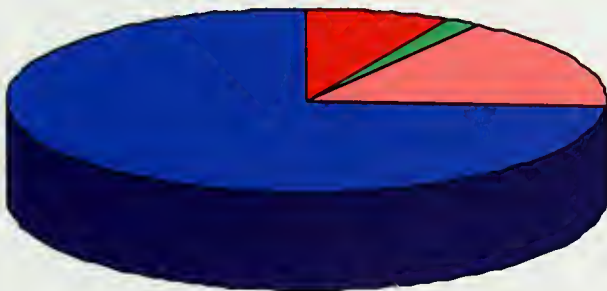
Reach 2: Canyon Section 1999



Reach 4: Wales Creek Section 2004



Reach 5: Scotty Brown Bridge Section 2004



Reach 6: Johnsrud Section 2004



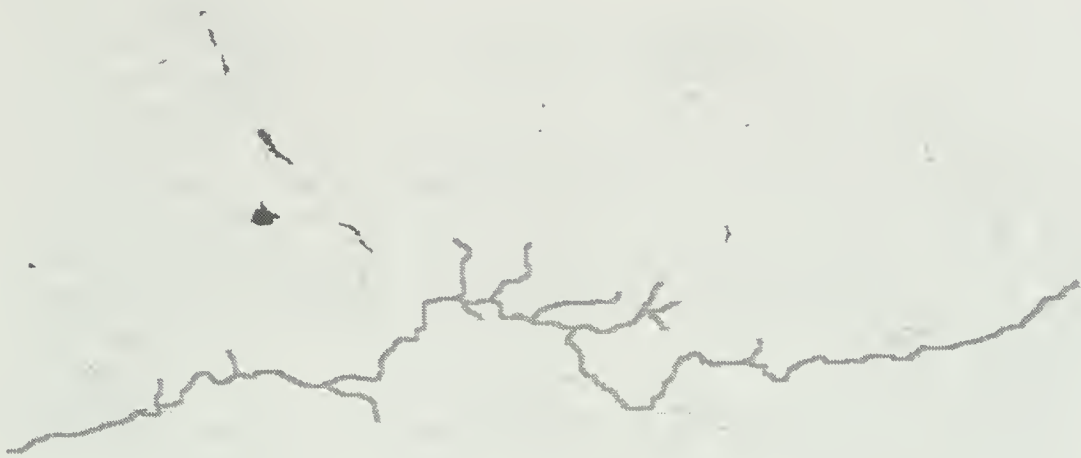


Figure 4-7. Generalized Whirling Disease Distribution Map for the Blackfoot Watershed.

**TABLE 4-1. ANTHROPOGENIC FISHERIES IMPAIRMENT ON 108
INVENTORIED STREAMS OF THE BLACKFOOT WATERSHED**

<u>Type of impact</u>	<u># Streams</u>
Concentrated livestock in riparian areas (feedlots, grazing)	58
Riparian vegetation	53
Lack of complexity	45
Instream flow	43
Irrigation (entrainment, dewatering, fish passage)	42
Channel alterations	42
Road crossings and road drainage	32
Recreational (illegal harvest, high angler pressure, stream damage)	10
Whirling disease	12
Mining	9
Residential	5

5.0 FISHERIES RESTORATION PRIORITIZATION

5.1 FISHERIES PRIORITIZATION STRATEGY

At the request of the Blackfoot Challenge, FWP updated a fisheries restoration prioritization matrix established by Pierce et al. (2002) for use by BBCTU, FWP and USFWS and their restoration partners. Nineteen (19) additional tributaries were inventoried since 2001 and six reaches of the Blackfoot River were added: (1) mouth to Clearwater, (2) Clearwater to NF, (3) NF to Nevada Creek, (4) Nevada Creek to Arrastra, (5) Arrastra to Lincoln, and (6) Lincoln to headwaters, bringing the total number of prioritized water bodies to 108. FWP incorporated the 303(d) list of water quality impaired streams and dewatered stream list into the prioritization matrix. This allowed TMDL and long-term water conservation strategies to be considered within a context of overall fisheries priorities. FWP then re-prioritized and ranked all water bodies using multiple criteria. FWP based stream scores on a hierarchical point system with emphasis on biological benefits (150 total possible points) along with social and financial considerations (50 total possible points).

FWP fisheries personnel (Ron Pierce, Don Peters, Ryen Aasheim and Craig Podner) were given the job of assigning data input and corresponding point values to the matrix. Scoring of some criteria (primarily social and financial considerations) necessarily relied on past landowner interviews, direct knowledge of tributaries, along with professional expertise and committee judgment for inventoried non-project streams.

For the biological benefits section of the matrix, streams with documented bull trout use received scores of 10, 20, 30 or 40 points, depending on whether the stream supported spawning (20 points), rearing (10 points) or is a designated bull trout “core area” stream (10 points). Compared with other criteria, streams supporting bull trout received more points due to their: 1) “threatened” status under ESA along with State and Federal priorities for the recovery of this species; 2) high potential for improvement in the Blackfoot watershed; and 3) downstream and sympatric benefits to other species resulting from bull trout recovery efforts.

For streams supporting WSCT, an additional zero to 20 points were possible, depending on whether a stream supported no WSCT (zero points), resident WSCT (10 points) or fluvial WSCT use (20 points). Fluvial WSCT streams received a higher score than streams supporting resident fish due to 1) the precarious status of the fluvial life-history, 2) high sport fish value to the Blackfoot River, and 3) downstream and sympatric benefits to other species resulting from WSCT recovery efforts. Streams with fluvial WSCT status (20 points) were those identified through 1) telemetry studies, 2) direct observations of fluvial-sized fish by fisheries personnel, or 3) direct tributaries to the Blackfoot River and biologically connected during high flows periods.

Streams received an additional zero, 10 or 20 points based on sport fishery value to the Blackfoot River. Streams with no sport fishery value (disjunct from the Blackfoot River) received zero points, single species sport fishery value (non-disjunct usually with WSCT) received 10 points, while non-disjunct streams that provide recruitment of multiple species

(bull trout, WSCT, rainbow and brown trout) to the Blackfoot River received 20 points. We assumed connected streams supporting rainbow trout, brown trout and bull trout provided sport fishery value to the Blackfoot River. We assumed small non-direct and non-fluvial headwater tributaries to support primarily resident WSCT and as such were not considered as providing sport fishery value to the Blackfoot River. We did not consider brook trout in this ranking due to their limited use of the Blackfoot River and adverse biological impacts to native species.

Stream restoration technical feasibility was also considered with zero points for not feasible and 20 points for streams considered technically feasible to restore. Streams with acid mine drainage or heavy metals (upper Blackfoot River and tributaries are not considered in this report), large instream reservoirs (upper Nevada Creek, Frazier Creek, and Wales Creek), over-appropriated water rights (lower Nevada Creek), major highway problems (Chimney Creek), and fully restored (Grantier Spring Creek) were considered not technically feasible to restore for the purposes of this report.

In addition to fisheries and feasibility criteria, streams with potential to increase instream flows (e.g. irrigation salvage potential) in the Blackfoot River were allotted 20 points. Finally, under the biological ranking section, streams with potential to improve downstream water quality by reducing: 1) instream sediment (10 points), 2) water temperature (10 points), and 3) nutrient loading (10 points) could earn up to an additional 30 points. This water quality point system was developed independent of 303(d) impaired stream list.

For social and financial considerations, FWP used three criteria: 1) landowner and land manager cooperation (5, 10, 15 or 20 points) - a measure of perceived landowner cooperation; 2) cost-effectiveness (5, 10 or 20 points) – an estimate of project cost/mile; and 3) demonstration/educational value of potential projects (5 or 10 points) - a measure of project uniqueness, landowner interest and project access.

FWP transferred matrix values to an EXCEL spreadsheet (Appendix E). For this report, we sorted all 108-stream bodies by total score and then prioritized streams by total rank. High scores are high priorities and are represented as low ranking values. For instance Monture Creek received the highest total score (175 points) for all streams and thus ranked 1st in total priority. FWP used this scoring and ranking method for all categories that rely on several numerical fields.

FWP scored and ranked all 108 streams by: 1) total rank, 2) biological rank, 3) native species rank (bull trout and WSCT fields), 4) sport fishery value, 5) potential to increase instream flow to the Blackfoot River, 6) potential for downstream water quality improvements, and 7) social and financial considerations (Appendix E). FWP then sorted the scorecard by the primary priority criteria (total rank, biological rank, and native species rank) and plotted histogram and associated cumulative percent values. For clusters of class values that approximated the 0-33, 34-66, and 67-100 percentiles, FWP assigned a respective high, moderate and low priority value (Figure 5-1). FWP also added dewatered stream list and by DEQ 303(d) list to the matrix and sorted these streams by total restoration priority (dewatered stream list – Table 5-1; 303(d) list – Table3-1).

5.2 DEWATERED STREAMS PRIORITIZATION

Stream dewatering, whether natural or human induced, can result in significant fisheries declines. In many cases, these declines can be mitigated by: 1) managing for native species whose life histories have evolved with cycles of drought; 2) managing water use (instream flows) in specific water bodies based on specific population needs, and by 3) restoring habitat quality by correcting human-induced limiting factors that either exacerbate drought or introduce additional stressors upon fish communities.

In order to develop long-term water conservation strategies under the Blackfoot Emergency Drought Response Plan, FWP added the dewatered stream list to the Action Plan prioritization (Table 5-1). Dewatering refers to a reduction in the stream-flow (natural and human-related) below the point in which habitat is deemed adequate for fish. This FWP generated list is based on direct field observations, measured flows, instream flow models, fisheries assessments and biological opinion. This allowed FWP to identify and prioritize instream flow enhancement projects consistent with biological priorities.

The dewatered stream list contains 54 water bodies (excluding the Clearwater River upstream of Blanchard Creek) and an estimated 194 miles of affected stream (Figure 5-2). Of this total, natural dewatering on 17 streams and totals 49 river miles, which includes 11 miles of the upper Blackfoot River. Human-related dewatering occurs on an estimated 45 tributaries and influences an estimated total of 165 miles and includes ~34 miles of the middle Blackfoot River. A combination of both natural and human-related dewatering occurs on 8 streams.

5.3 OTHER CONSIDERATIONS

This FWP prioritization scheme attempts to guide the limited resources of the Blackfoot Cooperators to biologically important tributaries located primarily on private lands. Although the prioritization is intended to guide restoration activities, as new information becomes available and as additional limiting factors are identified, priorities may shift. Good restoration opportunities may occur among the low priority streams, prompting restoration actions. FWP recognizes unique restoration opportunities may be presented, and that continued input from landowners and managers will help guide the Blackfoot River restoration initiative.

It is important to note that the ranking criteria does not consider many complex restoration-related issues, such as: 1) fisheries potential of sites, 2) potential contribution to connected systems, 3) severity of impacts to other systems, 4) population size, 5) native and non-native species interactions, 6) WSCT genetic concerns, 6) numerical water quality standards and criteria, or 7) industrial-scale timber harvesting practices, public land or hard-rock mine drainage issues, or 8) other specific agency programs geared toward fisheries and water quality improvements. Some of these issues are covered in the native species issues section and individual stream results section. Others should be considered on a project specific basis during early restoration development phases. Note also that, although the Clearwater

drainage is being assessed for TMDLs, local and state fisheries issues have not been addressed and will be incorporated when available.

5.4 PRIORITIZATION RESULTS

The results section begins by organizing all priority streams based on the total biological priority (high, moderate and low) classes. For these three classes, the names and locations of water bodies are referenced in maps that are numerically referenced to tables. These groupings include a brief discussion of restoration, recovery and conservation guidelines common to each priority class.

Appendix D includes the individual descriptions of all 108 water bodies. Each water body description outlines general impairments, fish species present and specific fisheries information related to the recovery and conservation of imperiled native species, as well as information related to recreational fisheries and TMDL issues. These tributaries are organized first by total biological priority and then by descending alphabetical order.

Appendix E contains the summary tables showing the prioritization of total restoration, biological, native species priorities as well as the dewatered stream sorted by total biological priority.

5.4.1 High Priority Streams

Of the 108 stream bodies, thirty-four received a high total priority rank (Figure 5-3). Projects in these watersheds will be considered as high priorities for fisheries funding and project development under the action plan. Streams bodies in this category include: 1) three reaches of the mainstem Blackfoot River, 2) all major bull trout spawning streams, and 3) other direct tributaries to the Blackfoot River including several from the Garnet Mountains. These streams are biologically connected to the Blackfoot River, and generally support the strongest native fish populations.

Tributaries originating in the northern mountains within the watershed are generally the larger streams. Headwaters range from USFS lands with wilderness designation to intensively managed private industrial forestlands. To varying degrees, these streams represent some of the best opportunities to protect, restore and manage essential habitats occupied by communities of both fluvial WSCT and bull trout. In lower stream reaches, several also support important recreational rainbow and brown trout fisheries, as well as brook trout. From a planning perspective, projects for these streams should be consistent with bull trout recovery plans and fluvial WSCT conservation plans unless site-specific measures suggest other actions.

The Garnet Mountain streams ranked high due in part to water quality, flow enhancement potential and social considerations. These streams all possess human-induced limiting factors related to habitat problems. Streams in this category generally contain fluvial WSCT and other species important to the Blackfoot River sport fishery.

Listed 303(d) streams in the high priority category are: 1) Monture Creek, 2) Belmont Creek, 3) Rock Creek, 4) Kleinschmidt Creek, 5) Blanchard Creek, 6) Warren Creek, 7) Elk Creek, 8) Blackfoot River reaches 1, 2 & 4, and 9) McElwain Creek.

5.4.2 Moderate Priority Streams

Thirty-four stream reaches fall in to the “moderate priority” category (Figure 5-4). Streams in this category would receive a moderate level of consideration for funding of fisheries-related restoration. Streams include three reaches of the upper Blackfoot River, many low-elevation tributaries to the Blackfoot River including several spring creeks, as well as a few outliners, including disjunct streams located higher in the watershed.

Most of the reaches that we consider moderate priorities are small direct tributaries to the Blackfoot River. Most of these are biologically and hydrologically (surface water) connected to the main stem Blackfoot River continually or during high flow periods. These tributaries support fluvial and stream resident WSCT and most support WSCT spawning and rearing. The tributaries should be generally viewed from a WSCT metapopulation conservation perspective. The lower portions of these tributaries variably contain rainbow trout, brown trout and brook trout. Streams generally support genetically unaltered WSCT in the upper watershed and introgressed WSCT in tributaries of the lower Blackfoot Watershed. With one exception (Arrastra Creek), these tributaries lack bull trout reproduction although many support limited bull trout rearing.

Other moderate priority streams are found both north and south of the general distribution pattern. The northern streams include lower priority bull trout core area streams. Stream on the south include several with potential for water quality and flow improvement or area ranked high with respect to social considerations.

Most streams in this moderate priority category support human-induced limiting factors and many controllable sources of fish mortality, such as entrainment of fish in irrigation ditches and stream dewatering. Most habitat-related problems can be reasonably corrected with sufficient commitment from landowners and resource managers. We have already begun to implement restoration project on many of these streams.

Streams on the 303(d) list considered moderate priority include: 1) Blackfoot River reaches 3, 5 and 6, 2) Nevada Spring Creek, 3) Yourname Creek, 4) Wales Creek, 5) Arrastra Creek, 6) Douglas Creek, 7) upper Nevada Creek, 8) Union Creek, 9) upper Willow Creek, and 10) Black Bear Creek.

5.4.3 Low Priority Streams

Forty streams ranked in the “low priority” category (Figure 5-5). Low-priority streams will not receive the same level of fisheries restoration consideration as high or moderate priority streams without a concerted local effort. However, despite a low ranking, most low priority streams possess locally valuable fisheries or potential for recovery. The majority (28) of low priority streams fall into two large sub-basins (Union Creek and Nevada Creek) of the

Blackfoot watershed. In these areas, reservoirs, subdivision and agriculture have either greatly reduced, or eliminated the biological connection with the mainstem. These streams no longer support fluvial native fish or contribute significantly to sport fisheries of the Blackfoot River. Rather, these are generally small headwater streams supporting stream resident WSCT or are degraded reaches that do not support salmonids.

Several low priority streams possess site-specific stream resident WSCT concerns that will be considered before restoration activities involving fish passage are implemented. Where WSCT populations are physically isolated, restoration measures should preserve the genetic integrity of 'pure' populations, fully consider downstream influences, and avoid exposure to hybridizing and invasive species. Where fisheries restoration is pursued, it should generally be conducted from the headwaters in a downstream direction. These methods would focus on expanding the size of individual populations by improving habitat conditions in headwater areas. This approach should improve populations, while providing sufficient time to evaluate: 1) the influence of climate change, 2) expansion potential of unwanted species, 3) disease risks, and 4) the efficacy of differing restoration methods implemented on similar streams. In all cases involving resident WSCT streams, FWP fisheries biologists should be involved in restoration planning from the onset.

Streams on the 303(d) list considered low priority include: 1) Camas Creek, 2) Murray Creek, 3) Washoe Creek, 4) Buffalo Gulch, 5) Cottonwood Creek (trib of Nevada Creek), 6) Jefferson Creek, 7) lower Nevada Creek, 8) Washington Creek, 9) Frazier Creek, 10) Gallagher Creek, and 11) Ward Creek.

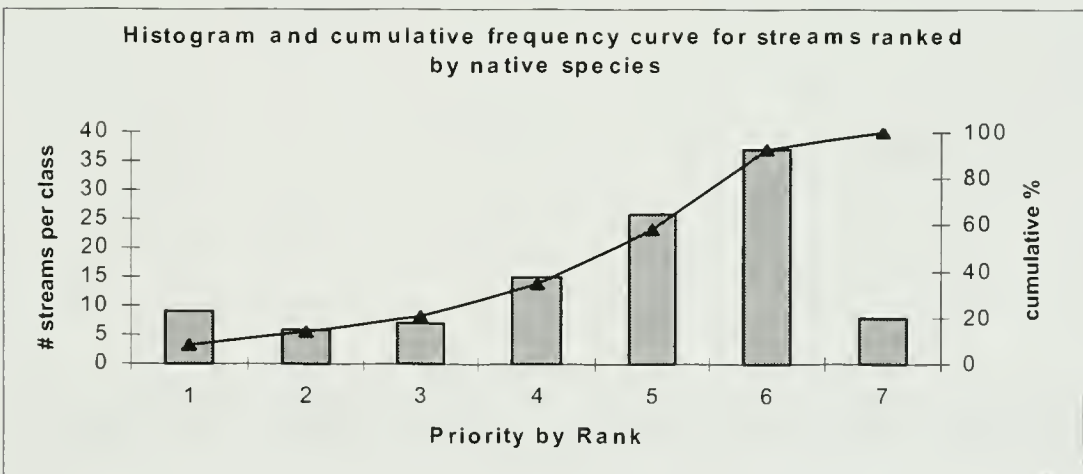
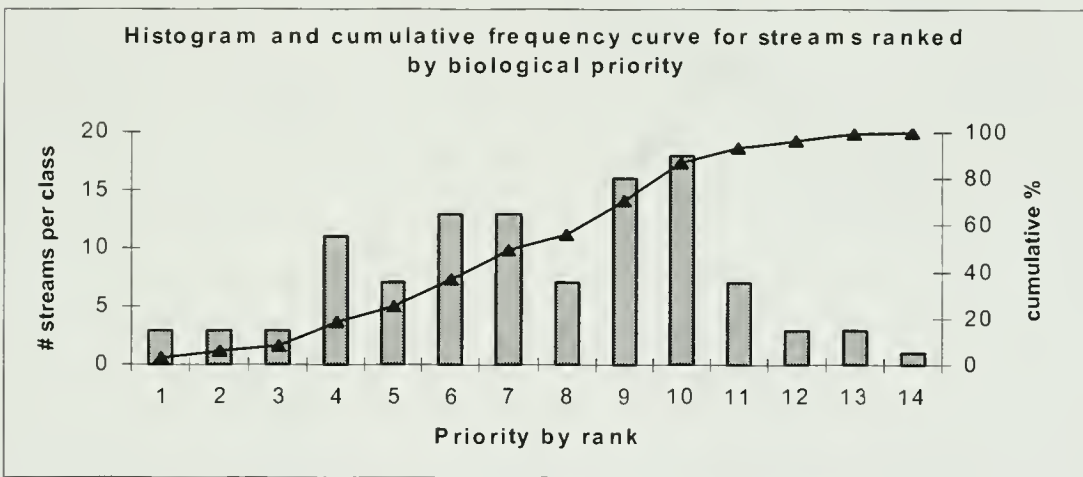
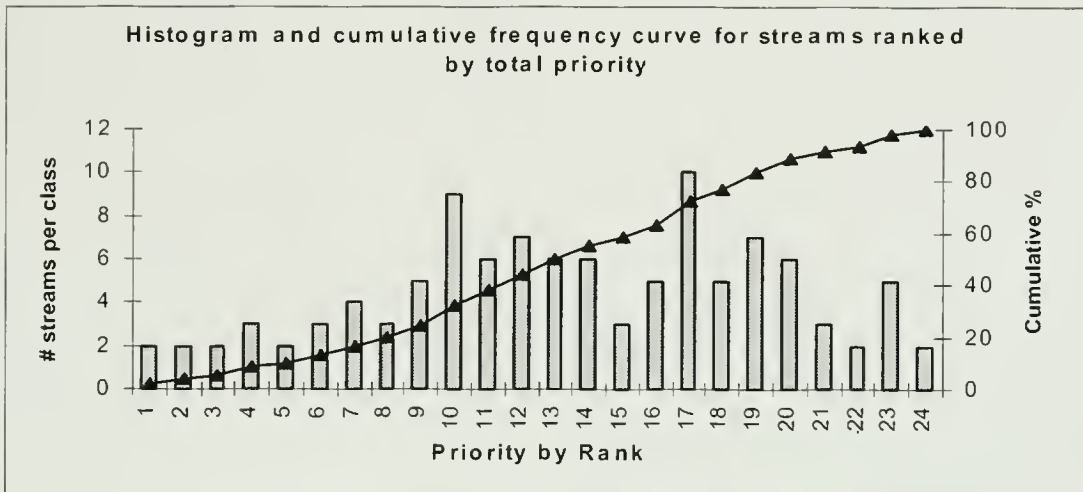


Figure 5-1. Histograms and Cumulative Percentage Curves used to Develop Prioritization Categories.

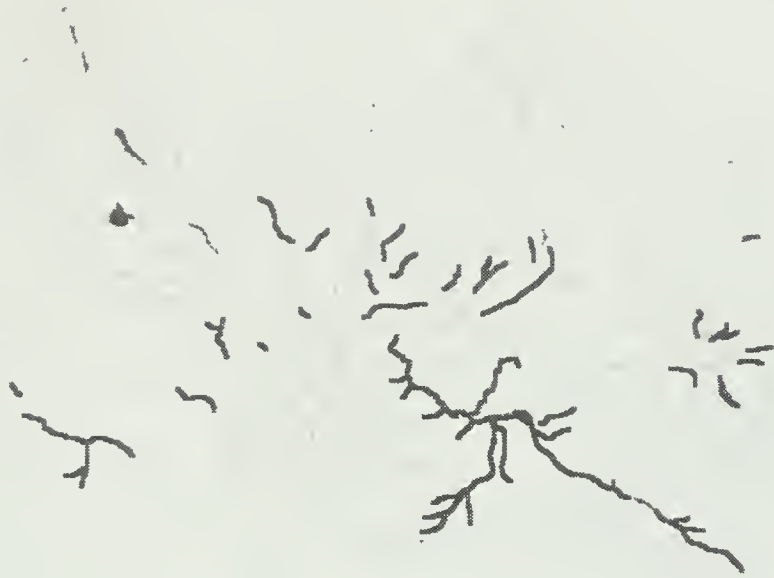
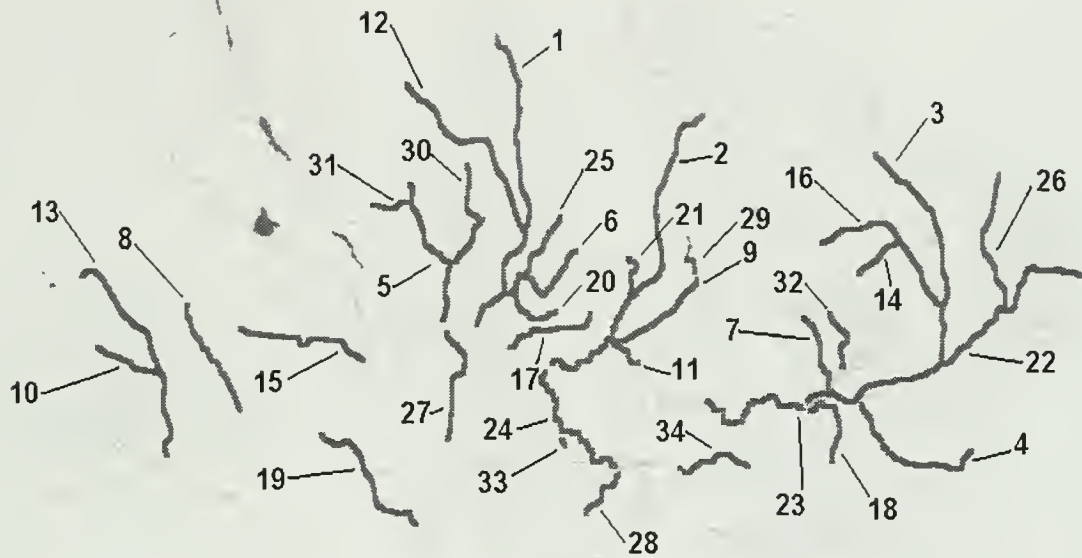
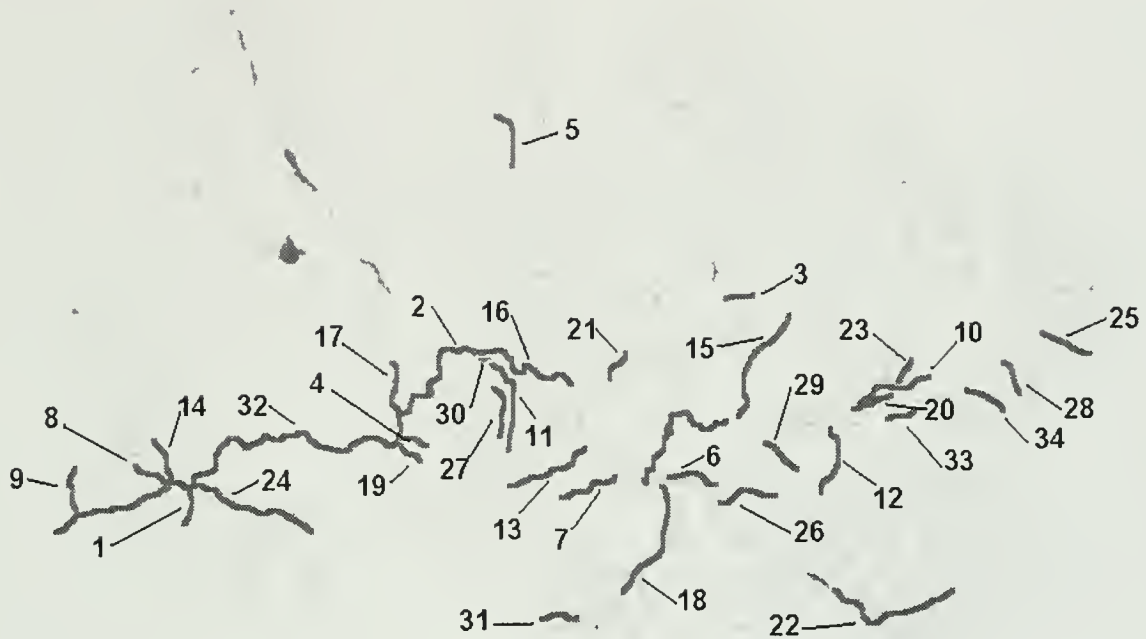


Figure 5-2. Dewatered Streams of the Blackfoot Watershed: Human Induced (top) and Natural Dewatering (bottom).



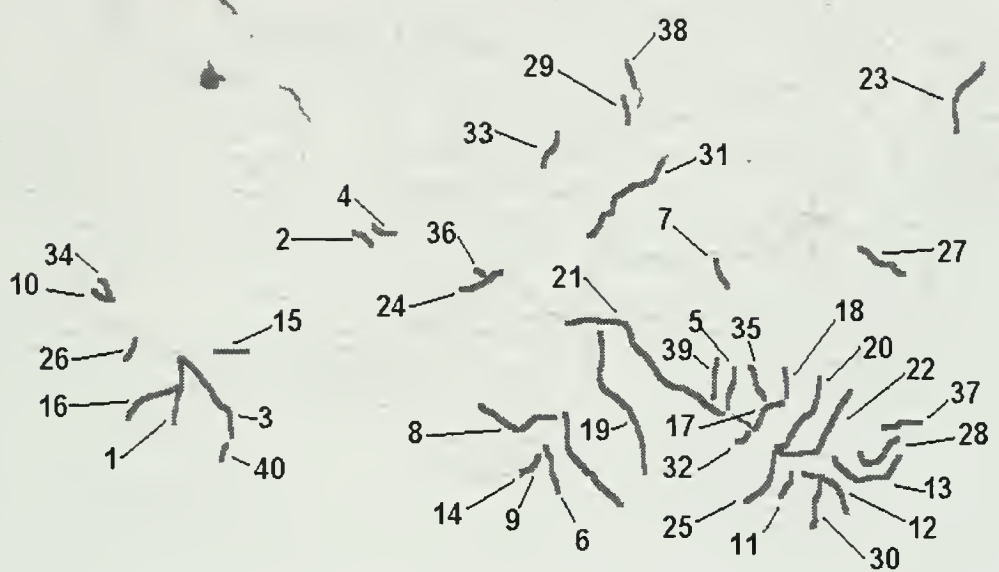
Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank
1	Monture Creek	1	12	Dunham Creek	6	23	Blackfoot River 2	9
2	N.F. Blackfoot R.	1	13	Gold Creek	6	24	Blackfoot River 4	9
3	Landers Fork	2	14	Snowbank Creek	6	25	McCabe Creek	9
4	Poorman Creek	2	15	Blanchard Creek	7	26	Alice Creek	10
5	Cottonwood Cr. (R.M.43)	3	16	Copper Creek	7	27	Chamberlain Creek	10
6	Dick Creek	3	17	Warren Creek	7	28	McElwain Creek	10
7	Beaver Creek	4	18	Willow Cr. (lower)	7	29	Salmon Creek	10
8	Belmont Creek	4	19	Elk Creek	8	30	Shanley Creek	10
9	Rock Creek	4	20	Hoyt Creek	8	31	Spring Cr.(Cottonwood)	10
10	Gold Creek, W,F	5	21	Spring Creek (N.F.)	8	32	Stonewall Creek	10
11	Kleinschmidt Cr.	5	22	Blackfoot River 1	9	33	Wales Spnng Creek	10
						34	Wasson Creek	10

Figure 5-3. High Priority Streams of the Blackfoot River Watershed.



Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank
1	Bear Creek (R.M.12.2)	11	12	Saurekraut Creek	12	23	Sucker Creek	14
2	Blackfoot River 3	11	13	Wales Creek	12	24	Union Creek	14
3	Little Fish Creek	11	14	West Twin Creek	12	25	Willow Cr. (upper)	14
4	Dry Creek	11	15	Arastra Creek	13	26	Wilson Creek	14
5	Lodgepole Creek	11	16	Blackfoot River 5	13	27	Chamberlain EF	15
6	Nevada Spring Cr.	11	17	Clearwater River	13	28	Hogum Creek	15
7	Youname Creek	11	18	Douglas Creek	13	29	Moose Creek	15
8	East Twin Creek	12	19	Fish Creek	13	30	Basin Spnng Creek	16
9	Johnson Creek	12	20	Lincoln Spring Cr.	13	31	Black Bear Creek	16
10	Keep Cool Creek	12	21	Jacobsen Spring Creek	14	32	Blackfoot River 6	16
11	Pearson Creek	12	22	Nevada Cr.(upper)	14	33	Grantier Spnng Cr.	16
						34	Seven up Pete Cr	16

Figure 5-4. Moderate Priority Streams of the Blackfoot River Watershed.



Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank	Stream ID #	Stream Name	Total Rank
1	Ashby Creek	17	14	Sturgeon Creek	18	27	Humbug Creek	20
2	Bear Creek (R.M.37.5)	17	15	Washoe Creek	18	28	Shingle Mill Creek	20
3	Camas Creek	17	16	Arkansas Creek	19	29	Bear Creek trib. to N.F.	21
4	Chamberlain WF	17	17	Buffalo Gulch	19	30	Strickland Creek	21
5	Chicken Creek	17	18	California Gulch	19	31	Ward Creek	21
6	Chimney Cr. (Douglas)	17	19	Cottonwood Cr. (Nev.)	19	32	Indian Creek	22
7	Little Moose Creek	17	20	Jefferson Creek	19	33	Warren Creek, Doney Lake	22
8	Murray Creek	17	21	Nevada Cr. (lower)	19	34	Burnt Bndge Creek	23
9	Sheep Creek	17	22	Washington Creek	19	35	Clear Creek	23
10	Warm Springs Cr.	17	23	Bartlett Creek	20	36	Frazier Creek, NF	23
11	Finn Creek	18	24	Frazier Creek	20	37	Gleason Creek	23
12	Halfway Creek	18	25	Gallagher Creek	20	38	McDermott Creek	23
13	Mitchell Creek	18	26	Game Creek	20	39	Chimney Cr. (Nevada)	24
						40	Smith Creek	24

Figure 5-5. Low Priority Streams of the Blackfoot River Watershed.

**TABLE 5-1. DEWATERED STREAM LIST FOR
THE BLACKFOOT WATERSHED**

Stream Name	Affected Length	Natural	Human	Both
Arkansas Creek	2		2	
Ashby Creek	2		2	
Arrastra Creek (sm 4.5-2.0)	2.5	2.5		
Bear Creek (North Fork)	1	1	1	x
Blackfoot River (Seven-Up Pete-Poorman Creek)	11	11	3	x
Blackfoot River (54.1 - 84.9)	30.8		30.8	
Blanchard Creek	1.2		1.2	
Burnt Bridge Creek	1		1	
Chamberlain Creek	1		1	
Chimney Creek (Nevada Creek)	0.5		0.5	
Chimney Creek (Douglas Creek)	3.5		3.5	
Clearwater River	3.5		3.5	
Copper Creek	1	1		
Cottonwood Creek rm 43.0 (sm 10.0-4.4)	5.6	2.8	2.8	x
Cottonwood Creek (Douglas Creek)	5		5	
Dick Creek (sm 3.5-6.0)	2.5	2.5	2.5	x
Douglas Creek	14		14	
Dry Creek (trib to Rock Creek)	0.5	0.5		
Dry Fork (trib to North Fork)	2	2		
Dunham Creek	5	4	1	x
Elk Creek	3		3	
Fish Creek	0.3		0.3	
Frazier Creek	1.5		1.5	
Frazier Creek, North Fork	0.5		0.5	
Gallagher Creek	3		3	
Hoyt Creek	1		1	
Humbug Creek	1	1		
Jefferson Creek	1		1	
Keep Cool	2		2	
Landers Fork (3.6-4.5)	1	1		
McCabe Creek	2		2	
McElwain Creek	1		1	
Monture Creek (12.0-15.0)	3	3		
Murray Creek	3	3		
Nevada Creek (sm 31.7-6.4)	25.3		25.3	
Nevada Creek (sm 40.0-34)	6		6	
North Fork of Blackfoot River (rm 12.0-6.2)	5.8	5.8	5.8	x
Pearson Creek	2	2		
Poorman Creek	2	2	2	x
Rock Creek (1.4-7.0)	5.6	5.6	5.6	x
Shanley Creek	1.6		1.6	
Spring Creek (trib to Cottonwood Creek)	1		1	
Spring Creek (trib to North Fork)	2.5		2.5	
Snowbank Creek	0.4		0.4	

**TABLE 5-1. DEWATERED STREAM LIST FOR
THE BLACKFOOT WATERSHED (continued)**






Stream Name	Affected Length	Natural	Human	Both
Stonewall Creek	2	1	1	x
Sucker Creek	1		1	
Union Creek (sm 7.0-0.5)	6.5		6.5	
Wales Creek	1.9		1.9	
Warm Springs Creek	1		1	
Warren Creek	6		6	
Washington Creek (Section 24 and 26)	1		1	
Wasson Creek	2		2	
Willow Creek (lower)	2		2	
Wilson Creek	0.8		0.8	
Yourname Creek	1		1	
Totals	196.3	51.7	164.5	

APPENDIX A







**COMPLETED RESTORATION PROJECTS
IN THE BLACKFOOT WATERSHED**








Legend

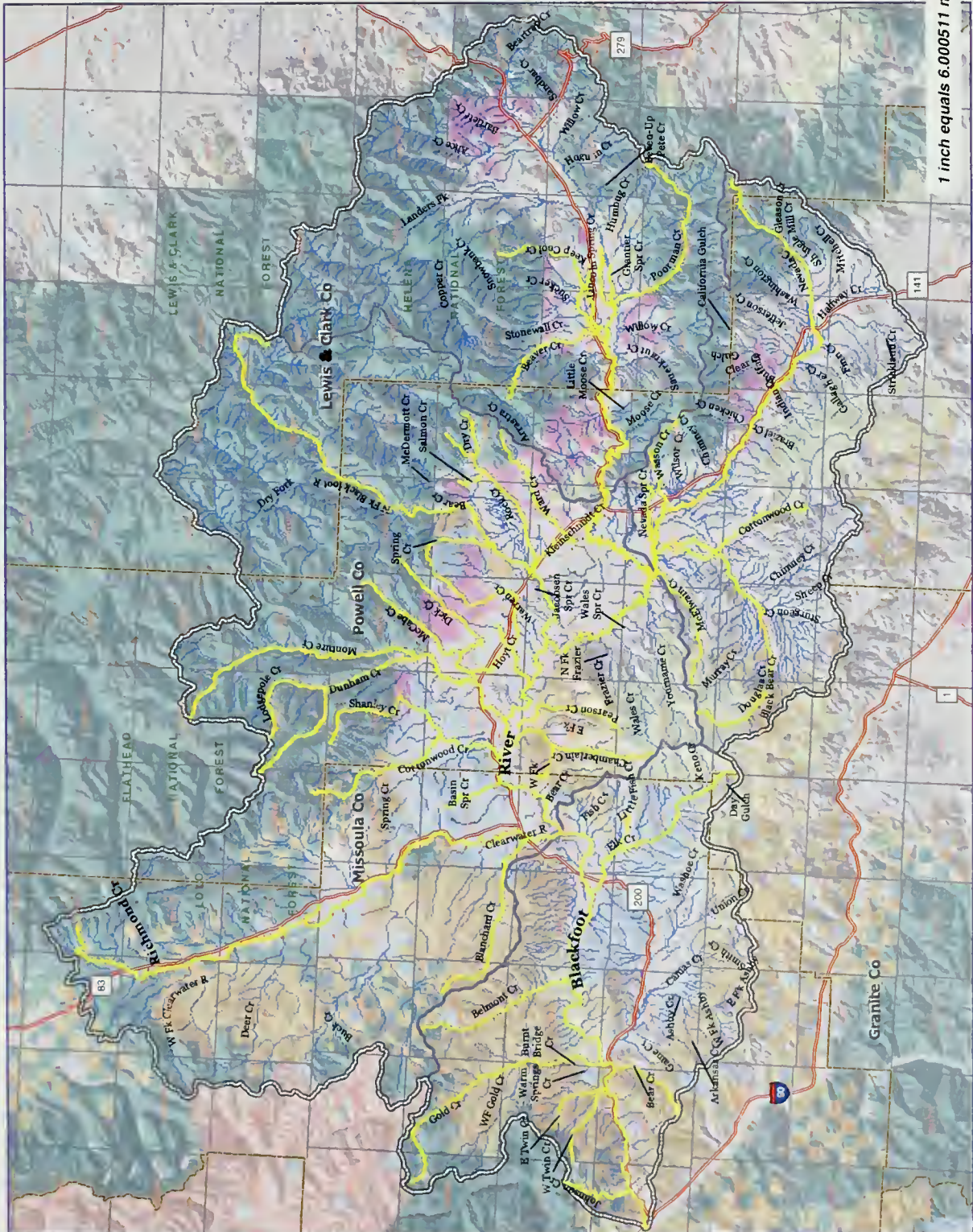
-  Blackfoot River Watershed
-  TMDL Planning Area Boundary
-  County Boundary
-  Highway
-  Restoration Project Stream

Land Ownership

-  USFS
-  US BLM
-  State Land
-  Flathead Tribal Land
-  Plum Creek
-  Nature Conservancy

Current Water Leases

-  North Fork Blackfoot
-  Wasson Creek
-  Murphy Spring Creek
-  Rock Creek
-  Poorman Creek



Appendix A Blackfoot Drainage Restoration Project Inventory Map

1 inch equals 6.000511 miles

Appendix A - Completed Restoration Projects in the Blackfoot Watershed

Stream Name	Number of Projects	Number of Landowners	Projects
Basin Spring Creek	11	2	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Bear Creek (RM 12.2)	11	3	Fish passage improvements; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Beaver Creek	16	2	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Improve wetlands; Improve irrigation
Belmont Creek	3	1	Fish passage improvements; Spawning habitat protection; Improve range/riparian habitat
Blackfoot River (Clearwater to mouth)	6	4	Improve instream flows; Improve irrigation
Blackfoot River (North Fork to Clearwater)	13	8	Improve instream flows; Improve wetlands; Improve range/riparian habitat
Blackfoot River (Lincoln to North Fork)	44	18	Channel restoration; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Blanchard Creek	4	1	Fish passage improvements; Riparian vegetation improvements; Improve range/riparian habitat; Improve irrigation
Chamberlain Creek	19	3	Fish passage improvements; Prevent irrigation ditch losses; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Chamberlain Creek (West Fork)	1	1	Improve range/riparian habitat
Clearwater River	5	2	Prevent irrigation ditch losses; Improve instream flows; Improve range/riparian habitat
Cottonwood Creek (RM 43)	15	3	Fish passage improvements; Prevent irrigation ditch losses; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Cottonwood Creek (Nevada)	6	1	Fish passage improvements; Channel restoration; Riparian vegetation improvements; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Dick Creek	27	7	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Douglas Creek	6	2	Fish passage improvements; Riparian vegetation improvements; Improve range/riparian habitat
Dry Creek	3	1	Riparian vegetation improvements; Improve range/riparian habitat; Remove streamside feedlots
Dunham Creek	10	3	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat; Improve irrigation
Elk Creek	4	1	Channel restoration; Fish habitat improvement; Improve wetlands; Improve range/riparian habitat
East Twin Creek	1	1	Fish passage improvements

Appendix A - Completed Restoration Projects in the Blackfoot Watershed

Stream Name	Number of Projects	Number of Landowners	Projects
Gold Creek	2	2	Fish habitat improvement
Grantier Spring Creek	11	1	Fish passage improvements; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat
Hoyt Creek	8	3	Fish passage improvements; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve irrigation
Johnson Creek	1	1	Fish passage improvements
Keep Cool Creek	1	1	Riparian vegetation improvements; Improve range/riparian habitat
Kleinschmidt Creek	19	4	Fish passage improvements; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots
Lincoln Spring Creek	4	1	Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve range/riparian habitat
Lodgepole Creek	1	1	Fish passage improvements
McElwain Creek	2	1	Improve range/riparian habitat; Remove streamside feedlots
McCabe Creek	14	2	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation
Monture Creek	23	5	Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Nevada Creek	17	4	Fish passage improvements; Channel restoration; Riparian vegetation improvements; Improve wetlands; Improve range/riparian habitat; Improve irrigation
Nevada Spring Creek	21	3	Fish passage improvements; Prevent irrigation ditch losses; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Remove streamside feedlots
North Fork Blackfoot River	23	11	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation; Conservation easement
Pearson Creek	17	1	Fish passage improvements; Prevent irrigation ditch losses; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Poorman Creek	9	2	Fish passage improvements; Channel restoration; Prevent irrigation ditch losses; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation
Rock Creek	42	12	Fish passage improvements; Prevent irrigation ditch losses; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots

Appendix A - Completed Restoration Projects in the Blackfoot Watershed

Stream Name	Number of Projects	Number of Landowners	Projects
Salmon Creek	18	3	Fish passage improvements; Prevent irrigation ditch losses; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Shanely Creek	5	2	Prevent irrigation ditch losses; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation
Spring Creek (North Fork)	5	6	Fish passage improvements; Prevent irrigation ditch losses; Improve instream flows; Improve wetlands; Improve irrigation
Ward Creek	8	6	Improve range/riparian habitat; Remove streamside feedlots
Warren Creek	34	8	Fish passage improvements; Spawning habitat protection; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve wetlands; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
Wasson Creek	10	2	Fish passage improvements; Channel restoration; Fish habitat improvement; Riparian vegetation improvements; Improve instream flows; Improve range/riparian habitat; Improve irrigation; Remove streamside feedlots
West Twin Creek	1	1	Fish passage improvements

Total Project Streams: 41

Total Projects: 501

Total Landowners: 147

APPENDIX B

**ONGOING AND POTENTIAL RESTORATION
PROJECTS ON TMDL STREAMS**

APPENDIX B: POTENTIAL RESTORATION PROJECTS ON TMDL STREAMS IN THE BLACKFOOT WATERSHED

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Project List?
BLACKFOOT HEADWATERS PLANNING AREA						
Blackfoot River from Headwaters to Landers Fork	Mine waste removal from floodplain	From the Anaconda/Beartrap Creeks confluence downstream 1 mile	Reduce metals loading; Improve habitat	Mixed private/public	Scheduled to be completed in 2006/07 by Asarco	Yes
Blackfoot River from Landers Fork to Nevada Ck	Weed management and revegetation, implement floodplain buffer, grazing BMPs				Identified in Sediment TMDL	Yes
Arrastra Creek	Culvert Replacement	Approximately 3 miles upstream of confluence with the Blackfoot River	Improve fish passage and flow/sediment conveyance	Public	Scheduled for implementation in 2005	Yes-Moderate
	Bridge installation	Approx 1 mi upstream of above culvert replacement		Private	Preliminary	
Beartrap Creek from Mike Horse Creek to mouth	Mine waste removal from floodplain	Beartrap Creek from Mike Horse Creek to mouth	Reduce metals loading; Improve habitat	Mixed private/public	Scheduled to be completed in 2006/07 by Asarco	No
Mike Horse Creek	Mine waste removal from floodplain	From Mike Horse Mine to confluence with Beartrap Ck	Reduce metals loading; Improve habitat	Mixed private/public	Scheduled to be completed in 2005/06 by Asarco	No
Poorman Creek	Swansea Mine reclamation	Swansea Gulch	Reduce metals loading; Improve habitat	Private	Identified in Metals TMDL	Yes-High
	Stream channel reconstruction in severely disturbed segment	RM 2.3 to 8.6	Restore aquatic habitat and limit excessive sedimentation	Private	Preliminary	Yes-High
	Riparian vegetation restoration, irrigation improvements	RM 0.0 to 2.3	Alleviate dewatering and restore aquatic habitat	Private	Identified in Sediment TMDL	

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Project List?
	Road related sediment reduction measures, road crossing replacement (barrier and ford removal), road maintenance, road drainage rehabilitation and reclamation	Poorman Creek and tributaries, Stemple Pass Road and South Fork Road	Reduce sediment delivery from county roads, provide fish passage and improve habitat	County	Identified in Sediment TMDL and by DNRC and USFS	Yes-High
Sandbar Creek	Remove downstream-most mine waste pile	Approximately 1.0 mi upstream of H'way 279	Reduce metals loading	USFS	Identified in metals TMDL	No
	Remove upper mine waste pile and mine waste in road	Approximately 1.75 mi upstream of H'way 279	Reduce metals loading	USFS	Identified in metals TMDL	No
Willow Creek	Implement grazing BMPs, weed management, channel restoration, and abandoned mine reclamation				Identified in sediment TMDL	Yes - High
MIDDLE BLACKFOOT/NEVADA CREEK PLANNING AREA						
Washington Creek (upper)	None identified at this time					Yes - Low
Washington Creek (lower)	None identified at this time					Yes - Low
Jefferson Creek (upper)	None identified at this time					Yes - Low
Jefferson Creek (lower)	Grazing Management, Off-stream watering	Immediately above highway	Increase flow	Private	Near completion- done by NRCS	Yes - Low
Gallagher Creek	None identified at this time					Yes - Low
Buffalo Gulch	None identified at this time					Yes - Low
Brazil Creek	None identified at this time					No
Nevada Creek (headwaters to Nevada Lake)	Stream channel reconstruction/stabilization, grazing management, riparian plantings	At confluence with Halfway Ck	Reduce siltation in creek reservoir	Private	Implementation in 2005	Yes - Moderate

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Project List?
Wales Creek	Potential restoration project(s) proposed on Wales Spring Ck by MDFWP					Yes - Moderate
Ward Creek	Riparian enhancement/grazing management/offsite watering		Improve habitat; Sediment/temperature reduction/, increase instream flow	Private	Implementation in 2005	Yes - Low
Rock Creek	Riparian revegetation	South Fork Rock Creek, middle and lower reaches	Temperature reduction, bank stability, cover, habitat improvements	Private	Completed in 2005	Yes - High
	Riparian revegetation	Upper reach from Salmon and Dry Creek confluence to State lands	Re-establish riparian willow and shrub communities	Private	Ongoing	Yes - High
Kleinschmidt Creek	Riparian enhancement/grazing management/offsite watering	Upper, middle, and lower reaches	Improve habitat; Sediment/temperature reduction/increase instream flow	Private	Implementation in 2005	Yes - High
Warren Creek	Riparian enhancement/grazing management/offsite watering		Improve habitat; Sediment/temperature reduction/increase instream flow	Private	Implementation in 2005	Yes - High
Monture Creek	Grazing management: off-stream water development, fencing, grazing plan development	From 0.5 to 1.5 miles upstream of confluence with BFR	Improve habitat; Sediment reduction	Private	Implementation in 2005	Yes - High
Blanchard Creek	None identified at this time					Yes - High
Buck Creek	None identified at this time					No
Deer Creek	None identified at this time					No
West Fork Clearwater River	None identified at this time					No
Richmond Creek	None identified at this time					No
Blackfoot River (Nevada Creek to Monture Creek)	None identified at this time					Yes
Blackfoot River (Monture Creek to Clearwater River)	None identified at this time					Yes

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Project List?
LOWER BLACKFOOT PLANNING AREA						
Belmont Creek	None identified at this time					
Blackfoot River (Clearwater River to Belmont Cr)	Irrigation Water Management-wheel lines to pivot	BFR immediately below confluence with Clearwater R	Increase mainstem flows	Private	In progress	Listed (mod) but not for restoration
Blackfoot River (Belmont Cr to mouth)	None identified at this time					
Canas Creek	Riparian Planting	Below Ashby Creek confluence to confluence with Arkansas Creek	Re-establish riparian shrub communities, prevent invasives, and bank stabilization	Private	Planning stage 2005	Yes - Low
Day Gulch	None identified at this time					No
East Fork Ashby Creek	None identified at this time					No
Elk Creek (headwaters to Stinkwater Cr)	Grazing Management, some channel reconstruction/stabilization, irrigation water management	Lower 4 to 5 miles	Improve habitat, water quality, instream flows	Private	In negotiation stage with landowner	Yes-High
Elk Creek (Stinkwater Cr to mouth)	None identified at this time					Yes - High
Keno Creek	None identified at this time					No
Union Creek	None identified at this time					Yes - Moderate
Washoe Creek	None identified at this time					Yes - Low
West Fork Ashby Creek	None identified at this time					No
303(d) Tributary Project Streams						
Hoyt Creek (tributary to Monture Creek)	Stream restoration and reconstruction (5,300 ft)	Middle reach of Hoyt Creek	Restore historic floodplain, habitat improvements	Private	Implementation in 2005	Yes - High
Moose Creek (tributary to Blackfoot River)	Culvert replacement and removal	T14N,R10W, S34 and T13N, R10W, S3	Safe fish passage, improve flood capacity, channel restoration	Public	Implementation in 2005	Yes - Moderate
Sturgeon Creek (tributary to Douglas Creek)	Grazing management- off stream watering, fencing, grazing plan	Upper one mile of Sturgeon Ck	Improve riparian area; Improve downstream water quality	Private	Potential NRCS CRP project - 2005 or 2006	Yes - Moderate

Listed Water	Project(s)	Location	Objective(s)	Land Ownership	Status	On Fisheries Project List?
Wasson Creek (tributary to Nevada Spring Creek)	Channel restoration, grazing management, stream crossing replacement	Above confluence w/Nevada Spring Creek	Improve fish passage, habitat, and instream flows	Private	Implementation in 2005	Yes - High

APPENDIX C

**DESCRIPTION OF NEAR TERM
RESTORATION PROJECTS**

APPENDIX C: NEAR-TERM RESTORATION PROJECTS

ARRASTRA CREEK PROJECT

Background: Arrastra Creek is the largest tributary to the Blackfoot River between river mile (rm) 68 and rm 105 and enters the Blackfoot as a second-order tributary near rm 88.8 with an estimated base flow of 10-15 cfs. Arrastra Creek is located in the Blackfoot Headwaters TMDL planning area and is listed as impaired for siltation and other habitat alterations. It is the only known stream to support bull trout reproduction between rm 54 and rm 108, and a 2002-03 telemetry study identified Arrastra Creek as the primary fluvial WSCT spawning stream to the middle Blackfoot River, the genetic composition of which has been tested as genetically pure. In 2002, Montana, Fish Wildlife and Parks identified twin culverts at stream mile 3.3 that were providing a significant barrier to the upstream movement of WSCT, with velocities exceeding seven ft/sec. As outlined in the Final Blackfoot Headwaters TMDL for sediment, replacement of undersized culverts to ensure sediment/flow conveyance is a specific recommendation in this reach of Arrastra Creek.

Project Goal: Eliminate a migration barrier and improve access to six miles of upper Arrastra Creek for westslope cutthroat trout (WSCT) and bull trout and to improve flow and sediment conveyance in this reach of Arrastra Creek.

Project Description: This project involves the replacement of these culverts with a bridge. The project is located in Section 17, T14N, R10W.

Restoration Monitoring Strategy: FWP assessed culvert velocities related to fish passage in 2003. Other parameters relating to TMDL impairments will also be collected as part of a 319 grant.

Partners and Funding Sources: BBCTU, Blackfoot Challenge, Bureau of Reclamation, Northwestern Energy, MDFWP, and DEQ/EPA.

BEARTRAP CREEK PROJECT

Background: Beartrap Creek flows from the continental divide westward to join with Anaconda Creek and form the Blackfoot River. The lower one mile of Beartrap Creek is impacted by past mining activities. Mine waste rock and tailings have been deposited on the floodplain throughout this stream reach, and a mine tailings impoundment constructed within the drainage bottom. This portion of Beartrap Creek lies within the Upper Blackfoot Mining Complex, an historic mining area and the subject of an ongoing mine reclamation program, and is included on the State's 303(d) list with metals listed as the cause of impairment.

The current project addresses water quality impacts from mine waste located along the Beartrap Creek floodplain. Reclamation alternatives are currently being evaluated, and will include some level of mine waste removal and stream channel/riparian restoration, with reclamation work to occur by 2008.

Project Goal: The goal of the Beartrap Creek reclamation project is to remove causes of metals-related water quality impairment in Beartrap Creek resulting from past mining activities.

Project Description: The project is located along the Beartrap Creek drainage bottom in Township 15N, Range 6W, Section 27, from the confluence with Mike Horse Creek downstream to the confluence with Anaconda Creek. Reclamation activities will include removal of mine waste materials that may be contributing metals to Beartrap Creek; establishment of a stable, functioning stream channel, and restoration of the flood plain/riparian area.

Restoration Monitoring Strategy: Project monitoring includes annual surface water sampling conducted four times a year upstream of, within, and downstream of the targeted stream reach. Macroinvertebrate sampling is also conducted once a year downstream of the stream reach. This monitoring is scheduled to continue for the next several years.

Partners and Funding Sources: The Beartrap Creek reclamation project is being conducted and funded by Asarco, Inc.

BLACKFOOT RIVER: HEADWATERS TO LANDERS FORK

Background: The Upper Blackfoot River forms at the confluence of Beartrap Creek and Anaconda Creek and flows approximately 1.5 miles westward into a large riparian wetland area. This portion of the Blackfoot River is impacted by past mining activities. Mine waste rock and tailings have been deposited on the floodplain throughout this stream reach, and the stream channel altered and relocated in places leading to an unstable stream channel configuration. This portion of the Blackfoot River lies within the Upper Blackfoot Mining Complex, an historic mining area and the subject of an ongoing mine reclamation program. The Upper Blackfoot River is included on the State's 303(d) list.

This project addresses water quality impacts from mine waste located along the Upper Blackfoot River floodplain. Reclamation alternatives are currently being evaluated, and will include some level of mine waste removal and stream channel/riparian restoration, with reclamation work to occur by 2008.

Project Goal: The goal of the Upper Blackfoot River reclamation project is to remove causes of metals-related water quality impairment in the adjacent river resulting from past mining activities.

Project Description: The project is located along the upper 1.5 miles of the Blackfoot River in Township 15N, Range 6W, Section 21, from the confluence of Beartrap/Anaconda Creeks, downstream to the confluence with Pass Creek. Reclamation activities will include removal of mine waste materials that may be contributing metals to the Blackfoot River; establishment of a stable, functioning stream channel, and restoration of the flood plain/riparian area.

Restoration Monitoring Strategy: Project monitoring includes annual surface water sampling conducted four times a year upstream of, within, and downstream of the targeted stream reach. Macroinvertebrate sampling is also conducted annually within this stream reach. This monitoring is scheduled to continue for the next several years.

Partners and Funding Sources: The Blackfoot River reclamation project is being conducted and funded by Asarco, Inc.

CHAMBERLAIN CREEK PROJECT

The project is located on private land but provides access to both state and private property. Chamberlain Creek ranks number 44 on BBCTU's prioritization. Currently, two bridges (one on top of the other) cross Chamberlain Creek which constricts the channel and has caused impacts upstream and downstream. Both bridges are unstable, unsuitable for timber harvest activities and are undersized. In a cooperative project with BBCTU, the landowners and DNRC, a new, larger bridge would be installed which would allow for timber harvest and private use, as well as improve stream stability and fish habitat. The new steel structure will be installed utilizing 100 year flood event standards and natural channel design.

Partners and funding sources for this project include the landowner, BBCTU, USFWS and DNRC.

CLEARWATER RIVER PROJECT

Project is located at T14N R14W Section 21. Current flood and wheel-line irrigation practices are taking the majority of flows in the lower Clearwater River at critically low flow periods. The landowner will enter into a cooperative agreement to improve irrigation efficiencies by converting from flood and wheel lines to a center pivot. The landowner will reduce irrigation by 50% when flows in the Blackfoot reach 700 cfs, and stop irrigation when flows reach 600 cfs. The sum of this project is expected to substantially enhance Blackfoot River flows during critical low flow periods over the next 20 years.

Partners and funding sources for this project include the landowner, BBCTU, USFWS, and MT FWP.

COTTONWOOD CREEK PROJECT

The project is located in upper Cottonwood Creek, T16N R14W Section 10, Seeley Lake Ranger District, Lolo National Forest. Cottonwood Creek is ranked number 5 on BBCTU's priority list of streams. An undersized culvert is leading to channel instability, aggradation of bedload upstream, and is a total fish passage barrier. In a cooperative project with the USFS, BBCTU will have the lead on the project. The culvert will be replaced with a bridge, and several hundred feet of stream will be restored along with the placement of several rock weirs or cross vanes for hydrologic stability and fish passage.

Partners and funding sources for this project include BBCTU, USFS, FWP, BOR and USFWS.

HOYT CREEK PROJECT

This project is located at T15N R12W Sections 19, 29, and 30, 1 mile west of Ovando, MT and south of Highway 200. Hoyt Creek is a 1st order spring creek tributary to the Dick Creek and Monture Creek systems and ranks 17th on BBCTU's priority list. Hoyt Creek south of Highway 200 is partially entrenched, straightened, and suffers from a lack of fish habitat and complexity. This project will restore approximately 5,300 ft of E4 stream channel by completely

reconstructing Hoyt Creek to a meandering wet meadow stream at its historic floodplain elevation. Coupled with this project will be 334 acres of wetland enhancement and a 1,629 acre upland/riparian grazing and haying management plan.

Partners and funding sources for this project include the landowner, BBCTU, Blackfoot Challenge, FWP, USFWS, BOR, NRCS and DEQ/EPA.

JACOBSEN SPRING CREEK PROJECT

This project is along the North Fork of the Blackfoot River and south of HWY 200, T14N R12W Sections 1, 11, 12, & 13. The North Fork of the Blackfoot River ranks number 1 on BBCTU's priority list. Jacobsen Spring Creek is a major season long, cold water spring creek tributary to the North Fork of the Blackfoot River. The stream is several miles long, originates from several spring sources on the ranch, and is suffering from a range of issues including over-widening, sedimentation, unrestricted livestock watering, elevated temperatures and loss of flows. Through 2004, season-long stream flows and temperatures were collected on the system, as well as preliminary fisheries investigations and whirling disease inventories performed in preparation for a restoration design. The stream will be restored to a properly functioning E4/5 spring creek and spawning tributary to the North Fork. As much as 3 miles of stream will be restored with several techniques including riparian fencing, off-site water development, revegetation, and channel restoration.

Partners and funding sources for this project include the landowner, MDFWP, BOR, NRCS, USFWS and BBCTU

KLEINSCHMIDT CREEK PROJECT

Background: Kleinschmidt Creek, located on the southern margin of Kleinschmidt Flat, is a spring creek tributary to the North Fork of the Blackfoot River (Figure 3-1). The lower 1.5 miles of Kleinschmidt Creek (downstream of Highway 200) is listed as impaired due to riparian degradation, fish habitat degradation, thermal modifications, other habitat alterations, and arsenic on the 2004 303(d) list (Table 3-1). Grazing, dam construction, hydromodification, and bank destabilization are all cited as sources of impairment.

A major in-stream restoration project was completed on the lower 1.5 miles of Kleinschmidt Creek in 2000. Impairment conditions are also being addressed through ongoing TMDL planning effort in the Middle Blackfoot Planning Area.

Project Goal: The goal of this project is to reduce nutrient, sediment, and thermal impacts and improve fish habitat in Kleinschmidt Creek through grazing management and stream channel restoration.

Project Description: This project will utilize a combination of restoration techniques including riparian fencing, riparian revegetation, off-stream stock water development, grazing management on over 640 acres, and traditional in-stream channel restoration. A rotational grazing management plan is currently being developed by the Blackfoot Challenge and the landowner, although detailed schedules and stocking rates have not yet been determined. Riparian fencing

will be used to establish a healthy riparian corridor extending 20 to 30 feet on either side of the stream. The riparian corridor will be planted with native species following intermittent stream channel restoration along approximately 600 feet of stream.

Restoration Monitoring Strategy: Pre-restoration water quality and macroinvertebrate sampling was completed for the project in November 2004. Post-restoration monitoring will commence upon project completion, most likely in 2005/06. Kleinschmidt Creek is also a long-term temperature, stream flow, whirling disease and fisheries monitoring stream.

Partners and Funding Sources: Landowner, NRCS, FWP, and BBCTU

MONTURE CREEK PROJECT

Background: Monture Creek is included on the 2004 303(d) list as impaired for habitat alteration. Impairment sources include agriculture and grazing-related activities. Extensive in-stream habitat restoration has been completed in the last 12 years on private lands in this drainage. The currently proposed project would further enhance habitat within the drainage (for both fisheries and wildlife), through grazing management and other improvements to promote riparian area vegetation and the health of adjacent uplands.

Project Goal: The goals of this project are to reduce sedimentation and improve riparian habitat through grazing management.

Project Description: Improved livestock management will be attained through enclosure fencing and off-stream stock water development. Approximately four miles of new fencing is proposed to exclude livestock from the stream and riparian zone. Three new wells will be drilled, almost two miles of buried water line installed, and at least nine stock water tanks installed to facilitate animal distribution. These proposed projects will improve habitat conditions over approximately two miles of Monture Creek near the confluence with the Blackfoot River.

Restoration Monitoring Strategy: Pre-project vegetation transects have been established and will be monitored annually or bi-annually to record future changes in the plant community. Stream habitat surveys will also be conducted annually to assess the response to restoration activities. Ongoing FWP monitoring activities include fish population surveys; redd counts, and temperature monitoring.

Partners and Funding Sources: Landowner and NRCS

MOOSE CREEK PROJECT

This project is located Township 14N Range 10W Section 34 sw ¼ and Township 13N Range 10W Section 3 ne ¼. The project will replace the lower culvert in the drainage with one that provides for safe vehicle travel, has the capacity to pass the 100-year event and provides passage for fisheries and other non-fish aquatic species. Replace the lower overflow culvert with one of greater capacity. Remove the upper culvert to reduce flood risk in the drainage and to provide passage for fisheries and other non-aquatic species. Restore the channel to natural configuration at the crossing and stabilize the road. Forest Service personnel will monitor the structure at the

lower site after installation. The structure and stream channel dimensions will be measured after construction the following year and at a minimum after any large flood events that take place in the drainage in following years. Success of this project will be measured by how well the new structure at the lower site continues to mimic the stream channel characteristics over time.

Partners and funding sources for this project include BBCTU and USFS – Lincoln Ranger District.

NEVADA CREEK PROJECT

Background: This Nevada Creek project is located near the confluence of Nevada Creek and Halfway Creek in Section 34, T12N, R9W. Nevada Creek is listed as impaired due to metals, flow alteration, nutrients, habitat alterations, thermal modifications, siltation, and suspended solids. Key elements of the project include stream channel reconstruction/stabilization, grazing management, and riparian vegetation planting.

Project Goal: Project objectives include stream channel and streambank stabilization, and reduction of sediment loading to Nevada Lake. Landowner negotiations have been completed by the Blackfoot Challenge and a preliminary restoration plan is currently being designed. This project includes approximately 1,000 feet of stream corridor.

Project Description: The stream channel reconstruction/stabilization portion of the project will reconstruct about 500 feet of channel. Grazing management includes fencing to control livestock grazing in the riparian areas, off-site stock water development, all included with the development of a grazing plan with the landowner. Riparian planting will also be performed to promote riparian area recovery and streambank stabilization. Plantings will include native rhizomatous grass species and native willow species to promote stability and habitat.

Restoration Monitoring Strategy: Pre-restoration monitoring data includes stream channel physical features survey. Additional pre-restoration data needs include establishment of vegetation monitoring transects. Corresponding post-restoration data will be collected following project completion and site stabilization.

Partners and Funding Sources: Landowner, NRCS, Blackfoot Challenge, and DEQ/EPA

WARD CREEK PROJECT

Background: Ward Creek originates on Arrastra Mountain and is the main tributary to Brown's Lake and Kleinschmidt Lake. Ward Creek is listed on the 1996 and 2002 303(d) list as impaired for flow alterations, other habitat alterations, and siltation. Impairment sources are sited as agriculture and irrigated crop production. Ward Creek is part of the ongoing Kleinschmidt Flats restoration and monitoring effort which has produced four major restoration projects with the cooperation and support of landowners and watershed partners. In addition, impairments on Ward Creek are being addressed through ongoing TMDL planning activities and extension work in the Middle Blackfoot. Ward Creek presently supports a resident brook trout population.

Project Goal: The goals of this project are to reduce sedimentation and stream channel impacts through improvements to riparian habitat, livestock management, and the protection of a large, intact wetland.

Project Description: The project includes a well (60 FT.), frost-free pipeline (1750 ft), off-stream winter watering facilities (4), riparian and wetland fencing (4400 ft), and stream bank stabilization (500ft). The project will require an excavator to shape banks and transplant sod mats/willow clumps along about 500 feet of Ward Creek. Willow sprigs will also be planted on approximately 7000 sq. ft. of bank. Additional equipment will be necessary to lay and bury the frost-free pipelines. Livestock will be excluded from the riparian area and the southern portion of the wetland area. All of these combined efforts will improve livestock management, riparian/stream habitat conditions, lower water temperatures, reduce sedimentation, and improve water quality.

Project Monitoring: Restoration monitoring for the Ward Creek restoration project will include pre- and post-restoration monitoring for water column chemistry, water temperature, and geomorphic surveys. The restoration monitoring program is summarized in Table I. Biological monitoring, including macroinvertebrate sampling and fish population surveys, is not proposed for Ward Creek due to the low fisheries potential for this segment of the creek, and due to the limited budget available for restoration monitoring.

Water quality monitoring will include sampling at two locations, one immediately upstream and the second immediately downstream of the restoration area. Water samples from each location will be tested for total suspended solids and particulate nutrients (total kjeldahl nitrogen, nitrate plus nitrite as N, ammonia as N, total phosphorous, and ortho-phosphorus). Streamflow will also be measured at each water sampling site.

Geomorphic surveying will include streamside surveys of channel morphology (width to depth ratio, pool frequency, large woody debris density, etc.), Wohlman pebble counts, and riparian area assessments. Geomorphic surveys will be conducted along the entire length of the proposed restoration project.

Pre- and post-restoration data for water temperature will be collected by the Department of Fish, Wildlife and Parks following procedures outlined in the Blackfoot Challenge Project QAPP. Continuous water temperature data will be collected immediately upstream and downstream end of the proposed restoration project in 2005 and 2006.

Partners and Funding Sources: Landowner, BBCTU, USWFS, EPA, and the Blackfoot Challenge

WARREN CREEK PROJECT

Background: Warren Creek originates on Ovando Mountain and flows 12 miles southwest until its junction with the Blackfoot River. Warren Creek is listed on the 1996, 2000, and 2002 303(d) list as impaired for flow and habitat alterations. Irrigation causes the middle section to dewater and riparian clearing, heavy grazing, and straightening have all contributed to the degradation of the stream.

Impairments on Warren Creek are being addressed through restoration efforts on various stream reaches, including the current restoration project on lower Warren Creek, and through TMDL planning efforts in the Middle Blackfoot. This project is supported by landowners that have participated in numerous restoration projects to improve stream and riparian conditions on their property. Warren Creek presently supports low densities of WSCT and resident brook trout.

Project Goal: The goals of this project are to reduce sedimentation and improve riparian habitat conditions through re-vegetation techniques, the development of off-stream watering facilities, and improved livestock management.

Project Description: The project includes a well (150 ft), pipeline (9000 ft), off-stream watering facilities (6), armored water gaps (3), and willow sprigging along stream banks (2000 sq.ft.). Water gaps will be armored to withstand livestock impacts and reduce sediment load to the stream. The development of off-stream watering facilities will enable the landowners to implement/enhance their deferred grazing system and significantly limit livestock access to the stream. The grazing system integrates both the McNally's property and adjacent grazing leases on Plum Creek Timber Co. Lands. The system will improve livestock distribution and range conditions, as well as, offer the landowner more options and flexibility in livestock management.

The pastures below are included in the deferred rotation grazing plan. The actual schedule will be developed with the landowner based on AUM's and pasture type.

Pasture #1 = 24 AUM	Pasture N1 = 44.4 AUM
Pasture #2 = 32.3 AUM	Pasture N2 = 25.8 AUM
Pasture #3 = 4.2 AUM	Pasture N3 = 54.8 AUM
Pasture #4 = 12 AUM	
Pasture #5 & #6 = Mothering and spring feeding	
Pasture #7 = 5.7 AUM	
Pasture #8 = 1 AUM	
Pasture #9 = 5.1 AUM	
Pasture #10 = 8.4 AUM	
Pastures #F2, #11, #12, #13, & #14 = Aftermath grazing and winter feeding.	

Project Monitoring: Restoration monitoring for the upper Warren Creek restoration project will include pre- and post-restoration monitoring for macroinvertebrate populations, water column chemistry, water temperature, and geomorphic surveys. The restoration monitoring program is summarized in Table 1.

Macroinvertebrate sampling will occur at one location on the mainstem of Warren Creek in the vicinity of the downstream-most proposed water gap (Section 25, T15N, R12W). Samples will be collected with a Hess sampler following procedures outlined in the May 12, 2004 Big Blackfoot Watershed Water Quality Monitoring Program Quality Assurance Project Plan.

Water quality monitoring will include sampling at three locations for total suspended solids and particulate nutrients (total kjeldahl nitrogen, nitrate plus nitrite as N, ammonia as N, total phosphorous, and ortho-phosphorus). Sampling locations will include the east fork and west fork of Warren Creek above the respective proposed water gaps, and the mainstem downstream of the lower proposed water gap. Streamflow will also be measured at each water sampling site.

Geomorphic surveying will include streamside surveys of channel morphology (width to depth ratio, pool frequency, large woody debris density, etc.), Wohlman pebble counts, and riparian area assessments. Geomorphic surveys will be conducted in the vicinity of the three proposed water gaps; one on the east fork of Warren Creek, one on the west fork, and one on the mainstem immediately downstream of the confluence of the two forks.

Continuous water temperature data will be collected near the mouth of Warren Creek using automated temperature recorders. Although this monitoring location is a considerable distance downstream of the Upper Warren Creek restoration project, the long period of record at this site, dating back to at least 2000, provides a good dataset for comparison to future water quality data.

Partners and Funding Sources: Landowner, NRCS, MDFWP, BBCTU, EPA, and the Blackfoot Challenge.

WASSON CREEK PROJECT

Wasson Creek is a tributary to Nevada Spring Creek near the town of Helmville, MT. Historic land and water uses have significantly altered Wasson Creek channel and aquatic habitat, limiting the sustainability of WSCT in the drainage. Existing water and land uses continue to exert significant destabilizing impacts to the stream system. The goal of this project is to return Wasson Creek to a significant source of WCST recruitment to Nevada Spring Creek, Nevada Creek, and the Blackfoot River and provide sufficient forage production for economic sustainability to ranchlands, while demonstrating a successful collaborative effort. This project will utilize a variety of restoration activities including grazing management, irrigation management, fish passage and loss prevention at diversions, new channel construction, new floodplain in straightened reaches, floodplain containment, channel clearing, stream crossing structure replacement, and an in-stream flow lease. Monitoring of this project will include water chemistry samples, substrate, riparian surveys, geomorphic assessments, water temperature, flow, and fish population surveys.

Partners and funding sources for this project include two private landowners, FWP, BBCTU, Blackfoot Challenge, USFWS, Western Water Project, and EPA.

MID-TERM PROJECTS WITH FUNDING NEEDS

NEVADA CREEK PROJECT

Background: This Nevada Creek project includes approximately one mile of stream starting extending from one mile to two miles downstream of the Nevada Lake dam in Section 10, T12N, R10W. Nevada Creek is listed as impaired due to metals, flow alteration, nutrients, habitat alterations, thermal modifications, siltation, and suspended solids. Key elements of the project include, grazing management, irrigation water management, and stream channel restoration. The Blackfoot Challenge is currently in negotiation with the landowner. A conceptual design will be completed summer 2005 with implementation occurring once funding is secured.

Project Goal: Project objectives include aquatic habitat restoration, sediment/temperature/nutrient load reduction, and maintenance of in-stream flows, with the overall goal being improvement of fishery and wildlife habitat.

Project Description: The grazing management portion of the project will include fencing to better control livestock grazing in riparian areas, off-stream stock water development, and development of a long-term grazing plan with the landowner. Irrigation water management will include changing from a high pressure system to a low pressure system, which will reduce water use from the stream. Stream channel restoration will include channel and habitat reconstruction using wood and vegetation, which will promote long-term stability in the system.

Restoration Monitoring Strategy: Pre-restoration monitoring data will include stream physical features and vegetation parameters from permanently located transects. Corresponding post-restoration data will be collected following project completion and site stabilization.

NEVADA CREEK PROJECT

Background: This project is located approximately three miles downstream of Nevada Lake in Section 4, T12N, R10W. This project focuses on mitigating an approximately 1,000-foot long segment of Nevada Creek that abuts the toe of an irrigation ditch berm. If not addressed, the current situation could lead to undercutting of the berm, sediment loading to Nevada Creek, and the potential release of the irrigation ditch water. As currently envisioned, this project would include either relocation or stabilization of the affected portion of the stream channel to prevent future undercutting, and grazing management. This project is in the early landowner negotiation phase. The project is considered a priority TMDL project due to the potential environmental and property damage that could occur with failure of the irrigation ditch.

Project Goal: The goal of this project is to prevent undercutting of the irrigation ditch berm by Nevada Creek, reduce sediment and nutrient loading to the creek, and reduce summertime high water temperatures through streambank stabilization and grazing management.

Project Description: Project details have not yet been developed due to the preliminary nature of this project. If implemented, the project would likely involve either relocating the affected portion of the creek away from the irrigation ditch berm, or, if stream relocation is not feasible due to landowner concerns or other factors, stabilizing the affected stream reach through vegetation plantings and/or limited use of riprap to prevent further undercutting. The stream work would be coupled with grazing management to promote long-term stability of the project.

Restoration Monitoring Strategy: No stream monitoring data or other relevant information is known to exist from this portion of Nevada Creek. Pre-restoration monitoring will likely be required prior to project implementation, and may include stream channel geomorphic surveys, as well as water quality monitoring to assess the affects of grazing management. Pre and post restoration monitoring needs will be determined once a conceptual project design is developed.

APPENDIX D

108 FISHERIES PRIORITY STREAM SUMMARIES

**APPENDIX D: SUMMARY OF PRIORITY STREAMS
TRIBUTARY DESCRIPTIONS - DESCRIPTIONS FOR EACH OF 108
TRIBUTARIES IN THE BLACKFOOT**

HIGH PRIORITY STREAMS

MONTURE CREEK: Priority - High

Monture Creek, a large 4th order tributary to the middle Blackfoot River, originates in a roadless watershed along southern flanks of the Bob Marshall Wilderness. Monture Creek is ~24 miles long, with the lower ~12 miles flowing through private ranch land. Monture Creek, located in the bull trout core area, ranked as a high priority for all criteria. This ranking is due to 1) bull trout spawning, rearing and core area status, 2) presence of fluvial WSCT, 3) a high (multi- species) sport fishery value, 4) high potential to improve water quality in the Blackfoot River, and 5) cooperative lands resulting in a high ranking for the social category. Monture Creek, a primary spawning and rearing stream to the middle Blackfoot River, supports populations of fluvial bull, fluvial WSCT, rainbow trout and brown trout and resident brook trout. Most fisheries impairments for Monture Creek were corrected over the last decade. However, localized impairments in the lower Monture Creek include: 1) localized channel alterations, 2) lack of instream complexity, 3) degraded riparian areas due to excessive livestock access to the stream. Monture Creek first tested positive for whirling disease in 2000 and infections in 2002 were detected at a mean grade of 3.22.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat alterations, siltation.

Dewatering Issues

Middle Monture Creek between mile 12 and 15 are on the dewatered stream list due to natural losses.

Native Species Issues

Fluvial bull trout spawning stream, proposed critical bull trout habitat, bull trout core area stream, bull trout recovery/recreational conflict area.

Fluvial WSCT spawning

WSCT genetic composition: tested 94% WSCT

Restoration Activities

Past Restoration

Restoration actions began in 1990 on two large ranches encompassing nine miles of stream. Work included riparian fences on critical bull trout spawning sites, developing low-impact grazing, creating off-stream water developments, removing two winter livestock feeding areas, planting woody vegetation and two miles of instream habitat restoration work. Two water conservation projects have been implemented.

Current/Planned Restoration

Monture Creek is a high priority restoration stream. Restoration activities will continue as opportunities are presented.

Monitoring Activities

Past Monitoring

FWP inventoried fish population surveys in 1989 and resurveys sampling sites in 1994, 1998, 2000 and 2002. FWP measured stream temperatures in 1998, 1999 and from 2001-2004 and stream flows in 1989, 2000 and 2004. FWP has conducted annual bull trout redd counts beginning in 1989. Fitzgerald (1996) conducted a riparian health survey in 1995. Koopal (1998) conducted a large wood survey in 1998. FWP conducted geomorphic surveys, winter water temperature and McNeil Core samples near a bull trout spawning sites in 2004. FWP began whirling disease monitoring in 1998. FWP conducted whirling disease tests from 1997 through 2003. Telemetry studies beginning in 1995 identified Monture Creek as a critical fluvial bull trout WSCT spawning stream. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Monitoring of existing fish population survey sites, bull trout redds, water temperatures, and whirling disease are expected to continue.

Planned Future Monitoring

None although grazing pressure on stream banks prone to damage should be monitored.

NORTH FORK BLACKFOOT RIVER: Priority - High Description

The North Fork Blackfoot River, the largest tributary (4th order) to the Blackfoot River, drains the Scapegoat Wilderness before entering private land at river mile ~17. The North Fork received a high rank on the restoration priority and total rank list due to its 1) bull trout core area status (spawning and rearing), 2) presence of fluvial WSCT, 3) a high (multi-species) sport fishery value and 4) high potential to increase flows in the Blackfoot River. The North Fork also has some potential to improve water quality by reducing sediment and temperature. Along with supporting one of the Blackfoot watersheds largest bull trout spawning populations and fluvial WSCT, the North Fork also supports rainbow trout, brown trout and low densities of resident brook trout. These species inhabit the North Fork at a varying distribution at low to moderate densities. Fisheries impairments are confined to localized areas of middle reaches include: 1) localized channel alterations that lack instream complexity, 2) suppressed riparian vegetation, and 3) instream flow during in critical bull trout migration corridors due to natural dewatering and irrigation. Whirling disease is also present in the lower drainage.

TMDL Issues

Listing history: 1996; in 2000, determined that beneficial uses are fully supporting.

Listed causes of impairment: Habitat alterations, siltation.

Dewatering Issues

The North Fork of the Blackfoot River is on the dewatered stream list between stream mile 6.2-12.0 due to natural losses and irrigation.

Native Species Issues

Proposed bull trout critical habitat, bull trout spawning stream, bull trout core area, bull trout recovery/recreational conflict area.

Fluvial WSCT migration corridor

Restoration Activities

Past Restoration

Restoration on the North Fork has involved working with irrigators. Projects involve screening five irrigation canals to prevent fish losses, nine miles of stream under improved riparian grazing systems, and streambank stabilization at two locations to protect infrastructure related to diversions and fish screens. One diversion point has been moved and a ditch retired resulting in enhanced flows.

Current/Planned Restoration

Instream flow enhancement project are being considered with several irrigators.

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1989 and re-surveyed sample sites in 1994, 1998, 2000 and 2002. Bull trout redd counts began in 1989. The USGS has a flow monitoring station (#12338300) near the mouth with six years of continuous data. The USFS periodically collects flow data near the FS boundary and the DNRC collected flow data at Ryan Bridge. FWP monitored water temperatures near mouth from 1998 through 2004. FWP began testing for whirling disease in 1996. The DNRC completed a hydrologic analysis of ground and surface water in 2001 (Roberts, 2001). FWP tested for whirling disease from 1997-2004. Telemetry identified this stream as a fluvial WSCT migration corridor, summering and wintering area. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Ongoing monitoring includes periodic fish population surveys at established sites, annual bull trout redd counts, continued water temperature and whirling disease monitoring, DNRC and BBCTU ground and surface water monitoring.

Planned Future Monitoring

None beyond ongoing monitoring.

LANDERS FORK: Priority - High

Description

The Landers Fork, a 4th order stream and major tributary to the upper Blackfoot River, originates in the Scapegoat Wilderness and flows ~ 28 miles. The upper ~16 miles are entirely public (National Forest) land with mixed ownership in lower stream reaches. At mile 7.2 Silver King Falls creates a natural barrier to upstream fish movements. The Landers Fork watershed support genetically unaltered WSCT throughout the watershed. Upstream of Silver King Falls, a population of Yellowstone cutthroat trout is also established in Big Horn Lake, which may put the WSCT genetic status of the upper drainage at risk. Below Silver King Falls, the Landers Fork supports fluvial bull trout, fluvial WSCT along with very low densities of brown trout and brook trout. The Landers Fork received the highest total rank

due to its bull trout core area status, high native species value, high (multi-species) sport fishery value to the Blackfoot River, potential to increase flow in the Blackfoot and potential to improve water quality in the Blackfoot River. Fisheries impairments in the lower seven miles include: 1) localized channel alterations, 2) lack of instream complexity due in part to channel clearing activities and flood events, 3) riparian vegetation suppression, and 4) instream flow problems, which appear to partially result from over-widened channels. Over-widened channels contribute to elevated water temperatures upstream of Copper Creek.

TMDL Issues

Not listed

Dewatering Issues

Natural dewatering occurs in approximately one mile of stream near the mouth of Copper Creek.

Native species Issues

Bull trout core area stream, proposed critical bull trout habitat, critical migration corridor
Fluvial WSCT spawning stream
WSCT genetic composition: tested 100% WSCT above and below Silver King Falls

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1989 and re-surveyed sample sites in 1999, measured stream temperatures in 1998, 1999, 2001, 2002 and 2004 and stream flows in 1989 and 2000. In October 2000, FWP conducted a habitat survey with an emphasis on pool size and frequency, LWD abundance and function and geomorphic data including bankfull measurements and pebble counts. FWP conducted whirling disease tests in 1997. Telemetry identified this stream as a fluvial WSCT spawning stream. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Periodic fish population and water temperature measurement are ongoing.

Planned Future Monitoring

None beyond periodic monitoring.

POORMAN CREEK: Priority - High

Description

Poorman Creek, a 3rd order tributary to the upper Blackfoot River, flows ~14 miles through public land (National Forest) in upper reaches and private ranch land in mid to lower reaches. Poorman Creek ranks high on the restoration priority and total rank list due to high native species and biological values. High biological ranks are the result from bull trout spawning

and rearing, presence of fluvial WSCT and a multi-species sport fishery value. Poorman Creek also has potential to increase flows, and ranks high in potential to improve water quality in the Blackfoot River. Poorman Creek supports populations of bull trout, fluvial WSCT, brown trout and resident brook trout. Low numbers of bull trout use the upper reaches including the South Fork for spawning and rearing. WSCT and brook trout are found in low densities in the middle to upper reaches of Poorman Creek, while brown trout are found in low numbers in the lower and middle reaches. Fisheries impairments located primarily in the lower reaches include: 1) channel alterations related to placer mining, 2) road crossings, fords and sediment delivery, 3) irrigation impacts (fish entrainment and fish passage), 4) excessive livestock grazing impacts to riparian vegetation resulting and stream bank degradation, and 5) dewatering resulting from natural losses and irrigation.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Dewatering, flow alteration, metals, other habitat alterations, riparian degradation, and siltation.

Dewatering Issues

The lower two miles of Poorman Creek is on the dewatered stream list due to natural losses and irrigation. In 2002, a project to enhance flows during the high flows was undertaken in order to improve native fish migrations. The project involved a flood-to-sprinkler irrigation conversion. The project includes enhanced flows at the upper portion of the intermittent reach.

Native Species Issues

Bull trout spawning stream

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Restoration projects near the mouth focus on high flow instream flow enhancement project and are still in the implementation phases. This project involved a flood to sprinkler conversion designed to 1) improve migrations of WSCT, 2) enhance summer flows in the naturally dewatered section and 3) prevents fish losses of fish to irrigation ditches. The project also involved the construction of three bridges and the removal of two culverts. Fencing, off-stream water developments are other components to the project are under construction. Upstream projects involve culvert replacements with structures suitable to pass fish. The USFS plans restoration work in the upper tributaries of the drainage.

Current/Planned Restoration

Shrub plantings and livestock measurement measures are planned near the mouth. Addition road crossings are planned in upper Poorman Creek.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1989, 1991, 1999, 2001, 2003 and 2004 and measured stream temperatures in 1999-2003 and stream flows in 1989, 2000, 2001 and 2003.

FWP tested for whirling disease in 2004. USFS has conducted McNeil Core sampling in Poorman Creek over a number of years. USFS also conducted fisheries surveys in 1995 and 1996 for inclusion in the Poorman EIS, as was a basin-wide road sediment and culvert survey.

Ongoing Monitoring

Ongoing monitoring includes fish population and instream flow monitoring in the lower portion of Poorman Creek.

Planned Future Monitoring

None beyond ongoing monitoring.

COTTONWOOD CREEK (rm 43): Priority - High

Description

Cottonwood Creek, a major, a 3rd order tributary to the middle Blackfoot River, flows ~16 miles through National Forest in upper reaches and mixed State and private lands in the lower ~12 miles. Cottonwood Creek ranks high on the restoration priority list for total and biological rank, including high native species and sport fishery values. These high rankings result primarily for the status as a bull trout core area and fluvial WSCT stream, and multi-species assemblage (rainbow and brown trout) in lower stream reaches. It has low potential water quality benefits with some potential for sediment reduction. Cottonwood Creek also has potential to increase downstream flows to the Blackfoot River. Low densities of rainbow and brown trout inhabit the lower reaches while moderate numbers of brown and brook trout dominate the middle reaches. Moderate densities of WSCT and with low numbers of bull trout dominate the upper reaches. Principle fisheries impairments, located in the middle and lower reaches, include: 1) lack of complex fish habitat (instream wood); 2) livestock induced stream bank degradation, 3) riparian vegetation suppression, and 4) whirling disease. Whirling disease was first detected in Cottonwood Creek in 1998. In 2002, whirling disease levels were detected at a mean grade of 4.5.

TMDL Issues

Listing history: 1996; in 2000, determined that all beneficial uses are fully supporting
Listed causes of impairment: Flow and habitat alterations, siltation.

Dewatering Issues

The middle reach of Cottonwood Creek (mile 4.4 –10.0) is on the dewatered stream lists due to natural losses and irrigation.

Native Species Issues

Bull trout core area, proposed critical habitat
WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Some restoration work has been completed in lower Cottonwood Creek. The work involves riparian grazing improvements and fish friendly irrigation upgrades (fish screens and fish ladders) at two locations. A water lease was implemented in 1997 to improve fish passage in

native fish migration corridors. In 2003, an open ditch in lower Cottonwood Creek was shut down with the conversion of a flood to sprinkler irrigation.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1989, 1991-92 and conducted annual fish population survey in the headwaters at a water-lease monitoring site between 1997-2004. FWP monitored stream temperatures in 1997, 1999 and 2001-2004 and stream flows in 1989, 2000 and 2003. Bull trout redd surveys have been attempted but low number of spawners has limited biologists ability to identify primary spawning sites. Whirling disease was first detected in Cottonwood Creek in 1995. A graduate student completed whirling disease research related *t. tubifex*, channel features and whirling disease. Whirling disease sampling continued in 1997-1999 and 2002. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

FWP ongoing monitoring involves annual fish population surveys and diversion withdrawal in the area influenced by water leases. Whirling disease monitoring is periodic and water temperatures are monitoring on an annual basis.

Planned Future Monitoring

In the next few years, FWP plans to resurvey several fish population monitoring sites established in the early 1990s.

DICK CREEK: Priority - High

Description

Dick Creek, a 2nd order tributary to lower Monture Creek, flows ~14 miles through both public (National Forest, State) and private agricultural and industrial forest (Plum Creek) lands. Dick Creek ranks high on the restoration priority list. Although located in a bull trout core area, Dick Creek does not support bull trout spawning and rearing. Its high native species rank results from the presence of fluvial WSCT and a multi-species sports fishery value to the Blackfoot River. It has the potential to increase flow, and ranks high in water quality benefits to Blackfoot River. Dick Creek supports populations of fluvial WSCT, rainbow trout, brown trout, and resident brook trout. Moderate densities of rainbow trout dominate its lower reaches along with brown trout and low densities of brook trout. Dick Creek's headwaters support WSCT and brook trout in moderate densities. Fisheries impairments include: 1) livestock induced stream bank degradation and riparian vegetation suppression, 2) lack of complex fish habitat (instream wood), 3) irrigation impacts (fish entrainment), 4) instream flow (low flow from irrigation withdraws and natural causes), 5) road crossing (culverts limiting fish passage).

TMDL Issues

Not listed

Dewatering Issues

The middle reach of Dick Creek (mile 3.5-6.0) is on dewatered stream list due to natural losses and irrigation.

Native Species Issues

Bull trout core area stream

Isolet WSCT population

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Dick Creek has substantial amount of restoration work completed, involving channel and wetland restoration and grazing improvements.

Current/Planned Restoration

A turbulent fountain fish screen is to be installed in 2005.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1992 and 2001 and measured water temperatures in 1997, 1999 and 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

BEAVER CREEK: Priority - High

Description

Beaver Creek, a 3rd order tributary to Keep Cool Creek located near Lincoln, flows ~ 9 miles through both public and private land. The private land is located in the lower three miles of stream. Beaver Creek ranks high for total and biological rank. Supporting very limited bull trout rearing and fluvial WSCT, Beaver Creek ranks high for native species value. In addition to providing a high multi-species sport fishery value, Beaver Creek also ranks high in both 1) potential water quality benefits, and 2) potential to increase flows to the Blackfoot River. Beaver Creek supports high densities of WSCT in headwaters along with brown trout and resident brook trout in lower reaches. Brown trout are dominant at increased densities in lower reaches. Fisheries impairments, located in the middle reaches include: 1) reduced instream flow from irrigation, 2) fish entrapment to irrigation canals, and 3) livestock induced stream bank damage, and 4) riparian vegetation suppression from livestock grazing and an instream corral.

TMDL Issues

Not listed

Dewatering Issues

Although irrigation occurs in the middle portion of Beaver Creek, the level of dewatering and fisheries impacts have not yet been evaluated.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Improvements on Beaver Creek include fish-friendly diversions and riparian grazing changes. The USFS has implemented several projects including drain dip construction and gravelling, were completed to reduce sediment delivery to Beaver Creek and tributaries to Beaver Creek. A baffle to provide fish passage has been installed on the Yukon Creek crossing of Beaver Creek road.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population surveys in 1989 and resurveys sites in 1999 and 2004 and measured stream temperatures in 1999, and 2001-04. FWP tested for whirling disease in Beaver Creek in 2004, the results of which are pending. The USFS conducts periodic McNeil core samples and most recently tributary fish surveys were completed in 2002 as part of the Copper/Stonewall watershed analysis. Bull trout were documented in Theodore Creek in the mid 1980's, however no bull trout were found in the 2002 fish surveys.

Ongoing Monitoring

None

Planned Future Monitoring

Periodic fish sampling and water temperature measurements are expected to continue.

BELMONT CREEK: Priority - High

Description

Belmont Creek, a large 2nd order tributary to the lower Blackfoot River, flows ~11 miles through public and private land-primarily industrial (Plum Creek) forest. The lower ~10 miles of stream are Plum Creek properties, except for a BLM section near the mouth. Past fisheries-related projects include a Plum Creek-sponsored basin-wide erosion control (road drainage) measures, along with fish passage improvements near the mouth. As a bull trout core area and fluvial WSCT stream, Belmont Creek ranks high on the restoration priority list for total rank, biological rank, and native species rank. In addition to native species, Belmont Creek supports rainbow and brown in lower reaches and very low brook trout densities. This species assemblage provides for high (multi-species) sport fishery value to the Blackfoot River. With only one of three water quality impairments (sediment), Belmont Creek ranked as a low priority for potential water quality improvements. Fisheries-related impairments include elevated levels of instream sediment (road drainage, riparian livestock access), along with areas of low habitat complexity in lower Belmont Creek. Whirling disease was detected in Belmont Creek in 2003 at a low grade (mean grade 0.38).

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat alterations and siltation.

Dewatering Issues

None

Native Species Issues

Bull trout core area stream, proposed critical bull trout habitat, bull trout spawning stream

Fluvial WSCT spawning

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Twin culverts that seasonally restricted upstream fish movements were replaced in 1990. Plum Creek Timber Company has initiated a sediment control project. The BLM has recently completed some habitat enhancement and grazing modifications in lower Belmont Creek.

Current/Planned Restoration Activities

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population surveys in 1989 and resurveyed some sites in 1994, 1997, 1998 and 2001, measured stream temperature in 1997-1999 and 2001-2004 and stream flows in 1989 and 2000. FWP tested for whirling disease from 2000 through 2004. Telemetry identified this stream as supporting fluvial WSCT spawning. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Annual summer water temperatures are expected to continue.

Planned Future Monitoring

Period fish population and whirling disease monitoring will continue.

ROCK CREEK: Priority - High

Description

Rock Creek, the largest tributary to the lower North Fork Blackfoot River, is a 2nd order stream that flows 8.2 miles through public (State) and private ranch land. State land is only found in the upper reaches of the stream. Rock Creek ranks high on the restoration priority and total rank list due to: 1) bull trout core area status, and bull trout rearing, 2) fluvial WSCT presence, 3) high (multi-species) sport fishery value, 4) potential to increase flow in the Blackfoot River, and 5) high potential to improve downstream water quality. Rock Creek ranked low for social and financial considerations. Rock Creek contains some rearing of bull trout, fluvial WSCT, brown trout, rainbow trout and resident brook trout. Many of the fisheries impairments were addressed over the last decade. Current fisheries impairments, concentrated in middle reach of Rock Creek drainage, include 1) dewatering, entrainment, fish passage problems related to irrigation, 2) lack of instream complexity, 3) heavily degraded riparian vegetation resulting from excessive livestock access to stream banks. Whirling disease approaching lethal levels is now present at in the watershed.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat and flow alterations, siltation.

Dewatering Issues

Rock Creek is on dewatered stream list between stream mile 1.4-7.0 due to both natural losses and irrigation.

Native Species Issues

Bull trout core area stream

Fluvial WSCT migration corridor

Restoration Activities

Past Restoration

Rock Creek has been the focus of restoration over its entire 8.2-mile length since the early 1990s. Restoration actions include channel and floodplain reconstruction, grazing management, shrub plantings, culvert replacements and instream flow enhancement using a flood to sprinkler conversion.

Current/Planned Restoration

Restoration focusing on shrub planting and floodplain construction will continue through 2005.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1989, 1990, 1994, 1996, 1998, 1999, 2001, and 2002-2004. FWP completed habitat surveys in 1990 on the lower 1.4 miles of stream (Pierce 1991), and then surveyed the remaining 6.8 miles of Rock Creek in 1998 (Koopal 1999). FWP measured stream flows in 1989 and 2002 and water temperatures in 1998, 1999 and 2002. Whirling disease monitoring has occurred in 1999-2001 and 2003.

Ongoing Monitoring

Ongoing monitoring includes continued fish population monitoring in lower Rock Creek, and periodic sampling of other sites. Periodic stream temperature and whirling disease monitoring is expected to be ongoing.

Planned Future Monitoring

In addition to ongoing monitoring, upon completion of all Rock Creek projects, post-project habitat and fish population will likely be undertaken.

GOLD CREEK, West Fork: Priority - High

Description

West Fork Gold Creek is a 2nd order tributary stream to Gold Creek in the lower Blackfoot watershed. Its headwaters begin at Bull Lake and flow 8.0 miles through both public (National Forest) and private industrial (Plum Creek) forestlands. West Fork Gold Creek ranks high in total ranking on the restoration priority list, due to its high native species value and multi-species sport fishery value to the Blackfoot River. It also ranks high in social and financial considerations. As a result of its generally high water quality, West Fork of Gold

Creek ranks low for providing potential downstream water quality benefits. Because the West Fork does not provide irrigation there is no potential for improving downstream flows to the Blackfoot River. A bull trout core stream, West Fork Gold Creek supports bull trout spawning and rearing. The lower reaches of the West Fork support low numbers of fluvial WSCT, juvenile bull trout, rainbow trout, brown trout and resident brook trout. Fisheries impairments include road drainage problems.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout core area, proposed critical bull trout habitat
WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

KLEINSCHMIDT CREEK: Priority - High

Description

Kleinschmidt Creek, a 1st order spring creek tributary to Rock Creek (North Fork watershed), drains the southern portion of Kleinschmidt Flat. This stream flows ~2.6 miles mostly through private land. Kleinschmidt Creek has been the focus of an extensive channel reconstruction and restoration project and is now in early recovery stage. Kleinschmidt Creek ranks high for project streams for all criteria. These high ranks are the result of bull trout core area status, bull trout rearing, and use by fluvial WSCT and multi species sport fishery values. Despite extensive restoration, Kleinschmidt Creek has potential for further water quality improvement with modified riparian grazing practices in upper reaches. Kleinschmidt Creek received a high social rank. Kleinschmidt Creek supports very low densities of juvenile bull trout and fluvial WSCT along with higher densities of brook trout and brown trout. Fisheries impairments limited to upper Kleinschmidt Creek include 1) lack of riparian vegetation, 2) excessive livestock access to the riparian area and 3) feedlot runoff. Kleinschmidt Creek support a high level of whirling disease.

TMDL Issues

Listing history: 2000, 2002, & 2004

Listed causes of impairment: metals (copper), thermal modification, fish habitat degradation, other habitat alterations, and riparian degradation.

Dewatering Issues

None in lower spring-fed portion of Kleinschmidt Creek.

Native Species Issues

Bull trout core area

No evidence of WSCT reproduction

Restoration Activities

Past Restoration

Complete channel reconstruction of the lower 1.5 miles of stream ending in 2001 Restoration objectives including reducing whirling disease infection levels, restoring stream channel morphology for all life stages of trout, increasing recruitment of trout to the Blackfoot River, and restoring thermal refugia and rearing areas for North Fork bull trout. Restoration activities included decreasing the width to depth ratio, restoring channel sinuosity, creation of pools, addition of woody debris and other natural materials to the channel, shrub plantings along streambank, creation of riparian wetlands, and livestock fencing.

Current/Planned Restoration

Grazing management changes are planned for the upper reach Kleinschmidt Creek.

Monitoring Activities

Past Monitoring

FWP assessed habitat in 1990 and 2002, surveyed fish populations beginning in 1990 and periodically through 2004. FWP measures stream temperatures in 1998, 1999 and 2001-2004. FWP conducted whirling disease testing between 1997 and 2003.

Ongoing Monitoring

FWP plans to continue fish population, water temperature and whirling disease studies into the next few years.

Planned Future Activities

Planned monitoring associated with 2005 restoration program included macroinvertebrate sampling, water quality sampling (nutrients, TSS), water temperature monitoring, and habitat/geomorphic/riparian assessments. Periodic fish population surveys will likely continue.

DUNHAM CREEK: Priority - High Description

Dunham Creek, a large 2nd order tributary to Monture Creek, flows ~13 miles through public land (National Forest) and a small portion of private land near the mouth. Dunham Creek ranks high on the restoration priority list for project streams. Supporting fluvial bull trout spawning and rearing and fluvial WSCT, Dunham Creek ranks high in native species and multi-species sport fishery values. Because of existing high water quality, Dunham Creek

has low potential water quality benefits. Dunham Creek supports populations of fluvial bull trout, fluvial WSCT, and resident brook trout. Fish densities for both WSCT and bull trout decline in the middle reaches. Fisheries impairments, located in the middle and lower reaches, include the loss of riparian vegetation related to past logging practices. Dunham Creek is also site of an extensive channel reconstruction, habitat restoration and revegetation project. Dunham Creek is in the early stages of project recovery.

TMDL Issues

Not listed; tributary to Monture Creek a 303(d) listed stream.

Dewatering Issues

The lower five miles of Dunham Creek are on dewatered stream list due to natural losses and some irrigation within the natural losing reach.

Native Species Issues

Bull trout core area, proposed critical bull trout habitat, bull trout spawning

Fluvial WSCT spawning

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

In 1996, the Dunham ditch was screened to prevent fish losses to the ditch. The diversion was then upgraded to better allow upstream low flow fish passage in 2003-04.

In the 1970's over a mile of Dunham Creek was channelized. In 2001, the Blackfoot cooperators reconstructed this stream section to natural channel dimensions, which include restoring features to a reference condition and aggressive revegetation. The project involved correcting sediment deliveries estimated at ~25-times natural levels. This influx of unnaturally high levels of sediment entered the channel immediately upstream of the Dunham Creek bull trout spawning area.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

Beginning in 1995, telemetry identified this stream as a fluvial bull trout and WSCT spawning stream, and identified the Dunham diversion as a native fish entrainment problem. FWP conducted fish population surveys in 1996, 1998, and 2000-2004 and began bull trout redd counts in 2002. FWP performed geomorphic, McNeil core and winter water temperature data collections in fall of 2004 in a section of the restored reach used by spawning bull trout. FWP observed bull trout redds in project area in 2002 and 2004.

Ongoing Monitoring

Fish population surveys in the reach affected by restoration activities.

Planned Future Monitoring

None beyond ongoing monitoring.

GOLD CREEK: Priority - High

Description

Gold Creek, a large 3rd order tributary to the lower Blackfoot River, flows ~19 miles through public (National Forest, BLM) and private industrial forest (Plum Creek) land. Gold Creek ranks high on the restoration priority list. As a core area bull trout stream, Gold Creek provides spawning and rearing of fluvial bull trout. Gold Creek also supports fluvial WSCT and rainbow trout and brown trout in lower reaches along with resident brook trout. Gold Creek ranks high in native species value and provides high (multi-species) sport fishery value. Because of generally high water quality, Gold Creek ranked low for potential water quality benefits. Gold Creek provides no irrigation and thus no potential to improve downstream flows to the Blackfoot River. Fisheries impairments include: 1) road drainage problems, 2) recreational impacts (access sites in bull trout spawning areas) and 3) low whirling disease infection. Gold Creek tested positive for whirling disease with a very low grade in 1999 and tests since have been negative.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout core area, proposed critical bull trout habitat, bull trout spawning, bull trout recovery/recreational conflict area

Fluvial WSCT spawning

WSCT genetic composition: tested 99% WSCT

Restoration Activities

Past Restoration

Past harvest of riparian conifers combined with the actual removal of large woody debris from the channel has reduced habitat complexity in the lower three miles of Gold Creek. Before 1996, pools accounted for less than 1% of the wetted surface area in this section of stream (Pierce 1990). Low densities of age 1+ fish, including native fish, resulted from this habitat simplification. In 1996, the Blackfoot cooperators installed 66 habitat structures made of native material (rock and wood) that resulted in 61 new pools in the 3-mile section.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1989, and monitored fish population response related to a habitat enhancement project between 1996 and 2003. A journal paper was also published relating the survival of habitat structures to a flood event (Schmetterling and Pierce 1999). FWP measured stream temperatures between 1999 and 2004 and stream flows in 1989 and 2000. Whirling disease testing was conducted in 1997, 1999-2000 and 2002. Telemetry

identified this stream as a fluvial WSCT spawning stream. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Periodic fish population, water temperature and whirling disease sampling are ongoing.

Planned Future Monitoring

None beyond periodic/ongoing monitoring.

SNOWBANK CREEK: Priority - High

Description

Snowbank Creek is a 1st order tributary stream to Copper Creek, an important spawning and rearing stream for WSCT and fluvial bull trout in the upper Blackfoot River watershed. Snowbank Creek's headwaters begin on the eastern slope of Stonewall Mountain then flow northeast 4.4 miles through the Helena National Forest before entering Copper Creek at mile 5.9. Snowbank Creek ranks high in the total ranking due to high native species value, including bull trout core area and rearing present, high social and financial rank and ability potential to provide increased flows to the Blackfoot River. Human-related fisheries impairments involve a defunct diversion structure. Impairments are: 1) fish entrainment to Snowbank Lake, 2) reduced fish passage, 3) stream channel dewatering below the diversion, 4) localized channel alterations in the area of the diversion, and 5) a road crossing identified as a partial fish passage barrier.

TMDL Issues

Not listed

Dewatering Issues

The lower 0.4 miles of Snowbank Creek is on the dewatered stream list due to a diversion to Snowbank Lake, which diverts a majority of the Snowbank Creek base to Snowbank Lake.

Native Species Issues

Bull trout core area stream

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

The existing diversion to Snowbank Lake results in several fisheries problems. In addition, the water diverted for the stream has no legal water right. Planning to correct these problems is ongoing. Wildfire-related restoration work including cross-drainage improvements on roads and upsized culvert replacements are planned for 2005.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 2003 and 2004 and measured stream and ditch flows in 2003. Initial McNeil core sampling of cutthroat spawning gravels has been conducted by the USFS and several more years of sampling is planned.

Ongoing Monitoring

Flow and fish population monitoring is expected to continue.

Planned Future Monitoring

Monitoring and planning is ongoing.

BLANCHARD CREEK: Priority - High**Description**

Blanchard Creek, a 2nd order tributary to the lower Clearwater River, flows ~13 miles through industrial (Plum Creek) forest, along with State land and private agricultural properties in lower reaches. Blanchard Creek ranks high for both total and biological rank, based largely on its potential for instream flow and water quality benefits. Because Blanchard Creek supports fluvial WSCT but no bull trout, it ranks moderate in native species value. However, because Blanchard Creek supports high rainbow trout densities and brown trout, it ranks high (multi-species) sport fishery value to both the Clearwater and Blackfoot Rivers. Fisheries-related impairments - located primarily in lower Blanchard Creek include 1) dewatering, 2) channel alterations, 3) road drainage problems, 4) livestock induced stream bank degradation and 5) riparian vegetation suppression.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat alterations, siltation, and flow alteration.

Dewatering Issues

The lower 1.2 miles of Blanchard Creek is on the dewatering stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 78% WSCT

Restoration Activities**Past Restoration**

Past restoration involved the installation of diversions with fish ladders and enhancement of flows between 1990 and 2002. Some grazing improvements have been implemented on State lands.

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP conducted fish population surveys in 1990, 1992-1995, 1997-2000 and 2002-2003 and measured stream temperatures in 1999 and 2001. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

None

Planned Future Monitoring

Periodic fish population sampling will likely continue.

COPPER CREEK: Priority - High

Description

Copper Creek, a large 3rd order tributary to the Landers Fork in the upper Blackfoot River watershed, flows ~14 miles entirely through public (National Forest) land, except a small portion of private land in the lower reaches. Copper Creek ranks high on the restoration priority list. With bull trout core area status, fluvial bull trout and genetically pure fluvial WSCT spawning and rearing, it ranks high in native species value and high (multi-species) in sport fishery value to the Blackfoot River. Because of existing high water quality and adequate flows, Copper Creek ranks low in potential water quality benefits to the Blackfoot River. Densities of WSCT and bull trout for both species are generally low throughout the drainage, but increase in middle reaches. Fisheries impairments include stream crossing (fords and undersized bridges) and localized areas of stream bank degradation from recreational users in the middle. Dewatering in Snowbank Creek, a tributary to Copper Creek, may impact instream flows.

TMDL Issues

Not listed

Dewatering Issues

The lower mile of Copper Creek is on the dewatered stream list due to natural dewatering and other areas in the headwaters are naturally intermitted the extent of which is unknown. How flows in Copper Creek are affected by flow reductions in Snowbank Creek is unknown.

Native Species Issues

Bull trout spawning stream, proposed critical habitat, bull trout core area, bull trout recovery/recreational conflict area

Fluvial WSCT spawning

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

Potential restoration work identified by the USFS includes the future obliteration of the Red Creek road. Restoration work includes cross drainage improvement, sediment conveyor installation, upsized culvert installation, culvert/bridge replacements and partial graveling of the roads within the basin. Approximately 10 miles of jammer trail reclamation is planned for 2005. A fish passage baffle is planned for installation in the Cotter Creek culvert in 2006. Natural barriers to migration (waterfalls) are located on Red Creek and the unnamed tributary entering in section 2 in the headwaters.

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1989 and resurveyed sites in 1998-1999, 2002 and 2004. FWP measured water temperatures 1999 and 2001-2004 and stream flows in 1989 and 2000. Annual bull trout redd counts conducted by the USFS began in 1988. The USFS has

collected several years of McNeil core sample data. Telemetry identified this stream as an important fluvial WSCT spawning stream.

Ongoing Monitoring

Bull trout redd counts occur annually in Copper Creek, bull trout spawning site assessments will be completed by 2005. Periodic fish population surveys at established sites are expected to continue.

Planned Future Monitoring

None beyond ongoing/periodic surveys.

WARREN CREEK: Priority - High

Description

Warren Creek, a small 2nd tributary to the middle Blackfoot River, flows ~14 miles primarily through forested foothills and private ranch land. Warren Creek ranks high on the restoration priority and total rank list. This high rank is due to high (multi-species) sport fishery value to the Blackfoot River and high potential to improve downstream flow and water quality. Warren Creek has a moderate native species value. Warren Creek contains a mixed species composition of brook trout, brown trout and low numbers of WSCT. Brook trout inhabit the entire drainage, brown trout are found in the lower reaches and WSCT are present in the lower and upper reaches of Warren Creek. Fisheries impairments, located throughout the drainage, include: 1) road crossings, 2) irrigation dewatering and diversion that inhibit fish passage, 3) channelization, 4) lack of instream complexity, and 5) degraded stream banks and riparian areas due to excessive livestock access. Warren Creek tested positive for whirling disease in 1998.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow and habitat alterations.

Dewatering Issues

The lower six miles of Warren Creek is on the dewatered stream list to irrigation.

Native Species Issues

WSCT genetic composition: untested

No evidence of WSCT reproduction

Restoration Activities

Past Restoration

Warren Creek has been the focus of extensive restoration efforts beginning in 1991.

Projects to date include 1) removal of three streamside corrals, 2) improved fish passage at three locations, 3) three miles of channel reconstruction, 4) six miles of improved riparian grazing, and 5) enhanced stream flows in the lower three miles of stream.

Current/Planned Restoration

Approximately one mile of Warren Creek is currently being reconstructed. Shrub planting and riparian grazing changes will be incorporated.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1991, 1992, 1997, and 2000-2004 measured stream flows in 2000, stream temperatures in 2000-2004 and conducted whirling disease tests in 1997-2000.

Ongoing Monitoring

Fish population, water temperatures and whirling disease monitoring are expected to continue into the next few years.

Planned Future Monitoring

None, beyond ongoing fish population surveys.

WILLOW CREEK (lower): Priority - High

Description

Willow Creek below Lincoln, a 2nd order tributary to the upper Blackfoot River, flows ~9 miles through public (National Forest) land in the upper drainage and private ranch land downstream of mile ~6. Willow Creek ranks high for restoration priority and total rank, due to: 1) high potential to improve water quality to the Blackfoot River, 2) moderate native species value, 3) high (multi-species) sport fishery value to the Blackfoot River, and 4) potential to increase flows in the Blackfoot River. Willow Creek supports fluvial WSCT, brown trout and resident brook trout. WSCT and brook trout dominate upper reaches. Low densities of brown trout occupy lower Willow Creek. Fisheries impairments include culverts and mining in the upper drainage as well as irrigation dewatering and degraded riparian vegetation from excessive livestock use in the middle and lower reaches.

TMDL Issues

Not listed

Dewatering Issues

The lower two miles of Willow Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% pure

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1992 and 1999, measured stream temperatures in 1999 and from 2001-2003 and stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

ELK CREEK: Priority - High

Description

Elk Creek, a degraded 3rd order tributary to the lower Blackfoot River, flows ~14 miles through both public (BLM and State) in headwaters and private (agricultural) land in lower ~7 miles. It ranks high on the restoration priority list as it has a high potential for improving water quality and downstream flows to the Blackfoot River. Elk Creek provides a high (multi-species) sport fishery value to the Blackfoot River, but ranked moderate in native species value and received a low social and financial ranking. Elk Creek supports populations of fluvial WSCT, rainbow trout, brown trout, and resident brook trout. Densities of all species decrease in the downstream direction. Fisheries impairments in upper Elk Creek include channel alterations (placer mining) and road drainage problems. Fisheries impairments for lower Elk Creek include: 1) lack of complex fish habitat (instream wood), 2) livestock induced stream bank degradation and riparian vegetation suppression, 3) elevated water temperature and channel instability, 4) irrigation impacts (instream flows, fish losses to ditches and fish passage), and 5) adverse effects of upstream mining and road drainage problems. Elk Creek tested positive for whirling disease in 2003 with a mean grade of 2.84.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow alterations, siltation, metals, nutrient, and habitat alterations.

Dewatering Issues

The lower three miles of Elk Creek is on the dewatered stream list due to irritation.

Native Species Issues

WSCT genetic composition: tested 94% WSCT

Restoration Activities

Past Restoration

To begin improving water quality in lower Elk Creek, a major erosion control project was undertaken in a channelized section of lower Elk Creek (mile 1.3-2.9) in 1994. This project included the reconstruction of 8,600' of new channel as well as some livestock management changes. Although this project corrected a major sediment problem, subsequent monitoring of water temperature, fish populations, and suspended sediment all confirm Elk Creek failed to meet intended project benefits. Objectives were not met, as grazing prescriptions were not adhered to. Other grazing plans on adjacent riparian pastures were not implemented.

Current/Planned Restoration

FWP is currently working with the Blackfoot Challenge and NRCS to again develop restoration and grazing plans for the lower four miles of Elk Creek

Monitoring Activities

Past Monitoring

FWP 1) conducted fish population surveys in 1989, 1991, 1995-1997, 2000 and 2003, 2) monitored water temperatures in 1997 and 1999-2003, 3) measured stream discharge in 2000 and 2003, 4) measured total suspended sediment in 2001, 5) performed geomorphic surveys at two locations in 2004, and 6) began monitoring for whirling disease in 1997 and continued in 1999 and 2000-2004. An extensive geomorphic, fish habitat and riparian habitat study was completed over the length of the mainstem (Watershed consulting 1996). An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Periodic monitoring of fish populations, water temperature and whirling disease will continue.

Planned Future Monitoring

Additional monitoring will depend upon outcomes of the current restoration planning efforts.

HOYT CREEK: Priority - High

Description

Hoyt Creek, a small 1st order spring creek tributary to lower Dick Creek, originates from alluvial aquifers located immediately north of Ovando. This spring creek flows ~4 miles exclusively through private ranch land. Despite a low native species rank, Hoyt Creek ranks high in the restoration and total rank priority list. This rank is due to high (multi-species) sport fishery value and potential to improve flow and water quality in the watershed. Hoyt Creek supports WSCT, rainbow trout, brown trout and brook trout in generally low densities. Fisheries impairments, located throughout the stream, include channel instability, lack of habitat complexity, irrigation dewatering and suppressed riparian vegetation.

TMDL Issues

Not listed but is a tributary to the 303(d) listed Monture Creek.

Dewatering Issues

Approximately one mile of Hoyt Creek is on the dewatered stream list due to irrigation.

Native Species Issues

Bull trout core area stream

No known WSCT reproduction in the stream

Restoration Activities

Past Restoration

Grazing management changes, diversion upgrades and culvert to bridge replacements.

Current/Planned Restoration

The reconstruction of an incised portion of Hoyt Creek is being considered.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1992 and measured stream temperatures at two locations in 2001. Geomorphic assessments were completed in 2003 and 2004.

Ongoing Monitoring

None

Additional Planned Monitoring

Additional monitoring will be necessary depending on outcome of current restoration planning.

SPRING CREEK (North Fork): Priority - High

Description

Spring Creek, a small 1st tributary to the North Fork Blackfoot River, originates on the north side of Ovando Mountain. It flows ~6 miles through private land. Spring Creek ranks high on the restoration priority and total rank list due to a high native species rank, high (multi species) sport fishery value, and a potential to increase flows in the Blackfoot. Located in the bull trout core area, Spring Creek supports juvenile bull trout rearing, and low densities of fluvial WSCT and brook trout. Fisheries impairments include dewatering and fish losses to an irrigation ditch.

TMDL Issues

Not listed

Dewatering Issues

The lower 6.5 miles of spring creek in on dewatered stream list due to irrigation.

Native Species Issues

Bull trout core area stream

WSCT genetic composition: tested 97% WSCT

Restoration Activities

Past Restoration

The restoration of spring Creek began in 1998 with the installation of a diversion retrofitted with a fish ladder at mile 1.8. A baffled culvert replaced an undersized culvert at mile 0.5 in 1998 in order to improve upstream juvenile bull trout passage.

Current/Planned Restoration

Water conservation projects and irrigation ditch fish screening options are currently in the development phases.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1997, 2000 and 2002. Stream flows were monitored by FWP in 2000 and BBCTU in 2003.

Ongoing Monitoring

None

Planned Future Monitoring

Fish population surveys and flow monitoring are expected to continue on a periodic basis one the instream flow and fish screening projects are complete.

BLACKFOOT RIVER (Reach 1: Headwaters to Lincoln): Priority - High

Description

The Blackfoot River begins on south-western slopes of the Continental Divide at river mile 132.5. This headwater reach begins as a small 2nd order stream at the confluence of Beartrap and Anaconda Creeks and extends 23.6 miles to the Lincoln (mile 108.9). It flows through private (Sieben Ranch Co, Plum Creek, privately owned) and public (National Forest, State) lands. Four larger basin-fed tributaries (upper Willow Creek, Alice Creek, Hogum Creek and the Landers Fork) feed this section of the river. These tributaries all support WSCT, usually brook trout and low densities of brown trout in lower reaches. Many other smaller tributaries not described in this report also support fisheries. The Landers Fork is the largest tributary and increases the Blackfoot River to a 4th order stream. Copper Creek, the largest tributary to the Landers Fork is the primary fluvial bull trout-spawning stream for the upper Blackfoot Watershed. This reach supports limited mainstem spawning by bull trout, WSCT and brown trout. This reproduction contributes to its high native species value and overall high total ranking on the restoration priority list. The effects of mining contamination remain the most serious threat to fish populations in this reach. Other mainstem fisheries impairments include: 1) instream flow limitations resulting primarily from natural stream losses with some irrigation in the lower portion of the reach, 2) channel alterations, 3) lack of instream wood, and 4) fish losses to an irrigation ditch. Whirling disease is also increasing in this reach.

TMDL Issues

Listed segment includes the Headwaters to Landers Fork and Landers Fork to Nevada Creek
Listing history: 1996, 2002, & 2004

Listed causes of impairment: Metals, siltation, and habitat alterations.

Dewatering Issues

The lower portion of this reach is dewatered due to natural stream losses and irrigation to a limited degree.

Native Species Issues

Bull trout nodal habitat, proposed critical bull trout habitat

WSCT migration corridor

WSCT genetic composition: tested 99-100% WSCT

Restoration Activities

Past Restoration

Some mine reclamation work has been completed

Current/Planned Restoration

Cleanup of toxic sites is planned on the national forest

Monitoring Activities

Past Monitoring

FWP established several fish population survey sections in this reach in the 1970s, which were periodically surveyed through 1999. Water quality and macro-invertebrates were assessed at three locations in 1988-89 (Ingman et al. 1990). A riparian health inventory was conducted in 1999 (Marler and Schmetterling). In 2000, FWP conducted a habitat survey of

the lower 12 miles of this reach with an emphasis on pool size, pool frequency, a large wood inventory, bankfull measurements, pebble counts, flow and water temperature measurements. FWP tested for whirling disease from 1998 through 2004. The USFS periodically collects McNeil core samples in this reach and completed fisheries surveys in 1999.

Ongoing Monitoring

FWP conducts periodic (4-10 year interval) fish population surveys and monitors summer water temperature data and whirling disease samples on an annual basis.

Planned Future Monitoring

None beyond periodic monitoring.

BLACKFOOT RIVER (Reach 2: Lincoln to Arrastra Creek): Priority - High

Description

This 20.1-mile reach of the upper Blackfoot River extends from Lincoln (mile 108.9) to Arrastra Creek (mile 88.8). It begins in an intermittent reach where the mainstem gains large volumes of groundwater and spring creek inflows during base-flow periods. Landownership consists of private and mixed public (National Forest, BLM and State) lands. Several basin-fed tributary streams enter this section of the Blackfoot (Poorman Creek Keep Cool Creek, Lincoln Gulch, lower Willow Creek, Sauerkraut Creek, Little Moose Creek, and Moose Creek), all supporting WSCT populations, as well as other salmonids depending on the specific stream. This gaining section of the river provides concentrated spawning areas for brown trout and very limited bull trout reproduction. Brown trout is the dominant species, followed by low, but increasing numbers of WSCT and very low bull trout densities, all of which contribute to its high ranking for native species value and multi-species sport fishery value. Overall, this reach ranks high in total ranking on restoration priority list. Fisheries impairments include: 1) localized lack of in complexity, 2) localized areas of historic and current livestock grazing involving on riparian vegetation and stream bank degradation, and 3) an increasing level of whirling disease.

TMDL Issues

Listed segment of the Blackfoot River includes Landers Fork to Nevada Creek

Listing history: 1996, 2002, and 2004

Listed causes of impairment: Siltation and habitat alterations

Dewatering Issues

Natural dewatering occurs in the upper-most portion of this reach. There are no human related-dewatering issues on this mainstem reach *per se*.

Native Species Issues

Bull trout nodal habitat, proposed critical bull trout habitat

Restoration Activities

Past Restoration

Riparian grazing management changes and localized streambank stability projects have been implemented.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP established the *Canyon* fish population survey section in the early 1970's and has periodically sampled this section. FWP completed several juvenile fish population surveys in 1998. A riparian health inventory was conducted in 1999 (Marler and Schmetterling). A baseline habitat survey and native fish telemetry study was completed in 2003-04. FWP tested for whirling disease between 1998 and 2002 and in 2004. Water quality and macro-invertebrates were assessed at two locations in 1988-89 (Ingman et al. 1990). The USFS conducts periodic McNeil core samples near the Nevada Ogden bridge.

Ongoing Monitoring

FWP conducts periodic fish population surveys in the Canyon section, along with annual monitoring of summer water temperatures and whirling disease samples.

Planned Future Monitoring

At this time, FWP no additional surveys beyond periodic monitoring activities.

BLACKFOOT RIVER (Reach 4: Nevada Creek to the North Fork.): Priority - High Description

This reach extends 13.7 miles from the mouth of Nevada Creek (mile 67.7) downstream to the mouth of the North Fork Blackfoot River (mile 54). It flows mostly through private ranch with only ~0.8 mile flanked by public (State) lands on the south side at the lower portion of the reach. Below Nevada Creek, the river becomes more confined by moraine where channel gradient increases and sinuosity decreases. This reach is naturally subject to anchor-ice formation and high accumulations of fine sediment in the substrate. In addition to Nevada Creek, three small tributary streams (Yourname, Wales and Frazier Creeks) enter this reach, all of which are fisheries impaired. The sum of mainstem and tributary impairments result in very low mainstem salmonid densities. This reach ranks high in total ranking due to its high potential for improving water quality and increasing downstream flows and high in native species value, despite low rank for sport fishery value resulting from a lack of mainstem recruitment. Human-induced mainstem fisheries impairments include: 1) water quality problems originating from Nevada Creek involving elevated nutrients, 2) low summer flows, 3) high summer water temperatures, and 4) livestock suppressed riparian vegetation and stream bank degradation. Whirling disease is also increasing in this reach.

TMDL Issues

Listed section includes Nevada Creek to Monture Creek

Listing history: 1996, 2002, 2004

Listed causes of impairment: Nutrients, siltation, and thermal modifications

Dewatering Issues

The entire 13.7-mile reach is listed on the dewatered stream list due to mainstem irrigation and dewatering of all tributaries entering this reach.

Native Species Issues

Bull trout nodal habitat, proposed critical bull trout habitat

Restoration Activities

Past Restoration

Riparian grazing management improvements have occurred in this reach.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP established *Raymond Bridge* fish population survey section and a water temperature monitoring sites in this reach in 1988. In 2002, FWP moved the fish population surveys immediately upstream and renamed the survey site the *Wales Creek* section. FWP monitors populations in this reach on a bi-annual basis. Water quality and macro-invertebrates were assessed at four locations in 1988-89 (Ingman et al. 1990). A riparian health assessment was completed in 1999 (Marler and Schmetterling 1999). FWP completed a habitat survey was completed for this reach in 2003. FWP measured whirling disease infection levels from 1998 through 2004.

Ongoing Monitoring

FWP expects to monitor fish populations in the Wales Creek section bi-annually, summer water temperatures annually and whirling disease on a periodic basis.

Planned Future Monitoring

None beyond ongoing monitoring activities.

MCCABE CREEK: Priority - High

Description

McCabe Creek, a small, 2nd order tributary to Dick Creek, flows ~9.5 miles through public (National Forest) and private (agricultural) land in middle to lower reaches. McCabe Creek ranked high on the restoration priority and total rank list due to a high native species rank, high biological rank, single species (WSCT) sport fishery value and low potential to improve water quality due to its restored condition. McCabe Creek, located in the bull trout core area, contains fluvial WSCT and brook trout. McCabe Creek has been the focus of a concerted restoration project that included a culvert upgrade, instream flow enhancement, elimination of irrigation ditch fish losses, instream habitat enhancement and riparian grazing changes. Except for suppressed riparian woody vegetation, the majority of fisheries impairments have been addressed through an extensive restoration program. The stream is currently in a recovery phase although grazing impairments continue.

TMDL Issues

Not listed: Tributary to the 303(d) listed Monture Creek

Dewatering Issues

Lower McCabe was a dewatered stream in lower reaches due to irrigation; however, water conservation measures have improved flows resulting in the removal of McCabe Creek from the dewatered stream list.

Native Species Issues

Bull trout core area stream

WSCT genetic composition: tested 98% WSCT

Restoration Activities

Past Restoration

A comprehensive restoration project for McCabe Creek began in 1999 and was completed in 2001. This project 1) consolidated four irrigation ditches into one pipeline and screened the intake; 2) converted flood to sprinkler irrigation; 3) restored habitat conditions including the placement of instream wood and shrub plantings along 1/2 mile of stream; 4) incorporated necessary riparian livestock management changes; and 5) improved a county road crossing. In 2001, the project completed the irrigation conversion, developed off-stream livestock watering and reconstructed ~1/2 mile of stream channel.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1992, 1995, 1997, and 1999-2004 and measured stream temperatures in 1998 and 2001.

Ongoing Monitoring

Fish population monitoring is approaching final monitoring phases.

Planned Future Monitoring

None, although a grazing monitoring plan should be initiated.

ALICE CREEK: Priority - High

Description

Alice Creek, an upper Blackfoot River 2nd order tributary, flows ~16 miles through mixed public (National Forest) and private ranch land. The lower ~3 miles of stream is exclusively private. Alice Creek ranks high on the restoration priority list and high in native species value as it supports very limited bull trout spawning and rearing, and populations of fluvial WSCT and brook trout. Alice Creek also ranked high on the biological priority list, but provides a low (single species) sport fishery value to the Blackfoot River and ranks low in potential water quality benefits. Recent fish population sampling found no fish in lower Alice Creek and low densities of WSCT in middle reaches. The upper reaches support low densities of WSCT and brook trout. Fisheries impairments near mile two include: 1) the lack of complex fish habitat (instream wood), 2) localized stream banks degradation and 3) an instream road crossing from recreational users. Sections of Alice Creek are seasonally intermittent.

TMDL Issues

Not listed

Dewatering Issues

The middle reaches of Alice Creek are seasonally intermittent, the extent of which is unknown.

Native Species Issues

Historic bull trout spawning stream

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

The USFS has undertaken culvert removal in the headwaters, road closure and obliteration, two constructed ford installations and graveling of the Alice Creek road. Riparian shrub plantings were conducted in along the middle reaches in 2002.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1999 and measured stream temperatures in 1999, 2001 and 2003 and stream flow in 2000. An ambient water quality survey was completed in 1989 (Ingman et al. 1990). The USFS conducted bull trout redd surveys in lower Alice Creek from 1999 to 2003.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHAMBERLAIN CREEK: Priority - High

Description

Chamberlain Creek, a 2nd order tributary to the middle Blackfoot River, flows ~10 miles through both public (BLM) and private (Plum Creek and agricultural) lands. Private land is located in the lower seven miles of stream. Chamberlain Creek ranked high for restoration and total priorities and moderate for biological ranking. This moderate biological ranking is the result of improved flow and water conditions related to past restoration projects. Because Chamberlain Creek supports bull trout rearing and fluvial WSCT, it ranked high in native species value. Chamberlain Creek also supports a multi-species sport fishery value to the Blackfoot River. WSCT dominate the lower four miles along with low numbers of rainbow, brown, brook and bull trout. Fisheries impairments, located in the mid-to lower reaches include: 1) elevated stream sediment (road drainage), 2) livestock induced riparian vegetation suppression, 3) lack of complex fish habitat (instream wood), and 4) dewatering. Whirling disease was first detected in Chamberlain Creek in 1999 and infection had increased to a mean grade of 2.63 in 2002.

TMDL Issues

Listing history: 1996; in 2000, beneficial uses found to be fully supporting.

Dewatering Issues

The lower mile of Chamberlain Creek is on the dewatered stream list due to a diversion. A water lease is currently in place for 50% of the basin discharge, which maintains a minimal level of base flows.

Native Species Issues

Bull trout rearing

Fluvial WSCT spawning stream

WSCT genetic composition: tested 97-98 % WSCT

Restoration Activities

Past Restoration

Since 1990, Chamberlain Creek has been the focus of a comprehensive fisheries restoration effort. Projects include: road drainage repairs, riparian livestock management changes, fish habitat restoration, irrigation upgrades (consolidate ditches, water conservation, eliminate fish entrainment, fish ladder installation on a diversion), and improved stream flows through water leasing. Restoration occurred throughout the drainage but focused mostly in the lower mile of stream.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1989, and resurveyed sampling sites in 1995, 1997, 1998, 2000 and 2002-2004. FWP completed a habitat survey in 1990. BLM flow monitoring occurs upstream of the West Fork. FWP measured water temperatures from 1999 through 2004 and stream flow in 1989 and 2000. FWP monitors two staff gauges associated with a water lease in the lower mile of stream. FWP began testing for whirling disease in 1997 and continued from 1999 through 2004. Telemetry identified this stream as an important WSCT spawning stream.

Ongoing monitoring

Fish population, whirling disease and flow monitoring related to the water lease are ongoing.

Planned Future Monitoring

FWP plans to evaluate instream sediment levels using McNeil core samples beginning in 2005.

MCELWAIN CREEK: Priority - High

Description

McElwain Creek, a 2nd order tributary to lower Nevada Creek, flows 9 miles through public (BLM) and private ranch land. Private land is located in the lower 6 miles of the stream. McElwain Creek ranks high on the restoration priority and total rank list due to its potential to increase flows in the Blackfoot river and high potential to improve water quality due to its degraded condition. McElwain received a low native species value as it lacks bull trout single species, but does support pure resident WSCT with densities decreasing in the downstream direction. Fisheries impairments, located mostly on private land, include 1)

poor road crossings and drainage, 2) irrigation impacts (fish passage and dewatering), 3) degraded riparian vegetation, and 4) excessive livestock access to stream banks.

TMDL Issues

Listing history: 1996; in 2000, lacks sufficient credible data to determine impairment.

Listed causes of impairment: Siltation, Flow alteration, pathogens.

Dewatering Issues

The lower mile of McElwain Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Some grazing improvements have been completed, including the removal of a streamside feedlot and offstream water development.

Current/Planned Restoration

Grazing improvements and offstream water are in the development phases.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1998 and measured stream temperatures in 2000-2002.

Ongoing Monitoring

None

Planned Future Monitoring

None

SALMON CREEK: Priority - High

Description

Salmon Creek, a small, 1st order outlet stream from Coppers Lake, flows ~2.5 miles in length through entirely public (National Forest) private agricultural land before joining Dry Creek to form Rock Creek. This small stream received high rankings for restoration priority and total rank, native species, biological and sport fishery values. Salmon Creek has a low potential to improve on water quality and received a low rank for social/financial considerations. Salmon Creek, located in the North Fork bull trout core area, supports very low densities of both juvenile bull trout and fluvial WSCT along with high densities of brook trout. Most of the habitat-related problems were corrected on Salmon Creek through extensive restoration. Current fisheries impairments, located on lower Salmon Creek include instream flow problems related to flood irrigation.

TMDL Issues

Not listed; tributary to Rock Creek a 303(d) listed stream

Dewatering Issues

Irrigation occurs but at currently insufficient levels to include Salmon Creek on the dewatered stream list.

Native Species Issues

Bull trout core area stream

No evidence of WSCT reproduction

Restoration Activities

Past Restoration

Between 1996 and 2000, a comprehensive fisheries improvement project was completed on Salmon Creek. The project included channel reconstruction, habitat enhancement, increased stream flows, changes to streamside grazing, removal of a streamside corral, fish screening on two ditches and the placement of a Denil fish ladder to the outlet structure of Spawn Lake.

Current/Planned Restoration

Water conservation projects are being discussed.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1994, 1995, and 1999 and tested for whirling disease in 1997.

Ongoing Monitoring

None

Planned Future Monitoring

None

SHANLEY CREEK: Priority - High

Description

Shanley Creek, a 2nd order tributary to Cottonwood Creek, flows ~9 miles through public and private land, including the Bandy Experimental Ranch. Shanley Creek received a high total rank and biological rank and a moderate native species value. Shanley Creek's high total rank is due to a high (multi-species) sport fishery value and potential water quality benefits. Shanley Creek, located in the Cottonwood Creek bull trout core area, historically contained bull trout based on landowner interviews. However, this species was absent from recent FWP surveys. Shanley Creek now contains resident WSCT, brown trout and brook trout. WSCT dominate upper Shanley Creek. Brown trout dominate lower Shanley Creek. Several restoration projects were completed on Shanley Creek including livestock management changes, and screening an irrigation ditch. Current fisheries impairments include degraded riparian vegetation due to excessive livestock access to stream banks.

TMDL Issues

Not listed

Dewatering Issues

The lower 1.6 miles of Shanley Creek is on the dewatered stream list due to irrigation, although attempts are made to maintain a minimal flow level.

Native Species Issues

Bull trout core area stream.

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Three restoration projects were completed on Shanley Creek beginning in 1994. These involved a riparian exclosures near the mouth, the placement of a fish screen on the ditch to Bandy Reservoir and the development of a three pasture riparian grazing system between stream mile 0.6 and 1.8.

Current/Planned Restoration

None, although grazing plans need to be evaluated and refined.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1993 and 1996 and continued to monitor populations in 1997, 2001 and 2003. FWP measured stream temperatures in 1997 and 1999 and tested for whirling disease in 1997.

Ongoing Monitoring

Periodic fish population monitoring related to restoration action is expected to continue.

Additional Planned Monitoring

None beyond periodic fish population monitoring. A grazing monitoring plan should be developed.

SPRING CREEK (upper Cottonwood): Priority - High

Description

Spring Creek, a 1st order tributary to upper Cottonwood Creek, flows ~2.5 miles exclusively through private timber and agricultural lands. Spring Creek scored high in total rank due to high native species value, high (multi-species) sport fishery value, and potential to increase flows to the Blackfoot River. Spring Creek has low potential to improve downstream water quality and ranks low in social and financial considerations. Located in the bull trout core area, Spring Creek supports WSCT and brook trout and bull trout rearing as recently as 1989. Since 1989, Spring Creek has been diverted on a year-around basis and is now disjunct from Cottonwood Creek. Bull trout have not been detected in more recent sampling. Fisheries impairments in the lower reaches include: 1) irrigation impacts (fish passage, entrainment, and dewatering), 2) channel alterations, and 3) suppressed riparian vegetation.

TMDL Issues

Not listed

Dewatering Issues

The lower mile of Spring Creek is on the dewatered stream list due to irrigation.

Native Species Issues

Bull trout core area stream.

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1989 and 1999.

Ongoing Monitoring

None

Planned Future Monitoring

None

STONEWALL CREEK: Priority - High

Description

Stonewall Creek is a 1st order tributary stream to Keep Cool Cr, a 3rd order tributary stream to the upper Blackfoot River. Stonewall Creek drains the western slopes of Stonewall Mountain then flows south ~7.65 miles through a checkerboard of public (National Forest and State) and private lands. Stonewall Creek ranks high on the restoration priority and total ranking list due to a high sport fishery value (multi-species), and moderate potential to improve Blackfoot River water quality by reducing sediment and temperature and increase stream flows. Stonewall Creek supports populations of WSCT, brown trout, and brook trout. Fish densities are low throughout the drainage. Brown and resident brook trout are found in the lower reaches of the stream. Middle reaches support resident WSCT and brook trout and only WSCT were found in the upper reaches. Fisheries impairments include: 1) elevated sediment levels, 2) excessive livestock grazing impacts on riparian vegetation, 3) over-widened stream banks and braided channel, 4) instream flows (dewatering both natural and irrigation induced), 5) extensive placer mining, and 6) a stream ford at the USFS boundary.

TMDL Issues

Not listed

Dewatering Issues

The lower two miles of Stonewall Creek is on the dewatered stream list due to irrigation and natural losses.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys and measured water temperatures in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

WALES SPRING CREEK: Priority - High

Description

Wales Spring Creek, a 1st order spring creek tributary to lower Wales Creek, flows ~0.9 miles through private ranch land. Wales Spring Creek ranks high on the restoration priority and total ranking list due to its high potential to improve water quality, moderate native species value and multi-species sport fishery value to the Blackfoot River. Wales Spring Creek supports moderate densities of brown trout and very low densities of WSCT. Fish likely coming from Wales Creek, no spawning habitat observed. Fisheries impairments include: 1) slumping stream banks, 2) excessive livestock grazing impacts on riparian vegetation (grasses).

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

No evidence of WSCT reproduction

Restoration Activities

Past Restoration

None

Current/Planned Restoration

Wales Spring Creek will be assessed for restoration in 2005.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flows in 2003.

Ongoing Monitoring

None

Planned Future Monitoring

None

WASSON CREEK: Priority - High

Description

Wasson Creek is a small 1st order tributary to upper Nevada Spring Creek with a length of ~8.4 miles. The Wasson drainage contains both public (National Forest) land in the upper drainage and private land downstream of mile ~ 4. Wasson Creek ranks high on the restoration priority and total ranking list due to a high rank in potential water quality benefits, potential to increase flow in the Blackfoot River, moderate native species values and a moderate rank in social and financial considerations. Wasson Creek supports high densities of WSCT in upper reaches with densities decreasing significantly in lower reaches. Impairments to fisheries, located in the middle and lower reaches, include: 1) excessive livestock access to the stream, 2) channel alterations, 3) dewatering, 4) possible fish barriers at diversion points, and 5) a culvert crossing on the National Forest.

TMDL Issues

Not listed but is tributary to the 303 (d) listed Nevada Spring Creek.

Dewatering Issues

The lower two miles of Wasson Creek is listed on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% pure

Restoration Activities

Past Restoration

Past restoration actions involve irrigation diversion upgrades, cattle fords, off stream water developments and riparian pastures.

Current/Planned Restoration

A comprehensive restoration project for Wasson Creek is currently being developed with private landowners. The project is expected to include: 1) enhancement of instream flows, 2) improvement of riparian grazing and 3) reconstruction of less than a mile of stream.

Monitoring Activities

Past Monitoring

FWP inventoried fish population 1991 and re-surveyed established sites in 2000, 2003 and 2004. FWP measured stream temperatures and stream flows in 2000, 2003 and 2004 and tested for whirling disease in 1997. Channel measurements related to instream flow needs and channel reconstruction were collected 2004.

Ongoing Monitoring

FWP expects to continue to monitor fish populations, flows and water temperatures on an ongoing basis until approximately 2010, if the current restoration project develops as anticipated.

Planned Future Monitoring

None beyond expected ongoing monitoring.

MODERATE PRIORITY STREAMS

BEAR CREEK (rm 12.2): Priority – Moderate

Description

Bear Creek, a small, 2nd order tributary to the lower Blackfoot River, flows ~6 miles through private land including industrial forest in upper reaches. Bear Creek has received extensive restoration over the last several years. With the exception of undersized culverts in the headwaters, Bear Creek is approaching final restoration phases. Bear Creek ranks moderate on the restoration priority list for total and biological rank and high for native species and multi-species sport fishery value but low in potential water quality benefit due to the completion of many restoration projects in the basin. Bear Creek supports limited bull trout rearing, fluvial WSCT, rainbow trout, brown trout and resident brook trout. Bear Creek is the tributary south of reach 6 of the Blackfoot River thought to provide significant recruitment to the Blackfoot River sport fishery. Fisheries-related impairments involve perceived elevated levels of stream sediment resulting from extensive timber harvest and road drainage. Culverts at two locations appear undersized and should be evaluated for fish passage. In the lower reaches of Bear Creek, the stream is currently in the restoration recovery phases where channel reconstruction and grazing management changes were completed.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout rearing

WSCT genetic composition: untested

Restoration Activities

Past Restoration

Beginning in 1995, approximately 6000' of lower Bear Creek was reconstructed or habitat enhanced where channelization and historical grazing had damaged the channel. The project involved grazing management changes, shrub planting and improved diversions at two locations. In 1996, culverts at two locations were upgraded; however, these culverts do not appear to be meeting fish passage objectives and need to be re-evaluated.

Current/Planned Restoration

Two possible stream crossings are under consideration for upgrades.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1994, 1995, and 1998-2004. Water temperature data was collected in 1998, 2001 and 2002. FWP completed a post reconstruction habitat

survey in 1998. FWP tested for whirling disease in bear Creek in 2004, the results of which are pending.

Ongoing Monitoring

Fish population monitoring in the restoration project area is nearing completion.

Planned Future Monitoring

McNeil core sampling is tentatively planned for 2005-06. Periodic project monitoring and fish population survey may continue. Stream sediment delivery should also be evaluated.

BLACKFOOT RIVER (reach 3: Arrastra creek to Nevada Creek): Priority – Moderate Description

This 4th order reach extends 21.1 miles from Arrastra Creek (mile 88.8) downstream to Nevada Creek (mile 67.7) through a mix of private ranch and public (National Forest, State and BLM) lands. No tributary streams enter this reach of the Blackfoot River. The channel loses slope and becomes highly sinuous, erosive and prone to the deposition of fine sediment due to the extremely low channel slope. Instream wood and channel complexity decreases in the downstream direction. Water temperature changes are more extreme during summer and winter as compared with the upstream reach (2). The salmonid assemblage includes low densities of brown trout as the dominant fish, followed by very low densities of WSCT and bull trout. This reach ranks high in native species and biological values but moderate with other criteria, resulting in a moderate total rank. Beyond a host of natural limiting factors, human-related fisheries impairments include: 1) irrigation related low flows, 2) entrainment of fish to some ditches, 2) reduced instream complexity, and 3) excessive livestock to riparian areas resulting in suppressed riparian vegetation and stream bank degradation. Whirling disease is also increasing in this reach.

TMDL Issues

Listed segment include Landers Fork to Nevada Creek

Listing history: 1996, 2002, and 2004

Listed causes of impairment: Siltation and habitat alterations

Dewatering Issues

The majority of this river reach (17.1 miles) is on dewatered stream list due to irrigation.

Native Species Issues

Bull trout nodal habitat, proposed critical bull trout habitat

Restoration Activities

Past Restoration

Streamside corrals were removed at one location.

Current/Planned Restoration

One fish screen project is being developed. Irrigation canal on this portion of the Blackfoot River will be evaluated for entrainment in 2005.

Monitoring Activities

Past Monitoring

An FWP completed habitat survey and native fish telemetry study was completed in 2003-04. Water temperature monitoring began in the early 1990s. A USGS monitoring station (#12335100) was recently established and has three years of continuous flow data. Water quality and macro-invertebrates were assessed at one location in 1988-89 (Ingman et al. 1990). A riparian health inventory was conducted in 1999 (Marler and Schmetterling).

Ongoing Monitoring

FWP collects monitors summer water temperature and whirling disease surveys on an annual basis.

Planned Future Monitoring

None beyond ongoing monitoring activities.

DRY CREEK: Priority – Moderate

Description

Dry Creek is a tributary to Rock Creek in the North Fork of the Blackfoot River drainage. It flows through public (National Forest) land except for the lower-most portion of the stream. Dry Creek ranks moderate on the restoration priority and total rank list and has a high native species value. Dry Creek is considered a non-impaired stream due to recent grazing management changes on private land, which will address the only known fisheries-impairment to this stream. Dry Creek supports bull trout rearing, fluvial WSCT and resident brook trout.

TMDL Issues

Not listed; Tributary to the 303(d) listed Rock Creek

Dewatering Issues

The lower 0.5 miles of lower Dry Creek is on the dewatered stream list due to natural losses.

Native Species Issues

Bull trout core area stream

Fluvial WSCT spawning stream

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Riparian grazing improvements were initiated in 2001.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1994 and 2000. The USFS has collected McNeil core sampling over several years.

Ongoing Monitoring

None

Planned Future Monitoring

None

LITTLE FISH CREEK: Priority – Moderate

Description

Little Fish Creek is a small 1st order tributary stream to the lower Blackfoot River. Draining the southern slopes of Lost Horse Mountain, it flows 5.8 miles in a northwest direction through a mix of public (State, BLM) and private agricultural and industrial forest (Plum Creek) lands before entering the Blackfoot River at river mile 32.8. Little Fish Creek received a moderate total ranking because of a high ranking in social and financial considerations, a high biological ranking and moderate native species value. Little Fish also has a single-species sport fishery value and potential to increase flows to the Blackfoot. Little Fish Creek supports only WSCT throughout its entire length. Fish densities are low and decrease in the downstream direction. Fisheries impairments include: 1) road crossing (undersized culvert), 2) irrigation impacts (low flow), 3) areas of excessive livestock grazing on riparian vegetation, stream bank degradation, and moderate to high sediment levels, and 4) road drainage.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2003.

Ongoing Monitoring

None

Planned Future Monitoring

None

LODGEPOLE CREEK: Priority - Moderate

Description

Lodgepole Creek is the primary tributary to Dunham Creek. It drains Monture Mountain before flowing exclusively through public (National Forest) land. Lodgepole Creek received a moderate rank on the restoration priority and total rank list due to its high native species

value, moderate biological priority rank, and lack of any known impairments. Lodgepole Creek supports both WSCT and bull trout in low numbers.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout core area stream, proposed critical bull trout habitat.

WSCT genetic composition: untested

Restoration Activities

Past Restoration

A bridge was constructed on the Forest Service land to facilitate high flows and address fisheries concerns.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1996.

Ongoing Monitoring

None

Planned Future Monitoring

None

NEVADA SPRING CREEK: Priority - Moderate

Description

Nevada Spring Creek, a 2nd-order spring creek tributary to lower Nevada Creek, flows ~3.2 miles in length exclusively through private ranch land. Nevada Spring Creek ranks moderate on the restoration priority and total rank list due to moderate native species values and high biological priority values. Nevada Spring Creek has potential to increase flow in the Blackfoot and the high potential to improve downstream water quality to lower Nevada Creek and possibly the Blackfoot River. Nevada Spring Creek supports very low densities of fluvial WSCT and brown trout in the upper reaches and very low densities of WSCT, brown trout and bull trout in the lower reaches. Before 2001 fisheries impairments, located over the length of the stream include: 1) irrigation impacts (dewatering and fish passage), 2) channel alterations, 3) lacks instream complexity, 4) degraded riparian vegetation resulting from excessive livestock access to stream banks. Nevada Spring Creek tested negative for whirling disease in 2002.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat alterations and siltation

Dewatering Issues

Dewatering issues were addressed as part of the 2003 restoration project.

Native Species Issues

Limited bull trout rearing

WSCT genetic composition: untested

Restoration Activities

Past Restoration

Since 2001, Nevada Spring Creek has been the focus of a concerted restoration effort over its entire length, which included channel reconstruction, instream flow enhancement and riparian grazing changes. The entire Nevada Spring Creek has been subject to an extensive restoration project, involving complete reconstruction and livestock management measures.

Current/Planned Restoration

Current planned work involves completion of localized floodplain work. This involves importing sod mats to areas where the floodplain is to be elevated to better maintain channel cross-section. Shrub planned for the final phases of the project.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1990 and resurveyed monitoring sites in 1991-02, 1994, and in 2000-2004. FWP sampled dissolved oxygen and water quality at two sites in 1989. FWP measured stream temperatures in 2000 through 2004, and stream flows in 2000, 2002 and 2004. FWP completed a baseline habitat assessment in 1990 and post-project survey in 2003-04. FWP tested for whirling disease in 1997 and 2002-2004.

Ongoing Monitoring

Fish population and water temperature measurements are expected to continue for the next 3-5 years.

Planned Future Monitoring

None beyond ongoing monitoring

YOURNAME CREEK: Priority - Moderate

Description

Yourname Creek, a 2nd order tributary to the middle Blackfoot River, originates near Elevation Mountain and flows ~9 miles through both public (BLM) and private land. Public land is found only in the upper 1.4 miles of stream. Yourname Creek ranks moderate for restoration priority and total rank due to a 1) moderate native species value, 2) single-species sport fishery value to the Blackfoot River, 3) potential to improve downstream water quality to the Blackfoot River, and 3) potential to increase flow to the Blackfoot River. Yourname Creeks ranks low for social and financial considerations. Yourname Creek supports a genetically pure population of fluvial WSCT with densities increasing substantially in the upstream direction. Fisheries impairments include: 1) irrigation impacts (dewatering and entrainment), 2) lack of instream complexity, and 3) degraded stream banks resulting from excessive livestock access to riparian areas.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow alterations

Dewatering Issues

The lower mile of Yourname Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% pure

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 1992 and 2000, measured stream temperatures in 2000-2004 and stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

EAST TWIN CREEK: Priority - Moderate**Description**

East Twin Creek is a small 2nd order tributary to the lower Blackfoot River. It flows ~5 miles through private land, except for a small parcel of public land in the headwaters. East Twin Creek ranks moderate on the restoration priority list, due to low potential for improving downstream water quality and increasing flows to the Blackfoot River, and a high ranking in native species value as it supports bull trout rearing and fluvial WSCT. East Twin Creek provides a high (multi-species) sport fishery value to the Blackfoot River by supporting a diverse fish assemblage of fluvial WSCT, bull trout, rainbow trout, brown trout, and resident brook trout. In general, densities are low for all species in the lower to middle reaches. The only known problem for East Twin Creek is an undersized culvert, which contributes to localized channel instability.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Restoration Activities

Past Restoration

An undersized culvert was replaced in the mid-1990s.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1996, 1998 and 2000, and measure stream temperature in 1998, 1999 and 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

JOHNSON CREEK: Priority - Moderate

Description

Johnson Creek is a 2nd order tributary to the lower Blackfoot River that drains public (National Forest) and private land. Johnson Creek received a moderate rank in the total and restoration priority rank list, and a high native species rank. Restoration work (fish passage near the mouth) was completed in 1997. And no additional impairments on this stream have been identified since. Johnson Creek is a small, cold stream that supports several fish species including bull trout, WSCT, rainbow trout and brown trout in low numbers.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout rearing stream, concentrates bull trout at the mouth

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

A stream crossing was improved in the late 1997 to improve fish passage.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population 1997, measured stream temperatures in 1999 and stream flow in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

KEEP COOL CREEK: Priority - Moderate**Description**

Keep Cool Creek, a 3rd order tributary to the upper Blackfoot River, drains Stonewall Mountain and the Keep Cool Lakes. Keep Cool Creek flows ~12 miles through public (National Forest) land before entering private land near mile ~6. Keep Cool Creek ranks moderate in the total ranking and restoration priority list. This rank is due to a moderate native species rank, high (multi-species) sport fishery value to the Blackfoot River and high potential to improve water quality in the Blackfoot River by reducing sediment and temperature. Keep Cool Creek supports populations of fluvial WSCT and brown trout and limited bull trout use. Brown trout are found in low numbers in the lower reaches of the stream. Fisheries impairments include 1) mining impacts, 2) dewatering and 3) excessive access by livestock to the stream banks in the middle reaches.

TMDL Issues

Not listed

Dewatering Issues

Two miles of upper Keep Cool Creek are on the dewatered stream list due to irrigation.

Native Species Issues

Receives fluvial bull trout use (non spawning)

WSCT genetic composition: tested 100% WSCT

Restoration Activities**Past Restoration**

The middle portion of Keep Cool Creek is currently under more sensitive grazing management. The USFS has upsized culverts.

Current/Planned Restoration

The USFS is planning additional road crossing improvements on the Sucker/Copper road.

Monitoring Activities**Past Monitoring**

FWP inventoried fish population and measured stream temperatures and stream flows in Keep Cool Creek in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

PEARSON CREEK: Priority - Moderate

Description

Pearson Creek, a small 2nd order Garnet Mountain tributary to Chamberlain Creek, flows ~9 miles through mostly private (Plum Creek) land and a small section of public (BLM) land in the upper reaches. Pearson Creek ranks moderate on the restoration priority and total rank list due to a moderate native species rank, low (single-species) sport fishery value and high potential for improving downstream water quality. Pearson Creek supports fluvial WSCT in the lower drainage. Pearson Creek has been the site of an extensive restoration program, which corrected the majority of identified problems. Current fisheries impairments located in lower Pearson Creek include: 1) lack of instream complexity, 2) degraded riparian vegetation, and 3) road drainage problems.

TMDL Issues

Not listed

Dewatering Issues

Two miles of lower Pearson Creek are listed on the dewatered stream list due to natural losses and past irrigation practices. This reach of stream has been under a water lease since 1996 and currently is not dewatered except in drought years.

Native Species Issues

WSCT genetic composition: tested 98% WSCT

Restoration Activities

Past Restoration

Reconstruction of three segments of channel totaling ~4,000 feet of stream, water lease for all flows from the watershed, habitat restoration including shrub planting, wood placement and grazing management changes began in 1996.

Current/Planned Restoration

Additional grazing management changes are ongoing.

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1994, 1995, 1997, 1999, 2001, and 2002-2004.

Ongoing Monitoring

Annual water lease and fish population monitoring are expected to continue.

Planned Future Monitoring

Future grazing monitoring is needed.

SAUERKRAUT CREEK: Priority - Moderate

Description

Sauerkraut Creek, a 1st order tributary to the upper Blackfoot River, flows ~7 miles through public (National Forest) land in the headwaters and private land downstream of mile ~3. Sauerkraut Creek received a moderate rank on the restoration priority and total rank list due to high native species values, high (multi-species) sport fishery value to the Blackfoot River, and moderate potential to improve water quality in the Blackfoot River. Sauerkraut Creek

received a low rank for social and financial considerations. Sauerkraut Creek supports limited bull trout rearing, fluvial genetically pure WSCT, brown trout and brook trout. We found bull trout and brown trout in lower Sauerkraut Creek, whereas WSCT and brook trout are found throughout the drainage. Brook trout densities decrease in the upstream direction. Fisheries impairments, located in the middle reaches, include: 1) undersized culverts, 2) road sediment delivery to the stream, 3) channelization and a lack of instream complexity due to placer and gravel mining activity, and 3) stream bank damage in localized area excessive livestock access to riparian areas.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

Limited bull trout rearing

Fluvial WSCT spawning stream

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1999 and measured stream temperatures in 2002 and 2003. Telemetry identified this stream as a fluvial WSCT spawning stream.

Ongoing Monitoring

None

Planned Future Monitoring

None

WALES CREEK: Priority - Moderate

Description

Wales Creek, a 2nd order tributary to the middle Blackfoot River, flows ~9 miles through both public (BLM) in headwater areas and private ranch land downstream of mile ~4. Wales Creek ranks moderate in total rank and restoration priority due to a 1) moderate native species value, 2) high (multi-species) sport fishery value to the Blackfoot River, 3) potential to increase flow in the Blackfoot, and 4) potential to improve water quality in the Blackfoot River. Wales Creek ranks low for social and financial considerations. A large instream reservoir limits the ability to address the entire Wales Creek system. Species composition is comprised of fluvial WSCT (below reservoir) and resident WSCT (above reservoir). The lower reaches also contain low brown trout densities. Above the reservoir, (mile 2.0), Wales

Creek supports genetically pure WSCT. Fisheries impairments above and below the reservoir include stream bank damage resulting from excessive livestock access to riparian areas. Severe dewatering occurs below the reservoir.

TMDL Issues

Listing history: 1996; in 2000, 2002, & 2004 lacks sufficient credible data to determine impairments.

Listed causes of impairment: Flow alterations and siltation.

Dewatering Issues

The lower 1.9 miles of Wales Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% above the reservoir

Isolet WSCT population above the reservoir

Introgression present below the reservoir

Restoration Activities

Past Restoration

Riparian pasture was developed upstream of the reservoir in 2004 in order to reduce grazing pressure on the riparian area.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1989, 2000 and 2003, measured stream temperatures in 2001, 2003 and 2004 and stream flows in 1989, 2000 and 2003. A telemetry study in 2002-03 identified Wales Creek as an important WSCT spawning stream. FWP tested for whirling disease in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

WEST TWIN CREEK: Priority - Moderate

Description

East Twin Creek is a small 3rd order tributary to the lower Blackfoot River, which originates from the slopes of Wisher Ridge and Sheep Mountain. It flows south through public (National Forest) and private land. West Twin Creek is a past project stream in which the only known impairment was addressed with the completion of a fish passage project at Highway 200. West Twin Creek received a moderate rank on the restoration priority and total rank list and a high native species value. West Twin Creek supports a high value sport fishery with a mixed species composition of WSCT, rainbow trout, brown trout, and brook trout in low numbers.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

WSCT genetic composition: untested

Restoration Activities**Past Restoration**

FWP assisted with a fish passage project near the mouth in the early 1990s

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP conducted fish population surveys in 1996, measured stream flows in 2000, measured stream temperatures in 1998, 1999 and 2001 and tested for whirling disease in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

ARRASTRA CREEK: Priority - Moderate**Description**

Arrastra Creek, a large 2nd order middle Blackfoot River tributary, flows 13 miles through public (National Forest) and private land. The lower half of the stream is private. Arrastra Creek ranks moderate in total ranking on the restoration priority list. Supporting bull trout spawning and rearing and genetically pure fluvial WSCT, it ranks high in native species value. Arrastra Creek provides a high (multi-species) sport fishery value to the Blackfoot River and ranks high on the biological priority list. A telemetry study conducted in the Blackfoot River watershed in 2002-03 identified Arrastra Creek as a primary fluvial WSCT spawning tributary. Arrastra Creek also supports populations of brown trout and resident brook trout. Fish densities are low for all species in lower reaches, but increase to moderate levels in middle reaches. Upper Arrastra Creek supports a native fish assemblage with both WSCT and bull trout. Fisheries impairments include a complete fish passage barrier in upper Arrastra Creek and a partial barrier in lower Arrastra Creek. We have identified no substantive water quality problems for Arrastra Creek: sediment-related issues are likely due to extensive timber harvest and road construction in the watershed. Fisheries impairments include 1) riparian timber harvest and habitat simplification and suspected road drainage, 2) perched culverts limiting upstream fish passage in the headwater and near the mouth, and 3) localized recreational impacts to stream banks. A low level of whirling disease was detected in Arrastra Creek in 2003.

TMDL Issues

Listing History: 2000, 2002, & 2004

Listed causes of impairment: Siltation and other habitat alterations.

Dewatering Issues

Arrastra Creek is on dewatered stream list between mile 2.0 and 4.5 due to natural dewatering.

Native Species Issues

Non-core area bull trout spawning stream.

Fluvial WSCT spawning stream

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

The removal of perched culverts at stream mile 3.5 is planned for fall of 2005. Velocities at high flows through these culverts have been measured at 8 ft/sec, sufficient to prevent seasonal upstream movements.

Monitoring Activities

Past Monitoring Activities

FWP inventoried fish population data in 1989 and resurveyed sites in 1996, 1999 and 2004, measured stream temperatures in 1999, 2001, 2002, 2003 and stream flows in 1989 and 2000. FWP began testing for whirling disease in 2003 and 2004. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Periodic samplings of fish populations and whirling disease are expected to continue.

Planned Future Monitoring

McNeil core samples are planned for 2005. An evaluation of roads and road drainage from a stream – sediment delivery perspective should also be conducted in the watershed.

BLACKFOOT RIVER (REACH 5: N.F to the CLEARWATER): Priority - Moderate Description

This 5th order reach of the Blackfoot River extends 19.3 miles from the North Fork (mile 54) downstream to the Clearwater River (mile 34.7). It flows through a mix of private agricultural and industrial forest (Plum Creek) lands and public (BLM, State) lands. Several tributaries enter this reach (North Fork Blackfoot River, Warren Creek, Monture Creek, Chamberlain Creek, Cottonwood Creek, and Bear Creek). With the exception of Bear Creek, these streams and many of their tributaries have been the focus of restoration actions. The two largest tributaries entering this reach, Monture Creek and the North Fork, are critical bull trout spawning streams. To varying degrees, these streams also support and recruit WSCT, rainbow and brown trout to the Blackfoot River. This reach ranked moderate in total ranking as a result of high native species value, a lack of sport fishery value due to the absence of mainstem spawning, and a low potential in downstream water quality benefits. In this reach,

rainbow trout become the dominant mainstem salmonid followed by brown trout, WSCT and bull trout. Densities of all species are below potential due to drought, whirling disease and tributary impairments. Most of the mainstem impairments are localized and include channel alterations, past livestock grazing, recreation impacts to banks. Whirling disease has escalated to high levels in this reach.

TMDL Issues

Listed segments include Nevada Creek to Monture Creek and Monture Creek to the Clearwater River.

Listing history: 1996, 2002, and 2004

Listed causes of impairment: Nutrients, siltation, and thermal modifications

Dewatering Issues

Although this river reach is subject to upstream dewatering, it is not on the dewatered stream list due to generally sufficient flows except during drought conditions.

Native Species Issues

Bull trout nodal habitat; proposed critical bull trout habitat, bull trout recovery/recreational conflict area

Restoration Activities

Past Restoration

Riparian grazing management changes have occurred in many areas of this reach.

Current/Planned Restoration

None planned

Monitoring Activities

Past Monitoring

FWP established the Scotty Brown Bridge fish population survey section in 1982. Fish population and water temperature surveys began in the 1980s. FWP tested for whirling disease testing from 1997 through 2004. DEQ assessed water quality and macro- at four locations in 1988-89 (Ingman et al. 1990).

Ongoing Monitoring

DNRC monitors flows using aquarods during drought years upstream of the Clearwater River junction. FWP monitors summer water temperature and whirling disease on an annual basis.

Planned Future Monitoring

None beyond ongoing monitoring.

CLEARWATER RIVER: Priority - Moderate

Description

Clearwater River is a major 4th order tributary stream to the middle Blackfoot River. The effluence of Clearwater Lake, it flows ~ 45.8 miles through seven lakes (Clearwater chain-o-lakes) and a checkerboard of private, industrial forest (Plum Creek) and public (National Forest and State) lands to its confluence with the Blackfoot River at mile 34.7. The Clearwater River ranks moderately in total ranking on the restoration priority list. This

ranking is due in part to low rankings for its potential to improve downstream water quality and social and financial considerations. It also ranked moderate for native species priority, but ranked high in multi-species sport fishery value to the Blackfoot River. Because of the lack of data, only the lower 3.5 miles of the Clearwater River is currently the focus of restoration efforts at this time. The Clearwater River supports a multi-species fishery. Data collected in a 2003 fish trap study show salmonid species present include WSCT, rainbow trout, brown trout, and mountain white fish. Bull trout have also been observed in the system. In addition, various species of forage fish (longnose dace and red-side shiners) are present. The Clearwater chain-of-lakes and river are also a major source of northern pike to the Blackfoot River. Fisheries impairments include irrigation impacts.

TMDL Issues

Not Listed

Dewatering Issues

The lower 3.5 miles of the Clearwater River is on the dewatered stream list due to irrigation.

Native Species Issues

Fluvial WSCT migration corridor

Restoration Activities

Past Restoration

None

Current/Planned Restoration

An instream flow project was completed in 2004 for the lower 3.5 miles of stream. This project is intended to increase instream flows during drought years. A fish screen is also planned for the canal in 2005.

Monitoring Activities

Past Monitoring

FWP conducted juvenile fish population surveys in 1989. FWP conducted electrofishing and ditch trapping in the Clearwater ditch in 2001, 2003 and 2004 to determine number and species entrained. FWP measured water temperatures in 1998 and 2000-2004 and stream flows in 1989, 2000 and 2004. FWP tested for whirling disease in 1997 and 2004. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Periodic fish population and water temperature monitoring

Planned Future Monitoring

In addition to ongoing periodic monitoring, flows will be monitored in the Clearwater canal during low flows years as part of an emergency drought plan.

DOUGLAS CREEK: Priority - Moderate

Description

Douglas Creek, a major 3rd order tributary to lower Nevada Creek, flows ~22 miles through public (BLM) and private ranch land. Most of the drainage, the lower ~18 miles, is private agricultural land. Douglas Creek ranked high for potential water quality benefits and

increases stream flows to the Blackfoot River, but low in native species value and lacks a sport fishery value which contributed to Douglas Creek's moderate restoration and total priority rank. The upper reaches support pure resident WSCT in moderate densities. Lower and middle Douglas Creek supports low numbers of native non-game fish species. Fisheries impairments, located throughout the drainage, include 1) lack of complex fish habitat (instream wood), 2) livestock induced stream bank degradation and riparian vegetation suppression, 3) elevated sediment and elevated nutrient levels and elevated water temperatures, 4) channel degradation related to instability and to road construction, and 5) reduced instream flows from irrigation.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairments: Siltation, habitat and flow alterations, thermal modification, nutrients, salinity, TDS and chloride.

Dewatering Issues

The lower 14 miles of Douglas Creek is dewatered due to irrigation.

Native Species Issues

Isolet WSCT population in headwaters of mainstem

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Fish ladders were constructed around two instream reservoirs in the headwaters in order to include population size for disjunct WSCT in the headwaters.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1994, 1997 and 2000, and measured water temperatures in 1998 and 2000 and stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

FISH CREEK: Priority - Moderate

Description

Fish Creek, a 1st order tributary to the lower Blackfoot River, flows ~5 miles through mostly private timber land with a small portion of public (State) land in middle reaches. Fish Creek ranks moderate on the restoration priority list due to a moderate native species value, single species sport fishery value to the Blackfoot River, and potential to increase stream flows to the Blackfoot River. We identified no potential water quality improvement benefits on Fish Creek. Fish Creek supports fluvial WSCT with densities that increase in the upstream

direction. Fisheries impairment in the lower ~3 miles include: 1) dewatering, 2) channel alteration (instream pond), and 3) an undersized culvert creating possible fish barriers.

TMDL Issues

Not listed

Dewatering Issues

The lower 0.3 miles of Fish Creek is on the dewatered due to irrigation.

Native Species Issues

WSCT genetic composition: tested 98% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

LINCOLN SPRING CREEK: Priority - Moderate

Description

Lincoln Spring Creek, a large 1st order spring creek flowing through the town of Lincoln, flows ~5 miles exclusively through private (residential) ownership. Lincoln Spring Creek ranked moderate on the restoration priority and total rank list. This rank is due to a moderate native species value, high (multi-species) sport fishery value to the Blackfoot River, potential to increase flow in the Blackfoot River, and low rank for social and financial considerations. The feasibility to address the entire stream is also questionable. Lincoln Spring Creek currently supports brown trout and brook trout in low densities and receives limited use by fluvial WSCT, but no reproduction. Fisheries impairments include: 1) poor road crossings, 2) lack of instream complexity, 3) degraded riparian vegetation, and 4) residential development.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

Historical bull trout use likely
No evidence of WSCT reproduction

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 1995 and measured stream temperatures in 2004. FWP tested for whirling disease in 1997 and 2004.

Ongoing Monitoring

None

Additional Planned Monitoring

None

JACOBSEN SPRING CREEK: Priority - Moderate**Description**

Jacobsen Spring Creek is a small 1st order spring creek tributary to the North Fork Blackfoot River, a major tributary and bull trout core stream in the Blackfoot River watershed. Jacobsen Spring Creek originates on and flows ~1.6 miles exclusively through private ranch land. It ranks moderately in total ranking and restoration priority, primarily because of its multi-species sport fishery value, high potential to improve downstream water quality, and high social and financial considerations. Jacobsen Spring Creek supports low densities of brown and moderate numbers of resident brook trout throughout its length. Very low densities of rainbow trout are also present in its lower and middle reaches. Rainbow spawning activity has also been observed in its middle reaches. Fisheries impairments include: 1) areas of livestock-induced stream channel degradation, 2) lacks complex fish habitat (instream wood), 3) livestock-induced riparian vegetation degradation and suppression.

TMDL Issues

Not listed

Dewatering Issues

This stream is being evaluated for dewatering.

Native Species Issues

Bull trout core area stream
No evidence of WSCT reproduction

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

The lower mile of Jacobsen Spring Creek is being considered for reconstruction and grazing management changes.

Monitoring Activities

Past Monitoring

FWP and USFWS conducted fish population surveys, monitored flows and collected temperature data in 2004. Geomorphic data (pebble counts, cross-section data) was also collected. The stream was tested for whirling disease in 2004.

Ongoing Monitoring

Stream flow measurements are ongoing.

Planned Future Monitoring

Additional monitoring will be considered as restoration plans are developed.

NEVADA CREEK (upper): Priority - Moderate

Description

Upper Nevada Creek, a large 3rd order stream, drains the northern slopes of Nevada Mountain on the continental divide. It flows ~ 18.8 miles through a combination of public (National Forest) and private agricultural lands before emptying into Nevada Creek Reservoir at mile 33.7. Upper Nevada Creek received a moderate total rank on the restoration priority list. This rank is due to a high native species value, high potential to improve downstream water quality and moderate social and financial considerations. It lacks sport fishery value to the Blackfoot River. Upper Nevada Creek supports populations of WSCT, rainbow trout, and brook trout. The USFS reports bull trout in upper reaches of Nevada Creek in very low numbers. Low densities of resident WSCT also inhabit the upper reaches of Nevada Creek on National Forest, but numbers decrease in the downstream direction. Rainbow trout and brook trout in low densities are found on private agriculture land upstream of Nevada Reservoir. Many additional tributaries not included in this report that have been sampled by the USFS. These streams variously contain WSCT and brook trout, some of which also have impairments identified by the USFS. Fisheries impairments on the mainstem of upper Nevada Creek include: 1) irrigation impacts (low flow), 2) channel alterations and instability, 3) lacks complexity (lacks instream wood), 4) excessive livestock grazing impacts on riparian vegetation and stream bank degradation, 5) low instream flows due to irrigation, 6) historic mining, and) undersized culverts and road sediment delivery to the stream.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairments: Flow and habitat alteration, nutrients, siltation, thermal modification, suspended solids, metals, and nitrogen.

Dewatering Issues

Six miles of Nevada Creek upstream of the reservoir (stream mile 34-40) is on the dewatered stream list due to irrigation-induced low flows.

Native Species Issues

WSCT genetic composition: tested 91% WSCT

Restoration Activities

Past Restoration

The North Powell Conservation District and NRCS has been involved in attempting to correct non-point runoff problems on private agricultural areas.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1957, 1996 and 2001 and measured stream temperatures in 2000 and 2001. A USGS gauging station monitors stream flows upstream of Nevada Reservoir.

Ongoing Monitoring

USGS flow monitoring

Planned Future Monitoring

None beyond ongoing flow monitoring.

SUCKER CREEK: Priority - Moderate

Description

Sucker Creek, a 1st order tributary to Keep Cool Creek, drains the southeastern slopes of Stonewall Mountain. It flows south then southwest ~ 6.0 miles through a checkerboard of public (National Forest and State) lands and private ranch lands. Sucker Creek received a moderate rank on the restoration priority and total rank list. This moderate rank is the result of its high potential to improve water quality for the Blackfoot River, but lack of sport fishery value. Sucker Creek supports very low densities of WSCT and brook trout in its lower reaches. Fisheries impairments include: 1) irrigation dewatering, 2) elevated sediment levels, 3) excessive livestock grazing impacts to stream banks and riparian vegetation, 4) lack of instream complexity, and 5) undersized culvert.

TMDL Issues

Not listed

Dewatering Issues

The lower mile of Sucker Creek is on the dewatered stream list due to irrigation and has a seasonally intermittent reach on the National Forest.

Native Species Issues

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP surveyed fish populations and measured stream temperatures in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

UNION CREEK: Priority - Moderate

Description

Union Creek, a primary 3rd order tributary to the lower Blackfoot River, flows ~18 miles through both public (BLM) and mainly private ranch land. The lower ~15 miles of this stream flows through private land. Union Creek ranks moderate on the restoration priority and total rank list. The moderate ranking results from a low native species rank, absence of sport fishery to the Blackfoot River, low rank for social and financial considerations, but high potential to improve water quality and increase flows to the Blackfoot River. Union Creek contains both brook trout and WSCT. Brook trout are present in very low densities in the middle reaches. Resident WSCT were sampled in low numbers in the middle and upper reaches. Fisheries impairments, located in the middle and lower reaches include: 1) poor road crossings (undersized culvert), 2) irrigation impacts (low instream flows), 3) lack of instream complexity, and 4) degraded riparian vegetation resulting from excessive livestock access to stream banks. Lower portions of Union Creek are also undergoing channel incision.

TMDL Issues

Listing history: 1996, 2000, 2002, 2004

Listed causes of impairment: Flow alterations, habitat alterations, siltation, thermal modification, metals, nutrients, and suspended solids.

Dewatering Issues

The lower 7.0 miles is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 92% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1989 and re-surveyed sites in 2000, measured water temperature in 2001 and 2002, measured stream flows in 1989 and 2000 and tested for whirling disease in 2004. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

None

Planned Future Monitoring

None

WILLOW CREEK (UPPER): Priority - Moderate

Description

Willow Creek above Lincoln, a 2nd order tributary to the upper Blackfoot River, flows ~8 miles through public (National Forest) in headwaters and private land downstream of mile ~6. Willow Creek ranked moderate for total rank and restoration priority due to high potential to improve water quality for the Blackfoot River and single-species sport fishery value to the Blackfoot River. Willow Creek ranks low in native species value and supports low densities of resident WSCT and brook trout. Headwater tributaries on the National Forest also contain WSCT. Fisheries impairments, located in the lower reach include localized stream bank degradation resulting from excessive livestock access to riparian areas.

TMDL Issues

Listing history: 1996, 2000, & 2004

Listed causes of impairment: Bank erosion, habitat alterations, and siltation

Dewatering Issues

The middle reach is seasonally intermittent although the extent is unknown.

Native Species Issues

Fluvial WSCT spawning stream

WSCT genetic composition: tested 100% pure

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1999 and measured stream temperatures in 2003. A telemetry study conducted by FWP identified upper Willow Creek as an important WSCT spawning tributary. FWP tested for whirling disease in 2004. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

None

Planned Future Monitoring

None

WILSON CREEK: Priority - Moderate**Description**

Wilson Creek, a 1st order tributary to Lincoln slough (Nevada Creek), flows ~6 miles first through public (National Forest) and private ranch downstream of mile ~3. Wilson Creek ranks moderate on the restoration priority and total rank list due to a high potential to improve downstream water quality and potential to increase flows to the Blackfoot, low native species value, lack of sport fishery value to the Blackfoot River and low rank for social and financial considerations. Wilson Creek supports a disjunct population of resident WSCT at very low densities. Fisheries impairments in the middle to lower reaches include: 1) placer mining in the headwaters, 2) poor road crossings, 3) irrigation impacts (fish entrainment, low flows), and 4) lack of connectivity to Nevada Creek.

TMDL Issues

Not listed

Dewatering Issues

The lower 0.8 miles of stream is on the dewatered stream list due to irrigation.

Native Species Issues

Isolet WSCT population

WSCT genetic composition: tested 100% pure

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish population, measured stream temperatures and stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHAMBERLAIN CREEK, East Fork: Priority - Moderate**Description**

The East Fork of Chamberlain Creek, a small, 1st order tributary to Chamberlain Creek, flows ~3.5 miles entirely through private (Plum Creek) lands. The East Fork is a past project stream. Past projects include correcting road drainage and replacing a culvert near the

mouth. The East Fork ranks moderate on the restoration priority list, biological priority list and native species priority list. These moderate rankings results from single species sport fishery status, and low potential for both water quality improvements and downstream flow benefits to the Blackfoot River. The lower reaches of the East Fork support high densities of fluvial WSCT. Fisheries impairments, located in the lower reaches, are believed to still include elevated instream sediment levels from poor road drainage. The new culvert may also restrict upstream movement of juvenile fish. The East Fork of Chamberlain tested negative for whirling disease despite positive results for whirling disease in the mainstem of Chamberlain Creek.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Fluvial WSCT spawning stream

WSCT genetic composition: untested

Restoration Activities

Past Restoration

A culvert was upgraded. Some erosion control work on Plum Creek properties was completed in the mid-1990s.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1997 and measured stream temperatures in 1999 and 2000. FWP tested for whirling disease in 1999 and 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

HOGUM CREEK: Priority - Moderate

Description

Hogum Creek, a 2nd order tributary to the upper Blackfoot river, flows ~6 miles through both public (National Forest) in headwaters and private land downstream of mile ~ 2. Hogum Creek ranks moderate in total rank and restoration priority. This moderate rank is due to a moderate native species value and (high) multi-species sport fishery value to the Blackfoot River. Hogum Creek ranks low in potential water quality benefits and moderate in social rank. Hogum Creek supports very limited numbers of bull trout, WSCT, brown trout and brook trout. All species, except the bull trout, show upstream increases at low densities. Headwater tributaries on the National Forest contain both WSCT and brook trout. Fisheries

impairments in the lower reaches include road crossings (undersized culvert) and localized stream bank degradation from livestock.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Bull trout rearing,

Fluvial WSCT spawning stream

WSCT genetic composition: tested 99-100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1995 and 1999, measured water temperatures in 2003 and stream flow in 2000. Telemetry identified this stream as a fluvial WSCT spawning stream.

Ongoing Monitoring

None

Planned Future Monitoring

None

MOOSE CREEK: Priority - Moderate

Description

Moose Creek, a small 1st order tributary to the upper Blackfoot River, flows ~4 miles through National Forest land, except for a small section of private land near the mouth. Moose Creek ranks moderate in total rank and restoration priority due to a moderate native species value, single species sport fishery value to the Blackfoot River and a high rank for social and financial considerations. Due to adequate flows and healthy riparian area, Moose Creek ranks low in potential to improve water quality and provides no potential for increasing flows to the Blackfoot River. Moose Creek supports a population of fluvial WSCT. Fishery impairments near the mouth include placer mining and two undersized culverts that partially limit upstream fish passage.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

WSCT genetic composition: tested 99-100% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

The USFS and others are planning to replace an undersized culvert near the mouth and remove a second culvert.

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 1999 and measured stream temperatures in 2002 and 2003 and stream flows in 2000 and 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

BASIN SPRING CREEK: PRIORITY - MODERATE**Description**

Basin Spring Creek is a 1st order spring creek tributary to lower Pearson Creek, a lower Chamberlain Creek tributary. This stream flows ~0.15 miles exclusively through private agricultural land. Basin Spring Creek ranked moderate on the restoration priority list, moderate on the native species priority list and low on the biological priority list. Restoration efforts on Basin Creek in the early 1990's included channel reconstruction, shrub planting and grazing management changes. We have no identified current impairments on this stream. Basin Spring Creek serves as a migration corridor for fluvial WSCT to Pearson Creek and supports low densities of resident brook trout.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Fluvial WSCT migration corridor

Restoration Activities

Past Restoration

The upper section of this stream was reconstructed in 1995. The project involved wetland enhancement and riparian grazing changes.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1991, 1995 and 1997.

Ongoing Monitoring

None

Planned Future Monitoring

None

BLACK BEAR CREEK: Priority - Moderate

Description

Black Bear Creek, a small 1st order tributary to Bear Creek in the upper Douglas Creek watershed, flows ~7.5 through both public (BLM) and private agricultural land. The upper reaches are public land. Black Bear Creek ranks moderate on the restoration priority list despite a high rank in potential water quality benefits, and currently does not support fish, resulting in a low biological and native species rank. Riparian impairments in the lower reaches include: 1) livestock induced stream bank degradation and riparian vegetation suppression, 2) a crushed and undersize culvert, and 3) reduced instream flow from irrigation.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat alterations and siltation

Dewatering Issues

unknown

Native Species Issues

No native fish present

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted electrofishing surveys and measured flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

BLACKFOOT RIVER (Reach 6: Clearwater River to the mouth): Priority - Moderate Description

The lower reach of the Blackfoot River extends 34.7 from the mouth of the Clearwater River (mile 34.7) downriver to the confluence with the Clark Fork River. It flows through private, agricultural and industrial forest (Plum Creek) and public (BLM, State) lands. Several tributaries enter this reach of the Blackfoot River. In the downstream direction, they are Fish Creek, Little Fish Creek, Elk Creek, Belmont Creek, Gold Creek, Union Creek, Bear Creek, East and West Twins and Johnson Creek. This reach ranks moderate in total ranking due to a high native species value, high social and financial considerations, low sport fishery value due to a lack of mainstem spawning and low potential of improving downstream water quality. This reach supports the highest salmonid densities in the Blackfoot River. The salmonid assemblage includes rainbow trout as the dominant fish, followed by brown trout, WSCT and bull trout. The majority of bull trout in this reach reproduce in the Monture and North Fork watersheds. Milltown dam located at the mouth of the Blackfoot River represents the largest fisheries impairment in the system. Lesser habitat related mainstem fisheries impairments are localized and include: 1) channel alterations, 2) lacks complexity, 3) road drainage, 4) livestock suppressed riparian vegetation and stream bank damage and 5) recreational impacts in the form of stream bank damage. This reach now supports moderate to high levels of whirling disease.

TMDL Issues

Listed segments include Clearwater River to Belmont Creek and Belmont Creek to mouth.

Listing history: 1996, 2000, and 2004

Listed causes of impairment: Siltation, habitat alterations, metals, total toxics, unionized ammonia

Dewatering Issues

Although this river reach is subject to upstream dewatering, it is not on the dewatered stream list due to generally sufficient flows except during drought.

Native Species Issues

Nodal bull trout habitat; proposed critical bull trout habitat, nodal bull trout habitat Junctions of cold tributaries considered bull trout recovery/ recreational conflict areas.

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

A USGS flow monitoring station (#1234000) established at river mile 7.9 has 68 years of flow data. FWP established the *Johnsrud* fish population survey section in 1982, continuous summer water temperature sites monitoring in 1993, and sentinel cage whirling disease monitoring sites in 1997. Water quality and macro-invertebrates were assessed at four locations in 1998-89 (Ingman et al. 1990). A riparian health inventory was conducted in 1999 from Corrick River bend to the mouth of Gold Creek, with noxious weeds, erosion and channel incision as the focus (Marler and Schmetterling 1999).

Ongoing Monitoring

FWP conducts bi-annual fish population surveys in the Johnsrud Section. USGS flow monitoring at the Bonner gauging station is continuous. FWP expects to continue to monitor summer water temperature data and whirling disease on an annual basis in this river reach.

Planned Future Monitoring

None beyond expected ongoing monitoring.

GRANTIER SPRING CREEK: Priority - Moderate

Description

Grantier Spring Creek is a spring-fed tributary to the upper Blackfoot River, located on private land. Grantier Spring Creek was the focus of extensive restoration over the past several years including channel reconstruction, habitat restoration and riparian land management changes. Grantier Spring Creek supports low densities of bull trout and fluvial WSCT as well as brown trout and brook trout, giving rise to a multi-species sport fishery value to the Blackfoot River and a high native species value. Because of restoration efforts, it now has low potential water quality benefits to the Blackfoot River. No fisheries impairments are present at this time.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

Adult bull trout use, likely historical bull trout spawning
Fluvial WSCT migration corridor

Restoration Activities

Past Restoration

Grantier Spring Creek was reconstructed in the early-mid 1990s. The project involved grazing management improvements.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1991 and 1994, measured water temperatures in 2001 and stream flows in 1989. FWP monitored whirling disease in 1997 and 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

SEVEN UP PETE CREEK: Priority - Moderate

Description

Seven Up Pete Creek, a 1st order tributary to the upper Blackfoot River drains the slopes of Crater Mountain and flows ~5 miles through both National Forest and private land. Private land is located only between mile 3 and 4. Seven Up Pete Creek ranks moderate in restoration priority and total rank. This rank is due to moderate native species values and single species sport fishery value to the Blackfoot River. Seven Up Pete Creek ranks low for potential to improve water quality in the Blackfoot River. Seven Up Pete Creek supports low densities of genetically pure fluvial WSCT and brook trout. Fisheries impairments include mining practices in headwater areas and an ATV trail that fords the stream a minimum of 15 times.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1999.

Ongoing Monitoring

None

Planned Future Monitoring

None

LOW PRIORITY STREAMS

ASHBY CREEK: Priority - Low

Description

Ashby Creek, a 2nd order tributary to Camas Creek in the Union Creek watershed, flows ~8 miles through public land in upper reaches and private agricultural land in the lower ~5.5 miles. Ashby Creek ranks low on the restoration priority list. Low native species value and lack of sport fishery value contributes this ranking, despite high potential for downstream water quality benefits. Ashby Creek supports a genetically pure population of resident WSCT along with brook trout and ranks moderate on the native species priority list. Densities are generally low for both species, although WSCT numbers increase in the upstream direction. Fisheries-related impairments, located in the middle and lower reaches, include 1) irrigation (seasonal fish passage and dewatering), 2) severe channel alterations, 3) lack of complex fish habitat, 4) excessive livestock access to riparian areas, and 5) elevated sediment from road drainage.

TMDL Issues

Not listed

Dewatering Issues

Channel alterations and inter-basin transfers to Arkansas Creek have caused dewatering for ~2.5 miles of Ashby Creek.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

Five Valleys Land Trust is taking the lead to secure a conservation easement to restore a portion of Ashby Creek and surrounding wetlands.

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 2000 and measured water temperatures in 2002.

Ongoing Monitoring

None

Planned Future Monitoring

Additional monitoring plans will be developed in conjunction with final restoration plans.

BEAR CREEK (R.M. 37.5): Priority - Low

Description

Bear Creek, a small, 2nd order tributary to the middle Blackfoot River, flows ~4 miles through public (BLM) and private land in middle reaches. A lack of potential water quality benefits, moderate native species value and moderate biological ranking characterizes Bear

Creek's low total ranking on the restoration priority list. Bear Creek supports fluvial WSCT, providing low (single species) sport fishery value to the Blackfoot River. The lower reaches support low densities WSCT that increase to moderate levels in the middle and upper reaches. Fisheries impairments include undersize culverts limiting fish passage.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues

WSCT genetic composition: tested 96.5% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1998.

Ongoing Monitoring

None

Planned Future Monitoring

None

CAMAS CREEK: Priority – Low

Description

Camas Creek, a 3rd order tributary to Union Creek in the lower Blackfoot River water shed, flows ~10 miles through private agricultural land. Overall, Camas Creek ranks moderate on the restoration priority list. This low rank results, low native species value, and no sport fishery value to the Blackfoot River despite potential downstream water quality benefits. Camas Creek supports resident WSCT and brook trout. Fish sampling found no salmonids in the lower Camas Creek. The middle reaches support brook trout in low number, while moderate numbers of WSCT dominates the headwaters, including Smith Creek an upper tributary of Camas Creek. Fisheries impairment in the middle and lower reaches include 1) livestock-induced stream bank degradation, 2) riparian vegetation suppression, and 3) lack of complex fish habitat (instream wood).

TMDL Issues

Listing history: 1996; in 2000, 2002, & 2004 uses assess are fully supported. Other uses not assessed.

Listed causes of impairment: Flow alterations, siltation, and thermal modifications.

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: untested

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 2000 and measured stream temperatures in 2002.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHAMBERLAIN CREEK, West Fork: Priority - Low**Description**

The West Fork of Chamberlain Creek, a small, 1st order tributary to lower Chamberlain Creek, flows ~2.5 miles entirely through private (Plum Creek) lands. The West Fork ranks low on the restoration, biological, and native species priority list. The lower reaches of the West Fork likely supports fluvial WSCT. Fisheries impairments, located in the lower reaches, are elevated instream sediment levels from poor road drainage. No fish sampling data has been collected on the West Fork; however, the mainstem near the mouth of the West Fork supports high densities of fluvial WSCT along with low numbers of brook trout. The West Fork of Chamberlain Creek tested negative for whirling disease in 1999 and 2000.

TMDL Issues

Not listed

Dewatering Issues

None

Native Species Issues**Restoration Activities****Past Restoration**

Some erosion control and riparian grazing changes were implemented in the mid 1990s.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP tested for whirling disease and measured stream temperatures in 1999 and 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHICKEN CREEK: Priority - Low

Description

Chicken Creek, a small 1st order tributary to Nevada Creek, flows ~4 miles through mainly private land with a small portion of public land (National Forest) near the headwaters. The total rank for Chicken Creek is low. This low rank comes from low native species value, no sport fishery value to the Blackfoot River despite high potential water quality benefits. Lower Chicken Creek supports low densities of resident rainbow trout, while the middle reaches support low numbers of resident WSCT. Fisheries impairments in the lower 1.5 miles include 1) livestock-induced stream channel degradation, 2) riparian vegetation suppression, 3) a lack complex fish habitat (instream wood), and 4) an undersized culvert on the National Forest.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Isolet WSCT population

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHIMNEY CREEK (Trib. to Douglas Creek): Priority - Low

Description

Chimney Creek, a 1st order tributary to middle Douglas Creek, flows ~7.4 miles entirely through private ranch land. Chimney Creek ranks low on the restoration priority list for non-project streams. Despite potential for downstream water quality and moderate social rank, Chimney Creek ranks low due to low native species value, and no sport fishery value to the Blackfoot River. Lower Chimney Creek supports only non-game fish species. The middle reaches support low densities of resident WSCT. Fisheries impairments include 1) livestock induced stream channel degradation and riparian vegetation suppression, 2) the lack of complex fish habitat (instream wood), and 3) channel alterations (instream reservoirs for irrigation).

TMDL Issues

Not listed; Tributary to the 303(d) listed Douglas Creek

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

LITTLE MOOSE CREEK: Priority - Low

Description

Little Moose Creek is a small 1st order tributary that drains the northern slopes of Ogden Mountain. The majority of its 1.9 miles flow through public (National Forest and State) lands. Only the lower 0.4 miles flow on private land where it empties into an isolated oxbow pond, only biologically connecting into the Blackfoot River during spring run-off. Little Moose Creek ranks low on the restoration priority and total rank list. Little Moose Creek supports very low densities of resident WSCT throughout its entire length. No known fishery impairments are present at this time.

TMDL Issues

Not Listed

Dewatering Issues

None

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP measured water temperature in 2002 and 2003. USFS inventoried fish populations.

Ongoing Monitoring

None

Planned Future Monitoring

None

MURRAY CREEK: Priority - Low**Description**

Murray Creek, a 2nd order tributary to Douglas Creek, flows ~8 miles through public (BLM) and private agricultural land downstream of mile ~4. Murray Creek received a low rank on the restoration priority and total rank list. This rank relates to a low native species rank, lack of a sport fishery value to the Blackfoot River despite potential to improve downstream water quality. Murray Creek supports low densities of genetically pure resident WSCT in the middle and upper reaches with densities increasing in the upstream direction. Fisheries impairments, located in the lower and middle reaches, include: 1) poor road crossings (perched and undersized culverts) and road drainage, 2) irrigation (dewatering and fish entrainment), 3) lack of instream complexity, and 4) degraded stream banks resulting from excessive livestock access to riparian areas.

TMDL Issues

Listing history: 1996; in 2000, 2002, & 2004 lacks sufficient credible data for impairment determinations.

Listed causes of impairment: Flow and habitat alteration, thermal modifications, and siltation.

Dewatering Issues

The lower three miles of Murray Creek are on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish population and measured stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

SHEEP CREEK: Priority - Low**Description**

Sheep Creek, a small 1st order tributary to Sturgeon Creek, located in the Douglas Creek watershed, flows ~4 miles exclusively through private ranch land. Sheep Creek ranks low for total rank, due to low native species value, lack of a sport fishery value, despite high potential to improve downstream water quality and a high social rank. No salmonid or other fish species were detected in Sheep Creek when it was sampled in 2000. Riparian impairments include low instream flows due to an aggraded channel and excessive livestock access to stream banks over most of the channel.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

No native fish present

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP sampled Sheep Creek for fish in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

WARM SPRINGS CREEK: Priority - Low**Description**

Warm Springs Creek, a small 1st order tributary to lower Gold Creek, flows ~2.5 miles primarily through private land with a small portion of public land. Warm Springs Creek ranks low for restoration priority and total rank. This low rank is due to low native species value, low (single-species) sport fishery value to the Blackfoot River and low potential for improved water quality benefits. However, Warm Springs Creek has potential to increase flow in the Blackfoot. Despite bull trout core area status, Warm Springs Creek supports low densities of resident rainbow trout and no other species. Fisheries impairments include: 1) fish passage problems at a road crossing, 2) excess road drainage, and 3) irrigation impacts.

TMDL Issues

Not listed

Dewatering Issues

The lower mile of Warm Springs Creek is on the dewatered stream list due to irrigation.

Native Species Issues

Bull trout core area stream

WSCT not detected

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 1998.

Ongoing Monitoring

None

Planned Future Monitoring

None

FINN CREEK: Priority - Low**Description**

Finn Creek, a small 2nd order tributary to upper Nevada Creek, flows ~3.3 miles entirely through private ranch land. Finn Creek ranks low in total ranking and currently has no native species or sport fishery value to the Blackfoot River, but did rank high in potential water quality benefits. No fish were collected on Finn Creek when it was sampled in 2001.

Fisheries impairments in the lower ~2 miles include: 1) low flows due to an aggraded channel, 2) livestock-induced stream bank degradation and riparian vegetation suppression, and 3) lack of complex fish habitat (instream wood).

TMDL Issues

Not listed; tributary to Nevada Creek a 303(d) listed stream

Dewatering Issues

Unknown

Native Species Issues

No native fish present

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

HALFWAY CREEK: Priority -Low

Description

Halfway Creek, a 3rd order stream, flows northwest 8.5 miles through private rangeland and enters Nevada Creek at mile 40.3. Halfway Creek ranks low in the total ranking due to a low native species value, lack of sport fishery value to the Blackfoot River and moderate social and financial rank. Halfway Creek ranked high in potential to improve downstream water quality including temperature, sediment and nutrients. No salmonids were collected at two sampling sites in Halfway Creek in 2001. Fish species were limited to redbreast shiner, longnose sucker and sculpin. Spotted frogs and western toads were also observed. Fisheries impairments include: 1) degraded riparian vegetation; 2) excessive livestock access to stream banks; 3) lack of instream complexity; 4) high sediment levels; and 5) thermal modification.

TMDL Issues

Not listed; Tributary to the 303(d) listed Nevada Creek

Dewatering Issues

Unknown

Native Species Issues

No native salmonids found

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations and measured water temperatures and stream flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

MITCHELL CREEK: Priority - Low**Description**

Mitchell Creek, a 1st order tributary to Nevada Creek, flows ~7 miles through a combination of public (National Forest) land in the headwaters and private agricultural land downstream of mile ~4. Mitchell Creek ranks low in restoration priority and total rank due to low native species value, lack of sport fishery value to the Blackfoot River, and moderate potential to improve downstream water quality. The only salmonid present in Mitchell Creek is resident WSCT in low to moderate densities. Fisheries impairments in middle reaches include 1) an undersized culvert near the mouth, 2) a general lack complex fish habitat, and 3) livestock access to stream banks.

TMDL Issues

Not listed; Tributary to the 303(d) listed Nevada Creek

Dewatering Issues

Unknown

Native Fish Issues

WSCT genetic composition: untested

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream temperatures and stream flows in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

STURGEON CREEK: Priority - Low

Description

Sturgeon Creek, a small 3rd order tributary to Douglas Creek, flows ~4 miles exclusively through private ranch land. Sturgeon Creek ranks low on the restoration priority and total rank list. This low rank is due to lack of native species and absence of sport fishery value to the Blackfoot River. However, Sturgeon Creek ranks high for potential to improve downstream water quality. No salmonids were sampled in Sturgeon creek, but a small spring creek tributary supports a small disjunct population of resident WSCT. Fisheries impairments located throughout the drainage include: 1) channel alterations (instream reservoir), 2) degraded riparian vegetation, 3) inadequate instream flow, and 4) excessive livestock access to stream banks.

TMDL Issues

Not listed; Tributary to the 303(d) listed Douglas Creek

Dewatering Issues

Unknown extent

Native Species Issues

WSCT genetic composition: tested 100% WSCT in the spring creek

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population and measured stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

WASHOE CREEK: Priority - Low

Description

Washoe Creek, a small 1st order stream, flows ~6.2 miles through public land (BLM) in headwaters and private ranch land downstream of mile ~3.5. Washoe Creek ranks low on the restoration priority and total ranking list. This low rank is due to low native species value, lack of sport fishery value to the Blackfoot River and potential to improve downstream water quality. Washoe Creek ranks moderate for social and financial consideration. Washoe Creek supports resident WSCT. Fisheries impairments in the lower Washoe Creek include excessive livestock access to stream banks and lack of instream complexity.

TMDL Issues

Listing history: 1996; in 2000, 2002, and 2004 uses assessed are fully supporting. Other uses not assessed.

Listed causes of impairment: Flow and habitat alterations and siltation.

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 99% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2000 and 2002 and measured water temperatures in 2002.

Ongoing Monitoring

None

Planned Future Monitoring

None

ARKANSAS CREEK: Priority - Low

Description

Arkansas Creek, a small 1st order tributary to Ashby Creek in the Union Creek watershed, flows 5 miles through private (Plum Creek and agricultural) land. It ranks moderate in potential water quality benefits, low in native species value, and provides no sport fishery value to the Blackfoot River, giving Arkansas Creek a low total ranking on the restoration priority list. Arkansas Creek supports pure resident WSCT and brook trout in its lower and middle reaches. WSCT densities are low but increase slightly in the upstream direction, while brook trout densities are low. Fisheries impairments include: 1) elevated stream

sediment levels from poor road drainage, 2) extensive channel alterations in mid-to lower reaches, 3) livestock induced bank degradation, and 4) dewatering.

TMDL Issues

Not listed

Dewatering Issues

The lower two miles of Arkansas Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

The NRCS, Five Valleys Land Trust and the principle landowner are planning a comprehensive stream and wetland restoration project in the lower reaches of Ashby Creek. This project may involve lower Arkansas Creek.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations 2000 and measured stream temperatures in 2002.

Ongoing Monitoring

None

Planned Future Monitoring

Additional monitoring will be developed in conjunction with restoration plans.

BUFFALO GULCH: Priority - Low

Description

Buffalo Gulch, a small 2nd order tributary to the Nevada Creek Reservoir, flows ~7 miles through both public (National Forest) in headwaters and private land in the lower ~4 miles of stream. Buffalo Gulch ranks high in potential water quality benefits, moderate in native species value, and provides no sport fishery value to the Blackfoot River, resulting in a low total rank for restoration priority. Lower Buffalo Gulch supports moderate densities of resident WSCT and low densities of rainbow trout. Fisheries impairments in the lower ~3 miles of stream include 1) livestock-induced stream bank damage, 2) riparian vegetation suppression and 3) lack of complex fish habitat (instream wood).

TMDL Issues

Listing History: 2000, 2002, & 2004

Listed causes of impairment: Siltation and habitat alterations.

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population, measured flows and collected water temperature data in 2001.

Ongoing Monitoring

None although a road sediment and culvert survey on private land is recommended.

Planned Future Monitoring

None

CALIFORNIA GULCH: Priority - Low

Description

California Gulch, a small 2nd order tributary to Buffalo Gulch in the upper Nevada Creek watershed, flows ~3.5 miles through both public (National Forest) and private land in the lower ~2 miles. High potential water quality benefits, low native species value, low social rank, and no sport fishery value to the Blackfoot River, ranks California Gulch low on the restoration priority list for non-project streams. California Gulch supports only resident WSCT. Fisheries impairments in the lower ~2 miles include 1) lack of complex fish habitat (instream wood), 2) livestock-induced stream bank degradation and riparian vegetation suppression, and 3) reduced instream flows from irrigation.

TMDL Issues

Not listed: tributary to Buffalo Gulch a 303(d) listed stream

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

COTTONWOOD CREEK (Trib. to Douglas Creek): Priority - Low

Description

Cottonwood Creek, a 2nd order tributary to lower Douglas Creek, flows ~ 18 miles first through public (BLM) and then private agricultural land in the lower ~8 miles of the stream. Overall, it ranks low on the restoration priority list. A low native species value, low social ranking, and lack of sport fishery value generate its low total and biological ranking. Due to dewatering, potential for a reduction in sediment, temperature and nutrients, Cottonwood Creek ranks high in potential water quality benefits. The upper reaches support high densities of resident WSCT and brook trout. Lower Cottonwood Creek supports only long nose suckers. Fisheries impairments, located in the lower reaches, include: 1) livestock induced stream bank degradation and riparian vegetation suppression, 2) lack of complex fish habitat (instream wood), 3) undersize road crossing culverts causing erosion, and 4) dewatering.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Siltation, thermal modification, nutrients, salinity, TDS, chlorides.

Dewatering Issues

The lower five miles of Cottonwood Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

Some restoration work has occurred in the lower basin. Projects involved riparian grazing improvements, instream restoration and fish ladders at diversions.

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish population since 1998 and 2000 and measured water temperatures and stream flows in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

JEFFERSON CREEK: Priority - Low**Description**

Jefferson Creek, a 2nd order tributary to Nevada Creek, drains the eastern slopes of Dalton Mountain and flows ~7.5 miles entirely through private land except for a section of public (BLM) land between mile 4 and 5. Jefferson Creek ranks low in the total ranking and restoration priority list. This rank is due a low (single) native species value, lack of sport fishery value to the Blackfoot River and low social and financial rank. Jefferson Creek ranked high in potential to improve downstream water quality due to its impaired condition. Jefferson Creek supports populations of resident WSCT and rainbow trout. Rainbow trout are found in low numbers in lower reaches. WSCT are found throughout the drainage in generally low densities. Fisheries impairments in the upper and middle reaches include: 1) poor road crossings (crushed undersized culvert), 2) channel alterations (mining disturbance), 3) lack of instream complexity, and 4) low instream flow.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow and habitat alterations and siltation.

Dewatering Issues

The lower mile of Jefferson Creek is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 93% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations and measured stream temperatures and stream flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

NEVADA CREEK (Lower): Priority - Low

Description

Nevada Creek below the reservoir is a large 3rd order tributary to the middle Blackfoot River that flows ~33 miles exclusively through private ranch land. Lower Nevada Creek ranks low on the restoration priority and total rank list due to the lack of native species and sport fishery values to the Blackfoot River. Although Nevada Creek ranks low overall, it ranked high for potential to increase flow and potential to improve downstream water quality to the Blackfoot River. Salmonids (rainbow trout and brown trout) inhabit lower Nevada Creek in very low densities immediately below Nevada Creek reservoir, but are absent from lower Nevada Creek. Fisheries-related impairments, located throughout the drainage, include: 1) irrigation impacts (entrainment, dewatering), 2) channel alterations, 3) lack of instream complexity, 4) degraded riparian vegetation resulting from excessive livestock access to riparian areas, and 5) low water quality. In 2003, low levels of whirling disease were detected in Nevada Creek.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairments: Flow and habitat alterations, nutrients, siltation, metals, thermal modifications, and suspended solids.

Dewatering Issues

The lower 25.3 miles of lower Nevada Creek is on the dewatered stream list due to reservoir management and irrigation.

Native Species Issues

WSCT not detected in lower Nevada Creek

Restoration Activities

Past Restoration

Grazing related projects have been completed in some portions of lower Nevada Creek, Fish ladder were installed on several irrigation diversions.

Current/Planned Restoration

Restoration activities are ongoing and focus on grazing issues.

Monitoring Activities

Past Monitoring

FWP inventoried fish population in 1989 and 1990 and resurveyed sample sites in 1994 and 2000. FWP measured stream temperatures annually from 1998 through 2004 and stream flows in 1989, 2000 and 2001. A USGS gauging station monitors stream flows near the mouth of Nevada Creek and a DNRC gauging station monitors flows below the reservoir. FWP tested for whirling disease below the reservoir in 2003. An ambient water quality survey was completed in 1989 (Ingman et al. 1990).

Ongoing Monitoring

Water temperature assessments are ongoing

Planned Future Monitoring

Periodic fish population will be completed.

WASHINGTON CREEK: Priority - Low

Description

Washington Creek, a 2nd order tributary to upper Nevada Creek, flows ~11 miles through mixed public (National Forest, BLM) and private ownership. Washington Creek ranks low for non-project streams on the restoration priority and total rank list. This low rank is due to: 1) low native species value, 2) lack of sport fishery value to the Blackfoot River, and 3) low social and financial rank. Washington Creek ranks high for potential to improve downstream water quality if restored due to its impaired condition. Washington Creek contains resident WSCT and resident brook trout throughout the drainage. Densities of WSCT decrease in the downstream direction. Brook trout are present in low densities from a fish barrier (mile 7.2) downstream to the mouth. Fisheries impairments are extensive and include: 1) channel alterations related to past placer mining irrigation, 2) channel alterations near the mouth, 3) lack of instream complexity, 4) stream bank damages resulting from excessive livestock access to riparian areas, and 5) at least one road crossing at site identified by the USFS.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow and habitat alterations and siltation.

Dewatering Issues

The lower mile of Washington Creek is on the dewatered stream list due to irrigation.

Native Species Issues

Isolet WSCT population.

WSCT genetic composition: untested

Restoration Activities

Past Restoration

Patented mining reclamation in 2001 and 2002

Current/Planned Restoration

None although a potential project would be the improvement of a fish passage barrier located at the upper end of the patented mining claim to prevent upstream invasion of brook trout.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations, measured stream temperatures and collected stream flow data in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

BARTLETT CREEK: Priority - Low

Description

Bartlett Creek, a 1st order tributary to Alice Creek in the upper Blackfoot River watershed, flows ~7 miles through private land and a small portion of public land (National Forest) in the upper reaches. Bartlett Creek ranks low on the restoration priority list. This low ranking is the result of low native species value, lack of sport fishery value and low potential downstream water quality benefits to the Blackfoot River. Bartlett Creek supports populations WSCT and brook trout. Fish densities are very low for both species in the lower reaches. High densities of brook trout were the only species found in the middle reaches. Fisheries impairments in lower Bartlett Creek include lack of complex fish habitat (instream wood) and localized recreational degradation (campsites) to stream banks.

TMDL Issues

Not listed

Dewatering Issues

Natural dewatering occurs in the middle reaches the extent of which is unknown.

Native Species Issues

WSCT genetic composition: tested 98.8% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1999

Ongoing Monitoring

None

Planned Future Monitoring

None

FRAZIER CREEK: Priority - Low

Description

Frazier Creek, a small 2nd tributary to the middle Blackfoot River, flows ~3.6 miles through both public (BLM) and private land. The private land is located in the lower two-thirds of the stream. Frazier ranks low on the restoration priority list due to its low native species value, low social and financial rank, lack of sport fishery value to the Blackfoot River and a technical inability to address the entire stream system. However, Frazier has moderate potential for water quality benefits and potential to increase stream flows to Blackfoot River. Frazier Creek supports a disjunct resident population of genetically pure WSCT and no other fish species. Fisheries impairments include: 1) reduced instream flows, 2) channel alterations

(two instream reservoirs), 3) stream channel fragmentation preventing fish passage, and 4) livestock grazing impacts to riparian areas.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Flow and habitat alterations.

Dewatering Issues

The lower 1.5 miles of Frazier Creek is dewatered stream list due to irrigation.

Native Species Issues

Isolate WSCT Population

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2000 and measured stream temperatures near the mouth in 2002 and 2003.

Ongoing Monitoring

None

Planned Future Monitoring

None

GALLAGHER CREEK: Priority - Low

Description

Gallagher Creek, a 2nd order tributary to upper Nevada Creek, flows ~7 miles through both public (National Forest) land in headwaters and private land downstream of mile ~3. Low native species value, low water quality benefits, and no sport fishery value to the Blackfoot River, ranks Gallagher Creek low on the restoration priority list. Gallagher Creek supports only resident WSCT. The lower reaches support low densities of WSCT that increase to moderate numbers in middle reaches. Fisheries impairments in lower reaches include localized livestock-induced stream bank damage and an undersized culvert.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairments: Flow and habitat alterations

Dewatering Issues

The lower three miles of Gallagher Creek is on dewatered stream list due to irrigation.

Native Species Issues

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2001.

Ongoing Monitoring

None

Additional Planned Monitoring

None

GAME CREEK: Priority - Low

Description

Game Creek, a 1st order tributary to Union Creek, flows ~5.6 miles through industrial forest (Plum Creek) and State land in the headwaters and private ranch land downstream of mile ~2. Low native species value, low social ranking, lack of sport fishery value to the Blackfoot River and moderate potential in water quality improvement benefits, ranks Game Creek low on the restoration and total rank priority list. Lower Game Creek supports resident WSCT. Fisheries impairments in middle reaches include localized livestock induced stream bank damage and a perched culvert limiting fish passage.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 98.7% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

HUMBUG CREEK: Priority - Low**Description**

Humbug Creek, a small 2nd order disjunct tributary to Poorman Creek, is located on the south side of the Lincoln Valley. Humbug Creek flows ~3 miles exclusively through private land. Humbug Creek ranks low in the total rank and restoration priority list. This rank is due to a low native species value, no sport fishery value to the Blackfoot River, low potential to improve downstream water quality and a moderate social and financial rank. Humbug Creek supports moderate densities of resident WSCT. Fisheries impairments in the lower reaches include: 1) dewatering, 2) channel alterations, 3) degraded riparian vegetation, 4) excessive livestock access to stream banks, and 5) a small mine in the South Fork, which contributes to channel instability.

TMDL Issues

Not listed

Dewatering Issues

The lower mile of Humbug Creek is on the dewatered stream list due to natural losses.

Native Species Issues

Isolet WSCT population

WSCT genetic composition: tested 100% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

A project is being planned to convert irrigation from the Blackfoot River to a groundwater source.

Monitoring Activities**Past Monitoring**

FWP inventoried fish populations in 1995.

Ongoing Monitoring

None

Planned Future Monitoring

None

SHINGLE MILL CREEK: Priority - Low**Description**

Shingle Mill Creek, a 1st order tributary to upper Nevada Creek, originates on the western slope of Nevada Mountain. Shingle Mill Creek flows ~5.5 miles mostly through public

(National Forest) with private ranch land in lower reaches. Shingle Mill Creek ranks low on the restoration and total rank list due to low native species value, low potential for improving water quality and lack of sport fishery value to the Blackfoot River. Shingle Mill Creek supports resident WSCT, with population densities that decrease in the downstream direction. Fisheries impairments in the lower reaches include irrigation impacts (dewatering and passage) and excessive livestock access to stream banks.

TMDL Issues

Not listed: Tributary to the 303(d) listed Nevada Creek

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2001 and measured stream flows in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

BEAR CREEK (Trib. to the North Fork) Priority- Moderate Description

Bear Creek, a small spring-fed 2nd order disjunct tributary of the North Fork Blackfoot River, flows ~2 miles through private land. Bear Creek ranks low on the restoration priority list, despite bull trout core area status. Bear Creek has a moderate native species value due to core area status, but lacks potential water quality benefits and provides no sport fishery value. Bear Creek supports low densities of genetically unaltered resident WSCT and no other fish species. Fisheries impairments in lower Bear Creek include dewatering and possibly WSCT entrainment to irrigation canals.

TMDL Issues

Not listed

Dewatering Issues

Both natural and human-caused dewater approximately one mile of lower Bear Creek.

Native Species Issues

Isolet WSCT population

WSCT genetic composition: tested 100% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP inventoried fish population in 1998.

Ongoing Monitoring

None

Planned Future Monitoring

None

STRICKLAND CREEK: Priority - Low**Description**

Strickland Creek, a 2nd order tributary to Halfway Creek, originates on the northern slopes of Gravely Mountain in the Garnet Mountain range. Strickland Creek flows ~6.5 miles exclusively through private ranch land. Strickland Creek ranks low in total rank and restoration priority due to lack of native species, no sport fishery value to the Blackfoot River, and low social and financial rank. However, Strickland Creek has high potential to improve downstream water quality. No salmonids were collected in lower Strickland Creek when it was sampled in 2001. Fisheries impairments on lower Strickland Creek include lack of instream complexity and degraded stream banks from excessive livestock access to riparian areas.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

No native salmonids present

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2001.

Ongoing Monitoring

None

Additional Planned Monitoring

None

WARD CREEK: Priority - Low

Description

Ward Creek, 2nd order tributary to the North Fork of the Blackfoot River, originates on Arrastra Mountain and flows ~17 miles through mixed ownership, with the lower ~6 miles exclusively on private land. Ward Creek is a tributary to two large lakes (Browns and Kleinschmidt Lakes) in the Blackfoot Valley. Ward Creek ranks low for restoration priority and total rank. This low rank is due to lack of native species, no sport fishery value to the Blackfoot River and low social and financial rank. Ward Creek ranks high in potential to improve downstream water quality. Ward Creek does not support native salmonids, but rather low densities of resident brook trout in lower reaches and moderate densities in upper reaches. Fisheries impairments are extensive and include lack of instream complexity and degraded stream banks and riparian areas resulting from excessive riparian livestock access.

TMDL Issues

Listing history: 1996, 2000, 2002, & 2004

Listed causes of impairment: Habitat and flow alterations and siltation.

Dewatering Issues

Unknown

Native Species Issues

No native salmonids present

Restoration Activities

Past Restoration

None

Current/Planned Restoration

Grazing management changes area planned for approximately one mile of stream.

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

INDIAN CREEK: Priority - Low

Description

Indian Creek, a 2nd order tributary to the Nevada Creek Reservoir, flows ~4.5 miles through mostly public (BLM) land and a small portion of private land near the mouth. Indian Creek ranks low on the total ranking and restoration priority list due to low native species value, no sport fishery value to the Blackfoot River, the lack of potential to improve water quality and a moderate social ranking. Indian creek supports resident WSCT in low densities within the lower to middle reaches. Fisheries impairments include lack of instream complexity in the lower reaches.

TMDL Issues

Not listed; Tributary to the 303(d) listed Nevada Creek

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

WARREN CREEK (East Fork from Doney Lake): Priority - Low

Description

East Fork Warren Creek, a 2nd order tributary stream to Warren Creek, drains the south-eastern slopes of Ovando Mountain. The upper one mile of stream is on public land (State) then flows predominately south ~3.8 miles through private industrial forest land (Plum Creek) and ranch land to its confluence with the main-stem Warren Creek (mile 8.6). At stream mile 1.6, a small (0.45 mile) effluent tributary stream from Doney Lake enters. East Fork Warren Creek ranks low on the restoration priority and total ranking list because it lacks sport fishery value and potential to increase flows to the Blackfoot River. However, it ranked moderate in potential to improve downstream water quality. East Fork Warren Creek supports low numbers of WSCT and resident brook trout in its lower reaches. Fishery impairments include channel alterations and excessive livestock grazing impacts to riparian vegetation.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native species issues

No evidence of WSCT reproduction

Restoration Activities**Past Restoration**

None

Current/Planned Restoration Activities

None

Monitoring Activities**Past Monitoring**

FWP conducted fish population surveys in 2004.

Ongoing Monitoring

None

Planned Future Monitoring

None

BURNT BRIDGE CREEK: Priority - Low**Description**

Burnt Bridge Creek, a small 1st order tributary to Gold Creek in the lower Blackfoot River watershed, flows ~2 miles through both private land and a small portion of public land near the mouth. Burnt Bridge Creek ranks low on the restoration priority list and although located in a bull trout core area, Burnt Bridge Creek also ranks low in native species value. Burnt Bridge ranked low in biological priority due to low potential to improve downstream water quality and also currently provides no sport fishery value to the Blackfoot River. Burnt Bridge Creek supports only resident brook trout in low densities. Fisheries impairments include: 1) an entrenched and altered stream channel, 2) elevated stream sediment levels from poor road drainage, 3) undersized culverts, 4) localized areas of riparian vegetation suppression, and 5) reduced instream flows from irrigation.

TMDL Issues

Not listed

Dewatering Issues

One mile of Burnt Bridge is on the dewatered stream list due to irrigation.

Native Species Issues

Bull trout core area stream

WSCT not detected

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations in 1998.

Ongoing Monitoring

None

Planned Future Monitoring

None

CLEAR CREEK: Priority - Low

Description

Clear Creek, a small 2nd order tributary to Buffalo Gulch in the upper Nevada Creek watershed, flows ~4 miles through both public (National Forest) in the upper drainage and private land downstream of mile ~1.5. Clear Creek ranked low in restoration priority and total rank. Clear Creek's low priority is generated from low native species value, no sport fishery value to the Blackfoot River and lack of potential downstream water quality benefits. Clear Creek supports a resident WSCT population. Densities are low throughout the drainage, although, numbers increase in middle reaches. Fisheries impairments include at least two undersized culverts in the watershed and minor livestock damage to riparian vegetation in the middle reaches.

TMDL Issues

Not listed; tributary to Buffalo Gulch a 303(d) listed stream

Dewatering Issues

Unknown

Native Species Issues

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

FRAZIER CREEK, North Fork: Priority - Low

Description

North Fork of Frazier Creek, a small 1st order tributary to Frazier Creek in the middle Blackfoot River watershed, flows ~2 miles through private timber and ranch land. The North Fork ranks low on the restoration priority list because of low native species value, low water quality benefits, no sport fishery value to the Blackfoot River and a technical inability to address the entire stream system. The North Fork supports a genetically pure population of resident WSCT. This population is disjunct from both upper Frazier Creek and the Blackfoot River due to instream irrigation reservoirs above and below the North Fork confluence. Fisheries impairments include: 1) fragmentation of stream reaches, 2) irrigation (entrainment and low flows), and 3) localized livestock-induced stream bank damage.

TMDL Issues

Not listed

Dewatering Issues

The lower 0.5 miles of NF Frazier Creek is on the dewatered stream list due to irrigation.

Native Species Issues

Isolet WSCT

WSCT genetic composition: tested 100% WSCT

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 1999 and 2002.

Ongoing Monitoring

None

Planned Future Monitoring

None

GLEASON CREEK: Priority - Low

Description

Gleason Creek, a 1st order tributary to upper Nevada Creek, flows ~4.4 miles entirely through public (National Forest) land. With low native species value, no potential water quality benefits, and no sport fishery value to the Blackfoot River, Gleason Creek ranks low on the restoration and total rank priority list. FWP surveys report Gleason Creek supports low densities of resident WSCT with no other fish species. The USFS observed as single

bull trout in a snorkeling survey in lower Gleason Creek in 1999. Fisheries impairments near the mouth of Gleason Creek include a perched culvert limiting fish passage and mining impacts.

TMDL Issues

Not listed; Tributary to the 303(d) listed Nevada Creek

Dewatering Issues

None known

Native Species Issues

WSCT genetic composition: untested. USFS observed one bull trout during a 1999 survey

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP inventoried fish populations and measured stream flow in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

MCDERMOTT CREEK: Priority - Low

Description

McDermott Creek, a small 1st order stream, drains the southwest slopes of Mineral Hill in the Scapegoat Wilderness. This stream flows south 3.6 miles through public (National Forest) and private land before emptying into northern end of Coopers Lake. McDermott Creek received a low ranking on the restoration priority and total rank list due to a moderate native species rank, and the lack of any known impairments. McDermott Creek supports moderate densities of brook trout and very low numbers of WSCT.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

Bull trout core area stream

WSCT genetic composition: untested

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 2001.

Ongoing Monitoring

None

Planned Future Monitoring

None

CHIMNEY CREEK (Nevada Creek trib. via Lincoln Slough): Priority - Low

Description

Chimney Creek, a small 1st order tributary to Lincoln Slough in the lower Nevada Creek watershed, flows ~5 miles through both public (National Forest) land in the upper drainage and private ranch land in the lower ~2.5 miles of stream. Chimney Creek ranks low in total rank due to low native species value, low social rankings, no sport fishery value, and a technical inability to address the entire stream system. Chimney Creek supports a small, low density, disjunct population of resident WSCT in middle reaches. Fisheries impairments in the lower 2 miles include: 1) localized livestock induced stream bank degradation, 2) dewatering from irrigation, 3) channel alterations, 4) undersized culverts, and 5) irrigation canals creating barriers to fish passage.

TMDL Issues

Not listed

Dewatering Issues

The lower 0.5 miles is on the dewatered stream list due to irrigation.

Native Species Issues

WSCT genetic composition: tested 100% WSCT

Isolet WSCT population

Restoration Activities

Past Restoration

None

Current/Planned Restoration

None

Monitoring Activities

Past Monitoring

FWP conducted fish population surveys in 2000.

Ongoing Monitoring

None

Planned Future Monitoring

None

SMITH CREEK: Priority - Low**Description**

Smith Creek is a small 1st order tributary stream to Camas Creek, a tributary to Union Creek in the Garnet Mountain range in the lower Blackfoot River watershed. Smith Creek flows~1.1 miles exclusively through private ranch and industrial forest land (Plum Creek). It ranks low on the restoration priority and total rank list because of its low native species value, no sport fishery value to the Blackfoot River, and low water quality improvement ranking. Smith Creek supports high densities of resident WSCT. Fisheries impairments include: 1) areas of livestock grazing impacts to riparian vegetation and stream banks, 2) road crossing (undersized culvert) and 3) road drainage.

TMDL Issues

Not listed

Dewatering Issues

Unknown

Native Species Issues

WSCT genetic composition: tested 99% WSCT

Restoration Activities**Past Restoration**

None

Current/Planned Restoration

None

Monitoring Activities**Past Monitoring**

FWP conducted fish population surveys in 2000 and 2001 near the mouth.

Ongoing Monitoring

None

Planned Future Monitoring

None

APPENDIX E

FISHERIES PRIORITIZATION MATRIX

Appendix E. Fisheries Prioritization Matrix

Stream Name	Project site stream	Impaired	Bull trout spawning present	Bull trout rearing present area	Fluvial WSC present	Resident WSC present	Native Species Totals	Native Species Ranking	Fishery BFR (M, U, S)	Sport Fishery value to stream	Bionomics able to address entire stream	Increased stream flows to BFR	Downstream (H, N, B)	Improves downstream water quality by reducing sediment	Improves downstream water quality by reducing turbidity	Water Quality Score	TMN stream	Water Quality Ranking	Bio score	Bio ranking	Landowner manager cooperation	Restoration feasibility cost/mile	Demo/ Edu value	Social and Financial Considerations-50 possible points					
																								Social ranking	Social score	Total Rank			
Alice Creek	N	Y	20	10	20	10	50	2	10	20	20	20	H	10	10	10	3	3	90	6	15	20	5	40	2	130	10		
Arkansas Creek	N	Y			20	10	10	6		20	20	20	N	10	10	20	2	4	50	6	10	15	10	35	2	85	19		
Arastra Creek	N	Y	20	10		20	50	2	20				N	10	10	20	Y	4	90	6	10	10	5	10	25	3	115	13	
Ashly Creek	Y	Y			20	10	10	6		20	20	20	H	10	10	30	Y	1	60	9	20	15	5	10	35	2	95	17	
Bartlett Creek	N	Y			20	10	10	6	10	20	20	20	B	10	10	10		3	40	11	15	20	5	40	2	80	20		
Bassett Springs Creek	Y	Y			20	10	50	5		20	20	20	B	10	10	0		3	40	11	15	20	5	10	35	2	105	16	
Bear Creek Inb to NF	N	Y	10	10		20	30	4	20	20	20	20	B	10	10	0		4	40	11	15	20	5	45	1	125	11		
Bear Creek (R M 12.2)	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Bear Creek (R M 37.5)	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Beaver Creek	N	Y	20	10	20	10	60	1	20	20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Belmont Creek	N	Y			20	10	20	0		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Black Bear Creek	N	Y			20	10	20	0		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 1	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 2	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 3	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 4	N	Y			20	10	30	4		20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 5	N	Y	20	10	20	10	50	2	20	20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blackfoot River 6	N	Y	20	10	20	10	50	2	20	20	20	20	B	10	10	0		4	50	10	7	20	20	5	40	2	160	4	
Blanchard Creek	N	Y			20	10	20	5	20	20	20	20	H	10	10	0		4	110	4	110	4	15	10	10	35	2	145	7
Buffalo Gulch	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	25	3	85	19	
Burns Bridge Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	25	3	85	19	
California Gulch	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	25	3	85	19	
Camas Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	25	3	85	19	
Chamberlain Creek	N	Y			20	10	30	4	20				H	10	10	0		3	80	7	20	10	20	5	35	2	95	17	
Chamberlain EF	Y	Y			20	10	20	5		10	20	20	H	10	10	0		3	60	9	20	10	20	5	48	1	130	10	
Chamberlain WF	Y	Y			20	10	20	5		10	20	20	H	10	10	0		3	60	9	20	10	20	5	48	1	130	10	
Chicken Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Chimney Cr. Douglas	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Chimney Cr. Nevada	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Clear Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Clear Creek (Nevada)	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Clemens River	Y	Y			20	10	20	5	20	20	20	20	H	10	10	0		4	60	9	10	10	10	5	35	2	95	17	
Cogner Creek	N	Y	20	10	20	10	60	1	20	20	20	20	H	10	10	0		4	100	5	25	3	10	5	25	3	85	19	
Cottonwood Cr. Nev	N	Y			20	10	60	1	20	20	20	20	H	10	10	0		4	100	5	25	3	10	5	25	3	85	19	
Cottonwood Cr. R M 43	Y	Y	20	10	20	10	60	1	20	20	20	20	H	10	10	0		4	100	5	25	3	10	5	25	3	85	19	
Dick Creek	Y	Y			20	10	30	4	20	20	20	20	B	10	10	0		4	120	3	15	20	15	10	10	45	1	165	3
Douglas Creek	Y	Y			20	10	30	4	20	20	20	20	B	10	10	0		4	120	3	15	20	15	10	10	45	1	165	3
Dry Creek	Y	N			20	10	6	6		20	20	20	H	10	10	0		4	80	7	20	10	20	5	45	1	125	11	
Dunham Creek	Y	Y	20	10	20	10	40	3	20	20	20	20	H	10	10	0		4	110	4	110	4	20	20	5	40	2	150	6
East Twin Creek	Y	Y			20	10	60	1	20	20	20	20	B	10	10	0		4	80	7	20	10	20	5	40	2	130	12	
Elk Creek	Y	Y			20	10	30	4	20	20	20	20	H	10	10	0		4	80	7	20	10	20	5	40	2	130	12	
Finn Creek	N	Y			20	10	20	5	20	20	20	20	H	10	10	0		4	70	8	15	20	15	10	5	30	3	140	8
Fish Creek	N	Y			20	10	0	7		10	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	90	16	
Frazier Creek	N	Y			20	10	20	5		10	20	20	H	10	10	0		4	70	8	15	20	15	10	5	40	2	90	16
Frazier Creek, NF	N	Y			20	10	20	5		10	20	20	H	10	10	0		4	70	8	15	20	15	10	5	40	2	90	16
Gaillard Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	130	12	
Game Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	130	12	
Game Creek	N	Y			20	10	10	6		20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	130	12	
Giessem Creek	N	Y			20	10	60	1	20	20	20	20	H	10	10	0		4	30	12	20	10	20	5	35	2	65	23	
Gold Creek	N	Y	20	10	20	10	60	1	20	20	20	20	H	10	10	0		4	30	12	20	10	20	5	35	2	65	23	
Gold Creek- WF	N	Y	20	10	20	10	60	1	20	20	20	20	H	10	10	0		4	30	12	20	10	20	5	35	2	65	23	
Grantier Spring Cr	N	Y			20	10	30	4	20	20	20	20	H	10	10	0		4	110	4	110	4	20	20	5	45	1	145	7
Hallway Creek	N	Y			20	10	30	4	20	20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	100	16	
Hartum Creek	N	Y			20	10	0	7		20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	100	16	
Hoyt Creek	N	Y			20	10	20	5	20	20	20	20	H	10	10	0		4	50	10	7	20	10	5	40	2	100	16	
Humbly Creek	N	Y			20	10	10	6	20	20	20	20	H	10	10	0		4	100	5	15	20	15	10	5	35	2	105	15
Indian Creek	N	Y			20	10	10	6	20	20	20	20	H	10	10	0		4	100	5	15	20	15	10	5	35	2	105	15
Jefferson Creek	N	Y			20	10	10	6	20	20	20	20	H	10	10	0		4	100	5	15	20	15	10	5	35	2	105	15
Johnson Creek	N	Y			20	10	30	4	20	20	20	20	H	10	10	0		4	30	12	20	10	20	5	10	25	3	85	19
Keel-Cool Creek	N	Y			20	10	20	5	20	20	20	20	H	10	10	0		4	60	9	10	10	10	5	40	2	120	12	

Appendix E. Fisheries Prioritization Matrix

Stream Name	Project site am	Impaired	Biological/Resource Benefits: 150 possible units										Social and Financial Considerations: 50 possible points														
			Bull trout spawning present	Bull trout rearing present	Bull trout core area	Fluvial WSC present	Resident WSC present	Native Species Totals	Native Species Ranking	Fishery value to BFR	Fishery value to BFR	Can technically address entire stream	Provide increased stream flows to BFR	Downstream water quality (H, N, B)	Improves downstream water quality by reducing Sediment	Improves downstream water quality by reducing Temp	Improves downstream water quality by reducing turbidity	Water Quality Score	TRD stream	Water Quality Ranking	Bio score	Bio ranking	Land owner manager cooperation	Restoration feasibility cost/mile	Demol/ Edu value	Social score	Total Score
Kianschmidt Cr	Y	Y	10	10	20	40	3	20	20	20	20	20	20	10	10	30	1	110	4	15	20	10	45	1	155	5	
Landers Fork	N	Y	10	10	10	60	1	20	20	20	20	20	20	10	10	20	2	140	1	15	5	10	30	3	170	2	
Lincoln Spring Cr	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	3	90	6	10	5	10	25	3	115	13	
Little Fish Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	15	10	10	4	80	7	15	23	12	45	1	135	9	
Lodgepole Creek	N	Y	20	20	20	20	2	20	20	20	20	20	20	10	10	10	4	80	7	20	20	20	5	45	1	125	11
McCabe Creek	Y	Y	10	10	10	10	3	4	10	20	20	20	20	10	10	10	3	90	6	20	20	20	5	45	1	135	9
McCarthy Creek	N	Y	10	10	10	20	3	5	10	20	20	20	20	10	10	10	4	20	23	20	20	20	5	45	2	65	24
McElwan Creek	N	Y	20	20	20	20	6	6	20	20	20	20	20	10	10	10	3	90	6	10	10	10	5	40	2	90	18
Michelle Creek	Y	Y	20	20	20	60	1	20	20	20	20	20	20	10	10	10	2	50	10	15	20	10	45	1	175	1	
Montrose Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	3	60	9	20	20	20	5	45	1	105	15
Murray Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	60	9	20	20	20	5	45	1	95	17
Nevada Cr. (lower)	N	Y	20	20	20	40	3	20	20	20	20	20	20	10	10	10	2	50	10	15	10	10	35	2	85	19	
Nevada Cr. (upper)	N	Y	20	20	20	40	3	20	20	20	20	20	20	10	10	10	2	50	10	10	10	10	35	2	85	19	
Nevada Spring Cr	Y	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	3	70	8	10	10	10	40	2	110	14	
N.F. Blackfoot R	Y	Y	20	20	20	60	1	20	20	20	20	20	20	10	10	10	2	140	1	15	10	10	35	2	125	11	
Poorman Creek	Y	Y	20	20	20	50	2	20	20	20	20	20	20	10	10	10	2	70	8	20	20	20	5	40	2	120	12
Rock Creek	Y	Y	10	10	10	40	3	20	20	20	20	20	20	10	10	10	3	140	1	10	10	10	30	3	170	2	
Salmon Creek	Y	Y	10	10	10	40	3	20	20	20	20	20	20	10	10	10	4	100	5	15	10	10	30	3	160	4	
Sauerkraut Creek	N	Y	20	20	20	30	4	20	20	20	20	20	20	10	10	10	2	90	6	15	10	10	30	3	130	10	
Seven up Pete Cr	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	3	60	9	15	10	10	30	3	120	12	
Shanley Creek	Y	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	50	10	15	10	10	30	3	120	12	
Sheep Creek	N	Y	10	10	10	20	5	20	20	20	20	20	20	10	10	10	3	60	9	15	10	10	30	3	120	12	
Shingle Mill Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	20	20	20	5	40	2	100	16
Smith Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Snake Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Spring Cr. (Cottonwood)	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Spring Cr. (NF)	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Stems Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Stockland Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Sturgeon Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Suckair Creek	N	Y	10	10	10	10	6	7	20	20	20	20	20	10	10	10	3	50	10	15	10	10	30	3	120	12	
Union Creek	Y	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Wales Creek	Y	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Walrus Spring Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Ward Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Warm Springs Cr	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Warren Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Washington Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Washington Creek (Upper Lake trib)	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Wasbon Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Wasson Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Wasson Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
West Twin Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Willow Cr. (lower)	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Willow Cr. (upper)	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Wilson Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	
Yousame Creek	N	Y	20	20	20	20	5	20	20	20	20	20	20	10	10	10	2	80	7	10	10	10	30	3	110	14	

APPENDIX F

**RESTORATION EFFECTIVENESS MONITORING
PROTOCOL FOR THE BLACKFOOT WATERSHED**

TABLE OF CONTENTS

LIST OF TABLES	iii
1.0 INTRODUCTION	1-1
2.0 RESTORATION EFFECTIVENESS MONITORING METRICS	2-1
3.0 RESTORATION MONITORING PROTOCOL	3-1
3.1 BIOLOGICAL MONITORING	3-1
3.1.1 Fish Population Surveys	3-1
3.1.2 Redd Counts.....	3-1
3.1.3 Macroinvertebrate Sampling.....	3-1
3.1.4 Periphyton/Chlorophyll a Sampling	3-2
3.2 PHYSICAL PARAMETERS.....	4-3
3.2.1 Habitat Assessments	4-3
3.2.2 Riparian Assessment.....	4-3
3.2.3 Water Temperature	3-6
3.2.4 Flow Monitoring.....	3-6
3.2.5 Photo Point Monitoring	3-7
3.3 WATER QUALITY MONITORING.....	3-7
3.3.1 General Water Sampling Procedures	3-7
3.3.2 Nutrient Sampling.....	3-9
3.3.3 Suspended Sediment Sampling.....	3-10
3.3.4 Metals Sampling	3-11
3.4 STREAM SUBSTRATE COMPOSITION	3-12
3.4.1 Percent Fine Content.....	3-13
3.4.2 McNeil Core Samples	3-13
4.0 REFERENCES	4-1

LIST OF TABLES

TABLE 2-1. RESTORATION EFFECTIVENESS MONITORING METRICS APPLICABLE TO VARIOUS RESTORATION OBJECTIVES/ IMPAIRMENT SOURCES.....	2-2
TABLE 3-1. ANALYTICAL PARAMETERS, SAMPLE REQUIREMENTS FOR NUTRIENT SAMPLING	3-10
TABLE 3-2. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR TOTAL SUSPENDED SOLIDS SAMPLING.....	3-11
TABLE 3-3. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR METALS SAMPLING.....	3-12

RESTORATION EFFECTIVENESS MONITORING PROTOCOL FOR THE BLACKFOOT WATERSHED

1.0 INTRODUCTION

The Blackfoot River watershed has been the focus of extensive stream restoration activities over the past several years, with the scope of restoration activities increasing in recent years. Restoration activities undertaken by various entities, including but not limited to, Montana Department of Fish Wildlife and Parks (FWP), the Blackfoot Challenge, and the Big Blackfoot Chapter of Trout Unlimited (BBCTU) have focused on fisheries restoration, water conservation, and mitigation of impaired streams as identified on the State of Montana 303(d) list. Due to the increasing scope of restoration activities in the watershed, and specific needs tied to certain restoration project funding sources, the restoration partners have identified a growing need for an established restoration monitoring program and protocol designed to document the effectiveness of restoration activities in the watershed in terms of immediate and long-term attainment of restoration goals.

This document presents a conceptual plan for restoration effectiveness monitoring in the Blackfoot Watershed. The purpose of this Restoration Effectiveness Monitoring Plan is to provide a common reference for restoration planners to determine appropriate monitoring parameters/activities and protocol to utilize on a given restoration project. Specific objectives of this document include:

- Promoting inclusion of appropriate pre- and post-restoration monitoring in ALL stream and riparian area restoration projects within the watershed;
- Establishing monitoring protocol and procedures to be employed for restoration monitoring to ensure consistency in data collection efforts between projects and between various organizations/agencies involved with stream and riparian area restoration; and
- Providing a tool for use in the planning and design phase of restoration projects throughout the watershed.

Attainment of these objectives will not only assist project planners in the design and implementation of appropriate restoration effectiveness monitoring on their projects, but should also result in a greater degree of consistency in the scope of monitoring, and monitoring methodologies employed, both from project to project and through time. This in turn will lead to development of a comprehensive database of restoration-related data and information collected under consistent methods, thus facilitating informational sharing among projects and, potentially, reduced monitoring costs in the long-term.

This Restoration Effectiveness Monitoring Plan is intended to serve as a guide to restoration project monitoring. The plan outlines various monitoring activities that should be considered for inclusion on restoration projects, depending on the restoration project objectives and/or

impairment conditions associated with the project. The specific scope of monitoring to be applied for a given project should be determined by the individuals and agencies involved in the project, with the scope of monitoring dependent on specific project needs as well as possible budget constraints. However, it is hoped that through consultation of this plan, all restoration projects will be monitored to the extent necessary to allow determination of the effectiveness of the restoration action, with a level of consistency in monitoring methodology so that data may be used by other restoration and land use planners in the watershed.

This document is designed to be a quick reference for restoration planners evaluating potential monitoring needs for their projects. Section 2 outlines monitoring parameters/activities, such as stream substrate characterization or water temperature monitoring, that may be applicable to restoration projects based on project objectives and goals, and stream impairment conditions. Section 3 summarizes actual protocol, or methodologies, to be employed for specific parameter measurement (i.e., streamflow measurement by USGS protocol).

2.0 RESTORATION EFFECTIVENESS MONITORING METRICS

Appropriate measures of restoration effectiveness will vary depending on the particular goals and objectives of the restoration project, be they restoration of aquatic habitat, maintenance of in-stream flow, or irrigation efficiency improvements. The various types of metrics used to assess the status of a water body generally include biological, physical, and chemical measurements. Table 2-1 shows suggested metrics to be used for restoration projects depending on the restoration goals and/or the particular water body impairment.

Biological metrics are particularly appropriate for many types of restoration effectiveness monitoring, due to their capacity to provide information on overall stream health by integrating the effects of many potential sources of impairment. For example, fish populations and macroinvertebrate community structure and abundance both will respond favorably to improvements in aquatic habitat and riparian conditions, as well as reductions in loads of specific pollutants such as nutrients or metals. Measurements of pollutant concentrations through water quality sampling should, if possible, be supplemented by one or more biological metrics to provide a more comprehensive representation of stream status and response to restoration activities. Note that biological metrics are typically more labor-intensive and expensive to conduct than water quality sampling; therefore, careful planning is important for conducting biological surveys.

As shown in Table 2-1, each restoration project category has multiple monitoring metrics identified as potentially applicable with some categories, such as “Excess Siltation in Stream Substrate”, showing the majority of metrics as applicable. This does not mean that all of the identified monitoring metrics need be, or should be, included. Instead, a suitable suite of parameters should be selected by project planners based on the specific project scope and needs, as well as availability of funding. It should also be noted that the list of monitoring metrics in Table 2-1 is by no means exhaustive. For instance, the methods included for quantifying stream substrate composition (percent fine content measurements and McNeil core sampling), represent only two of numerous methods available for stream substrate characterization. Other common methods, such as Wohlman Pebble Counts and Riffle Stability Index, may be equally as applicable. However, the list of metrics included in this document are intended to provide a reasonable spectrum of measurement options, from relatively simple semi-qualitative methods to more intensive methods, to fit most project needs and budgets. The number of methods has intentionally been kept short in order to promote consistency in the data collection methodology throughout the watershed. Specific monitoring protocols are summarized in Section 3.

TABLE 2-1. RESTORATION EFFECTIVENESS MONITORING METRICS APPLICABLE TO VARIOUS RESTORATION OBJECTIVES/IMPAIRMENT SOURCES

METRICS	RESTORATION PROJECT OBJECTIVES/IMPAIRMENT CAUSES									
	In-Stream Flow Maintenance	Habitat Restoration	Reduce Substrate Siltation	Reduce Thermal Modification	Reduce Ag Runoff	Riparian Area Restoration	Reduce Elevated Metals	Reduce Elevated Nutrients		
BIOLOGICAL METRICS										
Fish Population Surveys	X	X	X	X	X	X				
Redd Counts	X	X	X	X	X	X				
Macroinvertebrate Sampling	X	X	X	X	X	X	X	X		
Periphyton Sampling	X	X	X	X	X			X		
Chlorophyll-a					X			X		
PHYSICAL PARAMETERS										
Habitat Assessments	X	X				X				
Riparian Assessment		X	X	X	X	X				
Water Temperature	X	X	X	X	X	X				
Flow Monitoring	X			X			X	X		
Photo Points	X	X	X	X	X	X	X	X		
WATER CHEMISTRY										
TSS Samples			X		X		X	X		
Nutrient Sampling					X			X		
Metals Sampling							X			
STREAM SUBSTRATE COMPOSITION										
McNeil Core Samples		X	X			X				
Percent Fine Sediment Content		X	X			X				

X – Metrics marked in bold should be given primary consideration for monitoring
TSS- Total Suspended Sediment

3.0 RESTORATION MONITORING PROTOCOL

The following monitoring protocols represent methodologies and practices generally accepted and commonly used for biological, physical and chemical characterization of aquatic and riparian systems. These protocols have been compiled by the Blackfoot Challenge, with input from various restoration partners. For instance, the Department of Fish, Wildlife and Parks provided methodologies for fish population surveys, redd counts, habitat assessments, and water temperature monitoring. FWP has been the primary entity performing these monitoring activities in the past, and should be consulted when these monitoring activities are being considered for restoration projects.

3.1 BIOLOGICAL MONITORING

3.1.1 Fish Population Surveys

Depending on the survey objectives, fish population surveys take many different forms. Methods generally involve fish collections using traps, seines, electrofishing or other methods. In some cases, population surveys may involve direct observations of fish (eg. Snorkeling) or of spawning activity (redds). Restoration-related fish population surveys often involve electrofishing means. These methods usually involve some quantification of densities or biomass using single-pass, mark-recapture, or multiple pass-depletion methods. Other information typically collected includes age/length structure, species identification

3.1.2 Redd Counts

Counting spawning sites (redds) is a standard method of assessing the numbers of adult spawning fish within a spawning area or for a given population. Redd counts are not considered a useful method for certain spring spawning fish in environments where high water and turbidity confounds the identification of redds. Redd counts work best for fall spawning fish (brown trout and bull trout) or in spring creeks. Counts were made by walking the spawning areas shortly after the spawning period. Redd areas were identified by a cleaned, oval shape (pit), and a mound of unconsolidated gravel (tailspill) left by the females digging activities. Only redds where a definite pit and tailspill were discernable are counted. Redd counts are often made in index reaches where surveys are completed annually in order to assess population trends.

3.1.3 Macroinvertebrate Sampling

In instances where restoration project objectives include fisheries restoration, pre- and post-restoration macroinvertebrate sampling should be considered. Besides serving as an indicator for general water quality and substrate conditions, macroinvertebrate populations represent an integral component of a functioning biological system and will therefore help in determining restoration project success and/or beneficial use support associated with aquatic life. Careful consideration should be given to the need for and utility of macroinvertebrate sampling due to the considerable expense.

Procedure:

When conducting macroinvertebrate sampling, two general methods can be used; the quantitative and qualitative methods. The quantitative sampling method uses a Hess or Surber sampler, and is the preferred sampling method. When sampling by the quantitative method, sampling should include collection of multiple samples (replicates) at each site to allow for statistical analysis of the data. Typically, between 3 and 8 replicate samples are recommended depending on the suspected site variability, level of analysis required, and budgetary constraints. In most cases, 4 replicate samples per site should suffice for evaluating restoration effectiveness. The qualitative method uses a kick net for sample collection. The qualitative method is quicker and generally less expensive than the quantitative method, but yields less reliable results.

Macroinvertebrate sampling should be performed by experienced personnel following MDEQ's Rapid Bioassessment Protocols, Standard Operating Procedures 12.1.3.1 (Quantitative Method) or 12.3.1.2 (Qualitative Method). The MDEQ protocols are available upon request from the Blackfoot Challenge, or at:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/12-1-3.pdf>

If preferred, comparable procedures, such as the EPA Rapid Bioassessment Protocol, can be used provided they are consistent with substantive portions of the MDEQ protocol. When quantitative macroinvertebrate sampling is performed, it should also be performed in a manner consistent with the Status and Trends macroinvertebrate sampling to allow for comparison to the basin-wide Status and Trends data.

Monitoring Sites/Schedule:

Due to the considerable cost associated with macroinvertebrate sample analyses, careful consideration should be afforded to selection of sampling locations and schedules. Ideally, a minimum of two sampling sites should be established within and/or downstream of the restored stream segment. However, if budget constraints dictate, one sampling site properly located within the restored segment may suffice (see MDEQ SOPs for sample site selection). Once established, sampling sites should be photographed, and described using the Rapid Bioassessment Protocol Physical Evaluation Form and Contractor Evaluation Form provided with the MDEQ SOPs.

Macroinvertebrate sampling should occur at least once prior to and once after restoration. Sampling should occur after runoff, preferably in August/September, although samples can be collected later in the year if necessary. Sampling should not be conducted immediately after large storm-related runoff events.

3.1.4 Periphyton/Chlorophyll a Sampling

Periphyton refers to the assemblage of algae living attached to or in close proximity to the stream substrate. These assemblages represent the principle source of primary productivity in most Montana streams. In general, excessive crops of periphyton are indicators of poor

water quality, particularly elevated nutrient concentrations. In addition, species composition, diversity and abundance can be used as a measure of overall stream ecological health, since different species show variable sensitivity to potential impairment causes such as temperature, nutrients, and toxic constituents. Periphyton analyses may include quantification of chlorophyll a, and/or taxonomic identification to varying levels of precision. The methods chosen will depend on the specific project objectives.

Procedure:

MDEQ protocol divides periphyton sampling into three tasks of increasing complexity:

- Field observations;
- Standing crop/chlorophyll a sampling; and
- Community composition and structure sampling.

Field observations include completion of an Aquatic Plant Field Sheet, which records information on general composition, amount, color, and condition of aquatic plants and is equivalent to a Level I Rapid Bioassessment Protocol for plants (similar to the RBP for macroinvertebrates). Semi-quantitative assessments of biomass and taxonomy may also be conducted using a field-based rapid periphyton survey technique, which involves use of a gridded viewing bucket and a biomass scoring system.

Collection of samples for chlorophyll a analysis can include targeted sampling (sampling of heaviest accumulations of attached algae in a sampling transect), or more random sampling and direct extraction of chlorophyll a from streambed rocks. In both cases an estimate of amount of chlorophyll a per unit area of streambed is generated. Finally, collection of samples for laboratory identification of community composition and structure basically involves scraping rock surfaces, lifting algal film from nearshore sediments, and scraping several submerged branches.

Standard Operating Procedures for periphyton and chlorophyll a sampling have been developed by MDEQ, and are available at the following web address (comparable procedures may also be used):

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/12-1-2-0.pdf>

Monitoring Sites/Schedule:

Similar to macroinvertebrate analysis, periphyton analysis (identification of community structure and composition) is a time-consuming, labor-intensive, and thus relatively expensive endeavor. Thus, the objectives of sampling and the potential data uses should be thoroughly assessed prior to collecting samples for periphyton. Ideally, a reference site should be established to evaluate baseline conditions, in addition to 1 or 2 monitoring locations within and/or downstream of the restored stream section. For high-gradient streams, one periphyton sampling site should cover a single riffle, while in low-gradient streams, the sampling site should consist of at least one meander length (about 20 bankful channel widths).

The recommended time for periphyton sampling is summer (late June through September). During this period, stream flow is relatively stable, and most streams exhibit peaks of both periphyton standing crop (biomass) and community diversity. If temporal trends are to be assessed by repeated sampling over a number of years, the time of sampling should remain consistent from year to year to minimize seasonal variance.

3.2 PHYSICAL PARAMETERS

3.2.1 Habitat Assessments

Methods of assessing aquatic habitat vary greatly depending on the scale of the project and the specific survey objectives. An excellent reference for determining scale and objectives is found in *Aquatic Habitat Assessment: common methods* (Bain and Stevenson, 1999). At a restoration project level, habitat survey methods should focus on survey precision and repeatability necessary for post-project evaluation. Habitat surveys almost always involve a longitudinal and areal description of channel bed forms including pools, riffles and channel complexity. Habitat survey methods often involve geomorphic assessments, stream bank condition and riparian health, measurements of flow, water temperature and water quality, substrate compositions and instream wood counts.

3.2.2 Riparian Assessment

Assessment and monitoring of riparian areas is a critical step in assessing riparian system health. Initial stream reach inventories can be used as indicators of problem areas and identification of potential solutions to unstable stream situations. These same assessment techniques can also be used to observe changes over time, especially to gauge progress in restoring health and vigor to riparian systems functioning at levels below their potential.

Vegetation in stream zones is the best terrestrial indicator of stream health and function. Healthy vegetation within the watershed, especially within the riparian corridor, is the best indicator of a proper functioning stream system from a biological and hydrological perspective. Vegetation is also the component of a watershed over which a land manager has the most influence.

Consequently, when riparian vegetation is not in a healthy state, management changes may be warranted. Riparian areas are complex systems and thus present numerous options to the land manager to make positive changes in management, especially when dealing with grazing animals. If management of these areas is part of an unhealthy stream system, management changes must then be part of any solution to enhance riparian health. Downward trends in vegetation health can be reversed relatively quickly with positive changes in management of grazing animals.

Physical and biological processes occurring in riparian areas are sustainable in a healthy stream system. These processes are complex but need to be in balance to maintain a proper functioning, stable system. Inventory, assessment techniques used to gauge the health of these systems therefore need to account for this complexity.

Two riparian assessment techniques are recommended for use in the Blackfoot Watershed, as described below. Both techniques account for the complexity of riparian systems, yet are relatively user friendly to those familiar with inventory techniques, and also provide repeatable, quantifiable data. Whatever process is used for an initial inventory of the riparian system, it should quantify current condition, assess problems, and be repeatable. The first method was developed by the NRCS and is a relatively quick means of assessing riparian conditions. The second method is the USFS Green Line method, which is slightly more complex, yet should be readily implementable on most restoration projects. The appropriate method to use for specific restoration projects should be based on the project scope and budget, and importance of riparian conditions to the project goals and objectives.

The first riparian evaluation recommended for use in the Blackfoot Watershed is the Riparian Assessment procedure and field form developed by the USDA NRCS (USDA, 2004). This evaluation gives the user a good overview of a particular stream reaches status of the ecological and physical processes interacting at a site. This assessment will indicate problem areas within a stream system and yields a numeric rating which can be used to indicate trends through time. This evaluation technique is a relatively quick method for trained observers to utilize and will indicate specific physical or biological problems for more detailed inventory/analysis. The NRCS protocol document and filed forms are available at the following website, or from the Blackfoot Challenge upon request:

<http://www.mt.nrcs.usda.gov/technical/>

The stream reach evaluated should be well identified and documented (e.g. gps points, aerial photography, photo points) so that future evaluators can locate the same site. All pertinent observations should be recorded on the enclosed forms to enable future reference. The more notes/observations recorded during an assessment, the easier it will be for future evaluators to visualize the current conditions.

The second riparian evaluation method recommended for use is Monitoring the Vegetation Resources in Riparian Areas, USDA Forest Service, Technical Report RMRS-GTR-47 (USDA, 2000). Since vegetation is a key component in evaluating riparian health, this method zeroes in on one of the key monitoring tools for streams. This monitoring technique does require some technical knowledge of riparian vegetation, and thus should only be used when a more quantitative analysis of the riparian situation is desired. For example, when a grazing management problem is identified, a more detailed evaluation of the current vegetation condition may be warranted to enhance management changes. This monitoring technique also provides a more quantitative measure of vegetation trends through time. Sites where this technique is employed should again be accurately documented to ensure that assessment reaches can be relocated in the future.

The publication RMRS-GTR-47 is available form the Blackfoot Challenge upon request. The document can also be ordered from the USDA Forest Service Rocky Mountain Research Station at phone number (970) 498-1392, or downloaded from:

<http://www.fs.fed.us/rm>

3.2.3 Water Temperature

Water temperature measures now include programmable miniature temperature loggers. These loggers collect time and temperatures at user-defined intervals. Loggers can be record for several years if needed. Loggers can be downloaded in a manner that provide maximum, min and mean temperature values or as continuous data. Data can be easily manipulated in computer programs like EXCEL or can be statistically manipulated.

3.2.4 Flow Monitoring

Streamflow measurements should be recorded anywhere that restoration goals include maintenance of in-stream flow. In addition, accurate flow measurements are necessary for calculating loads of chemical constituents (e.g., nutrients, metals) within a water body. Streamflow measurements should be collected using one of three general methods, depending on the channel geometry and stream or seep discharge rate:

- Velocity-area method;
- Portable trapezoidal flume; or
- Volumetric method.

The velocity-area method is used to measure streamflow in larger, wadeable streams. Measurement of streamflow is performed in accordance with the area-velocity method developed by the USGS (USGS, 1977). In general, the entire stream width is divided into subsections and the stream velocity measured at the midpoint of each subsection and at a depth equivalent to six-tenths of the total subsection depth. The velocity in each subsection is then multiplied by the cross-sectional area to obtain the flow volume through each subsection. The subsection flows are then summed to obtain the total streamflow rate. Streamflow measurements are typically collected in a stream reach as straight and free of obstructions as possible, to minimize potential measurement error introduced by converging or turbulent flow paths. Streamflow measurement data should be recorded on specially prepared forms available from the Blackfoot Challenge.

Streamflow measurements on smaller streams or seeps are obtained using a portable flume such as a 90° v-notch cutthroat flume. This flow measurement method is based on equations developed by Skogerboe et al (1967). To measure streamflow, the flume is placed and leveled in the streambed, and the full streamflow directed through the flume throat. Water depth or head measurements are then collected at specified locations in the upstream (H_a) and downstream (H_b) sections of the flume. The head measurements are used to verify proper functioning of the flume and to calculate streamflow based on the water depth.

Collection of volumetric flow measurements consists of directing the flow into a container of known volume (such as a five-gallon bucket), and recording the time required to fill the known volume. Volumetric flow measurements are typically limited to monitoring points with small seepage flows (which can be diverted into a container) and discrete discharge points such as culverts and pipes.

3.2.5 Photo Point Monitoring

Photo points should be established for all restoration projects to assure collection of adequate pre- and post-restoration photographs. Pre- and post-restoration photos are invaluable for visually portraying large scale changes in response to restoration activities and in presenting such information to the general public. Following are a few simple rules that should be applied when establishing photo points to ensure that Pre- and post- project photos capture the level of information desired.

- Photo points should be selected and established in the earliest stages of the project. This will allow pre-restoration photos to be taken for all seasons.
- Photo points should be permanently marked to facilitate future relocation and identification. Once selected, photo points should be marked in the field with a steel or wood stake and GPS coordinates recorded. Photo points should be assigned a unique site code name and the marker stake inscribed with the site code.
- Long view photos representative of the entire or large portion of the project area should have a distinct permanent landmark in the background such as a mountain peak, rock outcrop, etc. Other considerations when choosing photo point locations include:
 - Locations should be easily relocatable and accessible;
 - Make sure that future plant growth will not obscure view; and
 - Select sites that will portray the level and depth of information applicable to the project.
- Information on project photos should be recorded on special project photo forms for systematic documentation into a project photolog. Forms should include information such as: Project name and location; Photo point number and location; Direction of photo; Photograph date, time, and weather conditions; Photographers name; Dates of previous photos, if known; and any comments/notes by the photographer.

3.3 WATER QUALITY MONITORING

Water quality monitoring needs for specific projects will depend on the restoration project objectives and the specific causes of impairment. In most cases, water quality monitoring needs will include nutrients, sediment, and/or metals. Monitoring for each of these general parameter groups is described below.

3.3.1 General Water Sampling Procedures

Procedure

The USGS has published water quality monitoring protocol for sampling of metals, nutrient, and suspended sediment concentrations. These methods are widely accepted and used for water quality monitoring across Montana. Restoration effectiveness water quality monitoring conducted within the Blackfoot River drainage should be completed in

accordance with USGS protocol, or in accordance with comparable methods such as MDEQ protocol. USGS procedures are available at the following web address:

<http://water.usgs.gov/owq/FieldManual/>

Current MDEQ procedures are available at:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/sop.asp>

Streamflow rates should be measured in conjunction with all water quality monitoring events to allow parameter loads (mass/time) to be calculated from parameter concentrations (mass/volume) determined through sampling. Comparison of parameter loads at multiple locations along a stream can be used to determine where load increases occur, and thus where sources of contaminant loading are located. Streamflow measurement should be performed as described in Section 3.2.

Monitoring Sites and Schedule

When water quality sampling is performed to assess restoration effectiveness, samples should be collected upstream of the restoration area in addition to sampling within and downstream of the restored stream reach. Sampling upstream of the restoration project will document the quality of surface water entering the restoration stream reach, allowing variations in upstream water quality to be taken into account when evaluating restoration project effectiveness. For restoration projects encompassing relatively short segments of stream (1,000 feet or less), one monitoring site near the upstream boundary and a second site near the downstream boundary will generally be sufficient. For stream restoration projects encompassing longer stream segments, one or more internal monitoring sites should be added to document water quality trends through the project area.

A minimum of one pre-restoration and one post-restoration monitoring event is required to assess restoration effectiveness from a water quality improvement perspective. However, due to intrinsic variability in surface water quality due to streamflow and climatic conditions, multiple pre- and post-restoration monitoring events should be conducted over a number of years. Ideally, water quality data should be collected from various portions of the streamflow hydrograph, with the specific sampling schedule dependent on the water quality parameters of interest. For instance, sampling for metals concentrations should be performed during the rising limb and falling limb of the spring runoff peak and during baseflow conditions since different metals loading sources will predominate under differing flow conditions (see discussion below). Conversely, nutrient sampling should focus on summer and early fall baseflow conditions when nutrient-related water quality problems are generally most severe. Pre- and post-restoration data used for evaluating restoration effectiveness should be collected under similar climatic conditions since runoff from heavy precipitation events can greatly affect short-term water quality. In general, a minimum of three pre- and post-restoration monitoring events should be performed under appropriate flow and climatic conditions to allow restoration effectiveness to be evaluated with a reasonable level of

confidence. Following is additional detail on monitoring protocol for specific water quality parameters.

3.3.2 Nutrient Sampling

Although nutrient pollution can result from a wide variety of sources, nutrient-related impacts to streams in the Blackfoot watershed will most likely be associated with agricultural runoff. Therefore, water quality monitoring for nutrients should be conducted for restoration projects associated with agricultural sources, and/or where the stream has been identified as impaired due to nutrients. In these cases, pre- and post-restoration water samples should be collected at the upstream and the downstream ends of the restoration project.

Table 3-1 includes a list of typical nutrient parameters for restoration projects, including total phosphorus, orthophosphate, nitrate plus nitrite (as nitrogen), ammonia (as nitrogen) and total kjeldahl nitrogen. This list will allow discrimination of the primary organic and inorganic forms of nitrogen and phosphorus. Samples for all parameters (except total phosphorus) should be filtered through a 0.45-micrometer filter in the field prior to placement in the sample container to remove particulate matter from the water sample that could affect analytical results.

When conducting nutrient sampling, the pre- and post-restoration sampling should be conducted during the same time of the year to prevent seasonal variations in nutrient concentrations from affecting the pre- and post-restoration comparison. Nutrient sampling should be performed during the summer months when water quality impacts from nutrients are expected to be greatest. Precipitation trends during and prior to sampling should be noted since runoff from intense precipitation events can greatly affect nutrient concentrations in streams through agricultural runoff.

**TABLE 3-1. ANALYTICAL PARAMETERS, SAMPLE REQUIREMENTS
FOR NUTRIENT SAMPLING**

Parameter	Detection Limit	Container	Preservation	Holding Time
Total Phosphorus	0.01 mg/l	250 ml polyethylene	Add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Orthophosphate	0.01 mg/L	250 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Nitrate+Nitrite as N	0.05 mg/L	50 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Ammonia as N	0.1 mg/L	50 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Total Kjeldahl Nitrogen (TKN)	0.5 mg/L	500 ml polyethylene	Filter to 0.45 micron, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days

3.3.3 Suspended Sediment Sampling

Total suspended sediment (TSS) monitoring will serve as the primary indicator of the effectiveness of restoration projects on water column sediment concentrations. Although other measures of water column sediment conditions (such as turbidity) are available, TSS monitoring represents the most direct measure of sediment levels within the water column available. Table 3-2 includes details on sample collection and handling for TSS.

Suspended sediment (or water column sediment) sampling will be applicable to many projects in the Blackfoot watershed due to the widespread nature of sediment-related impairment in the drainage. Excessive suspended sediment is not only detrimental to fish and other aquatic life, but also interferes with other beneficial uses such as irrigation water and drinking water supplies. Elevated suspended sediment concentrations also are indicative of or related to a myriad of other water quality problems and impairment causes, such as riparian degradation, agricultural runoff, substrate siltation, and elevated metals and nutrient concentrations. Therefore, documenting changes in suspended sediment concentrations through proper monitoring will be applicable to the majority of restoration projects in the Blackfoot watershed.

Pre- and post-restoration sampling for TSS must be performed under similar conditions to reduce the effects of natural variability in TSS concentrations. For instance, pre- and post-restoration samples should be collected from similar points on the annual hydrograph (rising limb, falling limb, baseflow) and during similar climatic conditions (extended dry periods, during or shortly after significant precipitation events), to exclude flow and weather-induced variations in TSS concentrations from the restoration effectiveness assessment. A minimum of three pre- and post-restoration TSS monitoring events should be performed under various

hydrologic and climatic conditions to adequately document restoration success. Monitoring should occur at the upstream and downstream boundary for smaller restoration projects (on the order of 1,000 feet in length), with one or more internal sites added for longer restoration projects.

TABLE 3-2. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR TOTAL SUSPENDED SOLIDS SAMPLING

Parameter	Detection Limit	Container	Preservation	Holding Time
Total Suspended Solids	10 mg/L	1000 ml glass or plastic	Cool to 4°C	7 days

3.3.4 Metals Sampling

Monitoring of metals concentrations in surface water should be performed on all restoration/reclamation projects designed to reduce metals loading to surface waters. This may include abandoned mine reclamation projects or mitigation of other metals loading sources. When monitoring metals concentrations in stream restoration projects, the objectives are to determine how restoration activities affect in-stream metals concentrations, and to determine how post-restoration concentrations compare to applicable water quality standards presented in Circular WQB-7, the official list of Montana Numeric Water Quality Standards published by MDEQ.

Table 3-3 includes sample collection and handling requirements for metals analyses. Typically, metals of interest in assessing surface water quality may include aluminum, arsenic, cadmium, copper, iron, lead, manganese, zinc, or numerous other metals. Actual metals to be analyzed for a project should be based on specific metals impairments or loading sources. On projects where information on specific metals of concern is lacking, the above list of metals should be sufficient for documentation of metals impairment and restoration effectiveness.

With the exception of aluminum, all metals should be analyzed for total recoverable concentrations for comparability to the water quality standards. If applicable, aluminum should be tested for dissolved concentrations (sample should be filtered through 0.45 micron filter prior to acidification) since the aluminum standard is based on the dissolve concentration. Although not typically considered a pollutant, the metals calcium and magnesium should be included in metals sample analyses to determine the water hardness. Because water quality standards for certain metals are dependent on the water hardness,

calcium and magnesium concentrations should be used to determine the water hardness by the following equation:

$$H = [Ca^{2+} \times 2.497] + [Mg^{2+} \times 4.117]$$

Where: H= water hardness (as CaCO₃) in mg/L

Ca²⁺ = dissolved calcium concentration

Mg²⁺=dissolved magnesium concentration.

Similar to other water sampling protocol, pre- and post-restoration sampling for metals should be performed during similar hydrologic and climatic conditions to reduce the effects of natural variability in metals concentrations. A minimum of two pre- and post-restoration metals monitoring events should be performed under various hydrologic and climatic conditions to adequately document restoration success. Monitoring should occur at the upstream and downstream boundary for smaller restoration projects (on the order of 1,000 feet in length), with one or more internal sites added for longer restoration projects.

TABLE 3-3. ANALYTICAL PARAMETERS AND SAMPLE REQUIREMENTS FOR METALS SAMPLING

Parameter	Detection Limit	Container	Preservation	Holding Time
TRC Metals	*	250 ml polyethylene	Add HNO ₃ to pH<2, cool to 4°C	6 mos
Dissolved Calcium, Magnesium	1.0 mg/L	50 ml polyethylene	Filter to 0.45 micron, add HNO ₃ to pH<2, cool to 4°C	6 mos
Dissolved Aluminum (if applicable)	0.05 mg/L	50 ml polyethylene	Filter to 0.45 micron, add HNO ₃ to pH<2, cool to 4°C	6 mos

TRC-total recoverable. Specific list of metals to be analyzed dependent on project needs but may include arsenic, copper, cadmium, iron, lead, manganese, zinc, or other metals of interest.

*Varies with metal. Detection limits for individual metals should be less than applicable water quality standard in WQB-7.

3.4 STREAM SUBSTRATE COMPOSITION

Stream substrate composition, or the distribution of sediment particle sizes in streambed sediments, can be an important measure of success and effectiveness for many stream restoration projects. Excessive fine sediment content, typically taken to be any sediment particles less than approximately 6 mm in size, can be detrimental to aquatic life and other beneficial uses. Changes in the fine sediment content of the stream substrate are also a useful measure of the effectiveness of specific restoration measures and objectives, such as reducing sediment runoff from roads or unstable streambanks. Following are two methods for documenting stream substrate composition before and after restoration actions. The Percent Fines Content method is a relatively simple measurement yielding semi-quantitative information on substrate composition, while the McNeil Core Sampling method provides more quantitative information. The specific method used on a project should depend on the scope of the project, importance of streambed siltation to the stream health and project objectives, and available funding. Other methods, such as Wohlman pebble counts, riffle

stability index, etc., may also be considered as long as standard methodologies are employed. Whichever method is chosen, the same method must be applied for the pre- and post-restoration monitoring to allow for direct comparison of the results.

3.4.1 Percent Fine Content

Procedure

Percent fines content is calculated using a five-gallon bucket fitted with a clear plastic bottom. The bottom is marked with a grid of one-inch spaced lines, with a 6 mm wide space demarcated at each intersection. The bucket is then placed in the water, and the streambed viewed through the bucket. At each grid intersection (a total of 45), the size of the sediment particle below the intersection (greater than or less than 6 mm), is recorded. The percent fines content is then calculated from the percentage of intersection points with sediment particles less than 6mm. The procedure is described in MDEQ Standard Operating Procedure 11.8.6, Percent Fines Calculation at the following website:

<http://www.deq.state.mt.us/wqinfo/monitoring/SOP/pdf/11-8-6.pdf>

Monitoring Sites/Schedule

Percent fine sediment measurements should be taken in pool tails and riffles, with the distribution of measurements dependent on the relative abundance of each. For instance, if the reach contains 70% riffles and 30% pools, 70% of the measurements should be taken from riffles and 30% from pools. The total number of measurements to be taken depends of the size and variability of the stream in the restoration area, and importance of stream substrate composition to the project. A sufficient number of measurements should be made to adequately characterize the percent fines content of the stream substrate for the project purposes.

3.4.2 McNeil Core Samples

McNeil core sampling provides more quantitative information on stream substrate composition than does the Percent Fine Content method, but is also more labor and equipment intensive. McNeil core sampling also requires that sediment samples be analyzed for grain size distribution, adding additional costs. However, collection of McNeil core samples should be considered where documentation of the percent fine sediment content in stream substrate before and after restoration is critical to project objectives.

The Helena National Forest has been conducting McNeil core sampling in the Blackfoot watershed for the past several years, resulting in an existing database of McNeil core data from the drainage. In order to ensure comparability of future restoration project sampling results with the existing database, McNeil core sampling performed for restoration projects should be conducted in a manner consistent with the HNF methodology. The following protocol was provided by the Helena National Forest. The general procedure is as follows:

Required Equipment:

- GPS Unit
- McNeil core sampler
- 1000 ml Imhoff cone
- 500 ml plastic bottle
- 5 gallon bucket with plastic bag liner

Field Data to be Recorded:

- Stream Name /Date /Location
- Observer Name
- Depth of core (6" for bull trout spawning gravel and 4" for cutthroat spawning areas)
- Site # and Core # with a description of the start point and the distance between points.
- Number of redds located at the site.
- GPS location
- Suspended sediment measure (ss) – The measurement of the depth of the water taken within the core sampler after the sample has been pulled into the reservoir, but the sampler is still in the stream.
- Imhoff cone measure (Imh) – Let the sample settle for approximately 20 minutes. If using a 500 ml bottle – double the total sediment reading in the cone (1000 ml) and multiply by 0.4. This will account for how much it would actually settle overnight.

Field Procedure:

- Locate a spawning site or a potential spawning site. (All successive sites will be located upstream from the first site.)
- Set up 5-gallon bucket with a plastic bag inside.
- Set up Imhoff cone.
- Write two identification tags on the flagging for each sample using a waterproof marker. One tag is short and will be placed inside the plastic bag with the sample and the other is long and will be used to tie the sample bag when finished. The tags contain the following information: Stream Name, Site #, and Core #.
- Place core sampler next to the existing redd, but not where it would be affected in any way by the coring (remember your feet). If the site is a potential site, place the core sampler where you would expect a redd.
- In a bull trout stream, take 6" of core, or 4" from the top of the inner rim on the McNeil sampler. (The inner cylinder is 10".)
- In a cutthroat stream take 4" of core, or 6" from the top of the inner rim on the McNeil sampler.
- When drilling the core into streambed, try not to let it walk over the stream bottom. If it hangs up on a large rock go ahead and re-core. If a piece of rubble is too big to fit through the 10" cylinder leave it out of the sample.
- Once the core sampler is down to the appropriate depth, remove the material from the inner 10" cylinder and place into the inner reservoir. You are finished when you feel the top of the teeth at the bottom of the sampler.
- Use the ruler to measure the depth of the water from the bottom of the core sampler.

- Quickly fill the 500 ml bottle to capture the suspended sediments and pour it into the Imhoff cone.
- Slowly pull up the core sampler and place it on the 5 gallon bucket with the bag around the 10" cylinder.
- Empty the sample from the reservoir into the plastic bag through the 10" cylinder. Use extra wash water to carefully wash the extra sediment from inside the core sampler. Pick up the sampler and drain the rest of the water into the bag.
- Remove the bag from the plastic bucket and pour any remaining sediment and water into the bag.
- Place the short tag inside the bag.
- Twist the bag and tie it with many wraps of the long flagging.
- Record the GPS reading, the ss depth in inches and the Imhoff cone reading. Empty the water from the cone using the cap at the bottom and then replace it tightly! (Easy to lose.)

Sample Analysis:

- Samples are processed by passing the sample through a set of soil sieves and recording the weight of soil passing through each sieve. The percent passing each sieve is then plotted against the sieve sizes on a semi-log plot to provide the grain size distribution of the sample. Samples should be passed through a stack of sieves consisting of the following sieve sizes:

Sieve Number	Opening Size (mm)
200	0.074
20	0.85
8	2.38
4	4.76
3	6.3
0.5"	12.7
1.0"	25.4
2.0"	50.8
3.0"	76.1

From the resulting data, the percent fine sediment can be determined. Other useful metrics, such as the Fredel Index and sorting coefficient, can also be calculated.

4.0 REFERENCES

- Bain, M. B., and N. J. Stevenson, 1999. Aquatic Habitat Assessment: Common Methods. American Fisheries Society, Bethesda, Maryland.
- Skogerboe et al., 1967. Design and Calibration of Submerged Open Channel Flow Measurement Structures: Part 3, Cutthroat Flumes. Utah Water Research Laboratory, Utah State University, April 1967.
- U.S. Dept. of Agriculture, 2004. Using the NRCS Riparian Assessment Method. Natural Resource Conservation Service. September 2004.
- U.S. Geological Survey, 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Office of Water Data Coordination, 1977 (with subsequent revisions through 1983).
- U.S. Dept. of Agriculture, 2000. Monitoring the Vegetation Resources in Riparian Areas. US Forest Service Rocky Mountain Research Station, General Technical Report RMRS-GTR-47. April 2000.

APPENDIX G

**GUIDING DOCUMENTS FOR THE
RESTORATION ACTION PLAN**

APPENDIX G:

GUIDING DOCUMENTS FOR THE RESTORATION ACTION PLAN

Recovery Documents

- Montana Bull trout Scientific Group. 1995. Blackfoot River drainage bull trout status report. Unpublished report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks.
- Montana Bull Trout Restoration Team. 1998. The relationship between land management activities and habitat requirements of bull trout. The Montana Bull Trout Scientific Group, c/o Montana Fish, Wildlife and Parks, Helena, Montana.
- Montana Bull Trout Restoration Team. 2000. Restoration plan for bull trout in the Clark Fork River Basin and Kootenai River Basin Montana. A report to Governor Marc Racicot c/o Montana Fish, Wildlife and Parks, Helena, Montana.
- Pierce, R., C. Podner and J. McFee. 2002b. A hierarchical strategy for prioritizing the restoration of 83 impaired tributaries of the Big Blackfoot River. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Region 2 Native Salmonid Management Guidelines, Montana Fish, Wildlife and Parks, Missoula.
- Shepard, B. B., B. E. May and W. Urie. 2003. Status of westslope cutthroat trout (*Onchorhynchus clarki lewisi*) in the United States: 2002. A report to the Westslope Cutthroat Interagency Conservation Team.
- USFWS, 2002. Draft recovery plan for the bull trout and proposed critical habitat. U. S. Fish and Wildlife Service, Portland, Oregon.

Research Documents

- McIntyre, J. D., and B. E. Reiman, 1995. Westslope WSCT. Pages 1-15 in M. K. Young, editor. Conservation assessment for inland WSCT. U. S. Forest Service General Technical Report. RM-256.
- Reiman, B. E. and J. D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. USDA Forest Service, Intermountain Research Station GTR INT-302.
- Schmetterling, D. A. 2001. Seasonal movements of fluvial westslope cutthroat trout in the Blackfoot River drainage, Montana. North American Journal of Fisheries Management 21: 507-520.
- Shepard, B. B., M. Taper, R. G. White and S. C. Ireland. 1998. Influence of abiotic and biotic factors on abundance of stream-resident westslope cutthroat trout *Onchorhynchus clarki lewisi* in Montana Streams. Final Report to: USDA, Forest Service, Rocky Mountain Research Station, Boise, ID.
- Smith, L. 1998. Study on the distribution and abundance of *Tubifex tubifex* within Cottonwood Creek in the Blackfoot drainage. Masters Thesis, University of Montana, Missoula, Montana.
- Swanberg, T. R. 1997. Movements of and habitat use by fluvial bull trout in Blackfoot River. Transactions of the American Fisheries Society 126:735-746.
- Pierce et al. 2004. Spawning migrations and habitat use by fluvial westslope cutthroat and bull trout in the upper Blackfoot Watershed, p. 63-78, in The Big Blackfoot River Restoration Progress Report for 2002 and 2003. Montana Fish, Wildlife and Parks, Missoula, Montana.

Restoration Monitoring Documents

- Fitzgerald, G. 1996. Inventory and analysis of riparian vegetation along Nevada Creeks. Report prepared for the North Powell Conservation District, and the University of Montana. Missoula.
- Fitzgerald, G. 1996. Inventory and analysis of riparian vegetation along Nevada Creek and Monture Creeks, MS Thesis, University of Montana, Missoula.
- Koopal, M. 1998. Stream habitat analysis of selected tributaries of the Blackfoot River. Report prepared for the Montana, Fish, Wildlife and Parks, Missoula.
- Ingman, G. L., M.A. Kerr and D.L. McGuire 1990. Water quality investigations in the Blackfoot River drainage, Montana. Department of Health and Environmental Services, Helena, Montana.
- Marler, M. 1997. Riparian health and inventory of the Blackfoot River between Nevada Creek and the North Fork Confluence: A GIS mapping project. Report to Montana Fish, Wildlife and Parks, Missoula, MT.
- Marler, M. J., and D. A. Schmetterling. 1999. Riparian health and inventory of selected reaches of the Blackfoot River. Final report to the BLM, Garnet Resource Area and Montana Fish, Wildlife and Parks, Missoula.
- Peters, D. and R. Spoon. 1989. Preliminary fisheries inventory of the Big Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.
- Peters, D. 1990. Inventory of fishery resources in the Blackfoot River and major tributaries to the Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.
- Pierce R. and D. Peters, 1990. Aquatic investigations in the middle Blackfoot River, Nevada Creek and Nevada Spring Creek corridors. Montana Department of Fish, Wildlife and Parks, Missoula.
- Pierce, R., 1991. A stream habitat and fisheries analysis for six tributaries to the Blackfoot River. Montana Department of Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R., D. Peters and T. Swanberg. 1997. Blackfoot River restoration progress report. Montana Fish Wildlife and Parks, Missoula, Montana.
- Pierce, R., and D. Schmetterling. 1999. Blackfoot River restoration project monitoring and progress report 1997-1998. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R. and C. Podner. 2000. Blackfoot River fisheries inventory, monitoring and restoration report. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R. and C. Podner and J. McFee. 2001. Blackfoot River fisheries inventory, monitoring and restoration report. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R., C. Podner and J. McFee. 2002. The Blackfoot River fisheries inventory, restoration and monitoring progress report for 2001. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Pierce, R., R. Anderson and C. Podner. 2004. The Big Blackfoot River Restoration Progress Report for 2002 and 2003. Montana Fish, Wildlife and Parks, Missoula, Montana.
- Schmetterling D. A., and R. W. Pierce. 1999. Success of instream habitat structures after a 50-year flood in Gold Creek, Montana. Restoration Ecology 7(4), pp. 369-375.
- USGS 2004. Gauging stations 1234000, 12335100, 12337800, 12338300, 12335500, provisional unpublished data.

**BIG BLACKFOOT WATERSHED
WATER QUALITY MONITORING PROGRAM**

Quality Assurance Project Plan (QAPP)

Prepared for:

THE BLACKFOOT CHALLENGE
Tina Bernd-Cohen, Executive Director
P.O. Box 563
Helena, MT 59624

Prepared by:

LAND & WATER CONSULTING, INC.
P.O. Box 239
Helena, MT 59624

Original February 6, 2004
Revised May 12, 2004

Project No. 310036

TABLE OF CONTENTS

APPROVAL SHEET.....3

DISTRIBUTION LIST.....4

1.0 PROJECT MANAGEMENT.....5

 1.1 Project Background.....5

 1.2 Project/Task Organization6

 1.3 Problem Definition/Background.....7

 1.4 Project/Task Description and Schedule9

 1.5 Measurement Quality Objectives.....12

 1.6 Training Needs and Certifications13

 1.7 Records Management.....14

2.0 DATA GENERATION AND ACQUISITION.....15

 2.1 Monitoring Design and Schedule.....15

 2.2 Sampling Methods Requirements19

 2.3 Sample Handling and Custody Requirements22

 2.4 Analytical Methods Requirements.....22

 2.5 Quality Control Requirements24

 2.6 Instrument Calibration, Testing, Inspection, and Maintenance25

 2.7 Inspection of Lab and Field Supplies and Materials.....26

 2.8 Non-Direct Measurements26

 2.9 Data Management26

3.0 QUALITY ASSURANCE OVERSIGHT PROCESS.....27

 3.1 Quality Assurance Review Process27

 3.2 Quality Assurance Response Actions27

4.0 DATA VALIDATION28

 4.1 Data Review Process.....28

 4.2 Data Verification and Validation28

 4.3 Data Validation Feedback Mechanism28

5.0 QUALITY ASSURANCE PROJECT PLAN IMPLEMENTATION.....29

 5.1 Review and Approval Process29

 5.2 Annual Review and Revision Process29

6.0 REFERENCES.....31

LIST OF FIGURES

Figure 4-1 *Data Validation Process*

LIST OF TABLES

Table 1-1 *Project Personnel Roles*

Table 1-2 *Summary of Restoration Project Monitoring Locations*

Table 1-3 *Water Quality Status and Trends Monitoring Network Stations*

Table 2-1 *Summary of Currently Scheduled Restoration Project Monitoring Activities*

Table 2-2 *2004 Water Quality Status and Trends Monitoring Activities*

Table 2-3 *Sample Volumes, Containers, Preservation, and Holding Times*

Table 2-4 *Analytical Methods and Detection Limits*

LIST OF APPENDICES

Appendix A *Blackfoot Watershed Water Quality Status and Trends Monitoring Program Summary*

APPROVAL SHEET

_____ Tina Bernd-Cohen Executive Director Blackfoot Challenge	_____ Date
_____ Bob Anderson, Contractor Blackfoot Watershed Monitoring Project Manager Quality Assurance Officer Blackfoot Challenge	_____ Date
_____ Julie DalSoglio Water Programs Manager U.S. EPA, Region 8, Montana Operations Office	_____ Date
_____ Tony Medrano Quality Assurance Officer U.S. EPA, Region 8, Denver Office	_____ Date
_____ John Lambing Status and Trends Monitoring Officer U.S. Geological Survey	_____ Date
_____ Bob Anderson, Contractor Restoration Monitoring Officer Blackfoot Challenge	_____ Date
_____ Gregory B. Mohrman Chief, National Water Quality Laboratory U.S. Geological Survey	_____ Date
_____ Judy Halm Laboratory Manager Montana Department of Public Health and Human Services	_____ Date
_____ Michael Pipp Data Management Section Supervisor STORET Database Liaison Montana Department of Environmental Quality	_____ Date

DISTRIBUTION LIST

Tina Bernd-Cohen
Blackfoot Challenge
P.O. Box 563
Helena, MT 59624

John Lambing
U.S. Geological Survey
3162 Bozeman Avenue
Helena, MT 59601

Julie DalSoglio
U.S. EPA Region 8
10 W. 15th St, Suite 3200
Helena, MT 59626

Tony Medrano
U.S. EPA Region 8
999 18th St. Suite 310
Denver, CO 80202

Gregory B. Mohrman, Chief
USGS National Water Quality Lab
Denver Federal Center
Building 95, MS 407, Entrance E-3
Lakewood, CO 80225-0046

July Halm
MT Dept. of Public Health and
Human Services Chemistry Lab
1400 Broadway
Helena, MT 59604

Ron Pierce
MT Dept. of Fish, Wildlife and Parks
3201 Spurgin Road
Missoula, MT 59801

Michael Pipp
MT Dept. of Environmental Quality
P.O. Box 200901
Helena, MT 59620-0901

Bob Anderson
Hydrometrics Incorporated
2030 Bozeman Avenue
Helena, MT 59601

1.0 PROJECT MANAGEMENT

1.1 Project Background

The Monitoring Work Group of the Blackfoot Challenge Habitat and Water Quality Restoration Committee has been working for over a year to develop a comprehensive water quality monitoring strategy for the Blackfoot watershed. To date, design details have been completed for two elements of the basin-wide monitoring plan. These include a monitoring program to evaluate the effectiveness of water quality and aquatic habitat restoration projects within the basin, beginning with four specific restoration projects that are planned or underway in sections of Nevada Spring, Wasson, Warren, and Poorman creeks. A second element of the basin-wide monitoring program is a water quality status and trends monitoring program designed to assess long-term time trends in the Blackfoot watershed, and to evaluate the cumulative effects of restoration and development activities. Both of these elements of the monitoring plan will be implemented in 2004 with the support of a watershed initiative grant being provided by the U.S. Environmental Protection Agency (EPA). Other details of the comprehensive monitoring strategy for the Blackfoot basin will be worked out in the coming months.

The purpose of this document is to present a quality assurance project plan (QAPP) to direct all EPA and/or Blackfoot Challenge-funded monitoring in the Blackfoot River watershed. This currently includes restoration project effectiveness monitoring program and the water quality status and trends monitoring program scheduled for 2004. Although the QAPP strictly applies only to those activities subject to the specified funding mechanisms, it is hoped and envisioned that all monitoring within the basin will follow the same or similar protocols as outlined in this QAPP to ensure consistency among all monitoring activities. This QAPP describes the quality assurance program that will accompany these monitoring activities, and presents details regarding the project organization, measurement quality objectives, data documentation, sample collection and laboratory analysis, data management, response actions, and data validation. This QAPP is intended to outline a consistent and acceptable approach to data collection and management that will facilitate achievement of program objectives. Implementation of this QAPP will help ensure that all data collected, compiled, and/or generated for these monitoring projects are complete, accurate, and of the type, quantity, and quality required for their intended use.

Under U.S. Environmental Protection Agency Order 5360.1 A2, all organizations conducting environmental programs funded by EPA are required to establish and implement a quality system. Additionally, EPA requires that all data used for purposes of environmental decision-making must be supported by an approved Quality Assurance Project Plan. This QAPP intends to satisfy these requirements, and has been prepared according to guidance provided in *EPA Requirements for Quality Assurance Project Plans*, and *Guidance for Quality Assurance Project Plans* (EPA 2001, 2002). Additional EPA quality system references that were consulted in the preparation of this document include *Guidance for the Data Quality Objectives Process* and *Guidance for Data Quality Assessment: Practical Methods for Data Analysis* (EPA 2000).

This QAPP addresses currently scheduled 2004 monitoring activities, including evaluation of the effectiveness of individual water quality and aquatic habitat restoration projects in the Blackfoot

watershed (restoration monitoring), and the operation of a long-term water quality status and trends monitoring program. The restoration monitoring program includes the continuation of fisheries and habitat assessment activities performed by Montana Fish, Wildlife and Parks (FWP), which have been performed in the basin since 1999. The basin-wide water quality status and trends monitoring plan was finalized in December 2003 and will be implemented in the 2004 calendar year. The QAPP is also intended to apply to other EPA/Blackfoot Challenge-sponsored monitoring activities that may occur in 2004 and beyond. It is important to note here that the scope of the proposed monitoring described in this document may change somewhat due to project developments. However, the quality assurance elements described in this QAPP will still apply regardless of any final adjustments to the monitoring plans.

1.2 Project/Task Organization

This section outlines the project personnel and organizations associated with the various elements of the monitoring programs. Project participant roles are defined in **Table 1-1**. Because of the long-term nature of this monitoring program, it is possible that some of the project participants will change. However, every effort will be made to maintain consistency with project tasks and elements described in the quality assurance project plan.

Table 1-1. Project Personnel Roles

Name	Organization	Project Responsibilities
Tina Bernd-Cohen	Blackfoot Challenge	Executive director, program grant liaison
Bob Anderson	Contractor/Blackfoot Challenge	Blackfoot monitoring project manager
Julie DalSoglio	U.S. EPA	EPA watershed grant project manager
Tony Medrano	U.S. EPA	EPA Region VIII QA officer
John Lambing	U.S. Geological Survey	Status and trends monitoring officer
Bob Anderson	Contractor/Blackfoot Challenge	Restoration monitoring officer
Gregory B. Mohrman	U.S. Geological Survey	Water chemistry analysis
Kent Dodge	U.S. Geological Survey	Suspended sediment analysis
Judy Halm	MT Dept. of Public Health	Chlorophyll sample analysis
Michael Pipp	MT Dept. of Env. Quality	STORET data management liaison

The Program Manager is Tina Bernd-Cohen, the Blackfoot Challenge’s Executive Director. She will be responsible for coordination, oversight, and management of all EPA-funded activities including contracting, financial management, and reporting.

Bob Anderson, under contract with the Blackfoot Challenge, will serve as the Monitoring Program Project Manager. As staff person to the Habitat and Water Quality Restoration Committee, the Project Manager will provide general oversight and coordination to the monitoring projects and related monitoring activities. They will also be responsible for reviewing the monitoring procedures and analytical results to ensure that measurement quality objectives and quality control requirements are met.

Julie DalSoglio is the EPA watershed grant project manager. Julie is the water program manager for the Montana office of EPA Region 8 and will be the primary EPA contact for these monitoring projects.

Tony Medrano is the EPA Region VIII quality assurance officer in Denver. Mr. Medrano will provide final review and approval of this quality assurance project plan.

John Lambing of the U.S. Geological Survey (USGS) is the status and trends monitoring officer and will be responsible for managing the water chemistry, sediment, and stream flow monitoring activities associated with the water quality status and trends network portion of this project.

Bob Anderson, under contract to the Blackfoot Challenge, will serve as the restoration monitoring officer and will be responsible for development of the restoration monitoring protocol and general coordination of restoration monitoring activities, working with Montana Fish, Wildlife and Parks and the Big Blackfoot Chapter of trout Unlimited.

For the Status and Trends Project, the USGS National Water Quality Laboratory (NWQL) in Denver will perform all chemical sample analyses associated with the status and trends monitoring network. The USGS NWQL is accredited by the National Environmental Laboratory Accreditation Program (NELAP). Gregory Mohrman is the laboratory chief. Suspended-sediment samples will be analyzed by the USGS Montana District Sediment Laboratory in Helena. The Sediment Laboratory supervisor is Kent Dodge. The Blackfoot Challenge will hire private contractors to collect, analyze and interpret periphyton and macroinvertebrate samples as well as stream channel monitoring. A monitoring summary report will be produced by the Blackfoot Challenge.

Judy Halm of the Montana Department of Public Health and Human Services Chemistry Laboratory will be responsible for overseeing the processing of chlorophyll samples collected as part of the Blackfoot watershed water quality status and trends monitoring program.

Michael Pipp of the Montana Department of Environmental Quality Data Management Section will be the liaison for purposes of coordinating monitoring data uploads to the EPA STORET database.

1.3 Problem Definition/Background

1.3.1 Restoration Monitoring

In 1988, concern over declining fish populations in the Blackfoot River prompted a basin-wide evaluation of fish populations and their habitats by Montana Fish, Wildlife and Parks staff and cooperating agencies such as the U.S. Fish and Wildlife Service and the U.S. Forest Service. Fishery evaluations reported declines throughout the Blackfoot River and the lower reaches of its tributaries. These studies specifically revealed the decline of native westslope cutthroat trout and bull trout.

Landscape level impacts identified as impacting the basin's fisheries included:

- Poor water quality
- Altered stream channels and contaminated sediments related to past mining activities
- Riparian degradation related to past riparian grazing practices
- Irrigation related impacts including reduced in-stream flows, poor upstream fish passage and entrainment of out-migrant fish to irrigation ditches
- Poor riparian timber harvest practices
- Wetland drainage and associated development (residential and/or agricultural)
- Subdivision activities
- Overexploitation of the fishery

In 1990, efforts shifted from fisheries and fish habitat inventories to on-the-ground restoration projects. Fisheries restoration has expanded from working on individual projects to a basin-wide approach, working with multiple landowners. Since then, the restoration program has expanded beyond fishery-specific issues to a broad level of landscape restoration and protection relying on expertise of several agencies and conservation groups in cooperation with private landowners.

To date, Blackfoot Challenge partners have completed more than 60 restoration projects in the Blackfoot watershed. These fisheries habitat improvement and watershed restoration efforts require a monitoring plan that demonstrates project effectiveness on a project-specific basis. This monitoring information is important to justify restoration expenditures, to inform constituents, and to support overall management decision-making. Where these restoration projects can be integrated with TMDL efforts, TMDL effectiveness monitoring may provide the required information. In other cases, focused monitoring efforts should be made to gather the needed data. A standardized, consistent approach will be applied to restoration project effectiveness monitoring in the Blackfoot watershed, with specific templates established for various project types. The methods developed have been selected to be cost effective and to build upon existing monitoring efforts wherever possible.

With funding from a recent EPA watershed initiative grant, the Blackfoot Challenge will establish monitoring protocols and assess the effectiveness of restoration activities on streams within the watershed. Streams scheduled for restoration in 2004 (and thus restoration effectiveness monitoring) include: Nevada Spring Creek, Wasson Creek, Poorman Creek, and Warren Creek. Although this QAPP addresses these four specific streams, it should be noted that certain streams may be added to or deleted from the 2004 restoration program pending project schedules and developments.

1.3.2 Water Quality Status and Trends Program

The Monitoring Work Group of the Blackfoot Challenge Habitat and Water Quality Restoration Committee has been meeting for over a year to develop a cooperative water quality-monitoring program for the Blackfoot watershed. Early on, the work group determined that development of a basin-wide water quality status and trends network was a high priority. Preliminary designs and funding alternatives for such a network were subsequently reviewed. In July 2003,

following notification of a significant grant award to the Blackfoot Challenge, a subcommittee of the work group was directed to complete a draft monitoring network design and present it for consideration by the entire group. The group met to review the proposal on December 3, 2003 and endorsed it with only minor modifications. The plan is scheduled for implementation beginning in 2004.

Accurate and up-to-date monitoring information is needed to track the health of the Blackfoot watershed, and to provide support for resource management decisions. Informational needs that will be addressed in part by the Blackfoot status and trends monitoring program include: 1) evaluating the cumulative benefits of restoration projects and TMDL implementation, 2) detecting the cumulative impacts of land use activities, 3) identifying priority tributaries and main stem river segments for restoration, and 4) reporting to the public and restoration sponsors on the true condition of the Blackfoot watershed.

1.4 Project/Task Description and Schedule

This section provides a summary of the study area and tasks involved in the monitoring program. More detailed descriptions of the program design, sampling methods, sample handling, and analytical procedures are provided in **Section 2.0**.

1.4.1 Restoration Monitoring

The 2004 restoration effectiveness monitoring project study area includes monitoring locations on four restored streams within the Blackfoot watershed, including Nevada Spring Creek, Wasson Creek, Poorman Creek, and Warren Creek. The locations selected for restoration monitoring represent sites currently used for fisheries assessment monitoring by Montana Fish, Wildlife and Parks (MFWP) personnel. MFWP began fisheries assessments in the Blackfoot watershed in 1999 and these have been continued annually. A summary of restoration project monitoring locations is provided in **Table 1-2**. The study area may be expanded to include additional restoration projects in 2004 and subsequent years.

Nevada Spring Creek

Currently, the fisheries assessments being performed by MFWP include one site on Nevada Spring Creek, located 3.0 miles above the mouth. The source of Nevada Spring Creek is a perennial spring on the eastern edge of the Nevada Creek Valley. The water source maintains a constant flow of 10 to 11 cubic feet per second and summer water temperature of 45 degrees Fahrenheit. Nevada Spring Creek flows into Nevada Creek at stream mile 6.2.

Habitat surveys conducted for Nevada Spring Creek report deteriorated conditions including: stream widening, heavy siltation, poor bank conditions, high summer temperatures in lower reaches, and lack of spawning areas. Past restoration activities since 1990 include fencing livestock from the stream, planting willows in riparian areas, and installing woody debris to aid in the deposition of sediment. Additionally, in 1999 one culvert was replaced with a bridge and a rock dam was removed. In 2001, The Nature Conservancy purchased Nevada Spring Creek Ranch (1,900 acres). In 2002, channel reconstruction began on the upper 1.5 miles of the creek.

These restoration activities aim to 1) improve fish recruitment by improving habitat conditions, and 2) decrease water temperatures during the summer low flow period.

Parameters currently being monitored by MFWP on Nevada Spring Creek include water temperature, stream flow, fish population densities and species composition, and photo points. MFWP has also been monitoring habitat conditions and morphological characteristics including: longitudinal profile, width/depth ratio, radius of curvature, sinuosity, stream type, and Wolman pebble counts.

Wasson Creek

Wasson Creek is a first-order tributary to Nevada Spring Creek, with a base flow of approximately 2 cubic feet per second. The fishery of Wasson Creek has been impacted by past grazing practices, dewatering from irrigation, and fish barriers present in the lower reaches. Restoration activities include implementation of a rotational grazing system, installation of fences, and off-site water development. Furthermore, in 1995 1,750 acres were perpetually protected through a conservation easement with MFWP. In 1998, an undersized culvert was replaced with a bridge and an irrigation diversion was installed to improve fish passage and facilitate sediment bed load transport.

Fisheries assessments are currently being conducted by MFWP at four locations on Wasson Creek. These sites are located 0.1, 0.9, 2.4, and 2.9 miles above the mouth. Parameters currently being monitored include water temperature, stream flow, fish populations, and photo points.

Poorman Creek

Poorman Creek is a third-order tributary to the Blackfoot River. Its headwaters are located on the Helena National Forest. The creek flows 14 miles through small subdivisions and one large ranch. Poorman Creek has been impacted by placer mining, undersized culverts, subdivisions, dewatering from irrigation, and poor grazing management. Past restoration activities include replacement of culverts by the Helena National Forest and Lewis and Clark County. Additionally, several restoration projects have been completed on the Grantier Ranch near the mouth of Poorman Creek. These activities include in-stream restoration, riparian management, consolidation of irrigation ditches, screening of ditches, conversion of flood irrigation to sprinkler systems, and water leasing to protect in-stream flows.

Currently, one site is being monitored by MFWP on Poorman Creek. This site is located 1.5 miles above the mouth. Parameters being monitored include flow, fish populations, and photo points.

Warren Creek

Warren Creek is a second-order tributary to the Blackfoot River. It originates on the north side of the Ovando Valley and flows 14 miles through knob-and-kettle topography, alluvial outwash plains and ranch lands to its confluence with the Blackfoot River. Warren Creek has a base flow of approximately 5 cubic feet per second. The fishery of Warren Creek has been impacted from fish barriers, heavy riparian grazing, and stream channel alterations. Since 2001, restoration projects have included removing feedlots from the stream, removing four fish barriers, installing riparian fencing, and developing off-stream watering.

Table 1-2. Summary of Restoration Project Monitoring Locations

Stream	Locations (mi. above mouth)
Nevada Spring Creek	3.0
Wasson Creek	0.1, 0.9, 2.4, 2.9
Poorman Creek	1.5
Warren Creek	(to be determined)

1.4.2 Water Quality Status and Trends Program

Table 1-3 provides descriptions of the monitoring station locations and sampling frequency as currently planned. The network consists of 12 core stations (6 main stem and 6 tributaries). The Blackfoot Challenge Monitoring Work Group has identified four optional monitoring stations (2 additional main stem and 2 tributary stations) that would be desirable future additions to the status and trends network, if additional funding becomes available.

Table 1-3. Water Quality Status and Trends Monitoring Network Stations

Core Stations	USGS Station Number	River Mile ¹	Station Description	Proposed Sampling Frequency ²
B-1	12334650	119.4	Blackfoot River below Alice Creek, near Lincoln	NMF-6 MPC-1
B-2	12334680	116.1	Landers Fork near Lincoln	NMF-6 MPC-1
B-3	12334800	104.0	Blackfoot River at Dalton Mountain Road Bridge, nr Lincoln	NMF-6 MPC-1
B-4	12335100	72.0	Blackfoot River above Nevada Creek, near Helmville	NMF-6 MPC-1
B-5	12336600	31.1 (NC)	Nevada Creek below Nevada Creek Reservoir	NMF-6 MPC-1
B-6	12337800	67.8	Nevada Creek near mouth, near Helmville	NMF-6 MPC-1
B-7	12337820	60.2	Blackfoot River at Raymond Bridge, near Ovando	NMF-6 MPC-1
B-8	12338300	54.1	North Fork Blackfoot River above Dry Gulch, near Ovando	NMF-6 MPC-1
B-9	12338690	45.9	Monture Creek near Ovando	NMF-6 MPC-1
B-10	12338700	45.8	Blackfoot River at Scotty Brown Bridge	NMF-6 MPC-1
B-11	12339450	34.7	Clearwater River near Clearwater	NMF-6 MPC-1
B-12	12340000	7.9	Blackfoot River near Bonner	NMF-6 MPC-1
Optional Stations				
To be assigned	BRSW12 (ASARCO)	130.8	Blackfoot River above Pass Creek	NMF-6 MPC-1
“ “		26.0 (CR)	Clearwater River above Seeley Lake	NMF-6 MPC-1
“ “		14.2 (CR)	Clearwater River above Salmon Lake	NMF-6 MPC-1
“ “		19.5	Blackfoot River at Whitaker Bridge	NMF-6 MPC-1

¹ From *River Mile Index of the Columbia River Basin*, Montana DNRC, 1984.

² NMF-6 = nutrients, metals, field parameters, 6 samples/year; MPC-1 = macroinvertebrates, periphyton, chlorophyll *a*, 1 sample/year. Stream channel dimensions measured once annually.

Sampling for the water quality status and trends program includes collection of field, laboratory, and biological parameters. Field parameters include: stream flow, water temperature, specific conductance, pH, dissolved oxygen, and channel cross-section dimensions. Laboratory parameters include: total recoverable metals (Fe, Cu, Zn, Cd, Pb), total and dissolved nutrients (total phosphorus, ortho-phosphorus, nitrate plus nitrite, ammonia nitrogen, total nitrogen), calcium and magnesium for calculation of hardness, and suspended sediment. Biological parameters include: quantitative macroinvertebrate samples, qualitative periphyton samples, and chlorophyll *a*.

1.5 Measurement Quality Objectives

Measurement quality objectives (MQOs) are the quantitative and qualitative terms used to specify how good the data needs to be to meet the project's specific monitoring objectives. MQOs for measurement data, also referred to as data quality indicators, include precision, bias, measurement range, representativeness, completeness, and comparability. Measurement quality objectives for the Blackfoot watershed restoration project effectiveness monitoring and status and trends monitoring programs are addressed below.

1.5.1 Precision

Precision refers to the degree of variability in replicate measurements. Precision for parameters measured in the field will be evaluated by conducting repeat measurements. Precision for laboratory analyses of samples can be evaluated by computing relative percent differences (RPDs) in duplicate sample analyses. RPD is calculated as follows:

$$\text{RPD} = (\text{O}-\text{D}) / ((\text{O}+\text{D})/2) \times 100, \text{ where O} = \text{original and D} = \text{duplicate}$$

The Montana Department of Public Health and Human Services chemistry lab has a stated precision goal of +/- 10 percent. Precision goals for the USGS National Water Quality Laboratory vary by parameter. For this project, precision goal of 20 percent will be established for water chemistry, suspended sediment, and for chlorophyll analyses.

1.5.2 Bias

Bias refers to the systematic tendency of analytical results to consistently deviate high or low relative to the actual value. Laboratories implement a system of ongoing QC testing using blanks and standards in order to maintain instrument calibration. Most laboratories also participate in external standard reference testing as a measure of performance. Another measure of bias is the magnitude of contamination that can be potentially introduced to the environmental sample by equipment and handling. To document the presence and magnitude of contamination, field blanks of de-ionized water will be submitted to the NWQL and analyzed for the same constituents as those of stream samples. These blanks are processed through the same sampling equipment used to collect the stream samples and subject to the same handling, preservation, and transportation.

Field blanks with consistent concentrations equal to or less than the laboratory reporting level (LRL) for the analytical method indicate that the entire process of sample collection, field processing, and laboratory analysis is presumably free of significant contamination. If detectable concentrations in field blanks are equal to or greater than twice the LRL (typical measurement precision at the detection level), the results from the next field blank are closely monitored for

presence of consistent trend. If concentrations for a particular constituent exceed twice the LRL in field blanks for two consecutive field trips, blank samples will be collected for individual components of the processing sequence in order to identify the source of contamination.

1.5.3 Measurement Range

Measurement Range is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer. The measurement ranges for field parameters are specified in the operation manuals of each instrument. The factory-determined measurement ranges have been adopted for field parameter measurements under this project. Operation manuals will be kept with each field instrument and will be read and understood before monitoring. Laboratory measurement ranges are specified by the laboratory in accordance with the manufacturers of the analytical equipment.

1.5.4 Representativeness

Representativeness is the extent to which the field measurements and samples collected actually represent the true environmental conditions. For this monitoring effort, the sample locations have been chosen to best represent the stream segment of interest and minimize site-specific bias. Representativeness will also be achieved through adherence to the monitoring protocols and procedures outlined in this QAPP.

1.5.5 Completeness

Completeness is the comparison between the amounts of data that were planned to be collected versus how much usable data was actually collected, expressed as a percentage. Data may be determined to be unusable in the validation process. A project completeness of greater than 90 percent is expected under normal operating conditions. If project completeness falls below 90 percent, then corrective measures including re-sampling or re-analysis will be employed.

1.5.6 Comparability

Comparability is the degree to which data can be compared directly to previously collected data. Data produced from this monitoring program will be obtained by using standard procedures, and can be compared to past monitoring data within the watershed, provided that data were collected using the same or similar procedures. Comparability will be achieved for this project through consistent sampling locations, procedures, and analyses as outlined in this QAPP.

1.6 Training Needs and Certifications

No special training or certifications are required for samplers or data managers of this project. However, strict adherence to sampling methods described in **Section 2.0** of the QAPP is required to ensure compliance with measurement quality objectives (MQOs). The restoration monitoring project officer and water quality status and trends monitoring officer listed in **Table 1-1** are responsible for training the various individual field personnel, under their supervision, according to the methods described in this QAPP or equivalent prescribed methods utilized by respective

agencies. Biological sampling oversight and training will be the responsibility of the biological sampling contractor. Selection of field personnel should be reviewed annually and approved by the project manager. Not applicable to agency staff.

All chemical analyses for this program will be performed by the USGS National Water Quality Laboratory (NWQL), the State of Montana Department of Public Health and Human Services (DPHHS) chemistry laboratory, Energy Laboratories, or other approved labs. Suspended sediment samples will be analyzed by the USGS Montana District Sediment Laboratory. Chlorophyll *a* samples will be analyzed by the Montana DPHHS chemistry laboratory or Energy Laboratories in Helena. Both of these facilities are state-certified analytical laboratories. Macroinvertebrate and periphyton samples will be analyzed by accredited private contractors.

1.7 Records Management

1.7.1 Restoration Monitoring

The documents and records produced from the restoration monitoring component of this project will consist of sample collection records, laboratory reports, and periodic narrative summary reports. Sample collection records will consist of field notes and field forms collected during site visits. All restoration monitoring activities will be described in the annual 2004 Status and Trends and Restoration Monitoring report to be prepared by the Blackfoot Challenge. In addition, the annual Blackfoot River Restoration Monitoring reports prepared by Montana Fish, Wildlife and Parks personnel will serve as the reporting product for all fisheries monitoring aspects of the Blackfoot River Restoration Monitoring Program described in this QAPP.

1.7.2 Water Quality Status and Trends Program

The following documents will be generated as components of the Blackfoot watershed water quality status and trends program:

1. *Field Notebooks and Related Forms.* These will be generated during the course of the field component of the monitoring program.
2. *Sample Shipping Records.* Sample shipping receipts from the carrier will be used to document transferal of samples. The NWQL of the USGS provides an electronic acknowledgement of sample receipt and condition.
3. *Laboratory Data.* These will be prepared by the analytical laboratory and will include reports of sample analysis results and related QA/QC information. Laboratory records, including instrument printouts and laboratory bench sheets, will be kept by the laboratory for three years and then archived.
4. *Project Reports.* These include the annual data summaries and periodic trends analyses.

Additional project documents will be generated during the course of the monitoring program, and will be maintained by the project manager. These documents may include the following:

1. *Data and Methodology QA/QC Evaluations.* These include documentation of QA/QC reviews that include data validation, assessment, and response actions, and other issues

that may arise during the course of the monitoring program. These informal records will be maintained in station files by the USGS for the water quality status and trends monitoring program, and by the restoration project monitoring coordinator for the restoration project effectiveness monitoring activities.

2. *Data Evaluation and Management Notes.* These will be maintained by the respective monitoring coordinators.
3. *Communication Records.* These include records of relevant communication between project team members and agencies, program sponsors, and the Blackfoot Challenge and its Habitat and Water Quality Restoration Committee.

In addition to hardcopy or paper documents, computer files will be generated during the course of the monitoring program. The project manager will maintain these files during the course of the program. The project manager will also maintain copies of all program documents on a regular basis for incorporation into a central project file.

2.0 DATA GENERATION AND ACQUISITION

This section presents additional details pertaining to data generation and acquisition for the Blackfoot watershed restoration effectiveness monitoring program and the water quality status and trends program. Components of this section include the following:

- 2.1 Monitoring Design and Schedule
- 2.2 Sampling Methods Requirements
- 2.3 Sample Handling Requirements
- 2.4 Analytical Methods Requirements
- 2.5 Quality Control Requirements
- 2.6 Instrument Calibration, Testing, Inspection, and Maintenance
- 2.7 Inspection of Lab and Field Supplies and Materials
- 2.8 Non-Direct Measurements
- 2.9 Data Management

2.1 Monitoring Design and Schedule

2.1.1 Restoration Monitoring

The restoration monitoring program described in this QAPP reflects a sampling strategy designed to evaluate the effectiveness of stream restoration activities in the Blackfoot watershed. As currently scheduled, this includes Nevada Spring Creek, Wasson Creek, Poorman Creek and Warren Creek in 2004. One monitoring site has been established on both Nevada Spring Creek and Poorman Creek. Four monitoring sites have been established on Wasson and Warren creeks. A summary of restoration monitoring activities as currently proposed at these sites is provided in **Table 2-1**. The scope of monitoring outlined in table 2-1 and in the following paragraphs represents a minimum scope of monitoring as currently planned for 2004. Additional monitoring sites and/or events, which may be incorporated into the 2004 program, will be performed in accordance with the protocols outlined in this QAPP.

Table 2-1. Summary of Currently Scheduled Restoration Project Monitoring Activities

Stream	Locations (miles abv. mouth)	Monitoring Parameters	Frequency
Nevada Spring Creek	3.0	Water temperature (F) Stream flow (cfs) Fish populations Photo points Fish habitat, channel morphology	Annually
Wasson Creek	0.1, 0.9, 2.4, 2.9	Water temperature (F) Stream flow (cfs) Fish populations Photo points	Annually
Poorman Creek	1.5	Stream flow (cfs) Fish populations Photo points	Annually
Warren Creek	(four locations to be determined)	Water temperature (F) Stream flow (cfs) Fish populations Photo points Fish habitat, channel morphology	Annually

Nevada Spring Creek will be monitored at least once in September 2004 at a location 3.0 miles above the mouth. Parameters monitored in Nevada Spring Creek will include stream temperature (F), flow (cfs), fish population metrics, photo points, fish habitat and channel morphology characteristics, including longitudinal profile, cross-sectional surveys, width/depth ratio, radius of curvature, sinuosity, stream type and Wolman pebble counts.

Wasson Creek will be monitored at least once in 2004 at locations 0.1, 0.9, 2.4 and 2.9 miles above the mouth. Monitoring will likely take place in August. Parameters monitored at these sites include stream temperature (F), flow (cfs), fish population metrics, and photo points.

Poorman Creek will be monitored at a site 1.5 miles above the mouth, at least once in 2004. Parameters monitored on Poorman Creek include stream flow (cfs), fish population metrics, and photo points.

Warren Creek will be monitored at least once at four locations. Monitoring will occur in September. Parameters monitored at Warren Creek sites will include stream temperature (F), flow (cfs), fish population metrics, photo points, fish habitat and channel morphology characteristics, including longitudinal profile, cross-sectional surveys, width/depth ratio, radius of curvature, sinuosity, stream type, and Wolman pebble counts.

2.1.2 Water Quality Status and Trends Program

The Blackfoot water quality status and trends monitoring program will address water quality in three distinct segments of the Blackfoot River main stem and its major tributaries, including Landers Fork, Nevada Creek, North Fork, Monture Creek, and the Clearwater River. The three main stem segments of the Blackfoot River correspond to Montana DEQ and U.S. EPA TMDL planning units, as follows: 1) Blackfoot Headwaters – from the confluence of Beartrap and Anaconda creeks to Nevada Creek, 2) Middle Blackfoot – from Nevada Creek to the Clearwater River, and 3) Lower Blackfoot – from the Clearwater River to the Clark Fork.

The 2004 status and trends monitoring sites are included in table 2-2. Considerations in establishing this network included: past monitoring activities and/or the availability of baseline data, stream flow gauging station presence or potential, evenly distributed basin-wide geographical coverage, representation of major tributary streams, representation of reference sites (sites B-8 and B-9 in Table 2-2), relationship to TMDL planning unit boundaries, existing or potential monitoring sponsorship, program costs, stakeholder input, and other factors.

The primary water quality impairment issues of concern in the Blackfoot watershed, now and into the foreseeable future, include: heavy metals, algal nutrients, siltation/suspended sediment, habitat alterations, riparian degradation, thermal modifications, and stream flow alterations. These impairments negatively affect designated uses of the Blackfoot Basin's waters, including aquatic life, coldwater fisheries, drinking water, primary contact recreation, and agricultural and industrial uses. Indicator variables have been selected which reflect water quality and beneficial water use-support of the Blackfoot watershed as influenced by these impairment causes.

Selected monitoring variables, which define “water quality” for purposes of the Blackfoot watershed water quality status and trends monitoring network, and their associated monitoring frequencies are described below and are summarized in **Table 2-2**.

Sampling for the water quality status and trends program includes collection of field, laboratory and biological parameters. Field parameters include: stream flow, water temperature, specific conductance, pH, dissolved oxygen, and channel cross-section dimensions. Laboratory parameters include, at a minimum: total recoverable metals (Fe, Cu, Zn, Cd, Pb), total and dissolved nutrients (total phosphorus, ortho-phosphorus, nitrate plus nitrite, ammonia nitrogen, total nitrogen), calcium and magnesium for calculation of water hardness, turbidity, and total suspended sediment. Biological parameters include: quantitative macroinvertebrate samples (4 replicate Hess samples/site), qualitative periphyton sample (1 composite sample/site), and chlorophyll *a* (natural substrates, 10 replicates/site).

Field measurements (except channel cross-sections) and water column sampling will be performed six times per year, at the following times: 1) spring rising limb of the hydrograph (April-May), 2) at or near peak of seasonal hydrograph (May-June), 3) falling limb of spring runoff hydrograph (June), 4) summer base flow (August), 5) late fall (November-December), and 6) an additional episodic high flow/runoff event (can occur anytime of year). Dissolved oxygen will be measured at the time of sampling during each of the six routine monitoring events.

Table 2-2. 2004 Water Quality Status and Trends Monitoring Activities

Core Stations	Station Description	Proposed 2004 Sampling Frequency¹
B-1	Blackfoot River below Alice Creek, near Lincoln	NMF-6 MPC-1
B-2	Landers Fork near Lincoln	NMF-6 MPC-1
B-3	Blackfoot River at Dalton Mountain Road Bridge, near Lincoln	NMF-6 MPC-1
B-4	Blackfoot River above Nevada Creek, near Helmville	NMF-6 MPC-1
B-5	Nevada Creek below Nevada Creek Reservoir	NMF-6 MPC-1
B-6	Nevada Creek near mouth, near Helmville	NMF-6 MPC-1
B-7	Blackfoot River at Raymond Bridge	NMF-6 MPC-1
B-8	North Fork Blackfoot River above Dry Gulch, near Ovando	NMF-6 MPC-1
B-9	Monture Creek near Ovando	NMF-6 MPC-1
B-10	Blackfoot River at Scotty Brown Bridge	NMF-6 MPC-1
B-11	Clearwater River near Clearwater	NMF-6 MPC-1
B-12	Blackfoot River near Bonner	NMF-6 MPC-1
Optional Stations	Station Description	
To be assigned	Blackfoot River above Pass Creek	NMF-6 MPC-1
“ “	Clearwater River above Seeley Lake	NMF-6 MPC-1
“ “	Clearwater River above Salmon Lake	NMF-6 MPC-1
“ “	Blackfoot River at Whitaker Bridge	NMF-6 MPC-1

¹ NMF-6 = nutrients, metals, field parameters, 6 samples/year; MPC-1 = macroinvertebrates, periphyton, chlorophyll *a*, 1 sample/year.

Note: Schedule may be modified after 2004 based on 2004 monitoring results, data needs, and project budgets.

Periodically (e.g. biennially or triennially), as funding allows, 24-hour diel dissolved oxygen surveys may be performed at each monitoring site during the hottest part of the summer (late-July to mid-August) to evaluate the degree of diurnal dissolved oxygen depression.

Biological variables will be monitored once annually, in mid- to late August. Channel cross-sections will be documented annually during the biological sampling event to evaluate the stability of the sampling location, and any potential influences on aquatic habitat features. This frequency may be reduced to biennially or less at sites demonstrating a high degree of stability and consistency.

2.2 Sampling Methods Requirements

2.2.1 Restoration Monitoring

Stream Temperature

Stream temperature (F) will be monitored at all sites on Nevada Spring Creek, Wasson Creek Poorman Creek, and Warren Creek. Water temperatures will be recorded at 48 to 72 minute intervals using Hobo temperature or Tidbit data loggers. Data for each station will be summarized with daily and monthly mean, maximum, minimum, and standard deviation values.

Stream Flow

Stream flow will be measured at all monitoring sites on all streams using a current velocity meter and standard USGS area-velocity method. For smaller streams, stream flow may be measured with a portable flume.

Fish Populations

Fish population metrics will be monitored at all sites on Nevada Spring Creek, Poorman Creek, Wasson Creek and Warren Creek.

Fish population densities are calculated using single-pass or multiple pass-depletion methods. Samplers will use depletion estimates and single pass catch-per-unit-effort (CPUE) in smaller streams. Confidence intervals (CI) were calculated using the equation $N \pm 1.96 (V(N))^{1/2}$ and calculated at the 95% confidence level.

For fish population estimates, samplers will use a standard two-pass depletion estimator and standard equations for calculating variance (Leathe 1983, Seber 1973). For this estimator:

$$N = \frac{(n_1)^2}{n_1 - n_2}$$

$$P = \frac{n_1 - n_2}{n_1}$$

Where:

N = point estimate,

n_1 = the number of fish collected on the first pass

n_2 = number of fish captured on the second pass

P = probability of capture (≥ 0.5 for $N \geq 50$, ≥ 0.60 for $N \leq 50$ for valid estimates)

$$\text{Standard deviation} = \frac{n_1 n_2 (n_1 + n_2)^{-2}}{(n_1 - n_2)^2}$$

$$95\% \text{ confidence interval} = N \pm 1.96 (\text{Standard deviation})$$

For population assessments, samplers will use a single pass catch-per-unit effort (CPUE) method, which provides an index of relative abundance. Pierce et al. developed a simple linear regression ($y = 1.717x - 0.797$) to help predict densities from CPUE, and reported significant

correlation between two-pass density estimates and CPUE ($R^2=0.902$, $P<0.001$). Small stream size and highly efficient electro fishing conditions in study streams contributed to this outcome. Although the regression demonstrates CPUE to be an index to population density, CPUE does not include a confidence interval like the actual population density estimate. For this project, CPUE refers to the number of fish collected in a single electro fishing pass and is adjusted per 100 feet of stream (I.e. CPUE of 8 means 8 fish captured per 100' of sampled stream). Actual population estimates are referred to as density/100'.

Fish will be captured using a backpack mounted electro fishing unit. In small streams, samplers will use a battery powered (Smith/Root) backpack mounted DC electro fishing unit. The anode (positive electrode) is a hand-held wand equipped with a 1-foot-diameter hoop; the cathode (negative electrode) is a braided steel wire. Juvenile trout are sampled in the tributaries from August to November. Extra effort is used to sample stream edges and around cover to enable comparisons of densities between sampling sections. Captured fish are anesthetized with either methanesulfonate (MS-222) or clove oil, weighed (g) and measured (mm) for total length (TL). For this project, samplers convert all weights and lengths to standard units.

Photo Points

Photo points have been established at all monitoring sites on all streams and will be established for any new monitoring sites. During each monitoring visit, the sampler will take a photo in both the upstream and downstream direction from a pre-determined location at the monitoring site. Photo number, location, and direction are to be noted in the field notes.

Habitat Condition and Channel Morphology

Habitat condition and channel morphology parameters will be monitored on Nevada Spring Creek and Warren Creek. The parameters to be monitored include longitudinal profile and cross section surveys, width/depth ratio, radius of curvature, sinuosity, stream type and Wolman pebble counts.

Pre- and post-treatment surveys of both longitudinal profile and cross sections have or will be completed at the monitoring site. Samplers will use modified Rosgen level II channel surveys, and Rosgen-modified Wolman pebble counts (Wolman 1954, Rosgen 1996) for the geomorphic assessments. These measurements include bankfull width, sinuosity, radius of curvature, substrate composition and channel type. Sinuosity will be determined using a hip-chain to measure total stream length and USGS topographic maps to measure total valley length.

2.2.2 Water Quality Status and Trends Monitoring

Field Parameters

Field parameters measured at the time of sampling include stream flow (cfs), water temperature ($^{\circ}\text{C}$), specific conductance ($\mu\text{s}/\text{cm}$), and pH (standard units), dissolved oxygen (mg/l), and channel cross section dimensions. Field parameters will be measured in accordance with USGS standard protocols (Wilde and others, 1998) or equivalent protocols. Several of the stations in the water quality status and trends network occur at locations of active USGS stream flow gauging stations. For these locations, continuous records of stream flow will be available from stage recorders. Stream flows will be gauged by hand at all other stations in the network during

each sampling visit using conventional USGS methods. Channel cross-section dimensions, which include bankfull width, bankfull depth, active channel width, and active channel depth, will be measured once annually using a hand-tape during the biological sampling.

Laboratory Parameters

Laboratory parameters include nutrients, metals, suspended sediment, turbidity, and calcium (Ca) and magnesium (Mg) for calculation of water hardness. Nutrient parameters include: dissolved orthophosphate, total phosphorus (TP), total nitrogen (TN), dissolved nitrate plus nitrite-nitrogen ($\text{NO}_2+\text{NO}_3\text{-N}$), and total ammonia-nitrogen ($\text{NH}_3+\text{NH}_4\text{-N}$). Metal parameters include: total recoverable copper (Cu), total recoverable zinc (Zn), total recoverable iron (Fe), total recoverable cadmium (Cd), and total recoverable lead (Pb). All samples will be collected using a depth-integrated sampling technique (equal-width or equal-flow increment methods) by wading or from a bridge (Wilde and others, 1998) to provide discharge-weighted composite.

Water samples for unfiltered TP, TN, Cu, Zn, Fe, Cd, and Pb will be subsampled from a sample splitter into acid washed polyethylene bottles. Samples will be acidified onsite to a pH of less than 2 by adding concentrated sulfuric acid (H_2SO_4) for nutrient samples and concentrated nitric acid (HNO_3) for metal samples.

Water for soluble nitrogen and phosphorous parameters ($\text{NO}_2+\text{NO}_3\text{-N}$, $\text{NH}_3+\text{NH}_4\text{-N}$, and orthophosphate - P) will be filtered from the sample splitter in the field through a 0.45 μm filter into acid-washed polyethylene bottles. Filtered nutrient samples are acidified to a pH of less than 2 with concentrated sulfuric acid. Samples for calcium and magnesium analysis will be filtered in the field through a 0.45 μm filter into acid-washed polyethylene bottles. The samples are then acidified to a pH of less than 2 with nitric acid.

Suspended sediment samples will be collected with a depth-integrating sampler using equal-width or equal-flow increment methods. The samples are collected in pint or quart sample bottles and are transferred to the USGS Montana District Sediment Lab unpreserved for analysis.

A summary of treatments required for sample preservation is provided in **Table 2-3**. USGS field procedures are described in more detail in the various references contained in Section 6.0 of this QAPP.

Samples must be clearly labeled with a waterproof marker or with pre-printed labels. Label information must include the site identification number, date and time, sample type, preservative, and sampler's initials. The same information is recorded on the field form for each site and on analytical request form that accompanies the sample to the NWQL.

Table 2-3. Sample Volumes, Containers, Preservation, and Holding Times

Analyte	Sample Volume	Container	Preservation	Holding Time
TP and TN	250 ml	Acid-washed polyethylene, dark bottle	Add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Total Recoverable Cu, Zn, Fe, Cd, and Pb	250 ml	Acid-washed polyethylene	Add HNO ₃ to pH<2	6 months
NO ₂ +NO ₃ , NH ₃ +NH ₄ , and orthophosphate-P	125 ml	Acid-washed polyethylene, dark bottle	Filter, add H ₂ SO ₄ to pH<2, cool to 4°C	28 days
Suspended Sediment	1-5 liters	Glass or plastic	Store in cool, dark area	6 months
Ca and Mg	250 ml	Acid-washed polyethylene	Add HNO ₃ to pH<2	6 months

Biological Parameters

The status and trends monitoring plan includes the annual collection of macroinvertebrate, periphyton and chlorophyll *a* samples at each of 12 sampling locations in the Blackfoot watershed. Periphyton sampling methods will utilize a single composite sample collected at each station. Macroinvertebrate sampling methods will include multiple replicate (e.g. 4/site) unit-area Hess samples. Chlorophyll sampling methods will utilize 10 replicate samples per site collected from natural substrates with a standardized unit-area-sampling frame. Sampling methods and associated field information forms for biological parameters are provided in the references listed in Section 6.0 of this QAPP.

2.3 Sample Handling

All water quality and biological samples will be immediately placed into appropriate storage containers in the field, as specified in **Section 2.2** above. Samples will be packaged appropriately to avoid damage and shipped promptly to maintain the specified holding temperatures.

2.4 Analytical Methods Requirements

The USGS National Water Quality Laboratory, the USGS Montana District Sediment Laboratory, the Montana Department of Public Health and Human Services chemistry laboratory, and Energy Laboratories are approved laboratories for performing analytical services for the Blackfoot monitoring programs described in this QAPP.

In 2004, the USGS National Water Quality Laboratory will perform all chemical analyses for the water quality status and trends monitoring program using USGS-approved methods (Fishman, 1993). The USGS Montana District Sediment Laboratory will analyze samples for suspended

sediment USGS approved methods (Lambing and Dodge, 1993). The analysis methods listed in **Table 2-4** represent standard accepted procedures that will be followed. Details regarding these methods are included in the references section of this QAPP. Additional quality assurance information for the USGS laboratory described in Pritt and Raese (1995) and is accessible through the web site <http://www.nwql.cr.usgs.gov> .

Biological samples will analyzed by the Montana Department of Public Health and Human Services chemistry laboratory (chlorophyll *a*), Energy Laboratories (chlorophyll *a*), and other private contract laboratories (macroinvertebrate and periphyton samples) following standard procedures.

Table 2-4. Analytical Methods and Detection Limits

Analyte	Lab Code/Method	Analytical Detection Limit
Total Phosphorus (TP)	USGS 2333	0.004 mg/l
Total Nitrogen (TN)	USGS 2756	0.03 mg/l
Dissolved Nitrate + Nitrite-Nitrogen (NO ₂ +NO ₃ -N)	USGS 1979	0.016 mg/l
Dissolved Ammonia-Nitrogen (NH ₃ +NH ₄ -N)	USGS 1980	0.010 mg/l
Dissolved Orthophosphate-P	USGS 1978	0.006 mg/l
Total Recoverable Copper (Cu)	USGS 2379	0.6 µg/l
Total Recoverable Zinc (Zn)	USGS 2390	2 µg/l
Total Recoverable Cadmium (Cd)	USGS 2376	0.04 µg/l
Total Recoverable Iron (Fe)	USGS 2359	9 µg/l
Total Recoverable Lead (Pb)	USGS 2380	0.06 µg/l
Suspended Sediment	Lambing and Dodge 1993	1 mg/l
Calcium	USGS 659	0.010 mg/l
Magnesium	USGS 663	0.008 mg/l

Following is a list of the laboratories to be utilized in the monitoring program. The project manager may consider and approve additional laboratories on an as-needed basis.

USGS National Water Quality Laboratory
Denver Federal Center
Building 95, MS 407, Entrance E-3
Lakewood, CO 80225-0046
Contact: Gregory B. Mohrman (303) 236-3500
Analysis: nutrient, metals, common ions

USGS Montana District Sediment Laboratory
3162 Bozeman Avenue
Helena, MT 59601
Contact: Kent Dodge (406) 457-5937
Analysis: suspended sediment

Montana Department of Public Health and Human Services
Laboratory Services
P.O. Box 6489
Helena, Montana 59604
Contact: Judy Halm (406) 444-2642
Analysis: chlorophyll *a* samples

Energy Laboratories, Inc.
3161 E Lyndale Ave (59601)
PO Box 5688
Helena, MT 59604-5688
Contact: Deb Grimm (877) 472-0711
Analysis: chlorophyll *a* samples

Rithron Associates, Inc.
1501 West Central Avenue
Missoula, MT 59801
Contact: Wease Bollman (406) 721-1977
Analysis: macroinvertebrate samples

Hannaea
1032 12th Avenue
Helena, MT 59601
Contact: Loren Bahls (406) 443-2196
Analysis: periphyton samples

2.5 Quality Control Requirements

Field quality control for the restoration and status and trends monitoring programs will be maintained by following the sampling methods described in Section 2.2.

Field quality control for the water quality status and trends network will be monitored by submitting a de-ionized water blank and a field duplicate sample for analysis at a proportion of about 10% of the sample load.

Blank - During field sampling, certified trace-element free de-ionized water is run through sampling equipment, sample splitter, a filter, acidified, and otherwise treated as an environmental sample.

Duplicate Samples - A duplicate sample is obtained by splitting from the sample splitter and submitted for analysis of all analytes as a quality check on lab procedures. Duplicate samples should be taken simultaneously and handled with the same procedures as the original.

Field quality control samples will be packaged, labeled and submitted to the analytical laboratory in a manner identical to the routine samples to ensure that they are treated and analyzed by the lab in a similar fashion.

The respective analytical laboratory through their documented QC procedures will monitor laboratory quality control. Immediately upon receipt of samples from the field, the laboratory will:

1. log-in the samples to establish a record number for tracking analytical results;
2. inspect the cooler to make sure the samples have been kept at the proper temperature;
3. inspect the samples for leakage or breakage.
4. notify the field office with an electronic acknowledgment of sample receipt and condition.

The samples will then be stored in accordance with the laboratory's procedures. The project quality assurance manager will be immediately notified if any deficiencies are observed upon sample receipt.

The project labs must follow procedures consistent with their own QA plans and laboratory certification requirements, including sample tracking and quality control procedures. Quality assurance/quality control procedures of the USGS NWQL are described in Pratt and Raese (1995) and is accessible through the website <http://www.nwql.cr.usgs.gov>. The USGS NWQL routinely analyzes quality control (QC) samples at a minimum of 1 in every 10 samples. These QC samples include at least one of the following: standard reference water sample, duplicate samples, standard solutions, blanks, or spikes. The QC data are reviewed following completion of an analysis set to ensure all results meet acceptance criteria. If criteria are met, the analytical data are acceptable. If QC sample results fail to meet criteria, the analytical instrument is shut down and re-calibrated.

2.6 Instrument Calibration, Testing, Inspection, and Maintenance

All field instruments and sampling equipment will be maintained in proper working order, with regular maintenance being performed as required by the manufacturer. Prior to mobilization to

the field, personnel will inspect the equipment to make sure it is in proper working order. Maintenance notes will be entered into the field logbook.

Field instrument calibration will be performed at the beginning of every sampling day. More frequent calibration will be performed at the discretion of field personnel, and may be warranted by weather conditions or if problems with the instruments are suspected. Post-sampling calibration will be used when warranted to verify accuracy. Calibration procedures will conform to manufacturer specifications. Calibration notes will be entered into the field logbooks.

2.7 Inspection of Field Supplies and Materials

All monitoring supplies and materials will be inspected by the sampler to ensure they are in proper condition and working order prior to mobilization to the field. Any problems as well as application of maintenance requirements will be documented in the field notes. Extra monitoring supplies and containers will be brought into the field in the event that contamination or damage occurs.

2.8 Non-Direct Measurements

Data from outside or secondary sources will not be used by this monitoring program, with the exception of pre-restoration project data that have been collected by MFWP since 1999. The previous monitoring data were collected using similar methods to those described in this QAPP.

Non-direct measurements for the water quality status and trends program include stream flow rating values obtained from USGS gauging stations, stage data from staff gauges or stage flow measuring devices, or any data not directly resulting from the procedures described in this QAPP. All non-direct measurements must be evaluated to determine compliance with measurement quality objectives before acceptance.

2.9 Data Management

Data collection activities during the restoration monitoring program will be recorded in field notes and on appropriate field forms, and will later be entered into a spreadsheet by the Blackfoot Challenge monitoring consultants and MFWP staff. The fisheries data will be included in MFWP's annual *Blackfoot River Fisheries Inventory, Restoration and Monitoring Progress Report*. All data generated in the fisheries restoration monitoring component of this project will be stored at MFWP's Missoula office.

Water chemistry and field measurement data generated during the water quality status and trends program will undergo standard review procedures and be stored in USGS's web-enabled National Water Information System database. This database is also accessible via links from the State of Montana NRIS web site. The private contractor will submit all project biological data to the Montana Department of Environmental Quality (DEQ) in a SIM-compatible format in Excel or text delimited file that will provide for minimum data and metadata requirements for import into EPA Storet database. Montana DEQ staff will perform the actual uploads to STORET until such time as a Web SIM application becomes available for DEQ data providers. Data provided in

incomplete or unacceptable format will be returned to the Contractor for correction or completion.

Inherent in the STORET format requirements for biological results is the requirement that all taxonomic names reported correspond exactly to a valid entry in the IT IS database, as this is the approved reference list. Should the private contractor not be able to provide the required format, a mutually agreeable alternative EDD may be negotiated with DEQ Data Management Section until the specified format can be achieved in its entirety.

3.0 QUALITY ASSURANCE OVERSIGHT PROCESS

3.1 Quality Assurance Review Process

The primary mechanism through which project measurement quality objectives (MQOs) will be met is adherence to prescribed protocols and quality control procedures. Planning and design of the project, documented instructions and procedures, and use of qualified and experienced personnel as outlined in this QAPP are expected to achieve reliable data quality.

An assessment program will be used to identify any problems with the project data and trigger response actions to bring the data back in line with the project MQOs. The assessment will include routine evaluation of the data with respect to MQOs such as precision, bias, and completeness, as presented in **Section 1.5**. The assessment will also include a structured data validation process, as discussed in **Section 4.0**. Assessment may include high-level monitoring of certain project activities or audits initiated as a response action (discussed below).

3.2 Quality Assurance Response Actions

In the event that the assessment program identifies problems with project data, response actions will be triggered. The nature of these actions will depend upon the severity and types of problems encountered, and will begin with a review of project procedures related to the identified problem(s). Additional costs to the monitoring program may incur if response actions are triggered. The project manager must approve these additional costs before response actions commence. Additional response actions may include:

- **Preventive Response Actions**

These measures would be directed at preventing the identified problem from being repeated, and include:

- implementation of high-level monitoring of project activities associated with the problem to prevent further deviations; and
- initiation of a system of audits that will include random and unannounced evaluations of personnel, equipment, or organizations to determine if procedures outlined in the QAPP are being adhered to. The project manager will be responsible for implementing corrective measures to address identified deviations from the QAPP.

- **Corrective Response Actions**

These measures will result in a correction of the problem and replacement of the problematic data with data that meet the project MQOs. Potential corrective actions include:

- re-analysis if the problem identified is or may be related to laboratory procedures and sample holding times allow it; and
- re-sampling if the problem is related to field procedures or if a new sample is required for laboratory analysis.

4.0 DATA VALIDATION

4.1 Data Review Process

Data will be reviewed in an ongoing manner through the detailed examination of raw data to check for anomalous values, calculation errors, measurements within calibration range, and data entry errors. Various computer software programs, including Microsoft Excel and SPSS, may be used to assist in the data review process to help identify potentially erroneous data. The USGS will employ standard checks and internal review procedures to ensure data validity.

4.2 Data Verification and Validation

Data verification refers to the routine checks the sampling oversight officer conducts in ensuring that the QAPP is followed, as well as to the quality control procedures of the analytical laboratory. The laboratory will conduct routine QA and maintain the supporting laboratory quality assurance documentation in accordance with standard laboratory procedures (Pritt and Raese, 1995).

At a minimum, data verification will include evaluation of sampling documentation/representativeness, compliance with sample holding times, and appropriate detection limits.

4.3 Data Validation Feedback Mechanism

Data validation refers to the confirmation by examination and provision of objective evidence that the particular requirements for the intended use of data have been met. Data validation is conducted on verified data and the methodology will differ for each parameter according to the project MQOs. All incoming data must pass the validation process before entry into the database. Data that fail the validation process will be qualified and flagged as such or, in extreme cases, excluded from the database. Identification of invalid data will trigger preventive or corrective response actions. At a minimum, the validation process will address the following:

- field forms and laboratory data sheets will be checked to verify that appropriate analyses were run and that the samples were analyzed within specified holding times;

- reviews of duplicate and blank samples will be used to evaluate method precision and bias by the laboratory;
- a comprehensive review of the analytical results will be conducted to evaluate the overall quality of the data. Included will be a review for potential transcription errors, detection limit discrepancies, data omissions, and suspect or anomalous values; and
- field data will be reviewed, and anomalous or suspect values will be noted and an explanation provided.

A flow chart describing the data validation process is provided in **Figure 4-1**.

5.0 QUALITY ASSURANCE PROJECT PLAN IMPLEMENTATION

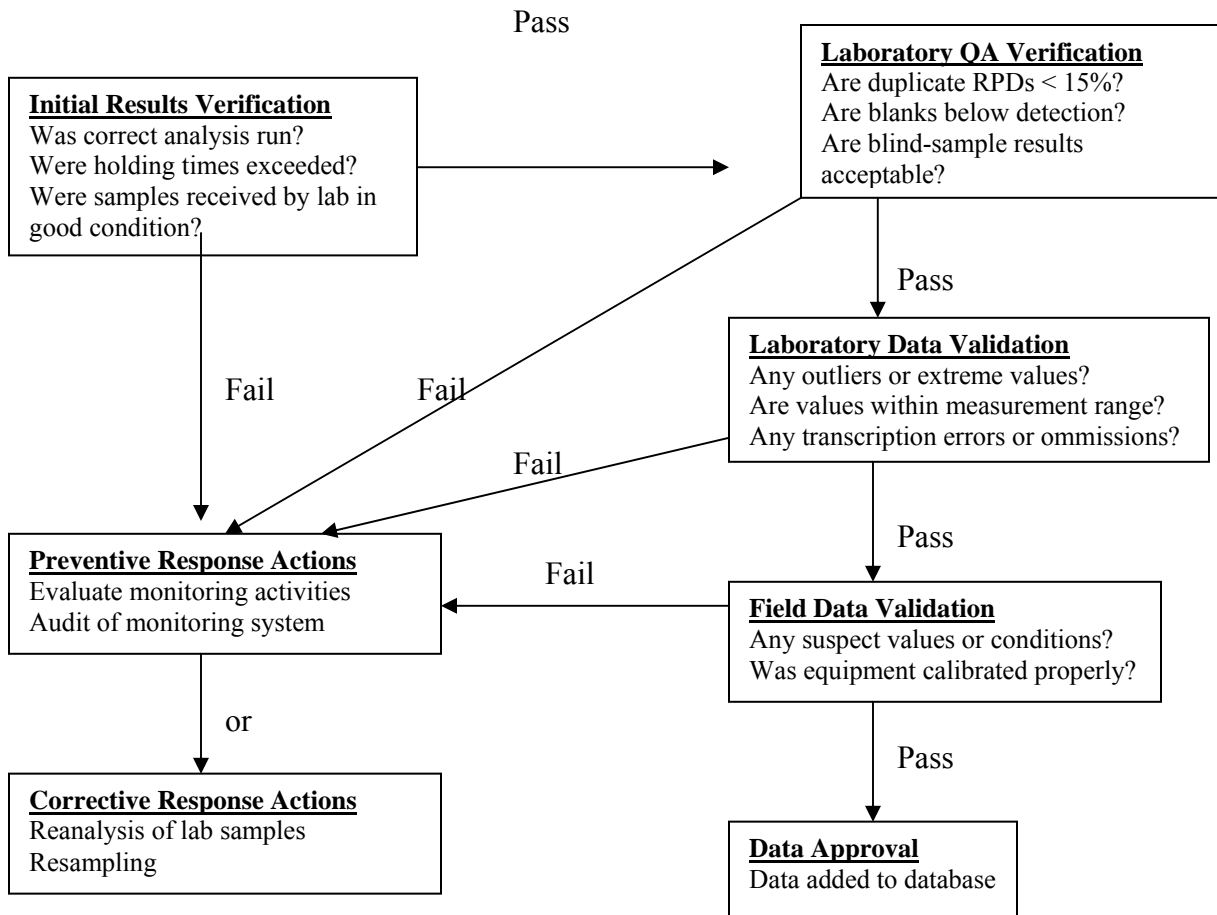
5.1 Review and Approval Process

This QAPP is to be distributed to all personnel and organizations listed on the distribution list. All personnel involved in the Blackfoot watershed water quality monitoring programs are to sign and date the Approval section of this document and return the signed portion to the project manager. By signing the Approval section, the signatory agrees that he/she has read and understands his or her role in the monitoring program, and will adhere to all sections of this QAPP relevant to their respective role in the program. Additionally, all personnel involved in the project should retain or have access to the current version of this QAPP.

5.2 Annual Review and Revision Process

This QAPP will be reviewed by the project manager annually, or as needed upon the adoption of changes to the program. Any modifications to this QAPP will require formal approval.

Figure 4-1. Data Validation Process



6.0 REFERENCES

- APHA/AWWA/WEF. 1998. *Standard Methods for the Examination of Water and Wastewater, 20th Ed.* American Public Health Association. Washington, D.C.
- Edwards, T.K. and G.D. Glysson. 1999. *Field methods for measurement of fluvial sediment: Techniques of water-resources investigations of the USGS.* Book 3, Chapter C2.
- Faires, L.M. 1993. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Determination of metals in water by inductively coupled plasma-mass spectrometry.* U.S. Geological Survey Open-File Report 92-634.
- Fishman, M.J., ed. 1993. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Determination of inorganic and organic constituents in water and fluvial sediments.* U.S. Geological Survey Open-File Report 93-125.
- Fishman, M.J., and L.C. Friedman. 1989. *Methods for determination of inorganic substances in water and fluvial sediments.* U.S. Geological Survey Techniques of Water-Resources Investigations, Book 5, Chapter A1.
- Garbarino, J.R., and T.M. Struzeski. 1998. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Determination of elements in whole-water digests using inductively coupled plasma-optical emission spectrometry and inductively coupled plasma-mass spectrometry.* U.S. Geological Survey Open-File Report 98-165.
- Hoffman, G.L., M.J. Fishman, and J.R. Garbarino. 1996. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- In-bottle acid digestion of whole-water samples.* U.S. Geological Survey Open-File Report 96-225.
- Jones, S.R., and J.R. Garbarino. 1999. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Determination of arsenic and selenium in water and sediment by graphite furnace-atomic absorption spectrometry.* U.S. Geological Survey Open-File Report 98-639.
- Knott, J.M., Sholar, C.J., and W.J. Matthes. 1992. *Quality assurance guidelines for the analysis of sediment concentration by U.S. Geological Survey sediment laboratories.* U.S. Geological Survey Open-File Report 92-33.
- Lambing, J.H. and K.A. Dodge. 1993. *Quality assurance for Laboratory Analysis of Suspended-Sediment Samples by the USGS in Montana.* U.S. Geological Survey Open-File Report 93-131.

Montana Department of Environmental Quality. 2004. *Web site for water monitoring standard operating procedures*: <http://www.deq.state.mt.us/ppa/mdm/SOP/MTSOP.asp>

Patton, C.J., and J.R. Kryskalla. *Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory -- Evaluation of alkaline persulfate digestion as an alternative to Kjeldahl digestion for determination of total and dissolved nitrogen and phosphorus in water*. Water-Resources Investigations Report 03-4174.

Pritt, J.W and Raese, J.W. (editors), 1995. *Quality Assurance/Quality Control Manual*, National Water Quality Laboratory. U.S. Geological Survey Open-File Report 95-443, 35p.

Rosgen, D., and H.L. Silvey. 1996. *Applied River Morphology*. Wildland Hydrology. Pagosa Springs, CO.

Seber, G.A.F. 1973. *The estimation of animal abundance and related parameters*. Charles Griffin and Co., Ltd. London.

U.S. Environmental Protection Agency. 2001. *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*. EPA/240/B-01/003. March 2001. Washington, D.C.

U.S. Environmental Protection Agency. 2002. *Guidance for Quality Assurance Project Plans (EPA QA/G-5)*. EPA/240/R-02/009. December 2002. Washington, D.C.

U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives Process (EPA QA/G-4)*. EPA/600/R-96/055. August 2000. Washington, D.C.

U.S. Environmental Protection Agency. 2002. *Guidance for Data Quality Assessment: Practical Methods for Data Analysis (EPA QA/G-9)*. EPA/600/R-96/084. July 2000. Washington, D.C.

U.S. Geological Survey. 1991. *Quality Assurance Plan for Water-Resource Activities of the USGS in Montana*. U.S. Geological Survey Open-File Report 91-194. Revised 1995.

U.S. Geological Survey. 1991. *Quality Assurance for Water-Quality Activities of the USGS in Montana*. U.S. Geological Survey Open-File Report 91-216.

U.S. Geological Survey. 1985. *Field Guidelines for Collection, Treatment, and Analysis of Water Samples, Montana District*. U.S. Geological Survey Open-File Report 85-409.

U.S. Geological Survey. 2004. *National Water Quality Laboratory web site*:
<http://nwql.usgs.gov/>

U.S. Geological Survey. 2004. *QA document for National Water Quality Laboratory*:
<http://nwql.usgs.gov/Public/pubs/QC/>

U.S. Geological Survey. 2004. *Web site for USGS reports, maps, and publications:*
www.usgs.gov/pubprod.

Wagner, R.J., Mattraw, H.C., Ritz, G.F., and B.A. Smith. 2000. *Guidelines and standard procedures for continuous water-quality monitors: Site selection, field operation, calibration, record computation, and reporting.* USGS Water-Resources Investigations Report 00-4252.

Wilde, F.D., Radtke, D.B., Gibbs, J., and R.T. Iwatsubo. 1998. *National Field Manual for the Collection of Water-Quality Data.* U.S. Geological Survey Techniques of Water Resources Investigations, Book 9. www.water.usgs.gov/owq/fieldmanual/index.html.

Wolman, M.G. 1954. *A method of sampling coarse river-bed material.* Transactions of the American Geophysical Union (EOS), Volume 35, pages 951-956.

Appendix A

BLACKFOOT WATERSHED WATER QUALITY STATUS AND TRENDS MONITORING PROGRAM SUMMARY

Final Plan

Blackfoot Watershed Water Quality Status And Trends Monitoring Program

Introduction

The Monitoring Work Group of the Blackfoot Challenge Habitat and Water Quality Restoration Committee has been meeting for over a year to develop a cooperative water quality-monitoring program for the Blackfoot watershed. Early on, the work group determined that development of a basin-wide water quality status and trends network was a high priority. Preliminary designs and funding alternatives for such a network were subsequently reviewed. In July 2003, following notification of a significant grant award to the Blackfoot Challenge, a subcommittee of the work group was directed to complete a draft monitoring network design and present it for consideration by the entire group. The group met to review the proposal on December 3, 2003 and endorsed it with only minor modifications. This document describes the final plan for the Blackfoot watershed water quality status and trends monitoring program, as approved by the Monitoring Work Group. The plan is scheduled for implementation beginning in 2004. The scope of monitoring in 2005 (and subsequent years) will be based on the 2004 monitoring results, project developments, and the availability of funds.

Additional technical details of the program can be found in the document entitled *Quality Assurance Project Plan - Blackfoot Watershed Water Quality Monitoring* (Land & Water 2004). A comprehensive review of monitoring needs in the Blackfoot watershed is provided in *Design Considerations and a Framework for Improving Water Quality Monitoring Programs in the Blackfoot Watershed*, which was commissioned by the work group in 2002 (Land & Water 2002).

Program Rationale

Accurate and up-to-date monitoring information is needed to track the health of the Blackfoot watershed, and to provide support for resource management decisions. Informational needs that will be addressed by this program include: 1) evaluating the cumulative benefits of restoration projects and TMDLs, 2) detecting the cumulative impacts of land development activities, 3) identifying priority tributaries and main stem river segments for restoration, and 4) reporting to the public and restoration sponsors on the true condition of the Blackfoot watershed.

Program Goals

The management goal driving the need for this water quality status and trends monitoring program is “*to maintain or improve water quality in the Blackfoot watershed*”. The associated monitoring goal is “*to evaluate and describe the status, spatial patterns, and time trends in water quality in the Blackfoot watershed*”(Land & Water 2002).

Monitoring Area

This 2004 program will address water quality in three distinct segments of the Blackfoot River mainstem and its major tributaries, including Landers Fork, Nevada Creek, North Fork, Monture Creek, and the Clearwater River. The three mainstem segments of the Blackfoot River correspond to Montana DEQ and U.S. EPA TMDL planning units, as follows: 1) Blackfoot Headwaters – from the confluence of Beartrap and Anaconda creeks to Nevada Creek, 2) Middle Blackfoot – from Nevada Creek to the Clearwater River, and 3) Lower Blackfoot –from the Clearwater River to the Clark Fork.

Monitoring Stations

Table 1 provides descriptions of the monitoring station locations, and provides site rationale, prior monitoring history, present sponsors (if any), and other information. Stations are also shown in Figure 1. The network consists of 12 core stations (6 main stem and 6 tributaries). The Monitoring Work Group has identified four optional monitoring stations (2 additional main stem and 2 tributary stations) that would be desirable future additions to the status and trends network, if additional funding becomes available.

Considerations in establishing this network included: past monitoring activities and/or the availability of baseline data, streamflow gaging station presence or potential, evenly distributed basin-wide geographical coverage, representation of major tributary streams, representation of reference sites, relationship to TMDL planning unit boundaries, existing or potential monitoring sponsorship, program costs, stakeholder input, and other factors.

Monitoring Variables and Frequencies

The primary water quality impairment issues of concern in the Blackfoot watershed, now and into the foreseeable future, include: heavy metals, algal nutrients, siltation/suspended sediment, habitat alterations, riparian degradation, thermal modifications, and streamflow alterations. These impairments negatively affect designated uses of the Blackfoot Basin’s waters, including aquatic life, coldwater fisheries, drinking water, primary contact recreation, and agricultural and industrial uses. Indicator variables have been selected which reflect water quality and beneficial water use-support of the Blackfoot watershed as influenced by these impairment causes.

Selected monitoring variables, which define “water quality” for purposes of the Blackfoot watershed water quality status and trends monitoring network, and their associated monitoring frequencies are described below and are summarized in Table 1.

Field Measurements

- stream flow
- water temperature
- specific conductance
- pH
- dissolved oxygen (at time of sampling event)

- channel cross-section dimensions (including bankfull width and depth, and active channel width and depth)

Water Column Variables

- total recoverable metals Fe, Cu, Zn, Cd, Pb)
- total nutrients (total phosphorus, ortho-phosphorus, nitrate plus nitrite, ammonia nitrogen, total nitrogen)
- water hardness
- total suspended sediment
- turbidity

Biological Variables

- quantitative macroinvertebrate samples (4 replicate Hess samples/site)
- qualitative periphyton sample (1 composite sample/site)
- chlorophyll *a* (natural substrates, 10 replicates/site)

Monitoring Frequencies

Field measurements (except channel cross-sections) and water column sampling will be performed six times per year, at the following times: 1) spring rising limb of the hydrograph (April-May), 2) at or near peak of seasonal hydrograph (May-June), 3) falling limb of spring runoff hydrograph (June), 4) summer base flow (August), 5) late fall (November-December), and 6) additional episodic high flow/runoff event (can occur anytime of year). Diel dissolved oxygen surveys will be performed at all sites on a periodic basis (biennially or triennially) during the hottest part of the summer (e.g. late-July to mid-August), contingent on funding, to evaluate the degree of diurnal sags.

Biological variables will be monitored once annually, in mid- to late August. Channel cross-sections will be documented annually to evaluate the stability of the sampling location, and any potential influences on aquatic habitat features. This frequency may be reduced to biennially or less at sites demonstrating a high degree of stability and consistency.

Application of Monitoring Information

The major product of the Blackfoot water quality status and trends monitoring program will be a consistent, high quality data set for a network of fixed-stations on the Blackfoot River and its major tributaries. These data will be made available to program sponsors via a web-enabled computer database (see *Data Management* section below). Interested parties will be able to download the various data by monitoring location, parameter, and time period, for use in a variety of applications.

Annually, the Blackfoot Challenge and its contractors will perform water quality status reviews for the Blackfoot watershed and develop a narrative summary report. In these reports, data for the previous calendar year(s) will be reviewed and compared to historical baseline conditions and relevant water quality standards. Spatial trends will also be examined along the river corridor and potential cause-and-effect relationships discussed, including natural and

anthropogenic factors. The annual reports will address chemical, physical and biological conditions in various segments of the main stem Blackfoot River, and for each of five major tributaries.

Periodically, following the collection of several years of monitoring data, statistical analysis of time trends will be performed to evaluate the presence, magnitude and statistical certainty of any changes in water quality over time. Trends in the chemical, physical and biological water quality data will be reviewed for each of the three primary segments of the Blackfoot River and the major tributaries. Data will be presented graphically and in summary tables, and described in a narrative interpretive report. It is anticipated that the trends analysis reports will be developed triennially, following the collection of five to seven years of initial monitoring data. Water quality management goals for the Blackfoot River, defined above, will be assumed to have been achieved when the water quality data trends analyses show no trend, or indicate improvements for each monitoring variable.

Delineation of Responsibilities

Montana DEQ and Blackfoot Challenge previously entered into a jointly-funded cooperative agreement (\$92,850) with the U.S. Geological Survey to perform monitoring at 8 of the proposed 12 core stations beginning in fall 2003 and continuing at least through September 2004. This network builds on this foundation, supplements the monitoring variables, and expands the station coverage and monitoring time period through calendar year 2004. The U.S. Geological Survey will operate the water-quality program. A private contractor will conduct the annual biological monitoring and develop the annual biological interpretive reports. A private contractor will also develop annual interpretive reports addressing the chemical/physical data collected by the U.S. Geological Survey. Time trend analyses and reporting that will occur following a full five to seven years of program operation are not presently budgeted in this plan. This task will be delegated to a private contractor or the U.S. Geological Survey, or both, at the appropriate time. The Blackfoot Challenge Habitat and Water Quality Restoration Committee will be responsible for disseminating narrative annual and periodic trends analysis reports and executive summaries to monitoring cooperators and other interested parties

Data Management

Water chemistry and field measurement data will undergo standard review procedures and be stored in USGS's web-enabled National Water Information System database. This database is also accessible via links from the State of Montana NRIS web site. The private contractor will submit all biological project data to the Montana Department of Environmental Quality (DEQ) in a SIM-compatible format in Excel or text delimited file that will provide for minimum data and metadata requirements for import into the EPA Storet database. Data provided in incomplete or unacceptable format will be returned to the Contractor for correction or completion.

Inherent in the STORET format requirements for biological results is the requirement that all taxonomic names reported correspond exactly to a valid entry in the IT IS database, as this is the approved reference list. Should the private contractor not be able to provide the required format,

a mutually agreeable alternative EDD may be negotiated with DEQ Data Management Section until the specified format can be achieved in its entirety.

Program Budget and Operating Period

This program will take advantage of the U.S. Geological Survey's joint funding program during the 2004 calendar year. The specific amount of match funding anticipated to be available for the "additional" monitoring to supplement the existing 8 station network during 2004 is \$16,000.00 and this is reflected in the following budget. This program will also take advantage of Montana DEQ/Blackfoot Challenge's/USGS sponsorship of 8 of the proposed 12 monitoring stations for a portion of the first year of the program. That program was jointly funded at \$92,850 (include a \$40,000 USGS match). This sponsorship is not reflected in the budget below, and only the additional costs for the supplemental monitoring are shown. Operation of the supplemental portion of the 12-station water quality status and trends network for the period beginning January 1, 2004 and ending December 31, 2004 is estimated at **\$58,210.50**, as follows:

- Water chemistry, stream flow and field measurements (6x/year – USGS) - **\$27,480** (\$43,480 - \$16,000 USGS match contribution)
- Water chemistry, stream flow and field parameter data interpretation and reporting (1x/year - contractor) - **\$5,000.00**
- Biological monitoring, channel dimension measurements, data interpretation, and reporting (1x/year – contractor) - **\$24,690.50**

More detailed budget information is appended to this monitoring plan. The Blackfoot watershed water quality status and trends monitoring program will be initiated during the 2004 calendar year. The Monitoring Work Group intends for this program to be operated indefinitely into the future, contingent upon funding, in order to provide a continuing basis for documenting and describing time trends in water quality.

References

Land & Water Consulting. 2002. Design Considerations and a Framework for Improving Water Quality Monitoring Programs in the Blackfoot Watershed. Prepared for the Blackfoot Challenge. September 2002. Helena, MT.

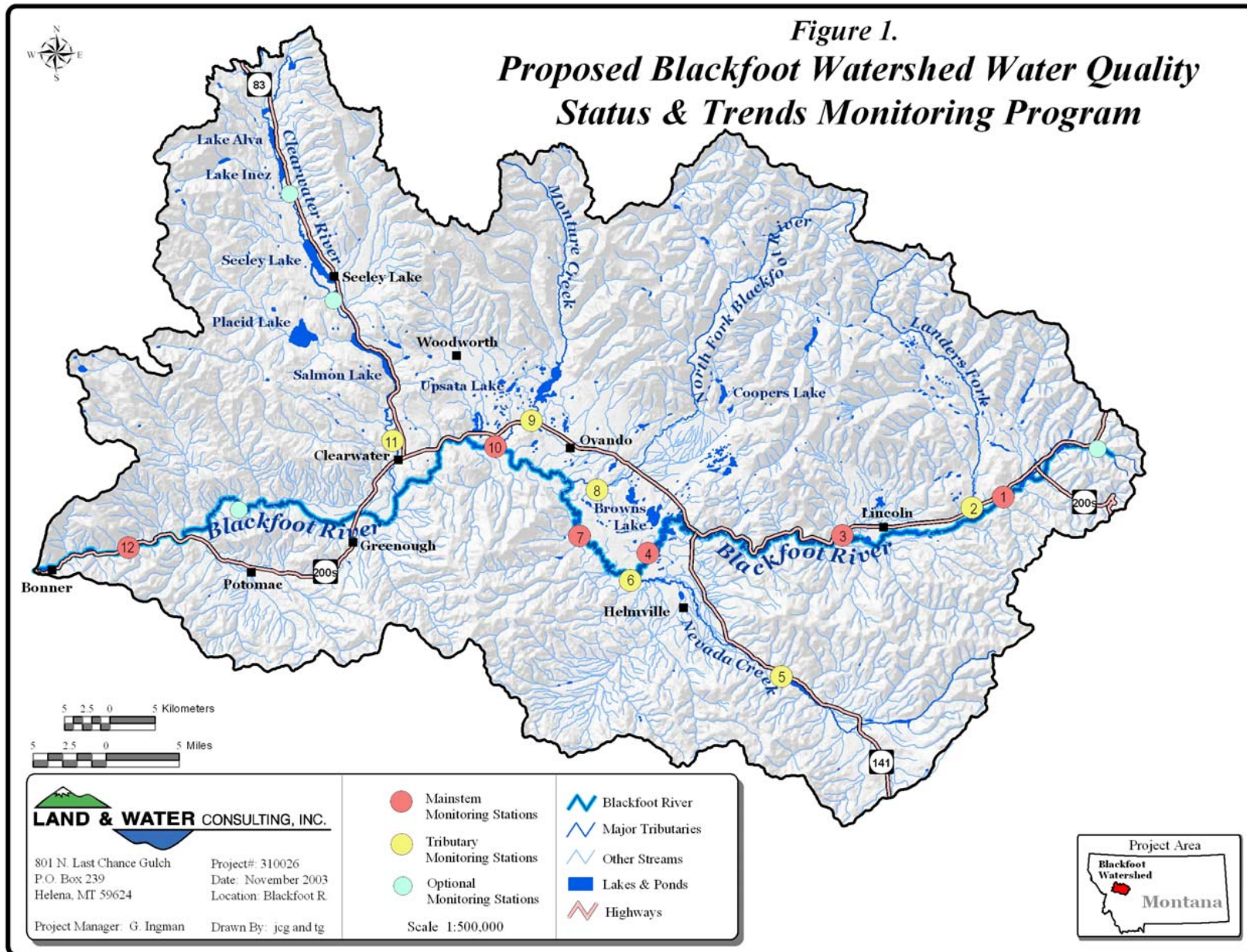
Land & Water Consulting. 2004. Blackfoot Watershed Water Quality Monitoring - Quality Assurance Project Plan. January 2003. Helena, MT.

Table 1. Blackfoot Watershed Water Quality Status and Trends Monitoring Network

Core Stations	USGS Station Number	STORET ID Number	River Mile¹	Station Description	Rationale	Present Sponsor	Proposed Sampling Frequency²
B-1	12334650	To be determined (TBD)	119.4	Blackfoot River below Alice Creek, near Lincoln	Metals recovery area located below wetlands depositional zone and a significant headwaters tributary. Control site above Landers Fork. Previous water quality and streamflow monitoring site operated by USGS from 1971-1975 and 1995-1997. Chemical, physical and biological monitoring performed at a nearby site by DHES (1988-1989) and MFWP (1969-1974).	None	NMF-6 MPC-1
B-2	12334680	TBD	116.1	Landers Fork near Lincoln	Major tributary to upper Blackfoot River with strong influence on water quality. Major fisheries importance. Downstream of former McDonald Gold Project proposal. Previous water quality, streamflow and/or fisheries monitoring by USGS (1995-1997), DHES (1989), MFWP (1969-1974), and various contractors.	None	NMF-6 MPC-1
B-3	12334800	TBD	104.0	Blackfoot River at Dalton Mountain Road Bridge, near Lincoln	Downstream of Landers Fork, Poorman Creek, and Lincoln area development activities. Former USGS (1995-1997, 1973), DHES (1988-1989) and MFWP (1969-1974) monitoring site.	None	NMF-6 MPC-1
B-4	12335100	TBD	72.0	Blackfoot River above Nevada Creek, near Helmville	Downstream integrator station for Blackfoot Headwaters TMDL planning unit, control site above Nevada Creek confluence, and active USGS flow gaging station. Former USGS water quality monitoring station (1995-1997).	DEQ, BC, USGS	NMF-6 MPC-1
B-5	---	TBD	31.1 (NC)	Nevada Creek below Nevada Creek Reservoir	Upper Nevada Creek watershed control site and active DNRC streamflow and former water quality monitoring station. Monitors water quality issues associated with dam operation, and 303(d) water quality issues in headwaters area.	DEQ, BC, USGS, DNRC	NMF-6 MPC-1
B-6	12337800	TBD	67.8	Nevada Creek near mouth, near Helmville	Major (negative) impact on Blackfoot mainstem water quality. Downstream integrator station for Nevada Creek TMDL planning unit and upstream TMDL restoration activities. Active USGS flow gaging and water quality station.	DEQ, BC, USGS	NMF-6 MPC-1
B-7		TBD	60.2	Blackfoot River at Raymond Bridge	Downstream of Nevada Creek confluence and upstream control station for North Fork Blackfoot River.	DEQ, BC, USGS	NMF-6 MPC-1
B-8	12338300	TBD	54.1	North Fork Blackfoot River above Dry Gulch, near Ovando	Major (positive) impact on Blackfoot mainstem water quality. High fisheries importance and provides reference information. Active USGS gaging station and former water quality monitoring station operated by USGS (1995-1997), DHES (1989), MFWP (1969-1974) baseline data available, and active flow gaging. Active fisheries monitoring by MFWP.	NRCS, USGS	NMF-6 MPC-1
B-9	12338690	TBD	45.9	Monture Creek near Ovando	Major tributary to middle Blackfoot with positive influence on mainstem water quality. High fisheries importance and reference stream. Active fisheries monitoring by MFWP, former streamflow gaging by USGS (1973-1983), and former water quality monitoring by DHES (1989) and others.	DEQ, BC, USGS	NMF-6 MPC-1
B-10	12338700	TBD	45.8	Blackfoot River at Scotty Brown Bridge	Downstream integrator station for Middle Blackfoot TMDL planning unit. Control site above Clearwater River and mid-basin evaluation station. Previous water quality monitoring by USGS (1995-1997), DHES (1988-1989) and others.	DEQ, BC, USGS	NMF-6 MPC-1
B-11	12339450	TBD	34.7	Clearwater River near Clearwater	Major tributary with major land use activities and water quality influence on mainstem Blackfoot River. Former USGS streamflow (1975-1992) and water quality (1995-1997) monitoring station.	DEQ, BC, USGS	NMF-6 MPC-1
B-12	1234000	TBD	7.9	Blackfoot River near Bonner	Existing long-term water quality/biology status and trends monitoring station with long-term historical record (Tri-State Council, DHES, DEQ, 1984-present), active USGS streamflow (1939-present) and water quality (1985-present) monitoring station. Integrator station for Lower Blackfoot TMDL planning area, and cumulative water quality of entire watershed.	DEQ, BC, USGS, TSWQC, ARCO(?)	NMF-6 MPC-1
Optional Stations	USGS Station Number	STORET ID Number	River Mile¹	Station Description	Rationale	Present Sponsor	
TBD	BRSW12 (ASARCO)	TBD	130.8	Blackfoot River above Pass Creek	Metals impact area located immediately downstream of Upper Blackfoot Mining Complex reclamation area. Previous chemical, physical, and biological monitoring performed by DHES, DEQ, MFWP and ASARCO.	ASARCO Inc.	NMF-6 MPC-1
TBD		TBD	26.0 (CR)	Clearwater River above Seeley Lake	Control station for evaluating lake influences and development activities on water quality.	None	NMF-6 MPC-1
TBD		TBD	14.2 (CR)	Clearwater River above Salmon Lake	Downstream test station for B-12 and control station for B-14. Evaluates development activities and lake effects on water quality.	None	NMF-6 MPC-1
TBD		TBD	19.5	Blackfoot River at Whitaker Bridge	Downstream of Clearwater River confluence and upstream of Union Creek.	None	NMF-6 MPC-1

¹ From *River Mile Index of the Columbia River Basin*, Montana DNRC, 1984.

² NMF-6 = nutrients, metals, field parameters, 6 samples/year ; MPC-1 = macroinvertebrates, periphyton, chlorophyll *a*, 1 sample/year.



APPENDIX A
“Additional” USGS monitoring
in the Blackfoot River watershed in support of a
Long-Term Status and Trends Water-Quality Network
2004

Scope of Work

(Revised January 2004)

A proposed scope of work is presented for “additional” USGS sampling in the Blackfoot River basin in support of a Long-Term Status and Trends Network, along with a budget for conducting the work. A preliminary scope of work provided in November 2003 has been updated subsequent to a December 3, 2003 meeting convened by the Blackfoot Challenge that defined the sites, parameters, and sampling frequency. The additional sampling at 4 sites is intended to integrate with current monitoring at 8 sites in the Blackfoot River basin recently initiated in a cooperative program between the Montana DEQ (through the Blackfoot Challenge) and USGS. The 12 sites collectively comprise the “core stations” in the Status and Trends network described in a proposal prepared by Land and Water Consulting. For consistency, the same sampling frequency and parameters will be utilized in both programs.

Samples at the 4 new sites will be collected 6 times per year for field parameters (water temperature, pH, specific conductance, streamflow), nutrients (dissolved nitrate, nitrite, and ammonia, total nitrogen, dissolved orthophosphate, and total phosphorus), suspended sediment, turbidity, selected metals (dissolved aluminum; total recoverable arsenic, cadmium, copper, iron, lead, manganese, and zinc), and hardness (calcium and magnesium). Samples will be distributed over the year to cover a range of seasons and hydrologic conditions (low-elevation spring flush, rising limb, near peak, and falling limb of the high-elevation snowmelt runoff, summer base flow, and late fall/winter base flow). The current program for the original 8 sites was designed with a reduced frequency (3/year) for analysis of metals and hardness. To seek consistency between the two programs, it was decided to supplement the sampling at the original 8 sites with analyses of metals and hardness on every visit. Because one of the six samplings for the original 8 sites has already been conducted, the supplemental analyses will be done for the 5 remaining samplings.

A summary of sites and costs is provided in the table below. For the 4 new sites that are not part of the current Blackfoot monitoring program, full operational costs are presented for salary, travel, vehicles, equipment, supplies, and laboratory charges. Supplemental analytical costs for two additional analyses of metals, hardness, and ammonia at the original 8 sites are also shown. **The total program cost for this additional monitoring is \$43,480. USGS matching funds are available in the amount of \$16,000.** The program period for the “additional” sampling has been requested to run from January-December, 2004 (calendar year), whereas the program period for the original 8 sites is for the October 2003 – September 2004 period (2004 federal fiscal year).

Proposed Blackfoot River basin sites for monitoring long-term status and trends

(Shaded cells represent water-quality sites currently in operation; funding for full operational costs are currently provided by another program)

Site	Full Operational Cost (2004)	Supplemental Analytical Cost (2004)	Total Cost (2004)
** Blackfoot R. above Pass Creek	10,350		
* Blackfoot R. below Alice Creek	<u>10,350</u>		10,350
* Landers Fork near Lincoln	<u>10,350</u>		10,350
* Blackfoot R. at Dalton Mountain Road	<u>10,350</u>		10,350
* Blackfoot R. above Nevada Creek		<u>260</u>	260
* Nevada Creek below Nevada Cr Reservoir		<u>260</u>	260
* Nevada Creek near mouth		<u>260</u>	260
* Blackfoot R. at Raymond Bridge		<u>260</u>	260
* North Fork Blackfoot near mouth	<u>10,350</u>		10,350
* Monture Creek near mouth		<u>260</u>	260
* Blackfoot R. at Scotty Brown Bridge		<u>260</u>	260
** Clearwater R. above Seeley Lake	10,350		
** Clearwater R. above Salmon Lake	10,350		
* Clearwater R. near mouth		<u>260</u>	260
** Blackfoot R. at Whitaker Bridge	10,350		
* Blackfoot R. near Bonner		<u>260</u>	260
TOTAL ANNUAL COST (4 new core stations sampled 6/yr, plus supplemental analyses at 8 current stations)			\$43,480.00
USGS Match (37%)			\$16,000.00
Blackfoot Challenge Match (63%)			\$27,480.00

* Core stations

**Optional Stations: Only operated if funds become available at an additional cost of \$41,400 for 2004.

APPENDIX B

Blackfoot Watershed Water Quality Status and Trends Monitoring Network

Biological Monitoring Component – Prepared by Land & Water Consulting

The proposed monitoring plan includes the annual collection of macroinvertebrate, periphyton and chlorophyll *a* samples at each of 12 sampling locations in the Blackfoot watershed.

Periphyton sampling methods will utilize a single composite sample collected at each station. Macroinvertebrate sampling methods will include multiple replicate (e.g. 4/site) unit-area Hess samples. The replicate Hess samples will be conducive to statistical analysis and will provide more conclusive results than standard RBP kick samples. Chlorophyll sampling methods will utilize 10 replicate samples per site collected from natural substrates with a standardized unit-area sampling frame.

Sample analysis results will be interpreted in annual narrative reports that provide a characterization of biological integrity and water quality, as well as the degree and causes of any water quality impairments.

Periodically, multiple-year data sets (e.g. 5-year period) will be statistically analyzed to evaluate time trends and apparent causes of any observed changes. A contractor will perform annual biological sample collection activities, and will oversee laboratory sample processing and analysis, and dissemination of the interpretive reports.

Schedule and Products

Biological sampling will commence in August 2004 and an interpretive biological monitoring report will be completed and distributed to interested parties by February 2005.

Budget

TASK	UNITS	UNIT COST	COST
Implement Blackfoot Watershed Biological Sampling and Analysis Plan			
Senior Scientist	4	\$ 83.00	\$ 332.00
Senior Environmental Technician	60	\$ 57.00	\$ 3,420.00
Mileage	250	\$ 0.65	\$ 162.50
Per Diem	4	\$ 29.00	\$ 116.00
Supplies and Materials	1	\$ 100.00	\$ 100.00
Lab Analysis – Hess samples (4/site)	48	\$ 150.00	\$ 7,200.00
Lab Analysis – periphyton composite samples (1/site)	12	\$ 205.00	\$ 2,460.00
Lab Analysis – chlorophyll <i>a</i> samples (10/site)	120	\$ 35.00	\$ 4,200.00
Interpretive report – macroinvertebrates	32	\$ 75.00	\$ 2,400.00
Interpretive report – periphyton	32	\$ 75.00	\$ 2,400.00
Interpretive report – chlorophyll <i>a</i>	24	\$ 75.00	\$ 1,800.00
Equipment Rental	4	\$ 25.00	\$ 100.00
TOTAL (12 sites/Hess samples)			\$ 24,690.50*

* Includes annual interpretive reports, but does not cover costs to develop 5-year trend report.