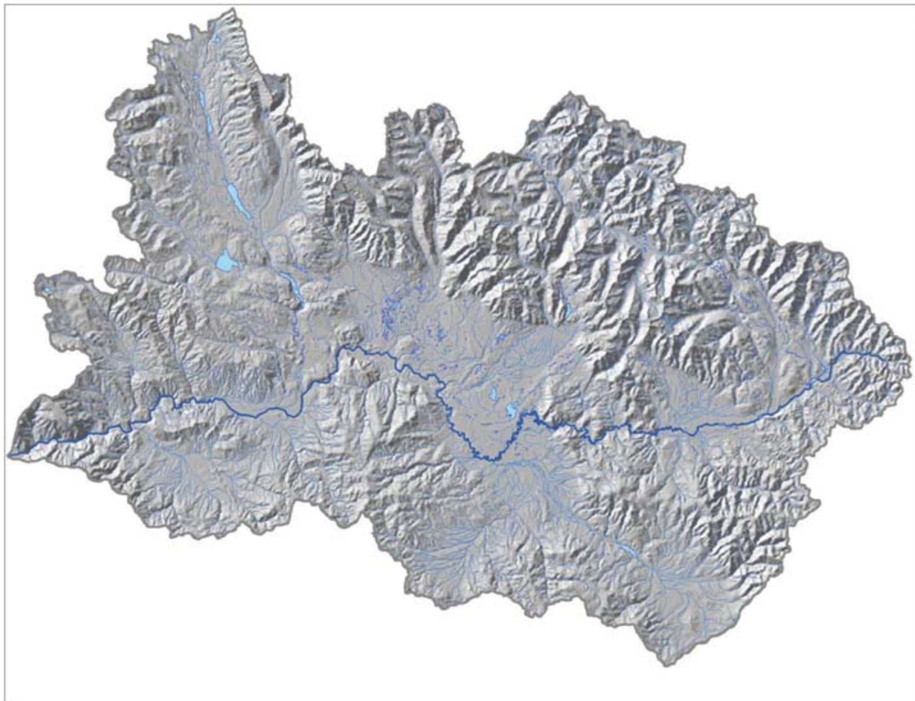
Blackfoot Subbasin Plan



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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.

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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 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

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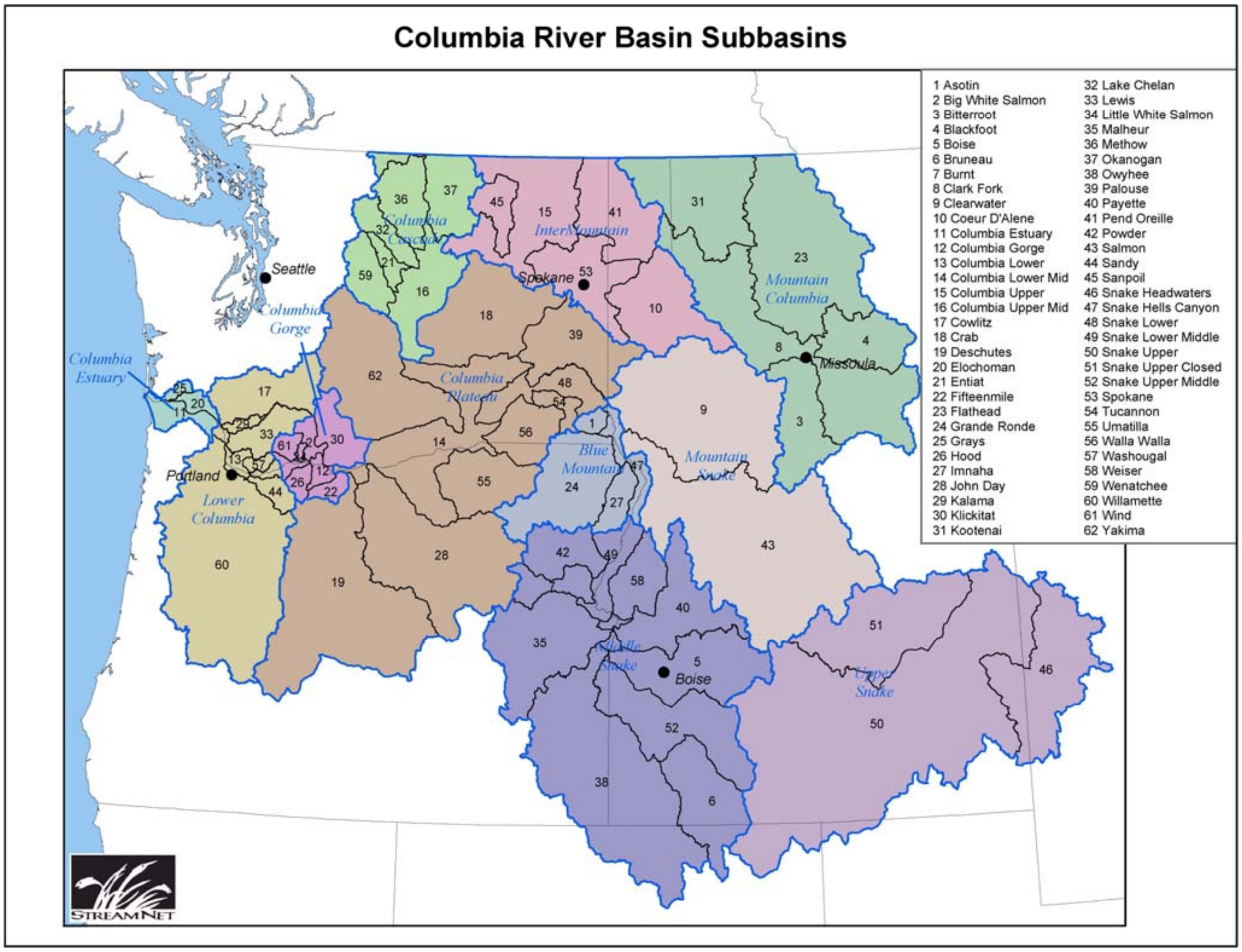
[1] **HUC** is the acronym for Hydrologic Unit Code (HUC). Every hydrologic unit is identified by a unique HUC consisting of two to eight digits based on the levels of classification in the hydrologic unit system. A hydrologic unit describes the area of land upstream from a specific point on the stream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

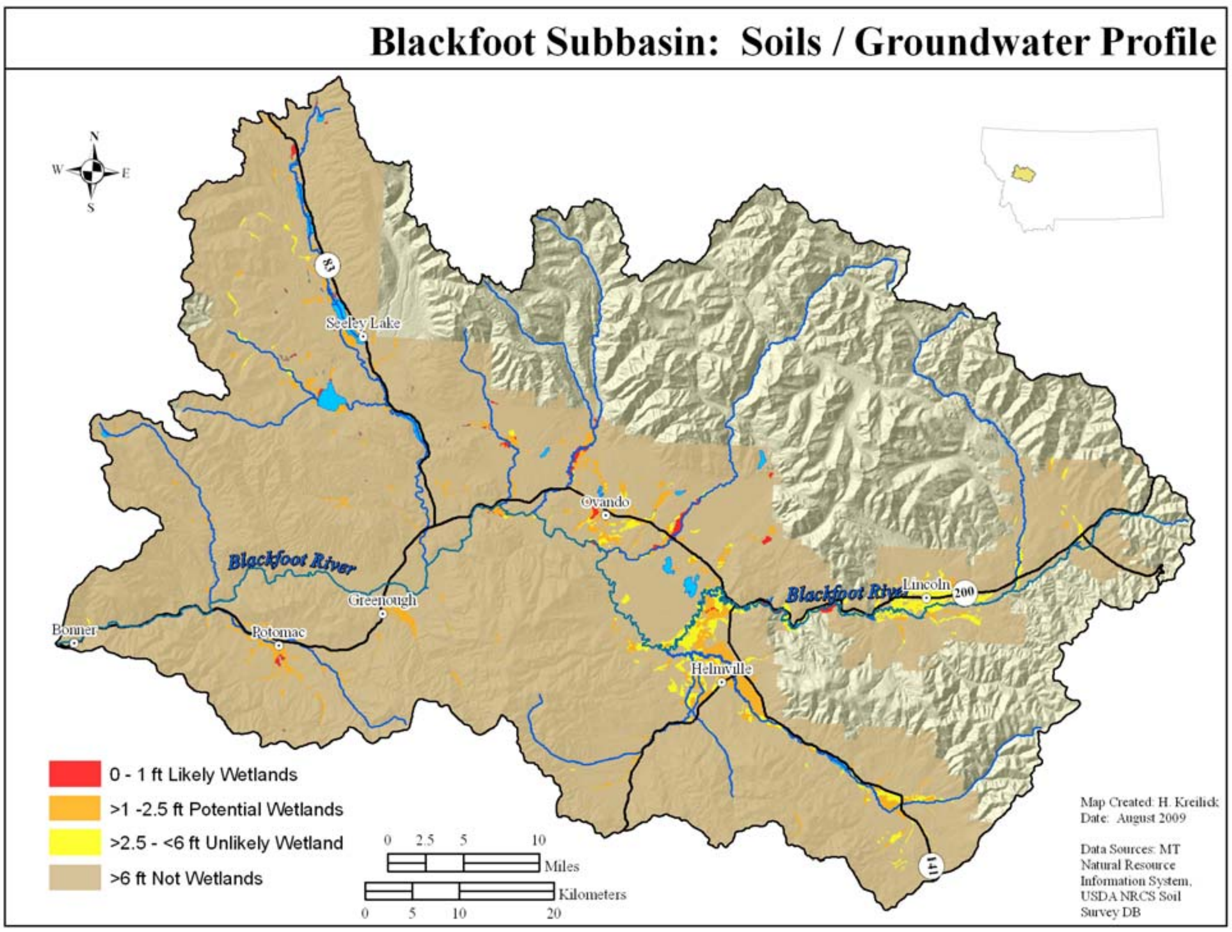
Fifteen soil units are present in the Lower Blackfoot planning area, five of which cover 76% of the planning area (Table 3.3). The most abundant five soil units are gravelly loams and correspond with the location of Quaternary alluvium and glacial deposits. The 10 minor soil units as a group correlate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

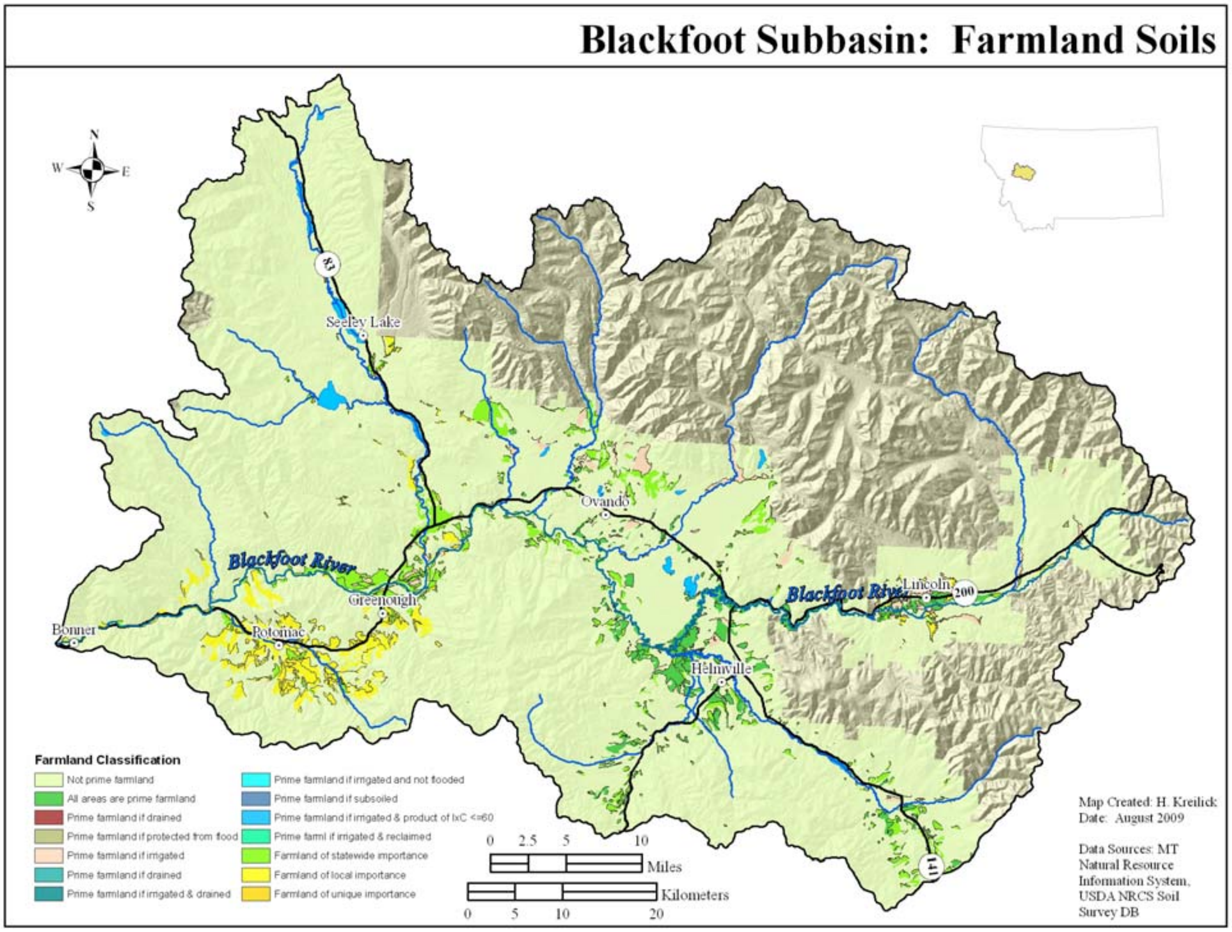
More detailed soils data are available in the Missoula, Powell, and Granite County Soil Survey Geographic (SSURGO) databases.[2] The U.S. Forest Service (USFS) Region 1 Land Type Association database, which covers national forest areas, is a good surrogate for detailed soil data and can assist with identification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

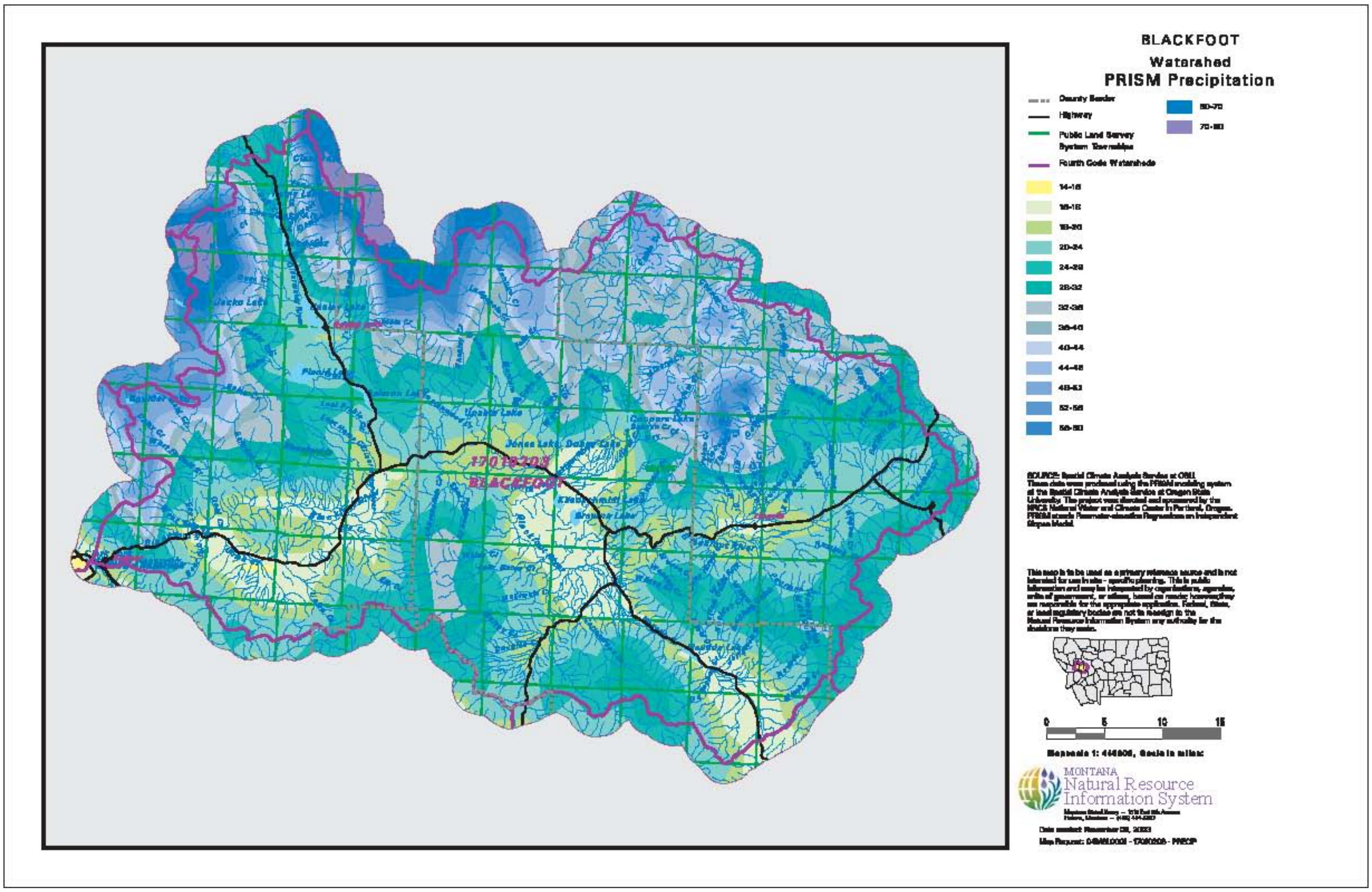
The Blackfoot Subbasin climate is dominated by Pacific maritime characteristics. Moderately moist and cool conditions prevail and cloudy weather is most frequent from late fall through early spring. Valley fog is common during the fall and winter months. The physiography of the nearby Continental Divide 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.

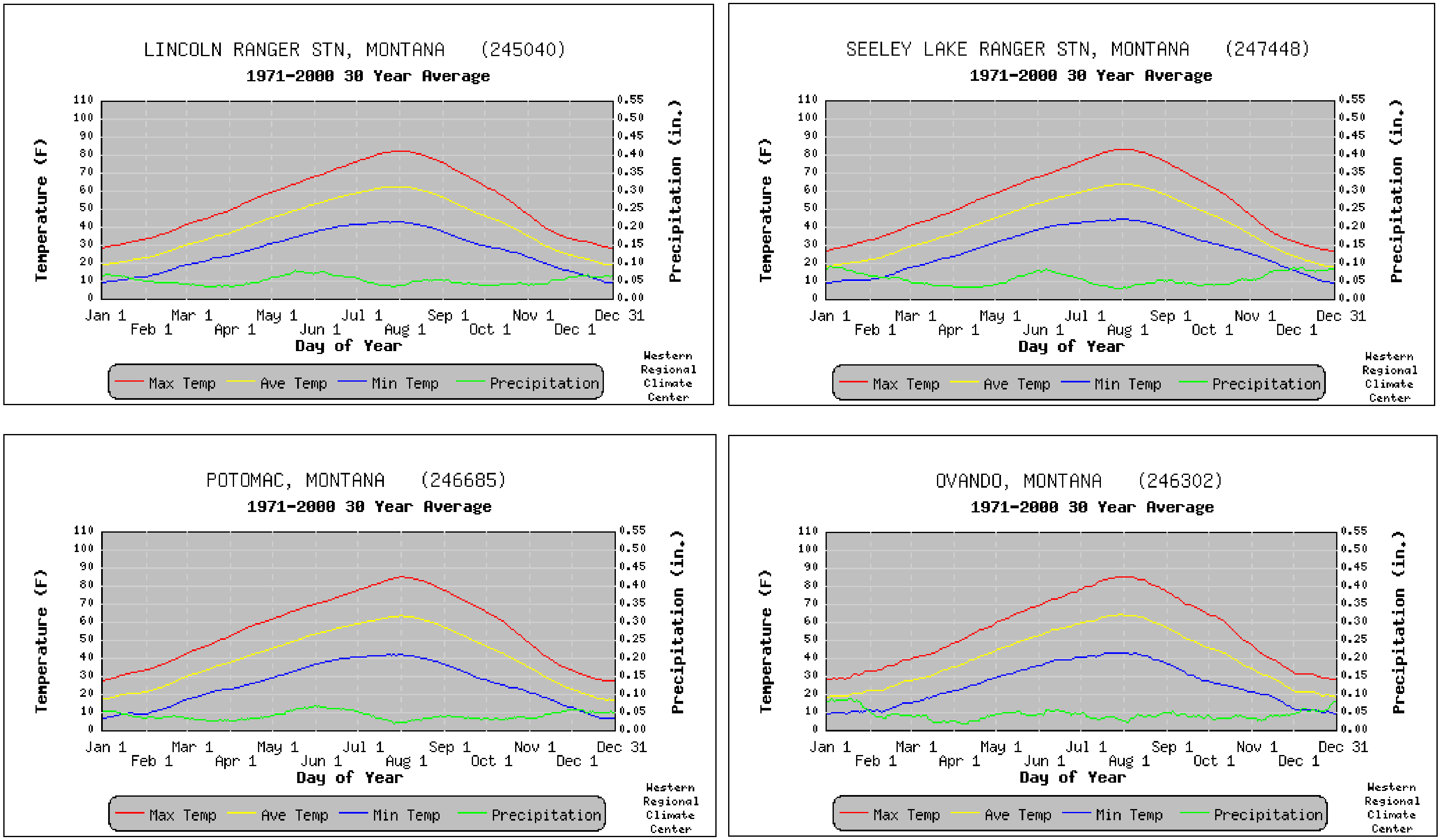
Recent trends in the Blackfoot Subbasin climate have been consistent with anticipated effects of global and regional climate change, including general warming, increased variability in total precipitation and drier summers. For example, peak runoff as measured in streamflow on the Blackfoot River at 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).

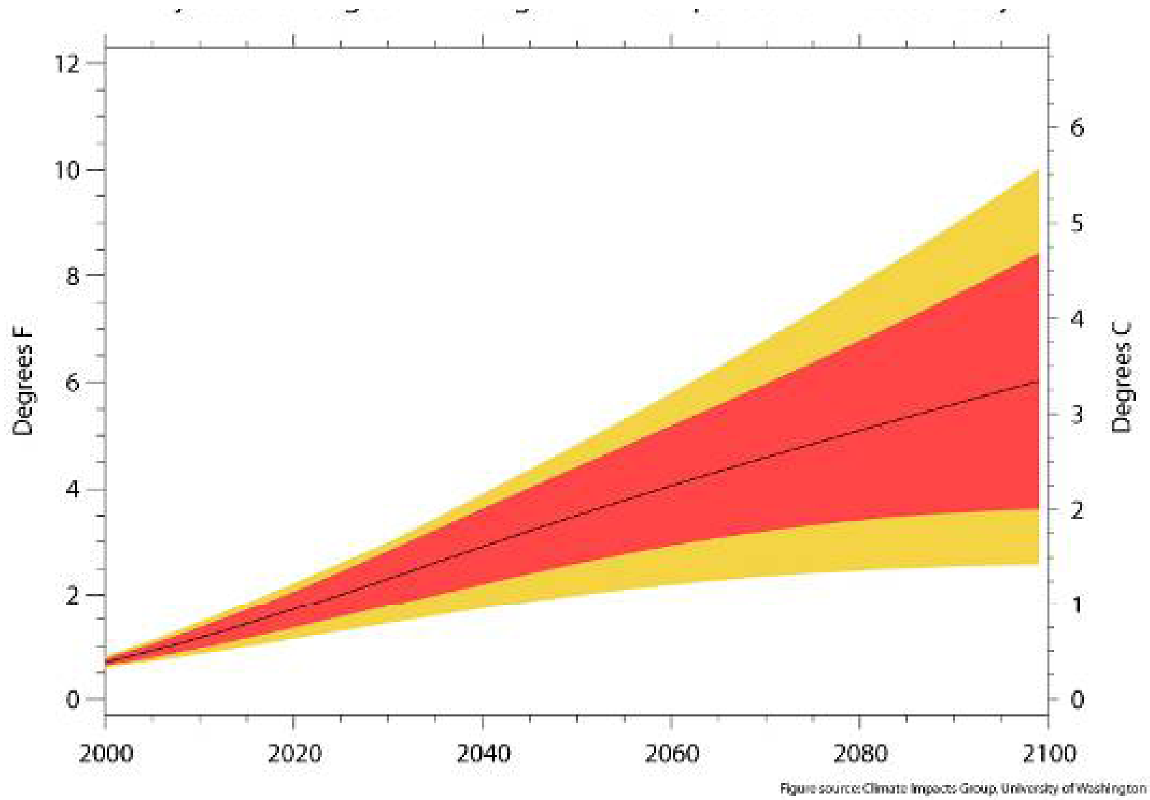
During the 20th century, the average annual temperature in the western United States rose by 1.7 °F, which is 70% more warming than the planet as a whole during the same time period (Kinsella 2008). Climate records show that the Pacific Northwest has warmed about 1.8 ºF since 1900, or about 50% more 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.

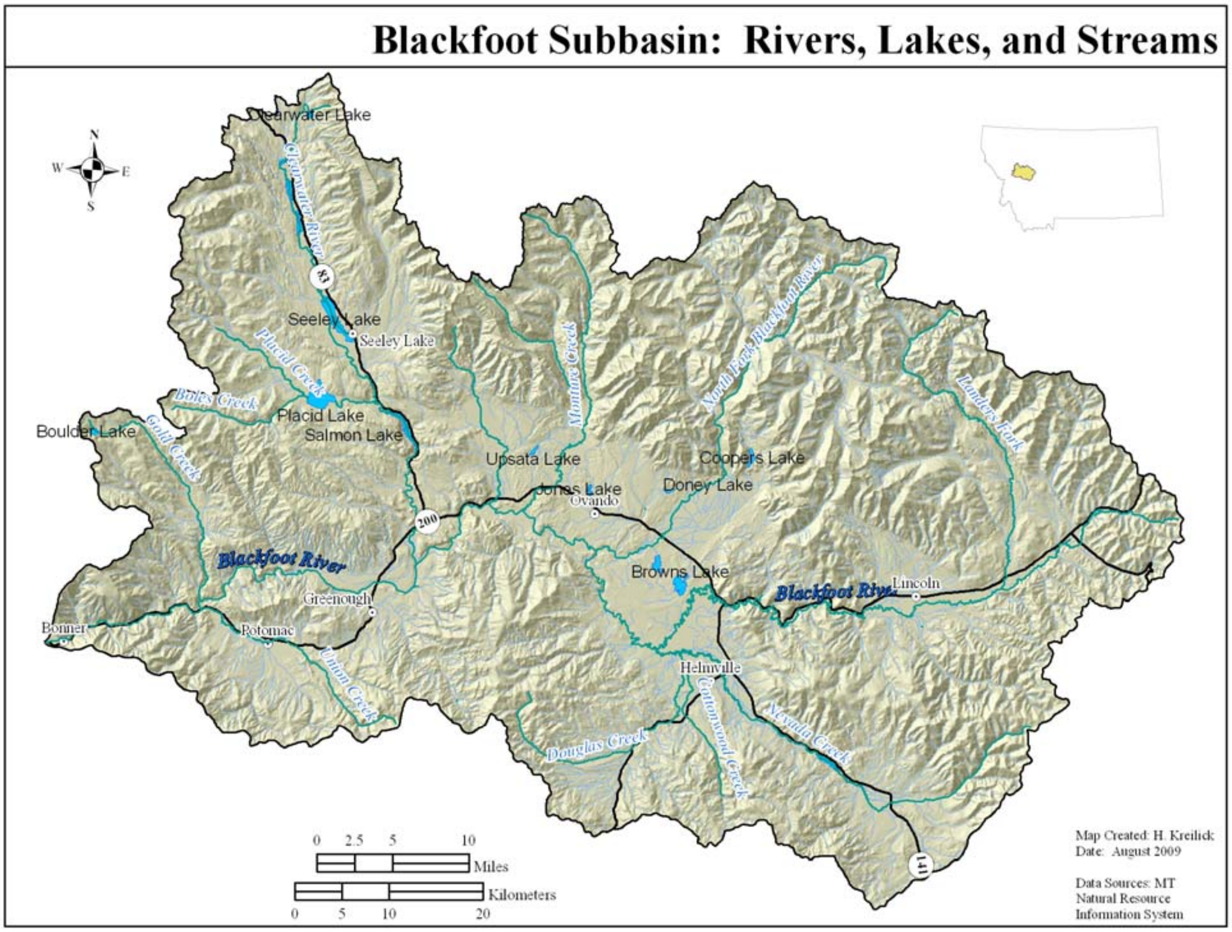
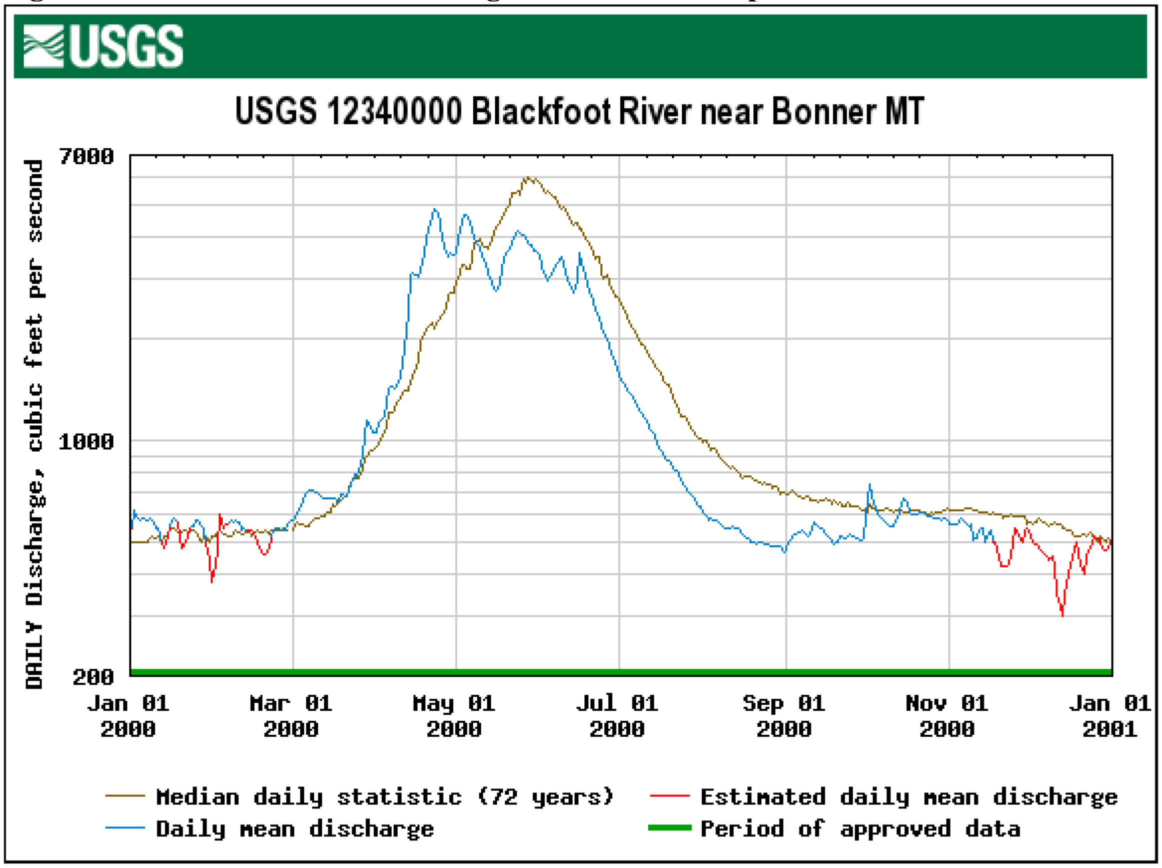


Table 3.4 Aquatic Habitat Types in the Blackfoot Subbasin.

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

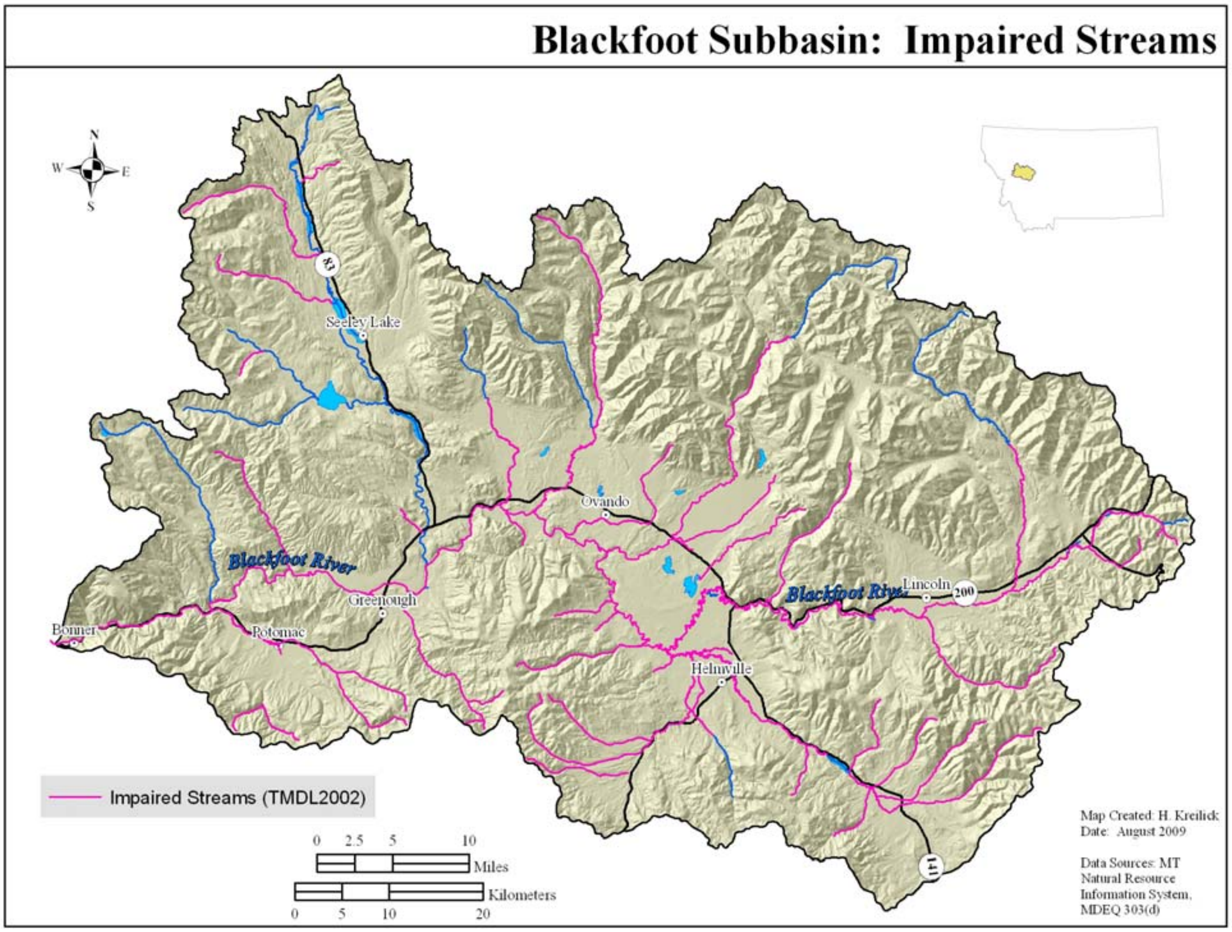
The Blackfoot River and its tributaries provide critical fish and wildlife habitat, irrigation water for agricultural lands, water for domestic use and high quality recreational opportunities for the public—all beneficial uses dependent upon clean water. Naturally high sediment production, low stream 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.

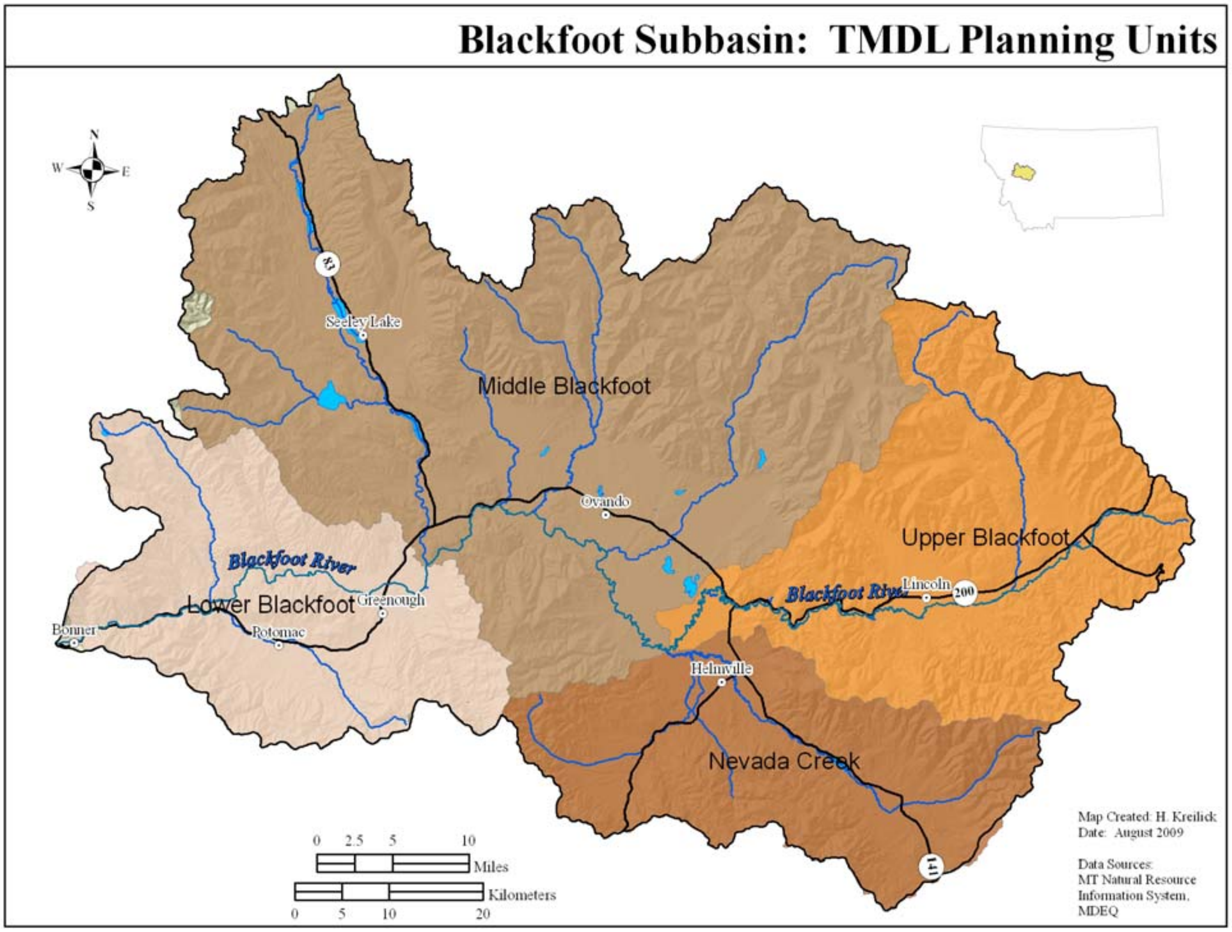


The Blackfoot Subbasin is divided into the following four planning areas for purposes of TMDL development (Figure 3.10):

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

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[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 litlgation 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 cricital 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 Cleawater 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 desicription 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.

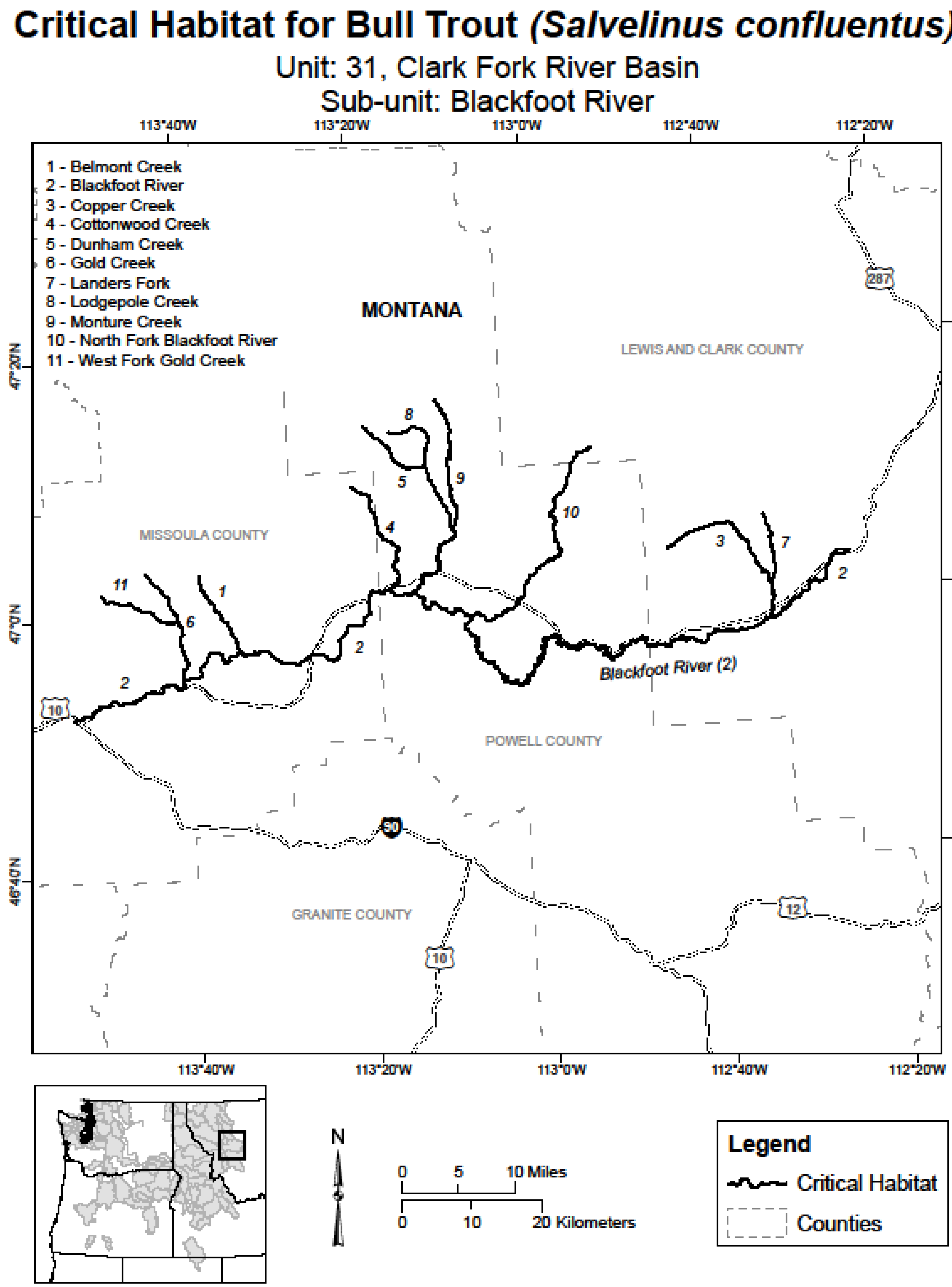
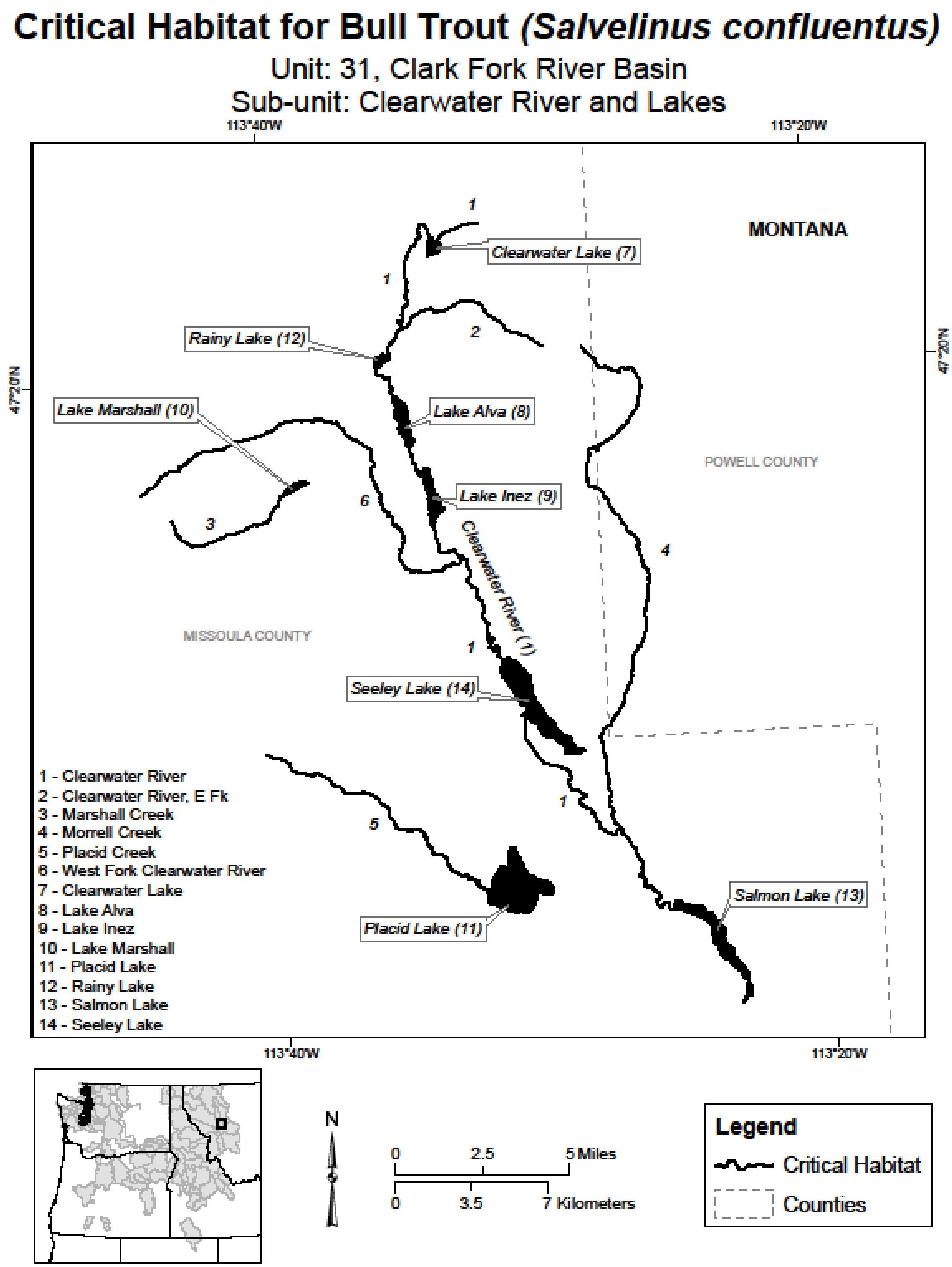


Figure 3.12 Critical Habitat for Bull Trout in the Clarwater River and Lakes Sub-unit.



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
BIRDS						
American White Pelican	*Pelecanus erythrorhynchos*	G4 S3B	III			
Bald Eagle	*Haliaeetus leucocephalus*	G5 S3	II	Delisted threatened	Special status	Delisted from threatened status on July 9th, 2007. Now designated as Delisted Taxon-Recovered.
Black Tern	*Chlidonias niger*	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	*Picoides arcticus*	G5 S2	I	Sensitive	Sensitive	
Bobolink	*Dolichonyx oryzivorus*	G5 S2B	III			
Brewer's Sparrow	*Spizella breweri*	G5 S2B	II		Sensitive	
Brown Creeper	*Certhia americana*	G5 S3	I			
Caspian Tern	*Hydroprogne caspia*	G5 S2B	II			
Common Loon	*Gavia immer*	G5 S2B	I	Sensitive	Sensitive	
Common Tern	*Sterna hirundo*	G5 S3B	II			
Flammulated Owl	*Otus flammeolus*	G4 S3B	I	Sensitive	Sensitive	
Forster’s Tern	*Sterna forsteri*	G5 S2B	II			
Franklin’s Gull	*Leucophaeus pipixcan*	G4G5 S3B	II		Sensitive	
Grasshopper Sparrow	*Ammodramus savannarum*	G5 S3B	II			
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	G5 S2B, S5N				
Great Gray Owl	*Strix nebulosa*	G5 S3	III		Sensitive	

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank [1]	PIF Priority Level [2]	USFS Status	BLM Status	Notes
BIRDS (CONT.)						
Harlequin Duck	*Histrionicus histrionicus*	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	*Ammodramus leconteii*	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	*Melanerpes lewis*	G4 S2B	II			
Long-billed Curlew	*Numenius americanus*	G5 S2B	II		Sensitive	
Northern Goshawk	*Accipiter gentilis*	G5 S4	II	Sensitive	Sensitive	
Olive-sided Flycatcher	*Contopus cooperi*	G4 S3B	I			
Peregrine Falcon	*Falco peregrinus*	G4 S2B	II	Sensitive	Sensitive	Delisted from endangered status on August 25th, 1999. Now designated as Delisted Taxon-Recovered.
Sharp-tailed Grouse (Columbian)	*Tympanuchus phasianellus columbianus*	G4T3 S1	II			
Trumpeter Swan	*Cygnus buccinator*	G4 S2	I	Sensitive	Sensitive	
Veery	*Catharus fuscescens*	G5 S3B	II			
White-tailed Ptarmigan	*Lagopus leucura*	G5 S3	III			

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank [1]	USFS Status	BLM Status	Notes
MAMMALS					
Wolverine	*Gulo gulo*	G4 S3	Sensitive	Sensitive	
Canada Lynx	*Lynx canadensis*	G5 S3	Listed threatened	Special status	Listed as threatened on March 24th, 2000. Critical Habitat designated on September 9th, 2006.
Fisher	*Martes pennanti*	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	*Canis lupus*	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	*Ursus arctos*	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	*Synaptomys borealis*	G4 S2	Sensitive		
Preble's Shrew	*Sorex preblei*	G4 S3			
Townsend's Big-eared Bat	*Corynorhinus townsendii*	G4 S2	Sensitive	Sensitive	
Fringed Myotis	*Myotis thysanodes*	G4G5 S3		Sensitive	

Table 3.5 (continued).

Common Name	Scientific Name	MTNHP Rank [1]	USFS Status	BLM Status	Notes
		FISH			
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	G4T3 S2	Sensitive	Sensitive	
Bull Trout	*Salvelinus confluentus*	G3 S2	Listed threatened	Special status	Listed as threatened on June 10th, 1998. Critical Habitat designated on September 26th, 2005.
		REPTILES and AMPHIBIANS			
Western Skink	*Eumeces skiltonianus*	G5 S3			
Western Toad	*Bufo boreas*	G4 S2	Sensitive	Sensitive	
		INVERTEBRATES			
Agapetus Caddisfly	*Agapetus montanus*	G3 S3			
Carinate Mountainsnail	*Oreohelix elrodi*	G1 S1			
Smoky Taildropper	*Prophysaon humile*	G3 S2S3			
Freshwater Sponge	*Ephydatia cooperensis*	G1G3 S1S3			
Gillette's Checkerspot	*Euphydryas gillettii*	G2G3 S2			
Lyre Mantleslug	*Udosarx lyrata*	G2 S1			
Magnum Mantleslug	*Magnipelta mycophaga*	G3 S2S3			
Millipede	*Austrotyla montani*	G1G3 S1S3			
Millipede	*Corypus cochlearis*	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), thecompliance 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 invertebrates[10]

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.

<u>Non-native parasites/pathogens</u>
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

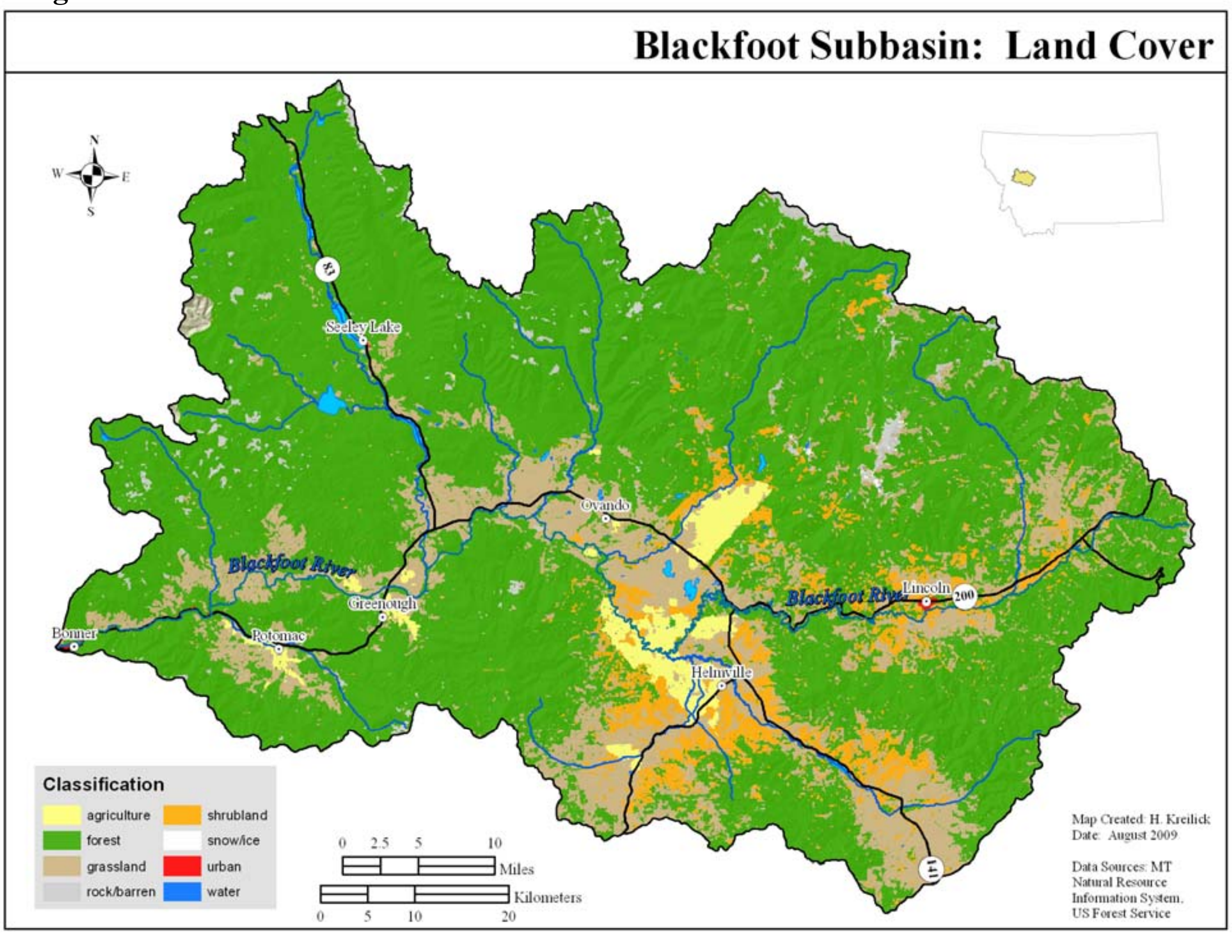
3.2.7.1 Overview of Vegetation Types in the Blackfoot Subbasin

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	*Polygonum austiniae*	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	*Carex rostrata*	G5 S1	Sensitive		
Beck's water-marigold	*Bidens beckii*	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	*Potamogeton obtusifolius*	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	*Centunculus minimus*	G5 S2		Sensitive	
cliff toothwort	*Cardamine rupicola*	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	*Carex crawei*	G5 S2		Sensitive	Known in MT from 8 occurrences, including 5 moderate to large populations.
creeping sedge	*Carex chordorrhiza*	G5 S2	Sensitive		
crested shieldfern	*Dryopteris cristata*	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	*Castilleja cervina*	G4 SH			Known from 3 widely separated historic collections in MT.
dense-leaf draba	*Draba densifolia*	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	*Lesquerella klausii*	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	*Drosera anglica*	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	*Sphagnum fimbriatum*	G5 S1			
green-keeled cottonsedge	*Eriophorum viridicarinatum*	G5 S3			
Hall's rush	*Juncus hallii*	G4G5 S2	Sensitive		
Howell's gumweed	*Grindelia howellii*	G3 S2S3	Sensitive	Sensitive	Howell’s gumweed occurs on vernally 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 *G. howellii* 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	*Hutchinsia procumbens*	G5 S1		Sensitive	
linear-leaved sundew	*Drosera linearis*	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	*Phlox kelseyi var. missoulensis*	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	*Botrychium spp.*	G1G2G3 S1S3			This is a general record for *Botrychium* species tracked by MTNHP and not specific for any particular species. MTNHP tracks and maintains observation data for all *Botrychium* species in the state excluding *B. multifidum* and *B. virginianum* which are fairly common and readily identifiable from all other *Botrychium* species.
moss	*Tetraplodon mnioides*	G4 S1			
moss	*Scorpidium scorpioides*	G4G5 S2	Sensitive	Sensitive	
pale sedge	*Carex livida*	G5 S3			Listed as a *Species of Potential Concern*.
pygmy water-lily	*Nymphaea tetragona ssp. leibergii*	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	*Cypripedium parviflorum*	G5 S3	Sensitive	Sensitive	Listed as a *Species of Potential Concern*. 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	*Sphagnum riparium*	G5 S1			
water bulrush	*Scirpus subterminalis*	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	*Brasenia schreberi*	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	*Eupatorium occidentale*	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]

<table>
<tr><th>Common name</th><th>Scientific Name</th><th>Infestation Level</th></tr>
<tr><td>spotted knapweed</td><td>Centaurea stoebe</td><td rowspan="6">Widespread, well-established, infesting 25-50% of potential range</td></tr>
<tr><td>leafy spurge</td><td>Euphorbia esula</td></tr>
<tr><td>yellow toadflax</td><td>Linaria vulgaris</td></tr>
<tr><td>hound's-tongue</td><td>Cynoglossum officinale</td></tr>
<tr><td>Canada thistle</td><td>Cirsium arvense</td></tr>
<tr><td>oxeye daisy</td><td>Leucanthemum vulgare</td></tr>
</table>

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

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

* 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 Ratings[1] 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*	*Abutilon theophrasti*	possible	possible	possible			High
jointed goatgrass*	*Aegilops cylindrica*	possible	possible				High
bishop's goutweed	*Aegopodium podagraria*	Uncertain					
small bugloss*	*Anchusa arvensis*	possible	possible	possible			High
common bugloss	*Anchusa officinalis*	possible	possible	possible			High
weedy orache*	*Atriplex heterosperma*	Uncertain					
white bryony	*Bryonia alba*			possible	possible		Possible
plumeless thistle	*Carduus acanthoides*	high	high	possible	high		High
dwarf snapdragon*	*Chaenorrhinum minus*	possible	possible	possible			High
trailing crownvetch	*Coronilla varia*	possible	possible	possible	possible		High
sand rocket	*Diplotaxis muralis*	Uncertain					
Russian olive	*Elaeagnus angustifolia*				limited	limited	
babysbreath	*Gypsophila paniculata*	possible	possible	possible	possible		High
bluebuttons	*Knautia arvensis*	possible	possible	possible			High
malcolm stock*	*Malcolmia africana*	possible	possible				High
scentless chamomile	*Matricaria maritima*	high	possible		possible		High
cultivated knotweed	*Polygonum polystachyum*	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	*Polygonum sachalinense*	possible			high		High
European buckthorn	*Rhamnus cathartica*	limited		limited	limited		Limited
self salsify*	*Scorzonera laciniata*	Uncertain					
puncturevine	*Tribulus terrestris*	possible	possible	possible			High
syrian beancaper	*Zygophyllum fabago*	possible	possible				High

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

[1]The 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

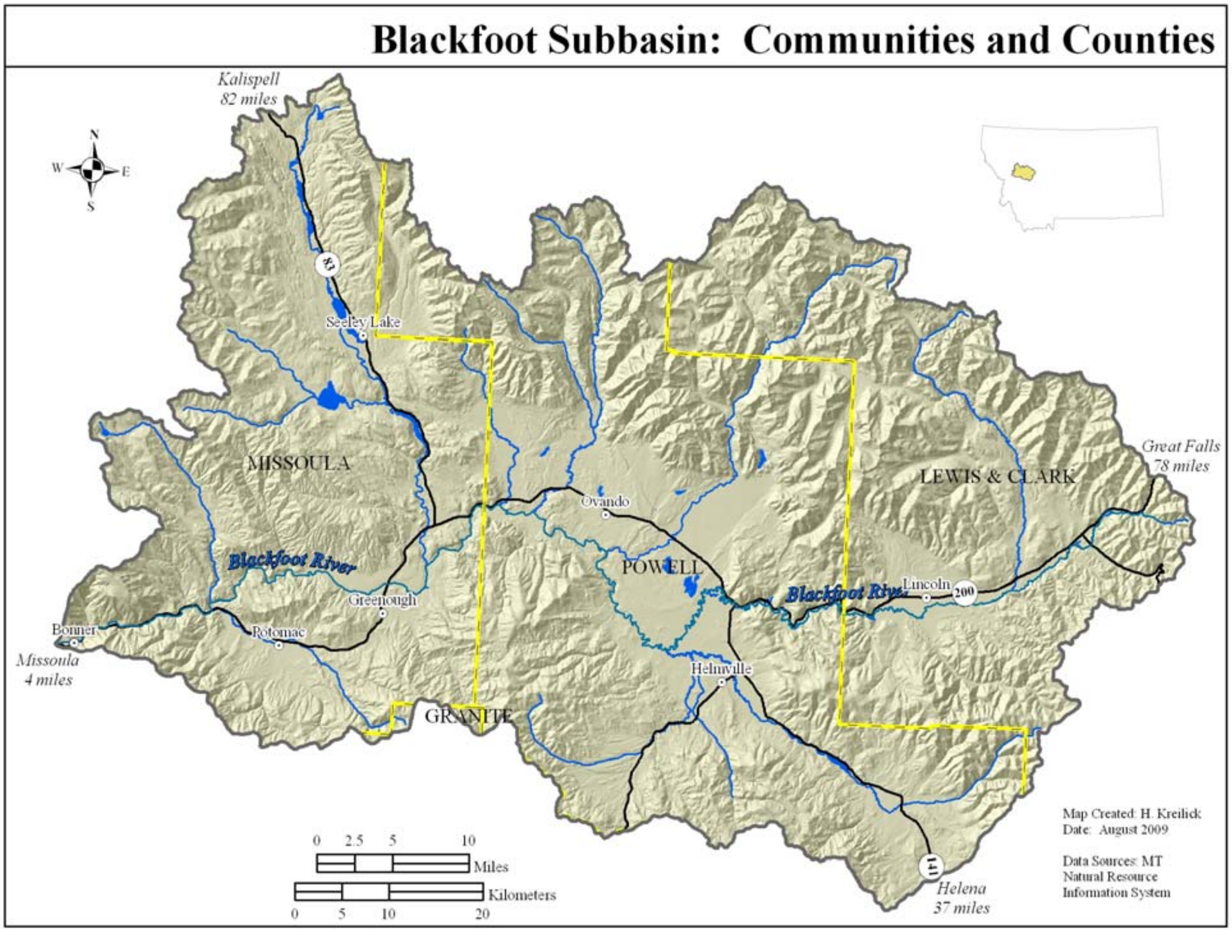
Prior to the arrival of white settlers in the 1800s, the Blackfoot Valley was occupied by the indigenous peoples of western Montana for thousands of years. The Kootenai, Salish, Nez Perce, Shoshone, Blackfeet and Crow tribes utilized the valley, known as *Cokahlahishkit* or the "Road to the Buffalo," 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

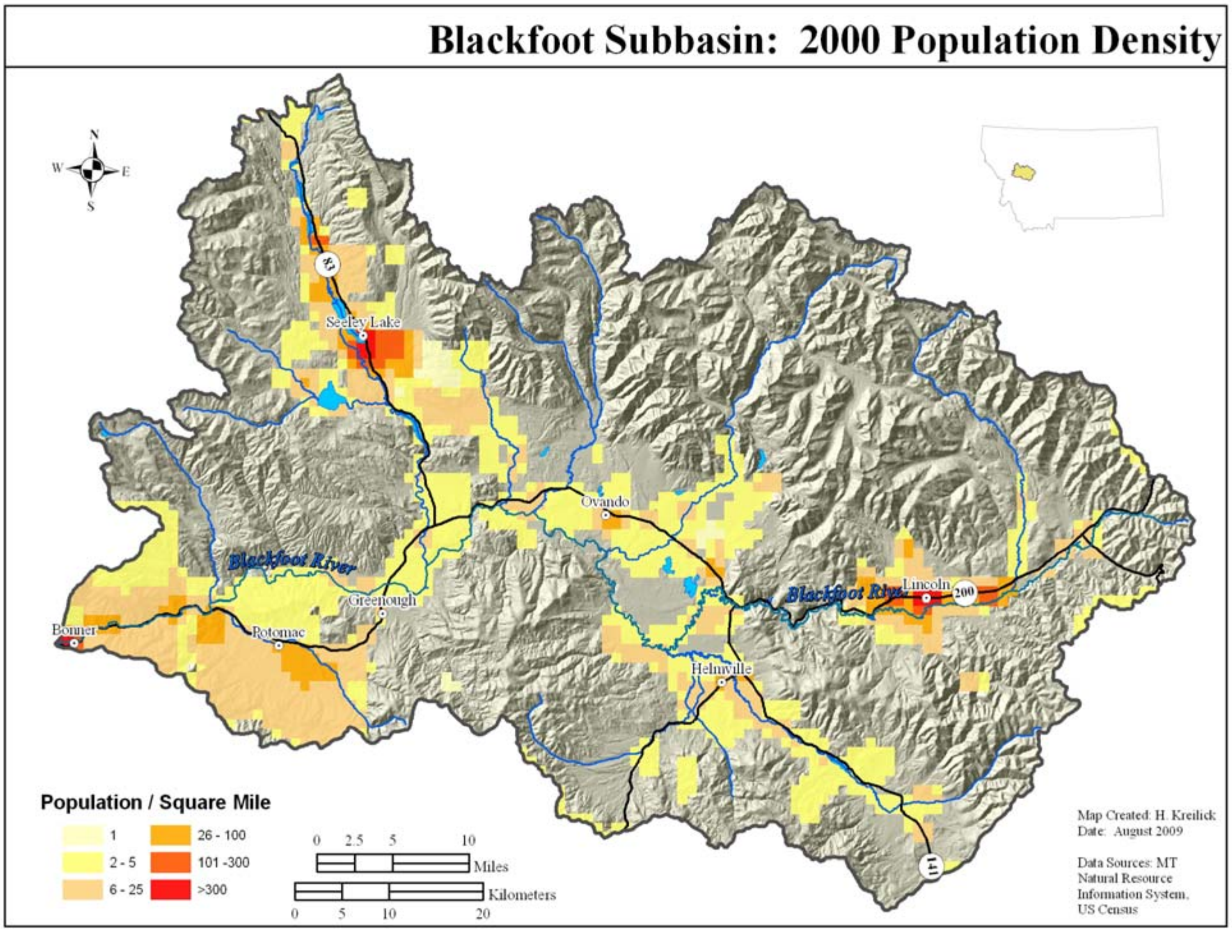
The Blackfoot Subbasin includes the communities of Lincoln, Helmville, Ovando, Seeley Lake, Greenough, Potomac, and Bonner and spans portions of Missoula, Powell, and Lewis & Clark Counties (Figure 3.14). There are approximately 8,100 people and 2,500 households in the subbasin. In this 1.5 million-acre 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.

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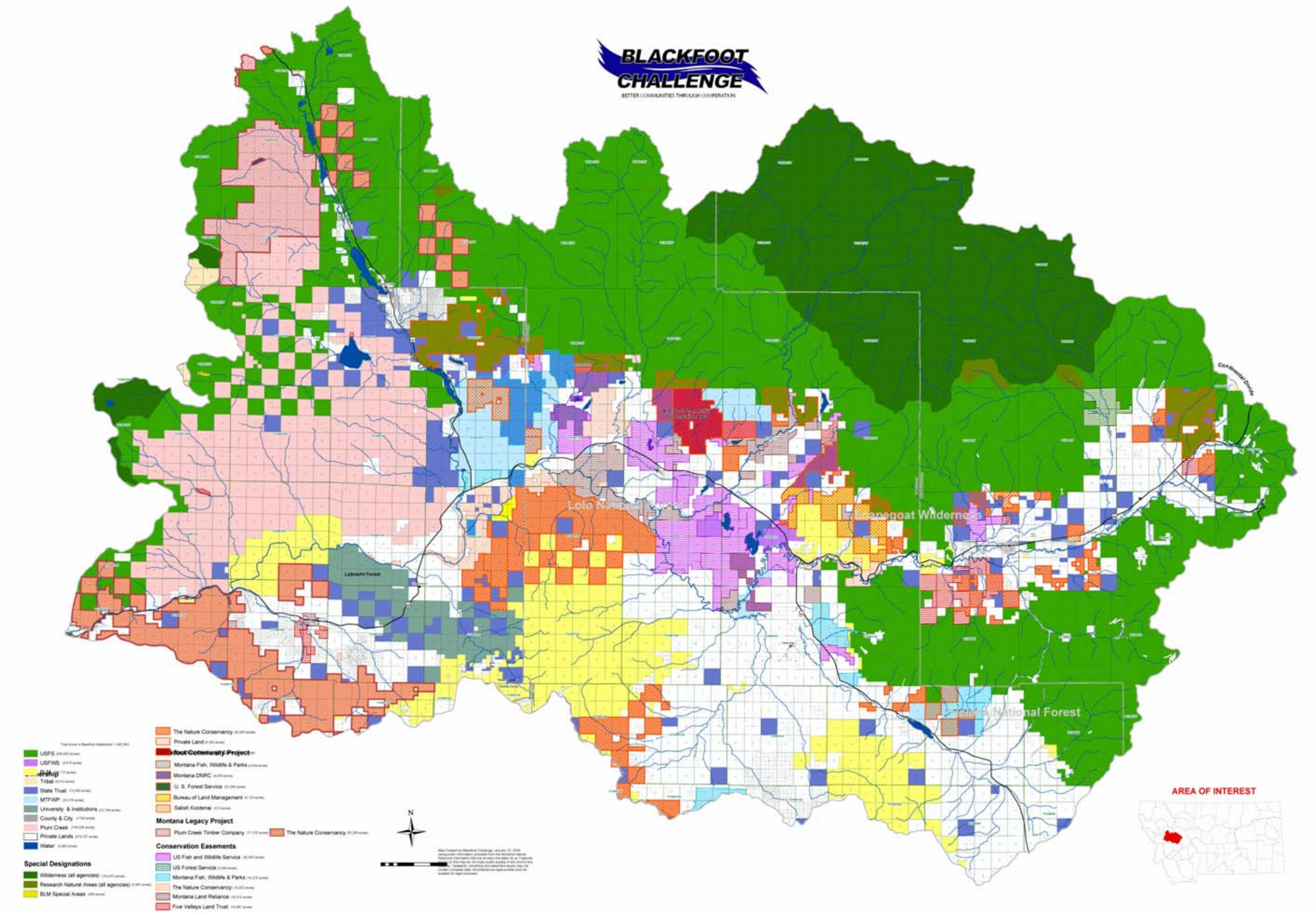
[16] See the Montana Legacy Project website (see www.themontanalegacyproject.org) for more information.

Figure 3.16 Land Ownership and Conservation Easements.

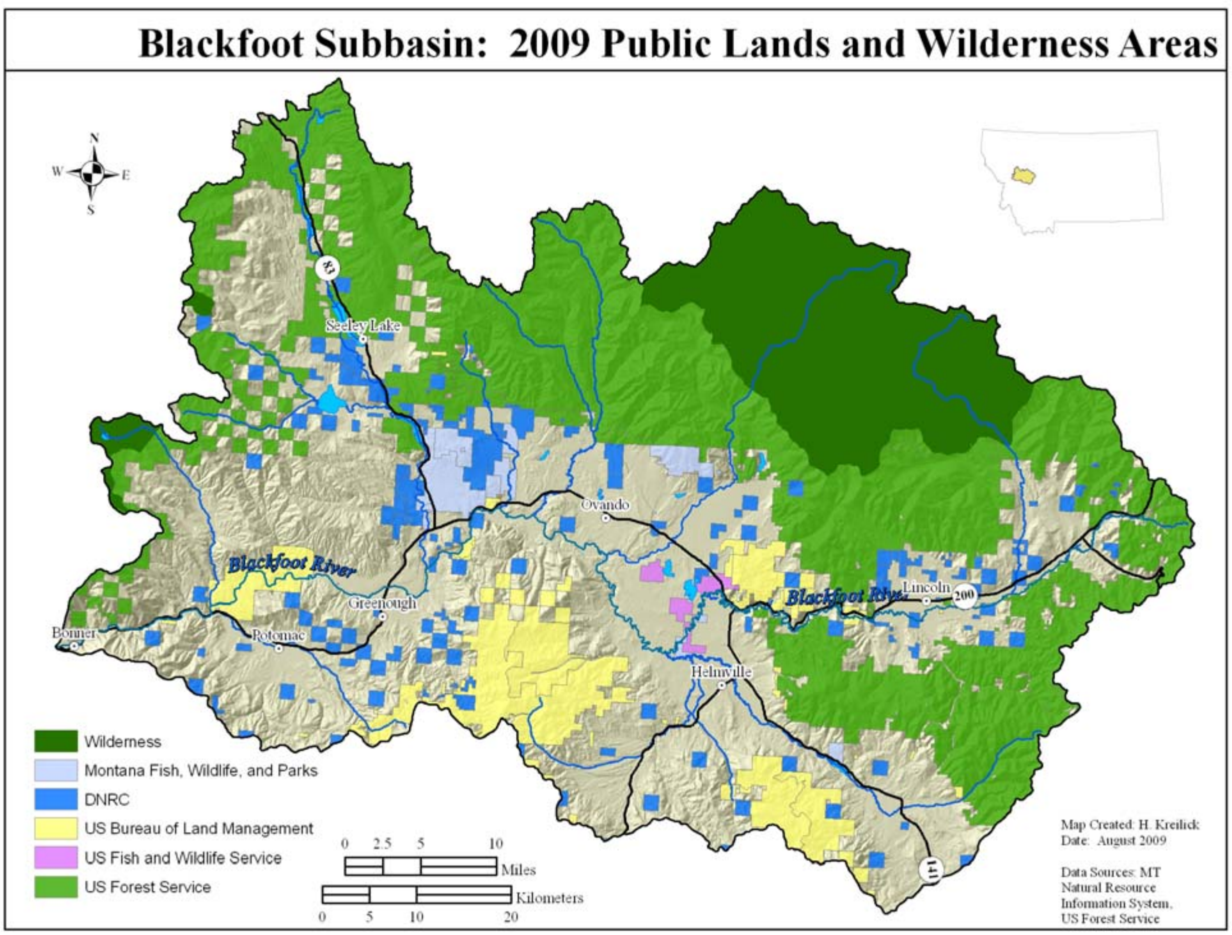


3.2.9.4 Land Use and Economy

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 since1886, 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:

Very Good	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).
Good	The indicator is functioning within its range of acceptable variation, although it may require some human intervention for maintenance.
Fair	The indicator lies outside of its range of acceptable variation and requires human intervention. If unchecked, the target will be vulnerable to serious degradation.
Poor	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 MDFWP 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 competed 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).

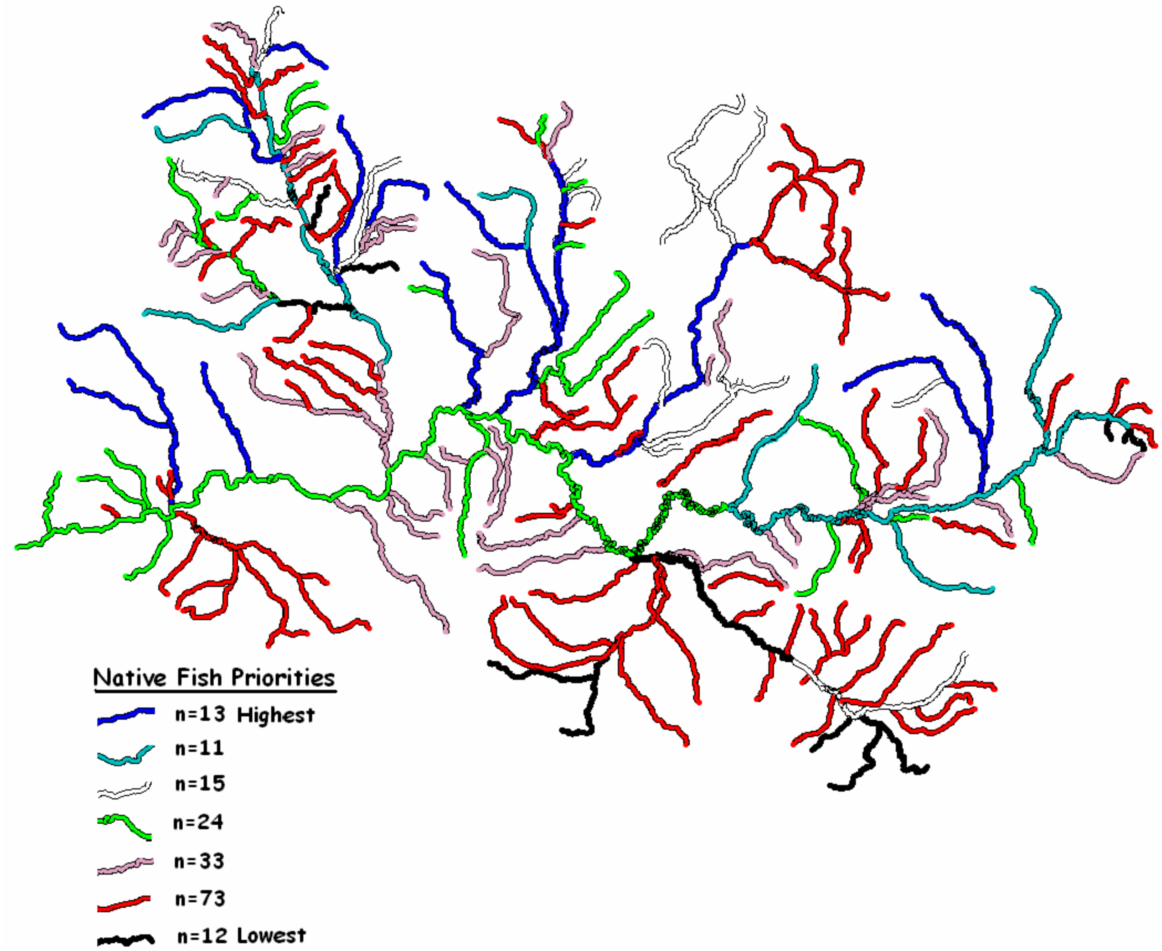


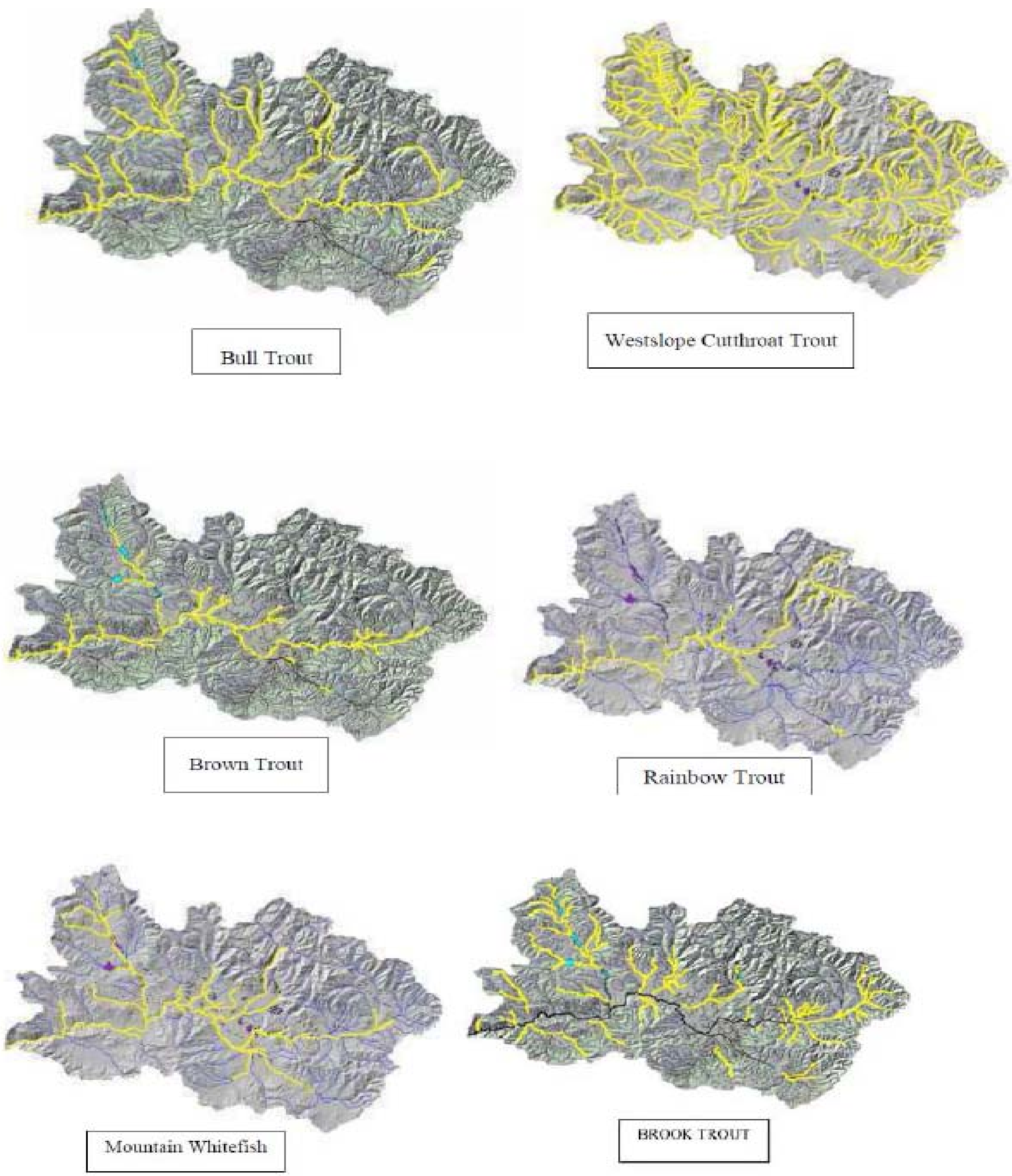
Table 3.12. Native fish priority streams sorted alphabetically high to low priority.

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	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 Fa	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 Cre	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.

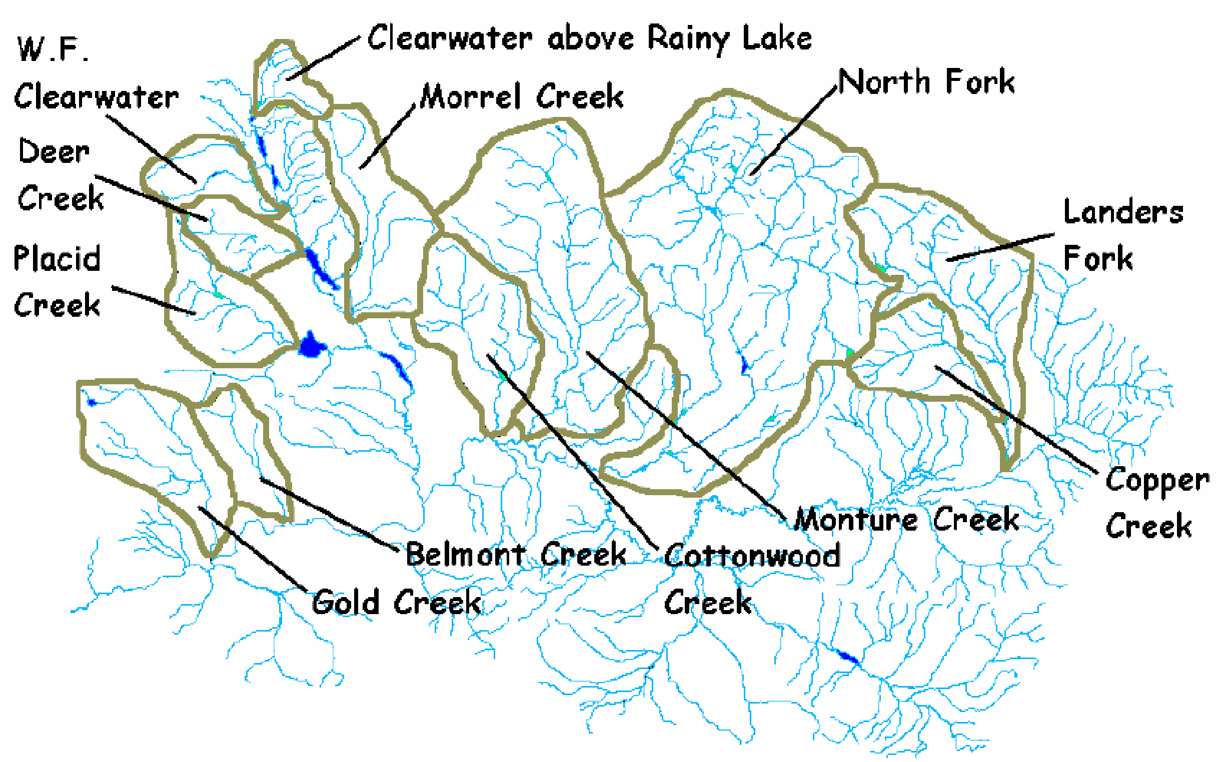
Bull trout abundance and distribution in the Blackfoot Subbasin has declined from historic levels (MBTRT 2000, USFWS 2002). This decline is attributable to a variety of factors, including habitat loss and degradation from land and water management practices. (USFWS, 2002, 2010; Appendix K), population 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 n 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).

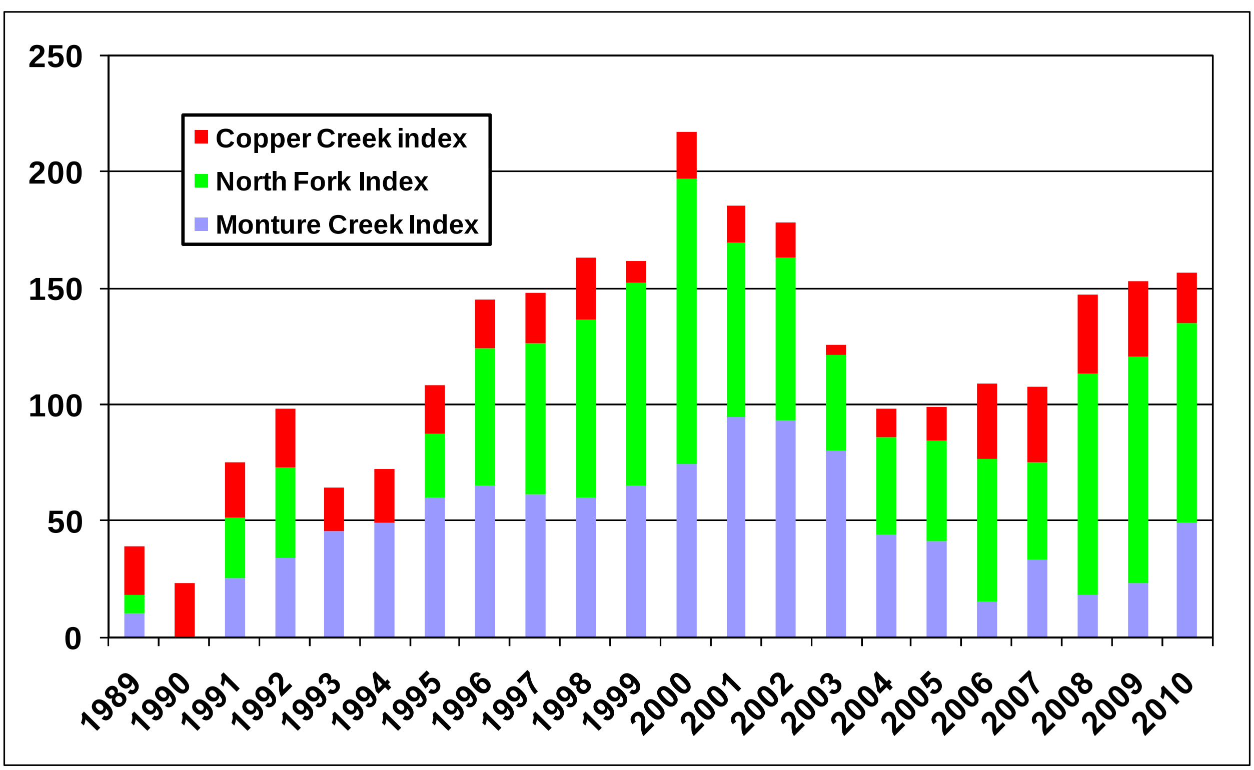
Figure 3.20. Bull trout "core areas" for the Blackfoot Basin ((MBTRT 1996).



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

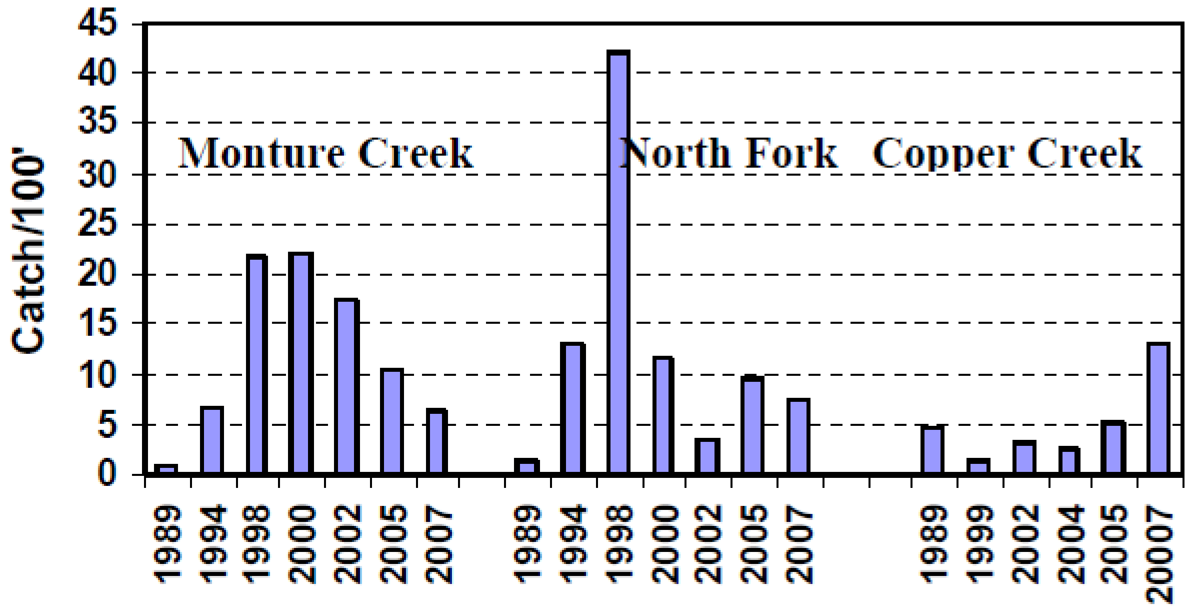
((Peters and Spoon 1989; Peters et al 1990; Pierce et al 2008). Population monitoring has included redd counts in all principle spawning streams and population monitoring sites throughout the Blackfoot River and tributaries supporting bull trout. Since 1989, MFWP has conducted redd counts on Monture 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 (Figure3.21). 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 indates 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: *Abundance*	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: *Life History Expression*	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).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Condition: *Resilience*	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: *Extent of habitat networks within the 6th code*	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: *Water Quality*	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).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context: *Habitat Structure*	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 6th 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: *Hyrdology*	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 6th code.
Landscape Context: *Barriers*	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).

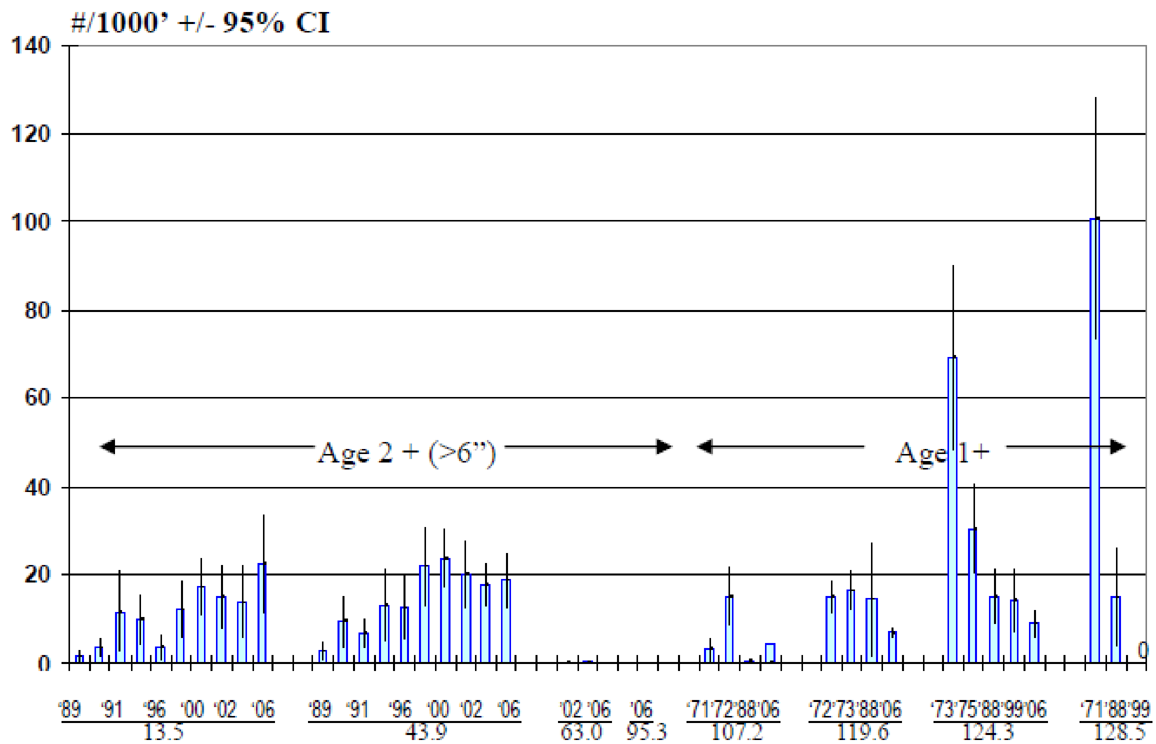
As with bull trout, Montana has been monitoring westslope cutthroat trout in the Blackfoot subbasin since 1989 (Peters et al, 1989; Pierce et al. 2008). This has included population estimates on both the mainstem Blackfoot River and on most of its tributaries (Pierce et al. 2008; Figure 3.23). Westslope 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.

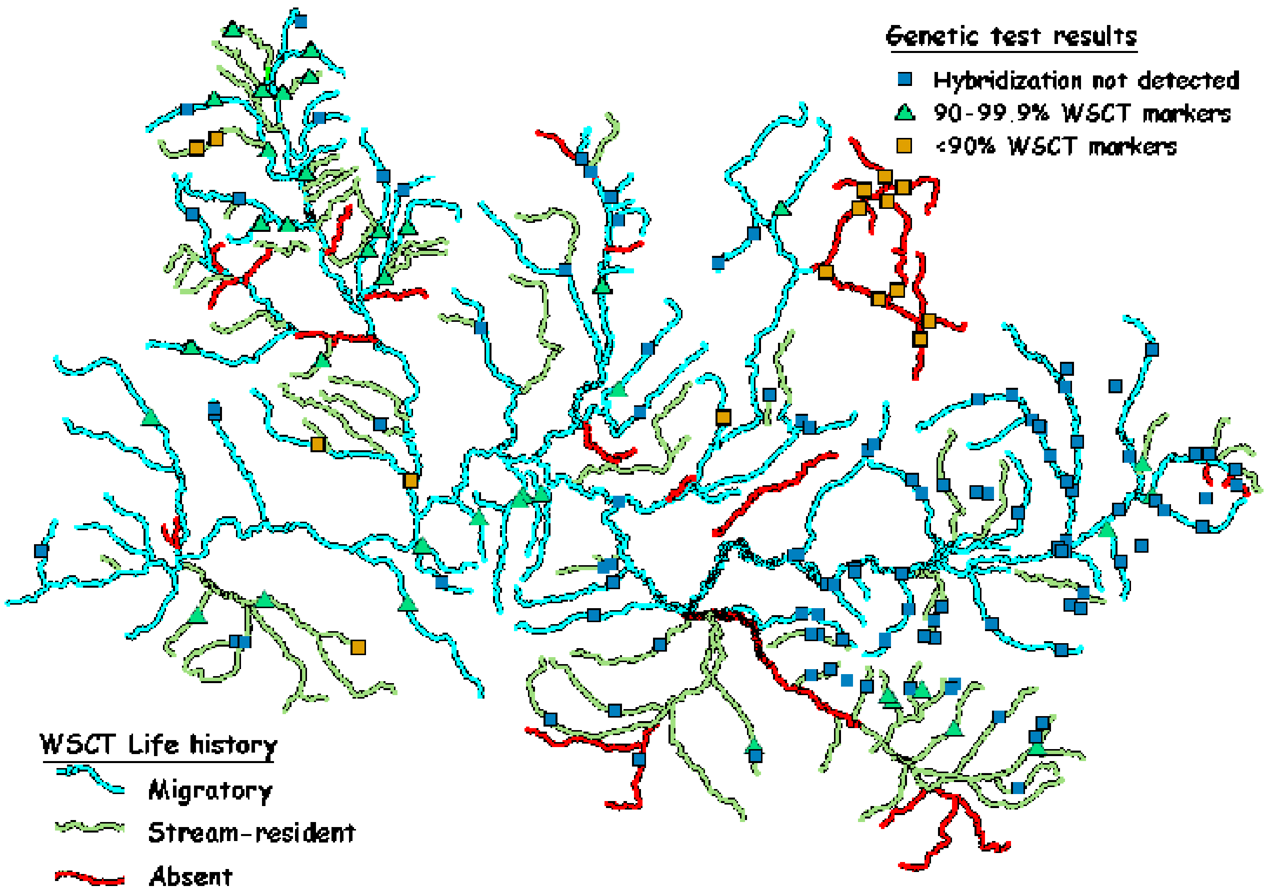
Figure 3.23. WSCT densities at eight sampling locations on the Blackfoot River. The horizontal axis shows the year of the survey and the river-mile mid-point of the survey. (Pierce et al. 2008)



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]

		Indicator Ratings						
Key Attribute [2]	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Condition: *Abundance*	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: *Life History Expression*	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: *Genetic Integrity*	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).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Condition: *Resilience*	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: *Extent of habitat networks within the 6th code*	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: *Water Quality*	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).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context: *Habitat Structure*	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 6th 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: *Hyrdology*	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 6th code.
Landscape Context: *Barriers*	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

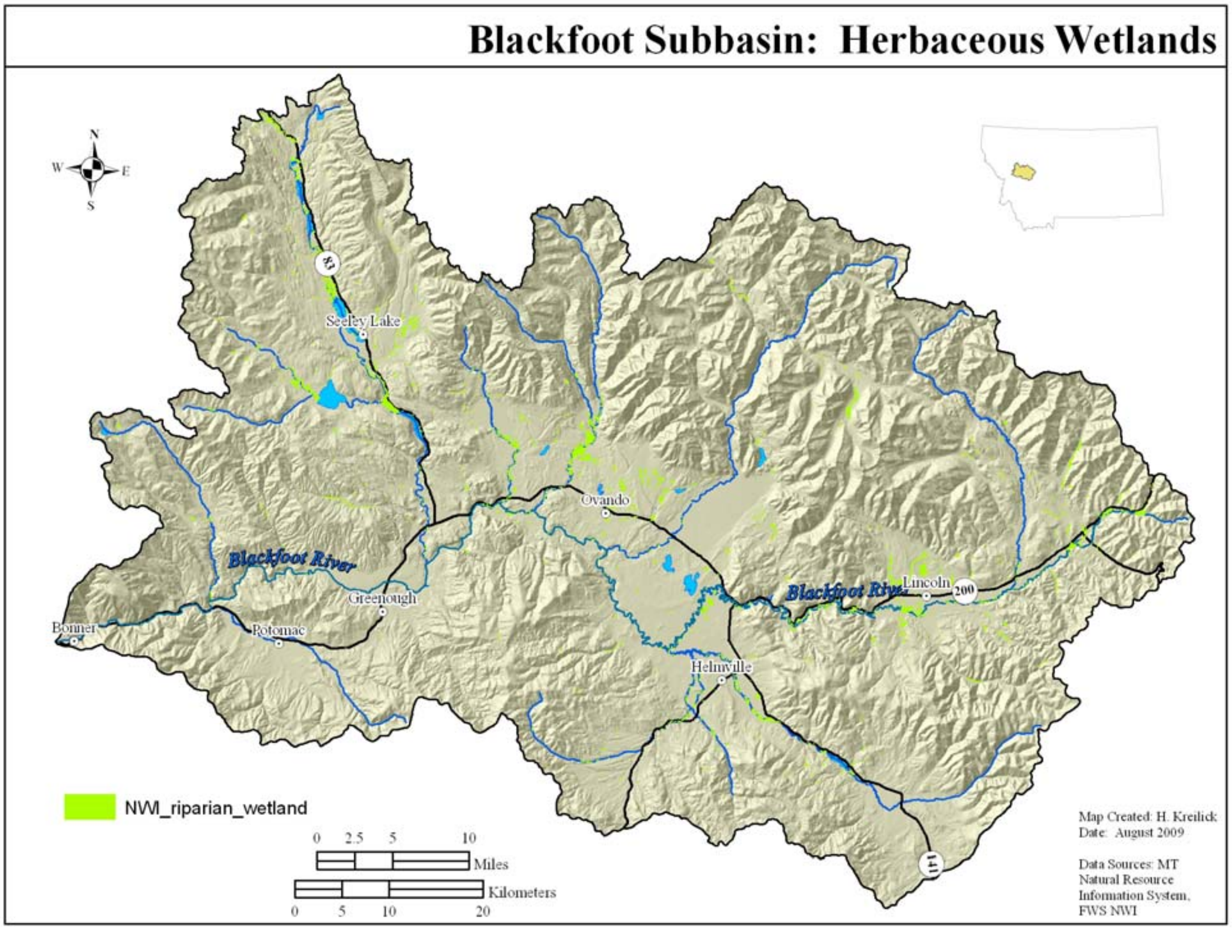
The western pearlshell mussel, a Species of Concern in Montana, is Montana's only coldwater stream mussel and the only native mussel found on the west side of the state. This mussel species appears to have crossed the continental divide in Montana from west to east with its salmonid host, the westslope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

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
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 *disturbance* by humans and other factors. Rating numbers developed from Common Loon monitoring data (Hammond 2009). Ratings apply to herbaceous wetlands *and* to larger lakes used for loon nesting.

Table 3.15 (continued).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Condition (*Reproductive Success of Trumpeter Swans*)	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 *disturbance* 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 *and* 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.

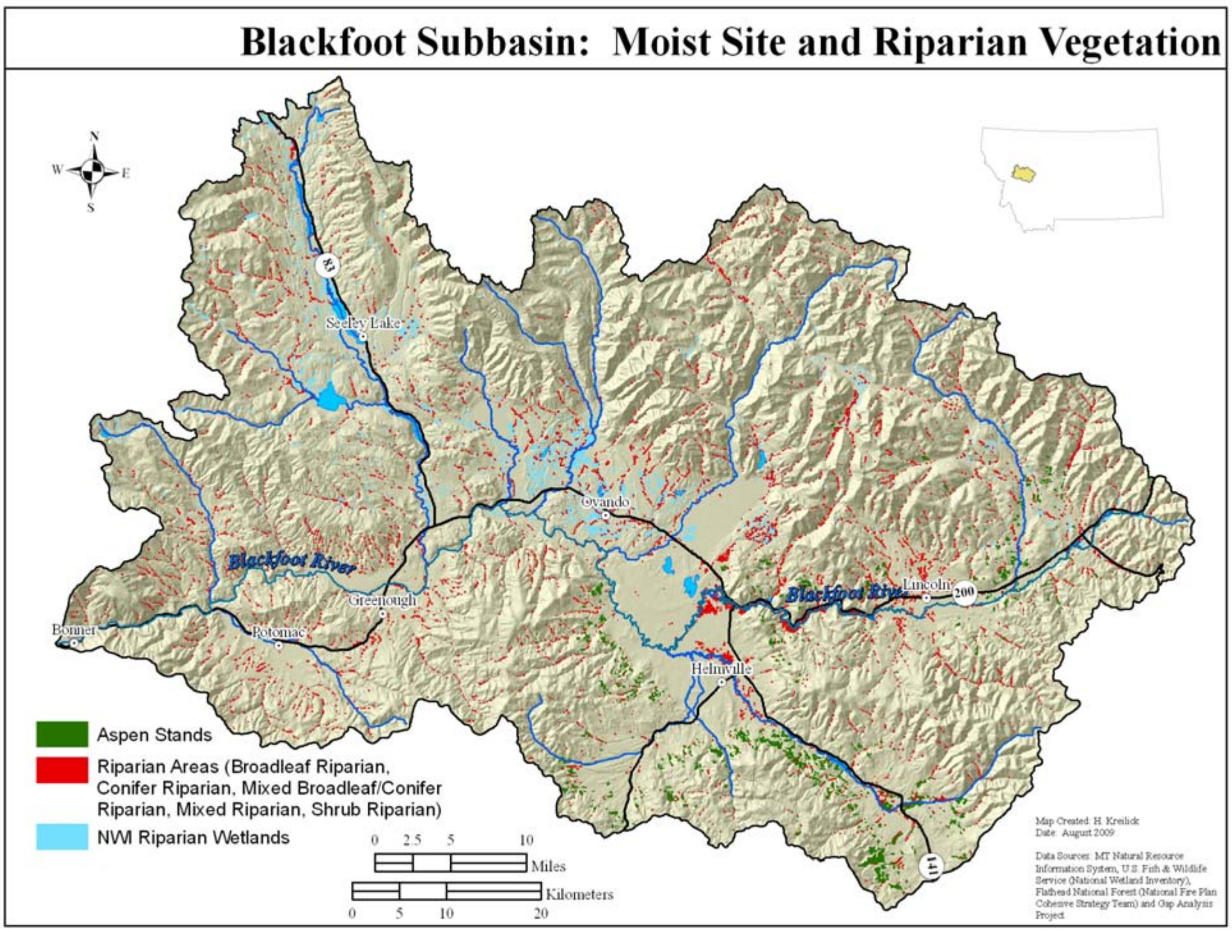
[2] In this case, HRV refers to the historic number, distribution and size of wetlands by wetland type in the subbasin. Collecting this baseline information is a high priority strategic action listed under conservation objectives 4-8 in the Blackfoot Subbasin Management Plan (Section 5.0).

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, Plats 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.

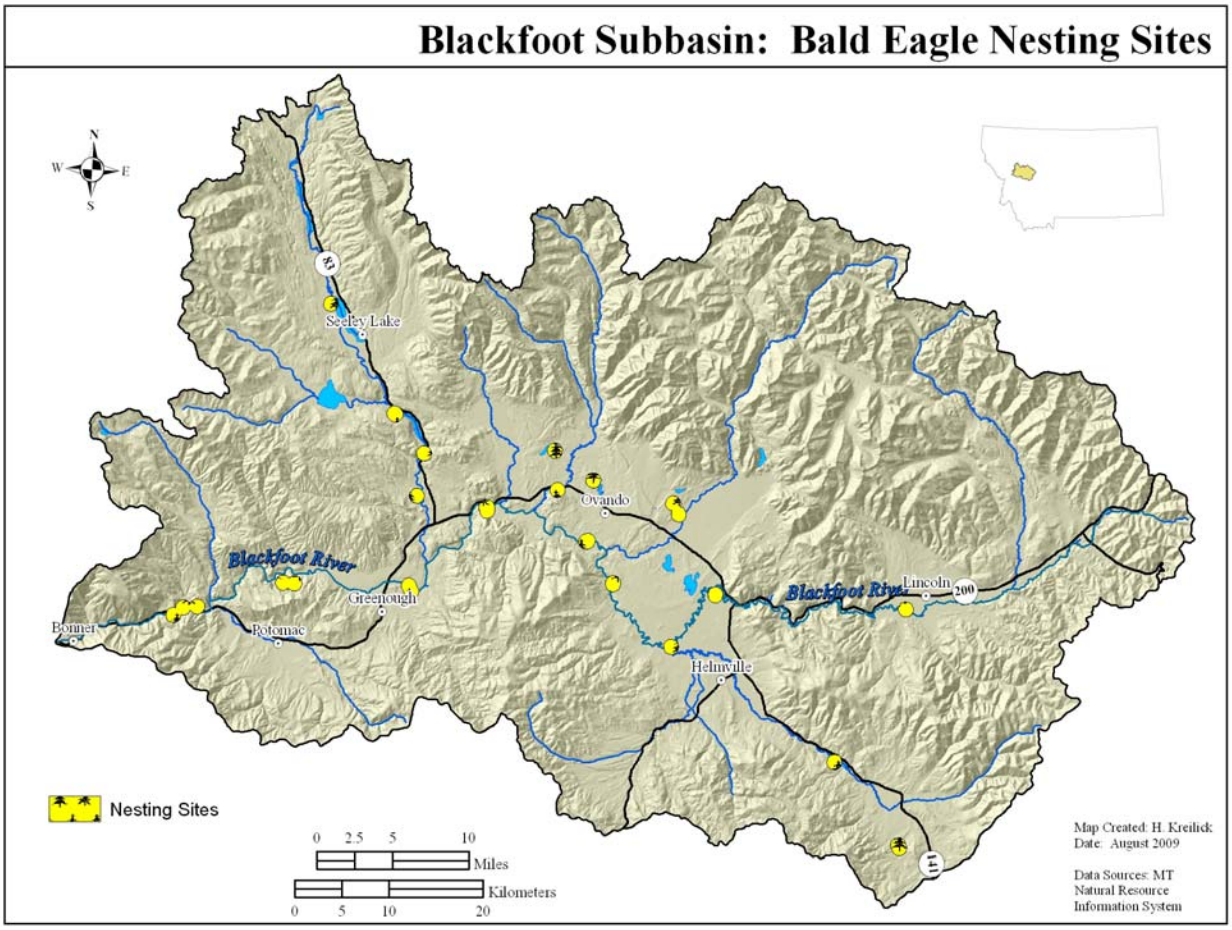
All of the woody plant dominated wetland types encountered in the Blackfoot Subbasin have been subjected to a variety of human impacts since European settlement (ca. 1880) including flood control, clearing, ditching, beaver control, fire control and grazing pressure. These disturbances have resulted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

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context (*Functioning natural disturbance regime*): 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 (*Intactness*): 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 (*Native vegetation community not invaded by exotic plants*)	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 (*Aerial Extent*): 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).

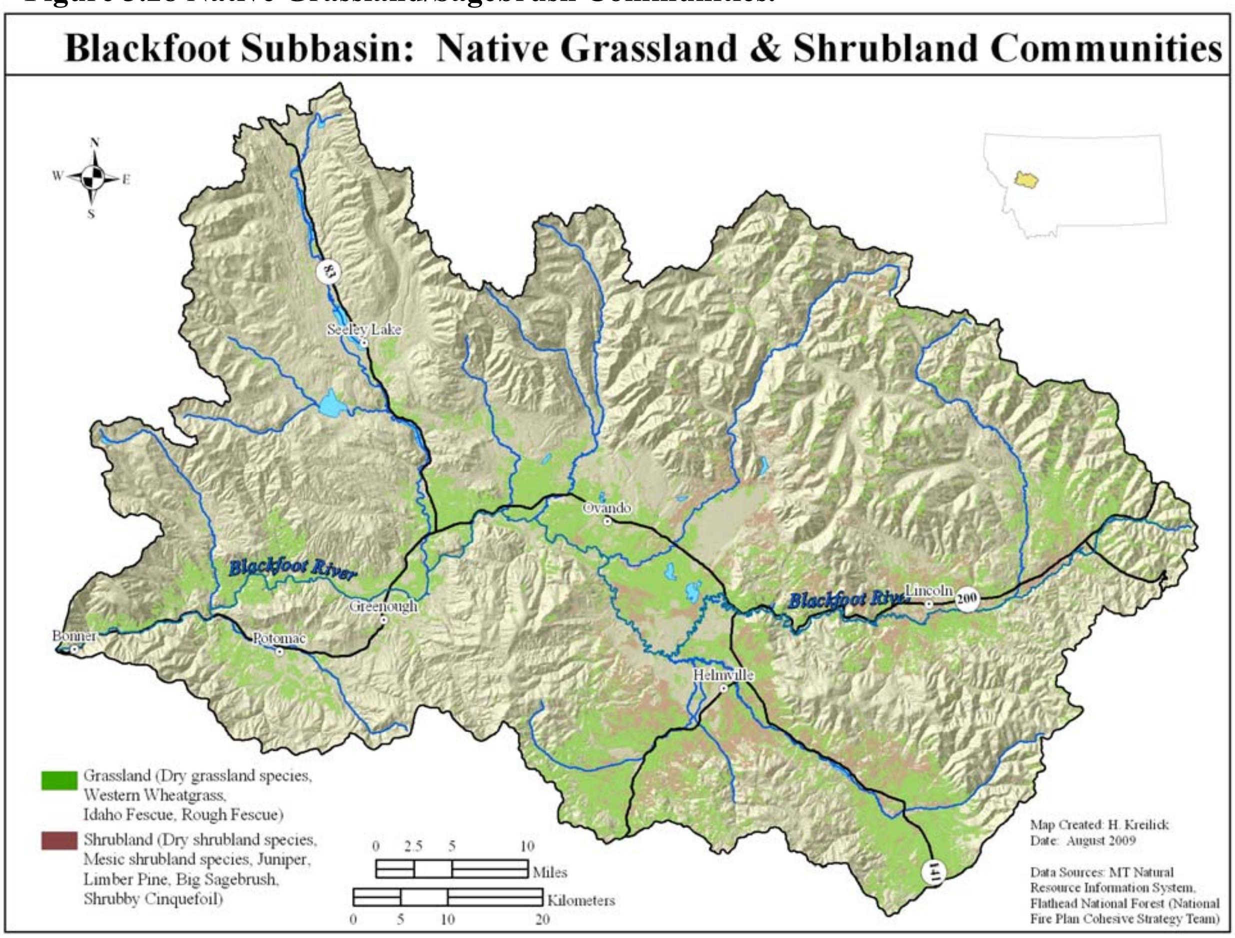
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12

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 Helmville. 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.

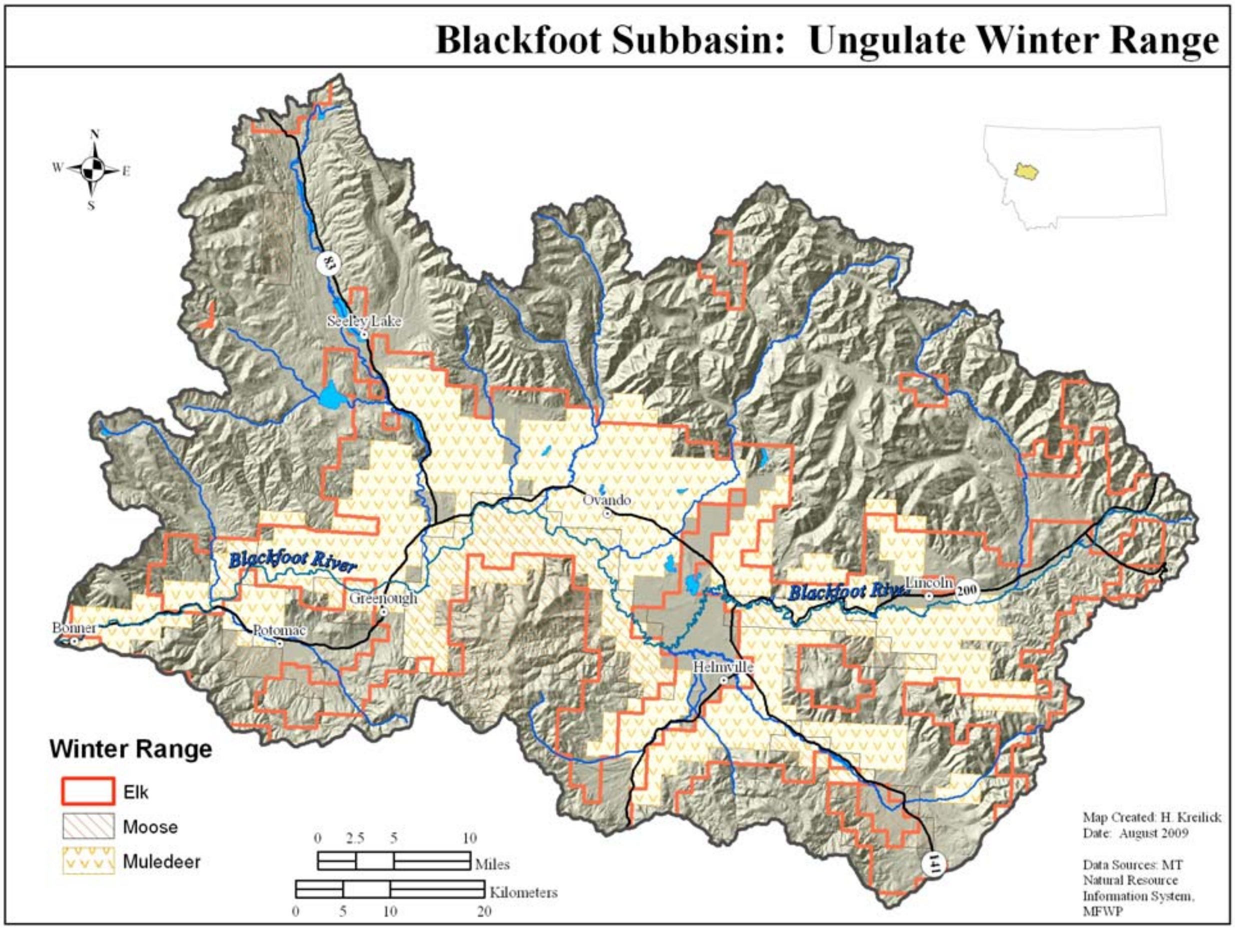


Table 3.17 Native Grassland/Sagebrush Communities Viability Assessment.

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context (*Functioning fire regime*)	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 (*Native vegetation community intactness*)	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 (*Native plant community not invaded by exotic plants*)	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 (*Areal Extent*): Area/size of grasslands/ sagebrush by vegetation type	Acres of grassland/sage-brush 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.

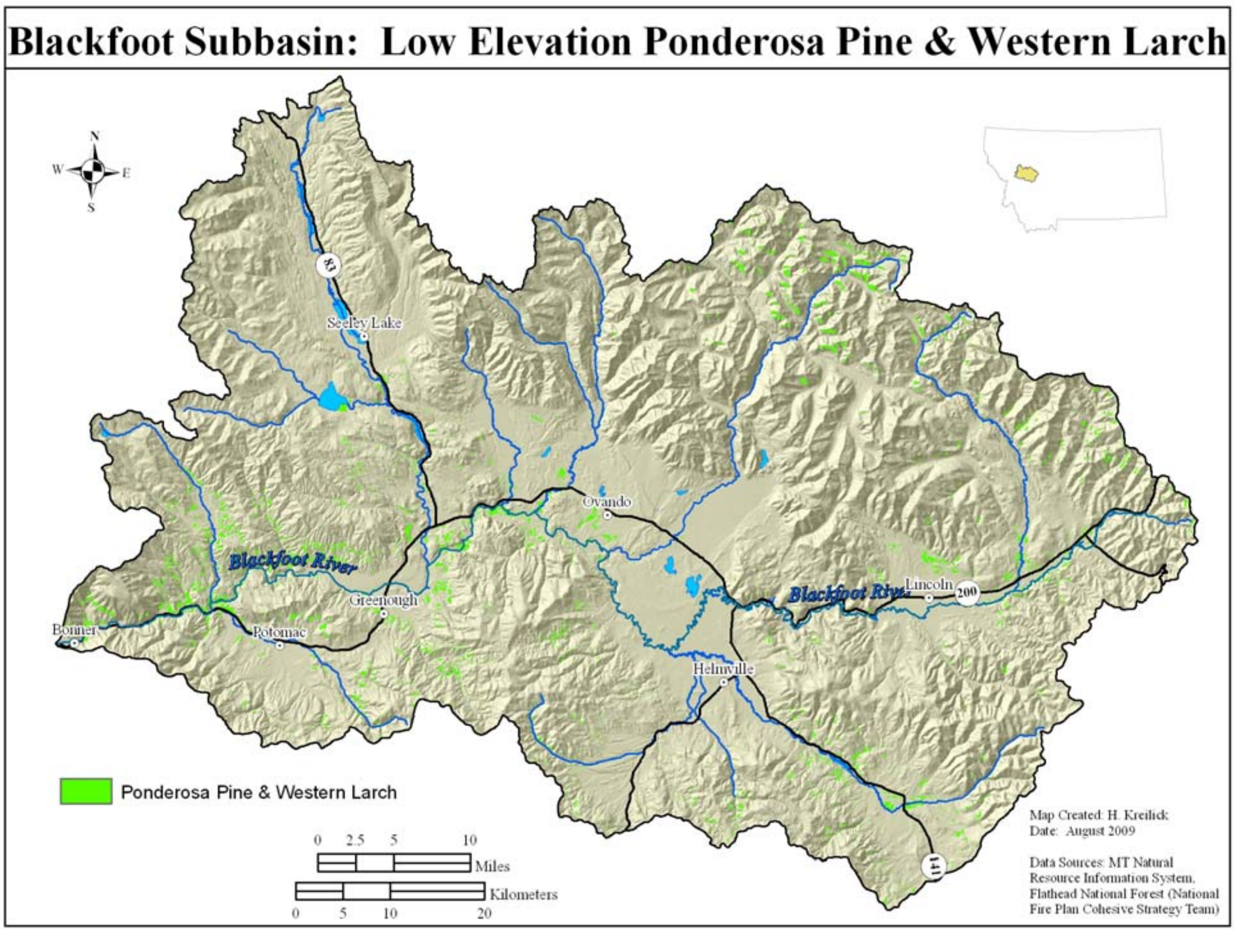
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

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.

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context/Condition (*Functioning disturbance regime*): 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 (*Patch Size and Distribution of Age Classes*)	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.

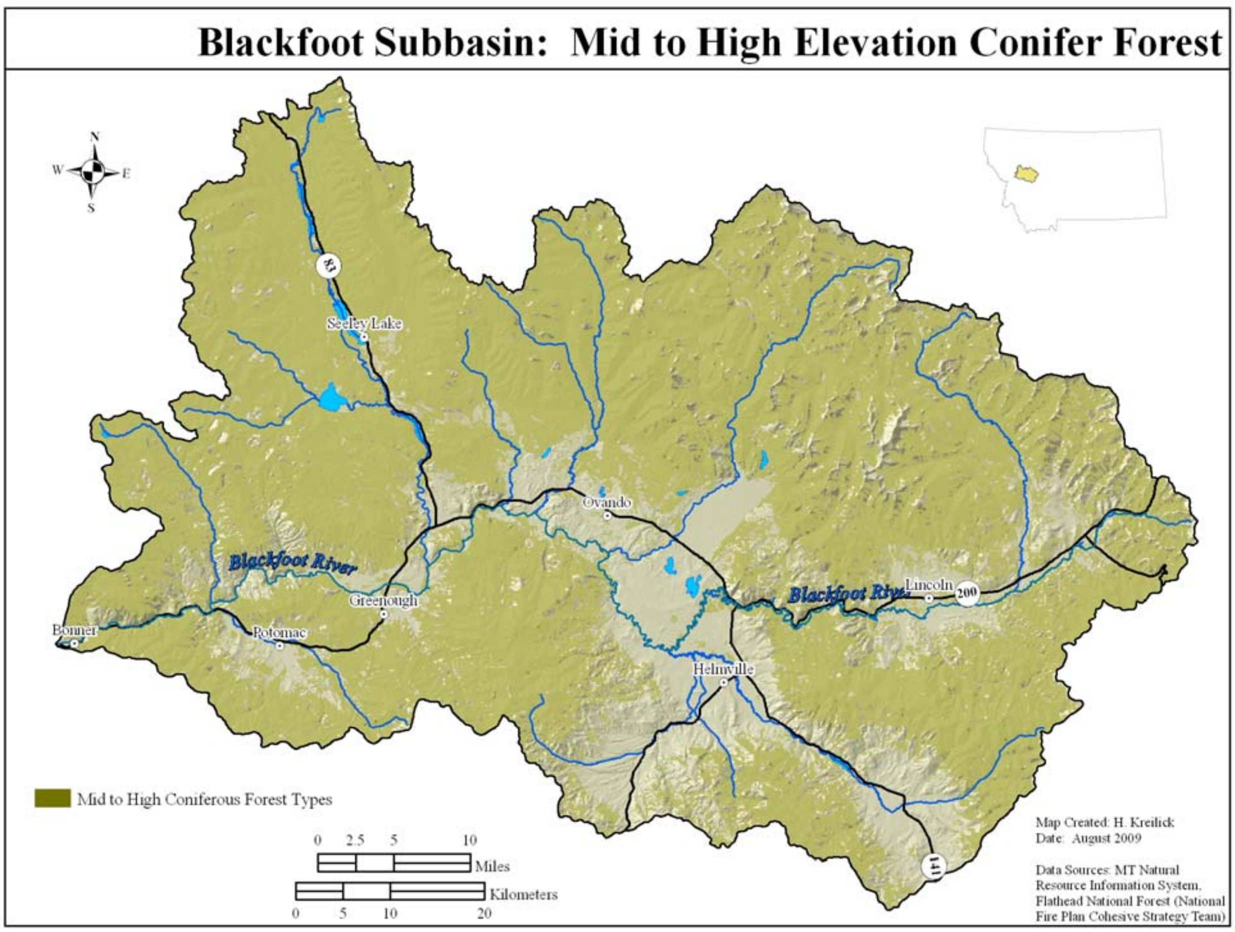
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

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).

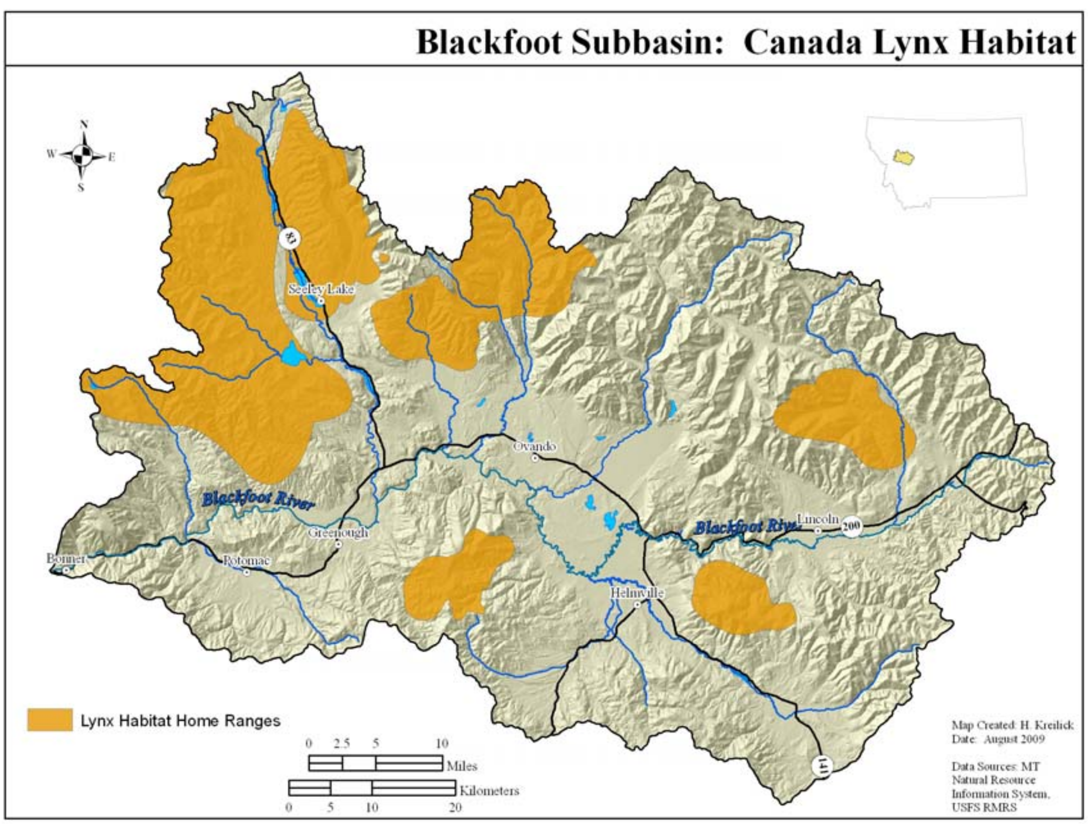
Olive-sided Flycatcher: The Olive-sided Flycatcher, a Montana Partners in Flight Level I Priority Species (PIF 2000), generally occurs in mid to high elevation coniferous forests throughout the mountains of western North America (Altman 1997). It breeds throughout western Montana. Olive-sided Flycatchers 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.

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context/Condition (*Functioning disturbance regime*): 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 (*Cone producing whitebark pine stand*)	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 (*Patch size and distribution of age classes*)	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.

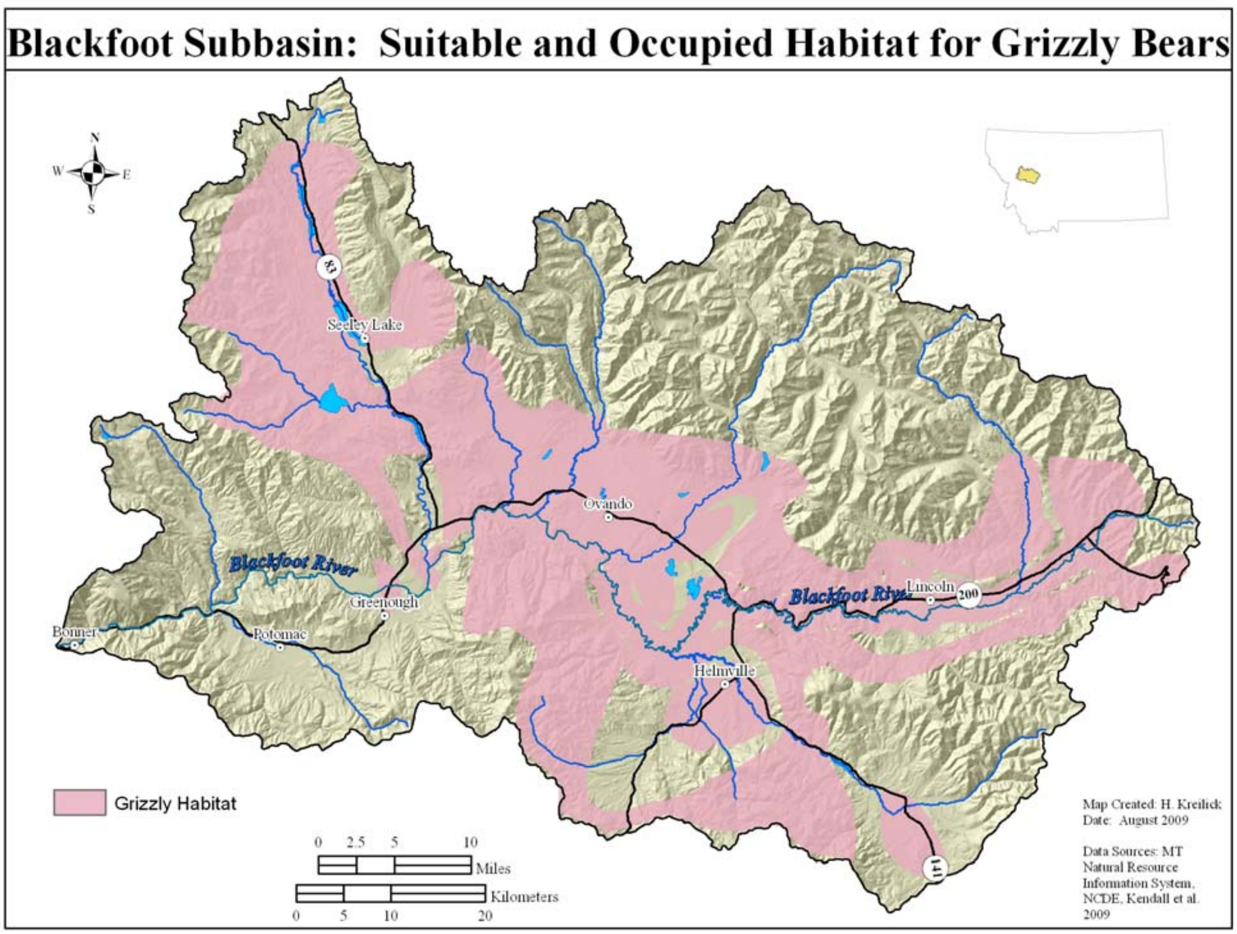
[1] HRV refers to "historic range of variability." A definition of HRV is provided in Table 3.12.

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.

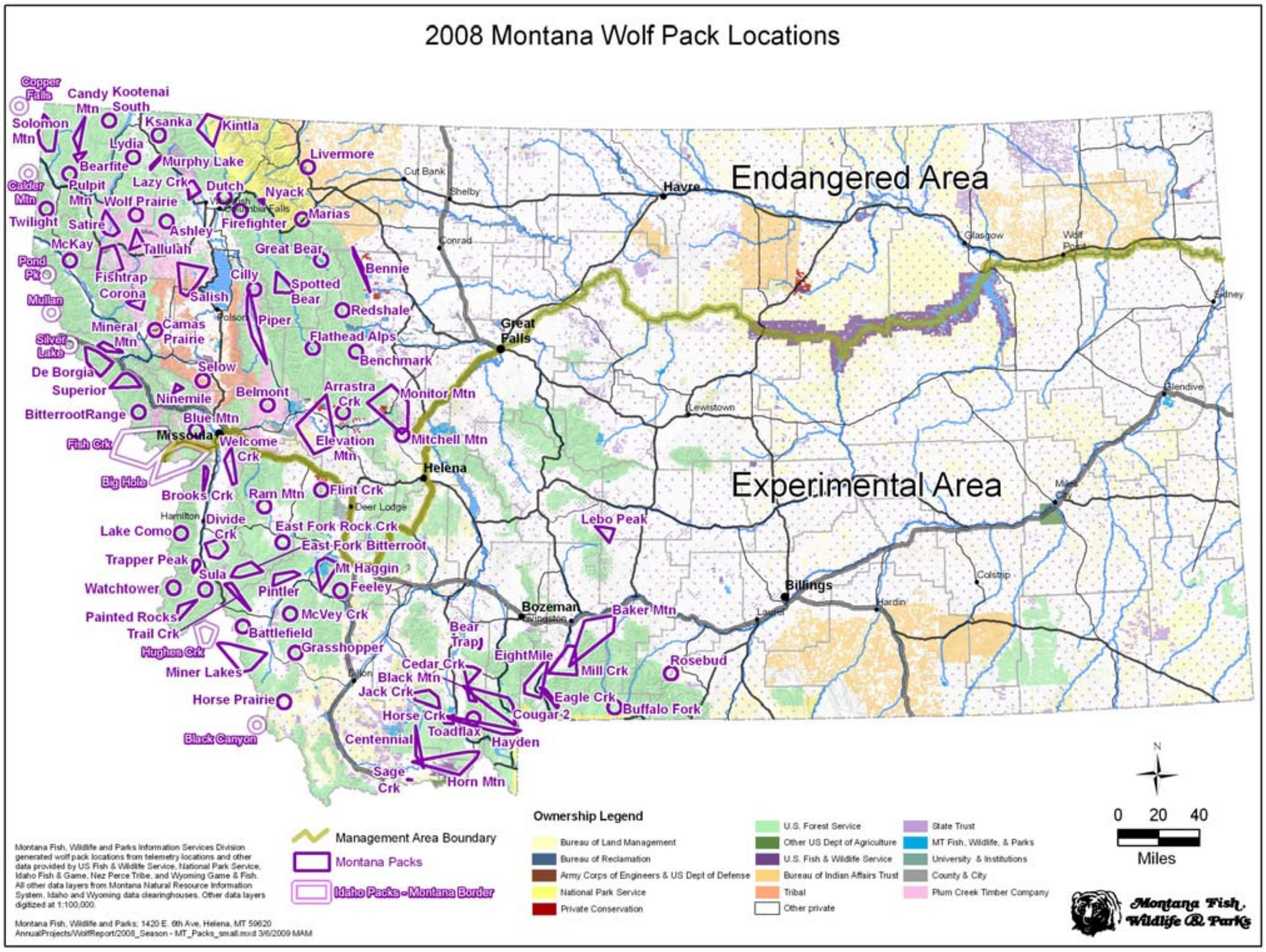
Grizzlies breed, forage and migrate throughout the subbasin and den above 6,500 feet. They move from high mountain elevations to lower valley bottoms to forage seasonally for available food. Lakes, ponds, fens and spring-fed creeks, common in portions of the valley floor, provide excellent bear habitat. 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.

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Landscape Context (*Habitat Connectivity*)	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 (*Secure Available Habitat*)	"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 (*Population demographics*): 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 (*Population demographics*): 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 (*Human/grizzly bear conflicts*)	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).

		Indicator Ratings						
Key Attribute	**Indicator**	**Poor**	**Fair**	**Good**	**Very Good**	**Current Rating**	**Desired Rating**	**Comments**
Size (*Population size and trend*)	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 modem 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 (4^{th} 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				**Fair** [4]

[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 attribute[23] 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.

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[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:

Very High **(VH)**	Not reversible (e.g., wetlands converted to a shopping center).
High **(H)**	Reversible, but not practically affordable (e.g., wetland converted to agriculture).
Medium **(M)**	Reversible with a reasonable commitment of resources (e.g., ditching and draining of wetland).
Low **(L)**	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 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.

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[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 (CO_2) – 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—islands 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.

<u>Non-native fish species</u>
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 Species[30] 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 invertebrates[31]

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)

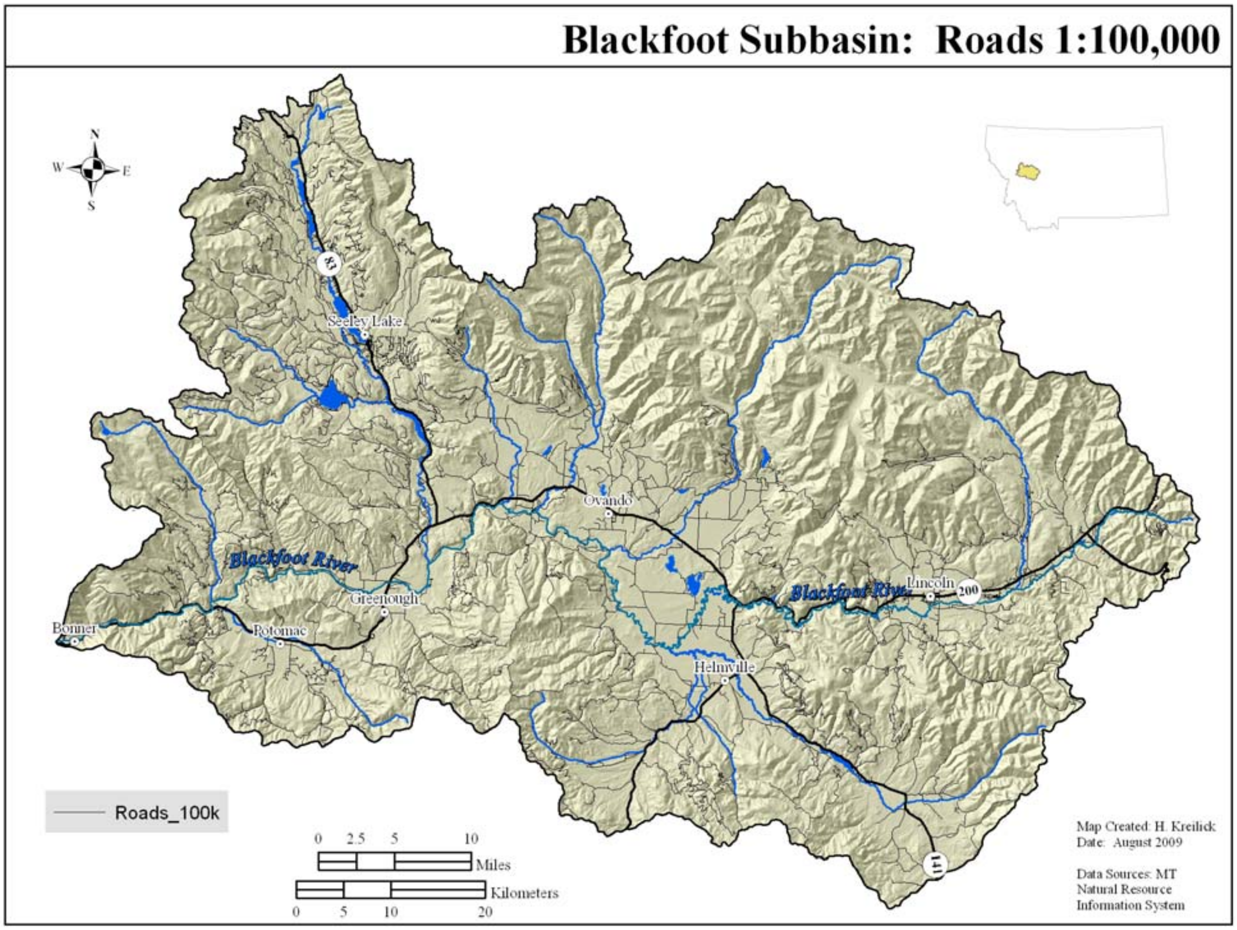
Current forestry practices can also negatively impact terrestrial and aquatic habitats in the subbasin. Current forestry practices to reduce the risk of fire in the wildland-urban interface, for example, can negatively affect subbasin forest types if they do not follow an ecosystem restoration prescription. 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

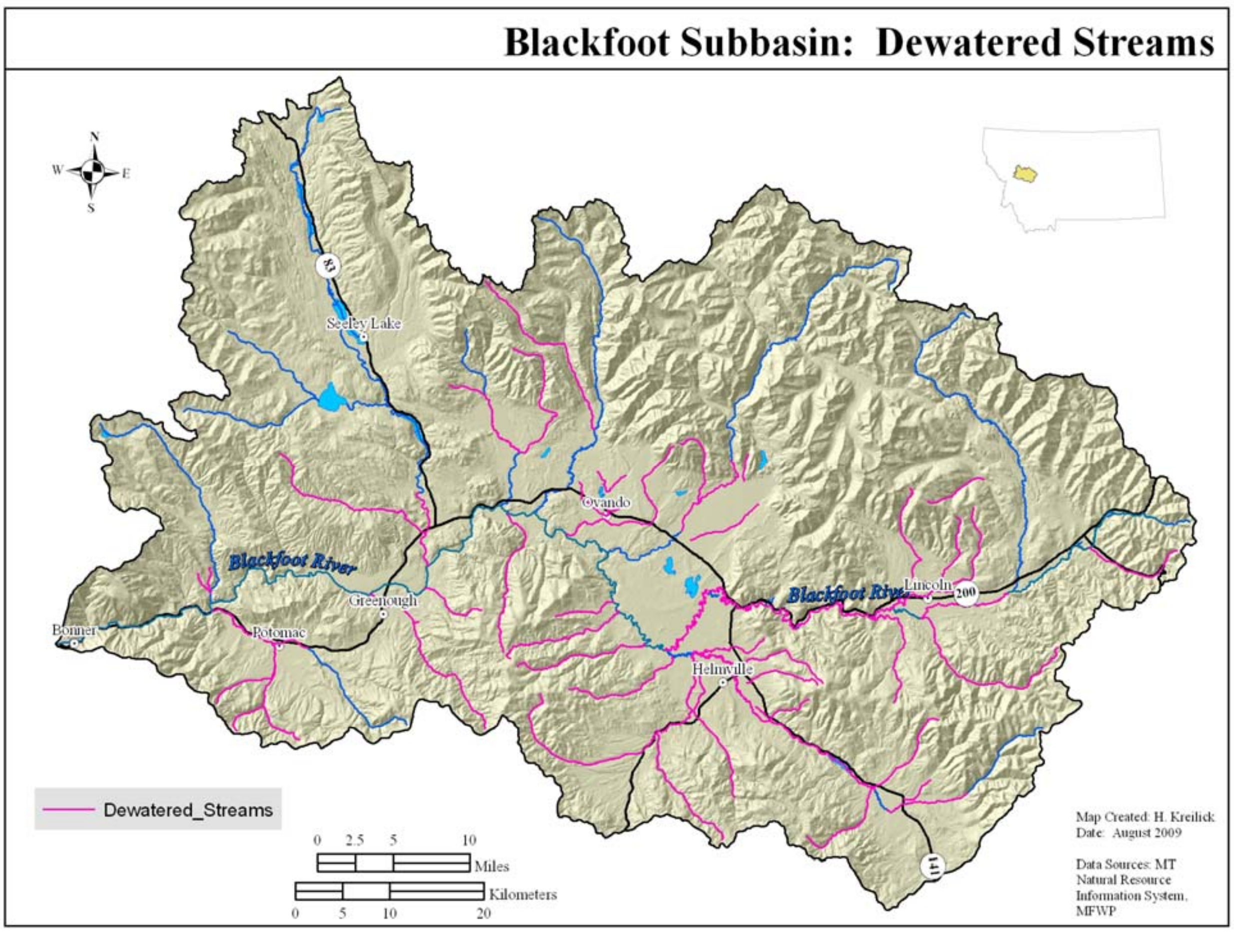
Description: Stream dewatering occurs naturally but is exacerbated in many cases by human activity. Drainage and diversion systems impact aquatic, wetland and riparian communities by altering the surface and groundwater flows that sustain them. Water is diverted from the Blackfoot River and its tributaries 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 re-sold 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 mange 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 a 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 of 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?
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 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?
BLACKFOOT HEADWATERS PLANNING AREA (CONT.)						
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
NEVADA CREEK PLANNING AREA						
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?
NEVADA CREEK PLANNING AREA (CONT.)						
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?
NEVADA CREEK PLANNING AREA (CONT.)						
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
MIDDLE BLACKFOOT PLANNING AREA						
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?
MIDDLE BLACKFOOT PLANNING AREA (CONT.)						
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?
LOWER BLACKFOOT PLANNING AREA (CONT.)						
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?
LOWER BLACKFOOT PLANNING AREA (CONT.)						
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 groups[35] 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 groups[37] 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.

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[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 invasive[39] 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 priority[41] 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.

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[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 Buffers[43] and Riparian Proper Functioning Condition.[44]

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[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.

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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 communities[45] 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.

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[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 process[52] 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

<u>Current long-term water quality monitoring efforts in the Blackfoot Subbasin</u>

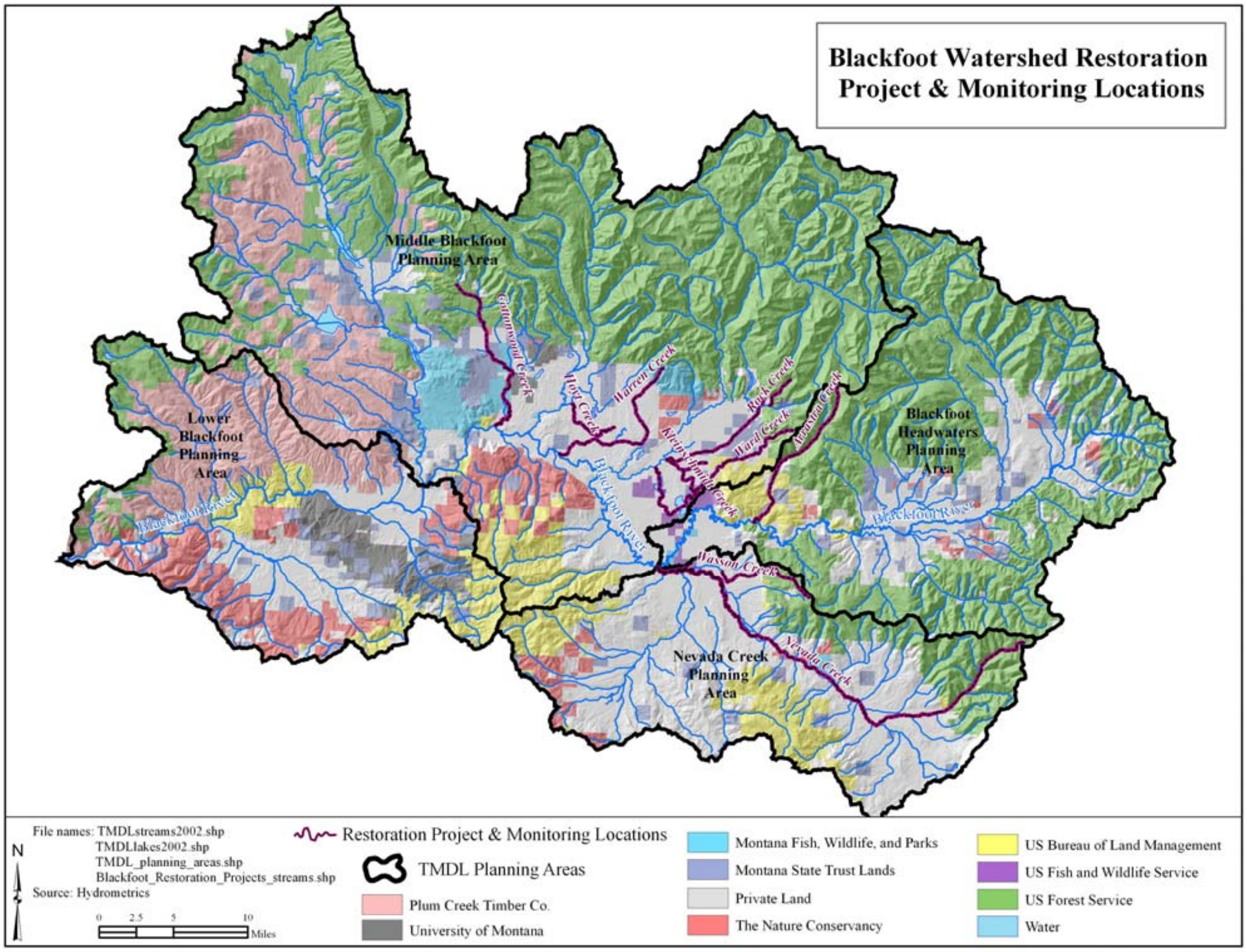
In addition to the restoration monitoring and protocol described above, the Blackfoot Subbasin hosts an ongoing, long-term water quality monitoring program (see Blackfoot Watershed Restoration Project and Monitoring Locations map below).

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).

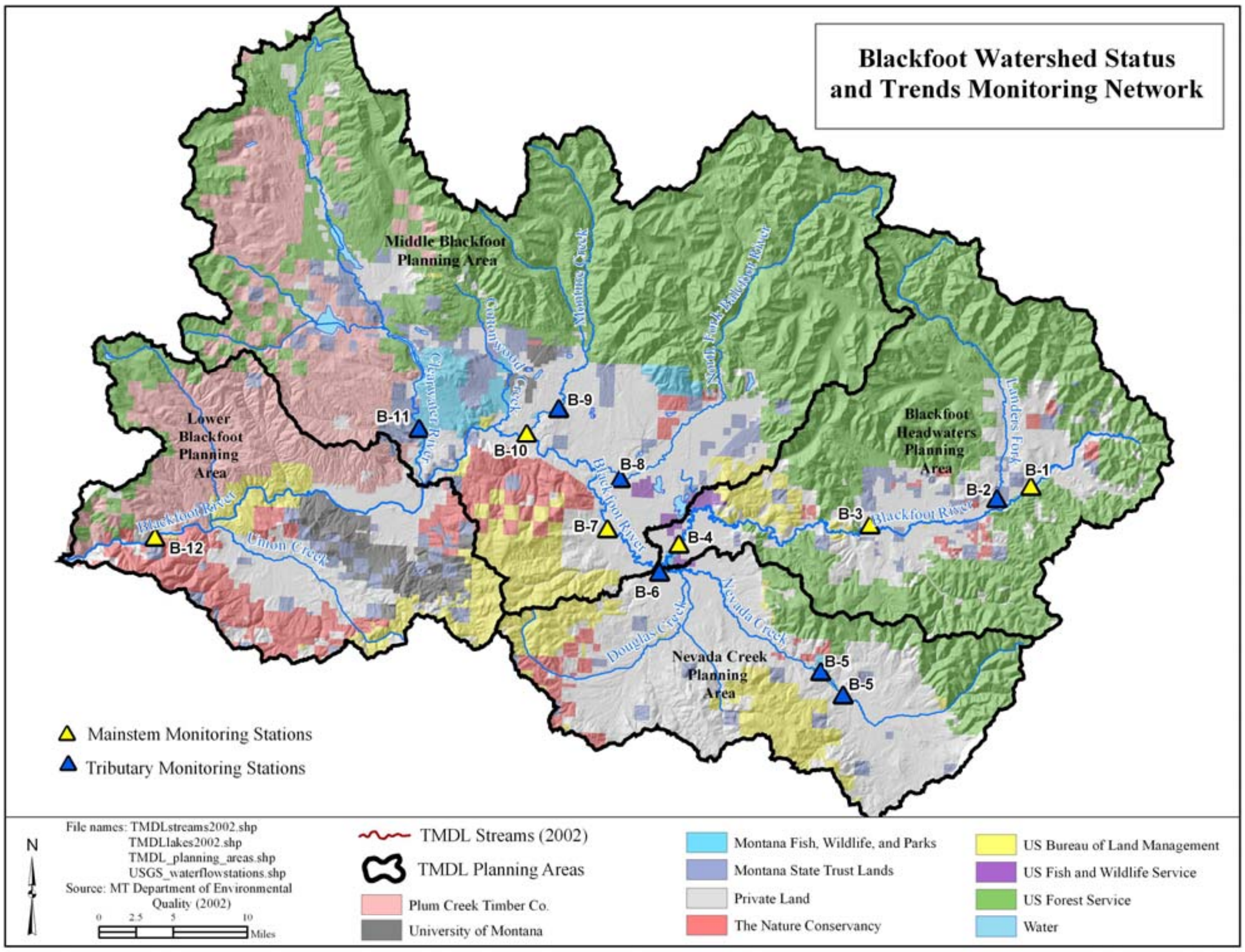
The Blackfoot River Valley Conservation Area Draft Plan (TNC and BC 2007)

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 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 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.	√	√

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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	*Sorex cinereus*
Preble's Shrew	*Sorex preblei*
Vagrant Shrew	*Sorex vagrans*
Dusky or Montane Shrew	*Sorex monticolus*
Water Shrew	*Sorex palustris*
Pygmy Shrew	*Sorex hoyi*
Little Brown Myotis	*Myotis lucifugus*
Long-eared Myotis	*Myotis evotis*
Fringed Myotis	*Myotis thysanodes*
Long-legged Myotis	*Myotis volans*
Western Small-footed Myotis	*Myotis ciliolabrum*
Silver-haired Bat	*Lasionycteris noctivagans*
Big Brown Bat	*Eptesicus fuscus*
Hoary Bat	*Lasiurus cinereus*
Townsend's Big-eared Bat	*Corynorhinus townsendii*
Pika	*Ochotona princeps*
Mountain Cottontail	*Sylvilagus nuttallii*
Snowshoe Hare	*Lepus americanus*
White-tailed Jack Rabbit	*Lepus townsendii*
Least Chipmunk	*Tamias minimus*
Yellow-pine Chipmunk	*Tamias amoenus*
Red-tailed Chipmunk	*Tamias ruficaudus*
Yellow-bellied Marmot	*Marmota flaviventris*
Hoary Marmot	*Marmota caligata*
Columbian Ground Squirrel	*Spermophilus columbianus*
Golden-mantled Ground Squirrel	*Spermophilus lateralis*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Flying Squirrel	*Glaucomys sabrinus*
Northern Pocket Gopher	*Thomomys talpoides*
Beaver	*Castor canadensis*
Deer Mouse	*Peromyscus maniculatus*
Bushy-tailed Woodrat	*Neotoma cinerea*
Southern Red-backed Vole	*Clethrionomys gapperi*
Heather Vole	*Phenacomys intermedius*
Meadow Vole	*Microtus pennsylvanicus*
Montane Vole	*Microtus montanus*
Long-tailed Vole	*Microtus longicaudus*
Muskrat	*Ondatra zibethicus*
Northern Bog Lemming	*Synaptomys borealis*
Western Jumping Mouse	*Zapus princeps*
Porcupine	*Erethizon dorsatum*

Common Name	Scientific Name
MAMMALS (CONT.)	
Coyote	*Canis latrans*
Gray Wolf	*Canis lupus*
Red Fox	*Vulpes vulpes*
Black Bear	*Ursus americanus*
Grizzly Bear	*Ursus arctos*
Raccoon	*Procyon lotor*
Marten	*Martes americana*
Fisher	*Martes pennanti*
Short-tailed Weasel	*Mustela erminea*
Long-tailed Weasel	*Mustela frenata*
Mink	*Mustela vison*
Wolverine	*Gulo gulo*
Badger	*Taxidea taxus*
Striped Skunk	*Mephitis mephitis*
Northern River Otter	*Lontra canadensis*
Canada Lynx	*Lynx canadensis*
Bobcat	*Lynx rufus*
Mountain Lion	*Puma concolor*
Elk or Wapiti	*Cervus canadensis*
Mule Deer	*Odocoileus hemionus*
White-tailed Deer	*Odocoileus virginianus*
Moose	*Alces alces*
BIRDS	
Common Loon	*Gavia immer*
Pied-billed Grebe	*Podilymbus podiceps*
Horned Grebe	*Podiceps auritus*
Red-necked Grebe	*Podiceps grisegena*
Eared Grebe	*Podiceps nigricollis*
Western Grebe	*Aechmophorus occidentalis*
Clark's Grebe	*Aechmophorus clarkii*
American White Pelican	*Pelecanus erythrorhynchos*
Double-crested Cormorant	*Phalacrocorax auritus*
American Bittern	*Botaurus lentiginosus*
Great Blue Heron	*Ardea herodias*
Great Egret	*Ardea alba*
White-faced Ibis	*Plegadis chihi*
Tundra Swan	*Cygnus columbianus*
Trumpeter Swan	*Cygnus buccinator*
Snow Goose	*Chen caerulescens*
Ross's Goose	*Chen rossii*
Canada Goose	*Branta canadensis*
Wood Duck	*Aix sponsa*
Green-winged Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Blue-winged Teal	*Anas discors*

Common Name	Scientific Name
BIRDS (CONT.)	
Cinnamon Teal	*Anas cyanoptera*
Northern Shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
Eurasian Wigeon	*Anas penelope*
American Wigeon	*Anas americana*
Redhead	*Aythya americana*
Ring-necked Duck	*Aythya collaris*
Lesser Scaup	*Aythya affinis*
Harlequin Duck	*Histrionicus histrionicus*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Common Goldeneye	*Bucephala clangula*
Barrow's Goldeneye	*Bucephala islandica*
Bufflehead	*Bucephala albeola*
Hooded Merganser	*Lophodytes cucullatus*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Turkey Vulture	*Cathartes aura*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Northern Goshawk	*Accipiter gentilis*
Swainson's Hawk	*Buteo swainsoni*
Red-tailed Hawk	*Buteo jamaicensis*
Ferruginous Hawk	*Buteo regalis*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
Gray Partridge	*Perdix perdix*
Ring-necked Pheasant	*Phasianus colchicus*
Spruce Grouse	*Falcipennis canadensis*
Dusky Grouse	*Dendragapus obscurus*
White-tailed Ptarmigan	*Lagopus leucura*
Ruffed Grouse	*Bonasa umbellus*
Greater Sage-Grouse	*Centrocercus urophasianus*
Sharp-tailed Grouse (Columbian)	*Tympanuchus phasianellus columbianus*
Wild Turkey	*Meleagris gallopavo*
Virginia Rail	*Rallus limicola*
Sora	*Porzana carolina*
Common Moorhen	*Gallinula chloropus*
American Coot	*Fulica americana*

Common Name	Scientific Name
BIRDS (CONT.)	
Sandhill Crane	*Grus canadensis*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Black-necked Stilt	*Himantopus mexicanus*
American Avocet	*Recurvirostra americana*
Greater Yellowlegs	*Tringa melanoleuca*
Lesser Yellowlegs	*Tringa flavipes*
Solitary Sandpiper	*Tringa solitaria*
Willet	*Tringa semipalmata*
Spotted Sandpiper	*Actitis macularius*
Long-billed Curlew	*Numenius americanus*
Marbled Godwit	*Limosa fedoa*
Least Sandpiper	*Calidris minutilla*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Wilson's Snipe	*Gallinago delicata*
Wilson's Phalarope	*Phalaropus tricolor*
Red-necked Phalarope	*Phalaropus lobatus*
Franklin's Gull	*Leucophaeus pipixcan*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Sabine's Gull	*Xema sabini*
Caspian Tern	*Hydroprogne caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Black Tern	*Chlidonias niger*
Long-billed Murrelet	*Brachyramphus perdix*
Ancient Murrelet	*Synthliboramphus antiquus*
Rock Pigeon	*Columba livia*
Band-tailed Pigeon	*Patagioenas fasciata*
Mourning Dove	*Zenaida macroura*
Flammulated Owl	*Otus flammeolus*
Great Horned Owl	*Bubo virginianus*
Snowy Owl	*Bubo scandiacus*
Northern Hawk Owl	*Surnia ulula*
Northern Pygmy-Owl	*Glaucidium gnoma*
Barred Owl	*Strix varia*
Great Gray Owl	*Strix nebulosa*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
Boreal Owl	*Aegolius funereus*
Northern Saw-whet Owl	*Aegolius acadicus*
Common Nighthawk	*Chordeiles minor*
Common Poorwill	*Phalaenoptilus nuttallii*
Black Swift	*Cypseloides niger*
Vaux's Swift	*Chaetura vauxi*
White-throated Swift	*Aeronautes saxatalis*
Black-chinned Hummingbird	*Archilochus alexandri*

Common Name	Scientific Name
BIRDS (CONT.)	
Calliope Hummingbird	*Stellula calliope*
Rufous Hummingbird	*Selasphorus rufus*
Belted Kingfisher	*Megaceryle alcyon*
Lewis's Woodpecker	*Melanerpes lewis*
Lewis's Woodpecker	*Melanerpes lewis*
Lewis's Woodpecker	*Melanerpes lewis*
Lewis's Woodpecker	*Melanerpes lewis*
Williamson's Sapsucker	*Sphyrapicus thyroideus*
Red-naped Sapsucker	*Sphyrapicus nuchalis*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Black-backed Woodpecker	*Picoides arcticus*
American Three-toed Woodpecker	*Picoides dorsalis*
Northern Flicker	*Colaptes auratus*
Northern Flicker (Red-shafted)	*Colaptes auratus cafer*
Pileated Woodpecker	*Dryocopus pileatus*
Olive-sided Flycatcher	*Contopus cooperi*
Western Wood-Pewee	*Contopus sordidulus*
Willow Flycatcher	*Empidonax traillii*
Least Flycatcher	*Empidonax minimus*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Cordilleran Flycatcher	*Empidonax occidentalis*
Say's Phoebe	*Sayornis saya*
Western Kingbird	*Tyrannus verticalis*
Eastern Kingbird	*Tyrannus tyrannus*
Scissor-tailed Flycatcher	*Tyrannus forficatus*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*
Bank Swallow	*Riparia riparia*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Gray Jay	*Perisoreus canadensis*
Steller's Jay	*Cyanocitta stelleri*
Blue Jay	*Cyanocitta cristata*
Clark's Nutcracker	*Nucifraga columbiana*
Black-billed Magpie	*Pica hudsonia*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Black-capped Chickadee	*Poecile atricapillus*
Mountain Chickadee	*Poecile gambeli*
Boreal Chickadee	*Poecile hudsonica*
Chestnut-backed Chickadee	*Poecile rufescens*
Red-breasted Nuthatch	*Sitta canadensis*
White-breasted Nuthatch	*Sitta carolinensis*

Common Name	Scientific Name
BIRDS (CONT.)	
Pygmy Nuthatch	*Sitta pygmaea*
Brown Creeper	*Certhia americana*
Rock Wren	*Salpinctes obsoletus*
Canyon Wren	*Catherpes mexicanus*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Marsh Wren	*Cistothorus palustris*
American Dipper	*Cinclus mexicanus*
Golden-crowned Kinglet	*Regulus satrapa*
Ruby-crowned Kinglet	*Regulus calendula*
Western Bluebird	*Sialia mexicana*
Mountain Bluebird	*Sialia currucoides*
Townsend's Solitaire	*Myadestes townsendi*
Veery	*Catharus fuscescens*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Gray Catbird	*Dumetella carolinensis*
Brown Thrasher	*Toxostoma rufum*
American Pipit	*Anthus rubescens*
Bohemian Waxwing	*Bombycilla garrulus*
Cedar Waxwing	*Bombycilla cedrorum*
Northern Shrike	*Lanius excubitor*
Loggerhead Shrike	*Lanius ludovicianus*
European Starling	*Sturnus vulgaris*
Warbling Vireo	*Vireo gilvus*
Red-eyed Vireo	*Vireo olivaceus*
Cassin's Vireo	*Vireo cassinii*
Solitary Vireo	*Vireo solitarius*
Tennessee Warbler	*Vermivora peregrina*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Black-throated Blue Warbler	*Dendroica caerulescens*
Yellow-rumped Warbler	*Dendroica coronata*
Audubon's Warbler	*Dendroica coronata auduboni*
Black-throated Gray Warbler	*Dendroica nigrescens*
Townsend's Warbler	*Dendroica townsendi*
American Redstart	*Setophaga ruticilla*
Ovenbird	*Seiurus aurocapilla*
Northern Waterthrush	*Seiurus noveboracensis*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Western Tanager	*Piranga ludoviciana*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*

Common Name	Scientific Name
BIRDS (CONT.)	
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*
Green-tailed Towhee	*Pipilo chlorurus*
Spotted Towhee	*Pipilo maculatus*
American Tree Sparrow	*Spizella arborea*
Chipping Sparrow	*Spizella passerina*
Clay-colored Sparrow	*Spizella pallida*
Brewer's Sparrow	*Spizella breweri*
Vesper Sparrow	*Pooecetes gramineus*
Lark Sparrow	*Chondestes grammacus*
Lark Bunting	*Calamospiza melanocorys*
Savannah Sparrow	*Passerculus sandwichensis*
Grasshopper Sparrow	*Ammodramus savannarum*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
White-throated Sparrow	*Zonotrichia albicollis*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
White-crowned Sparrow	*Zonotrichia leucophrys*
Harris's Sparrow	*Zonotrichia querula*
Dark-eyed Junco	*Junco hyemalis*
Dark-eyed Junco (Gray-headed)	*Junco hyemalis caniceps*
Dark-eyed Junco (Oregon)	*Junco hyemalis oreganus*
Dark-eyed Junco (Pink-sided)	*Junco hyemalis mearnsi*
Snow Bunting	*Plectrophenax nivalis*
Bobolink	*Dolichonyx oryzivorus*
Red-winged Blackbird	*Agelaius phoeniceus*
Western Meadowlark	*Sturnella neglecta*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Brewer's Blackbird	*Euphagus cyanocephalus*
Common Grackle	*Quiscalus quiscula*
Brown-headed Cowbird	*Molothrus ater*
Bullock's Oriole	*Icterus bullockii*
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*
Pine Grosbeak	*Pinicola enucleator*
Cassin's Finch	*Carpodacus cassinii*
House Finch	*Carpodacus mexicanus*
Red Crossbill	*Loxia curvirostra*
White-winged Crossbill	*Loxia leucoptera*
Pine Siskin	*Carduelis pinus*
American Goldfinch	*Carduelis tristis*
Evening Grosbeak	*Coccothraustes vespertinus*
House Sparrow	*Passer domesticus*
FISH	
Mottled Sculpin	*Cottus bairdi*
Slimy Sculpin	*Cottus cognatus*

Common Name	Scientific Name
FISH (CONT.)	
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*
Yellowstone Cutthroat Trout*	*Oncorhynchus clarkii bouvieri*
Rainbow Trout*	*Oncorhynchus mykiss*
Mountain Whitefish	*Prosopium williamsoni*
pygmy Whitefish	*Prosopium coulteri*
Brown Trout*	*Salmo trutta*
Bull Trout	*Salvelinus confluentus*
Brook Trout*	*Salvelinus fontinalis*
Northern Pikeminnow	*Ptychocheilus oregonensis*
Longnose Dace	*Rhinichthys cataractae*
Redside Shiner	*Richardsonius balteatus*
Longnose Sucker	*Catostomus catostomus*
Largescale Sucker	*Catostomus macrocheilus*
White Sucker*	*Catostomus commersoni*
Peamouth	*Mylocheilus caurinus*
Kokanee*	*Oncorhynchus nerka*
Coho Salmon*	*Oncorhynchus kisutch*
Arctic Grayling*	*Thymallus arcticus*
Fathead Minnow*	*Pimephales promelas*
Northern Pike*	*Esox lucius*
Brook Stickleback*	*Culaea inconstans*
Pumpkinseed*	*Lepomis gibbosus*
Largemouth Bass*	*Micropterus salmoides*
Yellow Perch*	*Perca flavescens*
AMPHIBIANS AND REPTILES	
Long-toed Salamander	*Ambystoma macrodactylum*
Rocky Mountain Tailed Frog	*Ascaphus montanus*
Western Toad	*Bufo boreas*
Pacific Treefrog	*Pseudacris regilla*
Columbia Spotted Frog	*Rana luteiventris*
Painted Turtle	*Chrysemys picta*
Rubber Boa	*Charina bottae*
Terrestrial Gartersnake	*Thamnophis elegans*
Common Gartersnake	*Thamnophis sirtalis*
Prairie Rattlesnake	*Crotalus viridis*
Eastern Racer	*Coluber constrictor*
INVERTEBRATES	
A Leech	*Helobdella stagnalis*
Virile Crayfish	*Orconectes virilis*
An Amphipod	*Hyalella azteca*
Signal Crayfish	*Pacifastacus leniusculus*
A Riffle Beetle	*Zaitzevia parvula*
A Riffle Beetle	*Heterlimnius corpulentus*
A Riffle Beetle	*Cleptelmis addenda*

Common Name	Scientific Name
INVERTEBRATES (CONT.)	
A Riffle Beetle	*Lara avara*
A Riffle Beetle	*Narpus concolor*
A Riffle Beetle	*Optioservus quadrimaculatus*
A Riffle Beetle	*Ordobrevia nubifera*
A Eukiefferiellan Chironomid	*Eukiefferiella brehmi*
A Mayfly	*Serratella tibialis*
A Mayfly	*Ephemerella excrucians*
A Mayfly	*Baetis bicaudatus*
A Mayfly	*Epeorus longimanus*
A Mayfly	*Drunella coloradensis*
A Mayfly	*Drunella doddsi*
A Mayfly	*Drunella grandis*
A Mayfly	*Drunella spinifera*
A Mayfly	*Acentrella turbida*
Hagen's Small Minnow Mayfly	*Diphetor hageni*
A Mayfly	*Timpanoga hecuba*
A Mayfly	*Plauditus punctiventris*
Northern Rocky Mountains Refugium Mayfly	*Caudatella edmundsi*
A Mayfly	*Caudatella hystrix*
Large Marble	*Euchloe ausonides*
Gillette's Checkerspot	*Euphydryas gillettii*
Hayden's Ringlet	*Coenonympha haydenii*
Pacific Spiketail	*Cordulegaster dorsalis*
Blue-eyed Darner	*Rhionaeschna multicolor*
Mountain Emerald	*Somatochlora semicircularis*
White-faced Meadowhawk	*Sympetrum obtrusum*
Last Best Place Damselfly	*Enallagma optimolocus*
A Stonefly	*Despaxia augusta*
A Stonefly	*Amphinemura banksi*
A Stonefly	*Zapada cinctipes*
A Stonefly	*Zapada columbiana*
A Stonefly	*Zapada oregonensis*
A Stonefly	*Yoraperla brevis*
A Stonefly	*Doroneuria theodora*
A Stonefly	*Hesperoperla pacifica*
A Stonefly	*Claassenia sabulosa*
A Stonefly	*Setvena bradleyi*
A Caddisfly	*Rhyacophila betteni*
A Rhyacophilan Caddisfly	*Rhyacophila brunnea*
An Agapetus Caddisfly	*Agapetus montanus*
A Caddisfly	*Hydropsyche confusa*
A Caddisfly	*Parapsyche elsis*
A Caddisfly	*Lepidostoma cascadense*
A Caddisfly	*Lepidostoma unicolor*
A Caddisfly	*Chyrandra centralis*
A Caddisfly	*Dicosmoecus atripes*
A Caddisfly	*Dicosmoecus gilvipes*

Common Name	Scientific Name
INVERTEBRATES (CONT.)	
A Rhyacophilan Caddisfly	*Rhyacophila alberta*
A Caddisfly	*Anagapetus debilis*
A Caddisfly	*Arctopsyche grandis*
A Rhyacophilan Caddisfly	*Rhyacophila narvae*
A Rhyacophilan Caddisfly	*Rhyacophila verrula*
A Caddisfly	*Neophylax splendens*
A Caddisfly	*Neothremma alicia*
A Caddisfly	*Micrasema bactro*
A Limnephilid Caddisfly	*Nemotaulius hostilis*
A Caddisfly	*Hesperophylax designatus*
A Caddisfly	*Onocosmoecus unicolor*
A Caddisfly	*Brachycentrus americanus*
A Caddisfly	*Brachycentrus occidentalis*
Western Pearlshell	*Margaritifera falcata*
Grooved Fingernailclam	*Sphaerium simile*
Forest Disc	*Discus whitneyi*
Magnum Mantleslug	*Magnipelta mycophaga*
Smoky Taildropper	*Prophysaon humile*
Brown Hive	*Euconulus fulvus*
Quick Gloss	*Zonitoides arboreus*
Meadow Slug	*Deroceras laeve*
Spruce Snail	*Microphysula ingersolli*
Alpine Mountainsnail	*Oreohelix alpina*
Carinate Mountainsnail	*Oreohelix elrodi*
Rocky Mountainsnail	*Oreohelix strigosa*
Subalpine Mountainsnail	*Oreohelix subrudis*
Lyre Mantleslug	*Udosarx lyrata*
Wrinkled Marshsnail	*Stagnicola caperata*
Two-ridge Rams-horn	*Helisoma anceps*
A Millipede	*Corypus cochlearis*
A Millipede	*Ergodesmus compactus*
A Millipede	*Lophomus laxus*
A Millipede	*Endopus parvipes*
A Freshwater Sponge	*Ephydatia cooperensis*

* 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

Infraspecific Taxon (trinomial) - The status of infraspecific 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
Ranuculus 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 6^{th} 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	*Stagnicola montanensis*	SOC	G3	S1S3	wetlands/marshes	?	**X**
Butterflies	Eyed Brown	*Satyrodes eurydice*	SOC	G4	S2S3	wetlands/marshes	?	?
Butterflies	Frigga Fritillary	*Boloria frigga*	SOC	G5	S1S3	mountain wetlands	?	?
Butterflies	Gillett's Checkerspot	*Euphydryas gillettii*	SOC	G2G3	S2S3	wet meadows	**X**	**X**
Dragonflies	Boreal Whiteface	*Leucorrhinia borealis*	SOC	G5	S1	Wetlands	?	?
Dragonflies	Brush-tipped Emerald	*Somatochlora walshii*	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	Subarctic Darner	*Aeshna subarctica*	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	Western Pondhawk	*Erythemis collocata*	SOC	G5	S1S2	Wetlands	?	?
Dragonflies	California Darner	*Aeshna californica*	PSOC	G5 S3S5		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Chalk-fronted Corporal	*Ladona julia*	PSOC	G5 S3S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Crimson-ringed Whiteface	*Leucorrhinia glacialis*	PSOC	G5 S3		wetland/lake w/ emergent vegetation	**X**	**X**
Dragonflies	Lake Darner	*Aeshna eremita*	PSOC	G5 S3S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Lance-tipped Darner	*Aeshna constricta*	PSOC	G5 S1S3		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Hudsonian Emerald	*Somatochlora hudsonica*	PSOC	G5 S2S4		wetland/lake w/ emergent vegetation	**X**	**X**
Dragonflies	Mountain Emerald	*Somatochlora semicircularis*	PSOC	G5 S3S5		Wetlands	**X**	**X**
Dragonflies	Ocellated Emerald	*Somatochlora minor*	PSOC	G5 S2S4		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Red-veined Meadowhawk	*Sympetrum madidum*	PSOC	G4 S2S3		wetland/lake w/ emergent vegetation	?	?
Dragonflies	Ringed Emerald	*Somatochlora albicincta*	PSOC	G5 S1S3		wetlands	?	?
Dragonflies	Sedge Darner	*Aeshna juncea*	PSOC	G5 S3S5		Wetlands	?	?
Dragonflies	Spiny Baskettail	*Epitheca spinigera*	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	• 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	• 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	• (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	• 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	• 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	• 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	• 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	• 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	• (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	• 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	• 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	• 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	• 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	• 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)	• 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	• 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	• Fire suppression	Not developed	Medium	?
Areal extent of grasslands/ sagebrush communities	native grasslands/ sagebrush communities	Area/ Size of grasslands/ sagebrush communities	• 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	• 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	• 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	• 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	• 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

APPENDIX J

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 heath, 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).

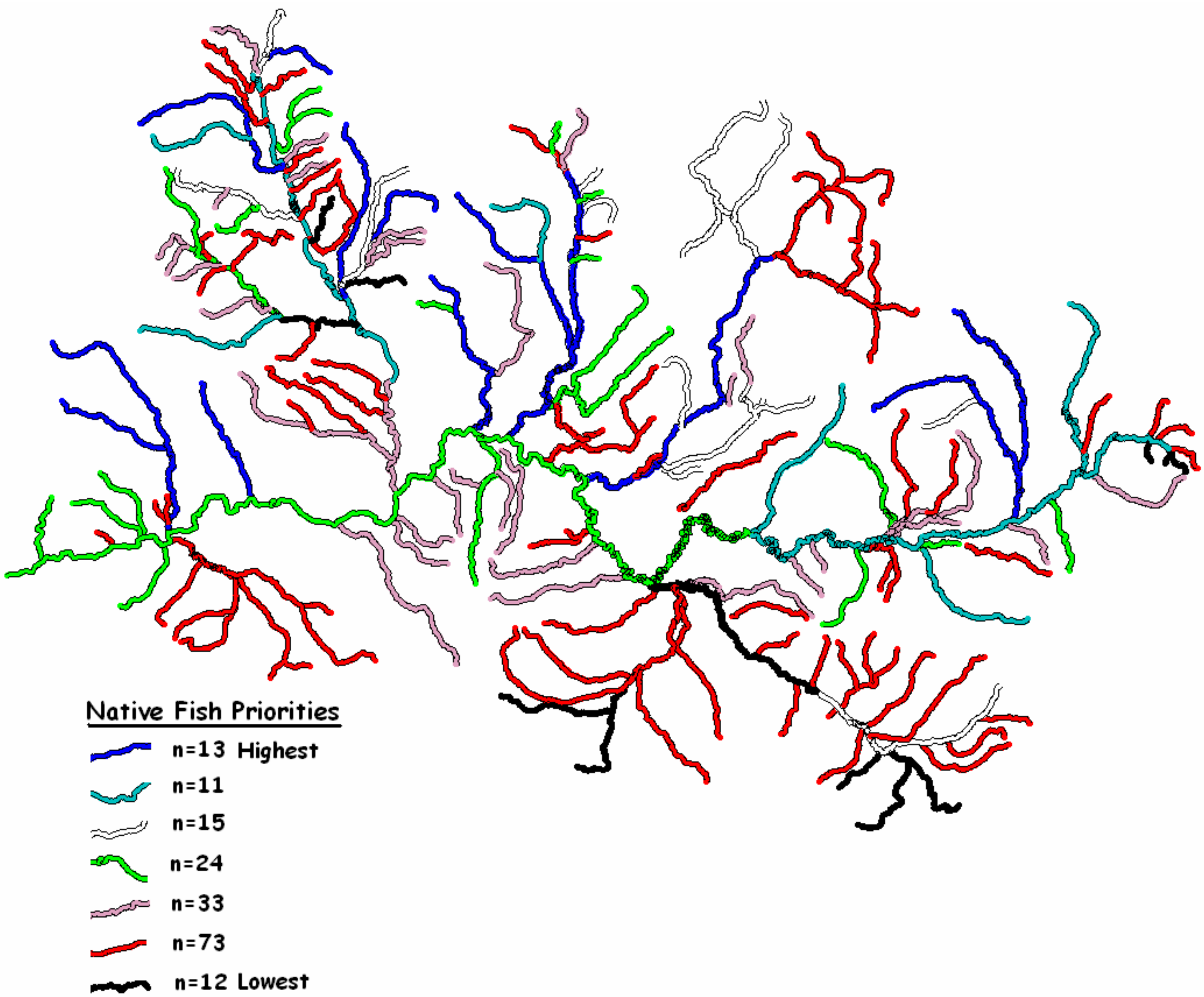

Figure 1. Native fish restoration priorities for the Blackfoot River Basin. Classes show the number of individual streams by priority grouping (Table 1). The highest scores are migratory bull trout and WSCT streams and the lowest scores possess little or no migratory native fish value to the Blackfoot 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.

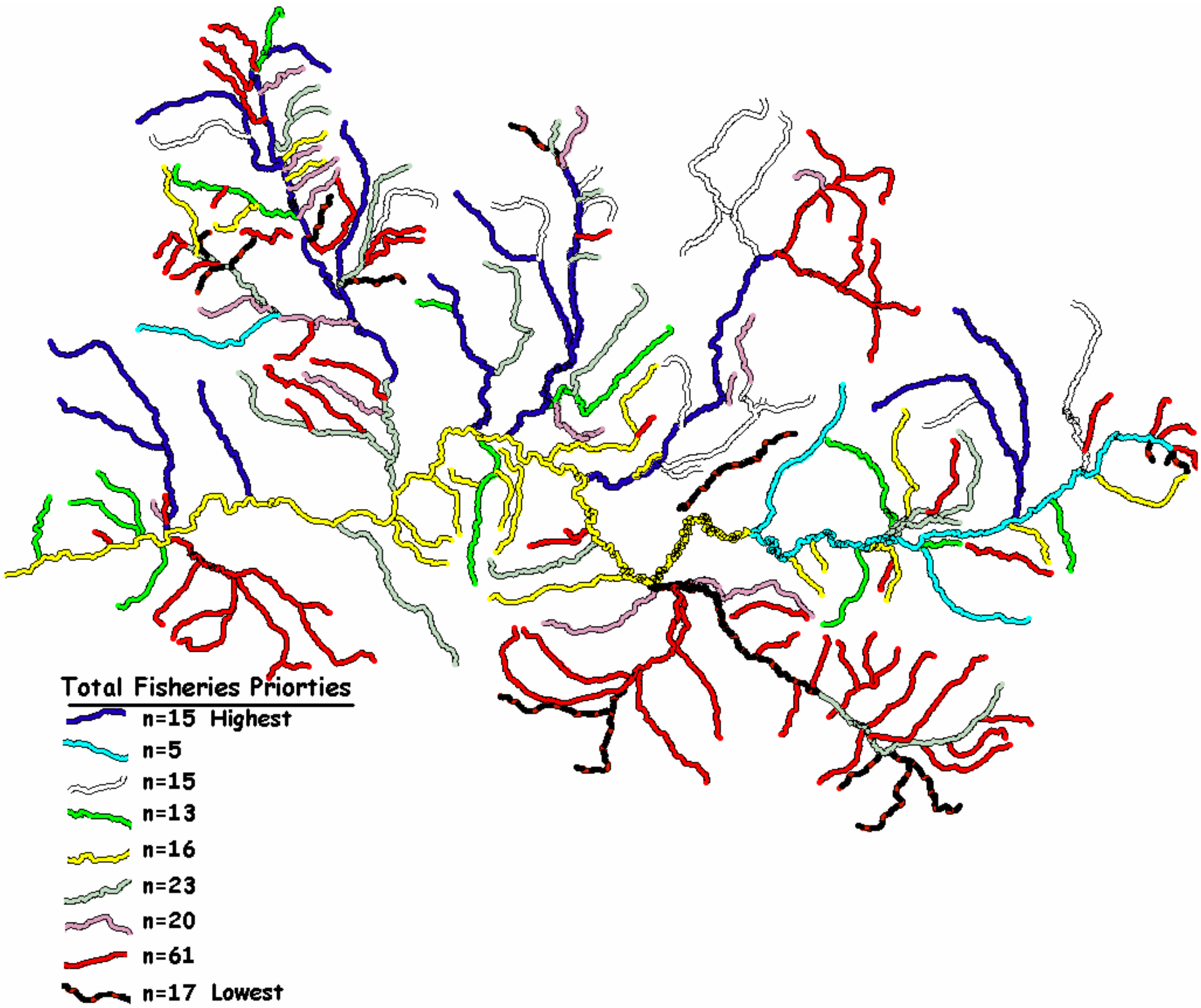

Figure 2. Total fisheries restoration priorities for the Blackfoot River Basin. High priority stream currently support migratory bull trout, WSCT and may recruit of game fish (rainbow and brown trout) to the Blackfoot River (Table 2). Streams near the bottom of the priority list provide very little or 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.

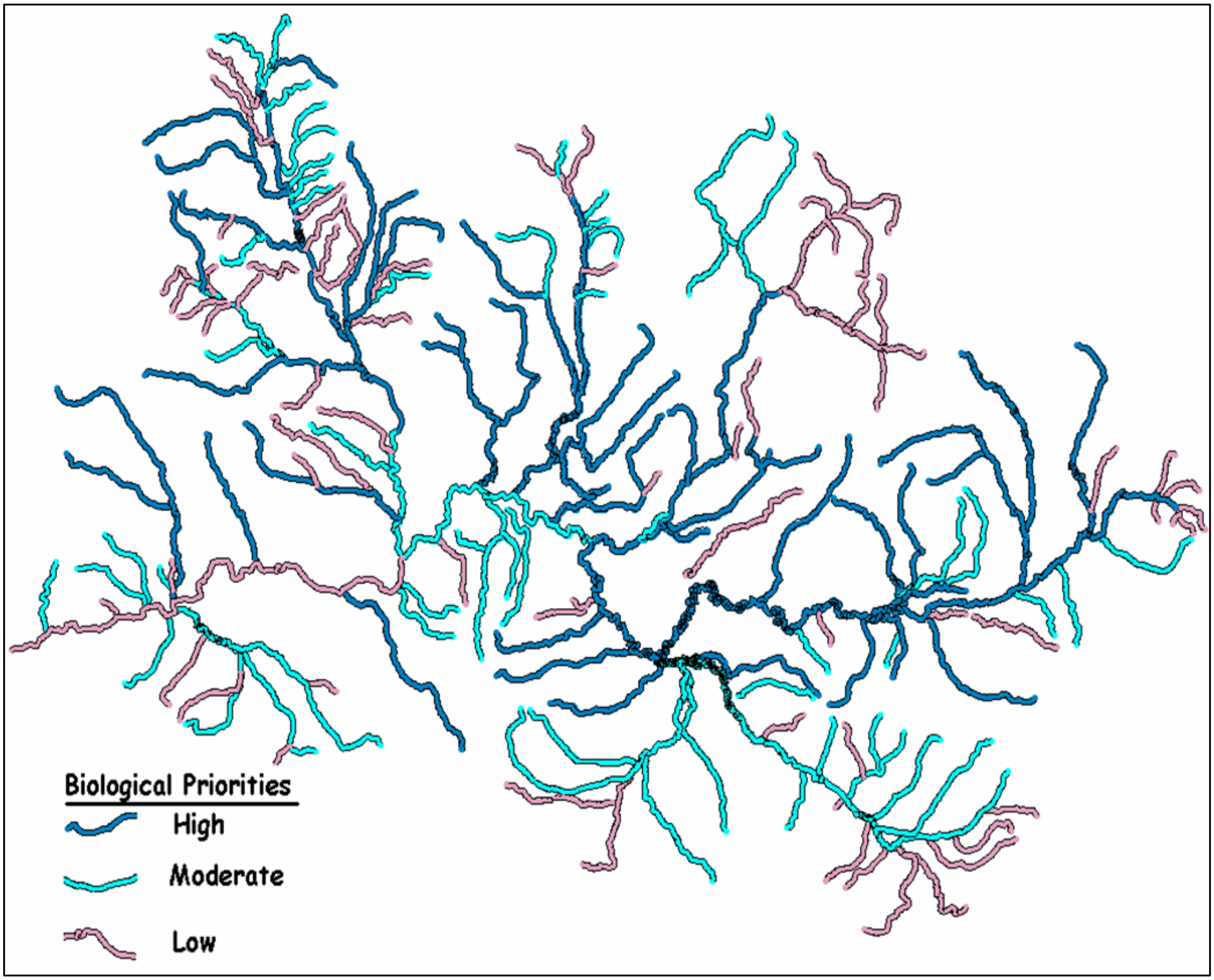

Figure 3. Biologically scores ranked by high, moderate and low values. High priority streams support native and sport fish and most possess high restoration (i.e., flow and water quality) potential. Moderate priority streams possess often posses less valuable fish but high restoration potential (Table 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.

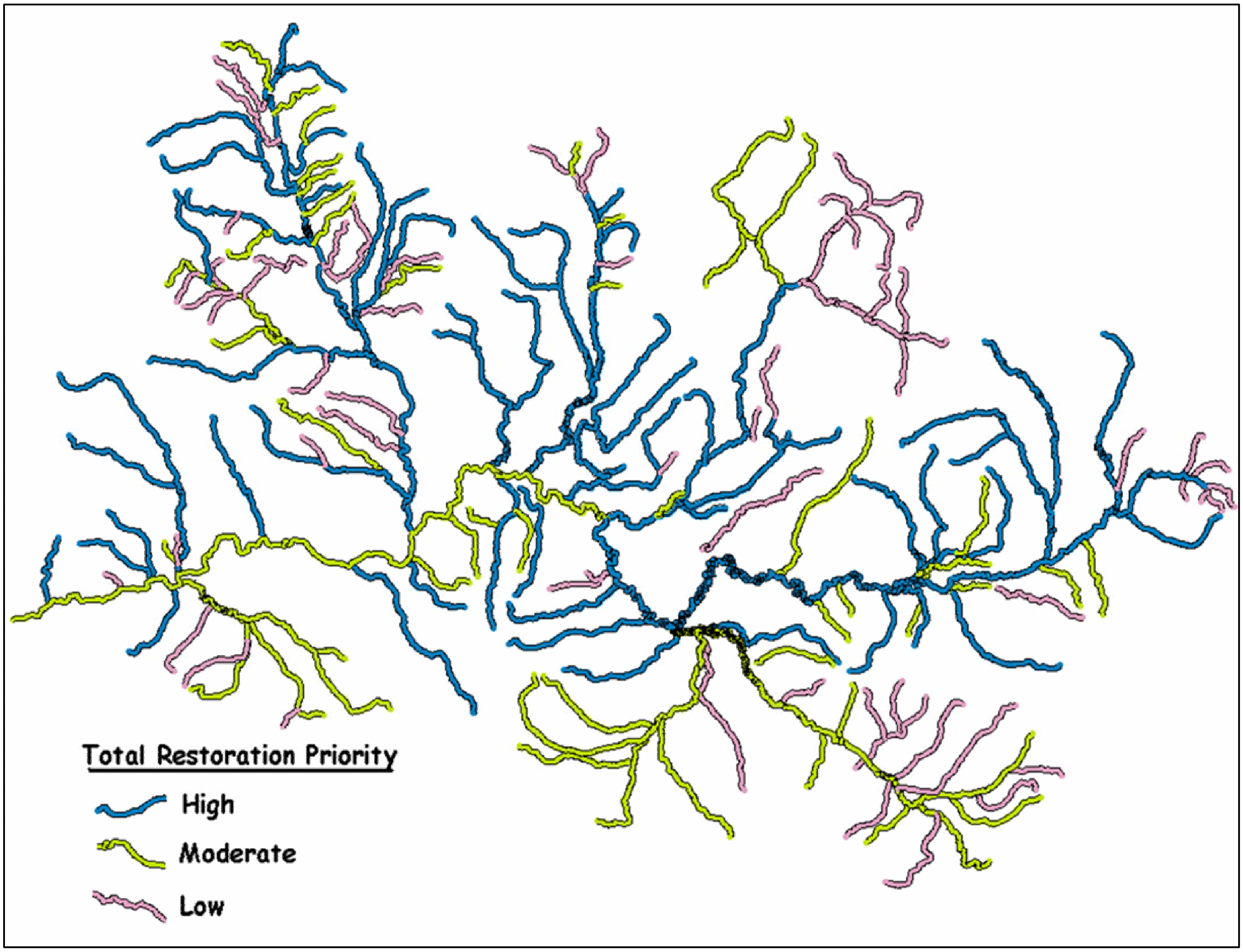

Figure 4. Total restoration priorities. This map is classified by high, moderate and low scores. In addition to the biological scores, the social scores influence this classification (Table 4).

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)	**Clark Fork River**
		    Twin Creek
		    Lightning Creek
		        Rattle Creek
		        Wellington Creek
		        Porcupine Creek
		        East Fork Lightning Creek
		    Johnson Creek (trib. to LPO)
		    Gold Creek (trib. to LPO)
		    North Gold Creek (trib. to LPO)
		    Granite Creek (trib. to LPO)
		    Trestle Creek (trib. to LPO)
		    Pack River (trib. to LPO)
		        Grouse Creek
		Priest River
		    East River (mc)
		        Middle Fork East River (mc)
		            Uleda Creek
		            Tarlac Creek

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	Flathead River (mc) **North Fork Flathead River** (U.S. / B.C.) **Howell Creek** (B. C.) **Kishinehn Creek** (B. C.) **Trail Creek** **Whale Creek** **Red Meadow Creek** **Coal Creek** **Big Creek** Middle Fork Flathead River (mc) **Strawberry Creek** (includes Trail) **Bowl Creek** **Clack Creek** **Schafer Creek** (includes Dolly Varden) **Morrison Creek** (Includes Lodgepole) **Granite Creek** **Long Creek** **Bear Creek** **Ole Creek** **Park Creek** **Nyack Creek**
Clark Fork RU Priest RSU	Priest Lakes	**Upper Priest River** **Hughes Fork** **Gold Creek** **Trapper Creek** (trib. to Upper Priest Lake) **Lion Creek** (trib. to Priest Lake) **Two Mouth Creek** (trib. to Priest Lake) **Granite Creek** (trib. to Priest Lake) **North Fork Granite Creek** **South Fork Granite Creek** **Indian Creek** (trib. to Priest Lake) **Kalispell Creek** (trib. to Priest Lake) **Soldier Creek** (trib. to Priest Lake)

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.

<u>Remaining Seven Primary Core Areas</u>. 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 (diverions).

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 usefull method for certain spring spawning fish in environments where to 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 reserved 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 preformed 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_2SO_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_2SO_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_2SO_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_2SO_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_2SO_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

Ca^{2+} = dissolved calcium concentration

Mg^{2+}=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 HNO3 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 than 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.
- Imholf 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 Imholf 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 Imholf 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

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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	
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					