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Department of Agriculture

Forest Service

Beaverhead-Deerlodge National Forest

Butte and Wise River Ranger Districts

FLEECER MOUNTAINS

WATERSHED ASSESSMENT

2009

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I. GOALS AND METHODS

The 2009 Beaverhead-Deerlodge National Forest (BDNF) Land and Resource Management Plan (Revised Forest Plan) directs us, through Goals and Objectives, to restore key watersheds and maintain all other watersheds to ensure long term ecological integrity of ecosystems, conserve genetic integrity of native species, attain desired stream function and support beneficial uses. The tool for accomplishing this, according to the Revised Forest Plan, is watershed analysis (Objectives, page 16). The BDNF coordinates Watershed Assessment of key watersheds with priority areas which contribute to the Northern Region Integrated Restoration Strategy. The Integrated Restoration Strategy identifies the Fleecer as a priority area for restoration for 2010.

The Northern Region Integrated Restoration Strategy was developed, starting in 2006, to accomplish regional ecosystem restoration and protection of social values at risk (http://www.fs.fed.us/r1/projects/int-restoration/overview.shtml). The Region identified the following agents which affect resource conditions:

- drought,
- forest insects and pathogens,
- invasive plant and animal species,
- forest colonization into grasslands,
- uncharacteristically dense vegetation that creates hazardous fuel conditions, and
- erosion, sedimentation, and toxic chemicals.

The Fleecer Watershed Assessment area has a high potential for contributing positive actions in resolving the Northern Region Integrated Restoration Strategy concerns as well as a high potential for meeting desired conditions, goals and objectives of the 2009 Revised Forest Plan. The Jerry Johnson and German Gulch watersheds, in particular, were identified in the 2009 Revised Forest Plan amongst a group 56 key fish watersheds with high priority for assessment and action

Watershed Analysis as a Planning Tool

Watershed analysis is a process used to describe the human, biological and physical conditions, processes, and interactions within a watershed. The analysis focuses on specific issues, values and uses identified within the landscape that are essential for making sound management decisions. For each resource of concern, the analysis describes past trends, existing conditions and desired conditions in both biophysical and social terms. The intention of this document then, is to present our current understanding of the processes and interactions of concern within the Fleecer Mountains watersheds based on information developed by a 10 person interdisciplinary team.

Watershed analysis is an intermediate step between land management planning (Forest Plans) and project planning. It is a stage-setting process which enhances our ability to guide the general type, location, and sequence of appropriate management activities within a watershed. One product of the watershed analysis is a description of management opportunities that will help to bring resources towards desired conditions. Opportunities are derived from the gap between existing and desired conditions. From a list of general opportunities, potential projects are identified for consideration by forest managers.

The type of information collected varies for each landscape but always includes descriptions of the following conditions within the landscape:

- basic geology, landform and soils
- watershed condition
- distribution of fish species
- vegetation conditions and changes
- key wildlife habitats
- recreation use and travel patterns
- resource uses
- cultural or historic uses

A watershed assessment makes no decisions, nor does it initiate or result in land management allocations. It does not select projects for implementations. Rather, the Wise River and Butte Ranger Districts will use this analysis to determine which specific projects would move the watersheds toward the desired condition described in the Beaverhead- Deerlodge National Forest Land and Resource Management Plan. Proposed projects will then be analyzed individually by a separate interdisciplinary team. Project analysis will include involvement by the public and result in a site-specific decision as required by the national Environmental Policy Act (NEPA).

Methods

The watershed analysis was developed by a 10-member interdisciplinary team under the
guidance of the Butte and Wise River District Rangers, using the "Federal Guide for Watershed Analysis – Ecosystem Analysis at the Watershed Scale (Version 2.2, August 1995)" as a guide. The purpose is to identify projects and priorities for restoring watershed and other resource conditions. The watershed analysis process includes the following steps:

Step 1 – Characterization of the watershed – a summary of the dominant conditions and interactions within the watershed.

Step 2 – Identification of issues and key questions

Step 3 – Description of current conditions

Step 4 - Description of reference conditions – Generally, this is the historical condition, prior to the influence of European settlement. Since historical conditions are not available for hydrologic parameters and not necessarily the reference condition for human uses on the landscape, these sections will focus on desired conditions described in management direction of the 2008 Revised Forest Plan.

Step 5 – Synthesis and interpretation of information – a comparison of current and reference conditions including discussion of similarities, differences, causes and trends. Identify the capability of the system to achieve Forest Plan objectives or desired conditions.

The interdisciplinary team identified the key issues in the watershed based on previous project work in the area, proposals for the Northern Region Integrated Restoration Strategy, the Big Hole Landscape Analysis (2001), resource data developed for revising the Forest Plan (2002-2008), and District and Forest specialists field experience in the area. These issues and questions around the issues focused the analysis

Desired conditions are based on the 2009 Revised Beaverhead-Deerlodge Forest Plan.

II. LANDSCAPE SETTING

The Fleecer Mountain Range lies about 10 miles southwest of Butte and just north of Wise River, Montana. See Map 1. Project Location. The Continental Divide splits the landscape nearly down the middle running from northwest to southeast. Streams flow north into the Clark Fork of the Columbia River destined for the Pacific Ocean. Streams flowing south into the Big Hole River end up in the Missouri River Basin, ultimately the Gulf of Mexico.

The Fleecer Watershed Assessment area is roughly 223,000 acres and includes all of the Fleecer Mountain Range. This is mountain range is located between the Pintler, Flint, Boulder, Highland and Pioneer ranges.

Table 1. Land Management within the Fleecer Watershed.

Area	Acres	Percent
National Forest	98,947	44
Fleecer Wildlife Management Area	5,429	2
Mt Haggin Wildlife Management Area	36,108	16
Other State Lands	5,196	2
Bureau of Land Management	15,422	7

Area	Acres	Percent
Private inside Forest Boundary	3,655	2
Private below Forest Boundary	58,031	26
Other	317	<1
Total	223,115	

Elevations range from 6,000 to 9,436 feet (Fleecer Mountain). Drainage density is moderate. Mean annual precipitation ranges from 10 to 25 inches, about 20 percent falling as snow.

Approximately three-fourths of the landscape is forested. Lodgepole pine is the major species but large stands of Douglas-fir are found on the lower ridges and slopes of the Fleecer Ridge. Scattered Englemann spruce grow along creek bottoms and at higher elevations in the north-central part of the area. Whitebark pine is common at high elevations. Grassland parks and meadows are scattered throughout, mainly at lower elevations and along the alpine ridges. Currently, the Fleecer assessment area is part of a larger epidemic of mountain pine beetle occurring across the majority of the Beaverhead-Deerlodge National Forest and on other forests in the Northern Region.

The diverse vegetation of this mountain range supports a comparable diversity of wildlife species including elk, mule deer, moose, black bear, coyotes, wolves, raptors, forest birds, birds of shrubland/grasslands and riparian bottoms, small mammals, and rodents. The Fleecers provide year around range for elk and deer. Most elk and deer winter on Fleecer Mountain or on sagebrush slopes in the southeast portion of the landscape.

Human activity in this landscape dates back 12,000 years. The area wasn't settled by notable numbers of people until the turn of the 20th century when minerals were discovered and mining communities sprang up in areas like German Gulch, accessible from Butte. Because of the area's accessibility, the Fleecer Mountains have been important to those small communities and the larger population center of Butte, for livelihoods like mining, logging, ranching and recreation. The recreation setting of the Fleecer Mountains is roaded and semi-primitive.

The area fills an important niches for these and visitors who enjoy hunting, camping, trail riding, firewood gathering and winter activities.

A significant amount of mineral exploration and development has occurred. Some of Butte's early colorful mining history has its beginnings in German Gulch. The legacy of mining past and present is with us in clean-up efforts at abandoned mines and the Beal Mountain Mine superfund site.

National Forest Land Management Summary

Management of resources in the Fleecer Watershed Assessment area is guided by the 2009 Beaverhead-Deerlodge Land and Resources Management Plan (LRMP). The LRMP goals and objectives are presented in this assessment for aquatics, fire management, heritage resources, livestock grazing, minerals, recreation and travel, soils, timber management, vegetation, and wildlife habitat.

The Assessment area lies across two Landscapes, the Big Hole and Upper Clark Fork. The Fleecer Mountains are managed for dispersed recreation, wildlife habitat (elk winter and summer range in particular), livestock grazing, and other forest products. The recreation setting is a mix of roaded and semi-primitive motorized backcountry. Proximity to Butte, Anaconda, and Wise River make this area attractive for day visits by a variety of recreationists as well as camping and hunting.

Vegetation management direction allows for timber harvest and production and forage for livestock and big game. The area provides supplemental secure wildlife habitat adjacent to two wildlife management areas, Mt Haggin and Fleecer. Travel is regulated to provide late fall and winter security for elk. Winter non-motorized allocations protect winter elk security adjacent to Fleecer Mountain Wildlife Management Area.

German Gulch and Jerry Creek are identified by the LRMP as Key Fish Watersheds, managed to conserve natural fish populations.

III. RESOURCE AREAS

A. GEOLOGY, LANDFORMS and SOILS

1. Characterization

Overview

A diverse array of geologic types and landforms make up the Fleecer Mountains. Subsection descriptions succinctly characterize the project area (Nesser et al., 1997). Subsections were mapped at a 1:500,000 scale, and described as smaller areas of sections with similar surficial geology, lithology, geomorphic process, soil groups, subregional climate, and potential natural communities (ECOMAP, 1993). Each subsection has landscape components that make it different from adjacent subsections. Map unit distinctions include geologic materials, geomorphic features, and climate. "Accessory characteristics" are used to describe each subsection but are not used to delineate the units; and include soils and vegetation. Two main subsections cover the area; the Continental Divide Uplands Subsection, and the East Pioneer Mountains Subsection.

The Continental Divide Uplands Subsection (M332Ea) comprises the north/northeast portion of the project area including much of Fleecer Ridge, Starlight Mountain, and Burnt Mountain as well as the areas to the north and west of these mountains. This subsection is characterized by block faulted mountains that formed in a variety of igneous, sedimentary and metasedimentary rocks. Elevations range from 5,300 to 8,383 feet (Burnt Mountain). Drainage density is moderate to high. Mean annual precipitation ranges from 10 to 35 inches, about 35 percent falling as snow. Soils are shallow to moderately deep, cobbly and very cobbly sandy loams and loams. Some have heavier textured loam and clay loam subsurface layers. Soils in granitic parent material are gravelly sandy loams and loamy sands. Productivity is low to moderate. Granitic soils are easily eroded but the remainder is more erosion resistant. Locally soils are susceptible to compaction and rutting. Principal ecological concerns affecting soil quality are invasive weed species, wildfire and flooding. Principal management activities with the potential to affect soil quality are roads, timber harvest, grazing, mining, electrical transmission corridors, off highway vehicle use, and suburban and recreational development. The Beal Mine and a portion of the Anaconda/Arco superfund site are located within this analysis area.

The East Pioneer Mountains Subsection (M332Eb) comprises the south/southwest portion of the project area including Bear Mountain, Dickie Peak, Little Granulated Mountain, Granulated Mountain, Hogback Ridge, Mount Fleecer, and the areas to the west and south of these mountains. This subsection is characterized by block faulted mountains that formed predominantly in limestone. Alpine glaciation has modified part of the landscape. Elevations range from 6,000 to 9,436 feet (Fleecer Mountain). Drainage density is moderate. Mean annual precipitation ranges from 10 to 25 inches,

about 20 percent falling as snow. Soils are shallow and moderately deep, cobbly loams, silt loams, and sandy loams; some with heavier textured loam and clay loam subsurface layers. Productivity is low to moderate. Soils are moderately susceptible to erosion and some are susceptible to rutting and compaction. Principal ecological concerns affecting soil quality are invasive weed species, wildfire and flooding. Principal management activities with the potential to affect soil quality are roads, timber harvest, grazing, mining, off highway vehicle use, and recreational development.

Soil Hazard Ratings: Erosion, Compaction, Rutting, and Mass Wasting

Soil hazard ratings describe the relative risk of erosion, compaction, rutting, and mass wasting that each landtype has *when exposed to management activity*. This is an important distinction to note, because erosion, compaction, and rutting do not generally occur without some sort of disturbance. Mass wasting can occur naturally, as can erosion. Good examples of natural erosion include streambank erosion from flooding, or rill/gully erosion due to hydrophobic, bare mineral soils from wildfire. Compaction can occur naturally in very limited areas such as game trails.

The interpretations for the landtype inventory are qualitative ratings based on field observations of past activities, the inherent characteristics of each landtype, and assumptions about the general modifications that would occur in the landtype as a result of management activities. Field observations of soil impacts on various landtypes formed the core of data used to develop the interpretive ratings. The landtypes with field observations were rated first. The remaining landtypes were rated relative to those with field observations. The landtype characteristics were used as criteria for comparison and evaluation in the rating process.

Erosion Hazard

Table 2 displays the acreages of landtypes rated as high, high-moderate, moderate, moderate-slight, and slight erosion hazards. See Map 2. Soil Erosion Hazard.

Table 2. Erosion ratings for the Fleecer watershed analysis project area, listed in total acres for each erosion class, and percentage that each class comprises.

Erosion Hazard	Total Acres	Percent
High	18,691	18.2%
High-Moderate	33,067	32.1%
Moderate	27,902	27.1%
Moderate-Slight	22,246	21.6%
Slight	978	1.0%
TOTAL	102,883	100.0%

Much of the eastern side of the project area is dominated by high-moderate and high erosion hazard soils. These are primarily moderate and steep stream dissected granitic soils, and are susceptible to erosion due to the erosive nature of soils derived

from granite, and also the relatively steep slopes they occur on. Other notable areas of high and high-moderate hazard soils occur in floodplains. Floodplains in granitic parent material are rated as high hazard, and floodplains in other parent materials are rated high-moderate hazard, due to the potential for high erosive forces over bare soil during flooding. On the western side of the project area, large acreages of moderate hazard rating are generally granitic soils on gentle slopes or glacial terrain, or soils derived from other parent materials such as quartzite and Cretaceous shale and sandstone on steep mountain slopes.

Compaction Hazard

The majority of soils in the project area have a slight compaction hazard rating (Table 3, below; Map 3. Soil Compaction Hazard). Areas of moderate compaction hazard rating are found primarily in the central and western portions of the project area. These soils are typically well drained with fine or fine loamy textures, or contain an argillic horizon with less than 35% coarse fragments. Other soils with a moderate hazard rating have ephemeral high water tables in 25-50% of the map unit. Soils with a high compaction hazard rating have high water tables in greater than 50% of the map unit, such as riparian areas.

Table 3. Compaction hazard ratings for the Fleecer *assessment* area by acres and percent

Compaction Hazard	Total Acres	Percent
High	1,805	1.8%
Moderate	19,111	18.6%
Slight	81,967	79.7%
TOTAL	102,883	100%

Rutting Hazard

Similar to the compaction hazard ratings, the majority of the project area has a low rutting hazard rating See Table 4, below and Map 4. Soil Rutting Hazard. The western portion of the project area has some soils with moderate rutting hazard rating; these soils have areas of ephemeral high water tables that comprise 25-50% of the map unit. Soils with a high rutting hazard are primarily located in riparian areas and greater than 50% of the soils within these map units have ephemeral high water tables.

Table 4. Rutting hazard ratings for the Fleecer assessment area by acres and percent.

Rutting Hazard	Total Acres	Percent
High	1,805	1.8%
Moderate	5,657	5.5%
Slight	95,421	92.7%
TOTAL	102,883	100%

Mass Wasting Hazard

The mass wasting hazard ratings assume a change in slope configuration caused by road, skid trail, or log landing construction. Less than 1% of the area has a high mass wasting hazard rating. See Table 5 below and Map 5. Mass Wasting Hazard. This acreage is mostly limited to landslides near the Johnson Ranch. Areas of moderate mass wasting hazard found in the south-central and western portions of the project area contain soils derived from Tertiary sediment parent materials, with springs and/or high water tables, and soils derived from Cretaceous shales.

Table 5. Mass wasting hazard ratings for the Fleecer *assessment* area by acres and percent.

Mass Wasting Hazard	Total Acres	Percent
High	731	0.7%
Moderate	11,318	11%
Slight	90,835	88.3%
TOTAL	102,883	100%

2. Current Condition

Current soil conditions in the Fleecer area are a result of the complex interplay between inherent soil characteristics and human activities that have altered the soil resource over time. Inherent soil characteristics such as texture, rock content, and drainage, as well as the landform the soils occur on and local climate, help determine susceptibility to erosion, compaction, rutting, puddling, and mass movement, which can be and have been caused by human activities. Soil hazard ratings are discussed in detail in Section 3, Description of Reference Conditions, below. Human activities that have affected the soil resource include livestock grazing, mineral exploration and development, recreation and travel, timber production, and fire management. These are discussed below.

Effects on Soils from Livestock Grazing Management

Livestock grazing is an historic and ongoing activity within the project area. Soil impacts exist mainly on heavily used areas such as trails, salt grounds and water developments. These areas normally have bare, compacted soil and erosion which contribute to productivity reductions on small areas within range allotments. Some areas, still recovering from past heavy grazing, have additional areas of disturbance where vegetation is inadequate to protect the soil. Cattle tend to congregate throughout allotments and cause effects that, while not as obvious as described above, increase the risk of erosion.

Effects on Soils from Minerals Management

Soil effects from minerals management consists of disturbance from roads, drill pads, open pit and underground mines and developments associated with these activities. The scale of impact varies considerably by activity. Exploratory drilling for locatable minerals can involve no more than a short temporary road and a very small pad open

for a short time and rehabilitated. Likely soil productivity impacts are very low to non-existent. Open pit mines and other activities create impacts at a much larger scale where soil productivity is eliminated for periods of months to years. When the operations close, they are required to rehabilitate and adequately revegetate disturbed areas to prevent erosion and other soil impacts. Productivity may be either lower or higher than the original soil.

The Beal Mine is the most recent and largest mining operation in the area. Rehabilitation has been an ongoing process during the operation of the mine and was essentially completed several years after the mine closed. Vegetative cover is sparse in many areas but appears to be improving gradually. Land application of water from the mine is ongoing and rehabilitation will be completed when the water problem is resolved.

Extensive, historic placer mining operations in German Gulch and French Gulch disrupted the respective riparian soils and stream channels. Vegetation has re-established naturally on much of these disturbances but bare areas persist. Several lengthy trails of soil disturbance from bulldozer exploration in the uplands of Minnesota Gulch and German Gulch have partially recovered. Other small-scale mining disturbance from placer, exploration, and mining operations occur throughout the area but are much smaller in scale.

Effects on Soils from Recreation and Travel Management

Recreational and transportation developments such as campgrounds, roads and trails remove areas from the productive soil base. Soil productivity impacts are accepted as a trade-off for the desirable attributes of the facilities. However, soil productivity for campgrounds is still desired in order to maintain the vegetative environment that adds to the recreational experience even though soil productivity reductions are inevitable. These facilities affect small areas intensively managed to maintain the desired vegetative environment and prevent erosion and sediment production.

Roads and trails are more extensive; they have the potential to produce on- and off-site impacts on the productive soil base; and they vary from high standard low impact to low standard high impact. Motorized road and trail use, except snowmobiles, typically has a wider travel way and more mechanical surface disturbance and therefore higher erosion risk than other types of use. Road and trail vehicle access is necessary for the variety of uses on the Forest. The lower the mileage needed to achieve these ends the lower the impact on the productive soil base. Road and trail surfaces are un-vegetated, compacted, and produce concentrated runoff. Road cuts and fills are more susceptible to erosion and produce more runoff than adjacent undisturbed soil. These attributes, if uncontrolled, have the potential to erode soil on site and off site and to deposit eroded material on soil below roads and trails. High standard roads and trails (properly located with adequate drainage and surfacing,

and with vegetated cuts and fills) have few soil effects other than on the travel way. Low standard roads and trails (many are user created) are generally in poor locations, have inadequate drainage and un-vegetated cuts and fills. They have the attributes described in the previous paragraph and produce soil impacts below roads and trails.

Roads and trails closed to motorized use have a much lower risk of erosion than those with motorized use because less bare soil is exposed and is subject to much less mechanical disturbance.

Some old existing roads in active use today are in poor locations, have steep grades, and/or inadequate drainage. They developed from a need to access areas on the Forest with little regard for their effect on the environment. Improvements on these roads have reduced these effects but many need to be replaced with new, properly located and engineered roads. Some notable examples are Lone Tree road 1594, road 8490 to Norton Gulch (see Road Sediment Survey, Appendix A), Sunday Gulch road 8505 and parts of road 8486 on the south end of Fleecer Ridge and in the upper part of the South Fork Divide Creek.

Effects on Soils from Vegetation Management

Mechanical vegetation treatments are assumed to have produced soil disturbance (namely soil displacement and compaction) from equipment used for harvesting, yarding, and slash disposal. Prescribed fire for fuel reduction and vegetation management has not likely caused soil disturbance because burns are planned in the spring and fall to prevent effects from intense soil heating. Also, the area burned is relatively small and produces a mosaic of unburned to moderately burned surfaces with little potential for erosion. These burns have the potential to prevent undesired long term soil effects from intense soil heating and from exposing large areas to soil erosion as a result of wildfire in areas with excessive fuel loads.

Effects on Soils from Fire Management

Fire is a natural process in all ecosystems managed by the BDNF. Soils and landforms reflect effects from past wildfires to varying degrees. Wildfire, by definition, is uncontrolled in terms of timing, intensity, and extent. Soil effects from wildfire are variable but the pattern usually leaves a mosaic of large areas of benign effects with small areas of damage from intense soil heating. Large areas can be exposed to erosion for varying time periods because the protective cover of vegetation, duff and litter are consumed. Wildfire may continue to burn large acreages across the forest, and could even increase over the next 15 years. Uncharacteristic wildfires will cause detrimental soil disturbance directly proportional to the amount of high intensity heating and area of bare soil. Prescribed fire usually does not cause this degree of disturbance and may have beneficial effects.

3. Reference Condition

Human activity in the Fleecer watershed area has affected soil productivity in localized areas, depending on the activity (see Section B, above, for a more detailed description). For example, roads have removed the soil they occur on from the productive base; they are unvegetated and compacted. Past timber harvest may have reduced soil productivity in small, localized areas such as old skid trails that may still have residual compaction. User-created trails have created compaction and erosion in the locations they occur. Mining operations have removed topsoil and altered soil productivity on a long-term basis. Cattle activity has affected productivity in localized areas such as cattle trails, water developments, and salt grounds.

Natural disturbances have affected soil productivity in a minor way. Soils that are left undisturbed by human activities have vegetation, litter and duff cover which protects the soil from erosion. Wildfires typically have affected soils in a mosaic pattern; with the vast majority of burned areas classified low severity burned and very localized areas of high severity burned soil (such as adjacent to a log that burned). There are a few localized areas where landslides have occurred. About 600 acres of landslide deposits exist both to the north and west of Johnson Ranch, and also to the south and west of Johnson Ranch. A small landslide deposit (about 22 acres) occurs near the end of road 1000A, in the Lincoln Gulch area.

4. Synthesis and Interpretation

The desired condition for soils is maintain productivity (USDA Forest Service, 2009). Soil productivity in the Fleecer Watershed Assessment project area is largely unchanged from natural (reference) conditions. Exceptions occur primarily in localized areas of dedicated use, such as roads and campgrounds, which are provided for with Forest Plan direction and the Regional Soil Quality Standards (USDA Forest Service, 1999).

Areas where we have opportunities to improve soil productivity include poorly located/unneeded road segments, unauthorized roads and trails, and also small areas of residual compaction on old roads/skid trails in previously managed timber stands. These areas form a miniscule percentage of the project area. (See Appendix B - Route Analysis)

Finding: Soil productivity issues in the Fleecer Mountains are confined to localized areas, such as roads and campgrounds, which are dedicated use areas accepted under Forest Plan direction and the Regional Soil Quality Standards (USDA Forest Service, 1999). Opportunities exist to improve soil productivity in other localized areas include poorly located/unneeded road segments, unauthorized roads and trails, dispersed campsites, and also small areas of residual compaction on old roads/skid trails in previously managed timber stands.

5. Recommendation

- Decommission or relocate problem roads. (See Appendix A-Road Sediment Survey and Appendix B – Route Analysis). Some old existing roads in active use today are in poor locations, have steep grades, and/or inadequate drainage. They developed from a need to access areas on the Forest with little regard for their effect on the environment. Improvements on these roads have reduced these effects but many need to be replaced with new, properly located and engineered roads. Some notable examples are Lone Tree road 1594, road 8490 to Norton Gulch, Sunday Gulch road 8505 and parts of road 8486 on the south end of Fleecer Ridge and in the upper part of the South Fork Divide Creek.

- Identify areas of residual soil compaction in old harvest units (likely very small in extent) in the field and prioritize them for treatment.

6. References

ECOMAP, 1993. National hierarchical framework of ecological units. Unpublished administrative paper. Washington, DC, U.S. Department of Agriculture, Forest Service. 20p.

Nesser, J., G. Ford, C. Maynard, D. Page-Dumroese, 1997. Ecological Units of the Northern Region: Subsections. Gen. Tech. Rep. INT-GTR-369. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 88 p.

USDA Forest Service, 1999. Forest Service Manual, R-1 Supplement 2500-99-1. Soil Management, Soil Quality Monitoring. Missoula, MT. 6p.

USDA Forest Service. 2009. Revised Forest Plan for the Beaverhead-Deerlodge National Forest. USDA Forest Service, Intermountain Region, Beaverhead-Deerlodge National Forest, Dillon, MT.

B. WATERSHED AND HYDROLOGY

1. Characterization of the Watershed - Context

The Fleecer Watershed Assessment area, located in Southwest Montana within portions of Silver Bow and Deerlodge counties, is defined by the Fleecer Mountain Range and consists of several watersheds. The Assessment area boundary is defined subjectively for the purpose of this assessment by Interstate 15 on the eastern edge, Interstate 90 on the north edge, Highway 289 (Mill Creek Hwy) to the west, and Highway 43 and the Big Hole River to the south. See Map 1. Project Location.

The Continental Divide splits the assessment area into two separate drainage basins. Streams located west of the divide flow to the Clark Fork River Basin, while streams east of the divide flow to the Big Hole River Basin. For analysis purposes the Fleecer Watershed Assessment area was broken down into nine 7^{th}-Field HUCs that have clearly defined watersheds lying primarily within the Forest Service boundary. See Map 6. 7^{th} Field HUC Boundaries. (Several other 7^{th} field watersheds lie on the periphery of Forest Service lands but do not contain enough federal land to analyze.) The 7^{th}-Field analysis watersheds consist of Beefstraight, German, Norton (located in the 6^{th} field German Gulch watershed), North Fork Divide and South Fork North Fork Divide (located in the Divide-Fleecer 6^{th} field watershed), Jerry, Moose, Bear, and Johnson. Beefstraight, German, Sand and Norton watersheds drain to the Clark Fork River, whereas remaining watersheds drain into the Bighole River. The Mount Haggin Wildlife Management Area, Fleecer Wildlife Management Area, BLM, state and private lands existing outside of the forest boundary were not included in the hydrology assessment.

The entire Fleecer Watershed Assessment area bounded by roads and the Big Hole River consists of 223,114 acres. Total Forest Service acreage in the Fleecer Analysis Watershed Assessment area, consisting of the nine 7th-Field HUCS, is 78,982 acres. This total represents mostly Forest Service lands with very small amounts of private in-holdings. Past and present human influences on this watershed with the potential to affect water quality include timber harvest, mining, grazing, roads and recreation.

There are nine major perennial streams within the Fleecer Watershed (Table 6). According to the GIS derived data the total perennial stream miles for the Fleecer Analysis Watershed within Forest ownership is 124.2 miles. In addition, there are 205 miles of intermittent streams within the analysis area.

Elevations on National Forest lands in the watershed range from 5,800 at the lower elevations to 9,436 feet (Fleecer Mountain). Maximum annual precipitation in the higher elevations varies from 28 to 36 inches, with 20 to 30 percent of this falling as snow between November and April. Maximum runoff flows generally occur between May and June.

Table 6. Watershed Characteristics by 7-Field HUC

HUC Name	Size (Acres)	Parent material (geology)	Perennial Stream Miles	Intermittent Stream Miles
Bear	3622.2	Granite/Shale/Quartz	5.6	11.1
Beefstraight	11315.3	Sandstone/Shale	21.4	19.7
German	6280.3	Sandstone/Shale/Granite	10.8	12.7
Jerry	26947.1	Granite/Shale	42.7	52.7
Johnson	5955.3	Granite/Shale/Quartz	12.7	14.1
Moose	1939.4	Granite/Quartz/Volcanics	3.6	1.3
Norton	7240.2	Granite/Volcanics	7.2	27.5
North Fork Divide	12730.8	Granite	14	57.1
S. Fork, N. Fork Divide	2951.1	Granite	6.2	8.8
Totals	78,982		124.2	205

The majority of the logging occurred throughout the area from 1961 to 1995 harvesting a total of 6,096 acres or approximately eight percent of the watershed. Grazing occurs throughout the analysis area within five different range allotments. Fire has not played a significant role on the Fleecer landscape in recent years.

There is no active mining under Plan of Operations taking place within the analysis area at this time (personal communication with Steve Kelley 05/13/2009). However, there are numerous abandoned and inactive mine sites within the analysis area. Mining efforts in the Fleecer Watershed Analysis area focused primarily on gold, mainly obtained through placer mining. Most mining activity occurred in German Gulch, Divide Creek, Jerry Creek and Fleecer Mountain with the most significant being the Beal Mountain Mine located in the headwaters of the German Gulch watershed.

German Gulch is the receiving stream for the majority of water quality issues associated with Beal Mountain Mine and the mine facilities. Gold was discovered in German Gulch in 1865 and was placer mined until the end of the 1860's when Chinese and Euro-American companies consolidated claims and began large scale hydraulic mining. Beal Mountain Mining (a subsidiary of Pegasus Gold Corporation) operated an open pit mine and cyanide heap leach facility between 1988 and 1997 in the headwaters of German Gulch. In 1998 Pegasus gold filed for bankruptcy and the Forest Service became the lead agency responsible for final mine closure.

The main impacts to water quality from mine facilities that appear to have potential long-term effects are elevated concentrations of cyanide and selenium. Habitat quality has been degraded in German Gulch due to extensive placer mine dredging throughout much of the watershed which has disrupted stream channels along with riparian soils and vegetation. The Forest Service has been collecting water samples and measuring surface flow to monitor water quality impacts to German Gulch, Minnesota Gulch, and Beefstraight Creek.

Table 7. Watershed activities in relation to timber harvest, road miles, road stream crossing, and miles of roads within 300 feet of a stream, all ownerships

Analysis Watershed (7th Field Watersheds)	Size (Acres)	Timber Harvest (Acres)	Road Miles	Road Density mi/mi^2	Road Stream Crossings	Road Miles Within 300 Feet of a Stream
Bear	3622.2	136.9	10.3	1.8	2	2
Beefstraight	11315.3	30.4	6.4	.36	3	1.9
German	6280.3	97	8.3	.85	2	4.5
Jerry	26947.1	2816.9	89.1	2.1	19	11.7
Johnson	5955.3	564.6	14.3	1.5	6	2.9
Moose	1939.4	106.3	2.6	.86	2	1.4
Norton	7240.2	59.1	7.3	.65	3	.49
North Fork Divide	12730.8	2124	43.4	2.1	8	10.2
South Fork, North Fork Divide	2951.1	161.2	4.6	1	1	.12
Totals	**78,982**	**6096.4**	**186.3**		**46**	**35.21**

Total road miles, roads within 300 feet of a stream, and road stream crossings have been calculated for Forest owned land within the watershed using GIS analysis. There is a total of 186 miles of roads, 46 road stream crossings, and 35 miles of road within 300 feet of a stream within this watershed. Table 7 below shows these values and timber harvest (acres) for each watershed.

These numbers represent the known routes within the Fleecer Watershed. Current routes that exist on the ground throughout the Fleecer Watershed are likely higher than what is displayed by the GIS analysis however these numbers are appropriate to help understand the current condition of the watershed.

The landscape within the analysis area is dominated by Lodgepole Pine and Douglas Fir forests. Total forested areas within the forest boundary equal 57, 757 acres while non-forested land equals 14,596 acres. Table 8 displays the TSMRS vegetation data for the Forest owned portion of the 7th field watersheds. It does not reflect the vegetation on areas outside of the forest boundary within the watersheds.

Table 8. TSMRS vegetation cover type within the 7th field watersheds, FS ownership only

Cover Type	Acres
Dry Meadow	8668
Wet Meadow	796
Fringe	806
Non-Stocked (cutting activity with no regeneration)	78
Rock or Scree	4248
Total Forested	57,757

Chapter 3 of the Beaverhead-Deerlodge Forest Plan lists specific goals, objectives and standards for 56 fish key watersheds and 15 restorations key watersheds. Both German Gulch and Upper Jerry Creek are listed as Fish Key Watersheds in the plan. Management in Fish Key Watersheds emphasizes conservation of westslope cutthroat and bull trout by protecting and restoring components, processes, and landforms that provide quality habitat (2009 Beaverhead-Deerlodge Forest Plan). There are no Restoration Key Watersheds within the analysis area.

Forest wide goals relevant to aquatic resources in the 2009 Beaverhead-Deerlodge Forest Plan are summarized below. Abbreviations in parenthesis indicate the Inland Native Fish Strategy goals, objectives, and standards carried forward as part of the Forest Plan.

Land Management Plan Direction for Aquatic Resource s

Goals:

Watersheds: Watersheds are maintained to ensure water quality, timing of runoff, and water yields necessary for functioning riparian, aquatic ecosystems, wetlands, and to support native aquatic species reproduction and survival. Watershed restoration projects promote long-term ecological integrity of ecosystems, conserve genetic integrity of native species, and contribute to attainment of desired stream function and support beneficial uses (IN1).

Fish Key Watershed: Populations of bull trout and westslope cutthroat trout exhibit numbers, life histories, age classes, recruitment levels, and reproductive

characteristics representative of historic conditions.

Restoration Key Watershed: Fish habitat, riparian habitat, and water quality are recovered to desired conditions developed through watershed assessments.

Watershed Restoration Projects: Projects are designed and implemented to promote long term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contribute to attainment of desired stream function (WR-1).

Municipal Watersheds: Site-specific criteria for managing municipal watersheds are developed, and degraded waters are restored to meet goals of the Clean Water Act and Safe Drinking Water Act.

Total maximum Daily Loads (TMDLS): Management actions are consistent with TMDLs. Where waters are listed as impaired and TMDLs and Water Quality Restoration Plans are not yet established, management actions do not further degrade waters. Water quality restoration supports beneficial uses.

Stream Channels: Stream channel attributes and processes are maintained and restored to sustain natural desired riparian, wetland, and aquatic habitats and keep sediment regimes as close as possible to those with which riparian and aquatic ecosystems developed (IN 2).

Instream Flows: Instream flows are secured to support functioning riparian and aquatic habitats, stable and effective stream function, and ability to route flood discharges (IN 3).

Floodplains: The condition of floodplains, channels and water tables are maintained and restored to dissipate floods and sustain the natural timing and variability of water levels in riparian, wetland, meadow and aquatic habitats (IN 4).

Riparian Areas: Riparian habitat, species composition, and structural diversity of native and desired non-native riparian plant communities are maintained or restored to (IN 5-6):

- Provide an amount and distribution of woody debris characteristic of functioning aquatic and riparian ecosystems;
- Provide adequate summer and winter thermal regulation for streams to support beneficial uses;
- Provide bank stability to maintain rates of surface erosion, bank erosion, and channel migration which are characteristic of functioning aquatic and riparian ecosystems;
- Effectively trap and store sediment, build stream banks and floodplains, and promote recovery after watershed disturbance.

Riparian Habitat: Habitat to support viable, well distributed populations of native and desired non-native plant, invertebrate aquatic-and riparian-dependent species are maintained or restored. Movement corridors within and between watersheds, where desired are maintained or restored to provide aquatic-dependent species' habitat needs and maintenance of metapopulations (IN 8).

Channel Integrity: Stream channel function and water quality are maintained or restored to support designated beneficial uses on all reaches through management decisions, restoration projects or Best Management Practices as outlined in the Soil and Water Conservation Practices handbook.

Aquatic Nuisance Species: Introductions of aquatic nuisance species in riparian and aquatic habitats are prevented. Forest biologists work cooperatively with appropriate state and federal agencies, or other stakeholders to reduce or eliminate impacts, where aquatic nuisance species are adversely affecting the viability of desired aquatic species.

Snow Courses, Telemetry Sites: Established snow courses, snow pack telemetry sites, and precipitation gauges are protected.

Sensitive Aquatic Species: Viable populations of sensitive aquatics species are maintained (R1 Sensitive Species list) by managing habitat.

Ungulate Impacts: Wild ungulate impacts that prevent attainment of the desired stream function or adversely affect native fish and sensitive aquatic species are identified and addressed through cooperation with federal, tribal, and state wildlife management agencies (FW 3).

Agency Cooperation: Adverse effects on native fish or sensitive aquatic species associated with habitat manipulation, fish stocking, fish harvest, and poaching are identified and addressed through cooperation with federal, tribal, and state fish management agencies (FW 4).

Leases, Rights-of-way, Easements: Leases, permits, rights-of-way, and easements are issued to avoid effects that would prevent attainment of the desired stream function and avoid adverse effects on threatened and endangered aquatic species and adverse impacts to sensitive aquatic species.

Where the authority to do so was retained, existing leases, permits, rights-of –ways, and easements are adjusted to eliminate effects that would retard or prevent attainment of the desired stream function or adversely effect on threatened and endangered aquatic species and adverse impacts to sensitive aquatic species. Where adjustments are not effective, the activity is eliminated.

Where the authority to adjust was not retained, existing leases, permits, right-of-way, and easements are negotiated with the lead agency to make changes to eliminate effects that would prevent attainment of the desired stream function, adversely affect threatened and endangered aquatic species, or adversely impact sensitive aquatic species.

Priority for modifying existing leases, permits, right-of-way and easements would be based on the current and potential adverse effects on native fish and sensitive aquatic species, and the ecological value of the riparian resources affected (LH 3).

Acquisitions and Exchanges: Land acquisition, exchange, and conservation easements are used to meet desired stream function and facilitate restoration of fish stocks and other species at risk of extinction (LH 4).

Livestock Grazing: Grazing practices are designed to attain, or maintain, desired stream function (GM 1).

Mineral Operations: Mineral operations minimize adverse effects to threatened and endangered fish species or adverse impacts to sensitive aquatic species (MM 1).

Mining Facilities: Structures, support facilities, and roads are located outside RCAs (MM 2).

Roads: Roads are designed, constructed, and maintained to meet desired stream function and avoid adverse effects to native fish and sensitive aquatic species (RF 2).

Transportation Atlas: The Transportation Atlas addresses the following items (RF 2c):
1. Road design criteria, elements, and standards that govern construction and reconstruction.
2. Road management objectives for each road which include criteria for operation, maintenance and management.
3. Season of use and type of vehicle.
4. Road condition surveys to identify annual and deferred maintenance needs.

Stream Crossings: Culverts, bridges, and other stream crossings can accommodate a 100- year flood, including associated bedload and debris (RF 4).

Recreation Sites: Developed sites, dispersed sites, and trails are designed, constructed, and maintained in a manner which achieves desired stream function (RM 1).

Water Drafting Sites: Water drafting sites are located in a manner that does not retard or prevent the attainment of desired minimum stream flows and stream function or have adverse effects, on threatened and endangered aquatic species or

adverse impacts to sensitive aquatic species (RA 5).

Riparian Management Objectives (RMO's) that are identified in the 2009 Revised Forest Plan are shown below. These RMO's are designed to maintain proper stream functioning condition.

Riparian Management Objectives: Establish stream specific Riparian Management Objectives (RMOs) using watershed or other analyses incorporating data from streams at or near desired function. RMOs are a means to define properly functioning streams and measure habitat attributes against desired condition. The following RMOs apply by stream reach until new RMOs are developed through watershed or other site specific analysis.	
East of the Continental Divide	
1. Entrenchment Ratio (all systems)	Rosgen Channel A-<1.4 Rosgen Channel B-1.6-1.8 Rosgen Channel C->10.3 Rosgen Channel E->7.5
2. Width/Depth Ratio (all systems)	Rosgen Channel A-<11.3 Rosgen Channel B-<15.8 Rosgen Channel C-<28.7 Rosgen Channel E-<6.9
3. Sediment Particle Size, %<6.25mm (all systems)	Stream Type B3-<12 Stream Type B4-<28 Stream Type C3-<14 Stream Type C4-<22 Stream Type E3-<26 Stream Type E4-<28
4. Bank Stability (non-forested systems)	>80% Stable
5. Large Woody Debris (forested systems)	>20 pieces per mile, >6 inch diameter, >12 feet long
West of the Continental Divide	
1. Pool Frequency (all systems) width/number of pools	10/96,20/56,25/47,50/26,75/23,100/18,125/14,150/12,200/9
2. Large woody debris (forested systems)	>20 pieces per mile, >12 inch diameter, >35 foot length
3. Bank stability (nonforested systems)	>80% stable
4. Lower bank angle (non-forested systems)	>75% of banks with <90 degree angle (i.e., undercut).
5. Width/Depth ratio (all systems)	<10, mean wetted width divided by mean depth
6. Water Temperature	Water temperatures meet life history requirements for native fish species.

Existing hydro surveys available within the analysis area were completed before these riparian management objectives were established. Therefore, there is not

enough existing data on all streams within the analysis area to accurately determine if they meet all of the riparian management objectives. Hydrological data was used to classify the streams as functioning, non-functioning or functioning-at-risk.

2. Current Conditions

Water Quality

The Clean Water Act and Code of Federal Regulations (CFR) require each state to identify water bodies that are water quality limited (Section 303(d) and 40 CFR (Part 130)). After water quality limited water bodies have been identified, they are prioritized and targeted to measure the Total Maximum Daily Load (TMDL). When final approval is granted by the Environmental Protection Agency, the list of water quality limited streams becomes part of an annual report to the State of Montana (305(b) Report).

There are currently five 303(d) streams within the Fleecer Analysis Watershed listed as Category 5 impaired, meaning that one or more uses are impaired and a TMDL is required. The five streams listed include Beefstraight Creek, German Gulch, Jerry Creek, Johnson Creek, and Divide Creek. Water quality information on these streams was assessed from the headwaters to the mouth, with the exception of Beefstraight Creek which was assessed from Minnesota Gulch to the mouth at German Gulch. Therefore, some of the probable causes of impairment and the associated sources listed in the table below are related to agricultural practices on private land outside of the forest boundary.

A TMDL is being developed for these streams by Montana DEQ but this process has not been completed. Table 9 below shows the probable impaired uses and the probable causes of impairment for these 303(d) listed streams.

Table 9. Montana Department of Environmental Quality 2008 Water Quality Information

Stream	Probable Impaired Uses	Use-Support Status	Probable Causes of Impairment	Probable Sources of Impairment
Beefstraight Creek	Aquatic Life, Cold Water Fishery	Not Supporting	Cyanide	Mine Tailings
German Gulch	Aquatic Life, Cold Water Fishery	Not Supporting	Selenium	Impacts from Abandoned Mine Lands (Inactive) Placer Mining
Jerry Creek	Aquatic Life, Cold Water Fishery, Drinking Water, Recreation	Not Supporting Partially Supporting	Alteration in stream-side or littoral vegetative covers, copper, excess algal growth, lead, low flow alterations, physical substrate habitat alterations.	Agriculture, Grazing in Riparian or Shoreline Zones, impacts from Abandoned Mine Lands (Inactive), Rangeland Grazing, Silviculture Activities, Site Clearance, Acid Mine Drainage, Irrigated Crop Production, Impacts from

				Hydrostructure Flow Regulation / Modification, On-site Treatment Systems (Septic)
Johnson Creek	Aquatic Life, Cold Water Fishery, Recreation	Partially Supporting	Alteration in stream-side or littoral vegetative covers, Low flow alterations, Sedimentation / Siltation, Total Kjehldahl Nitrogen (TKN)	Grazing in Riparian or Shoreline Zones, Irrigated Crop Production, Silviculture Harvesting
Divide Creek	Aquatic Life, Cold Water Fishery, Recreation	Partially Supporting	Alteration in stream-side or littoral vegetative covers, Low flow alterations, Phosphorus, Sedimentation / Siltation, Water Temperature, Total Kjehldahl Nitrogen (TKN)	Agriculture, Flow Alterations from Water Diversions

The Big Hole Watershed Committee posts the Lower Big Hole TMDL Draft Document (provided by MT DEQ) on their web at; http://bhwc.org/TMDL.htm. Their document can be referenced for more detailed information on the probable cause and sources of impairment for Divide and Jerry Creek.

The Draft TMDL for the lower and middle Big Hole watershed suggests none of the fine sediment targets for Divide Creek were met, indicating dramatic changes in stream bed composition and channel morphology likely due to increased sediment loads and decreased sediment transport capacity. Biological data indicate Divide Creek does not fully support aquatic life. Geology likely contributes to high loads of fine sediment, but there are also human-related sources of sediment affecting riparian vegetation, channel morphology, and sediment loads. The primary anthropogenic sediment sources are grazing and irrigated agriculture, though roads and timber harvest are additional sources.

According to the DRAFT TMDL for the lower and middle Big Hole watershed, some stream reaches on Jerry Creek meet sediment and morphological targets, but in other reaches, the high width/depth ratios, percentage of fine sediment, and altered channel morphology suggest a decrease in sediment transport capacity and increased sediment supply. The primary anthropogenic source of sediment within the watershed is rangeland grazing, though roads and timber harvest are additional sources. Nutrient concentrations met water quality targets, while chlorophyll a concentrations were exceeding the target at the upper site in 2005 and at both sites in 2006. Supplemental indicators suggest a reduction in understory shrub cover and an increase in bare ground, which may lead to increased nutrient inputs. The primary human caused source of increased nutrient loads is rangeland grazing, though rural residential development may also be a source. Upper Jerry Creek was one of the most heavily used livestock grazing areas observed in this study.

More detailed water quality status for German Gulch and Beefstraight Creek can be found in Tetra Tech's 2009 report, "2008 Water Quality Monitoring Summary, Beal Mountain Mine."

German Gulch has had extensive water quality testing due to Beal Mountain Mine operations and reclamation efforts. In 2008, water quality and flow characteristics at the Beal Mountain Mine surface water and spring sampling sites were similar to those measured over the past several years. Water quality criteria were exceeded for cyanide and selenium at stations where these excesses have been measured in the past. The surface water station directly below the mine site continues to have the poorest water quality in the German Gulch watershed; the chronic aquatic life standard for selenium was exceeded in all three events in 2008. Nitrogen and copper levels were the highest of all stations sampled, but did not exceed the aquatic standards. No aquatic life standards were exceeded at downstream stations on German Gulch with the exception of a total cyanide concentration of 0.009 mg/L during June 2008. Historically routine sampling for total suspended solids have been below the reporting limit of 10 mg/L. Nitrate concentrations in German Gulch were consistent with past monitoring events. Cyanide trends had shown a general decrease in concentration over the January 2003 through June 2006 time period. During the June and September sampling events in 2008, surface water sample locations on Minnesota Gulch, Beefstraight Creek and German Gulch showed a modest increase in total cyanide concentrations.

More detailed water quality information on South Fork Reservoir (Butte water supply) can be found in the Butte Silverbow Water Department 2003, "Water Delineation and Assessment Report."

According to the report, the State of Montana classifies the South Fork of Divide Creek as B-1 surface water. B-1 surface waters are to be maintained as suitable for drinking, culinary, and food processing purposes after conventional treatment. These waters must also be maintained as suitable for bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply.

Stream Morphology

Several streams within the analysis area have had hydrological stream surveys completed in the past. The data is summarized for each watershed below. Stream surveys are reach specific and are designed to classify each reach as to stream type as well as describe additional reach attributes, including function (Tables 10-17). Each component of the stream type designation is measured at a site representative of that reach. Stream survey data was analyzed with the idea of comparing the measured reach with a reference reach from a watershed similar in area, geology, valley bottom width, and valley bottom gradient. By comparing reference and "project" reaches, an assessment of stream function can be made (Beaverhead NF, 1997).

A wide range of existing conditions occurs on the streams within the analysis area. For the most part, streams function for the majority of their length, although some streams have reaches that are functioning-at-risk or are non-functioning. Map 7. Hydrologic Reach Survey Locations, displays all streams survey locations within the Fleecer Watershed Analysis area and to what degree they are functioning. These conditions are based on stream data collected from 1997-1999 using the Rosgen Stream Classification Methodology (Rosgen, 1992), the Stream Reach Inventory and Stability Evaluation (Phankuch, 1975), and the Bank Erosion Potential Rating (Rosgen, 1985), and Cumulative bankfull width and depth measurements (Decker, Bengeyfield et.al., 1993). Results are detailed below by individual stream.

German Gulch

Topography in the area consists of broad, gently to moderately sloping ridge tops and steep V-shaped valleys. Ridge tops and south facing slopes are typically open, and north facing slopes are tree covered. Average annual precipitation calculated in the vicinity is 25 inches per year with half of the annual precipitation occurring from April to July. For German Gulch historical maximum flow generally occurs between May and June with most of the flow being contributed by Beefstraight Creek, Edwards Creek, Greenland Creek tributaries, and Norton Gulch. In 2008 maximum surface flow in June below the confluence of Beefstraight Creek was 83.19 cubic feet per second (cfs). Minimum flows in April at the same location were measured at 4.33 cfs.

German Gulch has been subject to extensive mining activity in the past. The stream was evaluated by the North Zone hydrologist about 1 mile above its mouth and found to be a B4c channel type. The cross section location represents an anomaly for channel width and stability relative to the majority of the stream. Most of the stream is much wider and less stable and rates non-functioning. Bank stability is poor in many places, with braiding and high water channels common. Substrate composition in the section of German Gulch downstream of Beefstraight Creek is dominated by gravel sized material but does contain 30% fine sediment. Near Edwards creek, fine sediment makes up 15% of the substrate. Substrate in the uppermost reaches of German Gulch is highly embedded. The access road to Beal Mountain mine parallels the stream and has contributed to increased sediment delivery. Annual monitoring by BMMI indicates sediment deposition continues to affect habitat and periphyton metrics in German Gulch.

One stream monitoring measurement for German Gulch was completed in 1999, in the lower end approximately one half mile upstream of Durant. At this site, bank stability was reported as good in some areas but poor in lots of areas due to bank erosion with large sediment deposits of cobble and gravel. Bank vegetation consisted mainly of vigorous alder, dogwood, willow and grasses. Obvious watershed impacts were mining, historical logging and grazing. Riparian impacts

were linked to high flows and subsequent erosion, noxious weeds, and slight impacts from grazing. Stream resistance was rated as low due to highly erodible banks and the deposition of fine sediments. Resilience was rated as moderate due to the ability of the floodplain to dissipate high flow energy and the presence of vegetation growing on large gravel bars throughout the valley bottom.

In 1999 a riparian reconnaissance evaluation was performed on upper German Gulch above the confluence of Beefstraight Creek. This site has been 100% disturbed due to historical mining, and was noted to be a C3 channel type, functioning-at-risk. Stream banks are stable due to cobble composition and willow re-growth. Vegetation re-growth is mainly willow species, dogwood, aspen and wild rose. Beaver activity and trout were noted in the stream reach.

Physical habitat condition for the upper German Gulch location was considered "sub-optimal" in 1999 and 2001 for most habitat parameters. Habitat quality declined due to reduced riparian plant cover, increased bank erosion, and increased sediment deposition (Tetra Tech, May 2009). These conditions were worsened by drought and livestock use. Habitat degradation was also attributed to historic placer mine dredging.

Table 10. German Gulch stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
German Gulch Lower	1999	B4c	B4c	19.9	1.8	40	Functioning at risk

Beefstraight Creek

Beefstraight is a major tributary to German Gulch and has been impaired by past mining activities. Maximum flow was measured in June 2008 with a value of 34.94 cfs and minimum flow was measured in April with a value of 1.97 cfs.

In 1999 a hydrologic stream survey was completed on Beefstraight Creek, below the confluence of American Gulch. Banks were reported to be fairly stable with large cobble, shrubs and grasses, with eight percent unstable due to bank caving, minimal large woody debris and minor sedge development. Vegetation consisting mainly of Willow and Alder was healthy. Noted riparian impacts were due to grazing (minor bank trampling), and historical mining with the presence of ditches along upper meadow. Stream resistance was rated as moderate because of shrub protection along banks with high root density. Resilience was low due to the high stream gradient and low to moderate sinuosity with very minimal fine sediment deposition for bank recovery. Beefstraight Creek and Minnesota Gulch sampling sites were rated optimal for habitat in 2002.

Norton Gulch flows mainly through Forest Service land, but also flows through state and private lands. Livestock grazing, placer mining, and roads make up past and present management activities affecting stream function. The state purchased 800 acres of private land mostly within Norton Gulch in 1968, now part of the Fleecer Mountain WMA. Land use (grazing) was heavy under previous ownership, especially along streams. Except for unauthorized use, no cattle use has occurred since the purchase. While this area receives heavy use by wildlife, especially in winter, it has experienced major recovery in upland and riparian condition. A stream survey site measured on state land shows a functioning E4 channel type. On National Forest administered lands, stream conditions rate mostly non-functioning or functioning-at-high-risk with one short reach of functioning E channel just above the trailhead. These conditions are likely a result of excessive livestock grazing over the years. A B5c reach more typifies the existing stream channel condition with declining willows, loss of sedges, reduced streambank stability, and overwidened, unstable channels. Fine sediment deposition is high and becomes more apparent in the lower reaches.

Table 11. Beefstraight Stream Classification And Morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
Beefstraight	1999		B4	14.2	1.8	26	Functioning at risk

Norton Creek

Topography in this watershed consists of broad, gently to moderately sloping ridge tops and steep V-shaped valleys. The eastern edge of the watershed consists of large grassland parks while the rest of the watershed is dominated by lodgepole pine forests. The Norton Creek upper stream monitoring site is located on state land within an exclosure, and is a very stable reference E channel (1998 BDNF Streamreach measurements). Vegetation consists of grass and sedges along the stream banks with vigorous willow growth throughout the valley bottom.

Two additional measurements (Norton Lower #1 & #2) were taken downstream roughly one half mile from the confluence with German Gulch. Soft banks with low resistance but good resilience were reported. These lower sections were found to be functioning at risk with a downward trend due to bank trampling. An exclosure was built on the lower section of Norton Creek in late 2003 and stream conditions have since improved.

Table 14. Norton Creek stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function

Norton Up	1998	E4	E4	4.6	3.8	5.5	Functioning
Norton Lower #1	1998	E4	B5c	11.6	1.5	2.0	Functioning at risk
Norton Lower #2	1998	E4	E5	2.46	14	2.0	Functioning at risk

Sand Creek

The east side of the Fleecer range contains several small tributaries that were excluded from the 7th field watershed boundaries. Reconnaissance surveys were performed on these streams in 1999 so a collective summary of the findings are included here for reference. The individual streams that drain the area include, from north to south, Price Gulch, Powder Gulch, Sunday Gulch, Hanson Gulch, Rose Gulch, Pink Gulch, and Slab Gulch and are referred to as the Sand Creek watershed. These tributaries feed Silver Bow Creek about 6 miles west of Butte, MT. Silver Bow Creek joins with Warm Springs Creek to form the Clark Fork River near the town of Warm Springs. The geologic parent material of the Sand Creek watershed is granite, and the dominant landforms consist of stream-dissected slopes. Annual precipitation averages about 18 inches and elevations range from 5800 feet at the forest boundary, up to 7246 feet. The coarse-grained soil textures lead to a high potential for surface erosion. However, the short slope distances, relatively dry climate, and lack of perennial defined stream channels restricts sediment delivery to the mainstem of Sand Creek. Water produced on this landscape is limited due to the relatively dry climate and intermittent stream flows.

1999 riparian reconnaissance evaluations of Hanson, Price, Powder and Sunday Gulch reported the streams to be functioning at risk. Dominate substrate material in all streams surveyed was found to be silt/clay, willow communities were heavily browsed and in decline and wet areas showed hummocks and trampling evidence. Streams generally were found to have undefined channel systems due to limited flow regimes. They function as sedge/willow dominated wetlands along the valley bottoms that range from 10 to 100 feet wide. No water quality or stream flow data exists for waters within the Sand Creek watershed.

Roads, trails, timber harvest, and livestock grazing make up the land management actions in the area. The Sand Creek watershed also has rural housing and industrial development.

North Fork Divide

This watershed is located on the east edge of the Fleecer range and is dominated by low resistance parent material, namely granitic in origin. Topography exhibits high fluvial dissection with wet meadows found in many of the valley bottoms. Precipitation ranges from 20 to 35 inches per year with a majority of this falling as snow between November and May. Drainages in the watershed produce high

amounts of sand particles due to the decomposition of granite. This results in more sensitive stream types from a sedimentation and bank stability standpoint.

Functioning streams in the Divide Creek drainage tended to have E4 channel types, while non-functioning streams were shifted toward B4c types. Most of the stream survey sites were established within broad, low-gradient valley bottoms, which are typically sensitive to livestock grazing. The dominance of granite parent material and low stream gradients both play a large role in the high level of fine sediment. A revised allotment management plan was signed in 1998, with riparian use criteria established for bank alteration, utilization, stubble height and browse of woody species.

Past management activities that have affected this water resource include grazing, roads building and maintenance, timber harvest, mining and recreation. North Fork Divide was previously impounded to create the Bull Ranch Reservoir. The dam was breached and the stream has become reestablished and is continuous through what was once the reservoir. The present road network includes 43 miles of roads with 10 of those miles being within 300 feet of a stream. This watershed has a high road density of 2.1 mi/mi^2. In addition there are several OHV trails used for recreational purposes within this watershed. Timber harvest totals 2,124 acres or 17% of the watershed.

The North Fork of Divide 1 has shifted to a B4c stream type, which constitutes a major change in function. Field notes for this reach reported heavy grazing on soft stream banks that were moderately accessible to ungulates. The stream was reported as non-functioning. North Fork Divide Up and North Fork Divide Down are more entrenched than expected, resulting in a loss of floodplain access. Otherwise the two sites represent a functioning condition (BDNF 1997).

Two additional sites were measured farther down the creek just upstream of the Rocky Ridge trailhead and were classified as E4 and B4c stream types. Bank stability in this area was moderately stable due to the presence of boulders and large woody debris, except for certain areas where cattle had congregated in riparian areas. Cattle trails were noted throughout the valley bottom.

Table 12. North Fork Divide and tributaries stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
NF Divide Up	1997	E5	E6	3.4	7.4	.35	Functioning
NF Divide Dn X-Sec 1	1997	E4	E4	2.24	2.6	15	Functioning
NF Divide Dn X-Sec 2	1997	E4	B4c	4.39	1.7	15	Non-functioning

NF Divide 1	1997	E4	B4c	17.3	1.6	1.3	Non-Functioning
South Fk of N. Fork X-Sec 1	1999	B4	G4	9.56	1.3	8	Non-Functioning
South Fk of N. Fork X-Sec 2	1999	B4	G4	3.55	1.4	8	Non-Functioning
Beaverdam	1999	E5	E5	3	1	1.1	Functioning
Divide Dn (Rocky Ridge TH) X-Sec 1	1999	E4	E4	6.99	2.2	9.5	Functioning-at-risk
Divide Dn (Rocky Ridge TH) X-Sec 1	1999	E4	B4c	13.03	1.9	9.5	Non-Functioning

South Fork North Fork Divide

This watershed is located on the south edge of the North Fork Divide watershed and has very similar characteristics. During the 1997/99 field season the South Fork of Divide Creek was in a functioning-at-risk condition. The banks have a high sand component making them highly sensitive to alteration and resistance is moderate. Resilience is also moderate due to good vegetation and sediment entrapment. Many areas of channel widening and trampled banks were noted in the lower reach above the reservoir. A cattle exclosure was built in this section of stream in 2008.

Cattle use is lighter further upstream where the stream becomes steeper with a higher rock component in the banks. Conifers dominate the riparian area and the upper reaches appear functioning with limited areas that are affected by cattle.

The Butte-Silver Bow Water Department obtains its water via four surface water intakes in the Butte vicinity and the South Fork of Divide Creek Reservoir located in the South Fork North Fork Divide analysis area is one of the sources. The water is gravity fed roughly 13,000 feet to the Big Hole water treatment plant. The stream is basically dewatered below the reservoir. Thus, bankfull flows are very likely reduced along Divide Creek, resulting in altered channel morphology and decreased sediment transport capacity.

Table 13. South Fork North Fork Divide stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
South Fork North Fork	1999	E4b	E4b	5.5	2.3	6	Functioning

Divide X-Sec 1							
South Fork North Fork Divide X-Sec 2	1999	E4b	G4	10.83	1.0	6	Non-Functioning

Jerry Creek

The Jerry Creek watershed lies on the south face of the Fleecer Mountains, which are characterized by geologies that are moderate to high sediment producers and have moderate to steep slopes. Jerry Creek flows 12.3 miles from its headwaters to the Big Hole River and its watershed is entirely within grazing allotments. The topography consists of a broad, gentle to moderately steep alluvial valley. Timber, roads and grazing have all affected area streams. 10.5% of Jerry Creek watershed has had timber harvested. Jerry Creek watershed has a high road density of 2.1 mi/mi^2.

In 1999, eleven survey sites were measured on tributaries to Jerry Creek and three sites were surveyed on the main stem of Jerry Creek. Of the fourteen sites measured, three were found to be functioning-at-risk due to grazing.

Jerry Up was measured just above the confluence with Flume Creek. It is classified as an E3a stream type and the reach was functioning. Of the seven sites on tributaries in the upper and middle sections of Jerry Creek only one (Long Tom Dn) was found to be functioning-at-risk. The reach above the survey site was heavily braided, and exhibited lots of bedload transport and bank erosion. Libby Creek is a tributary to Jerry Creek, entering from the northwest about two-thirds up the drainage. There are two stream surveys in Libby Creek, above and below harvest units. Libby Up (functioning) has a lot of large woody debris throughout the channel. The downed material often leads to localized bank cutting, and increased channel width in some locations. Libby Dn (functioning) is below the timber harvest, and just above the confluence with Jerry Creek. Delano Creek Up (functioning) enters Jerry Creek from the west in the upper portion of the watershed. Delano Dn (functioning) was moving large amounts of bedload, as gravel bars were buliding at many points in the channel. Hanson Creek is also a functioning tributary to Long Tom. It classifies as an E2a, and is generally a channel through a boulder field.

Jerry Mid is just above the confluence with Delano Creek and classifies as a C3b. Channel stabilities are in the fair/good range and the reach is functioning with a slight downward trend.

Jerry down is located below the confluence with Long Tom Creek. It classifies as an F3b stream type and is slightly entrenched. Channel stability ratings classified Jerry Creek in the fair range. Most of the valley bottom shows evidence of livestock use, but there is currently little direct effect on the channel. The valley bottom has a number of old channels on what is now the terrace (formerly a floodplain), but they

haven't flowed water in a long time. Also, old gravel piles suggest some sort of placer mining took place at some time. It is not obvious what caused the entrenchment of Jerry Creek but it doesn't seem that current activities are affecting the channel.

Three of the four tributaries surveyed on lower Jerry Creek were functioning and are generally stable stream types. Moores Creek enters Jerry Creek from the east just above the forest boundary. The stream channel is dry in July, and probably only flows during peak flow events. The greater w/d ratio seems to indicate that banks have been unstable in the past, but the cobble sized material in the channel is probably continuing to hold the stream together. This reach is functioning with a slight downward trend. Indian Creek enters Jerry from the east above Moores Creek. Of the two survey sites,the upper site is functioning, while Indian down is functioning-at-risk. It classifies as a B4a, but shows some signs of a greater downward trend. W/D ratio is increasing and is approaching the range for a C stream type. Field notes mention accelerated bank trampling. Parker Creek drains into Indian Creek and was found to be functioning.

Table 15. Jerry Creek and tributaries stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
Jerry Cr Upper	1999	E3a	E3a	10.2	3.6	89	Functioning
Libby Cr Up	1999	E3a	C3b	19	3.9	120	Functioning
Libby Cr Dn	1999	B3a	B3a	11.4	1.7	70	Functioning
Delano Cr Up	1999	A3	A3	9.1	1.9	60	Functioning
Delano Cr Dn	1999	A2	A3	7.3	1.3	100	Functioning
Long Tom trib	1999	E5	E5	6.2	5.4	5	Functioning
Long Tom Dn	1999	E4	C3/C4	22	2.4	62	Functioning-at-risk
Hanson Cr	1999	E2a	E2a	6.4	1.3	300	Functioning
Jerry Mid	1999	C3b/E3b	C3b/E3b	11.0	3	80	Functioning
Jerry Down	1999	B3	F3b	23.3	1.2	160	Functioning at risk
Moores Cr	1999	B3a	B3a	12.3	1.4	100	Functioning
Indian Cr Up	1999	B4a	B4a	7.9	1.6	28	Functioning
Indian Cr Dn	1999	E4a	B4a	11.8	1.9	8	Functioning-at-risk
Parker Cr	1999	E3a	E3a	6.4	4.7	60	Functioning

Johnson Creek

Johnson Creek is a major watershed on the southwestern slope of the Fleecer Mountains and drains directly into the Big Hole River. It is characterized by geologies

that are low and high sediment producers, and slopes that are low to moderate in steepness. Management activities are moderate, and grazing causes damage in a number of streams. Existing timber harvest was minimal (565 acres) and road density is moderate at 1.5 mi/mi^2. There were four stream surveys completed on Johnson Creek and its tributaries.

The survey site on Johnson Creek is below all the tributaries except Henley. It was classified as a B3a stream type and was functioning at the time of survey. The existing condition of the Johnson Creek stream channel was classified as o.k., with two tributaries classified as non-functioning. Potential risk to the channel is low due to the stability of the channel.

Of the three other sites surveyed, Dodgson (B3a) and Henley (E4a) Creeks were found to be functioning, while Patton Gulch (C4b) was non-functioning (field notes indicated heavy trampling in the survey area). Patton Gulch was visited again on 6-22-00 and used as an example for riparian monitoring. A reach below the road and below the surveyed reach was assessed. The stream was heavily trampled (48%) by livestock, and riparian shrubs were heavily browsed by livestock and wildlife. This reach is similar to the surveyed reach, and is also non-functioning. Inside the exclosure existing vegetation had made good recovery, and the channel was beginning to regain its dimensions.

Table 16. Johnson Creek and tributaries stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
Johnson Cr	1999	B3a	B3a	8.2	2.4	12	Functioning
Cat Cr	1999	E3a	E3a	8.1	9.5	58	Non-functioning
Dodgson Cr	1999	B3a	B3a	14.3	1.5	35	Functioning
Henley Cr	1999	E4a	E4a	8.4	4.2	38	Functioning
Patton Gulch	1999	E3a	C4b	13.1	6.1	28	Non-functioning

Bear Creek

Bear Creek is located on the west end of the Fleecer range. No stream flow, water quality or stream morphology data exists for this stream other than qualitative-level reconnaissance information. Past and present activities within the Bear Gulch watershed include roads and trails, housing development, livestock management and timber harvest. Of these, housing development, roads, trails and livestock use within stream corridors represent the greatest potential to affect water quality and stream function. For example, Forest Road 920 follows the main stem of Bear Gulch, within a 300 foot buffer for much of its length. Bear Creek watershed has a moderate road density of 1.8 mi/mi^2. Sediment input and encroachment of the floodplain are likely in

places. Housing development and livestock use also occur within riparian areas. Past timber harvest within the Bear Gulch watershed includes 44 acres of selection harvest, 7 acres of pre-commercial thinning, and 86 acres of regeneration harvest. These past timber management activities appear to have no appreciable effect on soil/water function including water yield, but may have reduced large woody recruitment in some riparian areas. Effects to the Big Hole River are likely minimal due to the presence of beaver dams in the lower reaches of Bear Gulch. These dams are very effective in trapping any sediment transported from upstream areas.

Moose Creek

Moose Creek is also located on the western end of the Fleecer range adjacent to the Mount Haggin Wildlife Management Area. Stream surveys completed in 1999 show the stream to be functioning as a E4/E3a stream type. Approximately five percent (106 acres) of the watershed has been harvested for timber.

Table 17. Moose Creek stream classification and morphology.

Stream Name	Year Of Survey	Potential Rosgen Channel Type	Existing Channel Type	W/D Ratio	Entrenchment Ratio	D50	Stream Function
Moose Cr Dn	1999	E4	E4	3.7	2.4	15	Functioning
Moose Cr Up	1999	E3a	E3a	6.9	2.8	140	Functioning

3. Reference Conditions

Reference watershed conditions in the Fleecer Watershed Assessment area reflect conditions existing prior to European settlement and the ensuing the impacts. Historically, streams would all function appropriate to the geology, climate, and natural disturbance processes. Water quality would not be impaired due to the impacts from; timber harvest, fire exclusion, rangeland grazing, abandoned mines, mine tailings, placer mining, agricultural practices, livestock grazing in riparian zones, acid mine drainage, roads, irrigation dams, roads and trails, crop production, septic systems and water diversions or dams. Beaver activity would most likely be more prevalent throughout the watershed helping to control sediment levels within the streams. The presence of natural fire would have kept conifers from encroaching riparian areas, allowing willow and aspen communities to remain healthy.

Background information for surface water quality in upper German Gulch prior to mining indicate sulfate levels at low concentrations of less than 30 mg/L, nitrate and selenium were below detection limits and arsenic and zinc were below 0.02 mg/L and 0.05 mg/L respectively. Copper concentrations ranged from less than 0.001 mg/L up to 0.4 mg/L indicating that copper levels naturally exceeded the chronic aquatic life standard and occasionally exceeded the acute aquatic life standards for copper prior to mining (Tetra Tech May 2009).

4. Synthesis and Interpretation of Information

The majority of streams within the watershed headwaters are in a functioning condition. Several streams in mid to lower elevations within the watershed have been the most effected and are non-functional or functioning-at-risk. North Fork Divide Creek and German Gulch are the two most impacted watersheds (Map 7. Hydrologic Reach Survey Locations).

Current management activities impacting water resources throughout the Fleecer watershed include livestock grazing, road building and maintenance, trails, timber harvest, mining and recreation. Sedimentation due to naturally unstable soil types throughout the watershed was probably an issue historically, but all the management actions listed above have increased sediment levels within the streams.

Timber harvest - has been minimal throughout the watershed and most areas are showing healthy re-growth. North Fork Divide Creek and Jerry Creek Watersheds have the highest percentage of timber harvested at 17 percent and 10 percent respectively. Some of this harvest converted portions of the watershed into transitional range.

Road - density is high in part of the watershed. The present road network includes 186 miles of roads, 46 road stream crossings, and 35 miles of roads within 300 feet of a stream. This is in addition to several primitive OHV trails throughout the area. Watersheds with the highest concentrations of roads are Jerry Creek (2.1 mi/mi^2), North Fork Divide (2.1 mi/mi^2), Bear Gulch (1.8 mi/mi^2), and Johnson Creek (1.5 mi/mi^2). The "Butte and Wise River Ranger District Transportation Analysis" has documented management recommendations for many roads/trails or sections of roads/trails within the analysis area. Streams with a "High" watershed risk rating were analyzed and ranked according to the highest priorities for watershed recommendations (step 6). Jerry Creek is listed as a Fish Key Watershed and should take priority for road/trail improvement projects.

Road conditions were surveyed in the summer of 2009. Tons of erosion per mile and tons of sediment entering streams are calculated for the entire length of road where roads are near streams and for only those segments near streams where roads are separated by some topographical barrier or great distance. The results and recommendations are detailed in APPENDIX A. Surveys were completed for:

Bear Creek, Road #920
Divide Creek, Roads #96 and #8505,
German Gulch Roads, #83, #8490 and #78094,,
Jerry Creek, Roads #83, #8251 and #1204,
Johnson Creek, Roads #1208 and #2480,
Moose Creek, Road #1000.

Mining - impacts several watersheds within the analysis area. German Gulch and Beefstraight Creek watersheds show the most damage due to mining. The USDA-FS goal for German Gulch is to close the mine and allow the area to return to its pre-mining multiple use state. Although the majority of the mine property has been reclaimed, there are several on-going operational, maintenance, and reclamation requirements that need to be met for specific facilities before final closure is complete. Environmental issues that need to be addressed include the long-term geochemical reactivity of mine wastes (including both acidity and the release of selenium to the environment from several potential mine sources), geotechnical stability of the pit high wall and leach pad dike, infiltration of precipitation and groundwater into the leach pad, and treatment and disposal of excess solution accumulating on the heap leach pad (Tetra Tech, Inc. May 2009).

The George Grant Chapter of Trout Unlimited did some watershed improvement projects on the Layton Purchase (downstream of Norton Gulch confluence) before they transferred the property to the Forest Service. That area could be used as a reference reach in determining what improvements could be made on the upper reaches of German Gulch damaged by placer mining.

Grazing - has negatively affected select areas within the Fleecer Watershed in the past. Implementing riparian grazing standards and monitoring allotments are critical to ensuring that stream functions move toward properly functioning conditions and that increased resource damage will not occur. Several riparian exclosures have recently been constructed to protect sensitive riparian areas (South Fork North Fork Divide, and Norton Creek).

In 2008, the Beaverhead-Deerlodge NF implemented an integrated stream/riparian monitoring program to determine the effects of grazing on riparian areas and establish trends. In addition to monitoring efforts, on the ground stream surveysneed to identify management actions to improve specific reaches.

A revised allotment Management Plan (AMP) for the Divide Creek Allotment was signed in 1998, with riparian use criteria established for bank alteration, utilization, stubble height and browse of woody species. AMP objectives include: improve or maintain the ecological status of upland range and riparian communities, achieve or maintain properly functioning stream conditions, and maintain grasslands, shrublands and upland aspen to maintain vegetative diversity and wildlife habitat through conifer reduction. Direction under this plan would improve riparian and stream conditions within the Divide Creek Watershed.

5. Recommendations

Reverse past management's negative effects to the watershed with a focus to:

- maintain healthy and vigorous riparian vegetation to continue bank stabilization and provide shade,
- ensure existing roads and trails function properly to keep sediment out of streams,
- improve road and trail crossings at streams, and
- continue to monitor and reclaim past mining sites.

Under the 2009 Beaverhead-Deerlodge Forest Plan, Jerry Creek and German Gulch were identified as Fish Key Watersheds, managed to conserve native fish populations. Implementing strategies to achieve aquatic goals of the 2009 Forest Plan (Table 4) will contribute to attaining desired stream functions within the watershed. Problem areas in these Fish Key Watersheds should be given priority over other projects.

Several roads and trails in the Butte and Wise River Ranger District Transportation Analysis were rated high for watershed risk. See APPENDIX B. Roads in watersheds of concern (high road density, for example) were given a higher priority. Jerry and North Fork Divide Creek watersheds both have a high road density of 2.1 mi/mi^2. Also see recommendations from the Road Sediment Survey in Appendix A. Road/trail recommendations are prioritized in the following table.

Table 18. Road and Trail recommendations listed from highest to lowest priority.

Road ID	Road Name	BMP	EMP	Recommendation	Remarks
78092	Beefstraight	0	0.5	Decommission	Stream crossing
8490	Norton Gulch	0	5.19	Resource Concerns	Maintenance/Drainage
UR4-56,58,74	Bull Ranch Area	0	.44	Partially Decommission	Dispersed camping sites, partial deco. to address riparian areas
UR02N12W12-02	Moose Cr	0	.841	Decommission	Parallels stream-resource damage
8505	Bull Ranch	0	5.7	Resource Concerns	Maintenance
96	Divide Cr Road	0	6.1	Resource Concerns	Maintenance
Trail ID	Name	BMP	EMP	Recommendation	Remarks
4095	Norton Gulch Trail	0	1.3	Resource Concerns	Relocation

The Range Program had several riparian/range improvement projects within the Butte and Wise River Ranger District grazing allotments. Highest priority was given to those projects near areas of concern. Grazing/riparian improvement recommendations are prioritized in the following table. The hydrologist on the forest

would like to see removal of the Bull Ranch Dam to return the stream and riparian meadows to historical conditions. Watershed improvement projects in German Gulch (from the mine downstream to the canyon) would greatly benefit habitat and stream function.

Table 19. Riparian/range improvement projects from highest to lowest priority.

Watershed	Stream Name	Project	Remarks
German Gulch	German Gulch	Restoration Projects	Improve watershed condition through various restoration projects
German Gulch	German Gulch	Install water tank	Alleviate grazing pressure in German Gulch (T3N, R10W, NW¼, Sec 34)
Jerry Creek	Indian Cr	Install water development	Alleviate grazing pressure in Indian Creek
North Fork Divide Creek	East Tributary	Install water development	Pull cattle away from Bull Ranch riparian areas (T2N, R9W, NE¼, Sec 19)
North Fork Divide Creek	North Fork	Pull wood to creek	West Bull Ranch protect riparian area
North Fork Divide Creek	North Fork	Pull wood to creek	East Bull Ranch protect riparian area
North Fork Divide Creek	North Fork	Remove Bull Ranch Dam	Return stream and riparian area to historical conditions
North Fork Divide Creek	South Fork	Reconstruct Indian Saddle Water Development	Pull cattle out of South Fork drainage up onto ridge pasture (T1N, R10W NE¼ Sec.3)
North Fork Divide Creek	South Fork	Fall trees along creek	Riparian protection above Beaver Dam Campground
North Fork Divide Creek	South Fork	Install hardened creek crossing	Garrison moves 20 -100 head of cattle across the creek ¼ mile upstream of Beaverdam CG
North Fork Divide Creek	North Fork	Fall trees along creek	Riparian protection below Beaverdam Campground
Johnson Creek	Cat Creek	Install water development	Alleviate grazing pressure in Cat Creek
Beefstraight Cr	Beaver Creek	Add LWD	Cows trampling creek bottom
Norton Creek	Norton Creek	Molek water development	Add water development on ridge north of Norton Creek pond (T3N, R10W, SE¼, Sec. 36)

6. References

Montana Department of Environmental Quality 2006. Circular DEQ-7, Montana Numeric Water Quality Standards, February.

Tetra Tech 2009. 2008 Water Quality Monitoring Summary, Beal Mountain Mine, Silver Bow County, Montana. Tetra Tech, Inc., Helena, Montana. March 2009.

Tetra Tech 2009. Engineering Evaluation / Cost Analysis, Beal Mountain Mine, Beaverhead-Deerlodge National Forest, Silver Bow County, Montana. Tetra Tech, Inc., Bozeman, Montana. May 2009.

Montana Department of Environmental Quality;
http://www.deq.state.mt.us/wqinfo/index.asp

Beaverhead Deerlodge National Forest. Hydrology/Riparian Existing Condition-Divide Creek Allotment. File code1950/2210. October 1997.

Butte Silverbow Water Department. Public Water Supply System, source Water Delineation and Assessment Report. February, 2003.

Big Hole Watershed Committee. Middle and Lower Big Hole Watershed TMDLs – Executive Summary, Montana Department of Environmental Quality. January 2009.
http://bhwc.org/TMDL.htm

C. AQUATIC SPECIES AND HABITAT

1. Characterization

The Fleecer Watershed Assessment area encompasses parts of 12 6th field hydrologic units or subwatersheds. That includes two fish key watersheds as described in the Revised Forest Plan. They are the Upper Jerry and German Gulch watersheds. *T*he 6th code HUCs are outlined by black lines and names of each are displayed on Map 8. Blue shading indicates Fish Key Watersheds denoted by the Revised Forest Plan. The Revised Forest Plan, Subbasin reports for bull trout, and westslope cutthroat trout Conservation Plans utilize the same 6th code HUC format so the aquatic species section utilizes those same units. Note these are different in area than the 7th code HUCs described in the watershed-hydrology section. Acres, miles of road and road density figures are not equivalent between the two reports.

Aquatic species can be found throughout the Fleecer Assessment area. Based on information provided by Montana Department of Fish, Wildlife and Parks and electrofishing surveys conducted by the Beaverhead-Deerlodge National Forest biologists, mottled sculpin, westslope cutthroat trout, eastern brook trout, hybrid westslope cutthroat trout and long nosed dace are present. Amphibians in the Fleecer Assessment area include western toad, spotted frog, Rocky Mountain tailed frog and long toed salamander.

Forest Plan Direction

Selected direction from the Revised Forest Plan specific to the two fish key watersheds is listed in the box below.

2009 Beaverhead Deerlodge Forest Plan Fish Key Watershed Direction

Goal: Populations of bull trout and westslope cutthroat trout exhibit numbers, life histories, age classes, recruitment levels, and reproductive characteristics representative of historic conditions.
Objective: Prepare and maintain a schedule for completing watershed analysis, with emphasis on key watersheds shown on page 58, or listed in Appendix H.
Standard 8: New projects will have a beneficial effect or no measurable negative effect on westslope cutthroat or bull trout in Fish Key Watersheds. Short term negative effects are acceptable if outweighed by long term benefits.
Standard 9: Restoration projects should correct existing problems, not mitigate effects created by proposed activities (WR 3).

2. Current Condition

Information about fish habitat, fish species and amphibian species is organized by 6th field HUC. See Map 8 for location of 6th field HUCs.

Divide-Fleecer 6th Field HUC - #100200041101

Aquatic Habitat

The Divide-Fleecer sixth code HUC lies at the easternmost extent of the Anaconda Range about 15 miles southwest of Butte. Burnt Mountain on the Continental Divide is at the northern border. Divide Creek and its branches generally flow east toward Interstate 15 until it turns sharply south and runs for nine miles to enter the Big Hole River near the town of Divide.

Table 20. Attributes of Divide Fleecer Sub-watershed

Watershed Attributes	Divide-Fleecer HUC #100200041101
Total Area (Acres)	19,418
Forest Service % ownership **Forest Service acres**	87% 16,700
BLM acres	582
State of Montana acres	580
Private Ownership acres	0
Elevation Range (feet)	6000-9436
Inventoried Roadless Area (percent based on USFS only)	5%
Miles of Road (USFS only)	44.4
Road Density (USFS only) in miles/square mile	2.0 mi./sq.mi.
# stream crossings (USFS only)	71
% of area in grazing Allotment (USFS only)	Not available
Miles of Perennial Stream	21.9
Miles Intermittent Stream	68.8
Miles of road within 300ft of streams	10
Timber Harvest % (USFS land only)	11%

Land uses include Beaver Dam National Forest campground (centrally located in the HUC), grazing, Off Highway Vehicle use, and water diversions. The South Fork Reservoir provides ample habitat for brook trout and westslope cutthroat. It has been presumed, until recently, that upstream fish movement from the reservoir into the SF of the North Fork (NF) of Divide Creek was prevented by a series of culverts designed to meet the City of Butte's needs for municipal water. Downstream movement into the Reservoir appears to always have been possible. Butte officials have occasionally treated the reservoir with herbicides to reduce/eliminate an abundance of aquatic vegetation. This has commonly resulted in some level of fish mortality. The presence of brook trout in the lower reaches of the South Fork (SF) of

the NF Divide immediately upstream of the reservoir suggest something may have recently changed to allow upstream fish passage; or someone has transported brook trout around the reservoir's passage barrier.

Stream habitat conditions are at less than potential throughout most of the Divide Creek drainage. Non-native competition from brook trout, impacts to channel morphology and sediment introduction combine to result in significant limitations on the native cutthroat fishery. There is a dense road network in the west-central headwaters, and roads parallel and cross most streams numerous times. There are 10 miles of road within 300 feet of perennial streams, and 71 stream crossings. Hydrologic function varies greatly throughout Divide Creek, mostly as a result of livestock impacts to channel configuration. Areas of past timber harvest do not currently affect stream flow or sediment.

The Draft TMDL for the lower and middle Big Hole watershed suggests none of the fine sediment targets were met, indicating dramatic changes in stream bed composition and channel morphology likely due to increased sediment loads and decreased sediment transport capacity. Biological data indicate Divide Creek does not fully support aquatic life. Geology likely contributes to high loads of fine sediment, but there are also human-related sources of sediment affecting riparian vegetation, channel morphology, and sediment loads. The primary anthropogenic sediment sources are grazing and irrigated agriculture, though roads and timber harvest are additional sources.

Fish Species

Historical data exists for only three reaches in the Divide-Fleecer area, and cutthroats were found in all. See MAP 9, Divide Fleecer Species Distribution. Cutthroat are still found in these three reaches and beyond, according to the more comprehensive 2001 survey of these streams. Since brook trout mostly inhabit the upper NF, their limited distribution may present opportunities for expanding cutthroat distribution in the headwaters of four streams if habitat and other factors are favorable.

Species listed in Tables 21 – 38 are abbreviated as follows:

Westslope Cutthroat Trout	WCT
Hybridized Trout	HYB
Eastern Brook Trout	EBT
Long nosed Dace	LND
Mottled Sculpin	MS
Columbia Spotted Frog	RaLu
Western Toad (Boreal)	BuBo
Rocky Mountain Tailed Frog	AsMo
Long toed salamander	AmMa

Table 21. Index of species present in the Divide-Fleecer 6th code HUC by stream and proposal for special management consideration

Stream Name	Fish Species Present*	Amphibian Species Present*	Special Management Consideration
NF, Divide	MS; WCT; EBT	Ralu, BuBo	None
Unnamed Trib to NF Divide	None	Ralu; BuBo	None
Unnamed Trib to SF of NF Divide	WCT; EBT	Ralu; BuBo	None
SF of NF Divide	WCT; EBT		None
SF Divide Creek	WCT	BuBo	None
Unnamed Trib to SF Divide	WCT		None

*See paragraph above for list of species names as abbreviated in table

Amphibian Species Distribution

During 2001 electrofishing inventories, a single western toad and several spotted frogs were observed in or along the NF of Divide Creek. In 2002, while conducting detailed habitat inventories, these same species were observed along the NF Divide, an unnamed tributary to the NF of Divide and on the South Fork of Divide Creek. Other western toad sightings are noted on the South Fork of the North Fork of Divide Creek. Also juvenile spotted frogs were found near the reservoir on the South Fork of Divide Creek which identifies an amphibian breeding area. These data suggest western toads and spotted frogs may be fairly well distributed within the Divide Creek drainage.

Table 22. Surveys in Divide Creek 6th Code HUC listed by dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Red Count	Amphibian	Other
North Fork Divide	2001;	1996; 2001	2001			2001*	
Unnamed Trib to NF Divide							
Unnamed Trib to SF of NF Divide	2001	2001	2001			2001*	
SF of NF Divide	2001	2001	2001			2001*	
South Fork Divide Creek	1997; 2001	1997; 2001	2001			2001*	
Unnamed Trib to SF Divide		2001	2001			2001*	

Survey not designed specifically for amphibians. However, supervisory biologists and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin Assessments

Individual Stream descriptions

North Fork Divide Creek - The North Fork of Divide Creek is a tributary to Divide Creek in the Big Hole River Drainage. Maps depict it as a perennial stream flowing first westerly then northerly for approximately 9.6 miles to its headwaters. The lower-most 4.3 miles primarily flow through private ground, except for a segment approximately 1.0 mile long, which traverses a corner of National Forest.
[dcd1]

Electrofishing inventories were initiated 5.3 miles upstream from the mouth, and were repeated at regular intervals up to the headwaters. Mottled sculpin, eastern brook trout and westslope cutthroat trout are the fish species present, however brook trout are very abundant and for all intent and purposes represent the fishery of this stream. The surveys in 2001 found brook trout throughout most of the inventoried length of the NF Divide Creek. They almost certainly extend downstream of where sampling was conducted – presumably well below the Forest Boundary. Mottled sculpin were captured only in the lower-most reach. Their lack of occurrence upstream may be related to channel characteristics, where the substrate is largely comprised of sand and other fine materials. It seems likely that sculpin exist to some extent downstream of public land, however that has not been verified.

Westslope cutthroat occur only in close proximity to the confluence of the North Fork's largest tributary, the SF of Divide Creek (See Map 9) probably representing a segment of that stream's resident population; since there are no barriers separating the two. A 1996 genetic sample of 5 WCT suggests these fish are 100% genetically pure. Based on distribution data, brook trout have a stronghold in this creek, and efforts to remove them to foster cutthroat populations must consider the logistics for treating a significant length of stream.

South Fork Divide (South Fork , tributary to North Fork) - The South Fork Divide Creek flow originates on Fleecer Ridge and flows north for 1.5 miles, then turns east where it joins with an unnamed creek, passes the Beaver Dam campground, and continues to its confluence with the NF Divide Creek.

Cutthroat and brook trout coexist throughout most of the SF Divide Creek. Slight hybridization has been detected in this population. Despite a 21 fish sample showing 100% genetically pure WCT in 2001, two neighboring samples of 9 fish and 21 fish resulted in 95% and 97% WCT genetics respectively. It may be possible to eliminate this brook trout population, and perhaps link cutthroat in this creek with a small population up the unnamed tributary. There may also be a possibility of expanding

cutthroat upstream in the marginal habitat of the headwaters by making habitat improvements, such as creating deeper pools, and eliminating brook trout.

Unnamed tributary to South Fork Divide Creek (mouth near Beaverdam) - This unnamed creek is a tributary to the South Fork of Divide Creek. Topographical maps depict it as a perennial stream approximately 2.1 miles in length, however, (at least in drought years recently), its perennial length is closer to 1.6 miles. Westslope cutthroat were the only fish in this stream, however, they seem to occur sporadically and persist in low abundance. Based on analysis of 3 fish, they are 100% genetically pure WCT.

Fish were absent 0.15 miles upstream of the mouth, but present 0.6 miles further upstream, where 3 westslope cutthroat trout ranging from 4.2 to 4.8 inches long were captured. Stream flow diminished upstream of reach 2, such that fish could no longer be supported at Reach 3, 1.25 miles from the mouth. At stream mile 1.6 the channel was completely dry. Thus, it seems only marginally suitable fisheries habitat is provided over approximately 1 mile of this stream. The length of suitable habitat and its quality could increase during non-drought years.

Observations suggest bank disturbance by livestock is significantly affecting stream channel integrity throughout the inventoried reaches. Channel instability due to livestock was estimated to occur throughout 70% of inventoried reach 1 (see Map 9)

SF NF Divide Creek (SF NF Divide on the quad)-enters SF Reservoir - The South Fork North Fork runs three miles from the high northeast slopes of Mt. Fleecer to the South Fork Reservoir, where approximately 90% of the water is diverted for Butte. The 2001 survey crew found the creek dry below the reservoir[dcd2]

The upper reaches have little water, making for shallow pools and limited suitable fish habitat. There is ample conifer shade, some LWD, algae, and spawning gravel, but poor over-wintering habitat and heavy cattle trampling of the banks. Nevertheless, 21 cutthroats were captured at the upper end of their distribution in this habitat, and these most likely survive in the few deeper pools. The creek's fish habitat improves as it descends, and cutthroat trout are found. Just above the reservoir the creek is about 1.1 m wide and a B3 stream type. Cattle trampling has made the channel wide and shallow. Pools are small and of poor quality, averaging 15 cm. deep, with one 25 cm. deep.

Cutthroat trout have a reasonable stronghold in the South Fork North Fork, as they have exclusive occupancy over brook trout for one mile above a cascade barrier just above the confluence with the unnamed creek. Two genetic samples suggest WCT are 100% genetically pure fish, the first a 3 fish sample from 1997 and later a 27 fish sample from 2001. Brook trout coexist with cutthroats from this point downstream to the reservoir. No fish sampling was done in the reservoir, as it lies on private land.

An opportunity may exist for expanding the cutthroat population for over a mile upstream in the fishless portion of the South Fork North Fork, but habitat appears limited by low flows and shallow pools for over-wintering. Another opportunity may exist for securing the link with the cutthroat in the unnamed creek. The small number of brook trout above the reservoir may be a threat to the cutthroat strongholds above the barriers upstream. It will be difficult to eliminate brook trout if they freely move upstream from the reservoir. This would also thwart efforts to link the cutthroat populations in the South Fork North Fork and unnamed creek, as both cutthroat populations are protected by barriers that isolate them from brook trout and each other.

Unnamed Tributary to SF of NF Divide Creek - The habitat in this stream was surveyed extensively in 2002. That information is summarized here. This creek varies between the A and B stream gradients over its length. Most habitat parameters remain marginal throughout the system mainly due to mining and grazing impacts. Heavy ungulate presence has caused considerable bank erosion and instability, resulting in sedimentation that varies from slight to "choking." Surveyors noted heavy cattle grazing has reduced the grass to "nothing," and while better over-wintering habitat exists, increased acidity is evident. In addition, evidence of past mining activity exists in and along most of the stream's length, and this may account for increased acidity. As the creek approaches the confluence with the South Fork, it has only widened to 1.1 m from 0.9 m in the headwaters over 1.5 miles away, despite extensive trampling along most of it. The pools average 0.25 m deep, with good rock scour and LWD.

Three short, steep gradients lie at the head, about midway and near the confluence. In conjunction with these steep reaches are several natural barriers or features limiting upstream fish movement. As a result, fish only occupy the lower portion of the stream. A perched culvert prevents upstream expansion of the WCT population into approximately 1.5 miles of fishless stream. Habitat conditions in the fishless reach offer some suitable habitat. This culvert should be replaced or removed. Thus, this set of barriers provides a good opportunity for securing cutthroat if they can be established and this presents an opportunity to replicate a secure headwater cutthroat population above it.

The only fish found in this creek in both 1997 and 2001 surveys are cutthroat. Genetic samples were taken on all 20 fish. The genetic results suggest 99.6% WCT and 0.4% rainbow trout. Cutthroat distribution extends approximately three-fourths of a mile up from the junction with the SF.

CrazySwede 6 Field HUC - # 100200041103

Aquatic Habitat

The CrazySwede 6 Field HUC is located 12 miles southwest of Butte, MT. Most of the sub-watershed is composed of private land while the extreme west and east corners are USFS lands. Only the western corner is in the USFS portion of the Fleecer Watershed Assessment area.

Table 23. Attributes of Divide Fleecer Subwatershed

Watershed Attributes	Crazy Swede HUC #100200041103
Total Area	14,583
Forest Service % ownership Forest Service acres	26% 3,773
BLM acres	4
State of Montana acres	668
Private Ownership acres	8,980
Elevation Range (feet)	6000-8500
Inventoried Roadless Area (percent based on USFS only)	10.7
Miles of Road (USFS only)	9.3
Road Density (USFS only) in miles/square mile	1.7 mi/sqmi
# stream crossings (USFS only)	0 Perennial, 8 Intermittent
% of area in grazing Allotment (USFS only)	99%
Miles of Perennial Stream	2.2
Miles Intermittent Stream	6.5
Miles of road within 300ft of streams	0
Timber Harvest % (USFS land only)	8%

Current USFS land uses include recreational activities associated with a road and multiple-use trail system, grazing, and logging. The western unit of USFS land contains the most roads but road density is quite variable 40% of the USFS lacks roads, 15% has a low road density (<1 mi/mi^2), 20% has a moderate road density (1.1-2 mi/mi^2), and 25% has a high density (>2 mi/mi^2) of roads.

No amphibian, habitat, hydrology, or fish data have ever been collected for this HUC. Given this lack of data, it is not possible to propose WCT conservation projects.

DrySawmill 6 Field HUC - #100200041205

Aquatic Habitat

The DrySawmill 6 HUC is located 5 miles east of Wise River, MT. The eastern border of the HUC is formed by relatively low elevation land that includes portions of the Fleecer Mt. Wildlife Management Area and Humbug Spires. The remaining borders are formed by a variety of USFS, BLM, and private lands.

Table 24. Attributes of Dry Sawmill Subwatershed

Watershed Attributes	Dry Sawmill HUC #100200041205
Total Area	23,156
Forest Service % ownership Forest Service acres	38% 8,834
BLM acres	6,487
State of Montana acres	3,327
Private Ownership acres	4,639
Elevation Range (feet)	5,800-9,500
Inventoried Roadless Area (percent based on USFS only)	63.8%
Miles of Road (USFS only)	6
Road Density (USFS only) in miles/square mile	.9 mi/sqmi
# stream crossings (USFS only)	1 Perennial, 2 Intermittent
% of area in grazing Allotment (USFS only)	90%
Miles of Perennial Stream	7
Miles Intermittent Stream	24.9
Miles of road within 300ft of streams	.1
Timber Harvest % (USFS land only)	

Multiple-use trails and roads exist throughout the HUC: 55% of the USFS lacks roads, 34% has a low road density (<1 mi/mi^2), 10% has a moderate road density (1.1-2 mi/mi^2), and 1% has a high density (>2 mi/mi^2) of roads. Roads parallel Charcoal Creek and the Big Hole River. Current USFS land uses include recreational activities associated with an extensive road and trail system and grazing.

The Draft TMDL document for the lower and middle Big Hole River says that despite road encroachment on the stream and biological supplemental indicators not being met, bank erosion was limited, riparian vegetation was near its potential, fish habitat was in good condition, and anthropogenic sources appeared minor. Site assessment notes indicate elevated fine sediment is likely naturally occurring.

Fish surveys have been conducted in the HUC on Charcoal Gulch and Charcoal Creek, but USFS databases lack both fish numbers and species identifications. Leffler Creek and Sheep Gulch have not been surveyed for fish. The portion of the Big Hole River within Dry Sawmill is entirely off National Forest. No amphibian data has been collected for this HUC.

Given the lack of data available for this HUC, it is not possible to consider aquatic conservation projects in Dry Sawmill.

Lower Jerry 6th Field HUC - #100200041202

Aquatic Habitat

The Lower Jerry sub-watershed is located near the eastern extent of the Anaconda Range just north and east of the town, Wise River. It contains the lower reaches of Jerry Creek plus several tributaries. Coniferous forest covers 84% of the 6HUC, with sagebrush/grasslands covering most of the remaining acres.

Table 25. Attributes of Lower Jerry (JerryLow) Subwatershed

Watershed Attributes	Lower Jerry HUC #100200041202
Total Area	12,242
Forest Service % ownership Forest Service acres	77% 9,462
BLM acres	14
State of Montana acres	2
Private Ownership acres	0
Elevation Range (feet)	5,800-9,400
Inventoried Roadless Area (percent based on USFS only)	69%
Miles of Road (USFS only)	22
Road Density (USFS only) in miles/square mile	1.2 mi./sq.mi.
# stream crossings (USFS only)	9 Perennial
% of area in grazing Allotment (USFS only)	100%
Miles of Perennial Stream	13
Miles Intermittent Stream	19
Miles of road within 300ft of streams	3
Timber Harvest % (USFS land only)	6%

Current USFS land uses include recreational of the road and trail system, grazing, logging and mining. The Lower Jerry sub-watershed contains five active mining claims. Four of these consist of exposed prospects with minimal activity. The status

of the other claim is unknown. A series of patented mining claims lie along an intermittent tributary of Parker Creek. The status of these claims is unknown.

Road density is variable. Thirteen percent of the 6HUC contains no roads, 35% has a low road density (<1 mi/mi^2), 36% has a moderate density (1.1-2 mi/mi^2) of roads, and 17% of the 6HUC has a high density (>2 mi/mi^2) of roads. A Forest-wide inventory of culverts on B-D NF, in 2002, identified only a single culvert that may block upstream movement by fish. We don't have fish population data for this stream.

Table 26. Attributes of the Lower Jerry Road Network[++]

Road Type	Total Miles	Miles Within Riparian	# Stream Crossing Structures (Per./Int)*
Paved	0	0	0
Gravel	2.5	1.9	4/2
Native Surface	19.6	1.4	1/17
Total	22.1	3.3	5/19

[++]: Pertains to NFS lands only.
**: culvert numbers are a result of a GIS exercise, intersecting road and stream layers.*

Stream habitat conditions are at less than potential in portions of this sub-watershed, though most reaches have functioning stream channels. According to the DRAFT TMDL (State DEQ) for the lower and middle Big Hole watershed, some assessment reaches meet sediment and morphological targets, but in other reaches, the high width/depth ratios, percentage of fine sediment, and altered channel morphology suggest a decrease in sediment transport capacity and increased sediment supply. In addition to impairing the macro-invertebrate and periphyton communities, changes in sediment supply and channel form reduce fish habitat quality. The primary anthropogenic source of sediment in the watershed is rangeland grazing, though roads, timber harvest and rural residential development are additional sources. This indicates a link between habitat impairment and excess sediment in Jerry Creek. Nutrient concentrations met water quality targets, while chlorophyll concentrations exceed the target at the upper site in 2005 and at both sites in 2006. Supplemental indicators suggest a reduction in understory shrub cover and an increase in bare ground, which may lead to increased nutrient inputs. Upper Jerry Creek was one of the most heavily used livestock grazing areas observed in this study.

Fish Species

Fish sampling is limited in this sub-watershed to a few surveys on Jerry, Indian, Spruce, and Moores creeks. See MAP 10. Lower Jerry Species Distribution.

Table 27. Index Of Species Present In Lower Jerry 6th Code HUC By Stream And Proposal For Special Management Consideration.

Stream Name	Fish Species Present*	Amphibian Species present*	Other Species of Concern*	Special Management Consideration

Jerry Cr.	WCT, EBT, HYB			
Indian Cr.	WCT, HYB,			
Moores Cr.				
Spruce Cr.	WCT			WCT conservation Population; N=15, 100% WCT
LaDucet Cr.				

*See Page 46 for list of species names as abbreviated in table

Table 28. Surveys In Lower Jerry 6th Code HUC Listed By Dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Red Count	Amphibian	Other
Jerry Cr.				1986			
Indian Cr.	1995 (2x)	1995		1995			Hydro 99, temp 96
Parker Cr							Hydro 99
Moores Cr.	1995						Hydro 99
Spruce Cr.	1999	1999					
LaDucet Cr.							

* *Survey not designed specifically for amphibians. However, supervisory biologists and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin Assessments*

Amphibian Species Distribution

Our data contains no records of amphibian observations in this sub-watershed.

Individual Stream Descriptions

Jerry Creek - Jerry Creek is tributary to the Big Hole River, confluencing at river mile 61. In this sub-watershed, it flows for about 7 kilometers from its confluence with the Big Hole River to the mouth of Indian Creek. Four named tributaries flow into Jerry Creek within the portion of the stream in this sub-watershed.

General habitat information was collected on almost 11 miles of Jerry Creek, from the Forest Boundary to the headwaters, in 1974. Within this sub-watershed, Jerry Creek contains 10% pools, 30% riffles and 50% runs. Substrate consists primarily of rubble-sized material, with only 5% fines (<0.1"). Streambank stability was estimated at 70%. Dewatering was listed as the primary limiting factor. A 1986 hollow core sediment sample, located about 1.5 km above its mouth contained almost 25% fine sediment.

A 325' single-pass electrofishing effort, conducted in conjunction with the 1974 habitat assessment, yielded 9 WCT (2.9-10.5") and 3 EBT (4.4-5.4").

Indian Creek - Indian Creek flows perennially for over 4 kilometers before flowing into Jerry Creek at stream kilometer 7.5. It contains one named tributary, Parker Creek that enters Indian Creek at about stream kilometer 2.8.

The only available fish data comes from two, single-pass electrofishing surveys conducted in 1996. Cutthroat trout were the only fish captured in both reaches. Eight fish, collected from the downstream reach, were determined to contain alleles of both WCT (85.8%) and RBT (14.2%). A single fish (the only fish captured) from the upstream reach contained alleles of only WCT. Further testing is warranted to determine the extent of hybridization in Indian Creek and if there is physical separation between the hybridized population and a possible remnant pure population.

Table 29. Summary of electro-fish inventoried stream segments on Indian Creek

	1995 (1-pass)	1995 (1-pass)
Stream meter post	2440-2602	3847-3999
Fish species	HYB	WCT
Would support Fish	Yes	Yes
Amphibian Species	None noted	None noted

Parker Creek

The forest road 7448 crossing of Parker Creek is in disrepair and captures some of the stream flow. Upstream of this point, the channel is in poor condition and has no stream flow in areas. Multiple channels exist and possibly some placer mining has contributed to the rough condition of the stream channel. Grazing and timber management are having an impact in this small drainage as well.

Moores Creek - Moores Creek flows into Jerry Creek from the east at stream kilometer 5.5. The 1:2,4000 coverage depicts perennial flow for almost four kilometers.[dcd3]

Almost 200 meters of Moores Creek, about 1.5 km upstream of the mouth, was electrofished in 1996. No fish were found. No hard-copy files were available to cross check habitat suitability in the survey reach. An additional look at Moores Creek is warranted to definitively assess fish presence and habitat suitability.

Table 30. Summary of e-fish inventoried stream segments on Moores Creek

	1995 (spot check)
Stream meter post	1408-1603
Fish species	None found
Would support Fish	Yes
Amphibian Species	None noted

Spruce Creek - Spruce Creek flows perennially for about 4.5 km before entering Jerry Creek, at km 5.5, from the northwest. The downstream 0.5 km flows across private land. One survey of this stream took place in 1999. Fifteen WCT were captured and a genetic sample shows fish as 100% genetically pure. No other data is available for this survey. Based on visual and electrofishing surveys in 2009, WCT are the only salmonid species in Spruce Creek. WCT occupy the stream at least from the National Forest boundary near km post 0.5 up to the upstream limit of distribution near km post 4.0. Irrigation of the lower portion of stream on private property may have limited non native salmonid invasion of Spruce Creek.

LaDucet Creek - LaDucet Creek flows perennially for less than 1 kilometer before entering Jerry Creek at stream km 4.7. Almost the entire length of perennial stream channel lies on private land. No information is available for this stream. Given the genetic make-up of cutthroat trout in Jerry Creek, and the minimal quantity of habitat, it's unlikely LaDucet Creek supports WCT.

Upper Jerry 6th Code HUC - #100200041201

Aquatic Habitat

The Upper Jerry sub-watershed is located near the eastern extent of the Anaconda Range just north and east of Wise River. It contains the headwaters of Jerry Creek plus several tributaries entering from the west.

Table 31. Physical Attributes of Upper Jerry (JerryUP) Sub-Watershed

Physical Attributes	Upper Jerry HUC #100200041201
Total Area	*17,580 or 27.5 square miles*
Forest Service % ownership Forest Service acres	99% 17371
BLM acres	0
State of Montana acres	<1%
Private Ownership acres	<1%
Elevation Range (feet)	6,100-9,200
Inventoried Roadless Area (percent based on USFS only)	56%
Miles of Road (USFS only)	27
Road Density (USFS only) in miles/square mile	1.0 mi./sq.mi.
# stream crossings (USFS only)	14 (6 culverts prevent psg)
% of area in grazing Allotment (USFS only)	97%
Miles of Perennial Stream	30
Miles Intermittent Stream	32
Miles of road within 300ft of streams	7.1
Timber Harvest % (USFS land only)	10%

Six active mining claims lie in this subwatershed. One claim has been active in the past but only maintenance occurs now. Disturbance is limited on the others. Twenty-three percent of the 6HUC contains no roads, 33% has a low road density (<1 mi/mi^2), 33% has a moderate density (1.1-2 mi/mi^2) of roads, and 10% of the 6HUC has a high density (>2 mi/mi^2) of roads. A Forest-wide inventory of culverts on B-D NF, in 2002, identified 6 culverts on known fish-bearing streams in the drainage that preclude upstream fish passage.

Table 32. Attributes of the Road Network[++]

Road Type	Total Miles	Miles Within Riparian	# Stream Crossing Structures (Per./Int)
Native Surface	27.4	4.0	15/27
Total	27.4	4.0	15/27

[++]*: Pertains to NFS lands only.*

Jerry Creek reaches the Big Hole River at river kilometer 98, about two miles downstream of Wise River, MT. The Upper Jerry sub-watershed includes Jerry Creek upstream of the mouth of Indian Creek. There are almost 30 miles of perennial streams, plus another 32 miles of intermittent channel. Topography within the 6HUC is fairly steep, with narrow canyon bottoms.

Stream habitat conditions are at less than potential in portions of this sub-watershed, although most reaches do have functioning stream channels.

Fish Species

Upper Jerry Creek, Delano Creek and Libby Creek have been extensively sampled for fish presence and relative abundance. Some data exists for Long Tom Creek and its tributaries. Westslope cutthroat trout, eastern brook trout and WCT hybrids inhabit portions of most streams in this sub-watershed. See Map 11. Upper Jerry Fish Species Distribution.

Table 33. Index of species present by stream and proposal for special management consideration.

Stream Name	Fish Species Present*	Amphibian Species present*	Special Management Consideration
Jerry Cr.	WCT, EBT, HYB		WCT cons. Pop.
Jerry Cr. trib.	WCT, EBT		WCT cons. Pop.
Flume Cr.	WCT		WCT cons. Pop.
Delano Cr.	WCT, EBT		WCT cons. Pop.
Libby Cr.	WCT, EBT		WCT cons. Pop.
Long Tom Cr.	HYB, LND	RaLu	
Granulated Cr.			

Hanson Cr.			
Labree Cr.			
Long Tom Cr trib.			

*See Page 46 for list of species names as abbreviated in table

Table 34. Surveys listed by Dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Red Count	Amphibian	Other
Jerry Cr.	87, 93, 94, 95, 96	93, 96	87	87, 95			Hydro 99
Jerry Cr. trib.	95			95			Hydro 99
Flume Cr.	95		03				Hydro 99
Delano Cr.	87, 88, 93-95, 97-99	87, 93	87, 03	87, 93			Hydro 99
Libby Cr.	87, 88, 97-99		87	87			Flow 88, hydro 99
Long Tom Cr.	92	92					Hydro 99
Granulated Cr.	95						Hydro 99
Hanson Cr.	92						Hydro 99
Labree Cr.							
Long Tom Cr trib.							Hydro 99

Survey not designed specifically for amphibians. However, supervisory biologists and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin Assessments.

Amphibian Species Distribution

Two sightings of spotted frogs are reported in Long Tom Creek in 1996. One sighting was in New Meadows, the other was in Fish Lake. Western toadlets have also been observed in Fish Lake, hence this is considered a western toad breeding area. Also a 2003 observation of adult and tadpole spotted frogs in Flume Creek. Fish Lake observations in 2009 include larval long toed salamanders in addition to the previously observed western toad and spotted frogs.

Individual Stream Descriptions

Jerry Creek - Jerry Creek is tributary to the Big Hole River, confluencing at river mile 61. In this sub-watershed, it flows for over 12 km from its headwaters to its confluence with Indian Creek, at stream km 7.5. Four named, and one unnamed tributary flow into Jerry Creek within the portion of the stream in this sub-watershed.

[dcd4]
General instream habitat data was collected on nearly two kilometers of Jerry Creek in 1987, above and below the mouth of Libby Creek. Pools comprised 36% of the

surveyed reach, riffles 34%, runs 21% and pocket water made up 9% of the length of the reach. Most (59%) of the pool habitat is formed by lateral scour with much (32%) of the remaining habitat being formed by plunges. The vast majority of pools are low quality (79% class 3). Embeddedness was measured 51%, about 0.4 km downstream of the lower boundary of the habitat survey.

General habitat information was collected, in 6 reaches, on almost 11 miles of Jerry Creek, from the Forest Boundary to the headwaters, in 1974. Although very general in nature, this survey descibes a gravel/rubble dominated stream with 5-20% pools and generally good streambank stability. Livestock grazing, logging and road construction were noted as limiting factors. Electrofishing efforts in each reach documented a stream supporting both WCT and EBT throughout the entire length of the stream, with WCT the dominant species.

Fish populations in Jerry Creek have been extensively sampled. MFISH lists 10 separate sample locations/times in this sub-watershed. Results of genetic samples (1996) from the lower end of the 6HUC indicate a population of WCT hybridized with rainbow trout (82.5% WCT & 17.5% RBT). These results are consistent with those obtained in nearby tributary streams (Long Tom and Indian creeks). An 8-fish sample obtained in 1993, upstream of a possible barrier culvert about 8 km upstream of the 1996 sample location, contained fish with alleles characteristic of only WCT.

Brad Shepard (MFWP) published a paper discussing factors that appear to influence relative abundance of EBT and WCT in three headwater tributaries of the upper Jerry Creek drainage.

Based on available distribution data, EBT comprise a greater proportion of the total fish population in the downstream reaches of Jerry Creek, with WCT becoming relatively more numerous in upstream reaches.

Only a single sample site is listed upstream of the culvert on road #83. This culvert was surveyed in 2002 and modeled to be a complete barrier to upstream fish movement, but Shepard states he sampled EBT above it. The 1993 sample found only WCT. Based on Shepards observation, B-D NF fisheries personnel visited this reach on 8/5/2003. We spot shocked a 110-meter reach immediately upstream of the culvert and captured a total of 28 WCT.

We also verified the upstream (km 19.4) culvert barrier. It needs to be replaced with a road/stream crossing structure that will allow upstream fish passage and bedload transport. Channel conditions upstream of this pipe have been impacted by historic placer mining upstream of the upper culvert resulting in simplified habitat and channel instability. Livestock grazing may also be contributing to the current instability. One result of these impacts is excess bedload deposition at various locations in the channel upstream of the culvert crossing.

Flume Creek - Flume Creek flows perennially for about 2.5 kilometers to its confluence with Jerry Creek at km 17.2. [dcd5]

WCT were observed in Flume Creek in 1995 below where road #8251 crosses the stream (~km 0.8). Analysis of data gathered in 2002 resulted in a preliminary determination that the culvert constitutes a complete barrier to upstream movement by fish. However, the crew surveying the pipe observed fish above the culvert. Additional sampling should be done to determine fish species composition, distribution and relative abundance in Flume Creek. Fish presence (apparent WCT), upstream of the culvert, was verified on 8/7/03. We also observed both adult and tadpole spotted frogs, immediately upstream of the culvert and bivalves of the family *Sphaeriidae*.

Portions of Flume Creek above the road # 8251 culvert were historically placer mined. While the channel is now stable, habitat is somewhat simplified. This stream flows most of its length through a relatively young LPP forest. Instream LWD is sparse and contributes very little to pool formation or complexity. Scour associated with boulder forms most of the pools. Overhead cover and complexity is poor in most pools. Fish densities appear low – highest near the bottom and decreasing dramatically above the road crossing. Most fish I observed above the culvert were YOY and no fish exceeded 75mm.

Jerry Creek, Tributary #1 - This unnamed tributary flows perennially for about 2 kilometers before emptying into Jerry Creek at about km 16. [dcd6]

Both EBT and WCT were visually observed about 200 meters upstream of the mouth in 1995. However, a single pass electrofishing effort just a couple hundred meters above failed to document fish presence. Additional survey work is warranted to determine fish presence, distribution and species composition.

Delano Creek - Delano Creek flows perennially for over 2 kilometers before confluencing with Jerry Creek at stream km 15.9. [dcd7]

Results of a 1987 habitat survey, covering almost 2 kilometers, describe a stream containing 31% pools, 38% riffles, 11% runs and 20% pocket water. The surveyors tallied 100 pieces of LWD/mile in the reach. Most pool habitat (79%) was associated with

LWD plunges with lateral scour forming nearly all the rest. Almost all (98%) of pools were rated as "class 3" (Platts, 1983). Embeddedness, measured at the same time, was calculated at 50%.

Delano Creek loses all surface flow before reaching Jerry Creek, on private land. Recent flow events have deposited large amounts of bedload material in the channel near the private/Forest property boundary, filling the channel completely. Factors possibly affecting the channel include some areas of historic placer mining and some localized cattle impacts. Pool quantity and quality are low. Very few pools have a residual maximum depth exceeding 30cm.

Similarly the Draft TMDL for the lower and middle Big Hole watershed suggests historic timber harvest likely increased sediment loads at one time, despite the buffer along the stream channel. In addition, ongoing grazing near the mouth is impacting a short reach of Delano Creek just upstream of the confluence with Jerry Creek. Biological indices indicate Delano Creek is not fully supporting aquatic life. The primary anthropogenic source of sediment within the watershed is grazing, though roads and silviculture are additional sources.

Just upstream of the private land, about 0.2 km above the confluence of Delano and Jerry creeks, WCT was the dominant species in all samples, comprising between 90-100% of fish captured. Estimated densities ranged from 35-52/100 meters. Densities of EBT in these samples varied from 0-4/100 meters.

The culvert, under road #83, constitutes a barrier to upstream fish movement. Results from a 2002 culvert inventory also indicate this pipe prevents all upstream fish passage. Upstream of this barrier culvert, WCT was the only species captured. Estimated densities in this reach ranged from 21-47/100 meters.

Fish were collected for genetic analysis twice from this reach – in 1987 and 1993. Although sample sizes were small, eight and four in 1987 and 1993, respectively, results from both were tentatively determined to be from a genetically pure population of WCT.

Libby Creek - Libby Creek flows perennially for about 3.5 kilometers before entering Jerry Creek at km 12.1. Fish distribution appears to extend only up to about km 1.2, where road #83 crosses the stream. Limited sampling upstream of this point has failed to document fish presence.

Initial habitat surveys were conducted on two kilometers of Libby creek in 1987. These surveys depict a stream containing about 28% pools, 40% riffles, 4% runs and 28% pocket water. Virtually all pools were classified as "class 3" (Platts, 1983). Large woody debris is abundant, averaging over 600 pieces/mile in the lower reach and 380 pieces/mile in the upper reach. Plunges and dams associated with the LWD accounts

for most of the pool habitat. Embeddedness, measured at three sites in 1987, ranged from 54-64%. Habitat data collected by Shepard, in conjunction with his electrofishing samples, described a stream with an average wetted width of 3.4 meters and a width/depth ratio of 14/1. Pools comprised 42% of the length of his survey reach. Sand and silt-sized material was visually estimated to comprise 30% of the substrate. Large woody debris was very abundant in the sample reach.

[dcd8]
Most fish data in Libby Creek comes from B. Shepards surveys. He electrofished one reach, located about 0.4 km above the mouth, on four occasions between 1988 and 1999. His electrofishing samples indicate Libby Creek is predominately populated with EBT, with WCT comprising 9-22% of total fish population. EBT numbers averaged between 45-70/100 meters. Estimated WCT densities ranged between 7-20/100 meters. It appears the upstream extent of fish distribution is the culvert under road #83, at about km 1.2. Shepard sampled above this culvert in 1999 and found no fish. Further sampling should occur to verify the status of this portion of Libby Creek and to assess the potential of this stream segment to support WCT.

Long Tom Creek - Long Tom Creek flows for over 12 kilometers before joining with Jerry Creek at stream kilometer 9.8. It has three tributaries entering from the west; Granulated and Hanson creeks, and an unnamed tributary, plus Labree Creek, flowing from the northeast. It also contains two lakes in its headwaters.

Sampling in Long Tom Creek and its tributaries is limited to a few fish distribution and hydrologic surveys.

Fish surveys conducted in 1992 documented a population of cutthroat trout near the mouth of Hanson Creek (km 5.1). Analysis of 10-fish sample from this reach determined these fish are slightly hybridized (96.6% WCT, 3.4% RBT) with introduced rainbow trout. Longnose dace were found in this reach and their distribution extended another 2.5 kilometers upstream.

The two lakes in the headwaters of Long Tom Creek are listed in the B-D NF as supporting cutthroat trout although no records exist of their having been planted. They do not appear to have surface connection with Long Tom Creek so it's probable the fish were stocked at some point.

No fish were found in the Hanson ('92) or Granulated ('95) creek surveys. It is unlikely these streams or Labree Creek contain fish due to steepness. The unnamed tributary may contain habitat suitable for fish contains one-half mile of potentially suitable habitat upstream of a high gradient section precluding fish access. Additional surveys should verify suitability of this segment to support fish. The low gradient portion of the unnamed tributary may have potential to support a population of WCT.

Teddie/Tie 6th Field HUC - #100200040906

Aquatic Habitat

The Teddie/Tie sub-watershed is located on both sides of the Big Hole river near Wise River. Most of the sub-watershed is in private or BLM ownership. The Forest Service lands in Teddie/Tie are all located on the Pioneer Mountain side of the watershed, not the Fleecer side. Very little data have been collected for this system by the USFS.

Table 35. Physical Attributes of Teddie/Tie Sub-Watershed

Physical Attributes	Teddie/Tie HUC #100200040906
Total Area	19,028
Forest Service % ownership Forest Service acres	24% 4,831
BLM acres	8,379
State of Montana acres	609
Private Ownership acres	5,402
Elevation Range (feet)	5,800-8,700
Inventoried Roadless Area (percent based on USFS only)	57.3
Miles of Road (USFS only)	8.9
Road Density (USFS only) in miles/square mile	1.6 mi/sq.mi.
# stream crossings (USFS only)	O Perennial, 5 Intermittent
% of area in grazing Allotment (USFS only)	2,571
Miles of Perennial Stream	1.9
Miles Intermittent Stream	11.6
Miles of road within 300ft of streams	0
Timber Harvest % (USFS land only)	7%

No fish data have been collected by the USFS because nearly all of the streams within the HUC flow across non-USFS lands.

Johnson-Fleecer 6 Field HUC - #100200040903

Aquatic Habitat

Johnson-Fleecer sub-watershed lies about 6 km northeast of the town of Wise River. Johnson Creek is the primary stream within the HUC and flows southeasterly. All other creeks flow into Johnson Creek. Waters in Johnson Creek leave the HUC via the southern border at the confluence with the Big Hole River.

Table 36. Attributes of Johnson Fleecer Subwatershed

Watershed Attributes	Johnson-Fleecer HUC #100200040903
Total Area	7,841
Forest Service % ownership Forest Service acres	89% 6,981
BLM acres	691
State of Montana acres	0
Private Ownership acres	233
Elevation Range (feet)	6,100-9,200
Inventoried Roadless Area (percent based on USFS only)	72%
Miles of Road (USFS only)	11.4
Road Density (USFS only) in miles/square mile	Average is 1.5 mi/sq.mi. 46% of area = 0 mi/sq.mi. 20% of area=>2mi/sq.mi.
# stream crossings (USFS only)	9 Perennial/4 Intermittent
% of area in grazing Allotment (USFS only)	100%
Miles of Perennial Stream	13.7
Miles Intermittent Stream	14.2
Miles of road within 300ft of streams	2.4
Timber Harvest % (USFS land only)	<1%

Current land uses on the National Forest include recreational use of roads and trails, cattle grazing and logging. Conifer forest dominates the vegetation. Two fish species have been found during various surveys on USFS lands, in Johnson and Cat Creek. Both streams contained much suitable habitat during 2001 surveys while other tributaries contained little suitable habitat due to low water levels.

Fish Species

Surveys in 2001 found EBT in one creek and WCT in three creeks. Cat Creek contained only WCT in 2001 while Johnson Creek contained both EBT and WCT in its first reach only. Dodgson Creek held a single WCT. No fish were found in the four surveyed tributaries of Johnson Creek. See Map 12. Johnson-Fleecer Fish Species Distribution.

Table 37. Index Of Species Present By Stream And Proposal For Special Management Consideration.

Stream Name	Fish Species Present*	Amphibian Species present*	Other Species of Concern*	Special Management Consideration
Cat Creek	WCT hybrids	None Found		WCT 96.9% pure in 2001, N=6
Henley Creek	None Found	None Found		

Johnson Creek	EBT, WCT hybrids	RaLu, AsMo		WCT 90.5% pure in 1995, N=10, 100% pure in 2001, N=5
Johnson Creek Tributaries	None Found	None Found		
Dodgson Creek	WCT	None Found		

*See Page 46 for list of species names as abbreviated in table

Table 38. Surveys listed by Dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Redd Count	Amphibian
Cat Creek	2001	2001				2001
Henley Creek	2001					2001
Johnson Creek	2001	1995				2001
Johnson Creek Tributaries	2001					2001
Dodgson Creek	2001	2001				2001

*Survey not designed specifically for amphibians. However, supervisory biologists and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin assessments.

Amphibian Species Distribution

Surveyors in 2001 found one spotted frog in reach 5 of Johnson Creek. In 1995 crews noted finding Rocky Mountain tailed frogs in Johnson Creek. Also in 1995, 3 adult and 15 juvenile spotted frogs were reported north of the lower part of Johnson Creek.

Individual Stream Descriptions

Cat Creek - Cat Creek is a perennial tributary of Johnson Creek. Water flows southeasterly for approximately 6 km. The upper 5 km flow through National Forest and BLM lands while the lowermost 300 meters of the creek flow across a parcel of private land. 2001 surveys began 300 meters above the mouth and continued upstream to the headwaters. Average wet width varied from 1.2 meters in the uppermost reach to 3 meters in the lowermost reach. Channel stability was good in most of the surveyed reaches in 2001. 15% of Cat Creek's channel was unstable due to cattle trampling and channel splitting, which occurs at one point in the lower section. 30% of the surveyed reaches were judged suitable for fish and an unknown amount of this habitat was occupied due to the fact that fish were only found in the two lowermost reaches. The stream has a riffle/pool ratio of approximately 9:1 with most pools being formed by meanders, rock scours, and LWD. The maximum pool depth throughout the creek varied from 15-20 cm in 2001. 50% of the surveyed reaches of Cat Creek possess an A4 channel while the remainder of the stream is primarily A3.

Stream surveys began 300 meters above the mouth of Cat Creek, just above a private property boundary.

The headwaters of Cat Creek are located southwest of Little Granulated Mountain at an elevation of 8200 feet above sea level. The substrate of Cat Creek is composed of large gravel material and cobbles. Channel stability is generally high throughout the length of the stream.

2001 electrofishing inventories began 300 m above the mouth of Cat Creek and were repeated over 5km. WCT was the only fish species found in 2001 and was present in the lowermost two reaches. A total of seven WCT were found in the two reaches.

Ninety % of reach 1 was judged suitable for fish and 10% was occupied (according to surveyors) by one WCT. Juvenile and fry habitat was judged to be "excellent" but over-winter habitat is essentially nonexistent. The lack of pools for over-wintering appears to be a limiting factor in the reach but does not explain the lack of fish present in June 2001. This situation may be due to the channel splitting that occurs in the reach; the main channel branches into 4 smaller channels, which are presently very unstable. 15% of reach 3 was judged suitable for fish but none were found in 2001. Over-winter habitat does not appear to exist in the reach. The creek becomes subterranean in several sections as it passes beneath tree roots. Channel stability is high throughout the reach and no evidence of cattle activity was found in 2001. 80% of reach 4 was judged suitable for fish but none were found in 2001. Several potential barriers are present in the reach including a 40 cm plunge pool. Over-winter habitat is extremely limited as is juvenile and fry habitat. LWD was abundant in 2001. 100% of reach 5 was judged suitable for fish but none were found in 2001. Pools formed by rock scours and meanders provide over-winter habitat in 10% of the reach. Juvenile and fry habitat was considered excellent due to the presence of pools and numerous side pockets. It appears that there are effective barriers downstream that prevent fish from moving into this quality habitat. Reach 6 was not surveyed in 2001 due to a lack of water. Surveyors concluded that the reach could not support fish and thus collected little data.

The six surveyed reaches of Cat Creek contain a low percentage of suitable habitat and few WCT. A lack of over-winter habitat appears to limit the creek's ability to support a perennial fish population. The four lower reaches, however, may provide some year-round habitat if pools were created.

Genetic samples were taken on six WCT (from reach 2) found in Cat Creek in 2001. Analysis indicated that 96.9% of the diagnostic loci (genes) were indicative of pure WCT and 3.1% RB. With a sample size of six, there is a 52% chance of detecting 1% hybridization between WCT and RB. A larger sample size would provide greater confidence in the genetic analysis. A 1995 genetic analysis of two WCT indicated that 100% of the diagnostic loci were indicative of WCT.

Henley Creek - Henley Creek appears to be a perennial creek and is a tributary of Johnson Creek. Water flows south throughout the creek's 4 km. Henley Creek flows entirely through USFS land. Surveyors visited the stream in 2001, found little water and promptly left. Stream and habitat data do not exist for the creek and it is not clear exactly how little water existed in reach 1 or in any of the upper reaches. Several tributaries enter Henley Creek in the upper reaches but their status is unknown.

Johnson Creek - Johnson Creek is a perennial stream and a tributary of the Big Hole River. Water flow is southwesterly throughout the creek's 10.1km. The upper reaches of Johnson Creek flow through National Forest land while the lower sections flow through private land. Average wet width varies from 5m in the lower reaches to just 35cm in reach 7, which contained very little water. Channel stability throughout Johnson Creek was generally good in 2001. Typically, less than 10% of the reaches were judged to be unstable due to cattle trampling and some previous high water event. Generally, Johnson Creek contains much suitable habitat for fish, especially in the lower five reaches. The dominant channel type of the creek appears to be A-B2 while the subdominant type varies greatly throughout the reaches. 2001 stream surveys ceased at reach 7, 10.1 km above the mouth, due to a lack of water.

The headwaters of Johnson Creek are located northwest of Dickie Peak at an elevation of approximately 8400 feet above sea level. A spruce forest provides abundant shade in reach 1, which begins 4.1km above the mouth. An unnamed tributary enters Johnson Creek from the east within this section but it did not contain sufficient water to support fish in 2001. The riparian area of reach 2 is grown with conifers and grass. A 1-meter high LWD barrier twenty meters below the upper end of reach 2 appears to prevent fish from moving further upstream into quality habitat. Reaches upstream of this point were found to be fishless despite having suitable habitat.

Electrofishing inventories were initiated 4.1km above the mouth and continued to the headwaters. Three WCT (83-119 mm in length) were found in reach 1. Six EBT were also found in the reach during 2001 surveys. Two WCT were found in reach 2. The 1.8-meter cascade above reach 2 appears to prevent fish from moving further upstream and no additional fish were found above this barrier.

A 1-pass survey of the creek was conducted in 1987. EBT was the only fish species found in reach 1 while nine WCT were captured in reach 2. No additional data exist for this or any other historical survey.

A 1995 genetic analysis of ten fish from the creek revealed that 90.5% of the relevant loci were indicative of WCT while 9.5% indicated hybridization with RB. Genetic samples (fin clips) were taken from 5 WCT captured in 2001 and their analysis suggests %100 pure WCT, the caveat here is the very small sample size.

Johnson Creek Tributaries - The upper tributaries of Johnson Creek will be addressed collectively. No fish were found in any of the tributaries in 2001 despite suitable habitat existing in at least some locations. In general, barriers exist in some of the tributaries but habitat conditions are good.

Dodgson Creek – Dodgson Creek is a perennial stream and a tributary of Johnson Creek. Water flows south throughout the creek's approximately 3km. The entire length of the creek flows through National Forest land. Average wet width was 80cm in reaches 1 and 3. Channel stability has been reduced in areas 15-25% due to erosion caused by cattle activity. 10% of the surveyed reaches was judged suitable for fish but just one WCT was found. The riffle/pool ratio was 95:1 with most pools being formed by rock plunges. Both reaches possess a predominantly B4 channel throughout their lengths. 2001 stream surveys ceased at reach 2, 1.2km above the mouth due to a lack of water.

Dodgson Creek is located in a narrow canyon (15 meters wide) with steep (30^0) side slopes. The riparian vegetation is conifer forest and grass. Conifers shade about 30% of the stream in the two reaches.

2001 electrofishing inventories were initiated 250m above the mouth and ceased at 1.2km above the mouth. 10% was judged suitable for fish but just one WCT was found. 25% of the reach has suffered reduced channel stability due to cattle trampling and LWD jams. The primary limiting factors in the reach are a lack of over-winter habitat and bank trampling. The creek was surveyed in early summer and it would appear that the marginal habitat present at that time would decline further throughout the summer as water levels decreased.

Bear-Fleecer 6th Field HUC - #100200040902

Aquatic Habitat

The Bear-Fleecer 6th HUC lies in the north central portion of the Big Hole drainage about 10 miles northwest of Wise River. Elevation ranges from nearly 9200 feet at Dickie Peak to about 5800 feet at the confluence of the Big Hole River. The Bear-Fleecer 6HUC consists of Bear Creek, one unnamed tributary to Bear Creek and several intermittent streams.

Table 39. Attributes of Bear-Fleecer Sub-watershed

Physical Attributes	Bear-Fleecer HUC #100200040902
Total Area	5,440 (8.5sqmi)
Forest Service % ownership Forest Service acres	67% 3,956
BLM acres	760

State of Montana acres	0
Private Ownership acres	980
Elevation Range (feet)	5,800-9,200
Inventoried Roadless Area (percent based on USFS only)	58%
Miles of Road (USFS only)	8.6
Road Density (USFS only) in miles/square mile	1 mi/sq.mile
# stream crossings (USFS only)	2 Perennial, 12 Intermittent
% of area in grazing Allotment (USFS only)	66%
Miles of Perennial Stream	4.5
Miles Intermittent Stream	12.1
Miles of road within 300ft of streams	1.9
Timber Harvest % (USFS land only)	<2%

Nearly all of the perennial stream miles are a B Rosgen Channel Type. The primary vegetation class within the 6HUC is coniferous forest (3142 acres) with a moderate amount (697 acres) of grassland. Approximately 90 acres of the 6HUC are not vegetated. Other vegetative communities include aspen stands, sagebrush parks, and willows along Bear Creek.

Land uses include recreational use and grazing on National Forest lands. Approximately fifty percent of the private property is also grazed. Commercial timber was harvested on a large portion of the private property. Private property along Bear Creek is primarily summer residences and has been sub-divided (Bear Mountain Ranch).

Table 40. Attributes of the Road Network*

Road Type	Total Miles	Miles Within Riparian	# Stream Crossing Structures (Perennial./Intermittent)
Native Surface	8.6	1.9	2/12
Total	8.6	1.9	2/12

**Attributes of the road network are for USFS administered ground only, they are based on 1:100000 scale GIS information.*

Twenty eight percent of the 6HUC has no roads, twenty eight percent has a low road density (<1 mile/mile^2), nineteen percent has a moderate road density (1.1-2 mile/mile^2), and twenty five percent has a high road density (>2 miles/miles^2. (This information is for USFS administered ground only based on 1:100000 scale GIS information.). In addition to the above information, within the private there are three additional road crossings along the main Bear Creek road and several crossing to access private property home sites along the road. Highway 43 crosses Bear Creek

before it reaches the Big Hole River and a culvert is used at this crossing. There is one bridge on National Forest and generally the crossings to private property are bridges, the rest of the crossings are culverts.

Bear-Fleecer sub-watershed contains 4.5 miles of perennial stream. Beaver dams and ponds can be found throughout the drainage particularly along the private property. Two ditch diversions on Bear Creek are located above the Forest Boundary. These diversions are controlled with head gates and used for irrigation purposes. No mitigations are in place to control fish passage into the irrigation ditches.

Stream habitat conditions are generally unknown. No specific habitat surveys were done on Bear Creek. General habitat parameters were obtained from the 2001 electrofishing surveys. Field crews noted low to moderate impacts to channel stability caused by grazing but the channel overall appears fairly stable. Rosgen channel type were generally a B type with some inclusions of a C type. From these surveys few pools appear throughout the stream. Pool depths appear fairly shallow. Crews noted an adequate abundance of large, woody debris throughout the system.

Fish Species

Surveys done in 2001 found eastern brook trout and westslope cutthroat trout. See Map 13. Bear-Fleecer Fish Species Distribution. No other fish species were captured with the 2001 surveys. In 1996 the Forest Service collected two westslope cutthroat trout for genetics testing the results suggest 100% WCT. A 2001 genetics sample of 8 WCT resulted in 100% genetically pure WCT.

Table 41. Index of species present by stream and proposal for special management consideration.

Stream Name	Fish Species Present*	Amphibian Species present*	Other Species of Concern*	Special Management Consideration
Bear Creek	EBT, WCT			WCT 100% pure in 2001, N=8; 100% pure in 1996, N=2
Unnamed Tributary	None	RaLu		

**See Page 46 for list of species names as abbreviated in table*

Table 42. Surveys listed by dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Red Count	Amphibian	Other
Bear Creek	2001	'96; 2001	2001			2001*	
Unnamed Tributary	2001		2001			2001*	

**Survey not designed specifically for amphibians. However, supervisory biologists*

and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin Assessments

Amphibian Species Distribution

There is one incidental amphibian sighting in this 6HUC. In 1996 3 adult spotted frogs and 20 tadpoles were identified in the tributary to Bear Creek, indicating an amphibian breeding site.

Individual Stream Descriptions

Bear Creek - Bear Creek flows southwesterly to its confluence with the Big Hole River. The stream starts and flows approximately 5500 meters (3.5 miles) through National Forest where it then flows for approximately 3000 meters (1.9 miles) through private property. The stream then flows approximately 1500 meters (.9 miles) through BLM before passing through a small section of private property before draining into the Big Hole River. Channel typing, using 1:24000 digital elevation model and sinuosity, and visual observation calls from 2001 electrofishing crews appears to be a B type throughout the stream. Comments made by the 2001 electrofishing crews indicate that on National Forest there is some channel instability caused by grazing but generally the stream appears to be stable. There have been no hydrologic surveys done on Bear Creek. Beaver dam complexes can be found on Bear Creek, particularly along the private property, from meter post 500 through 5000. There also has been some beaver activity above the second irrigation diversion on National Forest at approximately meter post 7800. There appears to be only one perennial tributary that flows into Bear Creek, its confluence is located at meter post 7400. This is a small spring fed tributary that appears to be unsuitable for fish.

The 2001 survey effort consisted of electrofishing 100-meter reaches approximately every kilometer until upper distributions of fish were found. The first electrofishing reach started at meter post 4000 and reaches continued all the way to the headwaters. Brook trout were captured in low to moderate densities from reach one through reach six. Several age classes of brook trout were captured throughout these reaches. Two cutthroat trout were captured in reach three and six cutthroat trout were captured in reach four. No other cutthroat trout were captured in any other reach. Densities for cutthroat trout are obviously low. Genetic samples were taken from these fish and the results show that they are 100% westslope cutthroat trout. The crews noted several barriers along Bear Creek, most of these barriers appear to be seasonal, not allowing fish passage year round. However, there is a cascade/velocity barrier located between reach six and reach seven (meter post 7700), and no fish were observed or captured above this barrier. Crews did note that habitat conditions in reaches seven, eight, and nine could support fish.

Based on distribution data it appears that brook trout are out competing westslope cutthroat trout for the available habitat in Bear Creek. The beaver dam complexes below the Forest boundary are excellent habitat for brook trout. No electrofishing

information is available below reach 1 so cutthroat distribution is unknown through the bulk of the private property, however, habitat below this reach is supportive to brook trout with the many beaver dam complexes present.

Lincoln 6 Code HUC #100200040804

Aquatic Habitat

The Lincoln sub-watershed lies approximately 11 miles northwest of Wise River. All streams drain into Deep Creek which empties into the Big Hole River at the southern border of the HUC.

Table 43. Attributes of Lincoln Sub-watershed

Physical Attributes	Lincoln HUC #100200040804
Total Area	19193
Forest Service % ownership **Forest Service acres**	36% 6952
BLM acres	1550
State of Montana acres	7517
Private Ownership acres	3105
Elevation Range (feet)	6000-8618
Inventoried Roadless Area (percent based on USFS only)	2077 30%
Miles of Road (USFS only)	6.5
Road Density (USFS only) in miles/square mile	.3 mi/sqmi
# stream crossings (USFS only)	3 Perennial, 6 Intermittent
% of area in grazing Allotment (USFS only)	6150
Miles of Perennial Stream	9.1
Miles Intermittent Stream	11.2
Miles of road within 300ft of streams	1
Timber Harvest % (USFS land only)	5%

Current USFS land uses include cattle grazing and timber harvest. Roads are quite common along all of the streams although the upper reaches of several of the creeks lack road access: 33% of the USFS land lacks roads, 22% has a low road density (<1 mi/mi^2), 17% has a moderate road density (1.1-2 mi/mi^2), and 8% has a high density (>2

mi/mi^2) of roads. On USFS land there are three perennial and six intermittent stream crossings, all of which are composed of native materials.

Fish Species

A total of four fish species have been found during various surveys within the HUC although WCT, which were present in Moose Creek as recently as 1993, were not found in any of the three streams surveyed in 2001, including Moose Creek. See Map 14. Lincoln Fish Species Distribution.

Neither the fish population nor the habitat of French, California, Deep and First Chance Creeks and Julius, Connor, Woods and French gulches, have been surveyed. Very little if any portion of these streams flows through USFS lands. Since most of the streams within the Lincoln 6 HUC have never been surveyed, it is currently impossible to assess the status of their fish populations.

The 2001 surveys found three fish species in three surveyed streams. WCT were not found in any of the surveyed streams while EBT were abundant. Some of the uppermost reaches lacked fish due to low water levels.

Table 44. Index Of Species Present By Stream And Proposal For Special Management Consideration.

Stream Name	Fish Species Present*	Amphibian Species present*	Other Species of Concern*	Special Management Consideration
French Creek	No data			
Julius Gulch	No data			
French Gulch	No data			
First Chance Creek	No data			
Moose Creek	EBT, WCT, MSC	RaLu		WCT 100% pure in 1989, N=5, WCT cons. pop.
Lincoln Gulch	EBT, LNSU, MSC	RaLu, AmMa		
Panama Creek	EBT			
Deep Creek	MSC			
Connor Gulch		BuBo		
California Creek				

**See Page 46 for list of species names as abbreviated in table*

Table 45. Surveys listed by dates.

Stream Name	Fish	Genetics	General Habitat	Substrate	Redd Count	Amphibian	Other
French Creek	No data						
Julius Gulch	No data						

French Gulch	No data						
First Chance Creek	No data						
Moose Creek	'89, '93, 2001	'89					
Lincoln Gulch	'96, 2001						
Panama Creek	'96, 2001						
Deep Creek	'87						
Connor Gulch							
California Creek							

Survey not designed specifically for amphibians. However, supervisory biologists and field crews considered documenting amphibian presence and species identification as integral elements for completing Sub-basin assessments.

Amphibian Species Distribution

Amphibian data exist for several of the streams within the HUC. The Natural Heritage Database shows a western toad found on the highway near the mouth of Connor Gulch. Panama Creek and Lincoln Gulch were inhabited by spotted frogs and long-toed salamanders. Near the confluence of these 2 streams, immature spotted frogs found in June 2003 suggest an amphibian breeding site. Just downstream of the national forest boundary in Lincoln Gulch, an inactive beaver pond contained immature spotted frogs and long-toed salamanders further evidence of amphibian breeding sites. A spotted frog was found in lower Moose Creek in 2003.

Individual Stream Descriptions

Moose Creek - Moose Creek is a perennial stream and a tributary of French Creek. Water flows northwesterly throughout the creek's length (approximately 7km). The entire length of the creek flows through public lands, primarily USFS. Average wet width varies from 1.5 meters in the uppermost reach to 2.4 meters in the lower reaches. Channel stability, along with nearly all other habitat criteria, was not assessed in 2001. The middle reaches of Moose Creek flow through a fairly narrow canyon. An E4 channel type exists from 1-1.6 km above the mouth of the creek while an E3a channel type is found from 2.5-2.9 km above the mouth. A culvert exists approximately 3.2 km above the mouth.

Table 46. Summary of electro-fish inventoried stream segments on Moose Creek.

	Reach 1 (2001)	Reach 2 (2001)	Reach 3 (2001)	Reach 4 (1993)
Stream meter post	400-500	1400-1500	2700-2800	3003-3063
Fish species	EBT, MSC	EBT	EBT	WCT, EBT
Would support Fish	Likely	Likely	Likely	Likely
Amphibian Species	Unknown	Unknown	Unknown	Unknown

Table 46. Continued.

	Reach 5 (2001)	Reach 6 (1989)	Reach 7 (2001)	Reach 8 (2001)
Stream meter post	3250-3350	3355-3445	4200-4300	5500-5600
Fish species	EBT	WCT, EBT	EBT	None Found
Would support Fish	Likely	Likely	Likely	Unknown
Amphibian Species	Unknown	Unknown	Unknown	Unknown

While five WCT were found in reach 6 in 1989 and two in reach 4 in 1993, none were captured during 2001 surveys. Also in 2001, 47 EBT and 35 MSC were captured from reach. Surveyors report that cattle trampling was evident, shade was sparse, and silt was present in many of the pools. Reach 2 contained 124 EBT. MSC were not found in this section, which may indicate the presence of a barrier relevant to the species between reaches 1 and 2. According to surveyors, reach 2 contained "excellent" spawning habitat, much over-winter habitat, and no LWD. The riparian area of reach 2 is grown with willows and grasses. Surveyors found 16 EBT in reach 3 in 2001. Shade, over-winter habitat, and spawning gravel were all abundant in the reach. The stream banks in this section are grown with a mix of willows and conifers. A culvert at the upper end of the reach may act as a barrier during times of low water. Reach 4 was surveyed in 1993. The 1-pass survey yielded two WCT (3-6 in. long) and 16 EBT. Reach 5 was surveyed in 2001 and workers found 27 EBT. A "fair amount" of LWD was present in the reach. Reach 6 was surveyed in 1989. Five WCT were found in the reach along with 19 EBT. A 2001 survey of reach 7 found 19 EBT in the section. LWD was abundant but over-winter habitat was limited to just 10% of the reach. 30% of the reach was judged to provide suitable habitat for spawning. Surveyors report that a .5-meter barrier (type of barrier not documented) located at the upper end of the reach bars upstream fish movements. 75% of this reach was judged suitable for fish and 50% was occupied in 2001. Reach 8 was surveyed in 2001 but held no fish. LWD is abundant in the reach and spawning gravel is present in 50-75% of the reach. Surveyors also identified five over-winter pools. A significant cascade barrier is present at the upper end of reach 8. The entire cascade is 200 meters long and contains drops of .75 meters.

Genetics Data Electrophoretic analysis of five fish captured in the creek in 1989 found that 100% of the diagnostic loci were indicative of WCT. The small sample size, however, means that a certain amount of hybridization may have been present (Sage & Leary, 1990). Alas, such ponderings may be irrelevant since no WCT were found in Moose Creek in 2001.

Lincoln Gulch - Lincoln Gulch (approximately 6km long) flows across state land in its lower reaches and USFS lands in its upper sections. The gulch appears to be a perennial stream and is a tributary of French Creek. According to topographical

maps, the lower reaches pass through wet meadow habitat. There are several road access points located on USFS lands. A B4 channel type exists from 4.2-5 km above the mouth while a C3b channel exists from 5.7-6 km above the mouth.

Table 47. Summary Of Electro-Fish Inventoried Stream Segments On Lincoln Gulch.

	Reach 1 (2001)	Reach 2 (2001)	Reach 3 (1996)
Stream meter post	100-200	700-800	4715-4862
Fish species	EBT, LNSU, MSC	EBT, LNSU, MSC	EBT
Would support Fish	Yes	Yes	Unknown
Amphibian Species	Unknown	Unknown	Unknown

Reach 1 was surveyed in 2001. One hundred EBT and LNSU were captured in the reach along with two MSC. Surveyors report that beaver dams were abundant in the reach. Over-winter habitat was present in 100% of the reach but spawning habitat did not exist due to the mud and silt substrate. The average depth of water in this reach in 2001 was 0.75 meters. The riparian area is grown with willows and sedges. The lack of trees in this area indicates little potential for LWD. Reach 2 held 50 EBT and LNSU. Dense willows grow in the riparian zone. Reach 3 was surveyed in 1996. 14 EBT were found during a spot-check of this section. No other fish or habitat data exist for this stream.

Panama Creek - Panama Creek (approximately 4km long) appears to be a perennial stream and is a tributary of Lincoln Gulch. The headwaters drain a rather steep valley south of Bear Mt. An E5 channel type exists near the mouth of the creek. A culvert exists approximately 2.6 km above the mouth.

Table 48. Summary Of E-Fish Inventoried Stream Segments On Panama Creek.

	Reach 1 (1996)	Reach 2 (2001)
Stream meter post	1167-1320	2400-2500
Fish species	EBT	EBT
Would support Fish	Unknown	Unknown
Amphibian Species	Unknown	Unknown

A one-pass survey of reach 1 was conducted in 1996. 28 EBT (3-6 in. long) were captured along with 3 longer EBT (6-12 in. long). A 3-pass survey of reach 2 was conducted in 2001 and yielded 15 EBT. The reach contains a silt substrate, which may be related to an adjacent clear-cut. Over-winter habitat is limited to about 10% of the reach. The riparian vegetation in this section is composed of conifers, willows, and sedges.

Upper California 6 Code HUC #100200040801

Aquatic Habitat

The Upper California 6 HUC lies approximately 10 miles north of Wise River, MT. Water leaves the HUC via California Creek, which eventually empties into French Creek.

Table 49. Attributes of Upper California Sub-watershed

Physical Attributes	CaliforniaUp
Total Area	17200
Forest Service % ownership Forest Service acres	.3% 67
BLM acres	1
State of Montana acres	16083
Private Ownership acres	1046
Elevation Range (feet)	7700-8900
Inventoried Roadless Area (percent based on USFS only)	65 .3%
Miles of Road (USFS only)	0
Road Density (USFS only) in miles/square mile	
# stream crossings (USFS only)	
% of area in grazing Allotment (USFS only)	33
Miles of Perennial Stream	
Miles Intermittent Stream	
Miles of road within 300ft of streams	
Timber Harvest % (USFS land only)	

There are no roads on the National Forest portion. Road density is quite high, however, throughout the state land and all streams have an abundance of road access points and stream crossings. Current USFS land uses include cattle grazing

The tiny USFS portion of the HUC contains no streams. No WCT have been found in the HUC and little or no data exist for most of the streams. Without current and comprehensive data, projects cannot be envisioned at this time.

German Gulch 6 Code HUC# 170102010205

Aquatic Habitat

German Gulch is located on the north side of the Fleecer Mountains. The primary streams, German Gulch and its tributaries Beefstraight and Norton Creek, drain into

the Clark Fork River on the Columbia River side of the Continental Divide. Mt. Haggin Wildlife Mgt Area borders the north side of the sub-watershed. The primary streams in this HUC are German Gulch and its tributaries Beefstraight and Norton Creeks.

Current land use includes recreational use of roads and trails, mining and mine reclamation, and logging. Beal Mine, a "Superfund" Reclamation site has been monitored since 2002 to determine effects of mine waste on water quality and fish habitat. Water quality monitoring at Beal Mine concentrated on sites near and partially downslope of the soil pits and temporary springs along with established long term monitoring sites at various springs and stream monitoring stations Tissue sampling in fish throughout the HUC show presence of a variety of metals: selenium, arsenic, cadmium and aluminum. Remediation work continues at Beal Mine.

Table 50. Attributes of German Gulch Sub-watershed

Physical Attributes	German Gulch HUC# 170102010205
Total Area	26,275
Forest Service % ownership Forest Service acres	82 21,683
BLM acres	
State of Montana acres	4,592 18
Private Ownership acres	
Elevation Range (feet)	5,300-8,800
Inventoried Roadless Area (percent based on USFS only)	73%
Miles of Road (USFS only)	25.4 roads 29.8 trails
Road Density (USFS only) in miles/square mile	.7 miles/sqmiles
# stream crossings (USFS only)	9
% of area in grazing Allotment (USFS only)	96%
Miles of Perennial Stream	39
Miles Intermittent Stream	62
Miles of road within 300ft of streams (USFS only)	7
Timber Harvest % (USFS land only)	<1% (34% on all ownerships)

Fish Species

German Gulch contains both genetically pure westslope cutthroat trout (WCT) (Leary, 1984), eastern brook trout (EBT) and brown trout (documented near the mouth only). Sampling by MFWP in 1984 estimated a total population of 301

trout/1,000', with WCT comprising 43% of the total numbers in the portion of the stream downstream of Beefstraight Creek. Forest Service and MFWP personnel in 1993 found 345 trout/1,000' in the same section with WCT making up only 11% of the total population. Sampling near Edwards Creek in 1984 estimated a population of 209 trout/1,000' with 80% WCT. The 1993 sample estimated 226 trout/1,000' in roughly the same section with WCT comprising 72% of the population.

Norton Gulch was sampled by Forest Service personnel in 1997. Both EBT and WCT were found in equal densities in the sample section.

Beefstraight Creek also contains both EBT and WCT. It's tributaries; Minnesota Gulch, Spring Creek, Beaver Creek and Coyote Gulch, all provide some habitat for both species

Amphibian Species Distribution

Amphibian data exist for two of the streams within the HUC. The Natural Heritage Database shows many Norton Creek observations. Spotted frogs, long toed salamanders, and western toads have been found in the Norton Creek watershed. All 3 species have been observed breeding in this watershed. Two sites are known western toad breeding areas. A Columbia spotted frog breeding site was also observed near the lower end of Spring Creek, the tributary to Minnesota Gulch.

Individual Stream Descriptions

German Gulch –

This stream has been sampled for fish extensively. According to Montana Fisheries Information System (MFISH), WCT, brook trout and brown trout have been sampled in German Gulch. WCT are listed as rare from river miles 2.7 to 8.4. Brook trout are listed as common from the mouth to river mile 4.7 and rare upstream to 8.4. Brown trout are shown to exist in the stream from the mouth up to about the Forest boundary (near river mile 2.5).

WCT in German Gulch have been found to be very slightly hybridized with rainbow trout. Despite a 39 fish sample in 1984 being 100% genetically pure WCT, a more recent sample of 14 fish in 2002 was found to be 99.4% WCT and 0.6% rainbow trout.

The MFISH data base lists a restoration project in German Gulch to benefit Westslope cutthroat trout. Logging, grazing and historic placer mining have all contributed to degradation of habitat in the watershed. The proposed project comprehensively treats approximately 4.8 miles of stream. Improving habitat and increasing complexity would consist of adding woody debris and boulders to the stream, excavating approximately 300 new pools, widening the floodplain, and improving bank stability with vegetative treatments. MFISH states the project has been significantly downsized to a demonstration project. Its unclear what stage the project is currently in.

Greenland Gulch and Edwards Creek are tributaries to German Gulch. Each of these is thought to have the same species make up their fishery for the lower several hundred meters. Above these points the streams are fishless.

Norton Creek –

Norton Creek has been extensively sampled for fish distribution. According to the MFISH data base, WCT and brook trout are present in Norton Creek. WCT are common from the mouth to river mile 5.4. Brook trout are common from the mouth to river mile 1.5, and rare from 1.5 to 3.7. A barrier to upstream fish movement has been constructed to protect the genetically pure population of WCT; brook trout removal from above the barrier is still in progress. The WCT population has already responded positively despite incomplete removal of brook trout thus far. The genetics of the WCT population have been tested twice, once each in 1997 and 2002. The 1997 sample of 10 fish came back 100% pure WCT, and the 2002 sample of 14 fish showed 99.5% WCT and 0.5% rainbow trout genes. Canyon Creek is a tributary to Norton Creek. Its fish community is similar to Norton Creek made up of WCT and brook trout.

Beefstraight Creek –

Beefstraight Creek has been extensively sampled for fish distribution. According to MFISH, WCT and brook trout are present in Beefstraight Creek. WCT are abundant from the mouth to river mile 6.8. Brook trout are common from the mouth to river mile 1.8, and rare from 1.8 to 5.1. The genetics of the WCT population have been tested twice, once each in 2002 and 2003. The 2002 sample of 19 fish came back 99% pure WCT and 1% rainbow trout, and the 2003 sample of 25 fish showed 98% WCT and 2% rainbow trout genes. Clear and Beaver creeks are tributaries of Beefstraight Creek. WCT trout are listed as abundant in both streams but they have yet to be genetically tested. Brook trout are not listed as present in these streams.

Minnesota Gulch - This stream has been sampled recently as well. According to MFISH, WCT trout are present in Minnesota Gulch. They are listed as being abundant from the mouth to river mile 3.1 and brook trout are not listed as being present. A 29 fish genetic sample from 2003 suggests the WCT are 100% genetically pure. Spring Creek is a tributary to Minnesota Gulch. It is thought to have WCT for the lower 200 meters or so.

American and Coyote Gulches- are fishless tributaries to Beefstraight Creek.

3. Reference Conditions

Reference Conditions for the watersheds in Fleecer are those conditions that occurred over a range of time prior to the presence of mining activity, timber harvest, domestic livestock grazing, developed road and trail systems, irrigation diversions, dams, exclusion of fire, or the presence of non-native aquatic species.

Historically, streams would all be functioning under natural climatic cycles and natural disturbances. Riparian vegetation along stream bottoms would reflect a range of conditions resulting from fire and flooding.

Salmonid presence within any of the streams or lakes of the watershed would have been westslope cutthroat trout. These populations would have been migratory within the watershed because no dams or irrigation diversions to stop access to tributary streams or the Big Hole and Clark Fork Rivers would have existed. Amphibian species were probably more broadly distributed throughout the watershed in higher numbers. This historic population would be a reflection of no introduced diseases that are currently affecting amphibian populations and not necessarily a reflection of management activities.

4. Recommendations

Recommendations are organized by 6th field HUC. See Maps referenced for location of recommended projects. An evaluation of the priority and requirements for most of these proposals is located in the project file document "Fisheries Project Proposals".

Divide Creek Sub-watershed

See MAP 15. Divide-Fleecer Proposed Projects.

1. Eliminate brook trout from NF Divide Creek and the SF Divide Creek

Persistence of Westslope cutthroat in the Divide Creek drainage would be most secure if a single population could occupy the NF divide and its tributary the SF of Divide. This would require removing brook trout from approximately 4.3 miles of the NF of Divide Creek and approximately 0.75 miles of the SF Divide Creek. A barrier would have to be built on the NF of Divide Creek to prevent reinvasion of non-native brook trout.

3. Remove or Replace Culvert that is barrier to fish movement in unnamed tributary to SF of NF Divide Creek; Expand WCT upstream

The South Fork of NF of Divide Creek may provide suitable habitat above the uppermost extent of cutthroat distribution. Only genetically pure WCT should be expanded upstream. A series of possible barriers through 300 meters of high

gradient stream, and a perched culvert appear to prevent natural upstream expansion by the population.

This presents an opportunity to introduce cutthroat into the fishless habitat above. Habitat, while somewhat limited seems it may support limited numbers of fish.

2. Eliminate brook trout in SF NF Divide Creek above South Fork Reservoir[dcd9]-

Distribution of brook trout in the SF NF of Divide Creek, suggest introduction or invasion of this species from SF reservoir has only recently occurred. This scenario presents a significant threat to the WCT population/s in this area.

4. Reduce livestock bank trampling in Reach 1 of the South Fork Divide Creek. See recommendations in Table 19 Watershed and Hydrology section.

Upper Jerry Sub-watershed

See MAP 16. Upper Jerry Proposed Projects.

1. Secure WCT population in Upper Jerry Creek

This project entails removing/replacing the culvert barrier on Road #83, located at stream km 19.4 to allow fish movement between the lower culvert, at km 17.8, and the upper extent of suitable fish habitat at about km 20. Removing the upper culvert will allow both fish passage and bedload transport. This project is a high priority with a high likelihood of success.

2. Expand WCT population in Upper Jerry Creek

This is a high priority with a high likelihood of success. It involves constructing a barrier on Jerry Creek, downstream of the mouth of Flume Creek and removing EBT above the barrier. A potentially suitable barrier location lies about 200 meters downstream of the confluence of these streams. Incorporating fish passage into the road/stream crossings on Flume and Jerry creeks is integral to this phase of the project. Replacing these two pipes will not be easy or cheap. Upon completion of the project, we will have connected three kilometers of occupied habitat in Jerry Creek with 2.5 km in Flume Creek.

Before implementing this phase of the project, additional genetic data should be gathered from the downstream portion of this project phase to verify the genetic integrity of the WCT.

3. Second downstream expansion of WCT population

This is "phase 3" of the above-listed project. This phase involves installing a barrier at approximately stream km 12.5 on Jerry Creek and removing EBT from all

stream reaches upstream, including tributary streams. This project will require private landowner cooperation. Feasibility of this phase is uncertain. The portion of Jerry Creek flowing through the private land lies in a wide valley bottom and may be beaver influenced. If this is the case, EBT removal may become impractical. Stream size may also preclude full implementation of this phase of the project. Additional genetic analysis of the WCT population is necessary before implementing this phase. While previous samples from upstream sites in both Jerry and Delano creeks were determined to contain alleles of only WCT, a downstream sample was determined to be hybridized with RBT. Before proceeding with this phase, the genetic integrity of the WCT population needs to be ascertained.

This phase involves EBT removal from an additional 4.5 km in Jerry Creek, 1.3 km of Delano Creek and 2.0 km of the unnamed tributary of Jerry Creek that enters Jerry Creek at ~stream km 16. Following EBT removal, fish passage will need to be incorporated into the culvert crossing on Delano Creek. Completion of this phase of the Jerry Creek project will secure/expand WCT habitat in the Jerry Creek watershed by ~11 stream kilometers.

4. Alternative in the absence of genetic analysis to confirm WCT integrity.

Given the low numbers of EBT inhabiting Delano Creek, a periodic EBT suppression program could be initiated along with providing fish passage into the road/stream crossing structure on road #83, until genetic analysis confirms the integrity of the WCT population in the middle reaches of Jerry Creek. . This effort should be sufficient to provide a population-scale advantage to WCT in Delano Creek and would provide almost 2 kilometers of connected habitat within Delano Creek.

5. Phase 4 of Jerry Creek WCT restoration

This phase of the project involves establishing a barrier at ~stream km 10 on Jerry Creek. It appears a suitable site exists. The genetic integrity of the WCT population in Jerry Creek needs to be confirmed before implementing this phase. Other aspects of this phase include removing EBT from 2.5 km of Jerry Creek and 1.2 km of Libby Creek. If additional surveys in Libby Creek determine habitat upstream of the culvert under road #83 is suitable, then this culvert would need to be retrofitted to allow fish passage.

Successful completion of all four phases of this project could result in a total of over 18 kilometers of connected WCT habitat, in five headwater streams in the upper Jerry Creek sub-watershed.

6. Design a road improvement package for Upper Jerry

This design would include culvert removals, replacements, road segment reroutes, etc. The portion of road #83 that parallels this reach presents a problem. There are several areas that are actively eroding and slumping into the stream. There

may be possibilities to close and obliterate it, rerouting the access through road #7329 in Delano Creek. A decision on how to proceed will require an interdisciplinary approach to explore a variety of options.

7. Additional Data Needs

More genetic samples are needed to determine the current status of the WCT populations in this 6HUC before proceeding with any restoration projects.

Complete fish distribution, species composition and habitat suitability surveys on Upper Jerry Creek, Flume Creek, Jerry Creek tributary, Libby Creek and the unnamed tributary of Long Tom Creek, as identified in each stream narrative.

Lower Jerry Sub-watershed

1. Eliminate the ford immediately above the bridge over Jerry Creek near Indian Creek confluence

Simply move the gate in the fence to other side of the bridge. ….

.

Johnson Fleecer Sub-watershed

See Map 17. Johnson Fleecer Proposed Projects.

1. Secure and Expand WCT population in Cat Creek.

WCT could be moved into reaches 4 and 5. Barriers in reach 3 (subterranean water flow) prevent fish from moving into the quality habitat present in these reaches. The barriers in reach 3 would prevent EBT from moving into areas inhabited by WCT.

2. Expand and link WCT populations in Johnson and Dodgson Creeks.

A one-meter high large woody debris barrier located in reach 2 of Johnson Creek prevents WCT from moving further upstream, where quality habitat exists. WCT could be moved into reaches 3-6 to exploit available habitat. Placement of a barrier below the confluence of Johnson and Dodgson Creeks would prevent EBT from moving into Dodgson Creek while linking the WCT populations of both creeks. Such action would allow WCT to exploit seasonal habitat in Dodgson Creek while permitting retreat into the deeper waters of Johnson Creek during times of low water in the smaller Dodgson Creek.

Bear Creek Sub-watershed

See MAP 18, Bear Fleecer Proposed Projects.

1. Secure and expand WCT population above Forest Boundary in Bear Creek

Successful implementation of this project entails construction of a barrier on Bear Creek, at the Forest boundary, and removal of brook trout from approximately

2500 meters of stream. There would need to be barriers placed on the two diversions to exclude fish from the irrigation ditches. By placing the barrier at the Forest boundary almost all of the beaver dam complexes would be downstream so removal of brook trout from these complexes would be unnecessary. The brook trout removal upstream of the barrier could be done using electrofishing equipment to minimize the impact on westslope cutthroat trout. The captured brook trout could then be released downstream of the placed barrier. If habitat surveys conclude that the stream segment above the natural barrier (meter post 7700) would support fish, westslope cutthroat trout could be placed above this natural barrier.

Upon completion, this project would secure about 5000 meters of cutthroat habitat.

Before this project could be implemented, habitat surveys need to be done to verify that the fishless portions of the stream will support fish. There also needs to be some additional electrofishing work to ensure that there is a viable cutthroat population in place and to collect more genetic samples to verify the genetic purity. Additionally the landowner of Bear Mountain Ranch needs to be contacted to see if they would be willing to install different head gates on their irrigation ditches.

Lincoln Sub-Watershed

1. Data Collection

Very little recent data exist for many of the streams within the HUC. Collection of data for Moose Creek may be most valuable in generating projects, if WCT are still in that creek. If WCT are extirpated from Moose Creek, the culvert near km post 3.2 should be checked for aquatic organism passage. A culvert at the upper end of the reach may act as a barrier during times of low water.

German Gulch Sub-Watershed

2) Restore channel in Beefstraight Creek where over-widened road ford delivers sediment to the stream

1 Secure WCT and remove non-native trout competitions threat in Norton Creek- construct a fish migration barrier and remove non-native trout from upstream of the barrier site.

3) Reduce placer mining impacts to German Gulch stream channel and riparian area.

D. VEGETATION

Data Sources

Published literature was used to describe reference conditions, identify factors contributing to change and develop desired future conditions for vegetation resources in the assessment area. Local data sources were used to identify existing conditions: Beaverhead-Deerlodge National Forest Land and Resource Management Plan Final EIS (2008); Big Hole Landscape Assessment (2001); Beaverhead-Deerlodge National Forest (BDNF) Timber Stands Management Record System (TSMRS) spatial data; Satellite Land Classification (SILC3) data; and BDNF fire group spatial data.

1. Characterization

DOMINANT VEGETATION SHAPING PROCESSES

Vegetation composition and configuration in the Fleecer watersheds prior to European settlement was shaped by natural disturbances and processes and, to a lesser extent, Native American land management. Natural disturbances and processes that influenced and will continue to influence vegetation in this area include climate variability, watershed processes (i.e. flooding, mass wasting, debris flows, avalanches), fire events, and insect population dynamics. Native American land management was characterized by fire ignitions for travel corridors, forage improvement, game habitat improvement, and maintenance of native plant food sources. Although scientific research specific to the watershed analysis area is currently lacking, results of studies completed in ecosystems and landscapes of the western United States and northern Rocky Mountains can be used to assess the historic conditions and processes that operated in these watersheds.

More recently, vegetation in the Fleecer assessment area after European settlement has been shaped by Forest Service management practices, such as timber sale activity, domestic grazing and fire suppression.

Geological Processes

Geological processes operate on a temporal scale of thousands to millions of years. These processes are commonly slow and influence areas larger than most other processes influencing the analysis area. The large and long temporal and spatial scales of geologic processes shaped the current topography, rock formations, and parent material that exist within the Fleecer watersheds. Geological changes since the last ice age (18,000 to 12,000 years ago) in these watersheds include erosion and deposition, vegetation migration, and tectonic movement. Natural leveling processes of geological erosion include surface erosion and mass wasting (i.e. landslides, debris avalanches, slumps and earth flows, creep, and debris torrents) (Brooks et. al 2003, Pierce et al. 2004).

Climate

Variations in monthly normal (30 year average) temperature, precipitation, humidity, and wind define climate for any given area at any given time (Robinson & Henderson-Sellers 1999). However static climate may seem for an area, spatial and temporal climate variability has influenced vegetation in the western US for centuries (Whitlock et al. 2003). Periods of warming and cooling and/or high and low precipitation, such as the cool-moist conditions associated with the last phase of the little ice age (1800-1850), were driven by ocean-atmosphere interactions prior to onset of modern industrialization effects to global climate. Tree ring reconstructions of climate shape our current understanding of historical climate variability in the western US, a source of information limited in time by the longevity of the tree species used to compile past climate information.

Fluctuations in temperature and precipitation that characterized historic climate likely influenced vegetation distribution and patch size in the Fleecer assessment area by affecting other processes such as germination and establishment of native species, fire regimes, insect activity, erosion, and stream morphology.

A 20-year period of dry summers beginning in 1855 facilitated Douglas-fir (*Pseudotsuga menziezii* var *glauca*) expansion from small ecotone patches to sagebrush (*Artemesia tridentata vaseyana*) and grassland ecosystems on Fleecer Mountain (Heyerdahl et al. 2006). Dry summers in this community type negatively affect shallow rooted grass and herbaceous species and encouraged establishment of deeper rooted mountain big sagebrush that are nurse plants for Douglas-fir. These climate conditions of the late 1800s in combination with livestock grazing also facilitated the succession of juniper species in the western United States into sagebrush and grass dominated communities. This variation in climate, in combination with European settlement in the region, facilitated changes in the sagebrush and grassland communities of the Fleecer assessment area.

Since the little ice age subsided (1850), global average temperatures have increased due to natural climate variability and human induced climate change. During the 20th century, periods of drought and abundant moisture occurred in the southwest Montana (Figure 1). Recent variation in regional climate formed the human perception of seasonal temperature and precipitation variation.

Climate data collected in Dillon, Montana is used to describe the current climate of the assessment area (Figure 2).. Annual average precipitation at 5,102 feet elevation is 10.2 inches of rainfall, 30.8 inches of snowfall. Average precipitation is highest in late spring and lowest in winter months. Average temperature is highest in summer months (65.5°F July) and lowest in winter (24°F January). In the Fleecer mountain range where elevations range from 6,000 to 9,436 feet, mean annual precipitation ranges from 10 to 25 inches, about 20 percent falling as snow. The Fleecer assessment area experiences cool and moist springs, often hot and dry summers,

cool and dry falls, and cold and dry winters. These normals are characteristic of continental climates influenced by continental polar, maritime polar, and to a lesser extent, continental tropical air masses that shift according to summer and winter jet stream position.

As climate is anticipated to become warmer and drier in the future (IPCC 2007), precipitation and temperature trends in the assessment area are anticipated to change in response. Warmer springs may lead to earlier snow pack ripening and runoff, influencing riparian and upland vegetation. Longer fire seasons are likely to result from a change in these two climate elements and increased fire behavior may contribute to changes in erosion that influence stream morphology and habitat (Mote et al. 2005, Wondzell & King 2003).

Figure 1. Palmer Drought Severity Index of southwest Montana from 1900 – 2000 (NOAA 2005).

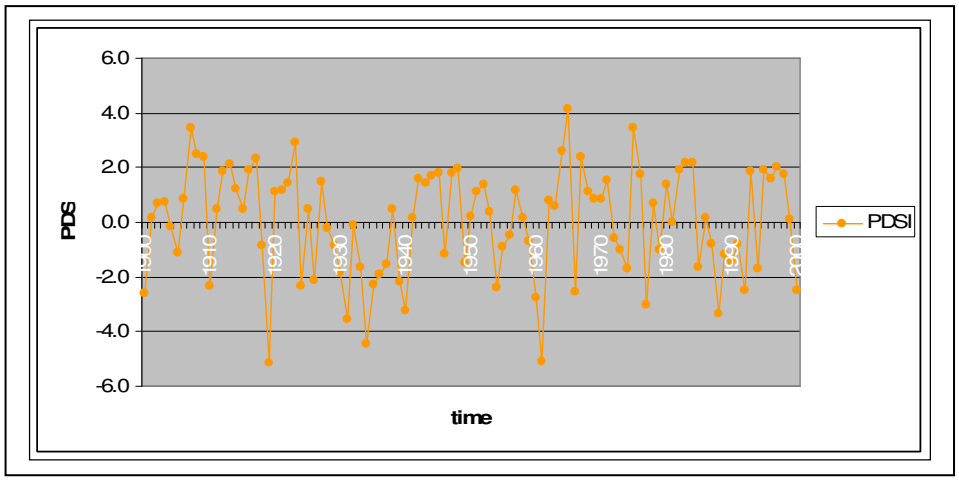
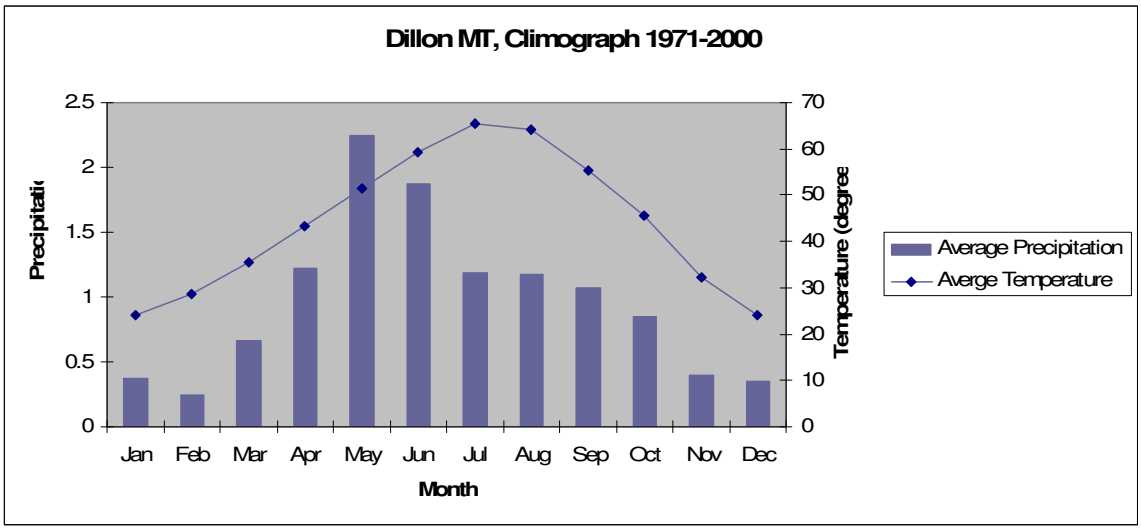


Figure 2. Monthly precipitation and temperature normals for Dillon Montana from 1971-2000 (NOAA 2005).



Insects

Mountain pine beetle (MPB) populations have been cyclic in conifer stands of the Fleecer area. This species affects three species in the area, lodgepole pine (*Pinus contorta*), limber pine (*Pinus flexilis*) and whitebark pine (*Pinus albicaulis*). Twenty to forty year cycles of population increases lasting up to 11 years initially kill larger individual trees before successively killing smaller individuals (Cole & Amman 1980). Up to 60% of trees greater than 8 inches in diameter are killed when MPB populations are epidemic. Currently, the Fleecer assessment area is part of a larger epidemic occurring across the majority of the Beaverhead-Deerlodge National Forest and on other forests in Region 1.

Lodgepole pine stands can sustain several episodes of MPB infestation, each episode killing many of the larger trees in a stand and creating conditions for seedling growth. Whitebark pine in the Fleecer area is less continuous than lodgepole pine and largely represented mid-successional stands characteristic of subalpine fir (*Abies lasiocarpa*) - Engelmann spruce (*Picea* engelmannii) mature and old communities. MPB mortality of whitebark pine individuals can result in succession to later successional stands for other species.

Low elevation stands have been most impacted by MPB, reducing the presence of lodgepole pine as a significant stand component. Mid elevation stands comprised of mostly lodgepole pine have also been greatly impacted by MPB, allowing opportunity for shade tolerant subalpine fir and Engelmann spruce to increase. At high elevations where lodgepole pine and whitebark pine are a lesser component of coniferous vegetation, mortality has occurred with the extent currently not known.

Map 19 displays the progression of MPB infestation, mapped by the USFS Aerial Disease Survey (ADS) project from 2000 through 2008. Table 51 summarizes the annual affected acreage totals and the total number of trees estimated to have been attacked over the entire Fleecer area, including non-federal lands for these years. Note that acreage totals can have overlap from year-to-year, as MPB attacks can be progressive over several years within a particular acre.

Table 51: Aerial Disease Survey data of Acres and Trees affected by Mountain Pine Beetle, years 2000 through 2008*

2000	2002	2003	2004	2005	2006	2007	2008
Acres	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**	**Acres**
14	*1,311*	*1,363*	*5,298*	*16,562*	*19,490*	*11,950*	*61,906*
Total Trees	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**	**Total Trees**
27	*2,475*	*3,925*	*32,967*	*61,723*	*54,611*	*31,666*	*1,048,092*

*No aerial survey performed in 2001.

Note: Acreage totals from year-to-year are not cumulative: MPB attacks are typically the same acre; however, the total trees attacked can be viewed as what was attacked in that individual year.

MPB populations have been maintained and increasing year-by-year due to the recent above average winter and spring temperatures, allowing a high over-winter success. Lodgepole pine stand conditions across the BDNF are conducive for carrying epidemic populations and without a change in over-winter temperatures to colder extremes, the epidemic will continue until the host species of the appropriate diameter (about 6 inches and larger) have been exhausted. Within the Fleecer watershed assessment area on NFS lands, it is estimated that about 83 percent of the lodgepole pine stands have been affected by MPB (33,400 acres).

Western spruce budworm (WSB) occurrence has been most evident at lower elevations where Douglas-fir occurs. WSB population booms last up to 30 years and cause mortality in small and defoliation of large Douglas-fir trees. Increasingly dense, later successional stands of Douglas-fir are susceptible to WSB because these stands are often stressed by competition. As a consequence of recent drought condition coupled with inter-specific competition and WSB population increases, mortality of large Douglas-fir individuals and stands is occurring in the Fleecer watershed assessment area. Areas of significant mortality due to WSB in contiguous stands of Douglas-fir can be seen in the Jerry Creek to Johnson Creek areas.

Douglas-fir beetle (DFB, *Dendroctonus pseudotsugae*) numbers have generally thought to be in decline in the Northern Region as well as the Fleecer watershed assessment area; however, an increase in individual numbers of Douglas-fir trees killed by DFB have been noted in the Lone Tree, Sunday Gulch and Jerry Creek areas. An increase of mortality due to DFB can be attributed to the heavy and repeated defoliation from WSB, which may lead to increases in DFB activity. Additionally, highly dense stand conditions are also contributing to the increase in mortality to Douglas-fir from DFB.

Rusts, fungi, and microbes

Rusts, fungi and microbes occur throughout the Fleecer assessment area. The majority of these species occurs at natural levels, is native to the greater ecosystem, regulates natural intra- and inter-specific competition, and is important ecosystem elements for decomposition and soil nutrient cycling. In aspen stands fungi and other microbial species kill individual trees, disrupting the stand hormone ratio that results in suckering and stand sustainability. Following conifer mortality from insect activity fungi weakens the boles of trees, resulting in an increase in downed wood that is cycled through the soil ecosystem by fungal and microbial activity.

The bulk of rust, fungi and microbes occurring in the Fleecer assessment area are important components of ecosystem function and structure. Alternatively, white

pine blister rust is a non-native species that has negatively affected five-needle pines in the western US during a portion of its life cycle (McDonald & Hoff 2001). Limber and whitebark pines are the only five needle pines on the Beaverhead-Deerlodge National Forest with whitebark pine most prevalent occurring in about 3 percent of the assessment area. This rust affects vigor and cone crops of whitebark pines, which occur at upper elevations of the watershed. In portions of the BDNF white pine blister rust has resulted in widespread mortality of whitebark pine; although a comprehensive field review of higher elevations within the Fleecer area have not been done, it is thought that most of the whitebark pine stands have been severely impacted by a combination of blister rust and mountain pine beetles.

Fire

Fire was historically the predominant natural disturbance in the Fleecer watershed area and lightning ignitions largely determined where and when fires started (Agee 1993, Baker 2002, Pyne 1982); while indigenous burning is presumed to have occurred at lower elevations within the assessment area (Kimmer & Lake 2001).

Fire regimes are differentiated by the frequency, extent, severity, and timing of fire events associated with vegetation. High frequency, low severity fire regimes were historically typical of low elevation dry forests such as Douglas-fir. Senesced grass and herb communities fueled understory fires in these forests, allowing dominant conifer species to survive multiple low intensity fire events that killed seedlings and created low density stands (Heyerdahl et al. 2006). Mixed severity fire regimes historically occurred in several forest types in the region such as early seral subalpine fir forest types dominated by lodgepole pine (Arno 1980, Arno et al. 2000). With less frequent fires than those of lower elevation forests fuel loads increased and when fire spread in these forests low severity surface fire, single or clustered tree torching, and high severity crown fire were typical within a single fire perimeter. High elevation forests such as subalpine fir and whitebark pine experienced low frequency, high severity fire regimes (Agee 1993).

Fire frequency determines vegetation successional stage and fuel conditions and past fire shape and size play a role in fuel connectivity and landscape heterogeneity or homogeneity (Arno et al. 2000, Turner et al. 1998). Summer persistent snow pack in high elevation forests historically resulted in high fuel moisture and low potential for fire spread on an annual basis; causing high fuel loading, easy fire spread from surface to crown, and canopy consumption when fire eventually occurred in these forests (Romme 1982). These trends in fire and the relationship between fire and climate in the northern Rocky Mountains existed in the distant (Heyerdahl et al. 2008) and recent past (Morgan et al. 2008).

Although a combination of disturbance factors contribute to size class distribution in forest types, the dominate disturbance factor determining size is fire when an active component, or the lack of fire with fire suppression management strategies. Below is a distribution of size classes by forest type (Table 52); the absence of fire with the past century of management strategies on Federal lands has resulted in a skewing

towards larger size classes. Early seral conditions have only been created through timber harvest practices (see following section). The old growth component is within the mid- to late-seral size classes in the Fleecer assessment area.

Table 52: Size Class distribution by Forest Type

Species	Size Class	Acres
Douglas-fir	Early seral - Seedling	687
	Mid seral - Pole	1,636
	Mid to late seral - Sawtimber	17,660
Lodgepole	Early seral - Seedling	3,715
	Mid seral - Pole	23,379
	Mid to late seral - Sawtimber	14,780
Subalpine fir	Early seral - Seedling	195
	Mid seral - Pole	783
	Mid to late seral - Sawtimber	6,514
Whitebark pine, limber pine, alpine larch	Early seral - Seedling	0
	Mid seral - Pole	730
	Mid to late seral - Sawtimber	4,668

Old growth forests are distinguished by old trees and structural characteristics developed over time (Green et al 1992). An analysis of old growth as part of forest plan revision using FIA data was completed (Bush and Leach, 2003). The old growth analysis was over large landscapes across the Beaverhead-Deerlodge National Forest; the results are presented for the Big Hole Landscape which includes the Fleecer assessment area. In the Big Hole landscape, Bush and Leach (2003) estimate that 16.1% of the Forest is in old growth with a 90% confidence interval of 11.3 – 21.3%. No old growth mapping specific to the Fleecer Watershed Assessment area is available. Existing old growth compared to historical abundance follows the same trend as mature and older trees; the present amount of old growth is near the upper range of historical conditions (Big Hole Landscape Assessment 2001). In addition, the Big Hole Landscape old growth estimate done by Bush and Leach indicates that old growth in the Big Hole is not deficient at the regional scale.

Flooding

Flooding was likely the most significant process in riparian areas, ranging from annual floods to large events that significantly altered stream channels. Flood frequency likely varied annually in the assessment area and was highly dependent on annual snow pack properties, storm characteristics during spring (regional storm activity) and summer (localized storm activity) months, and upstream lake holding capacities.

Beaver presence and stream damming historically led to sediment impoundment and changes in channel morphology associated with flooding. This modification of the stream environment resulted in seasonal and annual water persistence in the stream

channel and flood plain that facilitated surface to ground water connectivity and maintenance of riparian vegetation.

Timber Harvest

Timber was harvested in the Fleecer watershed assessment area to support mining, homesteading and settlement out in the valley. Timber harvest increased greatly from the 1960s through the mid-1980s and has declined in recent years. The decline in timber harvest across the west can be attributed to several factors; evolving administrative and judicial interpretation of agency legal requirements, advances in scientific understanding of how ecosystems work, and shifting public attitudes concerning management priorities for national Forest lands (USDA 2008). The Beaverhead-Deerlodge was never one of the higher producing timber forests in the Northern Region, and still is not. However, the level of timber produced by the Forest over the last 10 years (12 million board feet average) has been important in sustaining local mills like Sun Mountain in Deerlodge and RY Timber in Livingston.

Timber harvest activities included clearcut, selection cut, post and pole thinning, and thinning. See Map 20 - Past Timber Activities, and Map 21 - Timber Suitability Model (lands suitable for timber production).

Table 53: Timber Harvest totals

Activity	Total number of harvest units	Total acres	Unit Average (min-max) acres
clearcut	138	5,145	37 (1 – 184)
selection	47	1,804	38 (6 – 132)
post & pole	17	782	47 (12 – 240)
commercial thin	35	1,057	28 (1-117)

Land Management Plan Direction Relevant to Vegetation

Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Conditions for self-sustaining or viable populations of native and desired non-native plant and animal species are supported within the natural capability of the ecosystem.

Desired Condition – Natural disturbance processes are recognized and accepted as essential to the health of ecological communities at various spatial scales. Fire is allowed to play its natural role where appropriate and desired. Life, investments, and valuable resources are protected using the full range of appropriate management responses to fire.

Goal – **Biodiversity:** A variety of disturbance processes are managed or allowed to

produce resilient vegetation communities able to sustain diversity in the face of uncertain future climate-influenced disturbances. Resilient vegetation communities will have a mosaic of species and age classes of native trees, shrubs, grasses, and forbs for animal forage and cover, and perpetuate the diversity of plants and the microbial and insect communities upon which they are dependent. Old growth is managed on a forest wide basis and is well distributed.

Goal – **Unique Habitats**: The trend toward an older forest is altered by increasing the younger age classes providing greater forest diversity in age classes. Stable or upward trends are achieved for declining or unique habitats.

Goal – **Sensitive Plants**: Sensitive plant populations and their habitat are maintained or restored.

Goal – Non-native Species: The influx of persistent non-native species is minimized by using native plants, seed, and vegetative propagules for restoration work.

Goal – Pest management: Diagnosed pest problems are addressed with an integrated pest management approach, which allows monitoring, prevention, cultural, mechanical, biological, genetic and chemical techniques.

Objective- **Forested Vegetation**: Reduce forest density in the large size classes of dry forest communities and some lodgepole pine communities to maintain or improve resilient forest conditions.

Douglas-fir- Increase acres of Douglas-fir in the 0 to 5 inch DBH class by approximately 20,000 acres across the forest:

- where burned or insect infested stands are dead or dying,
- to reduce the risk from wildfire for public and firefighter health and safety, or to protect structures, infrastructure, and municipal watersheds.
- To meet objectives for lands suitable for timber production
- In former grasslands/shrublands not considered part of the Douglas-fir base. .

Lodgepole Pine type - Increase the acres of lodgepole pine 0 to 5 inch DBH class by approximately 74,000 acres where:

- Burned or insect infested stands are dead or dying
- Need to reduce risk from wildfire for safety, to protect structures, infrastructure and municipal watersheds.
- Needed to meet objectives for lands suitable for timber production.

Aspen component Increase the aspen component within lodgepole pine and other vegetation types on 67,000 acres. .

Whitebark pine/Sub-Alpine Fir Type: Promote regeneration of whitebark pine on

approximately 45,000 acres, largely through the use of fire.

Objective – **Grassland/Shrubland/Riparian**: Reduce conifer colonization on 74,000 acres of riparian areas, shrublands, and grasslands.

Objective – **Noxious Weeds**: Prevent, reduce, or eliminate infestations of non-native or noxious weed species with emphasis on areas where there is high likelihood of establishment and spread. Manage noxious weeds through Integrated Pest Management.

Objective – **Sensitive Plants**: Monitor G1 through G3 ranked sensitive plants, perform conservation assessments, and develop conservation strategies for species showing downward trends.

2. Current Condition

Summary

Vegetation within the Fleecer Watershed Assessment area was classified two ways, using satellite imagery data provided by Satellite Land Classification (SILC3) and using the USFS Timber Stands Management Record System (TSMRS) which is based on aerial photo interpretation verified by ground surveys.

Vegetation cover type data was mapped using the Timber Stands Management Record System (TSMRS) and satellite imagery data provided by Satellite Land Classification (SILC). That data is summarized in Table 54 and displayed on Map 22- SILC Vegetation Cover Types and Map 23 - TSMRS Vegetation Cover Types. Except for the Fire Group discussion, the basis for the specific vegetation type analysis that follows focuses only on National Forest System (NFS) lands acreage. (Vegetation cover type figures for all ownerships in the assessment area can be found in the wildlife section.) The accuracy of the Timber Stands Management Record System (TSMRS) spatial data is higher than the satellite imagery data provided by Satellite Land Classification (SILC3).

Table 54: Existing mapped vegetation of the Fleecer assessment area.

Cover description	Acres on Fleecer Watershed, All ownerships (SILC3: project_dissolve3)	Acres on NFS Lands only (TSMRS-photo interpretation)
Agriculture	1,340	0
Aspen	2,927	530
Dry grasslands, meadow	46,079	14,955
Sagebrush (low, moderate, & high cover)	41,094	6,456
Mesic shrublands (willow)	3,758	518

Mountain mahogany	1,183	75
Douglas-fir	17,280	19,984*
Lodgepole pine	77,280	41,873*
Subalpine fir	19,975	7,493*
Whitebark pine, limber pine	7,144	5,168
Rock	3,879	3,353

*Discrepancies between groupings of numbers in TSMRS and SILC3 are expected with satellite imagery providing a broad view and the photo interpretation providing a higher degree of accuracy.

FIRE GROUPS

The Fleecer assessment area is representative of six fire groups (Table 55). These fire groups describe fire regimes in the context of vegetation types (Fischer & Clayton 1983). In the text below, fire group classifications were used to describe historical fire processes that defined succession and resulting vegetation for coniferous habitats of the Fleecer area. All habitat types associated with miscellaneous, non-coniferous vegetation were described using other sources.

The two dominate fire groups in the Fleecer area are: the unique habitats of meadows, aspen, riparian areas which represent 45 percent of the area; and the cool mid-elevations where over one-third (38 percent) is dominated by lodgepole pine. See Map 24 for a display of fire group distribution across the Fleecer assessment area.

Table 55: Vegetation Classification and area of each mapped fire group

Fire Group	Vegetation Classification	Acres (%) All Ownerships
0	Special habitats: aspen, rock, water, meadow, willow	101,282 (45)
5	Cool, dry Douglas-fir	14,904 (7)
7	Cool, usually dominated by lodgepole pine	83,727 (38)
8	Dry lower subalpine fir	15,539 (7)
9	Moist, lower subalpine fir	413 (<1)
10	Cold, moist upper subalpine fir, whitebark pine	7,155 (3)
Total		223,020

A partial list of understory plant species is provided in Table 56, which presents the wide ranging distribution of species and indicates that there are more to these vegetative communities than just coniferous vegetation.

Table 56: Associate plant species of habitat types and fire groups described for the assessment area

Common name (latin name)	Habit	Fire Group
beargrass (*Xerophyllum tenax*)	grass-like	8, 9, 10
bluebunch wheatgrass (*Pseudoroegneria spicata*)	grass	5

bluejoint (*Calamagrostis canadensis*)	grass	7
elk sedge (*Carex geyeri*)	grass	5, 7, 8
Idaho fescue (*Festuca idahoensis*)	grass	5, 10
Parry rush (*Juncus parryi*)	grass	9, 10
pinegrass (*Calamagrostis rubescens*)	grass	5, 7, 8
Ross sedge (*Carex rossii*)	grass	9, 10
smooth woodrush (*Luzula hitchcockii*)	grass	9, 10
arrowleaf balsamroot (*Balsamorhiza sagittata*)	forb	5
ballhead sandwort (*Arenaria conjesta*)	forb	9, 10
broadleaf arnica (*Arnica latifolia*)	forb	5, 7, 8, 9, 10
false Solomon's seal (*Smilacema racemosa*)	forb	8
heart-leaf arnica (*Arnica cordifolia*)	forb	7, 8
pussytoes (*Antennaria* spp.)	forb	5
pyrola (*Pyrloa* spp.)	forb	8
slender hawkweed (*Heracleum gracile*)	forb	9, 10
strawberry (*Fragaria virginiana*)	forb	5, 8
sweet cicely (*Ozmorhiza bertori*)	forb	8
timber milkvetch (*Astragalus miser*)	forb	5, 8
valerian (*Valeriana spp*)	forb	8
violet (Viola *spp.*)	forb	8
western meadow rue (*Thalictrum occidentale*)	forb	5, 7, 8
buffaloberry (*Sheperdia canadensis*)	shrub	5, 7, 8
common juniper (*Juniperus communis*)	shrub	5, 7, 8, 9, 10
dwarf huckleberry (*Vaccinium caespitosa*)	shrub	7
grouse whortleberry (*Vaccinium scoparium*)	shrub	7, 8, 9, 10
kinnikinnick (*Arctostaphylos uva-ursi*)	shrub	7
mountain big sagebrush (*Artemesia tridentata vaseyana*)	shrub	5
mountain snowberry (*Symphoricarpos oreophilus*)	shrub	5, 8
mountain gooseberry (*Ribes sp.*)	shrub	
Oregon grape (*Berberis repens*)	shrub	7, 8
red mountain heath (*Phyllodoce sp.*)	shrub	9, 10
smooth menziesia (*Menziesia sp.*)	shrub	9, 10
twinflower (*Linnaea borealis*)	shrub	7, 8
wax currant (*Ribes lacustre*)	shrub	5
yellow mountain heath (*Phyllodoce grandiflora*)	shrub	9, 10

RIPARIAN HABITATS

The current condition of riparian habitats is of concern, and with a longer time period for data collection in the Fleecer assessment area, a more concise picture of historic, current and desired conditions could have been produced. The riparian habitats are discussed at length in the fisheries/hydrology portion of this watershed assessment.

ASPEN

Aspen currently occurs on 2,927 acres across the entire Fleecer Watershed assessment area. Within NFS lands, aspen occupies about 530 acres.

When historical aspen distribution is compared to current aspen distribution in Montana, results suggest this species has declined by over 60 percent (Bartos 2001). In the Gravelly Mountains, aspen declined by approximately 47 percent from 1947 to 1992 (Wirth et al. 1996). The reduction in aspen patch size and distribution in the Fleecer and Gravelly Mountains can be attributed to conifer expansion and disruption of fire return intervals, as well as domestic and wild ungulate grazing.

Aspen evolved with browsing by ungulates, however extreme browsing pressure on aspen stands can affect the stand vigor and reduce the amount of time that aspen stand persists on the landscape. Livestock have been widespread over the area, and use aspen stands for shade in the summer. Aspen is present but is found in small isolated clones, and is especially vulnerable to over browsing on big game winter ranges.

Field surveys in 1995 on the Divide Creek Allotment (east side of the mountain range, from the Continental Divide south to Mt Fleecer) had generally consistent results. Out of approximately 40 stands of aspen that were inventoried, about 75% were associated with riparian areas, while the remaining 25% were located in upland habitats. All of them were noted as having suckers, and in only one of those stands were they noted as being healthy and surviving. Browsing was noted as one potential reason for the lack of surviving suckers.

Monitoring of past aspen treatments across the Forest has found that browsing is the single most inhibitor of aspen regeneration on the Forest (BDNF 1999). Re-measurement in 2008 used a treatment rating system on the BDNF (excluding Madison Ranger District) indicated that 30% of the monitored aspen treatments were successful or progressing and 70% were static or failures (Draft, B. Hodge 2008). Fencing and slashing were generally ineffective in protecting aspen sprouts and saplings from browsing.

CURLLEAF MOUNTAN-MAHOGANY HABITATS

Existing vegetation maps indicate curlleaf mountain mahogany communities occupy 75 acres of the Fleecer assessment area. Many stands across the Beaverhead-Deerlodge National Forest are becoming old and decadent with inadequate surviving reproduction (BDNF, Revised Plan, FEIS, 2008). Stands include old, even-aged plants with high crown closure and excessive litter accumulation that prevents seedling establishment, with accessible plants showing heavy browsing pressure by big game including moose. In some areas, conifer encroachment into mahogany stands may be gradually shading out the mahogany plants. This is of concern in the Charcoal Gulch area, including lands manages by BLM, state and USFS (V. Boccadori, FWP Area

Biologist, pers. comm.). Many of these stands are co-dominated by Rocky Mountain juniper and moister sites have been colonized by Douglas-fir.

Curlleaf mountain mahogany is believed to be at risk of habitat conversion; which is largely attributed to Douglas-fir succession from surrounding vegetation into curlleaf mountain mahogany stands, potential for fire spread from the surrounding landscape into these unique communities, and the known negative effects of fire to curlleaf mountain mahogany in the western US.

Field surveys in 1995 on the Divide Creek Allotment found mountain mahogany at lower elevations across the east side of the mountain range. Five stands of mountain mahogany were mapped. None had 50% or greater canopy cover of dead plants and 2 of the stands had seedlings present. Most of the mountain mahogany is at lower elevations off of NFS lands and is often found in rocky inaccessible places.

BIG SAGEBRUSH STEPPE COMMUNITIES

The three sagebrush steppe community types are not delineated in current vegetation maps maintained by the USFS; however it is assumed that basin big sagebrush occupied a larger portion of the landscape in the past and that a finer mosaic of grassland to sagebrush steppe occupied upland foothills of these watersheds. Existing vegetation maps indicate dry grasslands occupy 14,955 acres of the Fleecer assessment area and sagebrush steppe accounts for 6,456 acres (Table 3). Fire exclusion and the introduction of livestock grazing to the assessment area may have shifted acres from dry grasslands to sagebrush dominated lands. Elimination of fire from the landscape similarly increased shrub densities, fuel, and conifer presence in sagebrush steppe communities.

COOL, DRY DOUGLAS-FIR HABITATS

Along with dry grassland parks, Douglas-fir currently dominates the low to middle elevations of the Fleecer Watershed Assessment area. In contrast to pre-settlement conditions, Douglas-fir stands in these watersheds are continuous, mid-successional, densely stocked, and establishing into sagebrush-steppe, grassland, aspen, curlleaf mountain mahogany, and riparian communities. Fire suppression and elimination of indigenous burning, in combination with intense livestock grazing during the first half of the 20th century have resulted in an increase of Douglas-fir in the area. The increase in extent and continuity of this coniferous vegetation type has effectively reduced landscape vegetation heterogeneity and associated biodiversity and put unique habitat types of the Fleecer assessment area (most importantly aspen and mountain mahogany) at risk of irreversible habitat conversion. Highly dense stands of Douglas-fir have been affected by western spruce budworm (whole-stand mortality in the Jerry Creek to Johnson Creek area). In addition, an increase of individual trees killed by Douglas-fir bark beetle has been noted in the assessment area.

COOL HABITATS DOMINATED BY LODGEPOLE PINE

Cool habitats dominated by lodgepole pine are the most common occurring vegetation type in the Fleecer assessment area (38 percent or 83,727 acres in fire group seven). Fire suppression management strategies have likely contributed to more homogeneous conditions than historically characterized in this area. Intraspecific competition of maturing stands coupled with drought has resulted in stand conditions susceptible to mountain pine beetle activity in the Fleecer area, as well as in adjacent areas on the Beaverhead-Deerlodge National Forest; mortality in lodgepole pine stands is quite severe from a current MPB epidemic (see previous discussion on MPB in the Vegetation Characterization section as well as Table 51).

DRY, LOWER SUBALPINE HABITATS

Dry, lower subalpine habitats are a small percentage of the Fleecer area, totaling about 15,539 acres (7 percent of the area). Most of these acres are currently in a mid- to late seral condition, which may represent historic conditions.

COLD, MOIST UPPER SUBALPINE AND TIMBERLINE HABITATS

Cold, moist upper subalpine and timberline habitats currently occupy less than 3 percent (7,155 acres in Fire Group 10) of the Fleecer assessment area.

Significant changes to whitebark pine are occurring due to white pine blister rust and MPB (see previous discussion in this document). Although extensive field review of these upper elevations has not occurred for this assessment, it is known that significant mortality is changing stand structures in whitebark pine.

SENSITIVE PLANTS

There are seven known plant species of concern in the Fleecer Watershed Analysis Area located as fifteen separate populations. See Map 25. Sensitive Plants and Other Species of Concern. Three species are currently listed as USFS R1 sensitive plants (USDA Forest Service. 2004). The remaining four species include one BLM listed sensitive plant, one former USFS R1 sensitive plant, and two "species of concern" to the Montana Heritage Program (see Table 57 for complete listing).

Table 57. Sensitive Plants and Other Plant Species of Concern

Sensitive plants and other plant species of concern						
Scientific name	G RANK	S RANK	FS	BLM	MT Heritage	Notes
Allotropa virgata Sugarstick	G4	S3			Potential Species of Concern	Former USFS R1 sensitive plant, removed from list in 2004
Arabis fecunda Sapphire Rockcress	G2	S2	Sensitive	Sensitive	Species of Concern	
Balsamorhiza hookeri Hooker's Balsamroot	G5	S1			Species of Concern	Only one know population in Montana
Erigeron gracilis Slender Fleabane	G4	S3			Potential Species of Concern	
Erigeron linearis Linearleaf Fleabane	G5	S1		Sensitive	Species of Concern	
Juncus hallii Hall's Rush	G4G5	S2	Sensitive		Species of Concern	
Penstemon lemhiensis Lemhi Beardtongue	G3	S3	Sensitive	Sensitive	Species of Concern	

US Forest Service "Sensitive Plants"

The three USFS R1 sensitive plant species known to occur in the analysis area are *Arabis fecunda* (Sapphire Rockcress), *Juncus hallii* (Hall's Rush), and *Penstemon lemhiensis* (Lemhi Beardtongue). The following is a brief description of the life history, habitat requirements, and management concerns for each species.

Arabis fecunda (Sapphire rockcress)

Sapphire rockcress is a small perennial forb endemic to the mountains of southwest Montana. It has not been reported from other states. Flowering is from late April to early June. It grows on moderate to steep slopes with warm southerly aspects and sparse vegetation at 5500-8000 feet elevation. In Beaverhead and Silver Bow counties, it is found in Mountain Mahogany (*Cercocarpus ledifolius*) – Rocky Mountain juniper (*Juniperus scopulorum*) or limber pine (*Pinus flexilis*) woodlands, very open Douglas-fir (*Pseudotsuga menziesii*) forest, or sparse Blue bunch wheatgrass (Pseudoroegneria spicata) grassland communities. Sapphire rockcress occurs on soils derived exclusively from calcareous sediments (Lesica 1993).

This species is known from five populations occupying slopes above the Big Hole River and Jerry Creek. All five populations are within a couple of miles of each other and on BLM and State managed lands. No populations are known to occur on Forest Service managed lands within the Fleecer Watershed Analysis Area.

Several factors may affect the long-term persistence of this species, including noxious / invasive weed competition and grazing. Livestock grazing impacts are still poorly understood. One study along the Big Hole River found sapphire rockcress increased with grazing at one site while decreasing in another (Lesica

1993). Spotted knapweed (*Centaurea maculosa)* has been shown to be a major threat to populations in Ravalli County where it reduces the successful establishment of sapphire rockcress seedlings (Lesica, P. and J. S. Shelly. 1991). The occurrence of spotted knapweed has not been reported for the Beaverhead / Silver Bow populations but up to date surveys are recommended.

Juncus hallii (Hall's Rush)

Hall's Rush is a slender grass-like perennial approximately 20-30 cm tall growing from a clump of fibrous roots. The lateral inflorescence, lack of an upper leaf blade, lobed seed capsule, and tailed seeds help distinguish this species from other Juncus, a notoriously difficult genera for identification purposes. Flowering typically takes place from July-August.

Habitat requirements include dry, wet, and boggy meadows, margins of ponds and lakes, and along streams from valley to montane and subalpine zones (Welsh, 1993).

Within the Fleecer Watershed Assessment Area Hall's Rush is know from one site on Forest Service managed land near Beals Hill. The Montana Natural Heritage Program has the population mapped such that it overlaps a large active mining operation. Further investigation including a site visit will be necessary to verify the status of this population.

Penstemon lemhiensis (Lemhi Beardtongue)

Lemhi Beardtongue is a regional endemic that occurs only in southwest Montana and adjacent Idaho. It is a tall conspicuous perennial forb with attractive blue flowers from early June to late July.

In Montana, Lemhi beardtongue occurs on moderate to steep, east- to southwest-facing slopes, often on open soils. It generally grows at or below the lower extent of Douglas-fir and/or lodgepole pine forest, in habitat dominated by big sagebrush (*Artemisia tridentata*) and bunchgrasses such as bluebunch wheatgrass (*Pseudoroegneria spicata*), western wheatgrass (Elymus smithii), and Idaho fescue (Festuca idahoensis).

It appears Lemhi beardtongue has some degree of adaptation to natural disturbance, as evidenced by its preference for more open habitats such as rock outcrops and steep, rocky slopes with natural soil slippage and its apparent ability to establish in roadcuts (Shelly 1990).

Fire suppression has been suggested as a factor in the range-wide decline of Lemhi beardtongue (Moseley et al. 1990). Monitoring of a prescribed burn in Big

Hole National Monument has documented population increases for a decade after the burn while the species disappeared from an adjacent untreated area (Heidel and Shelly 1997). Another monitoring study at Badger Pass found that recruitment increased dramatically after fire treatment, consistent with the tendency of fire-adapted species to emerge from seedbanks when fire removes accumulated litter and reduces competition (Heidel and Shelly 2001).
The effectiveness of fire as a management tool may be reduced because of the high potential for noxious weeds to expand after fire (Heidel and Shelly 2001).

Other plant "species of concern"

There are four additional plant species that merit attention *Allotropa virgata* (Candystick), *Balsamorhiza hookeri* (Hooker's Balsamroot), *Erigeron gracilis* (Slender Fleabane), and *Erigeron linearis* (Linearleaf Fleabane). Table 1 above describes each species agency status and Global and State Rankings.

Allotropa virgata (Candystick)

Candystick is saprophytic perennial herb with distinctive pink and white stems. It is found in areas with deep humus, litter, or partially decomposed logs typical of mature coniferous forests of the montane zone in particular lodgepole pine (*Pinus contorta*) stands. This species is on the edge of it range distribution in Montana and is more common in Oregon, Washington, and California. It has been removed from the USFS R1 Sensitive Plants list. There are two occurrences within the assessment area – Bear Mountain and Johnson Gulch.

Balsamorhiza hookeri (Hooker's Balsamroot)

Hooker's Balsamroot is a medium size perennial forb with yellow flowers and pinnately-divided leaves with coarse stiff hairs. It is considerably smaller and quite difference in appearance from the very common arrowleaf balsamroot (*Balsamorhiza sagittata*). This species has an irregular distribution in the pacific northwest and interior west. It is mostly found in sagebrush steppe, dry meadows, and grasslands. In Montana it is only known from one site on state land within the Mount Haggin Wildlife management Area.

Erigeron gracilis (Slender Fleabane)

Slender fleabane is a small perennial forb with bluish purple flowers from June – August. It has been reported from Montana, Idaho and, Wyoming from a variety of habitats including moist slopes, creek bottoms, sagebrush meadows from low elevation sagebrush to alpine areas. Within the watershed assessment area it is known from one occurrence near Patton Spring on BLM managed lands. This species is considered a Potential Species of Concern by the Montana Natural Heritage Program.

Erigeron linearis (Linearleaf Fleabane)

Linear leaf fleabane is a small to medium size perennial with a stout taproot, basal leaves with fine hairs, and small yellow flowers. It occurs in dry, often rocky soil from the foothills up to moderate elevations, frequently with sagebrush (Heidel and Cooper 1998) and blue-bunch wheatgrass (*Pseudoroegneria spicata*). It is a BLM listed Sensitive Plant Species and the two occurrences with the assessment area are on BLM managed lands. Noxious / invasive weeds are a threat at other populations in Montana. There is has been speculation that this species may benefit from low level disturbance such as burning or grazing Heidel and Vanderhorst (1996) but this has not been confirmed.

NOXIOUS WEEDS

There are approximately 125 noxious weed infestations identified on NFS lands, totaling an estimated 2,500+ acres, with individual infestation sizes ranging from a few plants up to approximately 800+ acres. The few large 100+ acre patch infestations are in Beefstraight Creek and Willow Gulch areas. A majority of the existing infestations consist of linear infestations along roads and trails, and spot infestations consisting of one acre or less. See Map 26. Noxious Weed Infestations.

The primary weed species in these watersheds include spotted knapweed, leafy spurge, musk thistle, Canada thistle, hounds tongue, and yellow toadflax. Spotted knapweed is the dominant invader on National Forest System (NFS) lands, with smaller infestations of other species scattered throughout. Leafy spurge is a particularly troublesome weed within the Mt. Haggin Wildlife Management Area (WMA) west of the Continental Divide. It's estimated at over 1,000 acres in this WMA. Significant weed populations have infested private lands as well; however, the extent of these infestations is unknown.

The Forest Service, Bureau of Land Management, Silver Bow County, and other partners treat noxious weeds through coordinated weed spray days. Most infestations are being controlled through current efforts, and a few small infestations have been eradicated through repetitive treatments over the years. However, some weed infestations are expanding at a greater rate than they can be controlled. On State and private lands, weed control efforts and the extent of weed infestations are unknown.

3. Reference Condition

ASPEN

Quaking aspen (*Populus tremuloides*) is the most widespread deciduous tree species in North America (Little 1971) and has declined by 50 to 90 percent in western landscapes (Bartos 2001). Throughout its distribution, aspen exists in a diversity of landscapes and this varied existence has resulted in a similar diversity of ecological roles (Romme et al. 1992). Approximately 75 percent of all historical and current North American aspen occurs in Colorado (50%) and Utah (25%) as large stands; while

in the northern Rocky Mountains, aspen historically occurred and currently exists in relatively small patches at the sagebrush steppe and coniferous forest ecotonal band (Romme et al. 1992).

Successful reproduction from seed is infrequent and episodic in western aspen, with estimated seedling establishment intervals of 200-400 years (Jelinski & Cheliak 1992). Regeneration from seed historically occurred during periods of cool climatic conditions (e.g. Little Ice Age; Tuskan et al. 1996), indicating the current rise in global average climate may not be conducive to reliance on sexual reproduction as a means of maintaining this species on western landscapes. With limited opportunities for sexual reproduction, once aspen is lost from a landscape it generally will not reestablish from seed.

Aspen is a disturbance dependent species; with fire as the primary and disease the secondary disturbance agents. Single aspen trees are typically joined by subterranean root systems, resulting in stands of genetically identical interconnected trees that are commonly referred to as clones. Reproduction is largely accomplished by suckering from underground root systems following disturbance or die back that disrupts the hormonal balance between above (trees) and below (roots) ground bodies. When trees are killed or stressed the flow of sucker suppressing hormones (auxins) from the crown is disrupted, influencing the hormone ratio in favor of sucker stimulation (via cytokinin). New trees will grow from sprouting suckers in the post-disturbance environment, if they escape browsing pressure of wild and domestic ungulates.

Historically, fire disturbances in the northern Rocky Mountains maintained stand vigor by killing or severely stressing trees and allowing for sucker production from clonal roots. High fire frequency at the steppe-conifer zone of elevation prior to European settlement in southwest Montana limited distribution of coniferous and sagebrush-steppe communities, effectively regulating competition between aspen and these adjacent vegetation types. Although aspen clones in southwest Montana were historically smaller and occupied smaller portions of the landscape than clones of Colorado and Utah, aspen clones were most likely more vigorous and larger in the past.

CURLLEAF MOUNTAIN MAHOGANY

Curlleaf mountain-mahogany (*Cercocarpus ledifolius*) habitat types were historically the most widespread of all mountain mahoganies (*Cercocarpus* spp.) and south-central Montana was the northernmost extent of the species (Dayton 1931, Dorn 1984). Pre-settlement stands were small in the context of landscape vegetation types and confined to calcareous derived soils and outcrops in the assessment area. Poor soils and dry characteristics of sites occupied by curlleaf mountain-mahogany supported sparse understory vegetation and resulted in slow regeneration of dominant shrub species following disturbance. These habitats occupied steep, low elevation sites (below 2,000 feet) and were commonly co-dominated by Rocky Mountain juniper (*Juniperus scopulorum*). In the absence of disturbance, late seral

open stands were long lived (over 100 years) and provided important forage for moose, mule deer, small mammals, and other wildlife species.

Curlleaf mountain mahogany stands were historically affected by herbivory, drought, and fire. The high palatability of dominant vegetation favored large ungulate utilization of stands, particularly in years when snowpack covered forage of low elevation sites. This pressure likely effected individuals and affected canopy structure. These habitat types occurred on normally dry sites and drought affected seedling survival and speed of regeneration following disturbance more than mature individuals. Dry site characteristics resulted in a sparse understory, low downed wood component and wide canopy spacing that limited fire spread and frequency. Mature stands were historically capable of surviving cool surface fires, while more intense fires killed mature curlleaf mountain-mahogany and destroyed seedbanks. Stand regeneration following fire was dependent upon seedbank survival, but postfire establishment was historically on the scale of decades. The oldest curlleaf mountain-mahogany individuals occupied the harshest sites (USDA 2008).

BIG SAGEBRUSH STEPPE

Three sagebrush steppe communities described under the heading "3. Reference Condition" occur in the Fleecer Watershed Assessment area at low, foothill elevations associated with deep and well drained soils. Communities dominated by Wyoming big sagebrush (*Artemesia tridentata* ssp. *wyomingensis*) are located on the most xeric sites, accounting for a large portion of the sagebrush steppe habitat; with 10 to 25 percent bare ground. Sagebrush steppe dominated by basin big sagebrush (*Artemesia tridentata* ssp. t*ridentata*) occur on more mesic locations compared to Wyoming big sagebrush and support more perennial herbs, higher overall plant cover, and generally are located in valley bottoms between riparian and upland vegetation. Mountain big sagebrush (*Artemesia tridentata* ssp.*vaseyanna*) is the most common sagebrush steppe community type in the assessment area. This dominant sagebrush community type tolerates the most mesic conditions of the three big sagebrush communities, located at mid to upper foothill locations and in parks within coniferous vegetation, and associated with a high diversity of bunchgrasses and perennial vegetation. All three of these sagebrush steppe community types historically included a large grass component and fire was the dominant agent of change (USDA 1998 & 2008).

Fire frequency and extent historically shaped the mosaic of grass and sagebrush succession that characterized sagebrush steppe landscape of the Fleecer assessment area prior to European settlement. Frequent fire suppressed big sagebrush and favored grass species domination most locations, while fire exclusion favored late succession sagebrush stand development and conifer expansion into sagebrush communities. Estimated fire frequency for the grassland-sagebrush mosaic was 5 to 60 years and fire extent was historically limited by fuel continuity and fire weather.

COOL, DRY DOUGLAS-FIR HABITATS

Cool, dry Douglas-fir habitat types were historically maintained by fire at mid elevations between the dry foothills and moister upper elevations. Many pre-settlement stands occurred as small, scattered stands in a mosaic of sagebrush-grasslands. Prior to European settlement, fire occurred frequently in Douglas-fir stands and limited the extent of this habitat type in the Fleecer assessment area. Thick bark insulated the cambium of mature individuals, providing for individual persistence and seeding onto the fire prepared seedbed. Competition between overstory and understory vegetation on droughty sites generally did not support seedling survival and regeneration; however in locations where seedling survival was high, fire likely acted as a thinning agent that allowed for stand longevity in the past (Arno & Gruell 1983; Fischer & Clayton 1983; Heyerdahl & Miller 2006).

Low severity and frequent fire historically maintained open stands with grassland and shrub components. Occasional associate conifer species historically occurred in cool-dry Douglas-fir stands and included Rocky Mountain juniper, lodgepole pine, Engelman spruce, and whitebark pine in the Fleecer assessment area. The presence and proportion of associate plant species was historically determined by frequency and severity of fire in Douglas-fir stands of the assessment area and the successional stage of these stands at the time of fire disturbance.

Fire group 5 is associated with the cool-dry Douglas-fir habitat type. In stand initiation, fire likely reduced grass cover and prepared sites for seedling establishment. Adequate seed source, germination conditions, and soil moisture combined to assist seedling establishment and even–age stand development. Fire events during this stage of stand development would have resulted in seedling mortality and regression to grassland. Stands comprised of pole-sized individuals were able to survive cool, low severity surface fires because these events thinned stands; while severe fire at this stage of stand development would have resulted in conifer mortality and regression to grassland. Historically mature Douglas-fir stands had been exposed to these thinning events and cool, low severity surface fires entering these stands reduced fuel loads and temporarily reduced competition by removing understory vegetation. Stands in time developed into mature or old communities that were maintained by repeated exposure to cool surface fires that maintained low fuel loads. When fire weather was favorable for high severity fire in these Douglas-fir stands, or if fire had missed an area over several intervals and multi-story conditions had developed, the stand in one fire event was reverted to grassland and the successional cycle was reset (Fisher & Clayton 1983).

COOL HABITATS DOMINATED BY LODGEPOLE PINE

Cool habitats dominated by lodgepole pine were historically common in the Fleecer assessment area. Two habitat types represented the broader cool habitat types dominated by lodgepole pine: habitats where lodgepole pine was the climax species and occurred as pure stands prior to climax; and mixed conifer habitats where lodgepole pine was dominant in most stands. Fire disturbances historically

characterized the mosaic of age classes and stand successional stages of cool habitats dominated by lodgepole pine that characterized mid to upper elevations in the Fleecer area. Although the thin bark of lodgepole pine as a species made stands susceptible to mortality from fire events, several key characteristics facilitated stand regeneration following fire (Fisher & Clayton 1983).

Cone serotiny historically allowed for seed storage in canopy seedbanks that were released by crown scorching and locations historically exposed to higher fire frequency historically had a higher proportion of serotonous cones than non-serotonous cones (Perry & Lotan 1979). Early and prolific seed production, highly viable seed (up to 80 years), and high seedling survival and rapid growth were historically traits that allowed for rapid regeneration following fire. Habitats characterized as mixed conifer with lodgepole pine as a dominant species were moister and supported Douglas-fir, Engelmann spruce, and subalpine fir at mid to late stages of succession. These associate conifer species lack traits that favor rapid post-fire regeneration and were typically killed or reduced in numbers during mixed-severity to high severity fire events that historically characterized high elevation forests.

Dense lodgepole pine stands dominated cool habitats, and are the most common vegetation type in the Fleecer area. Habitat types below 7,500 feet experienced more frequent fire than those above this elevation. At lower elevations fire perpetuated lodgepole pine by eliminating shade tolerant species from stands. Fischer and Clayton (1983) indicate that lodgepole pine dominated areas occurred in patches of 5 to 100's of acres. Understory burns occurred on a given acre at 40 to 80 years intervals; stand replacement fire occur at intervals of 40 to 300 years (Big Hole Landscape Assessment 2001). Lodgepole pine dominated this part of the Fleecer assessment area with stand replacement fires; with successful regeneration mechanisms, lodgepole pine occupied large areas with smaller amounts of other conifer species present dependent on fire patterns, frequencies and micro-habitats. This portion of the Fleecer area typically was single-aged and uniform in structure (Fisher & Clayton 1983). Stands older than 60 years were more dense and susceptible to increased competition, insect activity (most notably mountain pine beetle mortality) and dwarf mistletoe.

At elevations higher than 7,500 feet fire season historically was shorter due to cooler temperatures and snow pack persistence into summer months. Temperatures and productivity was lower at these locations and resulted in slower fuel accumulation, insect activity was limited, and fire potential was lower than lower elevation sites. Stands dominated by lodgepole pine above 7,500 feet elevation had a fire regime similar to subalpine fir, with fire frequency of approximately 150 years and stand replacing fire return intervals of 300 to 400 years (Romme 1980) that resulted in landscapes with a mosaic of age classes (Fisher & Clayton 1983).

Where lodgepole pine was the climax species, succession was dominated by this species regardless of fire frequency and stand structure reflected fire history. After initial succession of forbs and shrubs, a seedling/sapling stage occupied most stands and any fire during this stage of succession returned the stand to the initial species composition. Stands that were not exposed to fire matured; well stocked pole sized stands exposed to cool fires were thinned, while those exposed to moderate to severe fire reverted to the herb and shrub successional stage. Lodgepole pine stands lacking fire disturbance were dense with a large downed wood component, created through windthrow or insect associated mortality. Mature to climax stands exposed to cool fires were thinned and resulted in open, late successional stands. When lodgepole pine stands were at or near climax and exposed to fire, fuel loads and canopy spacing frequently resulted in high severity fire, stand mortality, and regeneration (Fisher & Clayton 1983).

Where habitat types were dominated by lodgepole pine but climax species were Douglas-fir, Engelmann spruce or subalpine fir, post-fire forest succession was similar to that described for pure lodgepole pine stands but understory species composition was different. Some climax species were present at the seedling stage and lodgepole dominated canopies of pole sized stands had a greater proportion of shade-tolerant climax species in the understory. Fire absence resulted in continued perpetuation of shade-tolerant climax species until lodgepole canopies were eventually overtopped. Cool fires interrupted successional development in a similar fashion described for the lodgepole climax habitat types, but these events were less frequent and of smaller extent. Moderate fires in pole and mature stands favored lodgepole by killing associate conifer species that were less fire resistant and thinning the stands. Severe fires at any stage of successional development reverted stands to the early forb and shrub state, favoring lodgepole pine as the early species in establishment (Fisher & Clayton 1983).

DRY, LOWER SUBALPINE HABITATS

Dry, lower subalpine habitats characterized by Engelmann spruce or subalpine fir historically were a small percentage of the assessment area. These habitat types were characterized by mixed conifer stands for stages of successional development and supported various densities of Douglas-fir, lodgepole pine, and whitebark pine. Fire disturbances historically produced a mosaic of age classes and stand successional stages of these subalpine habitats (Fisher & Clayton 1983).

The dry, lower subalpine habitats of the Fleecer assessment area had a similar relationship to fire as mixed conifer stands dominated by lodgepole pine described in the previous section but were characterized by fire group eight. Fire frequency was low for these habitats and ranged from 50 to approximately 130 years. Pole sized and mature stands that experienced cool fires were thinned and Douglas-fir was favored over the thinner barked and more flammable associate species; whereas moderate to severe fires favored lodgepole pine. Stands maturing to mature to old communities, where subalpine fir or Engelmann spruce were the dominant species

and the stand had a multi-storied structure required a long fire-free period that was likely associated with cool climates or terrain variable that created favorable micro sites or places that fire missed. Mature and old stands exposed to fire were commonly returned to early successional stages due to large amount of downed fuel, ladder fuel, and the fire weather conditions that were favorable to fire entering a stand and spreading through coniferous canopy.

COLD, MOIST UPPER SUBALPINE AND TIMBERLINE HABITAT

Cold, moist upper subalpine and timberline habitats characterized by forested stands of predominately whitebark pine and subalpine fir historically occupied portions of the Fleecer assessment area. These habitat types were characterized by mixed conifer stands for stages of successional development and supported various densities of Engelmann spruce and lodgepole pine. At timberline, alpine larch (*Larix lyallii*) may have been present in some stands. Ground vegetation varied in species composition and percent cover, but was generally sparser than other habitats in the assessment area. Climate and soil conditions were the primary factors that historically influenced these habitats in the Fleecer assessment area. Wind-throw, avalanches, and insect activity likely influenced stands of these habitats more in the past than fire. Despite the susceptibility to lightning, the low productivity and fuel connectivity of these sites resulted in a historically low fire frequency. When conditions facilitated fire, events were historically stand replacing due to heavy fuel loads and fire in-tolerance of species typical of these locations (Fisher & Clayton 1983, Romme 1980).

4. Synthesis

ASPEN

Aspen health is a concern forestwide. The FEIS accompanying the Revised Forest Plan cites a high level of downward departure from modeled historic to current vegetation conditions. This is reflected in the Beaverhead-Deerlodge Forest Plan (2009) objective of increasing aspen on 67,000 acres Forest-wide in a 10 year period, citing upland lodgepole pine and Douglas-fir stands where viable clones remain as the opportunity to meet the objective.

In general, all aspen stands in the Fleecer assessment area are also at high risk due to either singularly or cumulatively: conifer encroachment and overtopping; browsing; and age. The overriding objective with aspen would be to treat as many acres as possible in conducive stands where a level of protection from browsing to ensure full vigor and regeneration occurs can be assured. While surveys conducted on the eastern side of the Fleecer assessment area indicate relatively few aspen stands in upland areas contained within conifer stands, opportunity is available in other parts of the Fleecer to contribute to aspen objectives.

CURLLEAF MOUNTAIN MAHOGANY

The longevity of curlleaf mountain mahogany habitat is jeopardized by the threat of fire spreading into and within existing stands. A high intensity fire has the likelihood of destroying the older plants and any seed source. Eliminating Douglas-fir within these stands and treating Douglas-fir adjacent to curlleaf mountain mahogany stands can reduce potential fire effects to this vegetation type.

BIG SAGEBRUSH STEPPE

The natural role of fire has been disrupted in the sagebrush steppe and grassland mosaic of the area. Continued absence of fire will contribute to perpetuation of homogeneous sagebrush steppe dominated foothills and increased conifer dominance of the landscape. Returning fire to the sagebrush steppe-conifer ecotone can slow the succession of conifers down. Conifer removal from sagebrush steppe and grassland communities can contribute to the persistence of these communities and contribute to landscape heterogeneity and biodiversity.

The Revised Forest Plan sets an objective to reduce conifer colonization on 74,000 acres of riparian areas, shrublands, and grasslands forest-wide over the life of the Plan. This amounts to between 4,900 and 7,400 acres per year. The Fleecer WA provides an opportunity to meet a portion of that objective.

DOUGLAS-FIR

A total of 129 fire starts have been suppressed within the Fleecer assessment area since 1949. As discussed under "3. Reference Conditions", fire management practices in the last century have had a dramatic influence on Douglas-fir stand size class as well as allowing colonization of Douglas-fir in unique habitats that historically were free of conifers (dry grassland parks, mountain mahogany sites). The increase in extent and continuity of this coniferous vegetation type has effectively reduced landscape vegetation heterogeneity and associated biodiversity and put unique habitat types of the Fleecer assessment area (most importantly aspen and mountain mahogany) at risk of irreversible habitat conversion. Highly dense stands of Douglas-fir have been affected by western spruce budworm (whole-stand mortality in the Jerry Creek to Johnson Creek area). In addition, an increase of individual trees killed by Douglas-fir bark beetle has been noted in the assessment area.

COOL HABITATS DOMINATED BY LODGEPOLE PINE

Homogeneous lodgepole pine stands have become very susceptible to mountain pine beetle activity in the Fleecer area, as well as in adjacent areas on the Beaverhead-Deerlodge National Forest. Mortality in lodgepole pine stands is quite severe from a current MPB epidemic (see previous discussion on MPB in the Vegetation Characterization section as well as Table 51).

COLD, MOIST UPPER SUBALPINE AND TIMBERLINE HABITATS

Whitebark pine are declining on the landscape from white pine blister rust and mountain pine beetle. The extent of this damage and potential for regeneration is unknown.

SENSITIVE PLANTS

The primary threats to sensitive plants within the Fleecer Watershed Analysis Area are:

1) direct loss of a population thru mining, road construction, or similar large ground disturbing activities and

2) the competition of noxious and invasive weeds.

The direct loss of a population can best be addressed by adequate survey work prior to project implementation and subsequent project modification to avoid sensitive plant populations and habitat.

The threat posed by noxious and invasive weeds is a much more difficult issue. Many projects such as but not limited to timber harvest or motorized trail development will have the unintended effect of facilitating the spread and establishment of weeds. To some degree the risks associated with these activities can be mitigated thru education efforts, requirements for cleaning equipment, monitoring and treatment of weed infestations, and revegetation of disturbed sites. However, all of these mitigation measures carry a financial cost and require due diligence on the part of managers and staff. Prevention by forgoing certain projects may be the low cost option with regard to the threat of weeds to sensitive plant species.

NOXIOUS WEEDS

Roads and trails serve as the primary vectors for weed spread. Increased vehicle and OHV use has increased the spread, and potential for spread, of noxious weeds. New infestations are being found primarily along motorized vehicle routes such as roads and trails, and at recreation sites. Noxious weed spread potential increases with increased traffic on roads and trails, and the proliferation of user-created motorized trails. Low elevation areas within the watershed assessment boundary, especially sagebrush-grassland areas, are particularly at high risk of noxious weed invasion.

5. Recommendations

ASPEN

- Site specific field reviews of aspen stands will need to be done to determine suitable stands for treatment. In general, all aspen stands in the Fleecer assessment area are at high risk due to either singularly or cumulatively: conifer encroachment and overtopping; browsing; and age. The overriding objective with aspen would be to treat as many acres as possible in conducive stands where a level of protection from browsing to ensure full vigor and regeneration occurs can be assured.

- Increase aspen stand vigor by removing existing conifers from around the aspen clone in upland stand sites. All aspen stand acreage in upland stands where access is feasible should have the conifers removed around the clones.

MOUNTAIN MAHOGANY

- Increase productivity of mountain mahogany stands by eliminating Douglas-fir and/or juniper within the mountain mahogany stands. In addition, treat Douglas-fir stands adjacent to curlleaf mountain mahogany dominated areas to reduce potential fire effects to this vegetation type is recommended. Fire is not a preferred alternative for treatment. Fire can result in high mortality to curlleaf mountain mahogany, and is likely the quickest method to reduce the presence of the species.

BIG SAGEBRUSH STEPPE

- Use fire to create the mosaic of big sagebrush and grassland communities that historically occurred within the Fleecer assessment area.
- Where possible, remove the conifer succession into sagebrush steppe vegetation; this may be through a combination of mechanical means and the use of fire. This will contribute to Forest Plan Objectives to reduce colonization of sagebrush/grasslands. Caution with treatments adjacent to major travel routes is recommended; these locations typically support noxious weeds that have a high risk of spread into disturbed natural vegetation (Shelley et al. 2002). An assurance of adequate recovery by native vegetation prior to potential exposure to non-native plants is the best alternative.

DOUGLAS-FIR

- Push back colonization of Douglas-fir from sites that historically lacked the conifer. In addition, reduce stand densities on as many acres of Douglas-fir stands as possible. Where allowed, use timber harvesting systems on operable (ground-based to allow thinning) acres, so the largest trees are retained.
- Thin as many Douglas-fir stands as possible. Achieving the objective of sustaining most of the larger, older Douglas-fir trees in a stand may only be possible if as many stands of Douglas-fir are thinned as possible. When an

increase of Douglas-fir bark beetle populations develop, stands of larger trees are attacked and become the foci for development of an outbreak. However, mortality from DFB is less in stands with lower basal areas or in thinned stands.

- Develop a strategic fuels treatment plan to allow for natural fire starts to burn within the Fleecer assessment area to reduce the extent and continuity of Douglas-fir, and to encourage more open-grown stands of Douglas-fir.

COOL HABITATS DOMINATED BY LODGEPOLE PINE

- Salvage mortality in lodgepole pine created from the MPB epidemic. There is an opportunity to salvage harvest off of predominately the existing road system (some temporary road may be needed) using ground-based equipment capturing product value prior to deterioration, creating additional opportunities for land stewardship projects. Although overtime, the lodgepole pine stands killed by MBP will regenerate, the downfall will create heavy fuel loading. Large patches of Fuel Model 10 put the landscape at risk for severe wildfire. Without fire or treatment, and with the high levels of insects, substantial acres of FM 8 are converting to FM 10, adding to the risk. There is an opportunity to strategically harvest in areas to break up fuel continuity and create elk and other wildlife movement corridors.

- Create a strategic fuels treatment plan that would allow for fire starts to burn in portions of the Fleecer Watershed Assessment area to create early successional conditions. Given that a large percentage of the assessment area is roadless, the advantage of fire use management would enhance opportunities for resource benefits (i.e. to facilitate landscape heterogeneity).

DRY, LOWER SUBALPINE HABITATS

- Salvage harvest the lodgepole pine in stands where lodgepole pine dominates the overstory and has been attacked by MPB. This will create stands that are early successional without heavy fuel loading. These stands would maintain a mixed conifer component with other species maintained.

COLD MOIST UPPER SUBALPINE & TIMBERLINE

- Make a concerted effort to regenerate whitebark pine in the Fleecer assessment area. New monitoring of whitebark pine across the BDNF will provide key information related to regeneration practices locally. The most effective means for regenerating whitebark pine is to allow fire to burn in these timberline habitats when ignitions are natural. Management ignition may need to occur in strategic locations when conditions exist to promote regeneration. There is a need to conduct additional site specific inventory, mapping and analysis to implement these recommendations.

SENSITIVE PLANTS

- Complete adequate survey work prior to project implementation and subsequent project modification to avoid sensitive plant populations and habitat.

- Mitigate spread of noxious weeds into sensitive plant locations thru education efforts, requirements for cleaning equipment, monitoring and treatment of weed infestations, and revegetation of disturbed sites. If these are cost prohibitive, consider prevention by forgoing certain projects.

NOXIOUS WEEDS

- Continue existing management of noxious weeds in these watersheds including help from other agencies, organizations, and individuals. Where opportunities exist, seek new partners to collaborate with and expand weed control efforts.

- Seek options for new treatments including biocontrol and use of new herbicides. These options will be examined and applied where possible.

6. References

Vegetation

Agee JK. 1993. Fire Ecology of Pacific Northwest Forests. Island Press: Washington, D.C. 493 pp.

Arno, SF. 1980. Forest fire history in the northern Rockies. Journal of Forestry. 78(8): 460-465.

Arno, SF, and GE Gruell. 1983. Fire history at the forest-grassland ecotone in southwestern Montana. Journal of Range Management. 36(3): 332-336.

Arno SF, Parsons DF, RE Keane. 2000. Mixed –severity fire regimes in the northern Rocky Mountains: consequences of fire exclusion and options for the future. *In* 'Wilderness science in a time of change conference – Volume 5:Wilderness ecosystems, threats, and management; 23-27 May 1999; Missoula, MT.' Proceedings RMRS-P-15-VOL-5. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT

Baker WL. 2002. Chapter 2 Indians and Fire in the Rocky Mountains: The wilderness hypothesis renewed *In* Fire, Native Peoples, and the Natural Landscape. Island Press: Washington D.C. Pgs 42 – 76.

Bartos, DL. 2001. Landscape dynamics of aspen and conifer forests. *In* WD Shepperd, D Binkley, DL Bartos, TJ Stholgren, and LG Eskew, compilers. Sustaining Aspen in Western Landscapes: Symposium Proceedings; 2000 June 13-15; Grand Junction, CO.

Proceedings RMRS-P-18. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pgs 5-14.

Brooks KN, PF Ffolliott , HM Gregersen, and LF DeBano. 2003. Hydrology and the Management of Watersheds, Third Edition. Iowa State Press: Ames, IA. 574 pp.

Dayton, WA. 1931. Important western browse plants. USDA, Forest Service, Miscellaneous Publications No. 101. Washington, D.C. 214 pp.

Dorn, RD. 1984. Vascular Plants of Montana. Mountain West Publishing: Cheyenne, WY. 276 pp.

Cole, WE and GD Amman. 1980. Mountain pine beetle dynamics in lodgepole pine forests Part I: Course of an infestation. USDA, Forest Service, GTR-RM-119. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 283 pp.

Cooper, SV, P Lesica, and GM Kudray. 2005. Big sagebrush shrub-steppe post-fire succession in southwest Montana. Report to the USDI, BLM, Dillon Field Office. Montana Heritage Program, Helena, MT. 58 pp.

Cooper, SV, P Lesica, and GM Kudray. 2007. Post-fire recovery of Wyoming big sagebrush shrub-steppe in central and southeast Montana. Report to the USDI, BLM, State Office. Montana Heritage Program, Helena, MT. 16 pp. plus appendices.

Environmental Systems Research Institute, Inc (ESRI). 2007. ARC/INFO software, version 9.1 ed. Environmental Systems Research Institute, Redlands, CA, USA.

Fisher, WC and BD Clayton. 1983 Fire ecology of Montana forest habitat types east of the Continental Divide. USDA Forest Service, Intermountain Forest and Range Experiment Station. GTR-INT-141. Ogden UT. 83 pp.

Hendrickson, WH. 1970. Consideration of natural fire, variance in viewpoint. *In* The role of fire in the Intermountain West; proceedings of the Intermountain Fire Research Council symposium; 27-29 October 1970; Missoula, MT; USDA Forest Service.

Heyerdahl, EK, RF Miller, RA Parsons. 2006. History of fire and Douglas-fir establishment in a savanna and sagebrush-grassland mosaic, southwestern Montana, USA. Forest Ecology and Management. 230, 107-118.

Heyerdahl, EK, P Morgan, and JP Riser II. 2008. Multi-season climate synchronized widespread historical fires in dry forests (1630-1900), Northern Rockies, USA. Ecology.

Intergovernmental Panel on Climate Change (IPCC). 2007. Summary for Policy Makers. *In* IPCC Fourth Assessment Report; Climate Change 2007: Synthesis Report; An Assessment of the Intergovernmental Panel on Climate Change. 22 pp.

Jelinski, DE and WM Cheliak. 1992. Genetic diversity and spatial subdivision of Populus tremuloides (Salicaceae) in a heterogeneous landscape. American Journal of Botany. 79(7): 728-736.

Kimmerer, RW, and FK Lake. 2001. The role of indigenous burning in land management. Journal of Forestry. 99: 36-41.

Larson, ER. 2007. Whitebark pine regeneration in southwestern Montana and eastern Oregon. Nutcracker Notes. 13: 16-18.

Little, EL. 1971. Atlas of United States trees: Volume 1. Conifers and important hardwoods. Miscellaneus publication 1146. Washington DS: US Department of Agriculture, Forest SAervice. 9 pgs + 202 maps.

McDonald, GI, and RJ Hoff. 2001. Blister rust: an introduced plague. *In* DF Tomback, SF Arno, RE Keane; Whitebark pine communities. Island Press: Washington D.C.

Miller, RF, and JA Rose. 1995. Historic expansion of Juniperus occidentalis (western juniper) in southeastern Oregon. Great Basin Naturalist. 55(1): 37-45.

Morgan, P, Heyerdahl EK, and CE Gibson 2008. Multi-season climate synchronized forest fires throughout the 20th century, northern Rockies, USA. Ecology 89(3):717-728.

Mote, PW, AF Hamlet, MP Clark, and DP Lettenmaier. 2005. Declining mountain snowpack in western North America. Bulletin of the American Meteorological Society. 86:39 – 49.

National Oceanic and Atmospheric Administration (NOAA). 2005. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. [Available online from: http://www.cpc.ncep.noaa.gov/. Last accessed May 6, 2005].

Perry, DA and JE Lotan. 1979. A model of fire selection for serotiny in lodgepole pine. Evolution. 33(3): 958-968.

Pyne, SJ. 1982. Fire in America – a cultural history of wildland and rural fire. Princeton University Press: Princeton, NJ. 654 pp.

Pierce, JL, GA Meyer, and ATJ Jull. 2004. Fire-induced erosion and millennial-scale climate change in northern ponderosa pine forests. Nature. 432, 87-90.

Robinson, PJ and A Henderson-Sellers. 1999. Contemporary Climatology, Second Edition. Pearson Education Limited: San Francisco, CA. 317 pp.

Romme, WH. 1980. Fire frequency in subalpine forests of Yellowstone National Park. *In* Proceedings of the fire history workshop; 20-24 October 1980; Tucson, AZ. GTR-RM-81. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Range and Experiment Station. Pgs. 27-30.

Romme, WH. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park. Ecological Monographs. 52: 199-221.

Romme, WH, L Floyd-Hanna, D Hanna, and E Bartlett. 1992. Aspen's ecological role in the West. *In* WD Shepperd, D Binkley, DL Bartos, TJ Stholgren, and LG Eskew, compilers. Sustaining Aspen in Western Landscapes: Symposium Proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings RMRS-P-18. Fort Collins, CO: USDA, Forest Service, Rocky Mountain Research Station. Pgs 243-259.

Sheley, R., M Manoukain, and G Marks. 2002. Preventing noxious weed invasion. Montana State University, Extension Service, Bozeman, Montana. MONTGUIDE, MT199517 AG 08/200/. 4 pp.

Turner, MG, WL Baker,CJ Peterson, and RK Peet. 1998 Factors influencing succession: lessons from large, infrequent natural disturbances. Ecosystems. 1: 511-523.

Tuskan, GA, KE Francis, SL Russ, WH Romme, and MG Turner. 1996. RAPD markers reveal diversity within and among clonal and seedling stands of aspen in Yellowstone National Park, U.S.A. Canadian Journal of Forest Research. 26: 2008-2098.

USDA. 2001. Big Hole Landscape Assessment. USDA, Forest Service, Beaverhead-Deerlodge National Forest. Planning files.

USDA. 2008. Fire Effects Information System. USDA, Forest Service [Available online from: http://www.fs.fed.us/database/USDA Last accessed 30. January, 2008].

Whitlock, C, SL Shafer, and J Marlon. 2003. The role of climate and vegetation change in shaping past and future fire regimes in the northwestern US and the implications for ecosystem management. Forest Ecosystem Management. 178, 5-21.

Wirth, T, P Maus, J Powell, H Lachowski, K Suzuki, J McNamara, P Riordan, and R Brohman. 1996. Monitoring aspen decline using remote sensing and GIS – Gravelly Mountain Landscape, Southwestern Montana. Report prepared for Remote Sensing Steering Committee, USDA Forest Service. 14 p.

Wondzell, SM, and JG King. 2003. Postfire erosional processes in the Pacific Northwest and Rocky Mountain regions. Forest Ecology and Management. 178: 75-87.

Sensitive Plants

Heidel, B. L. and S. V. Cooper. 1998. Botanical survey of the Scratchgravel Hills, Lewis and Clark County, Montana. Unpublished report to the Bureau of Land Management. Montana Natural Heritage Program, Helena, Montana. 44 pp. + appendices.

Heidel, B. and J. S. Shelly. 2001. The effects of fire on Lemhi penstemon (PENSTEMON LEMHIENSIS)-final monitoring report, 1995-2000. Report to the Beaverhead-Deerlodge National Forest and the Dillon Field Office-Bureau of Land Management. Montana Natural Heritage Program, Helena, Montana. 22 pp. plus appendices.

Lesica, P. 1993. Effects of grazing on ARABIS FECUNDA: 1993 progress report. Unpublished report for the Bureau of Land Management, Butte District. Montana Natural Heritage Program, Helena, MT. 6 pp plus appendices.

Lesica, P. and J. S. Shelly. 1991. The effects of the introduced weed CENTAUREA MACULOSA on ARABIS FECUNDA, a threatened Montana endemic. Prepared for Montana Natural Heritage Program, Helena, MT. 15 pp. plus appendix.

Shelly, J. S. 1990. Status review update and establishment of demographic monitoring studies: PENSTEMON LEMHIENSIS. Unpublished report to the U.S. Forest Service, Missoula. Montana Natural Heritage Program, Helena, MT. 61 pp.

USDA Forest Service. 2004. Northern Region Sensitive Plants List for Montana. Threatened, Endangered and Sensitive Species Program, Northern Region, Missoula, Montana. Available on-line from http://fsweb.r1.fs.fed.us/wildlife/wwfrp/TESnew.htm.

Welsh, S.L., N.D. Atwood, S. Goodrich, and L.C. Higgins. (Eds.) 1993. A Utah flora. 2nd edition. Brigham Young Univ., Provo, Utah. 986 pp.

E. FIRE AND FUELS

1. Characterization

The presence and absence of fire plays a key role in the composition and structure of the vegetation on this landscape. Fire has been an integral part of all the sub-watersheds or Hydrological Unit Codes (HUCs) within the Fleecer Watershed Assessment area. Exclusion of fire from these ecosystems has resulted in a different range of vegetation conditions would have been found historically. Although other agents of change such as insects, disease, mining, grazing, and timber harvest have affected vegetation in the past, fire was the most influential. See the Vegetation, Characterization section for a detailed description of disturbance processes including fire.

The discussion in the Vegetation section also provides information regarding the different plant communities or habitat types that are present in each of the HUCs. These habitat types are associated with the fire groups described in "Fire Ecology of Montana Habitat Types East of the Continental Divide" (Fischer and Clayton 1983). A fire group is comprised of several different habitat types and is based on the response of tree species to fire and the roles these tree species take during successional stages. The frequency and severity of a fire that typically occurred are key factors in identifying each fire group. There are six fire groups representing the habitat types found in the analysis area. They are described in the next section in detail and in Table 58 below.

Table 58: Vegetation Classification and area of each mapped fire group

Fire Group	Vegetation Classification	Acres (%) All Ownerships
0	Special habitats: aspen, rock, water, meadow, willow	101,282 (45)
5	Cool, dry Douglas-fir	14,904 (7)
7	Cool, usually dominated by lodgepole pine	83,727 (38)
8	Dry lower subalpine fir	15,539 (7)
9	Moist, lower subalpine fir	413 (<1)
10	Cold, moist upper subalpine fir, whitebark pine	7,155 (3)
Total		223,020

These fire groups are represented spatially on Map 24, Fire Groups.

Land Management Plan Direction Relevant to Fire, Fuels and Fire Protection (2009)

Desired Condition - Ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Natural disturbance processes are recognized and accepted as essential to the health of ecological communities at various spatial scales. Fire is allowed to play its natural role where appropriate and desired. Life, investments and valuable resources are protected using the full range of appropriate management responses to fire.

Goal – Safety: Fire fighter and public safety is always recognized as the first priority for
fire suppression.

Goal – Wildland Fire Response: The full range of responses to wildland fire is available to meet social needs and to achieve ecosystem sustainability.

Goal - Fuels Management: A full range of fuels management activities is available to achieve ecosystem sustainability, including economic, and social components.

Goal – Wildfire Hazard Reduction: Effects of unplanned and unwanted wildfire are reduced by moving areas of condition class 2 and 3 to a condition class 1 for all regimes
and by maintaining areas in condition class 1.

Objective – Reduce the risk from wildfire to communities and resources in this priority:

- areas with a community wildfire protection plan, high risk areas adjacent to communities,
- areas in condition class 2 and 3 in fire regimes 4 and 5, and
- areas to be maintained in condition class 1.

2. Current Condition

FIRE GROUPS

The two dominate fire groupings in the Fleecer area are: the unique habitats of meadows, aspen, riparian areas which represent 45 percent of the area; and the cool mid-elevations where over one-third (38 percent) is dominated by lodgepole pine . For this report, these groupings are described as **Low Elevation Douglas-fir Series (Fire Groups 0 and 5) and Cool Moist Subalpine Series (Fire groups 7, 8, and 9)**

Low Elevation Douglas-fir Series (Fire Groups 0 and 5)

Over the last 100 years, fire suppression changed the landscape from one dominated by mature, open park-like stands to one dominated by overmature, overstocked, multi-layered Douglas-fir stands. These stands will burn as crown fires instead of ground fires if ignited during a dry season with windy conditions. This shift from a landscape that would generally burn as a ground fire with some crown fire on slopes

greater than 35%, to one that will generally burn as a crown fire, may be a substantial deviation from the pre-settlement disturbance processes in this area.

In addition, fire suppression has increased stand density and physiological stress for the Douglas-fir in this zone. Large areas of now pole-sized trees became established between 1895 and 1918. This may be related to heavy livestock grazing pressure along with better than normal moisture conditions. Reasons for the decline in conifer establishment after 1918 are not clear. However, drought was common starting in 1918 and prevalent from 1930 through 1940 (Stokes et al., 1973). Sapling invasion began in 1941 and continued until 1955. This was attributed to good seed crops that coincided with unusually moist spring weather over several years. Fire suppression contributed to the increase in big sagebrush which in turn provided micro-sites for seedling establishment.

The type of fire occurring in Fire Group Zero - Grasslands has also changed. The fuel in these areas has changed from what was mostly grass to a mix of grass, seedlings, saplings, and intermediate size trees. As the grasslands become more forested, fires are burning more intensely.

Cool Moist Subalpine Series (Fire groups 7, 8, and 9)
Fire exclusion reduced stand and landscape diversity in subalpine forests. From a landscape perspective, the forest mosaic aged more uniformly and is now less diverse spatially and compositionally (Murray 1998). By prolonging the survival of most pine age classes in this century, fire exclusion promoted stand decadence caused by pine beetles, blister rust, root rots, and subsequent windfalls. For example, fire exclusion likely exacerbated pine beetle epidemics in the region. Many stands in a mixed fire regime have shifted into the stand replacement fire regime during this century. Because the analysis area is considered an 'island range'—typically narrow and separated from other ranges by wide valleys—the area may exhibit a distinct fire regime. Fire rarely spread across the Continental Divide and rarely burned into neighboring drainages. Furthermore, fires rarely extended from lower timberline to upper timberline (Murray1998). Fire exclusion increases the likelihood that fuel buildup in the landscape will increase the number of fires crossing the Divide and burning adjacent drainages, decreasing the spatial landscape diversity in the area.

The lack of fire in the upper elevations (Fire Groups Eight, Nine and Ten) resulted in a change from a mosaic of different age classes and tree densities to a more continuous cover of mature trees. A fire start under the current conditions would more likely result in a stand replacement fire rather than a mosaic in the burn area.

Existing Fire Severity by Fire Group
A comparison of fire intensities associated with historic and existing conditions for each fire group is displayed in Table 59.

Table 59. Comparison of Historical and Existing Fire Characteristics for Each Fire Group

Fire Group	Historic Mean Fire Interval MFI	Historic Fire Severity	Existing Fire Severity
Zero-Grassland	10-45 years	low	low to moderate
Zero-Rock	none	none	none
Five	20-49 years	low	moderate to high
Seven	15-111 years	low to high	moderate to high
Eight	19-86 years	Low to high	Moderate to high
Nine	33-37 years*	low to high	moderate to high
Ten	38-124 years	low to high	low to high

FIRE REGIME / CONDITION CLASS

Fire regimes define how fire burned historically in different vegetation types. Different fire regimes have different frequency, extent, severity, and timing of fire events. The recorded history of wild fires on the forest is documented in a GIS database. This data base shows large fires in the general vicinity in 1889, 1898, and 1902. Since 1940, approximately 131 wild fires were suppressed and therefore very small in nature. Site visits confirm a lack of evidence large fires burned in the areas within the last 120 years. See Map 27, Fire History, Fire Regime.

Fire regime and condition class were mapped for the Fleecer watershed using the LANDFIRE Data Access Tool, which uses the National Map LANDFIRE. The tool allows users to interact with the LANDFIRE data distribution site (the USGS' *National Map LANDFIRE*) and download LANDFIRE data directly from within ArcMap. Specifically, the user can define the download area, select the desired LANDFIRE layers, & then download the data for the specified area. The tool and associated tutorial can be accessed via www.niftt.gov under Tools & User Documents.

Fire regime condition class defines the degree of departure from the historic fire return interval and is used to indicate where there is a high risk of wildfire. The higher condition classes 2 and 3 represent vegetation conditions with larger fuel loads than typical. Higher condition classes are more conducive to higher intensity fires which in turn hamper suppression efforts. The risk of a wildfire igniting would be the same regardless of the condition class.

Stands in condition class 1 reflect historic fire return intervals. For the purpose of this exercise, stands with any disturbance are mapped as Condition Class 1 or 2, whether that is timber harvest, prescribed burning or wildfire. Condition Class 3 is mapped where stands have not experienced some kind of disturbance within their respective fire regime. For example, a lodgepole stand with a fire regime of 35-200 years that was clearcut 35 years ago or that experienced a wildfire 10 years ago would be in condition class 1. If it has been 250 years since a wildfire modified the stand, it would

be in condition class 3. Condition class 3 represents a high degree of departure from historic fire return interval.

The majority of the assessment area is currently in condition class 2, indicating that these stands have missed at least one disturbance cycle. Most of the mapped condition class 3 areas fall outside of the Beaverhead-Deerlodge National Forest boundary, indicating that there is some opportunity to design treatments that would move them towards a more frequent disturbance, based on their natural disturbance regime. See Map 28. Fire Condition Class.

The National Fire Plan and 2008 Revised Forest Plan both set objectives for reducing acres in Fire Regimes Condition Classes 2 and 3. Treating these areas in Fire Regimes 1, 2, and 3 adjacent to communities is prioritized higher than Fire Regimes 4 and 5.

Table 60. Fire Regime (Type of Disturbance including logging activity)

Historic Fire Regime	Small Fire < 100acres		Large Fire		Selection	Clearcut	Prescribed Fire
	#	acres	#	acres	acres	acres	acres
I (0-35 years, low/mixed severity)	5	2	5	700	23	0	7
II (0-35 years, stand replacement)	2	<1	1	53	2	0	19
III (35-200 years, low/mixed severity)	89	252	2	2611	1267	2033	4132
IV (35-200 years, stand replacement)	27	95	1	1051	490	1622	2095
V (>200 years, any severity)	6	2	1	77	183	1075	725

Source of Disturbance Acres: FACTS database

Table 61. Fire Regime (% Acres disturbed by fire regime)

Historic Fire Regime	Total acres	Acres that have had disturbance	% Disturbance*
I (0-35 years, low/mixed severity)	4,080	732	18
II (0-35 years, stand replacement)	662	75	11
III (35-200 years, low/mixed severity)	142,222	10,295	7
IV (35-200 years, stand replacement)	58,391	5,353	9
V (>200 years, any severity)	17,391	2,062	12

No Vegetation (Rock/Water)	372	0	0
Totals	**223,118**	**18,517**	**8**

***%** Disturbance does not imply whether or not these areas need treatments. It simply means that this is the amount of disturbance that we have recorded for the study area.

Table 62. Percent Condition Class of Total Area

Condition Class	Total Acres	Percent of Total Area
FRCC 1	19,678	9
FRCC 2	162,075	73
FRCC 3	32,784	14
4 - Water	334	<1
5 - Snow/Ice	4	<1
6 - Barren	91	<1
7 - Developed	257	<1
8 - Agriculture	5,749	2
9 – Wet/Apline	1,360	<1
TOTAL	**222,332**	100

*** Acre variation between tables can be attributed to slight boundary differences with data sources analyzed.

FIRE BEHAVIOR

During the past two decades in the United States, the USDA Forest Service has developed fuel models that aid in the prediction of fire behavior. These models indicate how difficult a fire may be to control and allow managers to assess potential fire damage to resources. These mathematical models require descriptions of fuel properties as inputs to calculations of fire behavior potential. The collections of fuel properties have become known as fuel models and can be organized into four groups: grass, shrub, timber, and slash. The differences in fire behavior among these groups are basically related to the fuel load and its distribution. Table 63 represents the fuel models present in the Fleecer Analysis Area.

The fuel models represented in the Fleecer Watershed Assessment are displayed on Map 29. Fuel Model.

Table 63. Fuel Model Descriptions and associated fire behavior

Fuel Model /acres	Typical fuel complex	Fire Behavior
Grass and grass dominated		
FM 1 58,022 acres	Short grass (1 foot)	Fast moving surface fire.
FM2 21,969 acres	Timber (grass and understory)	Surface fire with litter and wood contributing to intensity.
Chaparral and shrub fields		
FM5 3,758 acres	Brush (2 feet)	Moderate intensity surface fire.
FM6 9,067 acres	Dormant brush, hardwood slash	Fires carry through the shrub layer with moderate winds, drops to ground with low wind speeds or openings.
Timber litter		
FM8 101,314 acres	Closed timber litter	Slow-burning ground fires with low flame lengths, can flare up in concentrations of dead fuel.
FM9 2,993 acres	Hardwood litter	Fires run through the surface litter faster than model 8 and have longer flame height.
FM10 20,011 acres	Timber (litter and understory)	Fires burn in the surface and ground fuels with greater intensity than other timber models. Trees will crown, torch and spot with concentrations of fuel.

Historically areas would have burned freely across the landscape periodically thinning mature timber stands, restricting the advancement of encroaching conifers into sagebrush grassland parks and reducing down dead woody debris in the forested understory. Successful fire suppression activities, limited prescribed fire treatments and insect and disease infestations have caused increases in fuel loadings and stems per acre to all conifer species causing fuel model changes from the reference condition. The reference conditions would have differed from the current condition by allowing habitat types to determine the fire behavior, not an uncharacteristically high accumulation of fuel and debris. The reference condition would have been one of low severity frequent wildfires promoting vigorous healthy uncongested stands. Fire would act as a maintenance treatment rather than a stand replacing event.

Currently, mountain pine beetle, MPB, (*Dendroctonus* ponderosae) activity is widespread in the assessment area (see Map 19. Bark Beetle Progression). The Fire and Fuels Extension to the Forest Vegetation Simulator was used to model MPB

mortality in the Basin Creek area approximately 12 air miles east of Fleecer. Based on this modeling, fall down rates for 10 to 20-inch trees killed by MPB are 95 percent in 20 years and 100 percent in 22 years (Basin Creek FEIS, 2004). The effect of all these down trees would be large accumulations of surface fuels greater than 25 tons/acre resulting in greater fire behavior indices such as flame length, rate of spread and spotting distance.

The specific differences evident in the assessment of fuel models are the predicted increases in down dead woody debris and understory colonization in mature timbered stands as well as the advancement of encroachment of conifers into sagebrush grassland parks and riparian communities..

VALUES AT RISK

There are currently 403 structures present in the assessment area boundary valued at over $5,000. The majority of these are located in the NE corner. Residences are also scattered along the east and southern boundary and clustered in Jerry Creek and Bear Gulch. There are 3 Forest Service administration sites: Long Tom and High Rye Cabins and the Fleecer Guard Station. High Rye and Fleecer are Forest rental cabins. Beaverdam is the only campground located in the Fleecers. Picnic tables, fences and toilets would require protection in the advent of a wildfire. Numerous mining claims have structures on site in varying condition. Some may be historic. There is also 2.7 miles of utility lines located on the forest in the NE corner of the assessment area.

Table 64 lists the man-made improvements to consider in the event of a wildland fire.

Table 64. Residences/Structures

Type of Structure	Count
Buildings	403
Bridges	7
Communication sites (4 proposed)	5
Campground	1
FS Facility (Recreation Cabin)	3
Mines	20

The Fire Behavior Assessment Tool (FBAT) was used to spatially display and identify areas with potentially hazardous fire behavior located within ¼ mile of identified structures, wildland urban interface (WUI). See Map 30. Crown Fire Threat to WUI. The Fire Behavior Assessment Tool, or FBAT, is a spatial planning tool that helps managers identify fuel hazards for fire management planning. FBAT is used to locate and prioritize fuel treatment opportunities based on potential fire behavior. FBAT uses accepted fire behavior modeling within the ESRI ArcMap program environment. Using topography and fuel layers, fuel and foliar moisture values, and wind direction and speed data, FBAT calculates potential fire behavior for each pixel.

Table 65 summarizes the inputs fuel moistures used to perform the FBAT model run and represents conditions at the 95th percentile weather.

Table 65. Percent Moisture Content by Fuel Size Class

1-Hour	10-Hour	100-Hour	1000-Hour	Herbaceous	Woody
3	4	5	30	60	100

Table 66 values were derived from FBAT output for crown fire type and include National Forest Service administered lands only and are displayed on Map 30. Crown Fire Threat to WUI.

Table 66. WUI Opportunity Acres within ¼ Mile of Structure by Crown Fire Hazard

Crown Fire Hazard Rating	Acres w/in ¼ mile of Structures
2 – Passive Crown Fire	63
3 – Active Crown Fire	685
Total	**748**

3. Reference Condition

This section describes historical conditions and fire intervals for the two primary broadly described habitats affected by fire: the low elevation Douglas-fir series and cool moist subalpine series. See the Vegetation, Reference Condition section for a detailed description of fire effects on aspen, mountain mahogany, big sagebrush, and four forested habitat types.

Low Elevation Douglas-fir Series (Fire Groups 0-5)

Historic fire played a role in keeping Douglas-fir stands open by burning the seedlings, saplings, and those pole sized trees too small to have bark thick enough to be somewhat fire resistant. Ignitions were both from lightning and Native Americans who used fire to signal, drive game, route enemies, and green-up pastures (Barrett 1980.) Historically, low elevation fires in drier areas, such as those characterized by Fire Groups Zero - Grasslands and Fire Group Five occurred more frequently, resulting in low intensity fires that cleared lower ground fuels without affecting the overstory. Fire Group Seven becomes more prevalent at the middle elevations. Fire Groups Eight, Nine, and Ten are generally found at the higher elevations and experienced understory and stand replacement fires. Severe fires usually took place during periods of drought. Fires in these groups left a mosaic of different age classes across the landscape.

General fire intervals were determined by cutting cross sectional wood-cookies and analyzing fire scars from sample trees in the habitat type across the southern half of the Beaverhead-Deerlodge National Forest. Finding trees with complete scar records was difficult because of extensive logging in the late 1800's. Ages of sample trees ranged from 165 to 300 years old. Habitat types included Douglas-fir/Pinegrass and

Douglas-fir/Idaho Fescue. These types fit Fischer and Clayton's Fire Groups 5, dry Douglas-fir habitat types.

Many of the sample trees originated in the late 1690's to early 1700's after a rather extensive, intense fire. This data indicated that fires were frequent and widespread from about 1690, the time of the earliest fire scars, until about the 1850's. After 1852 only two fires were recorded from the sample trees - 1895 and 1918. Livestock use of these edge grasslands, beginning in the 1860's apparently had a marked influence on fire occurrence. The effect of grazing in removing fine fuels can be seen today by comparing grazed to ungrazed rangeland. Grazing hampers fire spread. Thus, it is highly probable that the more intense use by early-day livestock greatly restricted frequency and size of fires.

Prior to settlement in the late 1800's and early 1900's fire frequencies were likely in the range of 20-40 years (Arno and Gruell 1983). This frequency prevented buildup of fuel and, consequently, most fires were low intensity (Schmidt and Larson 1989). Mean fire intervals in the Douglas-fir/grassland zone was 47 years. Intervals ranged from 23 to 65 years. Approximate fire years were in 1699, 1726, 1762, 1798, 1827, 1852, 1895, and 1918. The resulting intervals are probably an overestimation of the average time between fires. This can be expected because some fires failed to scar sample trees or they may have been burned off by subsequent fires. Fires on the driest sites went probably undetected because sparse fuels and old growth trees were often confined to rocky outcrops. This coincides with a study of fire history at the forest/grassland ecotone in Southwest Montana by Arno and Gruell (1983). They found mean fire intervals (MFI) to be between 41 and 45 years. They also estimated that at least one fire was missed at each site, resulting in a MFI of about 35 years.

More recent fire history studies in the Fleecers found results similar to those found in the larger forest study. Emily Heyerdahl et al. sampled 83 fire scarred trees just north of the Big Hole River on the southern end of the assessment area in 2004-2005. The surface fires they reconstructed burned from 9-302 hectare (ha.) and burned the sampled plots once every 2-84 years during the analysis period from 1700-1860. From 1860 to present, only a single small fire (32ha.) was documented in the study area (Heyerdahl et al. 2006). Surface fires occurred every 37 years on the average, and so would often have been frequent enough to kill young Douglas-fir trees.

Arno and Gruell also did a photo comparison from valleys of southwestern Montana. These comparisons show a substantial increase in mountain big sagebrush and conifers since 1900. Near the lower timberline, vigorous young Douglas-fir stands are found on sites with few or no mature trees or stands. Dead sagebrush is often found beneath these new stands. Many of the scattered aspen patches have similarly been shaded out in the last 100 years. Field inspections and comparisons showed that in the dry PSME/FEID habitat types, trees were normally confined to rock outcrops, talus slopes, and other microsites having surface rock and little vegetation or fuels. In

the last 100 years, trees have spread to the sagebrush/grass communities. In these dry sites, trees developed slowly and evidently few were able to reach a fire resistant size by the time the next ground fire swept through the area. Fire was the most common source of disturbance. Ground fires were typical on slopes less than 35%. Recurrent ground fires normally killed the seedlings and pole size trees, but the larger Douglas-fir survived. This resulted in open, park-like stands of large Douglas-fir trees, often of ages of 300 years or greater.

Cool Moist Subalpine Series (Fire groups 7, 8 and 9)
The Fleecer area also contains habitat types in the subalpine fir series that, regardless of potential climax species, are usually found here supporting lodgepole pine-dominated stands. Apparently these stands seldom reach a near-climax condition. Periodic wildfires seem to recycle the stands before a substantial amount of mature lodgepole pine dies out.

General fire intervals were determined by cutting cross sections of tree bases and analyzing fire scars from sample trees in this habitat type. The habitat types present fit Fischer and Clayton's (1983) Fire Group 7 - cool habitat types usually dominated by lodgepole pine. Results from sampling 26 stands in Fire Group 7 suggest a presettlement pattern of mixed severity fires at relatively short intervals. For example, the sampled fire intervals for lodgepole pine ranged from about 25 to 60 years on average, and the 26-stand mean fire interval was 43 years. (Barrett, 1997). This suggests the area has had recurring cool fires that thinned out the lodgepole pine.

Results were similar for Fire Groups Eight and Nine despite their differing environmental traits. Fire Group Eight is composed of dry lower subalpine stands dominated by Douglas-fir and/or lodgepole pine, whereas Group Nine contains moist lower subalpine stands with spruce (Picea engelmannii) and subalpine fir as a major component. Samples from both groups suggest primarily mixed severity fires after short to moderately long intervals (35-50 year MFI) during the presettlement era. The lack of variation between these groups likely results from the fact that only three stands in Fire Group Nine yielded long-term data. (Barrett, 1997).

4. Synthesis and Interpretation

Fire Regimes

Fire frequency as described by fire regimes has been measureably altered in the Fleecers compared to historic records. The effect of this change is a change in vegetation composition and structure, a gradual buildup of available fuel, and increased ladder fuels. The majority of the assessment area is currently in condition class 2, indicating that these stands have missed at least one disturbance cycle. Most of the mapped condition class 3 areas fall outside of the Beaverhead-Deerlodge National Forest boundary, indicating that there is some opportunity to design

treatments that would move them towards a more frequent disturbance, based on their natural disturbance regime. See Map 28, Fire Condition Class.

In the lower elevations where park like stands of Douglas-fir existed, a shade tolerant understory has developed. With this increase in the amount of vegetation, a fire start will more likely result in stand replacement rather than an underburn. Maintenance or restoration of these parklands to their reference condition will require re-introduction of fire, both prescribed and wildland fire.

Fire Behavior

Current fuel models show a distinct gap from reference conditions. Specific changes are uncharacteristic increases in fuel loadings (accumulation of fuel and debris) and stems per acre for all conifer species (understory colonization) and advancement of conifers into sagebrush grassland parks and riparian communities. This alteration from the reference condition to the current condition is causing changes in fuel models, such as altering fuel models 1 and 2 to display fire behavior most consistent with a fuel model 8 while fuel model 8 locations are displaying fire behavior more consistent with that of a fuel model 10. Riparian communities are also showing a change from what would have historically been described as burning similar to a fuel model 2 to burning more consistent with brush fuel model behavior similar to models 5 or 6 depending upon the amount of down dead woody debris and conifer colonization. Overall, departure from historic conditions in aspen, sage, mahogany and mature conifer stands appears to be the primary difference between the current and reference condition.

Values at Risk

The Fire Behavior Assessment Tool identified areas with potentially hazardous fire behavior located within ¼ mile of identified structures. There are currently 403 structures present in the assessment area boundary valued at over $5,000 and 685 acres within ¼ mile of structures which are vulnerable to active crown fire. The primary goal for wildland fire planning in this area would be to identify potential suppression challenges and identify ways to overcome these challenges prior to a wildland fire event.

Utilities are a particular concern when threatened by wildfire. Homes that would be easily considered defensible with utilities present would otherwise be considered not defensible if utilities are not adequate. Electrically powered wells/pumps are used to provide water to a home defense hose lay, power could remain live during the duration of the needed protection system. By ensuring that power could remain on during a wildfire event, the need to utilize water sources great distances from the structures could be avoided. By providing power sufficient to power wells home wildfire defense systems would be more likely than if power is not an option.

Summary

Some of the key conclusions from the fire/fuels assessment include:

- Fire Regimes 3 & 4 are lacking the most disturbance which coincidently is where the most residences/structures are located. Aspen, sage, mahogany and mature conifer stands display the greatest difference between the current and reference condition
- Mountain Pine Beetle stands will be generating fuel accumulations as trees die and snags fall to the ground, contributing to significant changes in fuel model.
- Residences and structures could benefit from some fuels reduction treatments in their proximity.

The issues above can provide a frame work from which to build and design fire management action points (for future wildfire management), incorporating the few natural barriers, current level of MPB activity, and past harvest units.

5. Recommendations

Fire Regime, Condition Class Recommendations:

- Treat stands in fire regimes 3 and 4 with a priority around residences and structures.
- Treat mountain pine beetle affected stands to reduce future fuel accumulations and restore/maintain as fuel model 8.
- Treat parklands, restoring them to Fuel Models 1 or 2.
- Take advantage of natural ignitions to manage for resource benefits along with prescribed treatment, if natural ignitions do not occur

Design vegetation treatments to incorporate areas with natural barriers, areas of MPB activity, and past harvest units to create fuel breaks on the landscape and facilitate future use of natural ignitions.

Identify areas where fire, in conjunction with thinning or slashing can be most beneficial.

Fire Behavior Recommendations

- Treat aspen, sage, mahogany and mature conifer stands by thinning commercial and sub-merchantable material and prescribed burning.
- Prioritize areas where the greatest number of stands requiring treatment are clustered, and the treatment can result in restoring these areas to their historic fuel model and fire behavior condition. Critical forest plan elements should be considered when prioritizing area for treatment.

Values at Risk Recommendations:

- Reduce fuel accumulations adjacent to any utility which may cause harm to the utility in the event of a wildfire. Specifically, remove all down dead woody debris and vegetation along utility corridors and, where possible, immediately

adjacent to utility lines. With combustible material gone, there is an increased probability the utility can be protected and fire fighters can implement a broader range of suppression strategies.

- Conduct a wildland fire structure assessment of each residence and structure within the assessment area recommend treatment. Remove areas of heavy fuel loading from the perimeter or private lands that could act as an ignition source to the private inholding in the event of a wildfire. Provide private land owners a list of actions to improve their defensability.

- Identify potential suppression challenges and ways to overcome these challenges prior to a wildland fire event.

6. References

Arno, S. F. 1976. The historical role of fire in the Bitterroot National Forest. USDA Forest Service, Intermountain Forest and Range Experiment Station, Research Paper INT-187.

Arno, S.F. and G.E. Gruell 1983. Fire History at the forest-grassland ecotone Southwestern Montana. J. Range Manage. 39:332-336

Arno, S.F. and G.E. Gruel. 1986. Douglas Fir Encroachment into mountain grasslands in Southwestern Montana. J. range Manage. 39:272-275.

Fischer, William C.; Bradley, Anne F. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Odgen, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 1-3, 33-35 p.

Gaylor, H.P. 1974. Wildfires Prevention and Control. ISBN 0-87618-131-0 Library of Congress Catalog No. 74-14269, 1974 by the Robert J. Brady Company Aprentice-Hall Company Bowie, Maryland 20715.

Gruell, G.E. Fire and vegetative trends in the Northern Rockies: interoretations from 1871-1982 photographs. General technical report INT-158. Ogden, UT: U.S. Department of Agricutlure, Forest Service, Intermountain Forest Range Experiment Station; 1983. 117 p.

Gruell, G.E., Brown J. K. and Bushey C. L. Prescribed Fire Opportunities in Grasslands Invaded by Douglas-fir: State-of-the-Art-Guidelines. General Technical Report INT-198. United States Department of Agriculture, Forest Service, Intermountain Research Station; 1986 1-8 p.

Heyerdahl, E.K., Miller R.F., Parsons R.A., History of fire and Douglas-fir establishment in a savanna and sagebrush-grassland mosaic, southwestern Montana, USA. USDA Forest Service, Rocky Mountain Research Station, Fire Science Laboratory, Missoula Mt., Oregon State University, Department of Rangeland Resources, Corvallis OR.

Loope, L.L. and G.E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, Northwestern Wyoming. Quaternary Research 3:425-443

Murray, Michael P. 1998. Fire history of an isolated subalpine mountain range of the Intermountain Region, United States. Journal of Biogeography. 25, 1071-1080.

NWCG, Fireline Handbook, January 1998, NWCG Handbook 3, PMS 410-1, NFES 0065 P. B-10 to B-19.

USDA Forest Service. 2004. Beaverhead-Deerlodge NF. FEIS Basin Creek Hazardous Fuels Reduction. Butte, MT.

Van de Koppel, J., M. Rietkerk, F. van Langevelde, L. Kumar, C. A. Klausmeier, J. M. Fryxell, J. W. Hearne, J. van Andel, N. de Ridder, A. Skidmore, L. Stroosnijder, and H. H. T. Prins. 2002. Spatial Heterogeneity and Irreversible Vegetation Change in Semiarid Grazing Systems. American Naturalist 159: 209-218.

F. WILDLIFE

1. Characterization

Wildlife is a product of the land (MDFWP 1971), reflected in part, by the habitat available. Habitat is comprised of food, cover, water, and space. Food and cover are both characteristics reflected encompassed by vegetation. Habitat for wildlife is tied integrally to vegetation cover types, structural classes and condition.

The Coarse Filter Analysis assumes that by maintaining a set of ecological communities of sufficient size, composition, structure and distribution, viability for the majority of all species is maintained (USDA 2003). The purpose of a Coarse Filter Analysis is to provide a basis for management recommendations to maintain or restore ecological communities of sufficient size, composition, structure, and distribution so viability for the majority of species will be maintained (Hunter et al. 1988 in USDA 2003).

Development of ecological communities in the Fleecer are described in the vegetation and fire resource sections of this report. The wildlife habitat discussion in the Current Condition section will focus on habitats or vegetation types of concern in this watershed which surface through the coarse filter look at vegetation and habitats.

There are species, that because of rareness or elevated human value, warrant individual analysis. This is the "fine filter" approach. The fine filter approach will addressThreatened, Endangered, Sensitive and management indicator species.

The Fleecer Watershed includes roughly 223,000 acres and includes all of the Fleecer Mountain Range. This is an isolated mountain range, located between the Pintlers, Flints, Boulder Mountains, Highlands and Pioneer mountain ranges. Open valleys and highways (and a river to the south) may reduce connectivity between mountain ranges for some species. Within the mountain range, there has been a history of vegetation management (especially timber harvest and associated roading) and livestock grazing. Within the Watershed, lands are managed by several different agencies as well as private lands, as shown in Table 67.

Table 67. Land Management within the Fleecer Watershed.

Area	Acres	Percent
National Forest	98,947	44
Fleecer WMA	5,429	2
Mt Haggin WMA	36,108	16
Other State	5,196	2
BLM	15,422	7
Private inside Forest Boundary	3,655	2

Area	Acres	Percent
Private below Forest Boundary	58,031	26
Other	317	<1
Total	223,115	

Wildlife Species of Interest

The Fleecer Watershed provides a wide variety of diverse habitats for wildlife and hence, a wide variety of species. Table 68 displays a screen for current threatened, endangered and sensitive species (TES), and Management Indicator Species (MIS) that are known or suspected in the Fleecer Watershed area. The analysis area provides or could provide year-round habitat for a number of MIS and Region 1 sensitive species.

Table 68. TES, MIS and other Wildlife species considered for presence in the Fleecer Watershed

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
Grizzly bear	Sensitive (Madison RD)	Habitat generalist. Lack of human disturbance.	No known occupancy or transient use. Only listed for Madison RD. Unlikely.
Peregrine Falcon	sensitive	Prominent cliffs for nesting within 1 mile of water and 10 miles of hunting habitat including riparian areas, parklands, and mountain valleys.	No known eyries within 10 miles; migratory birds may pass through
Gray Wolf	Sensitive	Habitat generalists. Lack of human disturbance (corresponding to low road densities and secure areas), abundant prey (primarily elk) required.	Yes-habitat Mt Haggin pack in area plus potentially another pair on east side (Feely)
Bald Eagle	Sensitive	Nesting trees/platforms near an open water body (> 80 acres) or major river system; available fish and water bird species prey near nesting habitat; forages on carrion in winter or during spring/fall migration.	Yes – along Big Hole River on south end and winter foraging on winter ranges
Elk	MIS	Habitat generalist. Winter range in lower elevation conifer/shrub/grasslands.	Yes
Greater Sage Grouse	Sensitive	Sagebrush obligate.	Potentially in southeast corner
Mountain	MIS	Steep, rocky high elevation	Species and habitat not

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
goat		areas.	present.
Black-backed Woodpecker	Sensitive	Burned or insect-killed forest	Yes- habitat increasing due to insect caused conifer mortality
Flammulated Owl	Sensitive	Mature (> 9 inches dbh) and old growth ponderosa pine/Douglas-fir with abundant moth species prey.	Yes-habitat marginal. Dry Douglas fir possible
Harlequin Duck	sensitive	Fast moving, low gradient clear mountain streams	No. Only activity in Rock Creek system on Pintler RD
Fisher	Sensitive	Moist coniferous forested types (including mature and old growth spruce/fir), riparian/forest ecotones	No known activity but potential habitat
Great Basin Pocket Mouse	Sensitive	Dry grassland with less than 40% cover.	Yes. Habitat. Assessment area at periphery of range
North American Wolverine	Sensitive MIS	Large areas of unroaded security habitat; alpine/subalpine talus slopes for secure denning habitat, ungulate carrion in winter.	Yes
Northern Bog Lemming	Sensitive	Wet riparian sedge meadows, bog fens.	No. Nearest activity at Maybee Meadows on Wisdom RD
Pygmy Rabbit	Sensitive	Dense clumps of big sagebrush or greasewood forage on grasses (wheat grass, bluegrass) in summer and sage in winter.	Yes. Assessment area at periphery of range. Active burrows detected on extreme eastern edge. Area is not typical habitat
Townsend's Big-Eared Bat	Sensitive	Roosts in caves, mines, rocks and buildings. Forages over tree canopy, riparian areas or water.	Yes-foraging & roosting No known hibernacula
Spotted Bat	Sensitive	Cliffs, Rock faces for roosting. Forest openings, riparian areas, wet meadows for foraging	Yes- documented on Forest to south in 2007
Canada lynx	Species of interest	BDNF is currently considered unoccupied, secondary habitat. Suitable habitat includes moist forest types	Suitable habitat is present in the analysis area
Pika	Species of interest –	High-elevation talus slopes	

SPECIES	2008 STATUS	HABITAT PREFERENCE	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA
	petitioned for listing		

Land Management Direction Relevant to Wildlife

Management indicator species have historically been identified under the premise that population changes can reflect the effects of management activities. The 2009 Revised BDNF Plan identifies wolverine and mountain goat as indicators of disturbance in high elevation winter habitat, and elk as an indicator of fall security at mid and lower elevations. Table 69 summarizes the MIS. The overall Plan objective for MIS is to maintain habitat conditions for elk security and winter habitat integrity for wolverine and mountain goat as reflected by changes in abundance of these MIS. Specific objectives that apply to this watershed are included in Table 69 below.

Table 69. BDNF Management Indicator Species

Species	Representative Habitat	Plan Objectives
Elk	Fall habitat security	Road Densities by Hunting Unit – from October 15 to December 1, reduce the open motorized road (and trail) densities in HU 341 to 0.5 mi/sq mi or less.
Wolverine	High-elevation winter security	NA, no specific objective for this area
Mountain goat	High-elevation winter security	NA, no specific objectives for this area. Not present in analysis area

Land Management Plan Direction (2009) Relevant to Wildlife

Desired Condition – ecological processes, which affect the chemical, physical, and biological components of the aquatic and terrestrial ecosystems and fully support designated beneficial uses, are present and functioning to provide the diversity of the forest, shrub land, grassland, riparian and aquatic communities.

Desired Condition – Conditions for self-sustaining or viable populations of native and desired non-native plant and animal species are supported within the natural capability of the ecosystem.

Desired Condition – Issues involving species with needs that go beyond forest boundaries and authority are identified and resolved in conjunction with other federal agencies, state, county, tribal and city governments.

Goal – Habitat: Cover and forage for animals is provided by a mosaic of species and age classes of native trees, shrubs, grasses and forbs.

Goal – Connectivity: Forest management contributes to wildlife linkages between landscapes, unless landscape isolation is determined to be beneficial. Linkage areas are those areas identified for large carnivores and ungulates through multi-agency coordination.

Goal – sage grouse: Sagebrush habitat supports sage grouse and pygmy rabbit populations by providing suitable sage grouse brood-rearing habitat on at least 40% of the sagebrush habitat within 18 km of documented active or inactive sage grouse leks and the area mapped as potential pygmy rabbit habitat.

Goal - Wildlife Security: Secure areas and connectivity for ungulates and large carnivores are provided, while recognizing the variety of recreational opportunities.

Goal – Wildlife Secure Areas and Connectivity: Manage density of open motorized roads and trails by landscape year-round, except fall rifle big game season, to achieve levels at or below the following (Scale – landscape)

Big Hole = 1.2 mile per square mile
Upper Clark Fork = 2.0 miles per square mile

Goal – Elk Security: Elk security is managed to provide quality elk habitat, provide a variety of recreational hunting opportunities, and provide support for Montana's fair chase emphasis. Manage open motorized road and trail density by MTFWP hunting units as of 2006 – on National Forest lands during the fall rifle big game season, to achieve levels at or below the following (Scale – Hunting Unit)

HU 319 = 0.6 miles per square mile
HU 341 = 0.5 miles per square mile

Objective - Road Densities by Hunting Unit – from October 15 to December 1, reduce the open motorized road (and trail) densities in HU 341 to 0.5 mi/sq mi or less.

Objective – MIS - Maintain habitat conditions for elk security and winter habitat integrity for wolverine and mountain goat as reflected by changes in abundance of these MIS

Objective – sage grouse: maintain or improve sagebrush height, and canopy and grass-forb canopy of sagebrush habitat, emphasizing habitat within 18 km of documented active or inactive sage grouse leks and the area mapped as potential pygmy rabbit habitat.

Objective – Snags – Snags and woody debris are well distributed by vegetation category and size class over time.

Objective – Sensitive and Federally Listed Species – Information in the following sources should be considered when designating projects that may affect sensitive species or federally listed species (list not included here).

The Fleecer Mountain Range is broken into two different Management Areas in the Plan. The Recreation Allocations for these areas indicate the potential for disturbance from recreational motorized use and are shown in Table 70.

Table 70. Management Area Recreation Allocations

Management Area	Summer non-motorized	Backcountry	Road-based	Winter non-motorized
South Fleecer	0%	60%	38%	0%
Northeast Fleecer	0%	39%	56%	21% (all low elevation)

2. Current Condition

Wildlife Habitat

The myriad of vegetation types in the Fleecer Mountains range from subalpine "tundra" and whitebark pine habitats to sagebrush to sub irrigated alfalfa fields. Each vegetation type contributes various habitat requirements to different species. Table 71 shows the percentage of each cover type that is on NFS lands compared to the watershed as a whole. The data used for this table is from SILC3 satellite imagery because it is available across all ownerships and provides a look across the whole analysis area. More information on vegetation on the NFS lands is found in the Vegetation Report. That report uses another set of vegetation data (TSMRS) which may be more accurate for the forested vegetation acres on the Forest.

Table 71.Percent of Cover Type in Watershed and NFS Lands in Watershed

Cover description	Acres on Fleecer Watershed (project_dissolve3)	Acres on NFS Lands (FS_dissolve4)	Percent of type on Forest
Agriculture	1,340	0	0
Aspen	2,927	670	23
Very low cover grasslands	25,202	1,470	6
Low/moderate cover grasslands	18,078	6,995	39
Moderate cover grasslands	2,799	582	21
Very low cover sagebrush	6,195	1,227	20
Low cover sagebrush	15,794	1,462	9
Moderate cover sagebrush	11,642	2,164	18
High cover sagebrush	7,463	1,603	21
Mesic shrublands	3,758	518	14
Mountain mahogany	1,183	75	6

Ponderosa pine (mistyped, maybe limber)	60	0	0
Douglas-fir/ponderosa pine (mistyped)	45	6	14
Douglas-fir	14,896	6,749	45
Douglas-fir/lodgepole pine	1,966	883	45
Mixed xeric conifer	418	206	49
Lodgepole pine	77,280	52,037	67
Mixed lower subalpine conifer forest	4,664	3,770	81
Mixed upper subalpine conifer forest	8,871	8,612	97
Subalpine fir/spruce	6,440	5,176	80
Whitebark pine	7,144	5,922	83
Rock	3,879	1,912	49

Mountain pine beetle populations are increasing in the area with above average winter and spring temperatures. Low elevation stands have been most impacted by MPB, reducing the presence of lodgepole pine as a significant stand component. Mid-elevation stands comprised mostly of lodgepole pine have also been greatly impacted by MPB, allowing the opportunity for shade tolerant subalpine fir and Englemann spruce to increase. The beetle activity increased foraging habitat for woodpeckers and other birds and greatly increased the availability of snag cavity nesting habitat across the analysis area.

The discussions of wildlife habitat below focus on vegetation types which show the greatest change, or are rare or unique. See the Vegetation Report for more detail.

Quaking aspen –
Aspen are ecologically important to many species of wildlife such as elk, deer, moose, beaver, and blue grouse. In coniferous forests in the interior west they provide abundant forage for browsers. In addition, they provide cooler microsites, provide cover and nesting structure, and provide a source of snags for cavity nesters.

For years, the amount and quality of aspen cover in the West has been declining. Aspen is second only to riparian areas in terms of biodiversity (Wooley et al. 2008). Aspen here, and region wide, is considered a community at risk because patch size and vigor decline. The State Comprehensive plan (2005) has identified altered fire regimes in aspen galleries with resulting conifer encroachment as a conservation concern.

This species exists primarily as clones with underground rootstocks. These rootstocks regenerate stems following disturbances, primarily by fire. At the Forest scale, aspen

is the single forest type considerably below the historic range of variation, so far below it is a serious concern for wildlife species dependent on aspen for food or cover (BDNF, Revised Plan, FEIS, 2008). Fire suppression has resulted in increased conifers which places additional competitive stress on aspen.

Aspen evolved with browsing by ungulates, however extreme browsing pressure on aspen stands can affect the stand vigor and reduce the amount of time that aspen stand persists on the landscape. Livestock have been widespread over the area, and use aspen stand for shade in the summer. Aspen is present but is found in small isolated clones, and is especially vulnerable to over browsing on big game winter ranges.

Field surveys in 1995 on the Divide Creek Allotment (east side of the mountain range, from the Continental Divide south to Mt Fleecer) had generally consistent results. Out of approximately 40 stands of aspen that were inventoried, about 75% were associated with riparian areas, while the remaining 25% were located in upland habitats. All of them were noted as having suckers, and in only one of those stands were they noted as being healthy and surviving. Browsing was noted as one potential reason for the lack of surviving suckers (A. Wells, Field Survey Forms, 1995).

Monitoring of past aspen treatments across the Forest has found that browsing is the single most inhibitor of aspen regeneration on the Forest (BDNF 1999). Remeasurement in 2008 used a treatment rating system. On the BDNF (excluding Madison Ranger District) 30% of the monitored aspen treatments were successful or progressing and 70% were static or failures (Draft, B. Hodge 2008). Fencing and slashing were generally ineffective in protecting aspen sprouts and saplings from browsing.

Whitebark pine –
Whitebark pine (WBP) is a high-elevation species with large seeds important as a food source for many species. Wildfire is important in maintaining WBP stands. Without fire, other conifer species replace the WBP. It often survives low intensity fires but still benefits from stand replacing fire, where regeneration is most successful (BDNF, Revised Plan, FEIS, 2008). Fire return intervals are every 50-300 years in the Northern Rockies. Across the Forest, only 2% is calculated to be young stands (0-20 years old). In the Fleecer mountain range there are no seedling stands (based on TSMRS data). Older stands are more susceptible to white pine blister rust and mountain pine beetle. WBP is declining across the west due to fire suppression, drought, white pine blister rust, and bark beetles. WBP was recently petitioned for federal listing (NRDC, Dec 2008).

WBP is a critical food source not only for Clark's nutcracker, but for many wildlife species including other birds, small mammals as well as bears. In particular, their seeds have several features that make them a valuable food. They are large and

therefore more energetically rewarding, the nutrients are less perishable compared to other sources, and they are a rich source of dietary fat (Whitebarkpine Ecosystem Foundation).

Higher elevations around Bear Mountain, Dickie Peak, Granulated and Little Granulated Mountains and Grassy Mountain on the west side of the analysis area provide these habitats. On the east side, whitebark pine is found along Fleecer Ridge to Mount Fleecer. Cursory field work on Fleecer Ridge noted stands with mortality due to mountain pine beetle, as well as young trees. Inventory of WBP in the watershed is needed to determine current status.

Bitterbrush –
Bitterbrush is a dominant or indicator species in sagebrush-grassland, mountain shrub and dry conifer. It is an important browse species for many wild ungulates, small mammals, game and nongame birds, and domestic livestock. Many ungulates utilize bitterbrush as a primary browse species during the winter months. Small mammals, game and nongame birds use if for food and cover. Bitterbrush is high in protein and energy content, and although actual nutritive content drops during the winter, it remains higher than other browse species, making it a very important winter food.

Bitterbrush is an important winter browse species for both mule deer and elk. Studies on the Mt Haggin WMA found that five browse species (including bitterbrush) comprised 95% of mule deer and 52% of elk winter diets. Frisina et al (2008) suggest that the data show a potential for forage competition when both species share winter ranges.

Bitterbrush regenerates after fire by sprouting or from off-site seed cached by rodents. Fire may be necessary to maintain viable populations of bitterbrush by removing competing vegetation and exposing mineral soil, which favors rodent seed caching. Results of research in Montana and Idaho have shown that bitterbrush plants are highly sensitive to fire; however the long-term survival appears to depend on early seral fire-generated conditions. Even though the plants are often killed by fire, they are found in communities with a high fire frequency (Fire Effects Information System, http://www.fs.fed.us/database/feis/).

In the mid to late 1950s and early 1960s several browse transects (line-intercept) were established on part of the Deerlodge Forest. They were established within sagebrush-bitterbrush-bluebunch wheatgrass range on south slopes. Their primary purpose was to track trends of important deer browse species, ie bitterbrush. Three of these transects are located in the Fleecers. Results of past monitoring are shown in Table 72.

Table 72. Bitterbrush transects (taken from graphs prepared by F. Russell)

Name	Year read	% bare ground	% bitterbrush	% conifer
Buxton	1958	53%	46%	0
	1994	95%	2%	3%
Norton Gulch C-1	1956	56%	38%	4%
	1962	60%	34%	4%
	1994	88%	6%	5%
Norton Gulch C-2	1956	40%	58%	0%
	1962	37%	62%	0
	1994	76%	9%	13%

Trends from these three transects suggest that bare ground is increasing, bitterbrush is decreasing and conifers are increasing over time. These transects were last read in 1994. An attempt to relocate the transects in Norton Gulch in June 2009 was unsuccessful, but one stand of bitterbrush had extensive defoliation due to tent catepillars.

Field surveys in 1995 on the Divide Creek Allotment found bitterbrush at lower elevations across the east side of the mountain range. Approximately 28 stands of bitterbrush were mapped in sagebrush/grassland openings. Of these, a third had 50% or greater canopy cover of dead bitterbrush plants. Only 2 of the stands had seedlings present (A. Wells, Field Survey Forms, 1995).

Weeds are a concern in some of the bitterbrush stands. Bitterbrush stands in Beefstraight drainage have been colonized by spotted knapweed. The knapweed in this area has been treated using transline, which is specific to composites (G. Godbolt, Range Specialist, pers. comm.).

A 2-year study on the north end of the Mt Haggin WMA (between Willow Creek and White Pine) found that over 18 study sites, 53% of the mule deer's winter diet was bitterbrush. The youngest plant from a sample of 360 plants was 7 years old. Utilization of leaders averaged 80% at the 18 sites (Guenther 1989). A later study, which included the same area (Fraas 1992) looked at burned and unburned bitterbrush stands. Plants on the burned areas had similar densities but plants were smaller and had less flower production 8 years after burning. He found that plants were often browsed and that there were few seedlings.

Potential opportunities include removing conifers, treating weeds and potentially prescribed burning.

Curlleaf mountain mahogany –
Mahogany is generally a long-lived tree or shrub that provides important wildlife habitat for a myriad of species. Curlleaf mountain-mahogany is good forage for all classes of browsing animals (especially deer) in both summer and winter and is one of the few browse species that meets or exceeds the protein requirements for wintering big game animals (Utah State University).

Mountain mahogany regenerates from seed, production of which can be variable but heavy at times. Bare mineral soil is the usual seed bed with regeneration very uncommon in established stands. Seed predation by insects in the fall may be nearly complete at times. (Ross undated). Although curlleaf mountain mahogany is sometimes referred to as a weak resprouter after fire, this is very uncommon. In the western Great Basin it is invariably killed by fire regardless of intensity and never resprouts. Even very light burns that do no apparent damage to mature trees result in full mortality within one year (Ross, not dated).

Many stands on the Forest are becoming old and decadent with inadequate surviving reproduction (BDNF, Revised Plan, FEIS, 2008). Stands include old, even-aged plants with high crown closure and excessive litter accumulation that prevents seedling establishment, with accessible plants showing heavy browsing pressure by big game including moose. In some areas, conifer encroachment into mahogany stands may be gradually shading out the mahogany plants. This is of concern in the Charcoal Gulch area, including lands manages by BLM, state and FS (V. Boccadori, FWP Area Biologist, pers. comm..).

Field surveys in 1995 on the Divide Creek Allotment found mountain mahogany at lower elevations across the east side of the mountain range. Five stands of mountain mahogany were mapped. None had 50% or greater canopy cover of dead plants and 2 of the stands had seedlings present (A. Wells, Field Survey Forms, 1995). Most of the mountain mahogany is at lower elevations off of NFS lands and is often found in rocky inaccessible places; this is a lower priority for surveys than other vegetation types.

Shrubland –grasslands –
As shown in Table 71, the majority of grassland and shrublands are found at lower elevations off-Forest. Many of these are altered habitats due to intensive livestock use around ranches, rural housing and highway corridors (from Big Hole Landscape Assessment 2001).

This habitat ranges from solid stands of grasses to a mixture of sagebrush and grasses to almost solid canopy of shrubs (mostly sagebrush). The lower elevation grasslands are relatively large and continuous, whereas the upper elevation habitats are interspersed with conifers and shrubs. Fire and herbivory were historically important disturbance processes in this habitat. The absence of fire and presence of

increased herbivory (including livestock grazing) have influenced the distribution and seral stages of sagebrush and grasslands available for wildlife. At present these habitats have increased conifer cover and nonnative vegetation than were present historically.

A variety of small mammals, invertebrates and birds are found in these habitats. Sagebrush stands in particular serve as important forage and cover for a number of wildlife species, including mule deer, elk, age grouse and pygmy rabbits. Winter range for elk has been mapped for the Revised Plan. The mapped winter range includes the northeast, east and southern edges of the mountain range and analysis area, on Forest, the Mount Haggin Wildlife Management Area, and on lands managed by BLM.

Field surveys in 1995 on the Divide Creek Allotment found that all of the shrublands inventoried had conifer becoming established in them; all had some Douglas-fir, while about half had juniper as well (A. Wells, Field Survey Forms, 1995). Some grasslands and shrublands have very little conifer (such as those on southest end of Fleecer) while other openings have dense conifer with sagebrush skeletons in the understory (such as northeast end around Sunday Gulch).

Young seral conifer stands -
Douglas-fir and lodgepole pine stands Forest-wide lack young replacement stands in the 0 to 5 inch size class (USDA FEIS 2008, pgs 453-455). This is in accord with fire suppression having allowed for more trees to advance into larger size classes. The 5 to 10 inch size class is 13% higher than the upper end of modeled historic range of variation (FEIS, 2008). These young seral stands are important to a number of species including snowshoe hare, a primary prey species for several other species. They also provide species for ungulates and habitat for birds that use more open areas (such as mountain bluebirds).

Table 73. Early Seral Forest (FEIS 2008)

Species	Lodgepole pine	Whitebark pine	Douglas-fir	
Percent of type 0-20 years old Forestwide (based on FIA data)	8%	2%	3%	
Percent of type 0-20 years old NFSL in Fleecer Watershed (based on SILC3 data, sapling 1"-4.9" dbh)	11,390 acres of lodgepole, or 22% of LPP	530 acres or 9% of WBP	692 acres or 10% of DF	
Percent seedling on NFS in Fleecer Watershed (based on TSMRS)	3,715 acres or 9% of LPP on NFS	0 acres or 0%	687 acres or 3% of DF on NFS	

Mature Douglas-fir forest –
Fire studies have found fire return intervals between 2 and 80 years before 1860 (see Fire/Fuels report). Douglas-fir stands which are found at lower elevations at drier sites have seen increased stand density as a result of a reduction of understory fires. This created ladder fuels, increases stress on trees and affects species that use more open Douglas-fir forests such as flammulated owls.

Old growth forest –
Old forest provides large trees, snags and downed wood that provides cover for some species, although none have been identified as dependent on old growth. Old growth by forest type was quantified in the Revised Plan (pg. 460, based on Bush et al 2006). Table 9 displays this, as well as percent old growth by landscape.

Table 74. Old Growth (Bush et al 2006)

Species	DF, PP, LP	SP, SAF	LPP	WBP
Forest-wide	20%	36%	17%	28%
Big Hole Landscape	20%	30%	10%	18%
Upper Clark Fork Landscape	15%	0	10%	na

The SILC3 satellite data shows a few Douglas-fir stands greater than 21" dbh; these are in the vicinity of Norton Gulch, and on Leffler Creek. Two area of lodgepole pine greater than 21" dbh; one south of German Gulch and one north of Lone Tree. TSMRS data shows Douglas-fir sawtimber in Norton Gulch and Leffler Creek, as well as in other stands on the north and east side, and the southern edge of the analysis area. Many of the Douglas-fir stands show signs of previous harvest, and some show significant budworm mortality. These stands could be reviewed for old growth characteristics.

Snags
Bush et al (2006) looked at snag densities based on FIA data. Snag densities for the landscapes are shown in Table 75.

Table 75. Snag Density by Landscape

Landscape	Snags 10-19.9" dbh	Snags 20" +
Big Hole	7.8	0.6
Upper Clark Fork	2.2	0

Wildlife Security Areas

Security is important for a range of mammals, including elk, bears, wolverines, and lynx. Christensen et al (1993), for instance, demonstrates that habitat effectiveness

for elk decreases as road densities increase. The State's preferred approach for both elk and grizzly bear habitat is to maintain road densities at < 1.0 mi/sq. mi (MT FWP 2002).

Increasing access and use of an area causes increasing conflicts and risks to wildlife resources that can be displayed in four broad categories: habitat alteration, disturbance, increased vulnerability to mortality, and increased noxious weed establishment.

Under the 2009 Revised Forest Plan, wildlife secure areas and connectivity direction is to manage Open Motorized Roads and Trails Density (OMRTD) by landscape year around (except fall big game hunting season) to achieve levels at or below the following:

Table 76. Wildlife secure areas by landscape

Landscape	Maximum OMRTD	Existing OMRTD (Alt 6 in FEIS)
Big Hole	1.2	1.2
Upper Clark Fork	2.0	2.0

Map 31 shows summer secure areas over the portions of the two landscapes in this analysis area. These secure areas are based on areas outside of the influence of open motorized roads and trails. On the Wise River RD portion of the Big Hole landscape, ongoing travel planning may result in a slight decrease in open motorized routes overall. Travel planning on the Butte Ranger District is further out in the future.

In addition, the Plan identified areas for winter non-motorized recreation. In the Northeast Fleecer Management Area 21% of the area is winter non-motorized. These areas are winter ranges on the north and south ends. There are no winter non-motorized use areas in the South Fleecer Management Area. Thus, there are no winter high-elevation non-motorized areas (see Table 5).

Elk security –
During hunting season, the Revised Plan includes direction to manage OMRTD by hunting unit, to achieve levels at or below the following in Table 77:

Table 77. Hunting season OMRTD by Hunting Unit

Hunting Unit	Maximum OMRTD	Existing OMRTD (Alt 6 in FEIS)
319	0.6	0.6
341	0.5	0.6 (need to close 6 miles to meet objective)

Map 32 shows secure areas during the fall hunting season.
Hunting Unit 341 is not currently meeting the OMRTD objective. On the Wise River RD portion of HU 319, ongoing travel planning may result in a slight decrease in open motorized routes overall.

Open road densities on adjacent BLM lands-
The BLM lands in the analysis area are part of the Upper Big Hole River Travel Planning Area (TPA). At the onset of planning the existing ORD was 1.0 miles/square mile. Road densities would decrease (to 0.3 to 0.4 mi/sq mi) and security habitat would increase (BLM RMP, vol II. pg 644).

Connectivity-
The Revised Plan includes a goal that the Forest would contribute to wildlife linkages between landscapes, unless isolation is determined to be beneficial. Linkage areas are those areas identified for large carnivores and ungulates through multi-agency cooperation. Options may include, but are not limited to; maintaining Forest Service ownership at highway and road crossings; consolidating ownership at approach areas to highway and road crossings substantiated by empirical data as necessary to facilitate wildlife movement; and provide secure habitat at the landscape scale to facilitate large animal movement.

Linkage areas for Canada lynx were identified for the Northern Rockies Planning Area (2007). This map shows a linkage on the north end of the Fleecer area heading northwest to the Anaconda mountains and Anaconda-Pintler Wilderness and a linkage to the southwest to the Pioneer mountains.

Cameras in the Quartz Creek area (south of the Big Hole) picked by several different bears (S. LaMarr, BLM Biologist, pers. comm.). They may be using this area to move down to the Big Hole and potentially across the river. The Upper Big Hole TPA was identified as providing a critical corridor from the Highland Mountains to the Pintler/Pioneer Mountains. This corridor also provides local daily movements and seasonal movements between higher elevation summer range along the Continental Divide and lower elevation winter range (BLM RMP, vol II. pg 644). Big game, including sheep, elk and pronghorn, (and presumably many other species) move between the Fleecer Mountains and Highland/Humbug area to the east. Movements to the west to the Pintlers are the least impacted by development (low standard highway).

Climate change

Changes in climate may change the amount, quality and distribution of broad-scale vegetation types or may impact forest structure and various successional stages associated with drought, insects, diseases and/or fire (see Vegetation Report for more). Wildlife can respond in three ways; they can respond in place through genetic, physiological or behavioral adaptations; they can move to a new location (distributional shifts) or they may be unable to do either and be unable to reproduce successfully and may face local extirpation or extinction.

There are numerous sources of uncertainty when trying to predict the effect of climate change. A few include variability in physical systems; uncertainty in vegetative community shifts; interactions between climate and non-climate stressors; and variation in species life history strategies, physiological tolerance and dispersal abilities (Hahn 2009).

Wildlife Species of Interest

Species carried forward from Table 1 are discussed below.

Table 78. TES and MIS Wildlife species considered

SPECIES	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA	SPECIES LIKELY TO BE PRESENT AND CARRIED FORWARD?
Peregrine Falcon	Yes-habitat No known eyries	No, foraging habitat for migrants not limiting
Gray Wolf	Yes-habitat March 2008 map shows Mt Haggin pack in area	Yes
Bald Eagle	Yes – along Big Hole River on south end and winter foraging on winter ranges. Nest on Big Hole River near Wise River	Yes
Elk	Yes	Yes
Black-backed Woodpecker	Yes- habitat increasing due to insect caused conifer mortality	Yes
Flammulated Owl	Yes-habitat marginal. Dry Douglas fir possible	Potentially
Fisher	No known activity	Potentially
Great Basin Pocket Mouse	Yes. Habitat Assessment area at periphery of range	No, Known from Beaverhead County, suspected in Madison County, unlikely in Watershed.
Greater Sage Grouse	Extreme southeast end is within 18 km of a known lek	Potentially, as part of the southeast end of the Watershed is classified as moderate or high cover sagebrush.
North American Wolverine	Yes	yes
Pygmy Rabbit	Yes. Assessment area at periphery of range.	Active burrows found on extreme eastern edge. Surveys in area found it to not be typical habitat, burrows found were occupied by ground squirrels and badgers.

SPECIES	HABITAT OR SPECIES PRESENT IN ANALYSIS AREA	SPECIES LIKELY TO BE PRESENT AND CARRIED FORWARD?
Townsend's Big-Eared Bat	Yes-foraging & roosting No known hibernacula	No, nearest maternity colony is over 35 miles away.
Spotted Bat	Yes- activity in 2007	Potentially
Canada lynx	Habitat present, BDNF currently unoccupied, secondary habitat	Not likely but potentially
Pika	Yes	Yes

The big game species elk, deer, black bear, and moose occupy portions of the area in all seasons. Elk are especially important in southwest Montana because of high public interest and value for hunting. Elk utilize a variety of habitats during different times of the year. The assessment area includes a portion of State Hunting Unit 319 and all of Hunting Unit 341 and is located in the Fleecer Elk Management unit (EMU).

Elk. The Elk Plan (FWP 2004) stated that high numbers of elk on the Fleecer winter range are the greatest population management challenge. At the time of the development of the Elk Plan, numbers on the Fleecer Face were 200-300 above the objective of 800 elk. At that time, FWP tried to address high numbers of elk by increasing numbers of antlerless permits.

Currently, there are around 500 elk on Fleecer and another 100-200 in the Big Hole Canyon. Over the past 5 years, population trend counts have been declining with calf:cow ratios in the 20-30:100 (V. Boccadori, FWP Area Biologist, pers comm.). This decline may have been a result of significant hunter harvest in hunting year 2005. Adjustments were made to the hunting seasons in 2007. Table 79 shows population parameters for Hunting District 319.

Table 79. Population Parameters for Hunting District 319, 2001-2008

Year	Total	Calves:100 cows	Bulls: 100 cows
2008	>729	17	12
2007	819	36	15
2006	936	31	29
2005	1,244	24	11
2004	1,212	21	15
2003	1,601	na	na
2002	1,109	24	15
2001	1,430	31	12

There have also been declines in big game populations for Hunting District 341 over the past 10-15 years (MFWP Decision Notice 2009).

Elk population objectives identified during the Plan Revision are shown in Table 80 below.

Table 80. Population Objectives during Plan Revision

Hunting unit	2005 State Elk Plan objective	FWP 2006 Population estimate	FWP 2007 Population estimate
319	1,100 max	936	819
341	600 max	494	272

Habitat management strategies for the Fleecer EMU (from Elk Plan 2004) include 1) improve elk security throughout the transition range used by the Fleecer elk herd, especially in Fish Trap, Mudd Creek, Seymour, Twelve-mile and Bear Gulch drainages, where elk security has been reduced by logging; 2) identify areas where either road closures or openings are necessary to enhance elk security or facilitate harvest; 3) provide assistance with grazing allotment management plans; and 4) cooperate with BDNF and BLM to improve elk habitat through projects designed to improve vegetative diversity and maintain or increase carrying capacity on winter range.

BLM manages important winter ranges near Wise River and Fleecer Mountain WMA. The Fleecer and Mt Haggin WMAs are managed by FWP for elk. Winter range on the Forest is found on the northeast end (Norton Gulch area) and on the southeast end (Charcoal Gulch area). Map 33 displays elk winter range found around the Fleecer mountains.

Table 81. Elk winter range within the Fleecer Watershed.

Total acres	Acres on Forest	Percent of elk winter range on Forest
86,714	29,776	34

The New Meadows area was identified as an important elk calving area (V. Boccadori, FWP Biologist, pers. comm.).

Wolves. Gray wolves are habitat generalists. They generally use areas that lack human disturbance (corresponding to low road densities), and have abundant prey (primarily elk). A March 2007 map shows the Mt Haggin pack territory. Currently there is at least a pair in this pack but it was not monitored in 2008. It is thought that they summer around Grassy and spend the winter around the winter ranges on the north end (N. Lance, FWP Wolf Biologist, pers comm.). In addition, there have been unconfirmed reports from the fall of 2008 of a couple of wolves on the east side near the Fleecer Wildlife Management Area (Feely).

Bald eagles. Bald eagles are a resident species in the forested, mountainous areas of Montana. Other individuals from more northerly altitudes either winter in Montana or migrate through the state to more southerly locations. Residents generally remain

in the vicinity of their breeding areas throughout the year, while some may move to areas with more temperate weather or to areas with higher concentrations of food. There is one known nest territory on the Big Hole River near Wise River on private or state land.

Bald eagle winter counts from Wise River to Melrose have been done over several years. Table 82 shows the results of those surveys.

Table 82. Bald eagle winter counts.

Year	Total	Adult	Immature
	7	7	0
1998	4	3	1
1999	8	8	0
2000	10	7	3
2001	5	2	3

While bald eagles may use the river corridor year round, most foraging use on the Forest is in late fall/winter or early spring when carcasses from dead big game would be available. Availability would vary, depending on animals wounded by hunters that later died, or animals that die as a result of harsh weather conditions, or those killed by predators or accidents.

Wolverine. Wolverines are generally solitary, wide-ranging species and are usually associated with areas with minimal human disturbance and areas that hold snow through the late spring. When inactive, wolverines occupy dens in caves, rock crevices, under fallen trees, in thickets, or similar sites. Natal dens are found in deep snow areas in the late winter/early spring. Dispersing individuals may be found far outside of usual habitats.

Potential wolverine tracks (Burnt Dam Ridge/Granulated Mountain) were seen during winter aerial surveys conducted my FWP. In addition, hunters reported seeing a wolverine on a carcass during hunting season of 2008 (V. Boccadori, FWP Biologist, pers. comm.).

The Plan identified areas for winter non-motorized recreation. In the Northeast Fleecer Management Area 21% of the area is winter non-motorized. These areas are winter ranges on the north and south ends. There are no winter non-motorized use areas in the South Fleecer Management Area. Thus, there are no winter high-elevation non-motorized areas. Map 34 displays modeled wolverine denning habitat in relation to roadless habitat (not necessarily non-motorized).

The Wildlife Conservation Society (WCS) has identified west central Montana as the "Central Linkage Ecosystem" or CLE (Inman et al, 2008). The CLE contains a significant amount of primary wolverine habitat that is in public ownership, and it

does support reproductive females. These areas are critically important because successful reproduction in this area is the most likely means of achieving successful dispersal among the larger Regional Population Centers (Yellowstone, Northern Continental Divide, Bitterroot and Salmon). The CLE is broken down into potential metapopulation units – the Fleecer Mountain Range is part of the Anaconda deme (Inman et al, 2008).

FWP changed wolverine trapping regulations for 2008. In order to achieve dispersal and gene flow among the core population centers, wolverine are protected in the Central Insular mountains, which includes the Anaconda deme and Fleecer mountains (Inman et al 2008).

Greater Sage Grouse. The nearest known lek location is in Soap Gulch south of the Highland Mountains. The extreme southeast end of the watershed is within 18 km of the lek and could potentially be used by nesting sage grouse. This may be unlikely, as the average distance from nest to the nearest lek varies from 1.1 to 6.2 km but is dependent on migratory characteristics and sagebrush cover with respect to lek location (Braun et al, 2005). This lek was last surveyed in 2004 and was not confirmed as being occupied (GIS layer from FWP). It was noted as active in 1994 (MNHP). There are two other leks to the southeast of the Soap Gulch lek. Both were last surveyed in 2006, one was confirmed active, the other was not.

Portions of the southeast end of Fleecer include moderate and high cover sagebrush (based on SILC3 data) and could provide nesting habitat. Brood-rearing habitat would be provided in adjacent open sagebrush and grassland habitats. However, walk-thru surveys in this area in early June found only small patches of sagebrush surrounded by open meadows. This area is unlikely to be used due to distance from lek and lack of cover.

Black-backed woodpeckers. Black-backed woodpeckers are primarily associated with fire-killed trees. Within the Watershed, there was a 200 acre fire up Charcoal Gulch in the summer 2008. The fire was mostly on private and BLM lands and burned in grass and shrublands with scattered trees.

Black-backed woodpecker secondary habitat has been increasing forest-wide due to insect caused mortality. While insect killed trees do not offer the immediate pulse of preferred habitat provided by fire killed trees, this mortality does provide habitat for wood boring beetles that follow mortality caused by the mountain pine beetle. Woodpecker surveys in adjacent areas in 2008 and 2009 (North Butte and East Deerlodge Valley) did not detect black-backed woodpeckers, but did detect three-toed, hairy and pileated woodpeckers. Woodpeckers noted by others in the watershed include pileated woodpeckers and three-toed woodpeckers (A. Shovlain, Price-Powder and D. Hutton, Charcoal).

In 2006 black-backed woodpecker surveys were done across Region 1 in beetle outbreak areas. Only a few were detected in the beetle outbreak areas, and they were all on the Nez Perce NF.

Aerial insect and disease flights have found that beetle infestations started at lower elevations on the south and east sides of the mountain range in the early 2000s. Yearly the infestations have moved up in elevation and mapping in 2008 show infestations across the mountain range, at all elevations (BDNF Insect and Disease progression map, 10/29/2008). There are proposed projects to remove hazard trees along main roads (Roadside 2) and developed campgrounds, but beetle populations and dead trees remain widespread across the mountain range.

Flammulated owls. Preferred flammulated owl habitat is Ponderosa pine which is not found in the assessment area. Marginal nesting habitat can be provided by dry-site Douglas fir which does occur in pockets in the assessment area. The SILC3 data shows a few Douglas-fir stands greater than 21" dbh; these are in the vicinity of Norton Gulch, and on Leffler Creek. TSMRS data shows Douglas-fir on the northeast corner, as well as stands across the south end of the Forest.

Region-wide Flammulated Owl surveys conducted in 2005 (Cilimburg 2006) found them on the south end of the Pioneers and Highlands (no survey points in the Fleecer Mountain Range). One survey done along Road 447 in June 2009 did not detect any owls.

Fisher. The fisher is believed to have been extirpated from the state in the early 1900s. In 1959, 36 fishers were released at three sites in western Montana; one release site was at Moose Lake on the Pintler RD. Fishers prefer continuous canopy, dense mature to old forest.

Vinkey (2003) shows a track detection on the western slope of the Pioneer Mountains. The Rocky Mountain Research Station conducted extensive snow track surveys in the Anaconda-Pintler Range during winter 2000-2003 and no fisher tracks were detected during this effort. Fisher are unlikely to occupy the Watershed.

Pygmy rabbit. Big sagebrush stands with high canopy closure and loose, deep soils provide habitat for pygmy rabbits. They burrow under the sagebrush plants and sagebrush provides the majority of the winter diet. Montana lies on the northeastern edge of pygmy rabbit distribution. The whole east face of the Pioneer Mountains to the south have been surveyed and no pygmy rabbits were detected. However, active burrows have been found on the extreme eastern edge of the Fleecers in 2008 (A. Shovlain, BDNF Wildlife Biologist, pers. comm.). Rather than using sagebrush, burrows were located under rock. Walk-thru surveys of the area in 2009 found active ground squirrel and badger burrows. Walk-thru surveys further south of this area found burrows located under mature sagebrush plants, but it was not confirmed to

be used by pygmy rabbits. These were small patches of sagebrush surrounded by open meadows.

Spotted bat. The State's range map for the species shows their distribution well east of the forest. In 2007, however, three reliable electronic detections were recorded to the south of the Watershed (including the lower Birch Creek area and Canyon Creek). While we are awaiting confirmation of the detection, we have added the species to the sensitive list.

As noted in Table 2 suitable spotted bat habitat is found in the assessment area (mostly on lands managed by BLM on the south end, north of the Big Hole River). Bat surveys have been done around the Hungry Hill Mine site (north end) but no bats were detected. Surveyors determined that the features did not provide suitable habitat (V. Boccadori, FWP Area Biologist, pers. comm.).

Bighorn Sheep. The Camp Creek (Highland Mountains) population of bighorn sheep experienced a die-off between 1994 and 1995 due to a pneumonia complex. Approximately 50 sheep were relocated to Soap Gulch/Camp Creek between 2000 and 2001 (BLM RMP, vol. I pg 251). Approximately 63 sheep were transplanted into Camp Creek/Soap Gulch between 2000 and 2004 (BLM RMP, vol. II pg 647). Additional sheep were transplanted during the winter 2007/2008. A few sheep have crossed I-15 and the Big Hole River, to make use of BLM lands on the south end of the Watershed. This use is considered incidental; mountain mahogany and other browse species provide forage in this area.

Canada lynx. From 1988 to 1999 there are 72 reports of lynx being trapped or observed in the Pioneers, Big Hole Mountains and Fleecer Range (Big Hole Landscape Assessment 2001). The Forest is currently considered unoccupied, secondary habitat. Map 35 displays lynx analysis units (LAUs) and lynx habitat as currently mapped for the Forest.

Pika. Pikas are restricted to rocky, talus slopes, primarily the talus-meadow interface, often above treeline to limit of vegetation. They have also been found at lower elevations in rocky areas within forests or near lakes (Natureserve 2009). Populations are currently listed as "secure" in Montana, but have recently been petitioned for listing under the Endangered Species Act. Map 36 displays locations of larger rocky outcrops which may provide suitable habitat.

3. Reference Condition

Natural vegetation, the cornerstone of wildlife habitat, reflects natural disturbances like fire, insects, disease, weather events, herbivory and natural succession. Prior to settlement in the mid to late 1800's, these disturbances were the primary influence on both the pattern of vegetation covering the foothills and mountains of the Fleecer

watershed area (patch size, juxtaposition, distribution), and the successional stages of the vegetation cover.

Before settlement, southwestern Montana's valley bottom and mountains were occupied by a great number of wildlife species year round or seasonally. It can be assumed that present animal communities, distribution, assemblages, densities and interactions (predation, competition and parasitism) are somewhat different now than before the 1850s. A shrinking base of native grassland/shrubland and riparian vegetation, historical and recent developments which convert vegetation or land use, highways, market hunting, and the interruption of natural processes like fire contribute to these differences.

Among many factors, the changes in land use in the valleys, introduction of non-native species, and public interest in hunting and game management preclude using historical distribution of wildlife species as a reference point. The desired condition (as expressed in the 2008 Revised Forest Plan) is a diversity of forest, shrub land, grassland, riparian, and aquatic communities which reflect ecological disturbance processes like fire. The resulting plant communities provide conditions for self-sustaining or viable populations of native and desired non-native species within the natural capability of the ecosystem.

4. Synthesis and Interpretation

Habitats of concern are directly linked to those cover types showing the greatest change: mountain big sagebrush, upland aspen, riparian aspen/alder/willow/cottonwood stands, bitterbrush, whitebark pine and mountain mahogany stands. Conifer encroachment has contributed to much of this, and has resulted in competition for water, sunlight and space. The change is precipitated by a combination of climatic change (an increase in droughty years) and lack of fire disturbance.

Open motorized road and trail densities exceed 2009 Plan direction for Hunting Unit 341 as shown in Table 12.

BLM has identified emphasis area in their new LRMP. These include winter ranges, sagebrush habitats and bighorn sheep ranges (S. LaMarr, BLM Biologist, pers. comm.). They are currently working on the "Wise River Project" that includes treatments of grass/shrub habitats, Douglas-fir (heavy thinning to reduce DF beetle and spruce budworm) and aspen and upland willow on the north end of the Pioneers, across the Big Hole River from the Fleecer Watershed.

Three main areas of concern in the Fleecers from FWP (V. Boccadori, FWP Area Biologist, pers comm.) include the High Rye/Norton Gulch area, south end of the Fleecer Mountain WMA and the Patton to Dickie Hills area (which is largely managed

by BLM). Issues identified on Mt Haggin WMA in the High Rye area include dead and dying lodgepole pine, and Douglas-fir expanding into aspen and bitterbrush stands.

FWP currently has a proposal that would remove dead and live trees to open up the forest, and remove conifers in shrublands and aspen. As a result, there would be increased forage and reduced future potential impediments to big game movements due to windfall. This area receives more use by elk but does get used by deer as well. There has been a shift in elk use from the Mt Haggin WMA to the Lone Tree area, and the proposed project should improve conditions on the WMA and perhaps shift some of the use back onto the WMA (V. Boccadori, FWP Area Biologist, pers. comm.).

FWP has initiated a moose-habitat interaction study on the east side of the Continental Divide on the Mt. Haggin WMA that is in its 3rd year of a 5-year study (MFWP Decision Notice 2009). They have also conducted a bear hair snare study but I don't have any results.

The south end of the Fleecer WMA gets more use by deer, and condition of mountain mahogany and spread of leafy spurge are concerns.

FWP is currently assessing effects of a proposed land exchange and grazing plan on Fleecer WMA and the adjacent Erickson Ranch. It would involve one 40-acre parcel for the adjacent 40-acre parcel. It would consolidate lands more efficiently (less fencing etc) and would incorporate a coordinated rest-rotation livestock grazing system on the WMA and a portion of the adjacent ranch (FWP, Draft EA, March 2009).

5. Recommendations

- Improve wildlife habitat by reducing conifer encroachment into: mountain big sagebrush communities and sagebrush grassland parks; aspen stands; willow stands and bitterbrush.

  Priorities for sagebrush and grassland treatments would be on big game winter ranges and sage grouse and pygmy rabbit habitat. Potential treatments may vary depending on the species involved.

  Priorities for aspen treatments would be upland sites, off of winter ranges, adjacent to main roads where there may be reduced browsing; or where fencing is practical to exclude ungulates. Concentrate aspen restoration in large treatment areas so wildlife browse on regenerating sprouts doesn't compromise recovery of the stands.

- Reread established bitterbrush transects, look at effectiveness of using transline on knapweed, assess potential for other treatments (cut conifers, light burn)

- Conduct surveys in larger contiguous stands of mature Douglas-fir stands and potential flammulated owl habitat and evaluate stand conditions for potential thinning of Douglas-fir.

- Inventory whitebark pine to determine current condition of stands; assess whitepine blister rust infection, mountain pine beetle infestation and other stand conditions.

- Reduce route densities in Hunting Unit 341 to meet Revised Forest Plan direction – prioritize changes to improve security area distribution.

- Survey sagebrush stands on southeast corner during sage grouse nesting and brood-rearing period (lower priority due to lower potential use, distance from leks).

- Survey sagebrush stands on the eastern edge of the Forest for pygmy rabbit use.

- Conduct bat surveys around hazardous mine openings that provide potential habitat.

- Current conditions of mountain mahogany stands are not known. This is a lower priority for surveys.

6. References

BDNF. 1999. Monitoring Aspen on the Beaverhead-Deerlodge National Forest. December 1999. Supervisors Office, Dillon, MT.

Braun, C.E., J.W. Connelly and M.A. Schroeder. 2005. Seasonal Habitat Requirements for Sage Grouse: Spring, Summer, Fall and Winter. RMRS-P-38.

Bush, R., R. Lundberg and D. Berglund. 2006. Detailed Estimates of Old Growth and large Snags on the Beaverhead-Deerlodge National Forest. June 14, 2006. USDA Forest Service, Region 1, Forest and Range Management, Missoula, MT. 7 p.

Cilimburg, A. 2006. Northern Region Landbird Monitoring Program; 2005 Flammulated Owl Surveys: Final Report. May 2006. www.avianscience.dbs.umt.edu.

Fraas. W.W. 1992. Bitterbrush Growth and Reproductive Characteristics in Relation to Browsing Levels in Southwest Montana. Masters Thesis, Montana State University, Bozeman, MT. pgs 88-94.

Frisina, M.R., C.L. Wambolt, W.W. Fraas and G. Guenther. 2008. Mule deer and elk winter diet as an indicator of habitat competition. USDA Forest Service. Proceedings RMRS-P-52. pgs 123-126.

Guenther, G.E. 1989. Ecological Relationships of Bitterbrush Communities on the Mt Haggin Wildlife Management Area. Masters Thesis, Montana State University, Bozeman, MT pgs 56-58.

Hahn, B. 2009. Terrestrial Wildlife. Climate change review written for Kootenai and Idaho Panhandle Forest Planning process. USDA Forest Service, Missoula, MT

Hunter, M. L., G. L. Jacobson Jr., and T. Webb III. 1988. Paleoecology and the coarse-filter approach to maintaining biological diversity. Conservation Biology 4:375-384.

Inman, R.M., M.L. Packila, K.H. Inman, R.S. Spence and D. McCauley. Greater Yellowstone Wolverine Program. Progress Report Nov 2008. Accessed at www.wcs.org/globalconservation/northamerica/yellowstone/wolverine.

Montana FWP.2004. Montana Statewide Elk Management Plan . Montana Department of Fish, Wildlife, and Parks Wildlife Division, 1420 East Sixth Avenue Helena, Montana 59620

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

Montana FWP. 2009. Environmental Assessment Decision Notice for the Mount Haggin Habitat Restoration Project. MFWP, Region 3, Bozeman, MT.

Montana FWP. 2009. Draft Environmental Assessment for Fleecer WMA and Erickson Ranch; Land Exchange and Grazing Plan. MFWP, Region 3, Bozeman, MT.

NRDC. 2008. A Petition to List the Whitebark Pine, *Pinus albicaulis*, as an Endangered Species under the Endangered Species Act. Dec. 8, 2008.

Ross, Christopher. Natural Resource Specialist, BLM Nevada State Office. Cercocarpus ledifolius NUTT. Species account.

John R. Squires, John R., Daniel H. Pletscher Co-Principal Investigator, Todd J. Ulizio, Leonard F. Ruggiero 2006. The Association Between Landscape Features and Transportation Corridors on Movements and Habitat-Use Patterns of Wolverines. Final Report # FHWA/MT-06-005/8171. Prepared for The State of Montana Department of Transportation in cooperation with The U.S. Department of Transportation Federal Highway Administration. June 2006

USDA Forest Service 2008. FEIS Beaverhead-Deerlodge NF Forest Plan Revision.

USDI Fish and Wildlife Service 2008. Threatened, Endangered,

Utah State University. Range Plants of Utah. Curlleaf mountain mahogany account. http://extension.usu.edu/range/Woody/curlleafmahog.htm

Whitebarkpine Ecosystem Foundation. Wildlife. www.whitebarkfound.org/Wildlife.

Wooley, Stuart C. ,Scott Walker, Jason Vernon, and Richard L. Lindroth. 2008. Aspen Decline, Aspen Chemistry, and Elk Herbivory: Are They Linked? Society of Range Management. February 2008.

G. RECREATION RESOURCES

1. Characterization

The Fleecer Assessment area is located in the South Fleecer Management Area of the Big Hole Landscape and the Northeast Fleecer Management Area of the Upper Clark Fork Landscape, as they are identified in the BDNF Land and Resource Management Plan, (Forest Plan). The section immediately below describes Land Management Plan direction for the Forest as a whole, followed by a direction for the two Management areas listed above.

Land Management Plan Direction Relevant to Recreation and Travel Management

Goals

Recreation Settings: Offer a choice of recreation settings ranging from remote backcountry to more developed front country areas. Recreation allocations use Recreation Opportunity Spectrum (ROS) concepts and definitions.

Summer Non-Motorized Allocations: Provide semi-primitive non-motorized recreation settings, and offer opportunities for mountain biking, horse and stock travel, hiking, dispersed camping, and other activities.

Summer Motorized Backcountry Allocations: Provide semi-primitive motorized recreation settings, and offer opportunities for varied types of travel and recreational activities.

Summer Roaded Allocation: Provide roaded natural and rural recreation settings, and offer a wide variety of opportunities for dispersed and developed recreational activities.

Winter Non-Motorized Allocations: Provide primitive and semi-primitive non-motorized recreation settings in these areas, and offer opportunities for ski touring, snowshoeing, and hiking, and other non-motorized activities.

Winter Motorized Allocations: Provide roaded and semi-primitive motorized recreation settings in these areas, and offer opportunities for a variety of motorized and non-motorized travel and activities. The majority of these allocations provide opportunities for travel by snowmobile.

Recreation Opportunities: High quality diverse outdoor recreation opportunities are provided, including but not limited to:

- Day use activities within a 30 minute drive of communities for motorized and nonmotorized trails, picnicking and interpretive sites,
- Winter use areas near communities for ski touring, snowshoeing and snowmobiling,
- Trails and routes for autos, four-wheel-drive vehicles, ATVs, motorcycles, mountain bikes, horses, and hikers to high mountain lakes and other features,
- Developed and dispersed camping.

Road and Trail Use: A system of routes and areas designated for non-motorized and motorized use are identified and available for public use. A Roaded or Backcountry recreation allocation does not determine the motorized status of any route, including the CDNST, within those allocations. A non-motorized recreation allocation (Summer Non-Motorized, Recommended Wilderness, or designated Wilderness) does close all routes within the area to motorized use.

Resources are protected and user conflicts are minimized by allowing motorized wheeled travel only on designated routes and areas. Established routes to dispersed campsites are recognized as part of the Forest transportation system.

A system of trails designated for nonmotorized uses are also identified and available for public use.

Developed Sites: High quality developed recreation facilities are strategically located to concentrate use, provide access to backcountry settings, and protect natural resources. Sites are clean, well maintained, and designed for universal accessibility.

Objectives

Non-motorized winter activities: Increase opportunities for non-motorized winter activities, such as ski touring and snowshoeing, where highway access points and parking are available.

Dispersed Sites: Identify dispersed campsites causing adverse resource impacts. Develop mitigation or relocate the site to protect the resource. Actions may include but are not limited to installing toilets for public health, bulletin boards, or hardening sites where necessary.

Close campsites where unacceptable resource damage cannot be mitigated.

Developed Recreation Sites: Complete mineral withdrawals for all developed recreation sites.

Trails – Maintain motorized and non-motorized trails to standard. Reconstruct trails that do not meet standards based on the following Region One priorities:

a. Safety hazards to users.
b. Actual or potential resource damage, especially in key watersheds,
c. Level of use

The following table shows the distribution of Forest Plan Recreation Management allocations in the Fleecers.

Table 83: Management Areas Summary

	South Fleecer Management Area	Northeast Fleecer Management Area
Travel Restrictions		
Summer Motorized Travel Not Allowed	**0%**	**0%**

Winter Motorized Travel Not Allowed	**0%**	**21%**
Recreation Allocations		
Wilderness	**0%**	**0%**
Recommended Wilderness	**0%**	**0%**
Summer		
Summer non-motorized	**0%**	**0%**
Backcountry Recreation	**60%**	**39%**
Road-based	**38%**	**56%**
Wilderness Study Area	**0%**	**0%**
Winter		
Winter non-motorized	**0%**	**21%**
Winter motorized	**98%**	**74%**
Wilderness Study Area Winter non-motorized	**0%**	**0%**
Wilderness Study Area	**0%**	**0%**

The two Management Area (MA) are described as follows:

Big Hole Landscape –

South Fleecer Management Area

This area is managed for dispersed recreation, livestock grazing, and other forest products.

The recreation settings include roaded and semi-primitive areas with mostly natural appearing scenery. Residents of Butte, Anaconda, Opportunity, and Wise River and others use the area for camping, hunting, ATV riding, mountain biking, and hiking. In fall additional walk-in hunting opportunities are provided to meet demand. In winter the area is popular for snowmobiling. Skiing and other non-motorized winter recreation use is incidental.

Other land uses include timber harvest and production. The adjacent Mount Haggin Wildlife Management Area, administered by Montana Fish, Wildlife, and Parks, makes the whole mountain range a large area of important habitat for elk and other wildlife.

Upper Jerry Creek watershed is managed to conserve native fish populations.

Visitors may encounter:

Vegetation changes as a result of timber harvest or fire,
Motor vehicle or mountain bike riders on roads and trails in the foothills,
Campers dispersed along roads,
Hunters,
Snowmobilers,
Livestock.

Objectives in addition to Forestwide Objectives

1. Improve motorized trail opportunities in summer.

Upper Clark Fork Landscape –

Northeast Fleecer Management Area

This area is managed for dispersed recreation; secure fall and winter wildlife habitat, and other resource uses.

The recreation setting is a mix of roaded and semi-primitive with a few exceptions to the natural appearing scenery, including Beal Mine. Proximity to Butte and Anaconda make this area attractive for a day of challenging motorized trail riding in summer and winter. Motorized loop trails cross this portion of the Fleecer Range and connect to the Continental Divide National Scenic Trail. Hunting is the biggest use, with some of the highest hunter densities in the State. Dispersed camping is common along Forest roads, especially near streams and riparian zones.

Vegetation management provides wood products and forage for livestock and big game.

The area provides supplemental secure wildlife habitat adjacent to two wildlife management areas. Travel is regulated to provide late fall and winter security for elk. Winter nonmotorized allocations protect winter elk security adjacent to Fleecer Mountain Wildlife Management Area.

German Gulch is a Key Fish Watershed managed to conserve natural fish populations.

Visitors may encounter

Vegetation changes from timber harvest or fire,
Roads for timber harvest,
Motor vehicles on roads and trails year-round,
Scattered campsites along roads,
Remnants of historic mining and current mining activity or reclamation,
Livestock.

Objectives in addition to Forestwide Objectives

1. Manage, harden and designate dispersed camping sites to concentrate campers and reduce impact to soils and aquatic resources,

2. Provide a separate loop opportunity for non-motorized use.

Recreation Facility Analysis

A Recreation Facility Analysis (RFA), completed by Beaverhead-Deerlodge National Forest (Forest) in 2008, characterized recreation sites, experiences and opportunities on the Forest in four types of areas:

1. **Frontcountry areas** –
   Visitors are more likely to experience higher concentrations of use, particularly near communities. Daily backyard access for trails, driving for pleasure, OHV and snowmobile riding are common, as are opportunities to visit developed campgrounds, resorts and interpretive sites.
2. **Roaded backcountry areas –**
   Use concentrations thin out, allowing visitors on foot or by vehicle to experience more wild-feeling landscapes and observations of wildlife. Driving for pleasure, OHV and snowmobile riding are common, but are more dispersed, along with activities such as mountain biking, hiking, skiing, and dispersed camping. Historic rental cabins are most common here.
3. **Backcountry areas –**
   Take visitors to more remote landscapes, where, other than by snowmobiles, access is non-motorized. Greater opportunities for solitude are found here. Activities include hiking, stock use, mountain biking, dispersed camping, snowmobiling and skiing. Historic cabins provide a unique overnight destination in backcountry areas.
4. **Wilderness and proposed wilderness areas –**
   These are the most wild and rugged landscapes where visitors experience remoteness, solitude, challenge and self-reliance. Visitors hike and use stock on day-trips and some multi-day treks and primitive camping.

The Fleecers are primarily roaded backcountry or backcountry. The Forest Plan Management Area description supports this.

2. Current Condition

Recreationists use the Fleecers primarily in summer and fall. In summer, visitor use is mostly motorized use on roads and trails in the area. The Continental Divide National Scenic Trail (CDNST) passes through the area and is currently open to motorized use on the section from Interstate 15 north and west to the boundary of the Mt. Haggin Wildlife Management area.

During the fall the area is used moderately to heavily by fall big game hunters from archery through the rifle seasons. Most trails in the Fleecer Range are closed to all motorized use from October 15 until December 1. Winter use is generally moderate to light snowmobile use depending on snow condition. . Spring use is light when the area is accessed for bear hunting.

Roads

There are currently 186 miles of roads inventoried in the assessment area. These numbers represent the known routes within the Fleecer Watershed. Current routes that exist on the ground throughout the Fleecer Watershed may be higher.

Table 84: Roads on the Wise River and Butte Ranger Districts in the analysis area

Unit	Road Name	Road Number	Length
2, 4	German Gulch	83	23.3
2, 4	Divide Creek	96	10.3
4	Charcoal Fleecer	447	9.5
2	Moose Creek West	1000A	1.4
2	Long Tom	1201	8.6
2	Jerry Creek	1204	9.2
2	Johnson Creek	1208	11.0
2, 4	South Fleecer	1593	2.6
4	Lone Tree	1594	8.7
2	Jimmie New	2480	12.2
2	Little Granulated	2480C	1.5
2	Burnt Dam Ridge	7443	2.7
2	Mitchell Park	7444	3.0
2	Tub Spring	7449	1.4
4	Dutchman Mountain	7451	9.4
2	North Fork Long Tom	7455	1.6
2	Fleecer Ridge	8251	4.4
4	Decker Connection	8400	1.7
4	North Fork Divide Creek	8440	3.5
2, 4	Fleecer Mountain	8486	8.4
4	Norton Gulch	8490	5.2
4	Fleecer Basin	8504	1.5
4	Bull Ranch	8505	9.2

2	Panama Moose	9600	5.1
4	Rose Gulch	78079	0.5
4	Hanson Gulch	78080	1.27
4	Powder Gulch	78082	5.7
4	Fir Road	78090	0.7
4	Rancho Spur	78097	0.5
4	Salt Block	78102	1.7
4	Ajax Cabin	78106	2.2
4	X1 - unidentified	78107	0.8
4	X2 - unidentified	78109	1.7
4	Willow Draw	78130	2.1
4	X3 - unidentified	78133	0.4
4	Beals Hill	78148	1.5

Trails

Many of the trails in the area are remnants of old two-track roads that devolved to motorized trails. Many of the trails are located in drainages, along creeks, and have steep grades. Some trails in the analysis area provide loop trail opportunities for motorized and non-motorized users. These loop trails are the primary motorized trail system on the Butte Ranger District. Currently there are no non-motorized trails in the analysis area.

Table 85: Trails on the Wise River and Butte Ranger Districts in the analysis area

Unit	Trail Name	Trail Number	Length
2	CDT	9	
2	Libby Creek	2080	3.9
2	Granulated Mountain	2142	3.4
2	Grassy Granulated	2166	3.9
2	Long Tom Creek	2241	9.8
2	Jerry Creek	2274	3.6
2	Henley Ridge	2275	4.8
2	Johnson Creek	2276	4.0
2	Burnt Dam Ridge	2737	1.0
2	Fish Lake	2738	2.4
2, 4	Norton Gulch	4095	4.5
2, 4	Bull Ranch	4124	1.5
2, 4	Burnt Mountain	4125	15.3
2, 4	Ditch Saddle	4143	4.1
2, 4	Spring Creek	4165	4.5
2, 4	Greenland (snow)	4166	2.8

The existing CDNST route is identified as Burnt Mountain Trail No. 125. It begins at the Rocky Ridge Trailhead off of Forest Service Road (FSR) No. 94, located two miles

west of the Feely exit on Interstate 15. When the trail was built in 1995 segments were relocated or reconstructed on existing motorized segments. There were no motorized restrictions placed on the trail when it was constructed.

The CDNST can also be accessed from FSR No. 8505 at the top of Sunday Gulch and the Bull Ranch Trailhead, approximately 5 and 8 miles north of the Rocky Ridge Trailhead respectively. The CDNST is part of a motorized trail system in the Fleecer Mountain Range that provides over 35 miles of motorized riding opportunities. Five motorized trails connect to the CDNST from the north and south:

1. Norton Creek Tr. No. 95,
2. Bull Ranch Cutoff Tr. No. 124,
3. Ditch Saddle Tr. No. 143,
4. Fleecer Ridge Tr. No. 94 (not the CDNST Fleecer Tr. No. 94 segment on Wise River Ranger District)
5. Greenland Tr. No. 166.

The CDNST Burnt Mountain Trail No. 125 is used heavily during the summer months, with the majority of the use in the area motorized. Most users of the trail system are from the local area who camp either at Beaverdam Campground or Bull Ranch dispersed camping areas, accessing the trail at Bull Ranch.

Hikers and mountain bicyclists use the trail as well. Adventure Cycling in Missoula identifies the CDNST as part of their Great Divide Ride. The route identifies another route via Forest Service Road No. 94 and Indian Creek to cross the Fleecer Mountain Range; however some riders use the Burnt Mountain Trail. There has been an increase in the number of CDNST long-distance hikers over the past several years.

Developed and Dispersed Sites

Dispersed use in the Fleecer's is primarily during the big game hunting (archery and rifle) season. The trails, except for Beals Hill Trail No. 164, are closed to all motorized use. All roads except for five forest development roads are closed from October 15 through December 1 to provide for non-motorized walk-in hunting opportunities.

Table 86: Developed and Dispersed Recreation Sites in the Analysis Area

Site	Type	Development
Beaverdam	Campground	Developed
High Rye Cabin	Rental Cabin	Developed
Fleecer Cabin	Rental Cabin	Developed
Long Tom Cabin	Grazing Association	Developed
Bull Ranch	Dispersed Camping	None
Indian Saddle	Dispersed Camping	None
Norton Gulch (Various sites)	Dispersed Camping	None
German Gulch (Various sites)	Dispersed Camping	None
Jerry Creek (Various sites)	Dispersed Camping	Developed

Rocky Ridge	Trailhead	Developed
Starlight	Trailhead	Undeveloped
Bull Ranch	Trailhead	Developed
Fleecer Ridge	Trailhead	Undeveloped
Beals Hill	Trailhead	Developed
Norton Gulch	Trailhead	Planned Developed

Beaverdam Campground is the only developed campground in the Fleecer's and is used by local residents as well as travelers through the area. There are 15 campsites at Beaverdam Campground. The campground typically has an occupancy rate of 30 to 80 percent throughout the summer.

High Rye Cabin is located at the north end of the Fleecer's in German Gulch. It is an historic ranger station that is now used as a rental cabin May 15 through December 1. The cabin receives quite a bit of use on weekends throughout this period. During the fall hunting season the cabin is rented during the week to a greater extent than during the summer.

Fleecer Cabin is a ranger station that is now used as a rental cabin from May 1 through January 1. The cabin is typically rented on weekends throughout this period except during the last seven (7) summers when it has been closed to the public for use by volunteer crews.

Long Tom Cabin is a line cabin used by the Grazing association in the summer. During the winter snowmobilers use it as a warming hut.

The Bull Ranch dispersed area is a popular camping area for local residents who ride the trails on ATVs and motorcycles. There are four dispersed sites in the Bull Ranch area that can accommodate up to 4 or 5 trailers in each site. In the Bull Ranch area the dispersed sites have almost 100 percent occupancy on weekends throughout the summer. The use season runs from Memorial Day through Labor Day in this area. The Bull Ranch area is also used during the fall big game hunting season.

Indian Saddle is a dispersed area that is primarily used during the fall by hunters until snow levels get too deep. There is light use during the summer, but this area tends to be more of a destination for OHV users as the area provides views into the Wise River and Butte valleys.

German and Norton Gulch receives dispersed camping use, but to a lesser degree than the Bull Ranch area. German Gulch dispersed use is primarily during the big game hunting season and Norton Gulch receives most of the use during the summer near Norton Creek along FSR no. 8490.

Jerry Creek is a dispersed camping area that is heavily used during the summer and fall. A toilet was installed in a central location in 2007 to accommodate the heavy use and reduce resource impacts. Some snowmobiling occurs in the area when snow conditions warrant it. Motorized activities are prevalent, especially in the fall big game hunting season.

Rocky Ridge Trailhead is located two miles west of the Feely exit on Interstate 15 and is the most popular trailhead used to access the CDNST. The trailhead is improved with a gravel parking area, registration box, and bulletin board.

Starlight Trailhead provides access via the Starlight Trail to the CDNST. It also provides a connection with the Bull Ranch area. The trailhead is not used much during the summer as most people begin at the Rocky Ridge trailhead or the Bull Ranch area. The trailhead is used during the fall big game hunting season to access the Burnt Mountain and Fleecer Ridge areas. There are no improvements at this site except for a registration box.

Bull Ranch Trailhead provides access to trails that head north, including the CDNST. The trailhead is located approximately 7 miles north of Rocky Ridge TH and provides access for day use hikes to Burnt Mountain, approximately a 6 mile hike from the trailhead. The trailhead is used primarily by hikers going to Burnt Mountain, but does receive some use from motorized trail users. There are no improvements at this site.

Fleecer Ridge Trailhead provides access to the Fleecer Ridge trail and CDNST; however it is not developed and received little use. Most trail users park lower down and ride through this area.

Beals Hills Trailhead provides access to trails around the Beal Mine. The trailhead was constructed by the Pegasus Gold Company as mitigation to provide access to the area around the mine. The area is used during the summer and fall big game hunting season. The trailhead is fenced and has a graveled parking area.

Norton Gulch Trailhead provides access to trails on the south end of Fleecer, including the CDNST. Currently the trailhead is undeveloped, but is planned for development in 2009 to include a gravel parking area, fence, bulletin board, and registration box.

Special Use Authorizations

There are two recreation residences located in the area. One residence is located in Hanson Gulch and the other is south of Beaverdam Campground. The residences are used intermittently as permanent residence is not allowed under the special use authorization.

There is a special use authorization to Northwestern Energy, Inc. for powerlines that run through the north end of the Fleecer's as well as to Vigilante Electric Co-Op for powerlines that run through the Feely area.

Recreation Opportunity Spectrum

The Recreation Opportunity Spectrum (ROS) provides a framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum that any given area might be able to provide. Recreation Opportunity Settings are the combination of physical, biological, social, and managerial conditions that give the value to a place. The Forest Service strives to provide and maintain a range of settings from roaded natural through primitive to meet the expectations and desires of visitors. ROS classifications help determine acceptable development for specific sites and areas. A combination of the following factors determines the ROS class for an area: remoteness (including distance from roads and settlements), degree of naturalness (level of human modification to the landscape), social setting (number of encounters with other people within a typical day), and managerial setting (degree of visitor controls).

ROS is divided into two opportunity categories: summer and winter. The area has four different ROS classes:

1. Roaded natural,
2. Roaded modified,
3. Semi-primitive motorized,
4. Semi-primitive nonmotorized.

The boundary for each class is similar for winter and summer. Forest Service Manual Direction (2330.3) describes each of the ROS classes found within the project area (Table 1).
(FSM 2300 - Recreation, Wilderness, And Related Resource Management,Chapter 2330 - Publicly Managed Recreation Opportunities).

Table 87. Recreation Opportunity Spectrum (ROS)

Recreation Opportunity Spectrum Class	Development Scale	Level of site modification
Primitive - (P)	1	**Minimum site modification.** Rustic or rudimentary improvements designed for protection of the site rather than comfort of the users. Use of synthetic materials excluded. Minimum controls are subtle. No obvious regimentation. Spacing informal and extended to minimize contacts between users. Motorized access not provided or permitted.

Semi-Primitive - Motorized: (SPM) Non-Motorized: (SPNM)	2	**Little site modification.** Rustic or rudimentary improvements designed primarily for protection of the site rather than the comfort of the users. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing informal and extended to minimize contacts between users. Motorized access provided or permitted. Primary access over primitive roads. Interpretive services informal.
Roaded Natural - (RN)	3	**Site modification moderate.** Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about 3 family units per acre. Primary access may be over high standard roads. Interpretive services informal, but generally direct.
Roaded Modified - (RM)	3	**Same as Roaded Natural,** except that the surrounding landscapes are generally within ½ mile of roads and substantially modified by timber harvest and other activities and do not appear natural.
Rural - (R)	4	**Site heavily modified.** Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density 3-5 family units per acre. Plant materials usually native. Interpretive services often formal or structured
Urban - (U)	5	**High degree of site modification.** Facilities mostly designed for comfort and convenience of users and usually include flush toilets; may include showers, bathhouses, laundry facilities, and electrical hookups. Synthetic materials commonly used. Formal walks or surfaced trails. Regimentation of users is obvious. Access usually by high-speed highways. Development density 5 or more family units per acre. Plant materials may be foreign to the environment. Formal interpretive services usually available. Designs formalized and architecture may be contemporary. Mowed lawns and clipped shrubs not unusual.

ROS classes are distributed across the Fleecer Assessment area as follows:

Roaded Natural (RN) –

These areas are located on the northeast 1/3 corner of Fleecer from Feely north to the forest boundary. Many of the roads in this area come from the private land boundary on the east side of Fleecer. Major roads in this area include FSR no. 8490, 1594, 8505, and 96. These roads are designated as open yearlong. A portion of the CDNST #125 runs through a portion of this area from Rocky Ridge trailhead to FSR no. 8505 at Sunday Gulch. Activities in this area associated with the CDNST as well as fall hunting. There is some summer use on the northern end on FSR no. 8490. Firewood gathering is also popular in this area along the major roads.

Roaded Modified (RM) –

A majority of the trails are located in this ROS class. Trails include the CDNST, Bull Ranch Cutoff, Fleecer Ridge, Starlight and a portion of Spring Creek. These trails are used extensively during the summer by ATVs and motorcycles except for the portion of CDNST from Bull Ranch Cutoff to Burnt Mountain vista. A portion of FSR no. 96 and most of FSR no. 83 runs through this area. Most other roads are secondary in nature and used in the past for timber activities.

Semi-primitive Motorized (SPM) –

Most of the development in this area are trails with a minimal number of roads. Spring Creek, Greenland, and Ditch Saddle trails run through this area. Major forest development roads in this class include FSR nos. 8486 and 1593.

3. Reference Condition

Recreation Use Potential: Maximum visitor use potential projections were made for the 1986 Deerlodge Forest Plan and 1987 Beaverhead Forest Plan. Updated projections for the 2009 Revised Forest Plan agree the Forest can supply three times more use than shown in the 2005 National Visitor Use Monitoring (NVUM) survey. However, the distribution of use between developed camping and hunting does not fit the distribution of current use or future predictions. Hunting was underestimated in the 1986 document and developed recreation was overestimated (Table 88).

Table 88. Distribution of Recreation Activities Compared to the Present

Recreation Use	Maximum	Actual Recreation Use Based on 2005 NVUM *	Maximum Benchmark based on Updated Percentages
Developed	30%	5%	279,600
Dispersed	66%	69%	3,858,480
Wilderness	2%	2%	111,840
Hunting and Fishing	3%	24%	167,760
Total Recreation Visitor Days	5,592,000	1,750,000	5,592,000

**National Visitor Use Survey 2005. Visits were converted to Recreation Visitor Days (RVDs) using a factor of 1 visit = 1,259 RVDs or 1 RVD= .795 visits.*

The Beaverhead-Deerlodge National Forest completed its Recreation Facility Analysis in April of 2007. The following statement summarizes the Forests' Recreation Niche:

> "On the surface, the vast, expansive landscapes of the Beaverhead-Deerlodge National Forest teem with elk, and a variety of other species. Nested beneath the surface other riches - copper, gems, silver and gold are found. Over time, these treasures have both attracted and supported people, from Native Americans, to early ranchers, to miners. Today, these building blocks form the foundation for local livelihoods and lifestyles. Hunting, fishing, rock hounding, or simply roaming the Forest to enjoy scenery, explore history, and appreciate wildlife year round are traditions that continue to span generations."

4. Synthesis and Interpretation

Recreation use in the analysis continues to be centered on motorized activities. Proximity to local population centers (Butte, Anaconda) and continuing increases in registration of off-highway vehicles (Quadcycles, Snowmobiles) has put increased demand on existing roads and trails in the area. There is only one developed campground in the analysis area (Beaverdam), thereby most recreation activities are concentrated in the dispersed camping areas. The highest levels of recreation activities are seen for hunting and camping during the fall big game hunting season. Moderate levels of snowmobiling during the winter. Light levels of activity are seen during the spring for bear hunting.

Activities – Sites – Trails

Recreational use in the analysis area continues to rise. Off-highway motorized registrations are increasing with a corresponding increase in use on roads and trails. Dispersed camping and recreation activities are concentrated in several areas and trailheads (Table 4.) Proximity to riparian areas and season of use (Spring thaw, Winter snow) has increased the damage to trail and road surfaces.

Recent outbreaks of beetle-killed trees in the analysis area have also led to greatly increased firewood gathering. Subsequently, more vehicles are going off of designated roads and trails to collect firewood and causing further damage to resources. Increased use by motorized recreationists and firewood collectors is leading to deterioration in the overall road and trail conditions in the analysis area.

Preliminary travel planning activities for sections of the analysis area (South Fleecer MA) were begun in 2008. Using the Forest Plan Interim Roads and Trails Map (2009 Forest Plan, page 53) as a baseline, roads and trails in the South Fleecer MA were reviewed. District and Forest staffs identified resource concerns and made recommendations on how they might be alleviated. See Appendix B – Route Analysis. The proposals on the future management of roads and trails in the analysis area will

be made available to the public for comment and feedback during the summer of 2009. Site-specific NEPA analysis will be needed to identify and analyze alternatives, using the recommendations from forest specialists and comments received from interested publics.

5. Recommendations

Trails and Roads

- Relocate trails to improve safety for motorized users and protect forest resources. Concerns include: trail proximity to streams and riparian areas, steep grades, and poor drainage controls. The proliferation of parallel trails that are in close proximity to each other and have the same destination continues to be an issue as increased motorized activities is seen in the analysis area. In some instances there have been landownership changes that have resulted in access issues. See Appendix B – Route Analysis.

  Ditch Saddle, Norton Creek, Starlight, and Long Tom are among the trails in need of capital investment work. Other trails (Table 2) require increased annual maintenance to address clearing, drainage, and signing issues.

- Identify a separate ATV route from Bull Ranch to Starlight Trail to link motorized segments of the CDNST yet keeps ATVs off forest development roads. In 2006, a segment of the CDNST from the junction of Bull Ranch Cutoff to the Burnt Mountain Vista was constructed for single-track use, including motorcycles. This trail was previously used by ATVs but is being rehabilitated back to a single-track. The CDNST was the backbone of loop opportunities for motorized use. By eliminating ATV use on this segment (approximately 5 miles) there is now a large gap that forces ATV users onto FSR No. 8505 to link with other trails. This poses potential safety issues that need to be addressed because of the high level of traffic and use..

- Move motorized use on Trail No. 95 off of the Lucon property off the property to address safety concerns around a wet meadow area and old buildings. The trail will be moved to a new location west of the private land. A trail connection will be added from FSR No. 1594 to the CDNST. In addition the northern segment of Trail No.95 needs to be relocated for ATV access and to get the trail up out of Norton Creek. The trail on either side is open to ATV use and reconstruction of this segment would help to provide quality motorized recreation opportunities. . An environmental analysis in 2009 will evaluate this location.

- Other trail opportunities include converting two-track roads to trails, linking existing trails and increasing loop riding opportunities. Discussion needs to occur on whether to provide youth 'riding areas' adjacent to dispersed sites in

Bull Ranch. Currently campers utilized several old two-tracks that loop around and provide 'play areas' for youth. Some of these routes cross or utilize FSR no. 8505, which would not be desired due to the high volume of traffic.

- Establish a non-motorized trail in the Northeast Fleecer management area. Options include:

  A trail to the top of Fleecer Mountain would access a popular destination for visitors. The mountain is a prominent peak and at one time there was a registration box (it still may be present) for visitors.

  A loop trail from High Rye Cabin south to Beefstraight Creek and back to the cabin would be desireable. The cabin provides corral space for horses and gets use throughout the summer. Visitors to the area request non-motorized trails usable from the cabin.

- Complete travel planning. Preliminary travel planning and recommendations in the South Fleecer area has been completed (Appendix B -Route Analysis) but on the ground field inspections will not be completed until summer of 2009. The Bureau of Land Management (BLM: Butte Resource Office) is also proposing to change their travel plan adjacent to the analysis area. Forest staff and BLM staff are currently coordinating proposals. Seasonal closures to protect wildlife security need to be reviewed for current validity. If closures are no longer needed, some existing roads and trails may be available for more loop trails. Also, parallel trails in the area could be closed to eliminate resource and riparian issues.

Dispersed Recreation Opportunities

- Harden or establish a boundary around Bull Ranch dispersed sites to limit future expansion. Four dispersed camping areas in the Bull Ranch area are very popular to visitors. These areas fill nearly every weekend from Memorial Day through August/September with less but consistent use during the fall hunting season.

- Reduce resource impacts at Indian Saddle dispersed site.

- Designate dispersed sites in Jerry Creek further away from the creek or restrict activities within 300' feet of the creek tomitigate impacts to the riparian areas. Dispersed camping in the South Fleecer area closer to Wise River is concentrated at a few spots along Jerry Creek road. A new toilet was installed in 2007 that decreased impacts to aquatic resources. Unfortunately, its location and proximity to Jerry Creek further concentrated use near the creek.

6. References

United States Department of Agriculture, Beaverhead-Deerlodge National Forest, Land and Resource Management Plan, Forest Plan, January, 2009.

United States Department of Agriculture, Beaverhead-Deerlodge National Forest, Recreation Facility Analysis, April, 2008.

Beaverhead-Deerlodge National Forest, National Visitor Use Monitoring Surveys, 2005.

H. HERITAGE RESOURCES

1. Characterization

Prehistoric peoples have occupied southwestern Montana for at least the last 12,000 years. Evidence for this occupation is based on material recovered from archaeological and historic sites. A wide variety of stone tools (but especially projectile point types) provide clues about when, where and how humans adapted to the environmental challenges presented by this areas high mountains and rigorous climatic extremes.

Fur traders passed through the Fleecers but mining was the main draw. The first likely discovery of gold in Montana was made on Gold Creek on the Clark Fork River between the Deer Lodge Valley and the Flint Creek Valley. The discovery was reputedly made by a French-Indian fur trader named Francois Findlay ("Bentese") in 1852.

The era of placer gold in southwestern Montana soon gave way to the dominance of lode mining. Lode mining called for a more complex level of industrial development. It gave rise to all of the larger cities and towns in and near the Analysis Area. Most of the smaller towns and mining camps also developed as a result of lode mining although some early placer camps like Butte persisted to become regional commercial and supply centers.

Mining efforts in the watershed focused primarily on gold mainly obtained through placering. The German Gulch Mining District lies generally within a relatively narrow valley known as German Gulch, a tributary of Silver Bow Creek which is at the headwaters of the Clark Fork River. Near the head of German Gulch is where the gold bearing quartz monzonite of the Boulder batholith outcrops. Weathering freed the gold from the quartzite.

The Divide Creek Mining District "includes the upper portion of Divide Creek, a south-flowing tributary of the Big Hole River, and its tributary streams on the west slopes of the Highland Mountains range west of the town of Divide" (GCM 1995:1). Lyden states (p. 90) that an early claim map shows only one patented placer claim, this on the South Fork of Divide Creek and the north slope of Mount Fleecer (thus, this one should fall in the Fleecer district, which is the western portion of the Divide Creek district).

GCM states in their 1995 report that seven lode mines produced 118 tons of ore in 1921; the yield was $296 in gold, 3,654 ounces of silver, 232 pounds of copper, and 13,786 pounds of lead. The total value was $4,600. In 1941, the report adds, some additional ore was shipped.

Winchell (1914:14) mentions the Fleecer district as being "in an area of limestone and other sedimentary rocks which are cut by the same [Boulder] batholith." As the original GCM report notes, Winchell describes this district (which, by implication, was sometimes considered part of the Divide Creek district) as on the west side of Divide Creek and southwest of Feely (1914:167). Of the district's history, the report states only that this district is not well known for its production; in fact, "only two mineral developments have been described in the mining literature. Both the Bonanza and the Cayuga claims were described in the 1910s. Development work for the mines was modest and no production was reported."

The two claims (groups of claims) mentioned by the report are those listed by Winchell in his discussion of the Divide Creek district; they are on the slopes of Fleecer mountain and thus in the western part of the area (Winchell 1914:166). Of them, Winchell wrote that "on the western slope of Fleecer Mountain, at an elevation of about 8,500 feet above sea level, several claims have been located and more or less developed"--these included the Bonanza (1914:166). He also states that "a little more than 2 miles northwest of Divide, on the southeast slope of Fleecer Mountain, the Cayuga Development Co. is prospecting for copper ore near a contact of quartz monzonite with sedimentary rocks that are apparently of Mesozoic age" (1914:166).

The High Rye Station is located in southwestern Montana. The current cabin was built in 1940. The High Rye Station originally served as an early headquarters for the Deerlodge National Forest. Although the date of withdrawal for this site is not clear, the station was manned as early as 1919. Albert Cole served as the Ranger for the High Rye district from 1919 to 1922. Cole describes the district as follows:

The dwelling at that time "was a very poor one" rumored to have once belonged to the Champion Mine Company and moved to the High Rye site "Cole recalled that while a new cabin was promised in 1919, it did not materialize during his tenure (USDA Forest Service 1962:10).

Land Management Plan Direction Relevant to Heritage Resources

Desired Future Condition (2009 Forest Plan Direction)

Goals:
There is no loss of significant heritage resources. Significant means listed in the national Register of Historic Places, eligible for listing, or awaiting formal evaluation for National Register eligibility.

Objectives:
Historic Preservation Plan: Write historic preservation plans for every heritage property listed in the national Register of Hitsoric Places within one year of listing.

Heritage Assessment: Complete an assessment of heritage resources with conclusions and priorities for inventory, protection, stabilization, and enhancement

Heritage Management Strategy: Develop and update as needed, a forestwide heritage management strategy ….

2. Current Condition

Records on file with the Heritage Program of the BDNF provide information on type and number of known cultural resources and level of inventory conducted on forest lands within the Fleecer Watershed analysis area. Forty-two surveys covered 2,226 acres of forest land with intensive inventories for cultural resources. This amounts to approximately 2% of the land managed by the Forest Service (98956 acres) and 1% of the total 223,114 acres within the entire watershed analysis area. This level of cultural resources inventory is similar to that completed elsewhere on the forest. These inventories were primarily project compliance inventories in advance of proposed federal undertakings including: timber sales, soil testing, small range improvements (fences, water developments), and a land exchange. The inventories vary from as little as 5 acres, to as much as 483 acres in extent.

The inventories described above led to discovery of 38 cultural properties which were recorded and three site leads were noted (see Table 1). Of the recorded sites, 18 % or seven sites are of prehistoric origin, 81% or 31 sites are historic.

Recorded prehistoric site types are primarily lithic scatters. Five lithic scatters and two tipi ring sites were recorded in the analysis area. Twenty historic sites are associated with historic mining activity, four homesteading/agricultural development sites, two logging activity sites, 1 historic Forest Service administration site, one historic transportation site, one historic mining district, and two other site types. Most importantly, nineteen historic sites have cabin remains and an additional two have wooden structural remains present. Though 38 sites were formally recorded within the watershed analysis area, only a handful has been formally evaluated for significance in consultation with the Montana State Historic Preservation Office.

In spite of the number of recorded mining sites on the south zone portion of the assessment area, there is no defined mining district in this area.

Table 89. Fleecer Watershed - Heritage Resources Summary

SiteNumber	Name	Site Type	Impacts
24BE1664	Montana Southern RR	Rail road	Abandoned
24DL129(117)		Logging Camp	Natural decay
24DL202	Hungry Hill Mine	Mining	Natural decay

24SB61		Cabin	Natural decay
24SB62		Homestead	Natural decay
24SB63		Cabin/Mining	Natural decay
24SB88		Cabin/Mining	Natural decay
24SB91		Cabin/Mining	Natural decay
24SB92		Cabin/Mining	Natural decay
24SB93		Cabin/Mining	Natural decay
24SB94		Cabin/Mining	Natural decay
24SB95		Cabin/Mining	Natural decay
24SB96		Cabin/Mining	Natural decay
24SB97		Cabin/Mining	Natural decay
24SB98		Cabin/Mining	Natural decay
24SB109		Cabin/Mining	Natural decay
24SB111		Lithic Scatter	Natural decay
24SB157		Mining	Natural decay
24SB158		Mining	Natural decay
24SB212	German Gulch Mining Dist.	Mining	Natural decay
24SB216	High Rye Cabin	FS Admin site	Rental Cabin
24SB242	Indian Cr. Cabin	Unknown	Hunter vandalism
24SB243	Pegasus Cabin	Homestead	Natural decay
24SB587		Timber Harvest	Natural decay
24SB598	Delano Homestead	Homestead	None noted
24SB610	Ditch Saddle Cabin	Mining	Natural decay
24SB645	Basque Shrine	Basque shepherding	Natural erosion
24SB646	New Meadow Mine	Mining	Reclamation
24SB647	Hanson Mine	Mining	Reclamation
24SB648	Long Tom Mine	Mining	Reclamation
24SB649	Peterson Mine	Mining	Reclamation
24SB680	Jerry Cr. Lithics	Lithic Scatter	Dispersed Camping
24SB691	Jerry Cr. Confluence	Lithic Scatter	Grazing/road const.
24SB776		Recreation Residence	None noted
24SB1008		Lithic Scatter	Natural decay
24SB1009		Lithic Scatter	Natural decay
24SB1011		Prehistoric tipi rings	None noted
24SB1012		Prehistoric tipi rings	None noted

3. Reference Condition

Humans occupied or passed through portions of this Forest for 12,000 years. We can learn much about our history and culture as humans from the evidence left behind by these previous residents. The desired condition for these heritage resources (2009 Revised Forest Plan) is to not lose any significant heritage resources. Significant means listed in the National Register of Historic Places, eligible for listing, or awaiting formal evaluation for National Register eligibility. The Forest also aspires to develop and maintain a heritage program that includes legal compliance, preservation, interpretation, public education, scientific research, partnerships, and tribal consultation.

4. Synthesis and Interpretation

Cultural resource inventories within the analysis area have been strictly "compliance" oriented in support of other forest programs over the past 25 years. Cultural resources that were encountered during these investigations were recorded and avoided. Most recorded properties were not formally evaluated for significance, in consultation with the Montana State Historic Preservation Office.

As noted above, a good share of the known cultural resources are of historic origin and contain wooden cabins, buildings, and/or structures that are in various stages of collapse, decay and neglect. There is a high probability that much of the original historical integrity of many of these sites may have been lost, resulting in Forest Plan objectives or desired conditions for Heritage Resources not being met.

5. Recommendations

- Complete additional inventories on Wise River side of the Fleecers. The Wise River District part of the assessment area is proportionally under-represented in the cultural resources inventory.

- Formally evaluate known or previously recorded cultural property for significance and eligibility to the National Register of Historic Places in consultation with the Montana State Historic Preservation Office. To complete this task each site would need to be relocated, revisited, and the site form updated. At this time the sites would be formally monitored to determine the rates of natural deterioration and decay at those sites with standing structures and to determine if increased motorized access has resulted in an increased occurrence of vandalism.

- Manage sites formally determined to be significant and eligible for the National Register of Historic Places to standards and monitor at least every five years to insure that no impacts occur that adversely affect site integrity or eligibility.

- Interpret history as part of providing future recreational opportunities in accordance with the recently developed Beaverhead-Deerlodge "recreational niche" concept. The best recreation based opportunity is to provide historical interpretation for the German Gulch historic mining area and significant episodes in local history.

6. References

GCM Services

1995 (Technical versions of reports on mining districts.) Prepared for Abandoned Mines Reclamation Bureau, Montana Department of State Lands, by GCM Services. Butte.

Lyden, Charles J.

1987 Gold Placers of Montana. Montana Bureau of Mines and Geology Reprint
6 (original 1948). Advanced Litho, Great Falls, Montana.

USDA Forest Service

1962 Beaverhead-Deerlodge National Forest Heritage Program Files. Butte Ranger District Butte, MT.

Winchell, Alexander N.

1914 Mining Districts of the Dillon Quadrangle, Montana and Adjacent Areas. United States Geological Survey Bulletin 574. Government Printing Office, Washington.

I. GRAZING

1. Characterization

The Fleecer Assessment includes the Lincoln Park C&H and Jerry Creek C&H grazing allotments on the Wise River Ranger District, and the Divide Creek C&H, Fleecer C&H, German Gulch C&H, and Norton Creek C&H range allotments on the Butte Ranger District. These grazing allotments consist mostly of National Forest lands with some BLM and State managed lands, and private ownership (see 38). A mix of sagebrush-grasslands, grasslands, mountain meadows, riparian areas, and transitory rangelands provide the grazing forage at all elevation zones within these allotments. All of these allotments are currently active, but authorized livestock numbers have varied over the last 10 years due to a number of factors including voluntary reductions in livestock numbers and/or season, and personal convenience and resource protection nonuse. For example, a voluntary 10 percent reduction in livestock numbers has occurred on the Jerry Creek allotment to address a loss of grazing capacity due to a loss of transitory range grazing areas. This reduction was started in 2005, and has continued to the present. One grazing permit attached to the Lincoln Park allotment has been in resource protection nonuse since the mid 1990's to address grazing capacity issues, and/or ability to comply with Forest Plan allowable utilization standards.

Land Management Plan Direction Relevant to Livestock Grazing

2008 Revised Forest Plan

Desired Condition – People and communities benefit from programs and infrastructure that support livestock grazing and an array of forest products and services. Methods for using resources to benefit people while maintaining functioning ecosystems are employed.

Desired Condition - Resources adversely affected by past management activities have been rehabilitated.

Goal: Grazing Opportunities – Sustainable grazing opportunities are provided for domestic livestock from lands suitable for forage production.

Goal: Forage Use – Use of forage by domestic livestock will maintain or enhance the desired structure and diversity of plant communities on grasslands, shrub lands, and forests. Use will be managed to maintain or restore riparian function as defined in the allotment management plan.

2. Current Condition

Current allotment-wide rangeland conditions or trend are not known for most of the Fleecer WA allotments. The most recent range analysis was completed in 1998 on the Divide Creek allotment. At this time the environmental analysis concluded that, overall, upland and riparian conditions were in satisfactory condition. In the mid 1990's a rapid rangeland condition assessment was completed for the Fleecer and German Gulch allotments. This assessment concluded that rangelands within the allotments were in satisfactory condition also. The next most recent analysis was completed in 1988 on the Jerry Creek allotment. Other allotment analyses date back to 1983 and much earlier. Since the mid 1980's there have been numerous changes to livestock management on these Fleecer WA allotments; however, for the most part it is not known if these changes have led to improved rangeland conditions.

In 1997 the Beaverhead-Deerlodge Forest agreed to settle a lawsuit by the National Wildlife Federation, implementing an allotment specific NEPA schedule and interim riparian allowable use levels until site specific allotment management could be analyzed. Since about 1997, interim riparian forage utilization standards have been implemented on the Jerry Creek and Lincoln Park allotments through an amendment to the 1986 Beaverhead Forest Plan, and, subsequently, term grazing permits held by Beaverhead Forest grazing permittees. The Divide Creek, Fleecer, German Gulch, and Norton Creek allotments are located on the Deerlodge portion of the Forest, and were not subject to the lawsuit. As a result, allowable use standards from either the 1987 Deerlodge Forest Plan or an updated Allotment Management Plan (AMP) are currently being implemented on these four allotments.

Compliance with Forest Plan allowable use standards has been variable on allotments within the Fleecer watershed assessment (Fleecer WA) boundary. A loss of transitory range and overstocking has resulted in compliance problems on the Jerry Creek and Lincoln Park allotments, especially within riparian areas. Voluntary livestock number reductions and resource protection nonuse has partially remedied these problems. The Divide Creek allotment has experienced similar problems. Permittee willingness to remove cattle early or reduce permitted numbers has helped resolve compliance issues in the past.

Increased recreation use, especially by OHVs, has resulted in an increased potential for conflict with livestock using the Fleecer WA allotments and has increased spread and potential for spread of noxious weeds. Along with wildlife, livestock have likely contributed to this spread also.

Over the last five years, mountain pine beetle infestations have led to a change in rangeland conditions on some allotments. Specifically, tree mortality has resulted in increased forage production due to less tree shading, and reduced plant competition for water and soil nutrients.

The following tables show the current grazing permit and allotment information:

Table 90. Grazing Permit Information

Allotment Name	Allotment Number	Permitted Number	Class of Livestock	Season of Use	Number of Permittees
Lincoln Park	20041	184	Cow/Calf	6/16 - 9/30	2
Jerry Creek	20038	915	Cow/Calf	7/1 - 9/30	3
Divide Creek	90406	350	Cow/Calf	7/1 – 9/30	1
Fleecer	90407	187	Cow/Calf	6/1 – 9/30	2
German Gulch	90408	218	Cow/Calf	6/16 – 10/10	1
Norton Creek	90412	144	Cow/Calf	6/16 – 10/15	4

Table 91. Allotment Information

Allotment Name	Acres Suitable Livestock Range	Acres Unsuitable Livestock Range	Total Acres	Pastures	Pasture Administration
Lincoln Park	1,779	4,250	6,029	Lincoln Park Panama Woods Gulch	FS FS FS
Jerry Creek	12,510	27,420	39,930	Delano Fish Lake Granulated Indian Saddle Johnson Creek	FS FS FS FS FS
Divide Creek	7,752	12,838	20,590	South Rocky Ridge North Rocky Ridge East Bull Olsen Park Indian Saddle Little Fleecer Old FS West Horse Pasture West Bull Gathering Pasture	FS FS FS FS FS FS FS FS FS
Fleecer	3,485	2,595	6,080	Exclosure Wet Ridge Upper Charcoal Antelope	FS FS FS FS

				Lower Charcoal Big Park	FS FS
German Gulch	1,860	12,110	13,970	Lower Beef Upper Beaver Lower Beaver Lower German Minnesota Mid Beef Beals	FS State State FS FS State FS
Norton Creek	4,875	9,217	14,092	Trail Sunday Norton Powder Greenland	FS FS FS FS FS

Table 92. Structural Range Improvements, Grazing System & Utilization Standards

Allotment Name	Grazing System	Miles of Fence	Number of Water Developments	Utilization Standards		
				Riparian	Upland	Winter Range
Lincoln Park	Rest Rotation	14	5	50% 45%**	55%	35%
Jerry Creek	Rest Rotation	23	7	50% 45%**	55%	35%
Divide Creek	Rest Rotation	19	16	50%	55%	35%
Fleecer	Rest Rotation	9	10	50%	55%	35%
German Gulch	Rest Rotation	10	5	50%	55%	35%
Norton Creek	Rest Rotation	23	14	50%	55%	35%

** Allowable use standard is applied to westslope cutthroat trout occupied streams.

3. Reference Condition

Vegetation in the Fleecer Mountains developed naturally with herbivory by wild animals as one of several disturbance processes. Livestock grazing has been ongoing since the early 1900s. Under "Forestwide Desired Conditions" the 2009 Revised Forest Plan identifies sustainable livestock grazing as a beneficial service and Forest product to provide communities and the public.

4. Synthesis and Interpretation

Under Revised Forest Plan and/or AMP direction for livestock grazing, the ability of Fleecer WA allotment permittees to meet prescribed forage utilization standards will be highly contingent upon a number of factors including current years forage production, level of their involvement in allotment management, and their capability to recognize when standards are being approached, or have been met. Until new, or updated, AMPs can be completed for these allotments, compliance with allowable use standards will be variable.

With increasing recreational use, potential for user conflict with livestock increases, especially at sites favored by both livestock and recreational users such as campsites and trails.

With increased traffic and soil disturbance from OHVs, the potential for noxious weed spread will likely increase. Livestock would continue to contribute to this spread.

Mountain pine beetle infestations will continue to result in tree mortality within the watershed assessment boundary; however, an increase in forage production from this mortality will not likely offset stocking problems on most allotments.

5. Recommendations

- Pursue opportunities to not reissue permits that have been waived back to the Forest Service when not waived in preference to a new owner of qualifying base property or livestock. This would help avoid non-compliance with Forest Plan utilization standards, and reduce the potential for user conflicts.

- Hold grazing permittees accountable to meeting Forest Plan forage utilization standards. Take adverse grazing permit action where noncompliance occurs on a repetitive and/or consecutive basis.

- Assess range allotments for opportunities to develop off-site water to help draw livestock out of riparian areas.

6. References

United States Department of Agriculture, Beaverhead-Deerlodge National Forest, *Beaverhead Forest Plan Riparian Amendment, 1997*

United States Department of Agriculture, Beaverhead-Deerlodge National Forest, *Divide Creek Allotment Management Plan Environmental Assessment, 1998*

United States Department of Agriculture, Beaverhead-Deerlodge National Forest, *Land and Resource Management Plan, Forest Plan, January, 2009.*

J. MINERAL MANAGEMENT

1. Characterization

Mineral Potential
The Fleecer Watershed Assessment area is favorable for a number of mineral deposit types. The west half is primarily favorable for polymetallic vein deposits: small vein deposits of gold, silver, and associated base metals. The east half is primarily favorable for copper deposits, replacement deposits of gold, silver and base metals, medium to high value know locatable mineral deposit area, or phosphate potential. None of the area has more than a low oil and gas potential. Most of it has very low potential.

Mining History
Mining endeavors in the Fleecer Watershed Assessment area focused primarily on gold, mainly obtained through placer mining. Three Mining Districts are located in the watershed: German Gulch, Divide Creek, and Fleecer. The latter two districts are described in detail in the Heritage Resources report. Neither were well known for mineral production. Only two notable mineral developments were described in the mining literature, the Bonanza and Cayuga claims on the slopes of Fleecer mountain.

German Gulch, a tributary of Silver Bow Creek, was the site of a major gold discovery in 1865 located above the three forks of Norton Creek, Beef-straight Creek and German Gulch Creek. Shortly after the discovery, there were nearly a thousand men in German Gulch mining, constructing ditches and houses. At the end of the 1860s the easy gold had been taken from German Gulch -- the amount estimated to be between $5 and $10 million. Many of the miners had left. With the end of the 1860s, Chinese and Euro-American companies consolidated claims and began large scale hydraulic mining.

In 1865, a Dr. George Beal moved his operations into German Gulch from Virginia City Beal was also noted for building the Centennial Hotel and being elected the third mayor of Butte in 1881. The Montana Gold Mountain Company took over placer and lode claims originally located by Dr. Beal and son, Perry Beal. The company built a concentrating mill on the creek. Although The Montana Gold Mountain Mining Company remained dormant and issued no annual reports during the war years, papers were filed to extend the existence of the corporation to 1987. Exploration continued by a number of companies in the 1970s and with the increase in the price of gold in the late 1980s, this low-grade ore deposit became an economically feasible mining project and Beal Mountain Mining Company, a subsidiary of Pegasus Gold Corporation, re-initiated mining the prospects that the Beal family worked to develop over the years in 1988. Beal Mountain Mining gained approval of a Forest Service Plan of Operation and the Montana Department of Environmental Quality (DEQ) Operating Permit for Open Pit Mining and Cyanide Heap Leach Facility and removed

14.8 million tons of ore and 20.3 million tons of waste from the open pit mine between 1988 and 1997. 457,884 ounces of gold were recovered.

In 1998 Pegasus filed for Bankruptcy. From 1998-2002 the FS and DEQ continued reclamation activities in cooperation with Bankruptcy Trustee. In 2003 the FS enacted Comprehensive Environmental Response, Compensation, and Liability Act authority (CERCLA) over the project.

Land Management Plan Direction Relevant to Mining

Desired Future Condition (2009 Forest Plan Direction)

Goals:
Hardrock and Saleable Minerals: Mineral commodities are explored and developed in accordance with national direction.

Locatable Minerals: Locatable minerals are developed on all parts of the Forest not withdrawn from locatable mineral entry in accordance with the 1872 Mining law, regulations, and national direction.

Objectives: None

Standards: (Apply to Oil and Gas Leasing only)

2. Current Condition

Mineral Availability

None of the Fleecer area has been withdrawn from mineral entry due to wilderness or ski areas. Recreations areas, administrative sites, campground/picnic areas, special designations (like Research Natural Areas), and streamside zones may also be withdrawn from entry by the 1872 Mining Law. Some of these withdrawals occur in the Fleecer area.

Active Mineral Operations

Mining activities have been localized in the German Gulch, Fleecer Mountain and Divide Creek portions of the landscape for the past 130 years with Beal Mountain mine a remnant of this activity. Underground and open pit precious metal mining occurred in portions of German Gulch and Johnson Creek drainages with phosphate mining occurring on the western slopes of Fleecer Mountain.

Current mining activity is minimal. Within the analysis area there are approximately 16 placer mining claims kept current by claimants paying necessary fees or doing assessment work. While this keeps the claims active, there is no active mining under Plan of Operation taking place. No plans of operation have been submitted recently.

Abandoned/Inactive Mines

There are several abandoned and inactive mine sites within the analysis area. These abandoned mine land (AML) sites are located in the Bighole and Clark Fork River watersheds. Some of the AML sites could potentially impact water quality and the environment (Environmental Compliance and Protection Program) while other AML sites contain hazardous mine openings (HMO) and are a potential threat to the public because of safety hazards. The most significant abandoned mine in the watershed assessment area is the Beal Mountain Mine (see discussion below under "Environmental Compliance and Protection").

Environmental Compliance and Protection. The Beal Mountain Mine is located in the headwaters of German Gulch in the Pioneer Mountains, Silver Bow County, Montana, about 16 miles west-southwest of Butte and 10 miles southwest of Fairmont (Gregson) Hot Springs, Montana. The mine is situated on land managed and controlled by the Beaverhead-Deerlodge National Forest (FS). Pegasus Gold Corporation completed open pit mining operations at the Beal Mountain Mine in 1997 and gold recovery from the heap leach pad in 1999. With the bankruptcy filing by Pegasus in 1998, and exhaustion of bonding funds to complete reclamation, the FS became the lead agency responsible for final mine closure.

The FS has been collecting water quality samples and measuring surface water flow since 2003. Flows at surface water and spring stations, and discharges from ponds were measured to determine water quality impacts to German Gulch, Minnesota Gulch, and Beefstraight Creek. The objective of this monitoring was to determine if there has been any change in water quality by comparing current and historic values. Results and changes in water quality will be reviewed in the Final Engineering Evaluation/Cost Analysis (EE/CA) scheduled to be completed in 2009.

In 2000 a biological water treatment plant was constructed to treat water from the heap leach pad. The FS continued biological water treatment, completed some road reclamation and leach pad diversion ditches, and dismantled the treatment plant in 2005. In 2008, .four dewatering wells were re-installed to reduce the threat of land slides and increase the stability of the leach pad dike. Water treatment, using a reverse osmosis (RO) water purification system, began in 2008.

The FS installed and operated a RO water treatment system in 2008 to treat solution that had accumulated within the leach pad. The system operated from July 21 through October 16, 2008. The leach pad solution contains concentrations of ammonia, dissolved aluminum, total recoverable arsenic, total recoverable iron, and total recoverable nickel exceeding their respective chronic aquatic life standards. Leach pad solution also contains concentrations of total cyanide, total recoverable copper, and total recoverable selenium exceeding their respective chronic and acute aquatic life standards. The treated water from the RO system did not exceed any

acute standards. Ammonia exceeded the chronic standard entering the Freshwater Pond. Because of this, water from the RO system could not be discharged directly into German Gulch and had to be land applied on Beal Mountain. About 12 million gallons of water was treated in 2008 and land applied through a sprinkling system. It is expected that water treatment will continue through 2010.

Hazardous Mine Openings (HMOs) Hazards in underground abandoned mines include deep vertical shafts, horizontal openings supported by rotting timbers, unstable rock formations, and the presence of unused or misfired explosives. Old surface mines contain hills of loose materials in stockpiles or refuse heaps that can easily collapse. It is not uncommon for recreational accidents and deaths to occur at abandoned mine sites.

The FS is inventorying all abandoned mine land (AML) sites that pose a public health and safety threat on the Forest. There are eight AML sites in the Bighole River watershed and seven AML sites in the Upper Clarks Fork River watershed that may have HMO associated with the sites, see Table 93 below and Map 37. A site assessment will be conducted on all of these sites to determine if there are threats to the public health and safety. Sites that have been determined to have hazardous mine openings will be closed after conducting an environmental assessment to determine method of closure.

Table 93. Abandoned Mine Lands identified in Fleecer WA

Mine Name	Drainage	Inspection status in data base
Jacqueline Mine	Bighole River	MGMB Checked, no effect
Unnamed (Rose Gulch)	Upper Clark Fork	None
Powder Gulch	Upper Clark Fork	None
Central District Placer	Upper Clark Fork	None
Fleecer Mountain Area (North)	Bighole River	MGMB Checked, no impact noted
Mt Fleecer-Jerry Cr. Star Group	Bighole River	None
Fleecer Mtn Area (South)	Bighole River	None
Newcomb	Bighole River	None – unable to locate
Unnamed Re (Powder Gulch)	Upper Clark Fork	None – unable to locate
Patsy Ann Mine	Bighole River	2 caved adits (1994) HMOs at site
Mooney Claim-Uranium	Upper Clark Fork	MGMB checked, no impact noted
Beal Lode	Upper Clark Fork	None
German Gulch (Siberia)	Upper Clark Fork	None
South Fork Parker	Bighole River	Hazard – Boarded up adit. No

Creek Mine		discharge
Unknown-Pine Dale Mine	BigHole River	Hazard – open vertical & inclined shafts. Dry

Source: Montana Bureau of Mines and Geology Hazardous Mine Site data base

3. Reference Condition

See the Section: A. GEOLOGY, LANDFORMS and SOILS for a discussion of the geologic character of the assessment area.

4. Synthesis and Interpretation

Current mineral activity is minimal. No plans of operation have been submitted recently, so there will be few opportunities related to active mineral work.

Abandoned mine reclamation is the primary concern in this assessment area because the sites affect both water quality and public safety. Hazardous openings have already been surveyed and those opportunities are laid out and only need funding. Most other abandoned or inactive mine sites have not been well inventoried, with the exception of Beal Mine.

The Beal Mine will continue to require heavy funding as a "Super Fund" site. The project dwarfs most other work on the Forest in scale. Beal Mine is impacting water quality in German Gulch, Minnesota Gulch, and Beefstraight Creek.

5. Recommendations

- Continue reclamation of the Beal Mountain Mine. The Beal Mountain Draft EE/CA, September, 2005 identified a range of reclamation alternatives. The preferred alternative was estimated to cost approximately $14 million for construction and over $1 million dollars for annual operation and maintenance expenses. The Forest Service, working with an established technical working group (TWG), will evaluate the most feasible and cost effective closure options for the Beal Mountain Mine. The final EE/CA and plan for reclamation of the Beal Mountain Mine is expected to be completed in 2009. Funding for the Beal Mountain Mine reclamation is from the Environmental Compliance and protection/Abandoned Mine Land (ECAP/AML) program as well as other FS program funds. To date, about $15.2 M from the ECAP/AML program funds have been spent at the Beal Mountain Mine. Water treatment and reclamation of this site is expected to take several years. Reclamation is dependent on funding.

- 2. Close hazardous mine openings. The closure of hazardous mine openings is prioritized based on accessibility by the public from roads, trails, and

campgrounds as well as eminent threats to their safety. Closures of HMO sites in the Fleecer Watershed will be based on recommendations after completion of the site assessment of the 15 HMO identified in the inventory of this watershed. Reclamation of these HMO sites is dependent on funding.

6. References

None

IV. FINDINGS and RECOMMENDATIONS by RESOURCE

This section summarizes the findings from individual resource write-ups and the subsequent recommendations for closing the gap between current conditions and desired conditions. These actions include restoration needs, maintenance of conditions or protection of ecosystem components in order to sustain the health and productivity of natural resources. Data gaps and monitoring needs are included as part of recommendations.

Any actions or projects, which utilize the information presented in this Watershed Analysis, will be analyzed on a site-specific basis by an interdisciplinary team and will include both public involvement and disclosure of decision as prescribed by the national Environmental Policy Act (NEPA).

See Section V for INTEGRATED RECOMMENDATIONS.

SOILS

Finding: Soil productivity issues in the Fleecer Mountains are confined to localized areas, such as roads and campgrounds, which are dedicated use areas accepted under Forest Plan direction and the Regional Soil Quality Standards (USDA Forest Service, 1999). Opportunities to improve soil productivity in other areas include poorly located/unneeded road segments, unauthorized roads and trails, dispersed campsites, and also small areas of residual compaction on old roads/skid trails in previously managed timber stands.

Recommendation:

1. Decommission or relocate problem roads. (See recommendations in Appendix B – Route Analysis and Appendix A-Road Sediment Survey). Some notable examples are Lone Tree road 1594, road 8490 to Norton Gulch, Sunday Gulch road 8505 and parts of road 8486 on the south end of Fleecer Ridge and in the upper part of the South Fork Divide Creek. These roads in active use today are in poor locations, have steep grades, and/or inadequate drainage. Past improvements reduced these effects but replacement with new, properly located and engineered roads may be the only real resolution.

2. Identify areas of residual soil compaction in old harvest units (likely very small in extent) in the field and prioritize them for treatment.

WATERSHED and HYDROLOGY

Finding: Increased sediment several streams in mid to lower elevations within the watershed results from livestock grazing, road conditions and location, and mining (Beefstraight and German Gulch Creeks).

Opportunities to reverse past management's negative effects to the watershed include:

- maintain healthy and vigorous riparian vegetation to continue bank stabilization and provide shade,
- ensure existing roads and trails function properly to keep sediment out of streams,
- improve road and trail crossings at streams, and
- monitor and reclaim past mining sites.

Projects in Jerry Creek and German Gulch, Fish Key Watersheds are a priority to achieve aquatic goals of the 2009 Forest Plan.

Recommendations:

1. Manage roads and trails to reduce watershed risk. See APPENDIX B - Route Analysis. Roads in watersheds of concern (high road density, for example) were given a higher priority. Jerry and North Fork Divide Creek watersheds both have a high road density of 2.1 mi/mi^2. Also see recommendations from the Road Sediment Survey in Appendix A. Road/trail recommendations are prioritized in the following table.

Table 18. Road and Trail recommendations listed from highest to lowest priority.

Road ID	Road Name	EMP	Recommendation	Remarks
78092	Beefstraight	0.5	Decommission	Stream crossing
8490	Norton Gulch	5.19	Resource Concerns	Maintenance/Drainage
UR4-56,58,74	Bull Ranch Area	.44	Partially Decommission	Dispersed camping sites, partial deco. to address riparian areas
UR02N12W12-02	Moose Cr	.841	Decommission	Parallels stream-resource damage
8505	Bull Ranch	5.7	Resource Concerns	Maintenance
96	Divide Cr Road	6.1	Resource Concerns	Maintenance
Trail ID	Name	EMP	Recommendation	Remarks
4095	Norton Gulch Trail	1.3	Resource Concerns	Relocation

2. Implement riparian/range improvement projects. Grazing/riparian improvement recommendations are prioritized in the following table. The hydrologist on the forest would like to see removal of the Bull Ranch Dam to return the stream and riparian meadows to historical conditions. Watershed improvement projects in German Gulch

(from the mine downstream to the canyon) would greatly benefit habitat and stream function.

Table 19. Riparian/range improvement projects from highest to lowest priority.

Watershed	Stream Name	Project	Remarks
German Gulch	German Gulch	Restoration Projects	Improve watershed condition through various restoration projects
German Gulch	German Gulch	Install water tank	Alleviate grazing pressure in German Gulch (T3N, R10W, NW¼, Sec 34)
Jerry Creek	Indian Cr	Install water development	Alleviate grazing pressure in Indian Creek
North Fork Divide Creek	East Tributary	Install water development	Pull cattle away from Bull Ranch riparian areas (T2N, R9W, NE¼, Sec 19)
North Fork Divide Creek	North Fork	Pull wood to creek	West Bull Ranch protect riparian area
North Fork Divide Creek	North Fork	Pull wood to creek	East Bull Ranch protect riparian area
North Fork Divide Creek	North Fork	Remove Bull Ranch Dam	Return stream and riparian area to historical conditions
North Fork Divide Creek	South Fork	Reconstruct Indian Saddle Water Development	Pull cattle out of South Fork drainage up onto ridge pasture (T1N, R10W NE¼ Sec.3)
North Fork Divide Creek	South Fork	Fall trees along creek	Riparian protection above Beaver Dam Campground
North Fork Divide Creek	South Fork	Install hardened creek crossing	Garrison moves 20 -100 head of cattle across the creek ¼ mile upstream of Beaverdam CG
North Fork Divide Creek	North Fork	Fall trees along creek	Riparian protection below Beaverdam Campground
Johnson Creek	Cat Creek	Install water development	Alleviate grazing pressure in Cat Creek
Beefstraight Cr	Beaver Creek	Add LWD	Cows trampling creek bottom
Norton Creek	Norton Creek	Molek water development	Add water development on ridge north of Norton Creek pond (T3N, R10W, SE¼, Sec. 36)

AQUATIC SPECIES AND HABITAT

Finding: Upper Jerry Creek and German Gulch, Fish Key Watersheds, are important to the Forest strategy for conserving westslope cutthroat and bull trout populations (Forest Plan 2009), APP H-3. The populations of westslope cutthroat trout cluster in these two drainages. They are not secure from hybridization by brook trout and rainbow trout. Throughout the Fleecers, roads paralleling streams, culverts, trail crossings and riparian grazing impact channel morphology and sediment levels.

Protection and restoration of populations needs to focus in key watersheds: build fish barriers, verify genetics, remove brook trout and, finally, enhance habitat. Opportunities are offered for WCT streams outside of the key watersheds as well. These efforts require close coordination with Montana Fish Wildlife and Parks and their priority work.

Recommendations are organized by 6th field HUC. See Maps referenced for location of recommended projects. An evaluation of the priority and requirements for most of these proposals is located in Section II. AQUATIC SPECIES AND HABITAT, P. 84-89 and the project file document "Fisheries Project Proposals".

Recommendations:

Divide Creek Sub-watershed SEE MAP 15. Divide-Fleecer Proposed Projects.

1. Eliminate brook trout from NF Divide Creek and the SF Divide Creek

2. Remove or Replace Culvert that is barrier to fish movement in unnamed tributary to SF of NF Divide Creek; Expand WCT upstream

3. Eliminate brook trout in SF NF Divide Creek above South Fork Reservoir.

4. Reduce livestock bank trampling in Reach 1 of the South Fork Divide Creek. See recommendations in Table 19 Watershed and Hydrology section.

Upper Jerry Sub-watershed SEE MAP 16 of proposed projects.

1. Secure WCT population in Upper Jerry Creek

2. Expand WCT population in Upper Jerry Creek

3. Second downstream expansion of WCT population

4. Alternative in the absence of genetic analysis to confirm WCT integrity.

5. Phase 4 of Jerry Creek WCT restoration

6. Design a road improvement package for Upper Jerry - culvert removals, replacements, road segment reroutes, etc.

7. Additional Data Needs

Lower Jerry Sub-watershed

1. Eliminate the ford immediately above the bridge over Jerry Creek near Indian Creek confluence. Move the gate in the fence to other side of the bridge.

Johnson Fleecer Sub-watershed See Map 17. Johnson Fleecer Proposed Projects.

1. Secure and Expand WCT population in Cat Creek.

2. Expand and link WCT populations in Johnson and Dodgson Creeks.

Bear Creek Sub-watershed SEE MAP 18 of proposed projects.

1. Secure and expand WCT population above Forest Boundary in Bear Creek

Lincoln Sub-Watershed

1. Data Collection - Collection of data for Moose Creek may be most valuable in generating projects, if WCT are still in that creek.

German Gulch Sub-Watershed

1. Restore channel in Beefstraight Creek where over-widened road ford delivers sediment to the stream

2. Remove non-native trout competitions threat in Norton Creek

3. Reduce placer mining impacts to German Gulch stream channel and riparian area.

VEGETATION

Finding: The absence of fire as a natural process results in decadence of lodgepole, aspen, whitebark pine and mountain mahogany stands and changes in stand density and location of Douglas-fir stands. Big sagebrush steppe and riparian willow communities are being displaced by conifer invasion. Increasingly dry climatic cycles exacerbate these stand changes, encouraging spread of insects and disease. Noxious weeds are found mostly along motorized routes and at recreation sites. Low elevation areas, especially sagebrush-grassland areas are at high risk of weed invasion and spread.

Recommendations:

1. Conduct site specific field reviews of aspen stands to determine suitable stands for treatment. The overriding objective with aspen would be to treat as many acres as possible in conducive stands where a level of protection from browsing to ensure full vigor and regeneration occurs can be assured.

2. Increase aspen stand vigor by removing existing conifers from around the aspen clone in upland stand sites. All aspen stand acreage in upland stands where access is feasible should have the conifers removed around the clones.

3. Increase productivity of mountain mahogany stands by eliminating Douglas-fir and/or juniper within the mountain mahogany stands. In addition, treat Douglas-fir stands adjacent to curlleaf mountain mahogany dominated areas to reduce potential fire effects to this vegetation type is recommended. Fire is not a preferred alternative for treatment. Fire can result in high mortality to

curlleaf mountain mahogany, and is likely the quickest method to reduce the presence of the species.

4. Use fire to create the mosaic of big sagebrush and grassland communities that historically occurred within the Fleecer assessment area.

5. Where possible, remove the conifer succession into sagebrush steppe vegetation; this may be through a combination of mechanical means and the use of fire. This will contribute to Forest Plan Objectives to reduce colonization of sagebrush/grasslands. Caution with treatments adjacent to major travel routes is recommended; these locations typically support noxious weeds that have a high risk of spread into disturbed natural vegetation (Shelley et al. 2002). An assurance of adequate recovery by native vegetation prior to potential exposure to non-native plants is the best alternative.

6. Push back colonization of Douglas-fir from sites that historically lacked the conifer. In addition, reduce stand densities on as many acres of Douglas-fir stands as possible. Where allowed, use timber harvesting systems on operable (ground-based to allow thinning) acres, so the largest trees are retained.

7. Thin as many Douglas-fir stands as possible. Achieving the objective of sustaining most of the larger, older Douglas-fir trees in a stand may only be possible if as many stands of Douglas-fir are thinned as possible. When an increase of Douglas-fir bark beetle populations develop, stands of larger trees are attacked and become the foci for development of an outbreak. However, mortality from DFB is less in stands with lower basal areas or in thinned stands.

8. Develop a strategic fuels treatment plan to allow for natural fire starts to burn within the Fleecer assessment area to reduce the extent and continuity of Douglas-fir, and to encourage more open-grown stands of Douglas-fir.

9. Salvage mortality in lodgepole pine created from the MPB epidemic. There is an opportunity to salvage harvest off of predominately the existing road system (some temporary road may be needed) using ground-based equipment capturing product value prior to deterioration, creating additional opportunities for land stewardship projects. Although overtime, the lodgepole pine stands killed by MBP will regenerate, the downfall will create heavy fuel loading. Large patches of Fuel Model 10 put the landscape at risk for severe wildfire. Without fire or treatment, and with the high levels of insects, substantial acres of FM 8 are converting to FM 10, adding to the risk. There is an opportunity to strategically harvest in areas to break up fuel continuity and create elk and other wildlife movement corridors.

10. Create a strategic fuels treatment plan that would allow for fire starts to burn in portions of the Fleecer Watershed Assessment area to create early successional conditions. Given that a large percentage of the assessment area is roadless, the advantage of fire use management would enhance opportunities for resource benefits (i.e. to facilitate landscape heterogeneity).

11. Salvage harvest the lodgepole pine in stands where lodgepole pine dominates the overstory and has been attacked by MPB. This will create stands that are early successional without heavy fuel loading. These stands would maintain a mixed conifer component with other species maintained.

12. Make a concerted effort to regenerate whitebark pine in the Fleecer assessment area. New monitoring of whitebark pine across the BDNF will provide key information related to regeneration practices locally. The most effective means for regenerating whitebark pine is to allow fire to burn in these timberline habitats when ignitions are natural. Management ignition may need to occur in strategic locations when conditions exist to promote regeneration. There is a need to conduct additional site specific inventory, mapping and analysis to implement these recommendations.

13. Complete adequate survey work prior to project implementation and subsequent project modification to avoid sensitive plant populations and habitat.

14. Mitigate spread of noxious weeds into sensitive plant locations thru education efforts, requirements for cleaning equipment, monitoring and treatment of weed infestations, and revegetation of disturbed sites. If these are cost prohibitive, consider prevention by forgoing certain projects.

15. Continue existing management of noxious weeds in these watersheds including help from other agencies, organizations, and individuals. Where opportunities exist, seek new partners to collaborate with and expand weed control efforts.
16. Seek options for new treatments including bio-control and use of new herbicides. These options will be examined and applied where possible.

FIRE AND FUELS

Finding: Reduced fire frequency in the Fleecers altered vegetation composition and structure, increased buildup of available fuel and increased ladder fuels. This means wild fires and their effects on soil and vegetation will be uncharacteristically severe compared to historical conditions. Aspen, sage, mahogany and mature conifer stands display the greatest difference between the current and reference condition.

Mountain pine beetle stands are generating significant fuel accumulations as trees die and fall to the ground. Some of the areas identified for potentially hazardous fire behavior are located within ¼ mile of residences, structures or utilities.

Recommendations:

1. Treat stands in fire regimes 3 and 4 with a priority around residences and structures.

2. Treat mountain pine beetle affected stands to reduce future fuel accumulations and restore/maintain as fuel model 8.

3. Treat parklands, restoring them to Fuel Models 1 or 2.

4. Take advantage of natural ignitions to manage for resource benefits along with prescribed treatment, if natural ignitions do not occur

5. Design vegetation treatments to incorporate areas with natural barriers, areas of MPB activity, and past harvest units to create fuel breaks on the landscape and facilitate future use of natural ignitions.

6. Identify areas where fire, in conjunction with thinning or slashing can be most beneficial.

7. Treat aspen, sage, mahogany and mature conifer stands by thinning commercial and sub-merchantable material and prescribed burning.

8. Prioritize areas where the greatest number of stands requiring treatment are clustered, and the treatment can result in restoring these areas to their historic fuel model and fire behavior condition. Critical forest plan elements should be considered when prioritizing area for treatment.

9. Reduce fuel accumulations adjacent to any utility which may cause harm to the utility in the event of a wildfire. Specifically, remove all down dead woody debris and vegetation along utility corridors and, where possible, immediately adjacent to utility lines. With combustible material gone, there is an increased probability the utility can be protected and fire fighters can implement a broader range of suppression strategies.

10. Conduct a wildland fire structure assessment of each residence and structure within the assessment area recommend treatment. Remove areas of heavy fuel loading from the perimeter or private lands that could act as an ignition source to the private inholding in the event of a wildfire. Provide private land owners a list of actions to improve their defense-ability.

11. Identify potential suppression challenges and ways to overcome these challenges prior to a wildland fire event.

WILDLIFE

Findings: Wildlife habitats at risk are linked to vegetation communities showing the greatest degree of change due to shifts in precipitation cycles and fire disturbances: mountain big sagebrush, upland aspen, riparian communities, bitterbrush, whitebark pine and mountain mahogany stands. Road densities impact secure habitat in about ½ of the assessment area (Hunting District 341).

Recommendations:

1. Improve wildlife habitat by reducing conifer encroachment into: mountain big sagebrush communities and sagebrush grassland parks; aspen stands; willow stands and bitterbrush. Priorities for sagebrush and grassland treatments would be on big game winter ranges and sage grouse and pygmy rabbit habitat. Potential treatments may vary depending on the species involved.

   Priorities for aspen treatments would be upland sites, off of winter ranges, adjacent to main roads where there may be reduced browsing; or where fencing is practical to exclude ungulates. Concentrate aspen restoration in large treatment areas so wildlife browse on regenerating sprouts doesn't compromise recovery of the stands.

2. Reread established bitterbrush transects, look at effectiveness of using Transline on knapweed and assess the potential for other treatments (cut conifers, light burn)

3. Conduct surveys in larger contiguous stands of mature Douglas-fir stands and potential flammulated owl habitat and evaluate stand conditions for potential thinning of Douglas-fir.

4. Inventory whitebark pine to determine current condition of stands; assess whitepine blister rust infection, mountain pine beetle infestation and other stand conditions.

5. Reduce route densities in Hunting Unit 341 to meet Revised Forest Plan direction – prioritize changes to improve security area distribution.

6. Survey sagebrush stands on southeast corner during sage grouse nesting and brood-rearing period (lower priority due to lower potential use, distance from leks).

7. Survey sagebrush stands on the eastern edge of the Forest for pygmy rabbit use.

8. Conduct bat surveys around hazardous mine openings that provide potential habitat.

9. Current conditions of mountain mahogany stands are not known. This is a lower priority for surveys.

RECREATION

Finding: Use of the area is increasing, particularly motorized use on roads and trails. The quality of motorized experience can be improved by creating better loop opportunities. Proliferation of parallel trails in close proximity to each other or with similar destinations reduces the quality of recreation experience and adds to resource impacts. (See details in Section II, Recreation, p. 180-182.

Gaps between the existing condition and LRMP direction include the absence of any non-motorized trail opportunities, heavy dispersed use concentrated in a couple areas with riparian and soil moisture issues, and high road density during fall hunting season.

Recommendations:

1. Relocate trails to improve safety for motorized users and protect forest resources. See Appendix B – Route Analysis. Ditch Saddle, Norton Creek, Starlight, and Long Tom are among the trails in need of capital investment work. Other trails (Table 2) require increased annual maintenance to address clearing, drainage, and signing issues.

2. Identify a separate ATV route from Bull Ranch to Starlight Trail to link motorized segments of the CDNST yet keeps ATVs off forest development roads.

3. Move motorized use on Trail No. 95 off of the Lucon property off the property to address safety concerns around a wet meadow area and old buildings.

4. Convert selected two-track roads to trails, linking existing trails and increasing loop riding opportunities (See APP B – Route Analysis). Evaluate whether to provide youth 'riding areas' adjacent to dispersed sites in Bull Ranch. .

5. Establish a non-motorized trail in the Northeast Fleecer management area. Options: 1)A trail to the top of Fleecer Mountain, a popular destination for

visitors. 2)A loop trail from High Rye Cabin south to Beefstraight Creek and back to the cabin. The cabin provides corral space for horses and gets use throughout the summer. Visitors to the area request non-motorized trails usable from the cabin.

6. Complete travel planning. Preliminary travel planning and recommendations in the South Fleecer area has been completed (Appendix B -Route Analysis) but on the ground field inspections will not be completed until summer of 2009. .

7. Harden or establish a boundary around Bull Ranch dispersed sites to limit future expansion.

8. Reduce resource impacts at Indian Saddle dispersed site.

9. Designate dispersed sites in Jerry Creek further away from the creek or restrict activities within 300' feet of the creek to mitigate impacts to the riparian areas.

HERITAGE

Finding: A large number of recorded historic mining sites are located around the assessment area, including one historic mining district but a comprehensive inventory has never been completed. Most recorded sites have not been evaluated for significance. A good share of the known cultural resources are in various stages of collapse, decay and neglect. There is a high probability the integrity of these sites has been lost.

Recommendations:

1. Complete additional inventories on Wise River side of the Fleecers which is proportionally under-represented in the cultural resources inventory.

2. Manage sites formally determined to be significant and eligible for the National Register of Historic Places to standards and monitor at least every five years to insure that no impacts occur that adversely affect site integrity or eligibility.

3. Manage sites formally determined to be significant and eligible for the National Register of Historic Places to standards and monitor at least every five years to insure that no impacts occur that adversely affect site integrity or eligibility.

4. Interpret history as part of providing future recreational opportunities in accordance with the recently developed Beaverhead-Deerlodge "recreational

niche" concept. The best recreation based opportunity is to provide historical interpretation for the German Gulch historic mining area and significant episodes in local history.

GRAZING

Finding: Compliance with the Revised LRMP will continue to be variable, contingent on current years forage production, level of permittee involvement in management, and skill at monitoring compliance with riparian standards. Potential for user conflict between recreationists and livestock is increasing with increased recreational use.

Recommendations:

1. Pursue opportunities to not reissue permits that have been waived back to the Forest Service when not waived in preference to a new owner of qualifying base property or livestock. This would help avoid non-compliance with Forest Plan utilization standards, and reduce the potential for user conflicts.

2. Hold grazing permittees accountable to meeting Forest Plan forage utilization standards. Take adverse grazing permit action where noncompliance occurs on a repetitive and/or consecutive basis.

3. Assess range allotments for opportunities to develop off-site water to help draw livestock out of riparian areas.

MINERALS

Finding: Abandoned mine reclamation is the primary concern in the Fleecers because the sites affect both water quality and public safety. Hazardous openings have been identified and only need funding to remediate. Beal Mine is impacting water quality in a Fish Key Watershed and affecting three separate creeks.

Recommendations:

1. Continue reclamation of the Beal Mountain Mine. The Beal Mountain Draft EE/CA, September, 2005 identified a range of reclamation alternatives. The preferred alternative was estimated to cost approximately $14 million for construction and over $1 million dollars for annual operation and maintenance expenses. The Forest Service, working with an established technical working group (TWG), will evaluate the most feasible and cost effective closure options for the Beal Mountain Mine.

2. Close hazardous mine openings. The closure of hazardous mine openings is prioritized based on accessibility by the public from roads, trails, and

campgrounds as well as eminent threats to their safety. Reclamation of these HMO sites is dependent on funding.

V. INTEGRATED RECOMMENDATIONS

The Interdisciplinary Team identified several common themes appearing in individual resource recommendations. The following actions will benefit numerous resources.

Three priority projects were identified to analyze through NEPA in 2010/2011. Priority was assigned partly because funding is or may be available.

1. Travel Planning (Motor Use Vehicle Mapping process for Wise River): address recommended route decommissioning, additions, conversions and possibly some of the maintenance and culvert work.
2. Vegetation and Fuel Treatment (harvest, salvage and burning)
3. Hazardous Mine Opening Closures

Action	*Purpose* and Rationale	Priority	Sideboards
ASPEN Remove conifers colonizing aspen stands. Remove conifers adjacent to clones. Treat as many acres as possible where protection from browse can be assured.	*Improve wildlife habitat:* A natural range of diverse habitats is important to retaining diverse wildlife populations. Loss of aspen stands impacts a number of wildlife species, levels of aspen have dropped below viability requirements. *Restore vegetation diversity*: Aspen stands are a unique, declining vegetation component at high risk of irreversible loss due to encroachment, overtopping, browse and age. *Restore fire disturbance regimes in Fire Regimes 1, 2, 3. Restore fuel model and fire behavior to Fuel Models 1, 2 and 8:* much of the area has missed more than one fire disturbance cycle. The result is a departure from historic conditions of aspen and conifer stands.	-Stands connected with other Douglas-fir treatments. -Stands that don't need fencing, where conifer slash can be left -Larger stands that will disperse browsing pressure -Where road access is available, remove conifers in a donut around aspen stands -Design treatments to incorporate areas with natural barriers and past harvest units to create fuel breaks and facilitate future use of natural ignitions. Identify areas where resource benefit fires can be beneficial.	-Protect sprouts from browsing: Concentrate on large treatment areas to reduce browse impacts. Avoid stands on winter range or near main roads due to browse impacts. -TMDL status and Forest Plan aquatic standards (RCA) may affect location and type of treatment in riparian areas.
CONIFER COLONIZATION Reduce conifer colonization in sagebrush/grasslands using a combination of mechanical and	*Improve wildlife habitat*: Sagebrush/grasslands are important forage and cover for everything from elk to small mammals and birds. Loss of fire from this community has affected the distribution and seral stage available for wildlife. Conifer	-Winter range!! -Wildland Urban Interface -Sage/grass with bitterbrush present. -Restore fire to the system	Use caution burning next to major travel routes where noxious weed seed may be present.

Action	*Purpose* and Rationale	Priority	Sideboards
fire treatments.	colonization reduced the availability of this cover type. *Restore sagebrush/grasslands to a more resilient condition reflective of natural disturbances*: Fire exclusion and introduction of livestock to the area have increased shrub densities, fuel, and conifer presence in sagebrush steppe communities. *Reduce fuel in areas with potentially hazardous fire behavior (Fire Regimes 1, 2, 3 and Fuel Models 1 and 2):* Fuel loading is high near structures and residences in Johnson, Bear Gulch, Sunday Gulch and Divide Creek		Implement smaller scale treatments where pygmy rabbit exists Limit in sage grouse habitat within 18 km of active leks
DOUGLAS-FIR Reduce extent and stand density in Douglas-fir stands -Thin stands on operable timber harvest ground -Allow natural fires to reduce extent, continuity and density of stands	*Increase landscape vegetative heterogeneity, diversity and resilience*: Douglas-fir stands have become more homogenous and less resilient to change or disturbance. Stands are continuous, mid-successional, densely stocked, and are establishing in aspen, mahogany and riparian communities as a result of fire exclusion. *Improve wildlife habitat*: Encourage more open grown old growth stand structure. Restore natural stand structure & maintaining integrity of stands *Restore fire disturbance regimes in Fire Regimes 1, 2, 3. Restore fuel model and fire behavior to Fuel Models 1, 2 and 8:* much of the area has missed more than one fire disturbance cycle. The result is a departure from historic conditions of aspen and conifer stands.	-Maintain old growth stand integrity -Stands threatened by insects -WUI -Treat areas with bigger blocks, commercially and non-comm., to reach Forest Plan objective acres -Design treatments to incorporate areas with natural barriers and past harvest units to create fuel breaks and facilitate future use of natural ignitions. Identify areas where resource benefit fires can be beneficial.	-Moderate soil erosion hazard areas on a portion of area -Two Roadless areas -Fish key watersheds will affect treatment size, type and location -Poor access to much of the Douglas-fir types
LODGEPOLE PINE	*Capture product value prior to deterioration*: 83% of the	-Suitable base	-Two roadless areas

Action	*Purpose* and Rationale	Priority	Sideboards
Salvage mountain pine beetle mortality	lodgepole pine stands in the Fleecer have been affected by MPB (33,400). Much of this on suitable base. *Break up continuous fuel,:* The lodgepole pine stands killed by MBP will fall down, regenerate, and the downfall will accumulate creating heavy fuel loading. *Retain travel-ways for elk and other big game*: Over time, the MPB killed trees will fall down and accumulate on the ground, blocking wildlife movement.	-Stands with access from existing roads, operable with ground based equipment -Stands that still have economic value to contribute in stewardship projects -Stands important for elk movement/corridors - -Stands in future fuel model 10	-Size of openings or location in relation to security cover, use patch/mosaic patterns. -Treat large stands where soil quality standards are a concern (concentrating activity in small areas is a problem)
WHITEBARK PINE Regenerate stands	*Restore a declining and important component of the landscape*: Mortality from white pine blister rust and Mountain pine beetle have changed stand structure and acreage covered by whitebark stands. The most effective means for regenerating WBP is to allow fire to burn in timberline habitats when ignitions are natural. Management ignition may need to occur in strategic locations when conditions exist to promote regeneration. *Improve wildlife habitat:* Whitebark pine is an important forage species for birds, small mammals and bears. It is difficult to regenerated and at high risk of change or loss. It is important to retain what stands are there.	Determine stand condition and regenerate with fire if conditions & success of wildfire monitoring indicate.	Don't know yet if wildfire results in successful WBP regeneration.
FIRE MANAGEMENT Develop a strategic fuels treatment plan	Create early successional conditions in Douglas-fir stands, linking openings, so fire starts can be allowed to burn in portions of the Fleecers. Given that a large percentage of the assessment area is roadless, fire use management may be the best opportunity to achieve landscape heterogeneity.		
FUEL MODEL 10	*Reduce the potential for widespread crown fire* : substantial		

Action	*Purpose* and Rationale	Priority	Sideboards
Harvest timber and/or introduce fire to reduce stands back to fuel model 8.	acres of fuel model 8 are moving or have moved into fuel model 10. The large patches of fuel model 10 put the area at risk for sever wildfire. Without fire or treatment, and with the high level of insects., this risk grows yearly. *Improve the age class distribution of Douglas-fir and lodgepole stands (Forest Plan Objective*): See row 3 and 4.		
NOXIOUS WEEDS Treat noxious weeds, eradicate if possible	Vegetative diversity, native plants Wildlife habitat, especially winter range Sensitive plants Hydrology	Cooperative with BLM and FWP German Gulch Winter range Charcoal Gulch Bitterbrush stands Beefstraight	
TRAVEL ROUTES Maintain, relocate, decommission or convert routes causing problems.	*Improve soil productivity and stream quality by reducing sediments moving off roads*: Some old access roads are continual maintenance problems. Improvements have reduced impacts but location and grade are essentially poor. In some cases, the sediment travels overland, impacting soil productivity offsite, in other cases it makes to streams. When these streams 303(d) listed streams the sediment impacts TMDLs. *Improve fish habitat*: poorly designed road culverts impact the success of native species outcompeting non-native fish, poor crossings and sediment from maintenance problems reduce habitat quality. *Improve recreational experience and public safety*: Roads that rut and require diverting around obstacles are unsafe to travel	-relocate or change season of use for routes on steep slopes, erodible soils, or in wet meadows (Fleecer Ridge 8486). Select routes in more “Maintainable” locations. -select routes that can contribute to loop opportunities -decommission routes close together serving same destinations -relocate routes in stream bottoms -obliterate/recontour routes closed due to sediment delivers rather than gating -redesign, relocate or decommission routes with fish passage concerns or sediment at crossings -prioritize routes near streams contributing directly to TMDLs	Consider which routes contribute best to security when choosing which to decommission or improve. Heritage review needed in case of historic routes Consider ramifications of changing culverts/crossing to non-native impacts

Action	*Purpose* and Rationale	Priority	Sideboards
	and detract from most driver's experience. Roads that parallel each other or spur off to no real destination do not contribute to recreational experience. Converting roads to trails will reduce conflicts between full size vehicles and OHVs and add to more semi-primitive experiences. *Improve wildlife security:* Reduce road density in Hunting District 341 to meet Forest Plan road density objectives.	NOTE: See table 18 in hydrology writeup Soils list: Road 1594 Lone Tree Road 8490 to Norton Gulch Rd 8505 Sunday Gulch, Bull Ranch Road 96 Divide Creek Road 8486 on south end of Fleecer Ridge and upper part of S Fk Divide Creek. Select routes that contribute best to distribution of security areas on the Landscape.	
TRAVEL ROUTES Add routes or segments	*Improve recreational experience and meet Forest Plan objectives for the Fleecer Management Area:* Loop trails are inadequate in the Fleecers for both motorized users and hikers/bikers/horseback riders.		-Can't increase motorized road or trail density in HD 341. Keep any new routes in this HD closed during hunting season.
DISPERSED CAMPING SITES - Designate harden or close if impacts can't be controlled.	*Improve soil productivity*: dispersed camping on a number of sites compacted soil and eliminated vegetative cover which can result in erosion. *Improve fish habitat:* camping in RCAs is resulting in stream bank impacts and potential sediment additions.	- Sites with uncontrolled ATV access and heavy concentrations of users (Bull Ranch) -Sites in RCAs and especially fish key watersheds, Lower Jerry, maybe German Gulch (Norton).	-Forest Plan aquatic standards
SENSITIVE PLANT POPULATIONS – Treat noxious weeds in proximity to stands	*Protect sensitive plant populations from eradication by competing noxious weeds:* There are 7 species on 6 known sites in the Fleecers that are globally sensitive. Some in areas we know to have noxious weeds.	Prioritize by "at risk" status	We don't know where all the populations are, risk of eliminating sensitive plants while targeting noxious weeds.
HISTORICAL INTERPRETATION PLAN FOR GERMAN GULCH	*Improve recreational experience and education:* Mining in German Gulch was a significant episode in local history. Educating our visitors about this history will improve their experience, their understanding of the significance of sites on		

Action	*Purpose* and Rationale	Priority	Sideboards
	the Forest. This fits the Forest's recreational "niche" concept. *Preserve historical significance:*		
FISH BARRIERS Build or remove as proposed in specialist reports	*Protect the genetic security of important WCT streams:* Competition by brook trout and hybridization by rainbow trout is a progressing threat in Jerry Creek which is given priority by the Forest Plan as a Fish Key watershed. The threat of hybridization and competition exists in several streams throughout the Fleecer Watershed area. Population numbers and purity can be enhanced with barrier projects. Risk of losing genetic purity is high.(See Aquatic Recommendations for complete list of opportunities).	-Fish key watersheds (Jerry Creek and German Gulch)	
HAZARDOUS MINE OPENINGS Inventory then close priority openings	*Protect health and safety of the public:* hazardous openings, especially around areas of high use like roads, trails and campgrounds need to be sealed off from public access.	The 15 HMO's already identified.	Protect potential bat habitat when designing closure structures.
LIVESTOCK Install water developments in uplands near non-functioning streams. Fell conifers along creek	*Maintain healthy riparian vegetation for bank stabilization and shaded fish habitat:* bank trampling by livestock has contributed to non-functioning condition of streams. Water troughs can pull cattle out of drainages onto ridge pastures. *Improve range management:* Assure permittees can meet new FPlan riparian standards and don't jeopardize permits.	See list in Hydrology section (Table 18)	
MINE RECLAMATION Continue Beal Mt. reclamation	*Improve water quality in German Gulch:* Need to reduce the acid mine wastes reaching streams and groundwater from the min and improve stability of the leach pad. Water treatment and reclamation of this site is expected to take several more years.		

Action	*Purpose* and Rationale	Priority	Sideboards
MOUNTAIN MAHOGANY Remove Douglas-fir and juniper colonizing mt mahogany stands and treat adjacent Douglas-fir stands	*Improve wildlife habitat, especially on winter range*: Mahogany is an important forage species for wintering big game. It is a difficult species to regenerate so it is important to retain what stands are there. *Restore vegetative diversity*: Age and colonization by Douglas-fir and juniper threaten to irreversibly change mt mahogany stands. Stands have high crown closure and litter which prevents seedling establishment. Douglas-fir adjacent to mahogany stands threaten to replace mahogany and increase fire risk to stands.	-Lower elevations on east side of Fleecers near BLM and FWP Game Range, especially Charcoal Gulch.	-Consult with FWP before treating juniper competition with mahogany.
BITTERBRUSH AND WILLOW- Reduce conifer colonization in these stands.	*Improve wildlife habitat, especially on winter range:* Bitterbrush and willow are important forage species, especially for wintering big game. - *Restore vegetative diversity:* Bitterbrush and willow are decadent and being replaced by conifers and invaded by knapweed		

VI. PARTICIPANTS

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VII. MAPS

APPENDIX A
Road Sediment Survey

(Chris Riley and Keif Storrar)

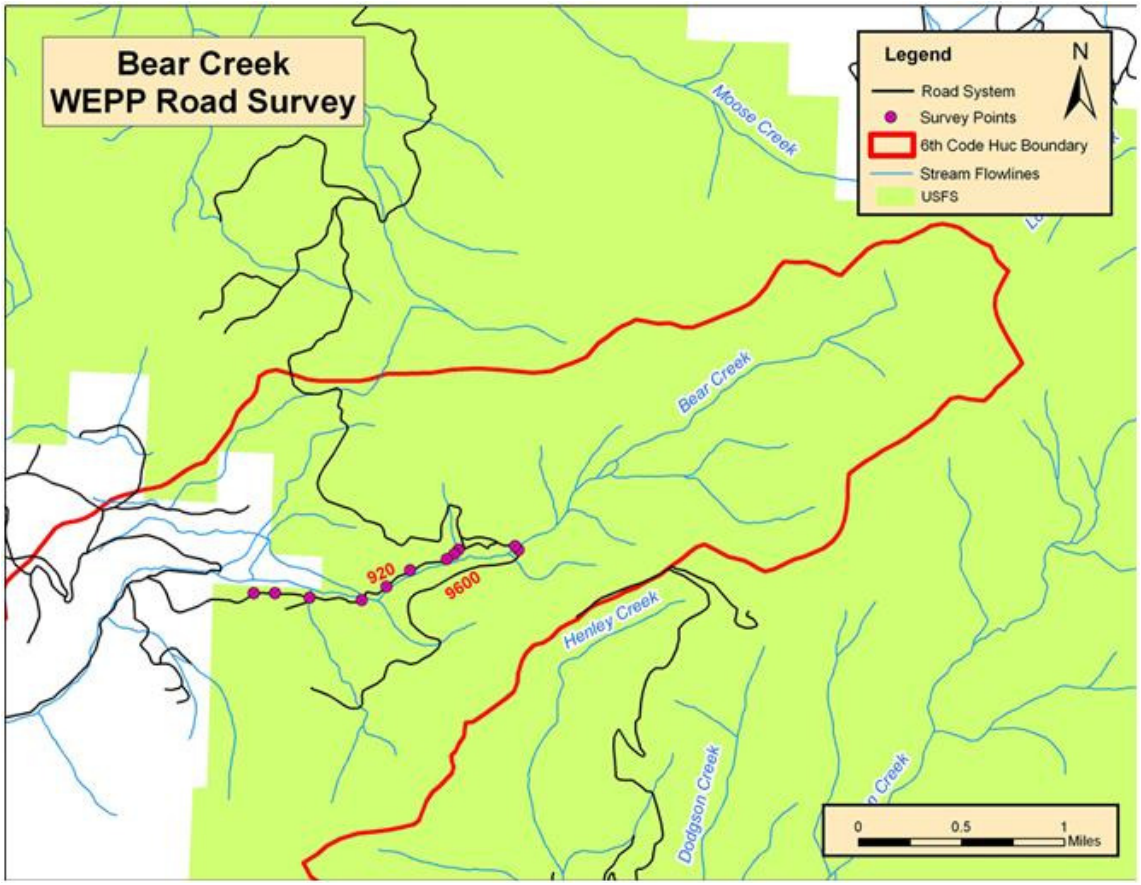
Methods and Assumptions: Total length of road surveyed includes total length of road(s) within a drainage that have potential to impacts to a stream. However, some sections were not surveyed because they were too far from the stream or separated from the stream by a barrier. Tons of erosion per mile and tons of sediment entering stream are calculated for the entire length of road. Road surveyed near stream is where the road was close enough to the stream to have a potential impact of sediment into the stream. Tons of erosion per mile and tons of sediment entering stream are calculated only where the road is near the stream. Tons of sediment delivered to stream and percent of eroded material delivered are based on only segments of road surveyed near the stream, but are calculated independent of road length.

Bear Creek:
Forest roads surveyed within the Bear Creek drainage include 920, which is surfaced with native materials. Beginning at the forest boundary the road is too far from the creek to have an impact. Within the timber sale area, the road is above the creek on the hill slope, but closer to the stream. Within this section of road the buffer is mostly a forested, lodgepole pine forest that flattens out in the wetland valley bottom. Just before the bridge crossing the road starts to follow along side the stream and enters into a narrow valley. The road stays just above the stream on the slope with vegetated grassy / boulder fill-slopes and buffers that are fairly steep until the stream.

Recommendations: Overall FR 920 is in poor condition, however because it is generally located far from the stream it rarely delivers sediment to the channel. The few sections adjacent to the stream could be higher priority for maintenance. Fixing or replacing the bridge that was closed on 5/29/09 should be done with as little impact to the stream banks as possible.

Table 94. Bear Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	1.36	1.13
Tons of erosion per mile of road	0.28	0.34
Tons of erosion entering stream per mile of road	0.12	0.14
Tons of sediment delivered to stream	-	0.16
% of eroded material delivered	-	41.15



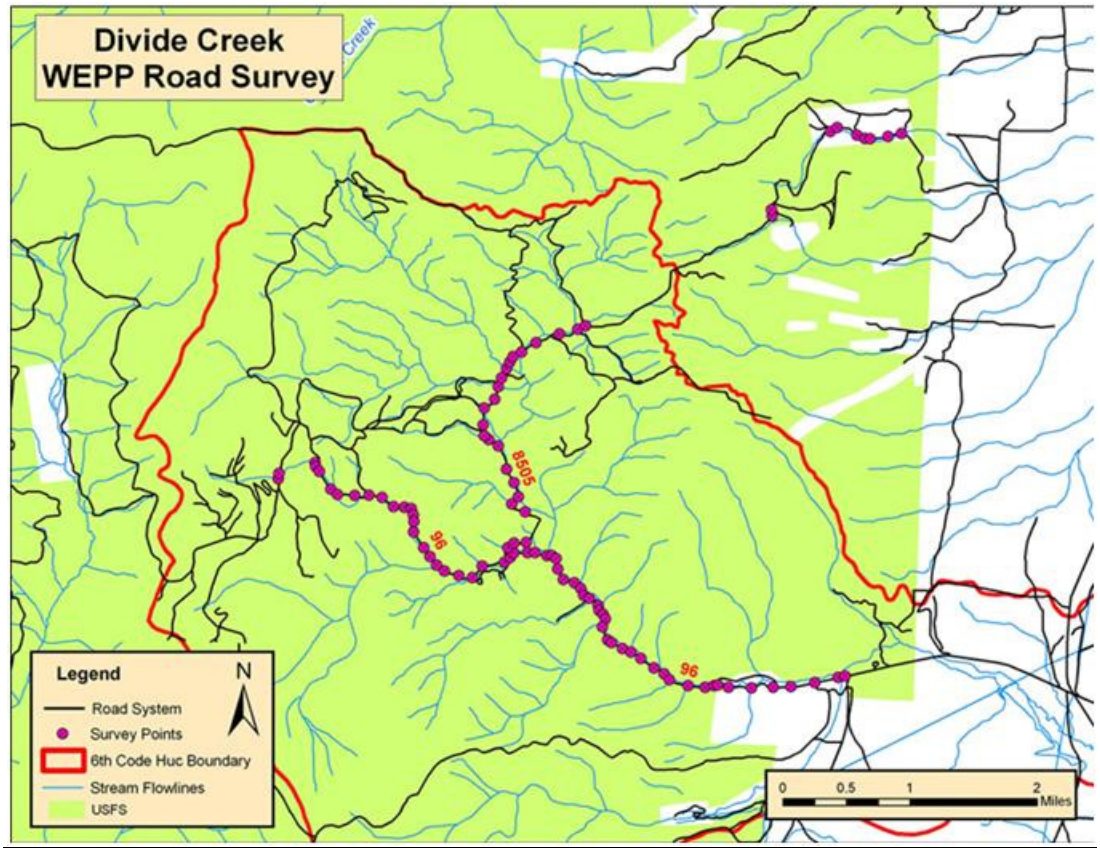
Divide Creek

Forest roads surveyed within the Divide Creek drainage include 96 and 8505 both are surfaced with native materials. Forest road 96 follows the North Fork of Divide Creek and is a low traffic road but very well maintained. The road is almost entirely in-sloped with frequent drainage features. Culvert drainage features are all intact, and fish culverts appear to be functioning properly (ie. no drops, water not moving too fast, etc.). Beaver Dam campground is about 4 miles from the forest boundary and in June 2009, had some cleanup activities with heavy machinery (ie. cutting danger trees, clearing brush piles etc.) This no doubt will increase some sediment into the stream, but the campground was not surveyed do to these activities. Forest Road 8505 is similar to FR 96 with well maintained drainage features and an in-sloped design. The road crosses multiple drainages and never seems to follow a specific stream for any length of time. Surveyed sections began at the point where it appeared that the water drained near to, or directly to a drainage crossing. Sections of road along a ridge, or that drained onto a hill slope further than 500 feet from a stream were not surveyed. After crossing the continental divide FR 8505 moves into another 6th code HUC. The road section after the divide follows a very ephemeral stream drainage that only begins to contain water in the section of private land.

Recommendations: Overall the roads within the Divide Creek drainage are in good shape. There is however a culvert near the Beaver Dam campground that has an 8 – 10 inch drop that is not passable for fish and should be replaced. Unless this acts as a barrier for pure WCT upstream, than this would be a priority to fix. There is also significant 4x4-vehicle damage to a wet-meadow area in the upper end of the drainage near the continental divide. This is known about and steps are being taken to rehabilitate the meadow.

Table 95. Divide Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	11.16	8.62
Tons of erosion per mile of road	0.37	0.48
Tons of erosion entering stream per mile of road	0.10	0.13
Tons of sediment delivered to stream	-	1.12
% of eroded material delivered	-	27.21



German Gulch

Forest roads surveyed within the German Gulch drainage include 83, 8490 and 78094, all are surfaced with native materials. Only the northern segment of FR 83 is within the German Gulch watershed, the southern part is within the Jerry Creek watershed. A small segment of the road was surveyed along the creek within the Haggin Wildlife Management Area just north of the forest boundary, but not included in the analysis. The road from the Forest Boundary is a very well maintained, probably due to the mine. The road design is almost exclusively in-sloped with frequently placed drainage features. Certain sections of the road are separated from the creek by a berm or series of berms from historic mining activities. The berm features act as sediment traps and were not surveyed. If there was a defined channel through the "bermed" areas were water would flow and sediment could be transported to the stream, this was taken into account as part of the buffer. The road was surveyed until the first switchback located at the base of the mine/pit. At this point the stream surfaces from it's sub-surface channel/flow path. Forest Road 8490 is out-slopped and is very rutted in parts and is quickly degrading and there is considerable sediment running from the road directly into the stream. After the junction of FR 8490 and FR 83, FR 8490 is fairly flat and to far from the stream to have an impact. After a bridge crossing, the road heads uphill / up-drainage. Closely placed waterbars have prevented complete degradation of the road surface, however the road is so close to the stream that at each waterbar directs sediment directly into the stream channel.

Forest Road 83 delivering sediment into German Gulch, June 2009

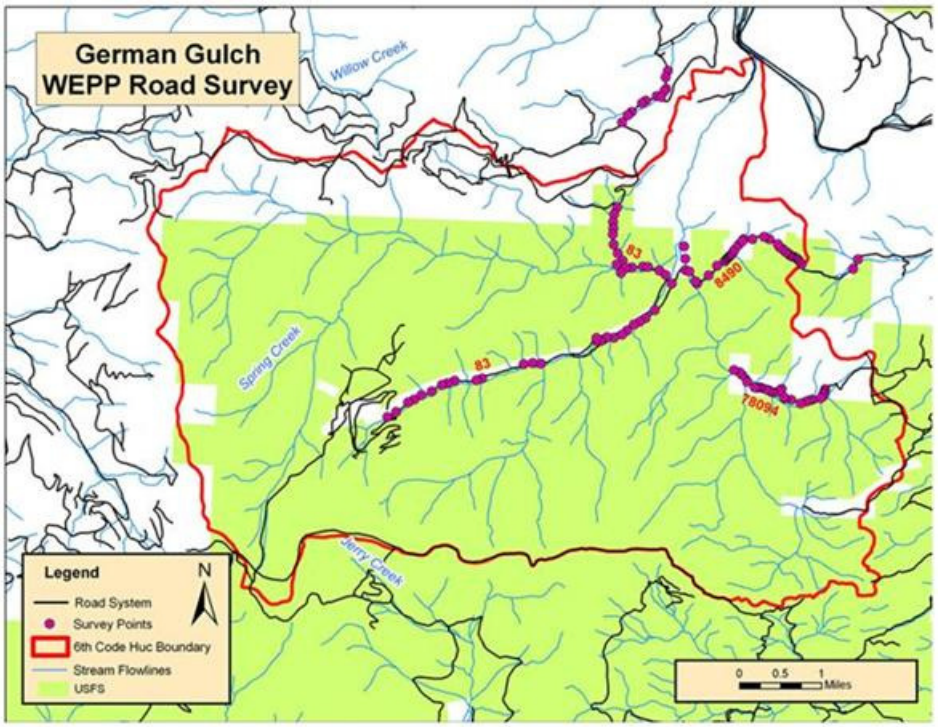
Forest Road 83 delivering sediment into German Gulch, June 2009

The road was surveyed until the small divide, however the upper part is so ephemeral, it doesn't seem reasonable (Due to flat spots, forested channel, etc.) that sediment in the upper part reaches the lower non-ephemeral stream. Forest Road 78094 was surveyed only within the Fleecer Mtn. section. The section of road on Forest Service land is not near a stream. Within the Fleecer Mtn. area the road is out-sloped and rutted. Surveys began within an ephemeral drainage where the road sediment washed into the drainage and the ephemeral channel drained into a tributary of Norton Creek. The road mostly traverses across a sage-slope fairly far from the stream. The road eventually moves closer to the stream and after the bridge the road, once again, moves further from the stream. The stream eventually runs into a reservoir. After the reservoir the road turns into a 4x4 road for about 0.5 miles. There is one crossing of the tributary of Norton creek on the 4x4 road. This road was surveyed until it turns into an ATV trail.

Recommendations: Overall FR 83 within the German Gulch drainage is in good condition. FR 8490 is in very poor condition and the lower portion of the road where the stream flows year round is in need of repair in order to reduce its high sediment load (0.85 tons for 2.2 miles of road). FR 78094 also has some areas that are in need of repair, however because it is generally located far from the stream it rarely delivers sediment to the channel, it would be a lower priority fix than FR 8490.

Table 96. German Gulch Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	8.58	6.71
Tons of erosion per mile of road	0.56	0.71
Tons of erosion entering stream per mile of road	0.22	0.28
Tons of sediment delivered to stream	-	1.89
% of eroded material delivered	-	39.58



Forest Road 83 delivering sediment to German Gulch

Jerry Creek

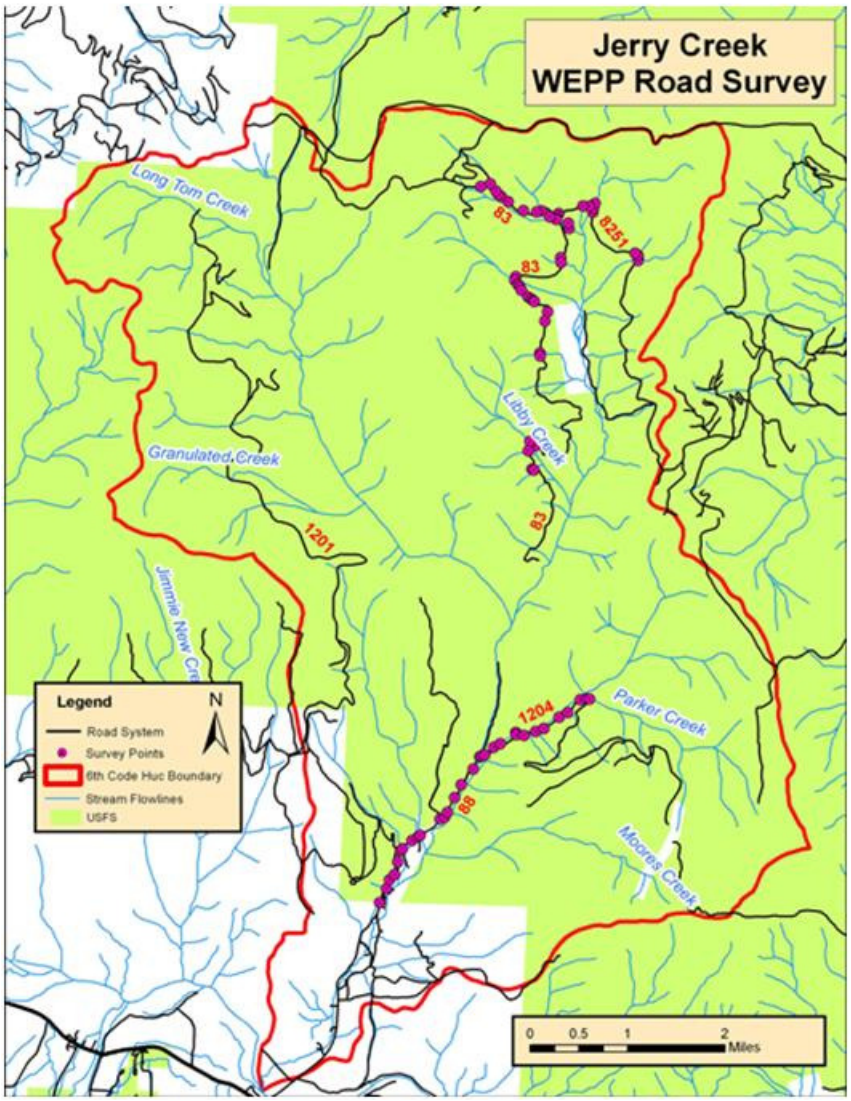
Forest roads surveyed in Jerry Creek drainage include 83, 8251 and 1204. All are surfaced with native materials. Forest Road 83 is an old logging road with an out-sloped design and is rutted. There are sections of the road that are close to the stream, however most of the road is on a hill slope too far from the stream to have an impact. The Jerry Creek, Delano Creek and Libby Creek crossings all have elevated culverts on the downstream side of the road, creating fish barriers. Jerry Creek has 2 separate crossings that are impassable for fish. Forest Road 8251 traverses high along a hill slope far above the stream. It has a few ephemeral stream crossings and at the junction of FR 83 there is a culvert crossing of Jerry Creek that acts as a fish barrier. Forest Road 1204 begins at the forest boundary, travels along the lower section of Jerry Creek with an out-sloped design. The lower section of the road is fairly well maintained, while further up the road becomes more rutted. Some sections of the road are close to the stream or tributaries to Jerry Creek with short buffers. Other sections are more than 500 feet from the stream and were not surveyed, unless there seemed to be significant reason that sediment would reach the stream, such as through an ephemeral stream channel crossing. Upper sections of the road move further from the stream and there are a few stream crossings that were surveyed.

Fish barrier culvert, FR 83, Jerry Creek drainage.

Recommendations: Overall the roads within the Jerry Creek drainage are in moderate to good condition and little road repair or maintenance is needed. Every culvert on a main drainage should be replaced, as they all are fish barriers, with between 1 and 3 foot drops on the downstream side.

Table 97. Jerry Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	14.91	8.64
Tons of erosion per mile of road	0.10	0.18
Tons of erosion entering stream per mile of road	0.02	0.04
Tons of sediment delivered to stream	-	0.34
% of eroded material delivered	-	22.22



Johnson Creek

In this drainage, Forest Roads 1208 and 2480 were surveyed. Both are surfaced with native materials and out-sloped and rutted. Forest road 1208 follows Johnson Creek before it splits and moves further uphill from the stream. The road generally follows the lower drainage with some sections close and others further from the stream. Forest road 2480 turns away from the creek and crosses Cat Creek in one spot.

Recommendations: While the roads within the Johnson Creek drainage are rutted, they are small ruts and normal for shallow out-sloped roads. These roads are in fair condition and should be lower priority for fixing.

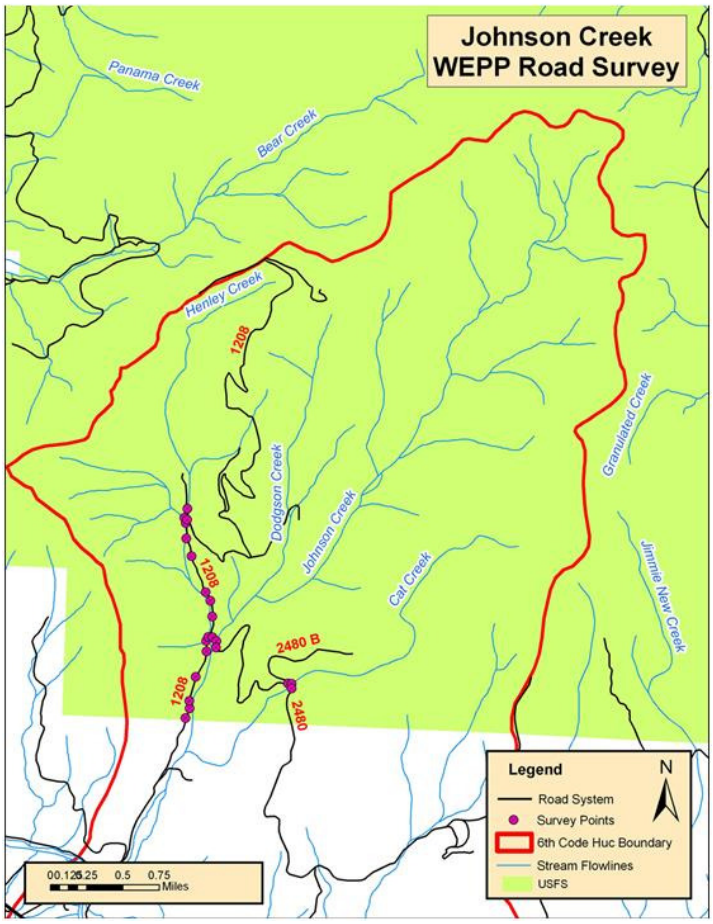


Table 98. Johnson Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	5.11	1.51
Tons of erosion per mile of road	0.12	0.41
Tons of erosion entering stream per mile of road	0.05	0.16
Tons of sediment delivered to stream	-	0.25
% of eroded material delivered	-	39.30

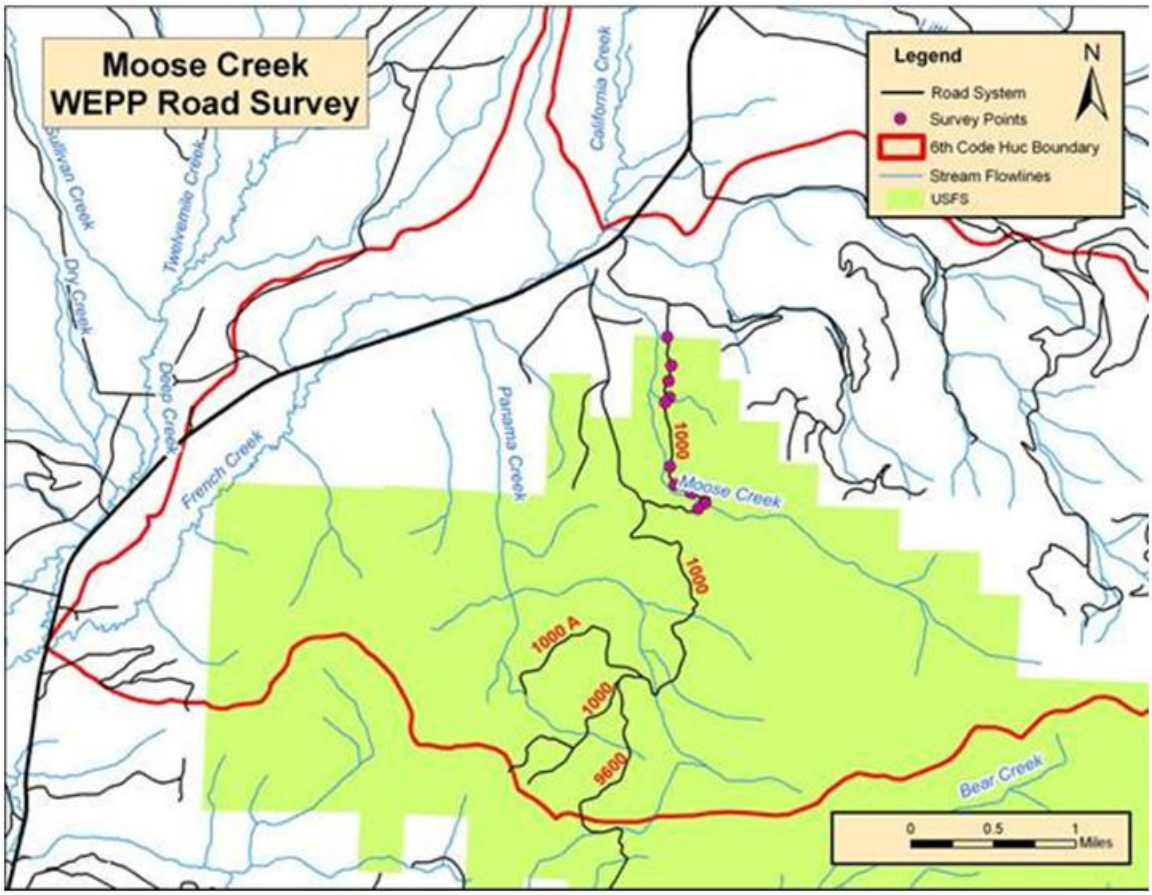
Moose Creek

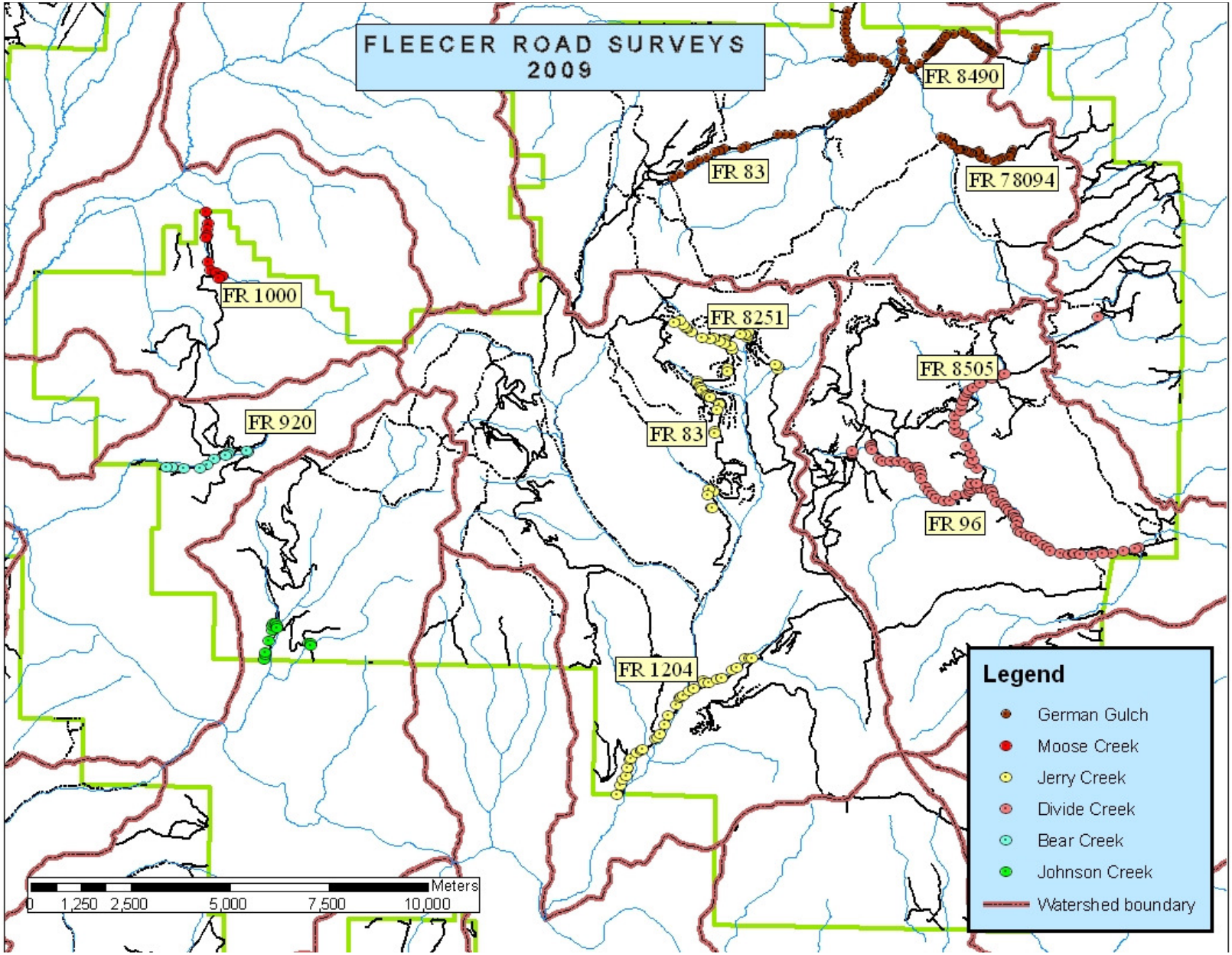
Forest Road #1000 was surveyed in the Johnson Creek drainage. FR 1000 is surfaced with native materials and is out-sloped and rutted. Forest Road 1000 is fairly far upslope from the stream with exception of a few sections and a stream crossing. Lower in the drainage the road is too far from the stream to have an impact.

Recommendations: The one culvert crossing has a 1.5 foot drop and should be replaced for fish passage. Most of FR 1000 is too far from the stream to have an impact and should remain lower priority due compared to other roads listed above.

Table 99. Moose Creek Forest Road Survey of Sediment Delivery

Description	Total Length of Road	Road Surveyed Near Stream (within 500 feet)
Total miles of road surveyed Miles of road near stream	2.83	1.27
Tons of erosion per mile of road	0.18	0.41
Tons of erosion entering stream per mile of road	0.03	0.07
Tons of sediment delivered to stream	-	0.09
% of eroded material delivered	-	16.73




FLEECER ROAD SURVEYS
2009
FR 8490
FR 83
FR 78094
FR 1000
FR 8251
FR 8505
FR 920
FR 83
FR 96
FR 1204
Legend
German Gulch
Moose Creek
Jerry Creek
Divide Creek
Bear Creek
Johnson Creek
Watershed boundary
Meters
0 1,250 2,500 5,000 7,500 10,000

APPENDIX B

Route Analysis

For electronic version, See separate .pdf files titled "APP B - Fleecer TAP Road Ratings", "APP B - Fleecer TAP Trail Ratings" and "APP B _ Supplement_PricePowder" .