



Centennial Watershed Assessment Report

Dillon Field Office

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Assessment Process

This document reports the land health assessment of the public lands administered by the Bureau of Land Management (BLM) in the Centennial Watershed (CW).

This is the first in a series of documents: the Watershed Assessment Report, the Authorized Officer's Determination of Standards, and the appropriate National Environmental Policy Act (NEPA) documentation and subsequent Decision(s).

The Watershed Assessment reports the condition and/or function of BLM administered land and resources within the CW to the Authorized Officer. The Authorized Officer considers the report to determine if the five Standards for Rangeland Health (Standards) are currently being met, and then signs a Determination of Standards documenting where land health standards are, or are not, in compliance.

This assessment will report condition and/or function for the following five Standards:

- Standard #1 Upland Health
- Standard #2 Riparian /Wetland Health
- Standard #3 Water Quality
- Standard #4 Air Quality
- Standard #5 Biodiversity

The Standards are assessed on an allotment scale, with the exception of Air Quality, which is made at the watershed level.

This assessment will also report condition and/or function for forest health and fuels. Forest health can affect each of the five standards, but in this assessment will be reflected under Standard #5 Biodiversity, along with other factors pertinent to biodiversity including Special Status Species and invasive species.

Condition/function declarations regarding the Standards are made as either:

- Proper Functioning Condition (PFC),
- Functioning At Risk (FAR); which is assigned a trend of up, down, static, or not apparent, or
- Nonfunctioning (NF).

Land Health Standards are met when conditions across an allotment as a whole are at PFC or FAR with an upward trend. This is dependent on scope and scale and determined by the Authorized Officer.

Reporting the conditions of the Standards will follow the following format:

- 1) Affected Environment - This section briefly describes the area and resources that were assessed.
- 2) Analysis and Recommendations - This section outlines the procedures the interdisciplinary team (IDT) used to determine conformance with the various standards,

lists the findings, and includes recommendations suggested by the IDT during the field assessments.

The Standards are described in detail in the Record of Decision (ROD) Standards for Rangeland Health and Guidelines for Livestock Grazing Management (S&Gs) for Montana, North Dakota, and South Dakota-Western Montana Standards. The preamble of the Western Montana Standards states: “The purpose of the S&Gs are to facilitate the achievement and maintenance of healthy, properly functioning ecosystems within the historic and natural range of variability for long-term sustainable use.” Standards are statements of physical and biological condition or degree of function required for healthy sustainable lands. Achieving or making significant progress towards these functions and conditions is required of all uses of BLM administered lands as stated in 43 CFR 4180.1.

This assessment is being done in accordance with the BLM regulations regarding Rangeland Health Standards.

- BLM Manual H-4180-1, Rangeland Health Standards Handbook and Guidance for Conducting Watershed-Based Land Health Assessments.
- Code of Federal Regulation 43 CFR, Subpart 4180
- Record of Decision - Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Montana, North Dakota and South Dakota.

Available trend monitoring data, existing inventories, historical photographs and standardized methodology are used by the IDT to assess condition and function of BLM administered lands. This information, including technical references, BLM policy and procedure handbooks, and monitoring guidelines and methodologies are available for review at the Dillon Field Office. Technical references and BLM procedural handbooks are also available on the BLM library website at www.blm.gov/nstc/library/library.html.

In addition, the Dillon Field Office is using data from the Middle Rockies Rapid Ecoregional Assessment (REA) to look at resource concerns and issues at multiple scales. The goal is to better understand these issues in a cumulative sense in order to prioritize projects for implementation within the Centennial Watershed that will incrementally mitigate resource issues and concerns within the Middle Rockies ecoregion.

The initial recommendations developed by the IDT during field assessments contained in this report focus primarily on livestock management, forest and fuels management, and wildlife and fisheries habitat. Other BLM administered public land resources, concerns, uses and designations addressed in the CW include recreation and public access, noxious weeds and invasive species, cultural resources, wilderness, and special status species.

The assessed land health conditions and/or functionality are the basis for the IDT’s management recommendations in this report and the Determination of Standards. As required by NEPA regulations, an Environmental Assessment (EA) will be completed to address resource concerns identified within the 36 allotments as well as unallotted BLM administered lands within the CW.

Alternative management will be analyzed wherever it is determined that:

- specific grazing allotments are not meeting the Standards
- allotments are meeting the Standards but have site specific concerns
- there are unhealthy forest conditions in the watershed
- vegetation composition and/or structure are outside the natural range of variability
- there are other documented resources concerns

Also, if existing grazing management practices or levels of grazing use on BLM administered lands are determined to be significant factors in failing to achieve one or more of the five Standards, the BLM is required by regulation (43 CFR 4180.1) to make grazing management adjustments.

Implementation of new plans will begin in 2016, but it may take several years to fully implement revised grazing management plans, range improvement projects, forest treatments and/or fuels projects. The new plans will be developed in consultation and coordination with the affected lessees, the agencies having lands or managing resources within the area and other interested parties.

As with all similar BLM decisions, affected parties will have an opportunity to protest and/or appeal these decisions.

Middle Rockies Rapid Eco-regional Assessment

Climate change and other widespread environmental influences are affecting the western landscapes that are managed, in part, by the BLM. In response, the BLM has launched fourteen Rapid Ecoregional Assessments (REAs) since 2010 to improve the understanding of the existing condition of these landscapes, and how conditions may be altered by ongoing environmental changes and land use demands. The REAs examine ecological values, conditions, and trends within ecoregions, which are large, connected areas that have similar environmental characteristics.

REAs look across an eco-region to more fully understand ecological conditions and trends, natural and human influences, and opportunities for resource conservation, restoration and development. They seek to identify important resource values and patterns of environmental change that may not be evident when assessing and evaluating smaller, local land areas. REAs establish baseline ecological data to gauge the effect and effectiveness of future management actions. In this way, REAs provide a foundation for an adaptive management approach that enables implementation strategies to adjust to new information and changing conditions.

In addition, the REAs present an opportunity for all land managers within an ecoregion to share information and discuss resource management conditions and needs. The REAs can provide a science-based information platform for formulating coordinated, multi-agency strategies that can respond effectively to climate change, wildfire, and other environmental challenges that transcend local administrative boundaries.

REAs describe and map conservation elements which are areas of high ecological value. REAs look across all lands in an eco-region to identify regionally important habitats for fish, wildlife, and species of concern. REAs then gauge the potential of these habitats to be affected by four overarching environmental *change agents*: climate change, wildfire, invasive species, and development (both energy development and urban growth). REAs also help identify areas that do not provide essential habitat; that are not ecologically intact or readily restorable; and where development activities may be directed to minimize impacts to important ecosystem values. The REAs provide regional information that will inform and help prioritize local management efforts.

The REAs, in summary:

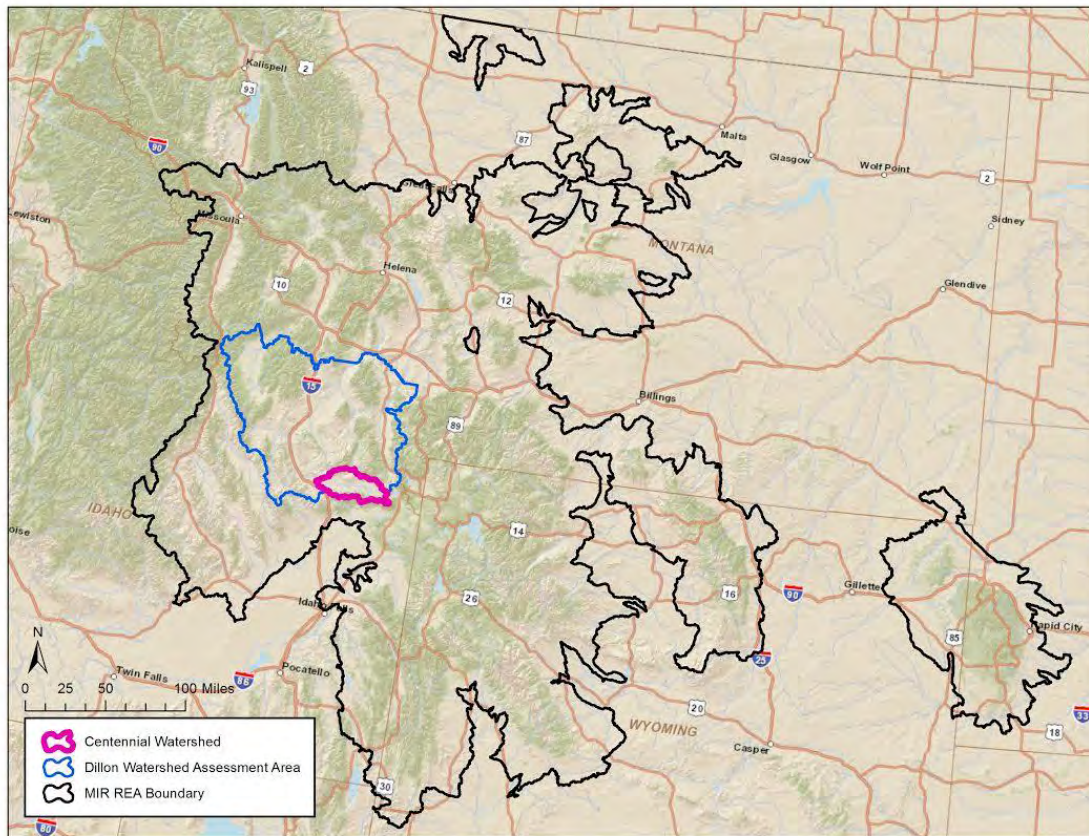
- identify and answer important management questions;
- document key resource values, which are referred to as conservation elements, with a focus on regionally-significant terrestrial habitats, aquatic habitats, and species of concern;
- describe influences from four environmental change agents: climate change, wildfire, invasive species, and development;
- assess the collective effects of projected trends;
- identify and map key opportunities for resource conservation, restoration, and development;
- identify science gaps and data needs; and
- provide a baseline to evaluate and guide future management actions.

Ecoregions span across all administrative boundaries and typically encompass areas much larger than those managed by individual BLM field offices. Assessments of these larger areas provide land managers additional information and tools to use in subsequent resource planning and decision-making.

At the ecoregional level, along with input from stakeholders, partner agencies, and tribes, the REAs will aid in developing broad-level management strategies for an ecoregion's public lands. This ecoregional direction will help identify priority areas for conservation and development, including focal areas for conserving wildlife habitats and migration corridors, and focal areas for potential energy development and urban growth. Ecoregional direction will also provide a blueprint for coordinating and implementing these priorities through the BLM's state and field offices.

The Middle Rockies eco-region is located in Montana (MT), Idaho(ID), Wyoming, and also includes a disconnected portion of South Dakota. The ecoregion has an area of 63,400 square miles including 3.9 million acres of public lands. The ecoregion includes all or portions of 20 BLM field offices. The Middle Rockies REA was initiated in September 2010. The Dillon Field Office is located within the Middle Rockies REA and encompasses about 9% of the 275,613 km² land area of the Middle Rockies REA. The CW encompasses about 1% of the total land area of the Middle Rockies REA. The Watershed assessment will include REA data and information that is applicable to the Centennial Watershed to help understand and prioritize issues and concerns for analysis that will incrementally mitigate regional resource concerns. The BLM will

use the REAs to guide and prioritize resource management at the ecoregional and Watershed levels.



Map 1: Centennial Watershed Assessment, Dillon Field Office and Middle Rockies REA boundary

At the Watershed level, the REAs will enhance the quality of documents like the Centennial Watershed land health assessment and environmental analysis. The information, maps, and tools provided by the REAs will strengthen analyses of the potential and cumulative effects of climate change and other environmental disturbances on important ecological values within these assessment areas. They will also help identify and prioritize projects at the Watershed level that will incrementally mitigate regional resource issues and concerns.

For more information regarding the Middle Rockies REAs, go to [http://www.blm.gov/wo/st/en/prog/more/Landscape Approach/reas/midrockies.html](http://www.blm.gov/wo/st/en/prog/more/Landscape_Approach/reas/midrockies.html)

Background

The Centennial Watershed is located in southeastern Beaverhead County, Montana on the eastern slopes of the Rocky Mountains. The watershed lies in Townships 13-15 South, Ranges 1-7 West and Range 1 East Montana Principal Meridian (M.P.M). The assessment area covers public lands administered by the BLM from approximately Lima Dam on the west to Red Rock Pass on the east and from the continental divide along the Montana-Idaho border on the south to the Gravelly Range on the north. This area includes public lands within two hydrologic unit

code (HUC) 5 boundaries covering the Centennial Valley. The assessment area boundary shown on Map A follows grazing allotment boundaries and includes some allotments that are partially within the watershed.

Within the Centennial Watershed Assessment boundary, there are approximately 347,543 acres of which the BLM administers 83,102 acres. This report addresses only public lands administered by the BLM within the watershed. However, approximately 59,832 acres administered by the State of Montana Department of Natural Resources (DNRC), 105,718 acres of privately owned lands, 39,231 acres of public land administered by the Red Rock Lakes National Wildlife Refuge, 15,538 acres administered by the USDA Agricultural Research Service (Sheep Experiment Station) and 44,122 acres administered by the US Forest Service (USFS) also occur within the watershed assessment area.

Elevations within the assessment area range from 6,520 feet along the Red Rock River on the west end to over 10,203 feet on Mount Jefferson on the east end of the valley. Topography varies from flat valley bottoms to steep mountainous ravines. Vegetation varies from wetland vegetation including *Carex sp.* and *Juncus sp.*, to black greasewood (*Sarcobatus vermiculatus*) and inland salt grass (*Distichlis stricta*), or low sage (*Artemisia arbuscula*) and needle-and-thread grass (*Hesperostipa comata*) in the valley bottom to three-tip sagebrush (*Artemisia tripartita*), mountain big sagebrush (*Artemisia vaysseana*), Idaho fescue (*Festuca idahoensis*) and bluebunch wheatgrass (*Agropyron spicatum*) on the foothills; and as the elevation goes up, transitioning into aspen, (*Populus tremuloides*), Douglas-fir (*Pseudotsuga menziesii*) forests, then to lodgepole pine (*Pinus contorta*), subalpine fir (*Abies lasiocarpa*) and/or whitebark pine (*Pinus albicaulis*) forests along the continental divide. Annual precipitation within the watershed varies from <12" in the lower elevations to >30" in the higher country. Because of the diverse landscape and vegetation within the watershed assessment area, it provides habitat for an abundance of wildlife.

The Red Rock Lakes National Wildlife Refuge, established in 1935, is located in the Centennial Valley. This 48,955 acre refuge covers a large portion of the Centennial Valley and includes many of the wetland acres found in the valley. The refuge completed a comprehensive Conservation plan in 2009 which will direct management for the next 15 years. BLM administered lands often are located adjacent to or border refuge lands.

The Dillon Field Office's Resource Management Plan (RMP) approved in 2006 provides guidance for all programs in the Dillon Field Office.

All BLM administered land within the Dillon Field Office has been assessed for land health over the last 12 years. The Centennial Valley Watershed was assessed in 2004 and was re-assessed during the 2014 field season. By working on a watershed basis, a broader landscape is considered and more consistent management can be applied. It is the BLM's intent to implement watershed management cooperatively. Any changes in livestock management will be implemented through grazing decisions that address allotments or groups of allotments with a common permittee. Forest health and fuels management treatments or projects and any other management projects or changes will be implemented through Decisions appropriate for the respective programs.

Over the previous 12 years (2002 to 2014), BLM has been conducting watershed Assessments on a 10 year adaptive management schedule. All 17 watersheds within the Dillon Field Office covering over 900,000 acres of BLM administered land have been assessed at least once and several have been assessed a second time. These watershed Assessments assessed all five standards for Rangeland Health including both upland and riparian systems. Uplands are defined as any part of the landscape beyond the non-streamside boundary of the riparian area (USDI, BLM 1998). Riparian areas are the “green zones” which lie between channels of flowing water and uplands. For each watershed Assessment, an interdisciplinary team of trained BLM resource professionals observed these systems and made an on-the-ground rating whether they were meeting BLM Standards for Healthy Rangelands following approved BLM protocols.

Prehistory and History

The Centennial Valley was occupied historically by Native Americans continuously from approximately 10,000 years ago until European contact, consisting primarily of small habitation and/or food and tool material procurement sites (Earle 1980). Various tribes continued to use the Centennial Valley through European contact as a food procurement location and as a travel route to and from the Yellowstone Park area.

In conjunction with the Mountain Foothills Grazing EIS in the late 1970s, a Class II cultural resources inventory was conducted for a 10% sample of lands within the Dillon Field Office Area. At that time a portion of the Centennial Watershed was included within the Dillon West Planning Area. Results of the sample inventory indicated that cultural site densities within the Dillon West Planning Area were higher than that observed in other planning areas, with an average density of 1 site per every 777 acres (1.2 sites per square mile).

An examination of existing records on file with the BLM-Dillon Field Office has provided information on the number and type of known cultural resources and level of previous cultural resource inventory conducted on public lands within the Centennial Watershed analysis area. Within the study area, approximately 6,634 acres of public land have been intensively inventoried for cultural resources at the Class III level. The majority of these inventories were specifically project compliance related in advance of a number of proposed federal undertakings including: small range improvements (fences, water developments), seeding projects, road rights-of-way, timber sales and fuels reductions. The inventory projects vary from as little as 1 acre, to as much as 323 acres in extent.

As a result of past Class II and Class III cultural resource inventory, there are a total of 170 recorded cultural properties within the Centennial Watershed study area. Of that number 96.5% (n=164) are of prehistoric origin, 2.5% (n=4) are historic, and two sites (1%) have both historic and prehistoric components. The prehistoric sites range in age from Paleo-Indian to Late Prehistoric. Recorded prehistoric site types include primarily lithic scatter, some with buried deposits and hearths. Recorded Historic sites consist of built structure including log cabins, some associated with homesteads.

Agricultural History and Socioeconomics

Although mining was an impetus in the region's development, cattle ranching was already established when the first miners found their way into Montana. The Grants and Orrs in the Beaverhead region and the Kohrs in Deer Lodge were grazing cattle and providing beef to local miners as well as to consumers in other parts of the west and east. These early ranchers faced difficult circumstances fighting with Blackfeet and other tribes over territory and initially competing with bison for range. Yet, through the 1870s the cattle and sheep business as well as farming continued to expand. By the end of the 1870s, bison were on the brink of extinction. Public lands became more accessible facilitated by an "open range" policy that made available public lands for grazing. Cattle ranching in Montana became another means to "strike it rich" and spurred another rush of settlers and speculators.

Before the boom of the 1880s, most Montana cattle operations were partnerships or family affairs, but many of the new outfits were full-fledged corporations with access to plenty of capital and plenty of livestock. Dozens of corporate ranches held Montana charters by 1886; and many others, such as the Texas-based XIT, and Continental Land and Cattle spreads, were incorporated in other states or territories. By 1886, at the peak of the open range boom, roughly 664,000 cattle and 986,000 sheep grazed Montana range lands. A large percentage of the animals belonged to the new corporate ranchers, whose managers packed them onto limited ranges with no provisions of winter hay, in hope of quick profits from minimal investments (Malone, Roeder, and Lang, 1991: 157).

A severe drought and hard winter in 1886-87 combined with overgrazing on public lands resulted in severe impacts to Montana's cattle business, with some estimates that half or more of the cattle died (Fletcher, 1960:89-94). Small operators who put up hay adapted better than the "get rich quick" operators did, and after 1887, the cattle industry settled into a period of recuperation and ultimately further expansion as the value of hay for winter feed became apparent (Fletcher 1960).

The agricultural boom began to go bust in the post-war depression of the 1920s, and large numbers of Montana farmers moved out of state, leaving a demographic profile that is similar to that of present day Montana: larger numbers of older persons and younger persons with the middle-age demographic group showing sharp declines. Prior to World War II, ranching and farming continued under pressure, but various New Deal programs supported these industries into World War II, when once again there was a small boom. A combination of weather, world economics, and cultural changes in the United States have continued to influence boom and bust cycles in ranching and farming in southwest Montana. Today these activities remain important to the overall economy and culture of the region, but the face of agriculture and ranching are changing. Ranchers or their family members may also work as fishing guides or outfitters or in town to supplement their income. Fluctuations in cattle prices, other market forces, and increasing equipment and operating costs require some diversification in order to ensure the fiscal viability of present-day ranching operations. Some choose to lease their lands, or access through them for hunting or fishing and thereby supplement ranch income. It is common for wives and children to work for the cash needed to keep family and ranching life viable. Unfortunately, for many ranchers, children are not staying on to ranch, either because the isolation and lifestyle demands are not appealing or because financial realities do not allow it.

The CW is sparsely populated with Dillon being the largest town near the watershed. Recreation and tourism are important components of the economy of the CW. Most of this recreation occurs during the big game hunting season which provides substantial contributions to the local economy.

Of Montana's 56 counties, Beaverhead County is the largest livestock producer. The USDA 2007 Census of Agriculture Inventory (<http://www.agcensus.usda.gov/publications>) indicated that there were 212,412 head of cattle and calves and beef cattle in the county. Beaverhead County was also third in sheep production with 14,065 sheep and lambs inventoried. Very few grain-fed cattle were produced. The focus was on calves and feeder steers along with beef cows or breeding stock. This type of ranching requires large expanses of grazing land.

According to the National Agricultural Statistical Service (<http://www.nass.usda.gov/mt/>), overall cattle production in Montana has been relatively stable since 1986. The January inventories in 1986 and 2002 reported 2.45 million head with a peak of 2.75 million during 1996. Sheep production, on the other hand, showed a general decline across the state, reflecting a broader national pattern. The data from 2010 reports that, of Montana's 56 counties, Beaverhead county ranked 1st in total hay production. The data from 2011 reports that, Beaverhead county ranked 1st in total cattle numbers; and 3rd in sheep numbers.

Several economic factors have changed since the early 1980s which might have affected ranching operations in southwest Montana, including rising real estate values, volatile commodity price fluctuations and rising overhead costs for agriculture. These factors along with state and national politics and changing livestock market conditions have affected the livestock industry over the last twenty years. Social factors include the rising popularity of southwest Montana as a place to live, work and play accompanied by related population growth and change.

BLM grazing fees are calculated using the formula required by 43 CFR 4130.8 and are considerably less than those charged by private landowners. In 2004, the average fee in Montana for grazing on private land was \$16 per AUM based on Montana Agricultural Statistics Service, National Agricultural Statistics Service figures, and the minimum fee charged on Montana State Lands was \$5.48 per AUM. In 2014, these same fees rose as the average fee in Montana for grazing on private land was \$21.00 per AUM, and the minimum fee charge on Montana State Lands is \$11.41 per AUM. The BLM and Forest Service used the same formula to derive a \$1.35 per AUM fee in 2014, which makes federal land the least expensive grazing available to area ranchers. Federal grazing permits are desirable for area cattle producers as a source of inexpensive forage, even though additional management costs are usually incurred.

On page 252 of the Dillon RMP/Final EIS, Table 48, Employment and Labor Earnings by Major Type and Sector in 2000, reports that private on-farm employment accounted for 17 % of total employment in Beaverhead County. Please refer to Table 56 on page 286 of the Proposed Dillon RMP and Final EIS, which shows employment and labor income response coefficients related to livestock grazing, timber management and recreation use for the area influenced by the Dillon

Field Office. In addition, page 251 of the EIS presents personal income statistics from 2000 that indicate that labor earnings are the largest source of income in Beaverhead County.

The Proposed Dillon RMP/Final EIS is available at

http://www.blm.gov/mt/st/en/fo/dillon_field_office/rmp/Final.html.

Special Management Designations

Approximately 27,691 acres of BLM lands within the CW are designated the Centennial Mountains Wilderness Study Area (See Map A). A study of these, and surrounding lands (including USFS, Agricultural Research Station (ARS), and State Lands) totaling approximately 92,815 acres, was completed in 1990 to assess the suitability of these lands for designation as wilderness. Approximately 21,774 acres of BLM-managed lands, 4,474 acres managed by the USFS near Mt. Jefferson, and 1,160 acres of land managed by the State of Montana were recommended for wilderness designation. Since the Centennial Wilderness EIS decision was completed, approximately 640 acres of those state lands have been added to the BLM-managed acreage. All BLM-managed lands within the wilderness study area, whether recommended for wilderness or not, are managed in accordance with BLM Manual 6330 entitled *Management of Wilderness Study Areas*. This manual, released in July, 2012 replaces the *Interim Management Policy for Lands under Wilderness Review* (BLM Handbook H-8550-1). Both current and former policies require that wilderness qualities (naturalness, opportunities for primitive and unconfined recreation, etc.) not be impaired until such time as Congress may make a final decision on whether to designate these lands as part of the National Wilderness Preservation System.

There are two Areas of Critical Environmental Concern (ACEC) within the Centennial Watershed (See Map A). The Centennial Mountains ACEC includes the public lands lying south of the Centennial Valley road from Red Rock Pass to the West Fork of Corral Creek. There are approximately 40,715 acres of public land in this area. About 55% of the area is included in the Centennial Mountains WSA and is provided protection under the BLM's *Interim Management Policy for Land Under Wilderness Review*. The area is an ACEC based on the habitat it contains for grizzly bear, lynx and wolf, its use as a wildlife migration corridor, its outstanding scenic value, and for the only known occurrence in Montana of Whipple's beardtongue. The area provides relatively intact habitat with limited evidence of human-caused impact, and provides an important route for wildlife migration and movement between high security habitats. The Continental Divide Trail traverses this area and passes through some of the highest quality scenic values in southwest Montana. The dramatic 3,000 foot rise of the northern face of the Centennial Mountains is a well-known landmark in the region.

The Centennial Sand Dunes ACEC is located six miles north of Lakeview. There are approximately 1,040 acres of public land in this area. The area contains one of only two sand dune complexes in Montana, and provides habitat for special status plant species. The area supports ecological processes related to sand dune migration, which provides habitat for several special status plant species including sand wildrye, Fendler cat's eye, and pointed milkvetch. Disturbances that allow sand dune activity are necessary to maintain the early seral habitat necessary for these endemic plants.

Lands with Wilderness Characteristics

The 27,691 acre Centennial Mountains Wilderness Study Area is within the planning area, and is subject to special management defined in the BLM Manual 6330 – Management of Wilderness Study Areas. This area is further described previously in the Special Management section of this document. The planning area was inventoried for other lands with wilderness characteristics in accordance with BLM Manual 6310 – Conducting Wilderness Characteristics Inventory on BLM Lands, published in March, 2012. As a result of this inventory, one area was determined to possess wilderness characteristics as defined in that guidance. That inventory unit was named Price Creek, and assigned inventory unit #MT-050-101. The area contains approximately 2,300 roadless acres adjacent to the Centennial Mountains WSA and was determined to retain its predominantly natural conditions as well as outstanding opportunities for solitude and primitive and unconfined recreation. The documented presence of wilderness characteristics within this area does not mean that it requires it to be managed consistent with the policy for the adjacent wilderness study area. It simply means that any proposed activities that will impact these wilderness characteristics must be analyzed within the context of this EA. Future land use planning may consider a longer term objective for the future management of this area, and the possible need to identify it for long term protection of these characteristics.

Visual Resource Management

The entire Centennial Mountains Wilderness Study Area (WSA) is managed as Visual Resource Management (VRM) Class I, which provides for preservation of the landscape as the primary management goal. It would allow for natural ecological changes, but would not preclude limited management activity provided the changes to the characteristic landscape remained low, and did not attract attention. Several small areas immediately adjacent to the WSA are identified to be managed as VRM Class II to retain the existing character of the landscape, which would allow activities that should not be evident, or attract the attention of the casual observer. The remainder of the CW is within Visual Resource Management (VRM) Class III. VRM Class III objectives require partial retention of the existing character of the landscape and allow for moderate changes to the existing landscape. Management activities may attract attention, but should not dominate the view of the casual observer.

Geology

The Centennial Mountains are one of the few mountain ranges in the northern Rocky Mountains that trend east-west. The mountains rise abruptly from the Centennial Valley along the Centennial fault zone. The Centennial Mountains are divided into two approximately equal parts by the north-northeast trending Odell Creek fault. The eastern Centennial Mountains consist of a core of Precambrian rocks overlain by Paleozoic and Mesozoic sedimentary rocks. The eastern Centennials are upthrown relative to the western Centennials along the Odell Creek fault. The western Centennials are composed of upper Mesozoic and lower Paleogene sediments considerably different from those in the eastern Centennials. The rocks in the western Centennials may be part of a thrust plate that has thrust from the southwest along the Monida thrust to its present location (Witkind 1981). Both the eastern and western Centennials have considerable exposures of Paleogene volcanics ranging from basalt to rhyolite. At one time these volcanic rocks probably covered the entire Centennial Mountains. Erosion has removed much of this volcanic overlay.

The Centennial Valley consists of Quaternary fan deposits, alluvial and lake deposits including an area of inactive dunes north of the Red Rock lakes.

The area north of the Centennial Valley consists of Quaternary lake deposits, cretaceous/Paleogene sedimentary rocks and Paleogene and Quaternary volcanic rocks.

Quaternary deposits include Yellowstone and Island Park volcanics, numerous glacial deposits in the eastern Centennials and earthflows, landslides, and other mass wasting features in the western Centennials. The glacial deposits in the western Centennials have been largely obscured by the more recent mass wasting activity.

Vegetation

In this report, sagebrush and grassland areas are discussed under Standard #1 Uplands, while forest and woodland habitats are discussed under Standard #5 Biodiversity.

The variety and distribution of plant communities and seral stages in the watershed area is a function of climate, geology, and soil combined with:

- historic uses (e.g., grazing, mining, logging, etc.)
- short term weather patterns
- disturbance regimes (e.g., drought, fire, floods, and herbivory)

Current vegetative cover was calculated using satellite imagery (LANDFIRE 2011b). Table 1 summarizes the estimated cover types on all land ownerships within the CW.

Table 1: General Cover Types Summary

Cover Type	BLM Acreage	% of BLM Acreage in Cover type	Total Watershed Acreage	% of Total Watershed in Cover Type
Forested	25,510	30	59,840	17
Grasslands	7,595	9	28,730	8
Sagebrush/Shrub/Steppe	41,850	49	189,320	53
Riparian/Mesic Shrubs	4,860	5	59,225	16
Aspen/Mixed Aspen Stands	710	1	3,010	<1
Other/Agriculture	2,020	2	7,650	2
Water	3,270	4	101,640	3
Totals	85,825	100	358,410	100

Average annual precipitation within the watershed varies from about 12 inches in the Lima Reservoir allotment to 32 inches on the high mountain slopes in the Centennial Mountains on the Montana-Idaho state boundary.

Fire History

The presence or absence of fire plays an integral role in the composition and structure of the vegetation that occurs in the CW. Fire has shaped western landscapes for the past 10,000 years, but more than a century of settlement activities have seriously disrupted that crucial role in most areas. Since the mid-1800s, the frequency of wildland fires occurring in southwestern Montana and the western United States in general have been reduced by domestic livestock grazing, land use practices, and aggressive fire suppression. Fire scarred trees and charred wood are found primarily in the mountainous terrain and foothills of the CW. The sagebrush/grassland communities that dominate the lower elevation BLM-administered land typically retain evidence of past wildfires for a relatively short amount of time.

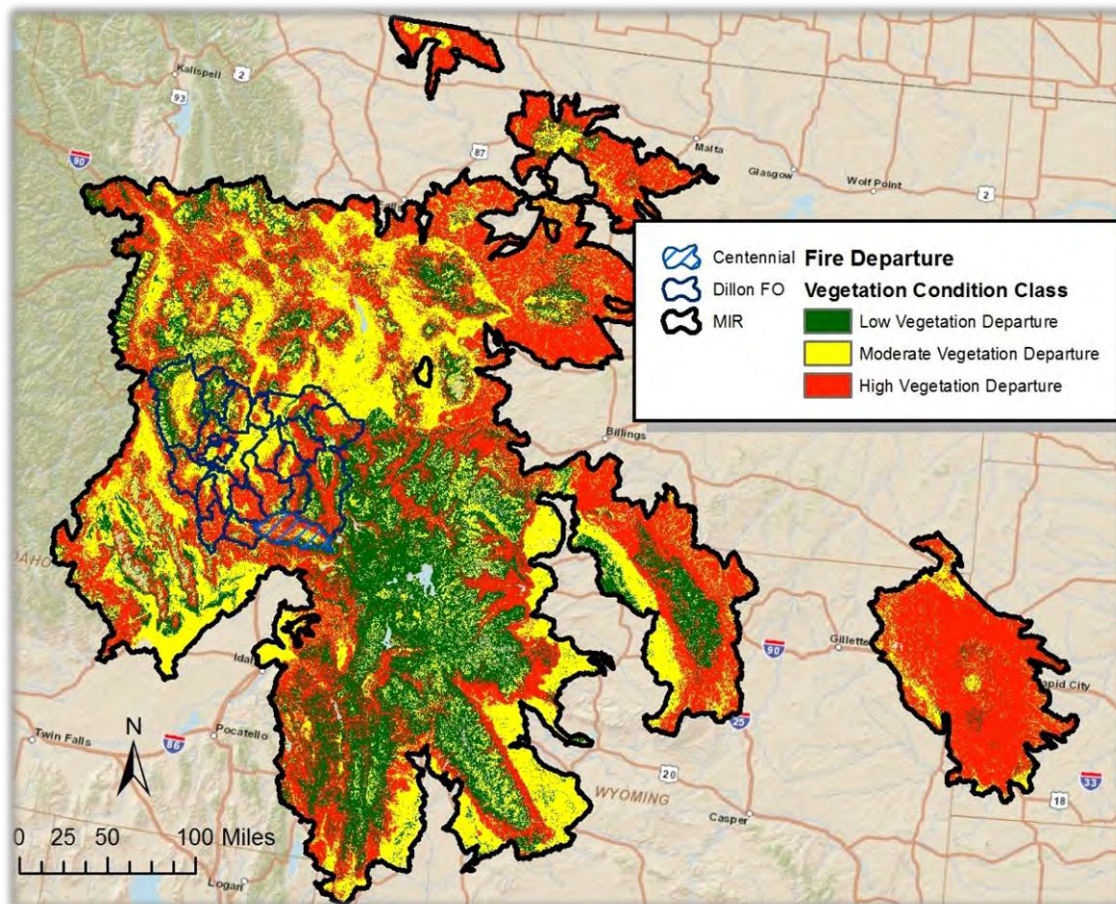
Higher elevation forest types have not missed a fire interval, though fuel accumulations are currently present to support a stand-replacing wildfire, as evidenced by the 2003 Winslow Fire. The Winslow fire burned a total of 13,558 acres including 6,111 acres of BLM lands. Ninety one percent of the affected BLM lands (5,578 acres) in the fire were part of the Centennial Mountains Wilderness Study Area. The Winslow Fire exhibited higher burn severity, larger stand-replacing patch sizes, and an absence of surviving trees compared to historic fire patterns (N. Korb, 2005).



Elk herd in a Portion of the 2003 Winslow Burn, July 2014

The BLM uses models that can help predict the likelihood of wildfires in a particular region or watershed area. The Landfire Vegetation Condition Class (VCC) fire model uses current vegetation and measurements of current vegetation's departure from simulated historical reference conditions to predict the likelihood of wildfires. A low departure from reference vegetation conditions are considered to be within the natural range of variability and the model shows a low probability for wildfires in these areas while a high departure in the model shows a

high likelihood those wildfires could occur. If the model shows a high departure of vegetation it is caused by the presence of invasive weeds, diseases to conifers, forest harvest and/or repeated grazing. When generally comparing the Middle Rockies Ecoregion and the Centennial Watershed Assessment area, the Middle Rockies region has a lower overall departure and a lower risk for wildfire with about 42% of the ecoregion in the high risk category (See Map 2 below). The Centennial Watershed area has a higher departure rating overall as more than 56% of its land area is in the high departure category signaling that more of the area is at a higher risk for wildfires.



Map 2 - Vegetation departure and risk of wildfire in the Middle Rockies REA, Dillon Field Office and CW

Authorized Uses

Forest Products

The BLM has commercially harvested forest resources within the CW since the mid-1960s, primarily in the Price, Bean, Jones and eastern Corral Creek drainages. Prior to this time, records of commercial harvest are unavailable but timber was certainly harvested to supply local building materials and fire wood. Old stumps, many with the marks of axe-felling, and the remnants of skid trails used long ago are common. Over time, the evidence and appearance of older harvest activities may have been changed considerably by natural processes which allowed

them to be included as former BLM Primitive Areas, and currently managed as BLM Wilderness Study Areas.

Throughout most of the mid 1960s and through early 1980s partial-cuts harvest that occurred in Douglas-fir/mixed conifer forest types now has regenerated with a dense understory of more shade tolerant trees. Clear cut harvest units, primarily in lodgepole pine, are regenerating with young, robust lodgepole pine trees, an unattractive food source for mountain pine beetle due to small diameter.

More recently, the BLM completed the Price of Beans Timber Sale in the Price and Bean Creek drainages. Between 2011 and 2013, the BLM harvested approximately 730 acres in Price Creek and 140 acres in Bean Creek, yielding 5.1 million board feet of timber products. Harvest units were primarily located in the low to mid-elevation Douglas-fir forest, but also included salvage of dead/dying lodgepole pine and subalpine fir. Following the 2003 Winslow Fire, the BLM commercially harvested approximately 150 acres of burned timber in the Curry Creek drainage.

The BLM sells permits authorizing firewood removal and Christmas tree cutting outside of designated wilderness or WSA.

Livestock Grazing

There are 83,102 acres of BLM administered land in the Centennial Valley Watershed. Of those acres, about 74,610 acres are located within 36 different grazing allotments with the remaining 8,500 acres unallotted and not in a grazing allotment. There are 19 different business entities or individuals currently authorized to graze livestock on the 74,610 acres of BLM administered lands. Those grazing permittees are authorized to harvest about 10,300 public land AUMs annually in the CW. The allotments are shown on Map A. Qualified individuals and business enterprises are authorized to graze livestock through a ten-year term grazing permit (43 CFR 4110). Many allotments have a mixed ownership pattern of public and private land pastures but there is a cooperative, comprehensive management plan that directs livestock grazing management on public lands. In most cases, private land owned by the permittees is adjacent to, or intermingled with, BLM administered land. Public lands, administered by BLM, provide a large proportion of the late spring, summer and fall forage base in the watershed. Changes in numbers of livestock, seasons of use, and/or increased labor inputs may have a considerable economic impact on individual operators.

Table 2. Livestock grazing allocations and management within the Centennial Watershed

Allotment Name, Number, and Category	Livestock Kind	Season of Use	Grazing System²	BLM Stocking Rate	BLM Acres	BLM AUMS	Acres in Other Ownership³	Total Acres
71 SGC 20153, (C)	Cattle	06/01-11/30	CU	2.2	343	157	More than 1,000 PVT	1,343
Antelope Peak, 20179, (I)	Cattle	06/01-11/30	DR	4.1	2,338	567	3,481 PVT	4,048
Bean Place, 10125,(C)	Cattle	06/01-09/01	CU	3.5	129	37	More than 1,000 PVT	1,129
Brundage Bridge, 20707, (C)	Cattle	05/01-11/30	C and Riparian Pasture	2.9	382	130	More than 1,000 PVT	1,382

Brundage Creek, 20708, (M)	Cattle	05/01-10/30	DR	4.5	4,118	912	640 St 800 PVT	5,558
Cayuse, 03234, (I)	Cattle	05/01-11/16	RR	8.2	475	58	684 PVT	1,159
Centennial, 20710, (M)	Cattle	05/01-12/15	RR	5.5	527	95	2,419 ST 2,615 PVT	5,561
Centennial Isolated, 20641, (C)	Cattle	05/01-12/15	CU	5.7	40	7	2,615 PVT	2,655
Cocanougher Ind., 10738, (C)	Cattle	04/25-10/31	RR	4.5	45	10	707 PVT	752
Curlew, 20199, (C)	Cattle	06/01-10/30	CU	1.5	181	122	More than 500 PVT	681
Davis SGC Common, 10737, (C)	Cattle	05/01-10/15	STG	25	446	18	94 PVT	540
Duff Creek AMP, 20688, (M)	Cattle	05/01-12/15	RR	32	3,344	106	None	3,344
Fish Creek, 20172, (I)	Cattle	06/13-10/22	DR	7.2	3,706	514	3,023 ST 947 PVT	7,676
Jones SGC, 20731, (C)	Cattle	05/01-12/15	CU	4.7	122	26	158 PVT	280
Lima Reservoir AMP, 10151, (M)	Cattle	05/01-12/15	DR	6.5	5,122	793	2,517 State 2,500 Private	10,139
Long Creek AMP, 20154, (I)	Cattle	05/01-12/15	RR	3.3	4,476	1,345	1,023 ST 1,911 PVT	7,410
Long Creek SGC, 20157, (C)	Cattle	05/01-12/15	CU	2.9	117	41	More than 1,000 PVT	1,117
Lousy Springs, 00763, (C)	Cattle	05/01-11/30	DR	5.6	621	110	219 ST 23 PVT	863
Mata-stib SGC, 10696, (C)	Cattle	05/01-12/15	CU	5.2	472	90	1,000 ST	1472
McCandless Brothers SGC, 20185, (C)	Cattle	06/01-10/31	CU	3.8	300	79	2,500 ST 549 PVT	3,349
Monida-Corral Creek, 00766, (C)	Cattle	06/01-09/01	CU	2.4	72	30	More than 1,000 PVT	1,072
Monida Hill, 20023, (I)	Cattle	06/01-10/31	RR	11	6,462	607	More than 1,000 PVT	7,462
Morton Ind./SGC, 20163, (C)	Cattle	05/15-11/14	CU	43	470	11	268 PVT	738
Mud Lake, 30260, (M)	Cattle	06/01-10/31	DR	6.5	1,083	166	649 ST 1,474 PVT	3,206
Oxbow, 20735, (I)	Cattle	05/15-11/16	RR	3.4	3,254	952	5,428 PVT	8,682
Passmore/SGC, 20183, (I)	Cattle	09/01-09/15	Riparian Pasture	5.2	83	16	None	83
Peet Creek, 10730, (I)	Cattle	05/15-11/14	DR	21	4,750	231	713 ST 2,269 PVT	7,732
Price Creek, 30040, (I)	Cattle	06/15-10/15	RR	10	14,562	1,468	365 PVT	14,927
Red Rock, 30636, (M)	Cattle	04/01-02/28	STG	3.1	267	86	86 PVT	353
Ritchie SGC, 30610, (C)	Cattle	05/01-11/30	CU	9	160	18	More than 1,000 PVT	1,160
Rody Individual, 20685, (C)	Cattle	07/01-10/30	CU	21	414	20	40 PVT	454

Saier Individual, 20169, (M)	Cattle	05/01-12/15	STG	3.1	321	104	640 ST	321
Sand Dunes, 20732, (M)	Cattle	05/01-12/15	Planned Grazing use to benefit rare plants	6.2	665	107	5 PVT 118 ST	670
Shambo Units, 20152, (I)	Cattle	07/01-11/30	RR	10	11,660	1,146	2,236 PVT	13,896
Shineberger, 20159, (C)	Cattle	04/01-11/14	STG	1.8	277	151	366 PVT	643
Tom Creek, 20701,	Cattle	06/08-10/15	CU	165	2,806	17	More than 2,000 PVT	4,806
BLM Totals					74,610	10,347		126,663
¹ Livestock Kind: C=cattle ² Grazing System: RR=rest rotation, DR=deferred rotation, STG= short term grazing system, CU=custodial use ³ Other Ownerships: ST=Montana DNRC, PVT=Private ³ Total Acres is an estimate. The total acres in the allotment may not be completely accurate because BLM doesn't have authority to map allotment boundary fences on private lands.								

All allotments in the Dillon Field Office have been categorized as *Improve* (I), *Maintain* (M), or *Custodial* (C), based on resource values and opportunities for improvement. Allotment category refers to BLM's level of management for a given grazing allotment and is used to establish priorities for distributing available funds and personnel during plan implementation to achieve cost-effective improvement of rangeland resources. Categorization is also used to organize allotments into similar groups for purposes of developing multiple use prescriptions, analyzing site-specific and cumulative impacts, and determining trade-offs. Allotments in the I-category are managed more intensively and are monitored more frequently. Allotments in the M-category are usually at a desired condition and are managed to maintain or improve that condition. Allotments in the C-category are usually isolated parcels with few resource concerns and/or limited management control that are fenced in with larger parcels of deeded land, are managed in conjunction with the permittee/lessee's normal livestock operation, and are usually monitored less frequently.

The BLM has worked cooperatively with individual livestock permittees/lessees in the watershed for many years to develop Allotment Management Plans (AMPs) that prescribe grazing management to maintain or improve natural resource conditions. Of the BLM-administered lands in the watershed that are available for livestock grazing (74,610), about 90% of the acres are managed under formal AMPs, or have agreed upon grazing systems, that prescribe a grazing system, such as rest rotation or deferred rotation (Table 2). About 5% of the BLM-administered acres that are available for livestock grazing are in custodial allotments, where BLM management inputs are minimal because of the small proportion of public land in the allotments (Map 1).

The stocking rate on BLM lands within the watershed averages 7.2 acres/AUM and varies from 1.5 to 165 acres/AUM. This wide variation is influenced by soils, vegetation, topography (aspect, elevation, and slope), distance from water and local weather. Cattle (mature individuals or cow/calf pairs) are the primary type of livestock authorized on the allotments; however, several allotments allow the flexibility to graze yearling cattle.

Recreation

Two commercial outfitters hold Special Recreation Permits to provide guided hunting opportunities and/or summer horse packing trips within this planning area. Centennial Outfitters provides both activities in the Centennial Mountains and in the valley on BLM, USFS, USFWS, and ARS lands, while the Broken Arrow Lodge offers primarily guided hunting opportunities on scattered BLM and State Lands on the north side of the valley/south end of the Gravelly Mountains. Another commercial recreation provider, Hell Roaring Powder Guides, is authorized to provide winter camping and backcountry skiing opportunities in the upper end of Hell Roaring Creek.

Mining, Mineral and Abandoned Mine Lands

The Mining and Minerals Policy Act of 1970, the Federal Land Policy and Management Act of 1976 (FLPMA), and the Natural Materials and Minerals Policy, Research and Development Act of 1980 direct that the Public lands be managed in a manner that recognizes the Nation's needs for domestic sources of mineral production. Under the 1872 Mining Law, claimants have a statutory right to develop their mineral deposits consistent with applicable environmental laws. Mining activity is typically cyclic with the amount of exploration or development of resources directly related to the demand for the material, technology available, and the market price of the commodity.

The BLM Abandoned Mine Lands (AML) program is responsible for cleaning up sites determined to be hazardous to human health, to the environment, or those which present physical safety hazards to the public. This program addresses mine sites abandoned prior to January 1, 1981, the effective date of the BLM's surface management regulations (43 CFR 3809) that implement the "unnecessary or undue degradation" provisions of the Federal Land Policy and Management Act of 1976 (FLPMA). Because early mining prior to 1981 did not require reclamation or bonding, many of these abandoned mines have legacy features such as eroding dumps, abandoned tailings, or open mine features. As mining activity is directly related to the demand for materials, commodity price, and advancing technologies, it is a cyclic activity. Therefore, relationships between abandoned mines and active mines/exploration will vary throughout time as demand for the resources change. Changes in reclamation standards, technology, and bonding will prohibit mining problems of the past from developing in the future. Mining activity after 1981 is administered by the Mineral Program.

Abandoned Mine Lands (AML) work in southwest Montana is conducted under a zoned program which incorporates the Dillon, Missoula, and the Butte Field Offices. Issues on AML are generally divided into two categories: those with environmental issues, and those with physical safety problems, although it is not uncommon for these issues to overlap on the same project. Since the CW is not heavily mineralized, there is not an abundance of abandoned mine features found in the area. Never-the-less, abandoned mine features are found from time to time in areas that are not generally mineralized. When features are found or reported they will be dealt with on a case by case basis and will be mitigated. At this time there are no major environmental hazards within the watershed known to exist on public land as the result of historic mining.

Energy and Mineral Resources

Leasable Minerals

Phosphate

One of the Mesozoic sediments in the eastern Centennials is the phosphate-bearing Permian Phosphoria formation. The phosphate deposits near the crest, along the flanks of Sheep and Taylor Mountains were mined by the J.R. Simplot Company from 1956 to 1958 but are no longer leased. Approximately 296,000 tons of phosphate were mined using open cut/pit mining methods. The remaining identified phosphate resources include approximately 93,000 tons of acid-grade material (greater than 31% phosphorous pentoxide); 150,000 tons of furnace grade rock (greater than 24%) and 195,000 tons of beneficiation grade (greater than 18%). Virtually all of these resources are only available using underground mining methods. Hypothetical resources are approximately twice as large as the identified resources. Phosphate deposits with 150 feet or less are found on approximately 300 acres on the Montana side of the state line. Possible by-products derived from processing phosphate include vanadium, chromium uranium, silver fluorine and the rare earth's lanthanum and yttrium (Witkind, 1981).

Oil Shale

Petroliferous black shale in the Phosphoria formation contains small amounts of kerogen. A black shale near REAS Peak-yield six gallons of oil per ton. (Condit 1919).

Oil and Gas

Oil and gas geologic favorability is rated from low to moderate in the area. The western end of the Centennials has the most interest with two anticlinal structures. The Peet Creek anticline was drilled unsuccessfully in 1978 by American Quasar. The Odell Creek anticline has not been drilled.

Coal

A thin horizon of subbituminous coal is exposed in the western Centennials. It was mined early in the century to supply coal for a local school. It is not currently of any economic significance.

Locatable Minerals

The geologic favorability for precious and base metals is low in the area. Past geochemical stream sampling failed to detect any anomalous concentrations of base or precious metals. A small diatreme near the crest of the eastern Centennials might be a likely exploration target but past samples show lead values only slightly above background levels.

Mining claims for decorative building stone were located near Reas Peak. They produced between 50 to 100 tons per year in the past.

Mineral Resource Projections

As discussed above, the Centennial Mountains have large resources reserves of phosphate. The phosphate deposits are near the crest of the range in areas of relative gentle terrain with little timber. Mining done in the 1950s was surface mining; any future mining will be primarily

underground mining. Supply and demand forecast by the Bureau of Mines for the foreseeable future indicate a surplus of phosphate in the domestic economy. Phosphate for fertilizer is expected to have a 1.5 % per year growth rate in domestic markets and a 2.7 % per year growth rate in export. The high mining costs, long distances to likely markets, and climate conditions make the deposits unattractive at the present time. Any development of the phosphate resources in the Centennial Mountains is unlikely.

The geologic favorability for oil and gas is low to moderate. The potential for decorative stone is moderate but long truck hauls and the short operating season will likely limit development. The geologic favorability for other mineral resources, industrial minerals, base and precious metals, oil shale and geothermal energy is low.

Format for Standards

The Upland, Riparian, Air Quality, and Water Quality Standards will follow the following format:

- **Affected Environment** - This section briefly describes the area and resources that were assessed.
- **Findings and Analysis** - This section describes the findings of the IDT during the field assessment.
- **Recommendations** - This section presents initial recommendations developed by the IDT during the field assessment.

Because of the complexities involved with addressing the Biodiversity Standard, the Affected Environment and Findings and Analysis are presented together and Recommendations are presented at the end of the section.



Photo looking southwest into the Tom Creek Allotment July, 2014

Uplands

Western Montana Standard #1: *“Uplands are in Proper Functioning Condition.”*

Affected Environment

Uplands are defined as land at a higher elevation than the alluvial plain or low stream terrace; all lands outside the riparian-wetland and aquatic zones (USDI 1996). Properly Functioning Condition (PFC) is defined as the condition in which vegetation and ground cover maintain soil conditions that can sustain natural biotic communities. The functioning condition of uplands is influenced by geomorphic features, soil, water, and vegetation (USDI 1994).

Soils

Soils in the CW are primarily affected by climate (temperature and precipitation), topography (slope and aspect), and parent material (geology and geomorphology). The soils in this watershed are in the Frigid (generally below 6,400 feet elevation) and Cryic (generally above 6,400 feet elevation) soil temperature regimes. Lands administered by BLM within the CW vary from about 12 to 30 inches of average annual precipitation and fall into the Aridic bordering on Ustic and Ustic soil moisture regimes. On BLM-administered lands, within the watershed boundary, elevations range from about 5,500 feet near Lima Reservoir to above 12,000 feet, along the Divide on the Southeast end of the CW.

The soils within the watershed formed in alluvium, colluvium, residuum, and glacial till formed mainly from quartzite, limestone, sandstone, andesite, rhyolite, and granitic rock sources. Major landforms include flood plains, stream terraces, alluvial fans, escarpments, hills, glacial moraines, and mountain slopes. Slopes range from nearly level and undulating (1 to 8 %), rolling and hilly (8 to 30 %), to steep and very steep (25 to more than 45 %). Soil textures are mainly sandy loams, loams, and clay loams; soil depths vary from shallow (less than 20 inches to a root restrictive layer) to very deep (more than 60 inches to a restrictive layer). The relative amount of lime, or calcium carbonate, within the rooting zone, as measured by observable effervescence with hydrochloric acid, ranges from none to more than 50 %. Salinity and sodicity (alkalinity) occur within the assessment area to a minor extent, and is limited to the upper margins of main drainage ways. Rock fragments, both on the soil surface and within the soil profile, range from none to more than 65 %.

Soil classifications and ecological sites within the assessment area reflect these soil's physical and chemical properties and variables. The main soil Orders encountered within the assessment area include: Alfisols, Entisols, Inceptisols, and Mollisols. Major Ecological Sites associated within the upland areas include: Saline Lowlands, Clayey, Shallow, Limy, Limy Droughty, Droughty, Droughty Steep, and Loamy. Within the river and stream areas the major Ecological Sites include: Wet Meadow, Riparian Wet Meadow, Riparian Sub-irrigated, Sub-irrigated, and Overflow.

A Soil Survey Geographic Database (SSURGO) was developed by the NRCS with work on public lands funded by the BLM. This soil survey encompasses public and private lands throughout Beaverhead County. This database includes a geographic layer which was available

for the ID Team during the assessment. The BLM has provided funding to NRCS to develop Ecological Site Descriptions which in conjunction with the soils information will improve available information.

Vegetation

Mountain Big Sagebrush/Idaho Fescue community type is very common in the Centennial Watershed



Most of the watershed's BLM administered uplands are dominated by sagebrush (49%), including mountain big sagebrush, basin big sagebrush, three-tip sagebrush, low sagebrush, alkali sagebrush and silver sagebrush. Winterfat, black greasewood and Gardner's saltbush are also found on many alkaline sites in the watershed. Some of the prominent herbaceous species included in the grasslands are bluebunch wheatgrass, western wheatgrass, Sandberg's bluegrass, needle and thread, prairie junegrass, Idaho fescue, basin wildrye and inland saltgrass. These same cool season grasses are prominent understory vegetation in the sagebrush habitat types. Rubber rabbitbrush, green rabbitbrush, gray horsebrush, fringed sagewort, and broom snakeweed are common native shrubs found on numerous ecological sites throughout the watershed. If any of these shrubs have greater than 5% canopy cover on a site, it usually indicates that site has been subject to some kind of past disturbance.

Special status plants, noxious weeds, and invasive species are discussed under Standard #5 Biodiversity.



Centennial Watershed IDT, TNC and WWP Evaluating Uplands on Sand Dunes Allotment July, 2014

Prescribed Fire

According to BLM records, prescribed fire treatments have occurred in one 700 acre unit during 2008. The treatment occurred in the Sand Hills Allotment located on the north side of the Centennial Valley.

Findings, Analysis and Recommendations

Procedure to determine conformance with Standard

The uplands were assessed on an allotment basis according to Interagency Technical Reference 1734-6 *Interpreting Indicators of Rangeland Health*. This technical reference is available to the public to read at the Dillon Field Office or download on the BLM Library webpage, <http://www.blm.gov/nstc/library/techref.htm>. This qualitative process evaluates 17 “indicators” (e.g., soil compaction, water flow patterns, plant community composition) to assess three interrelated components or “attributes” of rangeland health: soil/site stability, hydrological function, and biotic integrity. The IDT visits specific ecological sites and rates each indicator on the degree of departure, if any, from what is expected for the site. The rating for each indicator is then weighed to determine the degree of departure of the three attributes of rangeland health. The NRCS has developed Ecological Site Descriptions based on specific soil types, precipitation zones and location. They describe various characteristics and attributes including what

vegetative species, and relative percentage of each, are expected to be present on the site. The IDT refers to these site descriptions while completing the upland evaluation matrix.

As part of the procedure to determine conformance with the Upland standard, the 2014 Centennial Watershed IDT reviewed the long term trend study data, including photographic records, conducted extensive field surveys, and used the Indicators of Rangeland Health assessment process while visiting each allotment to assess the functionality of the uplands in the CW. The CW was also evaluated for weed infestations using treatment records and inventories from the Dillon Field Office, the Beaverhead County Weed Coordinator, and the IDT's collective observations during the field assessments.

Members of the IDT visited all the grazing allotments and the unleased public land in the CW during 2014 and completed 21 *Rangeland Health Indicator Evaluation Matrices* on various ecological sites and plant associations. In addition, 12 Daubenmire trend studies and over 40 permanent photo plots, which were established in the 1960s, 1970s and early 1980s, were duplicated in 2013 to help determine vegetative trends. The data collected were summarized and compared with baseline and interim data providing supporting information, along with the photographic record, for interpreting the upland indicators (see Table 4, Upland Qualitative Assessment Summary). Descriptions of these upland monitoring methodologies are found in Interagency Technical Reference 1734-4, *Sampling Vegetation Attributes*, which is available at the Dillon Field Office or online at <http://www.blm.gov/nstc/library/techref.htm>.

Conifer expansion into sagebrush/grasslands is affecting Upland Health within the majority of the allotments on the south side of the watershed, and is discussed under the Standard #5 – Biodiversity. Table 4 outlines the findings at sites throughout the watershed where the IDT completed the Indicators of Rangeland Health evaluation matrix. A moderate departure from expected conditions is analogous to a FAR rating (USDI 2000). Upland sites that were found to be in the none-to-slight or slight-to-moderate departure from expected conditions category are generally considered to be in PFC.

Table 3. Upland qualitative assessment summary of grazing allotments within the CW

Allotment Name, Number & Category	Ecological Site	Dominant Plant Species	Degree of Departure from Expected		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Antelope Peak, 20179, (I)	Loamy 15-19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Bean Place, 10125, (C)	Clayey 11-15" Precipitation Zone	Early sagebrush/Danthonia	None-Slight	None-Slight	None-Slight
Brundage Bridge, 20707, (C)	Loamy 15-19" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight

Allotment Name, Number & Category	Ecological Site	Dominant Plant Species	Degree of Departure from Expected		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Brundage Creek, 20708, (M)	Droughty 15-19" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Cayuse, 03234, , (I)	Loamy 15-19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Centennial, 20710, (M)	Loamy 15-19" Precipitation Zone	Basin Big Sagebrush/Basin Wildrye	None-Slight	None-Slight	None-Slight
Cocanougher Ind., 10738, (C)	Clayey 11-15" Precipitation Zone	Early sagebrush/Danthonia	None-Slight	None-Slight	None-Slight
Curlew, 20199, (C)	Shallow 11-15" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Lima Reservoir AMP, 10151, (M)	Clayey 11-15" Precipitation Zone	Early sagebrush/ Danthonia	None-Slight	None-Slight	Slight- Moderate
Long Creek AMP, 20157, (I)	Droughty 15-19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Lousy Springs, 00763, (C)	Loamy steep 15-19" Precipitation Zone	Idaho Fescue / Mountain Big Sagebrush	None-Slight	None-Slight	None-Slight
Monida Hill, 20023, (M)	Clayey 11-15" Precipitation Zone	Early sagebrush/ Danthonia	Slight- Moderate	Slight-Moderate	Slight- Moderate
Monida Hill, 20023, (M)	Shallow 11- 15 Precipitation Zone	Mountain Big sagebrush/Bluebunch Wheatgrass 11 – 15" PZ	Slight- Moderate	Slight-Moderate	Slight- Moderate
Morton Ind./SGC 20163, (C)	Loamy, 15- 19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	Slight- Moderate	Slight-Moderate	Moderate
Mud Lake, 30260, West, (M)	Limy, 11-15 Precipitation Zone	Bluebunch Wheatgrass /Idaho Fescue	Slight- Moderate	Slight-Moderate	None-Slight
Oxbow, 20735, (I)	Limy-15-19" PZ	Idaho Fescue / Basin Big Sagebrush	None to Slight	None to Slight	None to Slight

Allotment Name, Number & Category	Ecological Site	Dominant Plant Species	Degree of Departure from Expected		
			SOIL SITE STABILITY	HYDROLOGIC FUNCTION	BIOTIC INTEGRITY
Price Creek, 30040, (I)	Droughty 15- 19" PZ	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None to Slight	None to Slight	None to Slight
Red Rock, 30636, (M)	Droughty 11- 15" PZ	Bluebunch Wheatgrass	Slight- Moderate	Slight-Moderate	Slight- Moderate
Shambo Units, 20152, (I)	Loamy, 15- 19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None to Slight	None to Slight	None to Slight
Shineberger, 20159, (I)	Limy, 11-15" PZ	Black greasewood/Bottlebrush squirreltail	None to Slight	None to Slight	None to Slight
Tom Creek, 20701, (C)	Loamy, 15- 19" Precipitation Zone	Bluebunch Wheatgrass/Idaho Fescue / Mountain Big Sagebrush	None to Slight	None to Slight	None to Slight

Findings and Analysis

On the sites with none to slight departures from what is expected, the quantitative monitoring data supports the findings of the IDT. The ecological condition at these upland sites is stable or improving. Where erosion is present, it is scarce and usually a remnant of historical grazing. Tall cool-season bunchgrasses, specifically bluebunch wheatgrass and other palatable native grasses and forbs, match what is expected for the site.

On the sites with moderate departures, it is likely due to past and occasionally current, repeated spring and summer cattle grazing with little or no rest periods during the growing season. It can also be from a properly stocked allotment that has poor grazing distribution due to lack of available water across the pasture or difficult topography. Moderate departures denote a poorly functioning upland.



Uplands in the Antelope Peak Allotment, Centennial Watershed, July 2014

The uplands on 33 allotments comprising over 98% of the BLM-administered uplands in the CW assessment area were found to be functioning properly under existing management. Three allotments (Lima Reservoir AMP, Monida Hill and Mud Lake) had some localized site specific concerns but when considering scope and scale, were rated as low PFC by the BLM ID Team. The ID Team found several resource indicators with moderate departures from what is expected in similar sites in properly functioning condition on three allotments. These three allotments, comprising less than 2% of the public uplands in the CW, were not properly functioning. The uplands on Morton Individual, Red Rock and Rody Individual allotments were rated as FAR by the IDT. More information about each allotment's upland health is listed below.

Lima Reservoir AMP– The allotment was in relatively good condition except for some site specific and drought related concerns. The IDT noted slight to moderate departures from potential in some of the indicators. Increased composition of increaser forbs (e.g. phlox, pussytoes), shrubs (e.g. rabbit brush, fringed sagewort) and smaller, less palatable grasses (Sandberg's bluegrass) were noted. Low and/or three-tip sagebrush was decadent in many areas. The palatable forage plants were in low vigor, therefore productivity of these plants and litter was also reduced from potential. Trend data and photographic records show a slightly improved trend since the 2004 assessment. The upland health was rated as low PFC under the current deferred grazing system.

Monida Hill – The Monida Hill allotment is managed under a three-pasture rest rotation grazing system where each pastures receives rest every third year. The IDT noted slight to moderate departures in a few of the 17 indicators of rangeland health. The IDT noted departures in water flow patterns and slight active pedestalling in the allotment. There was excessive bare ground, reduced litter and slightly reduced reproduction capability. The plant community composition was found to still have the dominant cool-season species present. The departures were thought to be from past livestock use. A rest every three years was added to this system during the last assessment process and based on trend data and photographic records since the last assessment,

the allotment is slowly improving. The allotment uplands were found to be in low PFC with an upward trend.

Mud Lake – The IDT noted that vigor was low for key grass species within the allotment. Bare ground amount was noted to be higher than expected and litter was lower than expected. Water flow patterns were slightly to moderately departed from potential and active pedestalling was found, but only rarely. Additional resource concerns were noted on the allotment, but overall departures were slight to moderate. The allotment's uplands were found to be in low PFC.

Morton Individual- This allotment is a 640 acre custodial tract. The allotment has changed hands since the last assessment and custodial livestock use has been increased within the allotment. The IDT noted moderate departures from potential in water flow patterns and soil pedestals, and also noted some loss of soil due to erosion. Bare ground was found to have a moderate departure from what is expected for the site in proper functioning condition. Many undesirable and/or increaser plant species were present on the allotment including phlox, dandelion and annual forbs and grasses. The more palatable forage species are being replaced with less palatable and undesirable annual plants and forbs which is an indicator of heavy grazing and/or lack of rest. Litter amount, annual production and reproductive capability of desirable grasses and forbs are reduced from potential at this site. Canada thistle and houndstongue were also noted at this site. The IDT found the upland health in this allotment to be FAR with a downward trend.

Red Rock – The allotment consists of a single pasture. There is a substantial amount of disturbance from an irrigation ditch and the substantial fluctuation of water coming out of Lima Dam, as well as pronounced trailing along the irrigation ditch. The IDT noted that water flow patterns and pedestals were moderately departed from potential and some loss of soil due to erosion was occurring. Bare ground was found to have a moderate departure from what is expected for the site. Many undesirable and invasive plant species were present on the allotment including spotted knapweed, houndstongue, Canada thistle, as well as annual forbs and grasses. The potential plant community has been replaced with more undesirable and less palatable grasses and forbs likely due to heavy grazing, lack of rest and other disturbances. Both litter amount and annual production was found to be less than potential as was reproductive capability of desirable grasses and forbs. The IDT found the allotment's uplands to be in FAR condition.



Rody Individual- The IDT found several old fences in disrepair, as well as other old materials located on public land within the allotment. Water flow patterns were departed from potential in some areas within the allotment and there was some loss of soil due to erosion. Bare ground was found to have a moderate departure from what is expected for the site within the allotment. The composition of undesirable plant species was higher than expected (phlox, dandelion and annual forbs and grasses). The potential native plant community for this site has been altered to a plant community with more undesirable and less palatable plants species likely due to frequency, intensity and/or timing of livestock grazing over the long term. Both litter amount and annual production have been reduced from potential as was reproductive capability of desirable grasses and forbs. Relatively high composition of noxious weeds, Canada thistle and houndstounge, were also noted within the allotment. The IDT found the allotment's uplands to be in FAR condition. The boundary fence, in places, is in disrepair and not functional in controlling livestock within the allotment.

The following allotments may have had some small localized areas of concern for various reasons, but overall the upland health standard was found to be in properly functioning condition. Some of the upland sites, especially in higher elevations, are in very high PFC or near pristine condition.

7L SGC, Antelope Peak, Bean Place, Brundage Bridge, Brundage Creek, Cayuse, Centennial, Centennial Isolated, Cocanougher Ind., Curlew, Davis SGC Common, Duff Creek AMP, Fish Creek, Jones SGC, Long Creek AMP, Long Creek SGC, Lousy Springs, Mata-stib SGC, McCandless Brothers, Monida-Corrral Creek, Oxbow, Passmore/SGC, Peet Creek, Price Creek, Ritchie SGC, Saier Individual, Sand Dunes, Shambo Units, Shineberger and Tom Creek.



2003 Winslow Fire, Shambo Allotment, Centennial Watershed, July 2014

Recommendations

1. Continue to maintain or improve upland health in all 30 allotments that exhibit healthy or improving upland conditions.
2. On the Rody allotment, reconstruct/maintain the boundary fence and remove other unnecessary fences and materials. Adjust the grazing management to incorporate deferment and/or rest or adjust the season of use. Change the management category to Improve rather than Custodial.
3. On Morton Individual allotment, adjust grazing management to incorporate deferment and/or rest, or reduce the season of use or number of livestock authorized to graze. Change the management category to “Improve” rather than “C” custodial.
4. On Red Rock allotment, adjust grazing management to incorporate deferment and/or rest, or convert to dormant season use. Consider changing the season of use. Change the management category from “C” custodial to (I) “Improve”.
5. In the Monida Hill, Lima Reservoir AMP and Mud Lake allotments, continue to monitor the allotments to detect changes in plant vigor and trends in upland plant health. Make appropriate changes to include rest and/or additional deferment if allotments don’t show continued signs of upland health improvement.

Riparian and Wetland Areas

Western Montana Standard #2: *"Riparian and wetland areas are in proper functioning condition."*

Procedure to determine conformance with Standard

BLM policy specifies using several complimentary monitoring and evaluation methodologies to determine conformance with the Riparian Health Standard regarding riparian (lotic) and wetland (lentic) areas. The IDT used the Lotic and Lentic Riparian Area Management Assessment Methodologies TR 1737-15 and TR 1737-16 (USDI 1998, 1999), also known as Proper Functioning Condition (PFC) Assessment Methodologies as well as Interpreting Indicators of Rangeland Health TR 1734-6, to evaluate riparian wetland systems including streams, riparian meadows and riparian wet meadows (USDA 2013). The lotic methodology is used for flowing water systems and their associated riparian areas. The lentic methodology is used for ponds and still water systems. Wetlands are transitional areas between terrestrial and aquatic systems. Sensitivity to grazing impacts varies along a gradient from wet to dry. The wettest and the driest sites are often more resilient than intermediate sites where pugging frequently occurs. Applicable portions of the lentic methodology are used to assess springs and wet meadows. A Guide to Managing, Restoring, and Conserving Springs in the Western United States TR 1737-17 (USDI 2001a) is also used for springs. These technical references are available online at www.blm.gov/nstc/library/library.html

Proper Functioning Condition (PFC) is a range of conditions (continuum), not a single point. A high PFC rating may be analogous to Desired Future Condition (DFC), however a low PFC

rating, while meeting the Riparian Health Standard, may not meet site specific objectives. “Riparian-wetland areas can function properly before they achieve their potential.”(USDI 1998). The lotic PFC assessment utilizes attributes and processes that can be judged visually to evaluate riparian wetland areas with flowing water against their capability and potential. Some of these attributes and processes include the stream channel’s physical characteristics or stream geometry (dimension, pattern and profile). To function properly, adequate vegetation, landform or woody debris should be present to dissipate energy associated with relatively frequent high flow events and to filter sediment, capture bed load and aid floodplain development so the stream does not excessively aggrade or degrade (down-cut). The IDT uses the Rosgen Stream Classification System as a tool to help determine stream potential (Rosgen 1994). This system has gained wide recognition throughout the United States and abroad. A major benefit of the system is the ability to determine stream sensitivity and to predict channel evolution with some level of accuracy (Rosgen 1996). The classification system is available online at http://www.wildlandhydrology.com/assets/A_Classification_of_Natural_Rivers-Catena_Paper.pdf.

The Dillon Field Office used its riparian database, which has been developed over the course of 20 years, as a starting point for the CW. Many of the riparian areas in the assessment area were originally described and mapped based on aerial photos and U.S. Geological Survey (USGS) topographical maps. This information was the basis for GIS mapping. In recent years, springs and wetlands have been added to the GIS inventory and mapping effort. Subsequent ground-truthing has verified that a number of drainages previously mapped as riparian habitat are actually dry washes which lack riparian characteristics. These reaches have been removed from the stream/wetland inventory. Conversely, several stream reaches, springs and wetlands not previously categorized were identified during the watershed assessment process. These new streams, springs and wetlands were assessed by the BLM and added to the BLM riparian-wetland data base.

Data were collected on all the streams in the CW area using a modified version of the Montana Riparian Wetland Assessment (MRWA) methodology (Hansen et al. 2000) during the 2013 field season prior to the IDT’s PFC assessments. In accordance with the Dillon Resource Management Plan, the MRWA methodology has been adapted and modified by the Dillon Field Office to include channel morphology parameters. The MRWA methodology includes inventories of physical and vegetative characteristics and streambed materials, and measurements of channel dimensions (bank full width, mean bank full depth, flood prone width). Physical measurements are utilized to assess channel morphology and stability and tentatively classify streams at Rosgen Level II (Rosgen 1994, 1996). The MRWA also includes inventories and observations of the composition, cover, vigor and the amount of recruitment, regeneration and utilization of vegetative species within the riparian zone. The data gathered were used by the IDT in conjunction with the PFC assessment process to ascertain riparian health and trends on a reach by reach basis.

Riparian coverboards, greenline transects, cumulative width/depth transects, woody browse transects, and Rosgen Methodology monitoring were also used to measure various riparian attributes in the CW. Riparian coverboards were established in the CW in the 1980’s. Coverboard data measures relative change in canopy cover of woody species in the riparian zone. Greenline transects are also used to measure changes in the relative abundance of different plant community types in the riparian area. Greenline data track changes in vegetative

composition and cover within the narrow green vegetation ribbon adjacent to the channel. Cumulative width/depth is used to monitor changes in stream geometry. Woody browse, short for woody browse regeneration, is used to monitor age classes and recruitment of deciduous woody shrubs. Rosgen monitoring, similar to cumulative width/depth, is conducted to track changes in channel morphology. Photographs are also taken at the various monitoring sites to record current conditions and relative changes over time. All the monitoring data used to aid the IDT in its assessment are included in the CW project file and are available for review at the Dillon Field Office.

The Montana Natural Heritage Program was contracted to complete a wetland assessment of a several identified wetlands in the Centennial Watershed. This assessment was completed and published in 2009 (MNHP 2009.) The assessment was reviewed during the spring of 2014 and relevant information was used to inform the ID Team and to develop priorities for the CW.

To avoid duplication of effort, the Bureau of Land Management relies on the United States Fish and Wildlife Service for wetland inventory and mapping via the National Wetlands Inventory (NWI). The NWI has not been completed in Montana. Some wetland mapping work was done in the Centennial Valley in the 1980s and the United States Fish and Wildlife Service published Draft maps which have subsequently been digitized. The State of Montana established the Montana Wetland and Riparian Mapping Center in 2007 and has begun a mapping program. Some quadrangles have provisional mapping. Since many parts of Montana were never mapped, wetland mapping in the Centennial Valley will not be complete for some years. The 1980s Draft NWI mapping is the best available data and was used by the ID Team.

There are 163 lotic stream reaches comprising 139 miles of streams on BLM administered lands. The ID Team met during the spring of 2014 to prioritize which stream reaches they would walk during the field portion of the watershed assessment. It was determined by the ID Team that it was not practical or necessary to walk all of the reaches, especially those for which the 2013 MRWA inventory/monitoring and/or quantitative data showed they were in good to excellent condition. Field maps were prepared and provided to members of the ID Team which included GIS layers for the Draft National Wetlands Inventory wetlands, Montana Natural Heritage assessment sampling locations (MNHP 2009), BLM Developed Springs, BLM streams (lotic), BLM wetlands (lentic) and other layers. The 2004, where available, and 2013 MRWA scores for all reaches were categorized to help determine which reaches the IDT would walk. It was decided that all reaches that scored 84 out of a potential 100 or less on the MRWA data sheets would be walked by the ID Team. A score of 79 or less is generally considered a Functioning at Risk (FAR) score, according to the MRWA methodology. In addition, reaches that had potential projects, major stream reaches located inside the 2003 Winslow burn, or reaches that provided habitat for sensitive plants, fish and/or wildlife or had other concerns identified by any of the IDT members would be walked regardless of their MRWA scores. It was also decided that the ID Team would walk several reaches that had high (85-95) MRWA scores to determine if the MRWA scores from 2013 were in concert with the Centennial Watershed ID Team PFC methodology score for the reach (i.e. quality control).

During the summer of 2014, the IDT walked 52 of the 163 reaches (50 of 139 stream miles) in the Centennial Watershed. The IDT concentrated on flowing streams (lotic systems), but did look at several wetlands (lentic systems) and springs.



West Fork Price Creek (Lotic reach), Reach 348, in the Price Creek Allotment

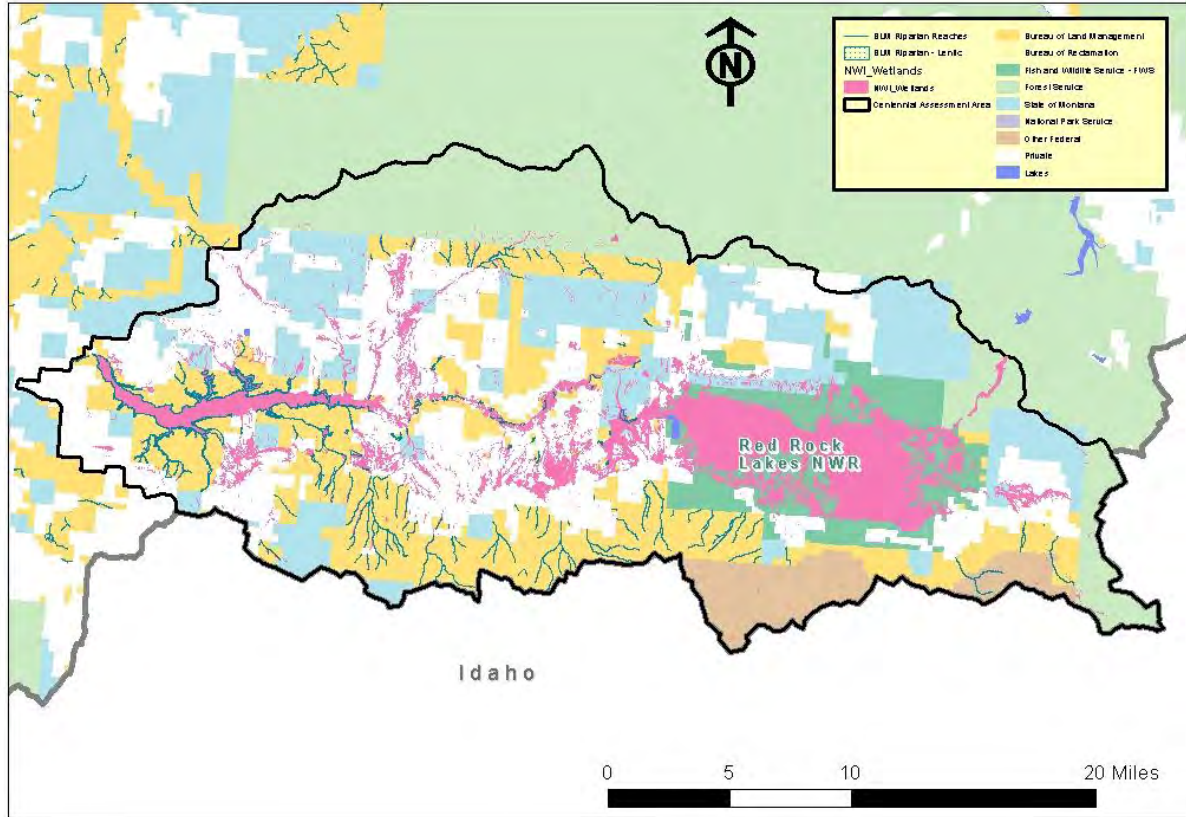


Affected Environment

Red Rock River, Lima Reservoir and Red Rock Lakes are the major surface water features in Centennial Valley. Red Rock River originates at the east end of the valley in Alaska Basin. A dominant hydrologic feature in Centennial Valley is Lima Reservoir formed by the construction of Lima Dam in 1893 (Giles et al 2006). The dam was rehabilitated in 1992. At its mean sea level elevation, 6,581 feet, the reservoir holds 75,180 acre feet at full capacity (USBR 2006). The reservoir floods a portion of the Red Rock River and its historic floodplain. The operation of the dam results in an unstable environment for the establishment of shoreline wetlands. Lima Reservoir is located on public lands pursuant to a right-of-way granted to the Lima Irrigation Company under the Act of March 3, 1891. In 1904, the Irrigation Company received a right-of-way from the Secretary of the Interior for development of a reservoir at the right-of-way site. The right-of-way was not conditioned in any manner. In 1911, the Secretary withdrew 880 acres from the public domain surrounding the right-of-way for possible enlargement of the dam and reservoir. In 1934, the Company received an enlarged right-of-way and promptly constructed a larger dam, thus creating a larger reservoir. Again, the right-of-way was not conditioned. Currently, even though these lands are subject to this existing right-of-way, the BLM is obligated to manage these lands consistent with current regulations and policy as long as the management actions of BLM do not interfere with the use of the right-of-way. The right-of-way includes all public lands from 50' above the high water mark of the reservoir.

High gradient mountain streams flow out of the Centennial Mountains, and as these streams enter the valley bottom their character changes. Often the streams from the Gravelly and the Centennial mountains are diverted for irrigation. The low gradient valley streams and associated floodplains developed in glacial materials and are maintained by sediments transported from the mountain streams. Flows coming out of the Centennial Mountains have large seasonal variations. The largest flows generally occur during spring or early summer because of snow melt and rainstorms.

The Centennial Valley contains vast wetland resources. Red Rock Lakes, which are located within the National Wildlife Refuge, are important to the hydrology of the valley. According to National Wetland Inventory (NWI) data, there are 47,526 acres of wetlands in Centennial Valley. Of those acres, 3,784 acres (8%) occur on public land administered by the BLM.



Map 3- 1980s National Wetland Inventory Wetlands shown in pink across all ownerships

Interpretation of the NWI data coverage in the valley indicates that wetlands are vigorous (intact hydrological functions, representative native plant communities, outstanding wildlife values, and/or rare plant and animal species) where there is sufficient water available. Some examples are the extensive emergent palustrine wetland complexes located in the Curlew and Lima Reservoir Allotments along the north shore just above and east of Lima Dam.

Streams in CW assessment area drain 347,543 acres of Public, Forest Service, State and private land. Of the total, 83,102 acres (24%) are administered by the BLM.

Within the CW there are 26 allotments and several unleased tracts which have stream reaches or wetlands identified within the Dillon Field Office Riparian Database. Table 4 provides a list of the allotments, the streams and wetlands miles of riparian resources. Habitat types for streams coming off the Centennial Mountains are mostly forested types, those flowing south out of the Gravelly mountains are mostly willow and the streams along the valley bottom have sedge or spike rush/foxtail barley habitat types.

Developed Springs

Developed springs within the CW are not included in the Riparian Database and are inventoried and assessed separately. These springs are listed and described in the Findings, Analysis and Recommendations section.

Past Spring Developments

Stockwater has been developed on public lands dating back to the 1930s with the Grazing Service (BLM predecessor). Because Water Rights, water quality and wetlands legislation, which emphasize resource conservation and the implementation of Best Management Practices (BMPs), the BLM evaluates stockwater developments from multiple perspectives. Flow regulation is important to manage the amount of water being used and to protect water rights. Enclosures are frequently constructed around stockwater sources to protect the spring source for both livestock water and resource condition.

Findings and Analysis

The majority of the allotments within the CW were assessed in 2004. Only streams and wetlands were assessed at that time. Developed springs were not inventoried or assessed. New AMPs were developed and implemented as a result of the assessment and 2005 BLM Decision. New AMPs were developed and implemented for eighteen allotments: Antelope Peak, Fish Creek, Long Creek, Munday, Mud Lake, Munday East, Oxbow, Windmill, Passmore, Phalarope East, Monida Hill, Price Creek, Brundage Creek, Saier, Sand Dunes, Brundage Bridge, Tom Creek and Cook Sheep Camp allotments. Some of these allotments were combined to form new or reconfigured allotments. Munday, Mud Lake and Munday East are now Mud Lake; Oxbow and Windmill are now Oxbow; Phalarope East and Monida Hill are now Monida Hill; Tom Creek and Cook Sheep camp are now Tom Creek.

Streams

Stream condition is reported below in Table 4 by allotment for management purposes.

Table 4. Functional status of lotic stream reaches within the Centennial Watershed by Allotment.

Stream Name	Allotment	BLM Reach ID	Functional Rating & Trend	Miles
Red Rock River	7L SGC	1633	PFC	0.6
Red Rock River	Brundage Bridge	357	PFC	0.9
Red Rock River	Brundage Bridge	387	PFC	0.1
Brundage Creek	Brundage Creek	358	FAR	0.2
Brundage Creek	Brundage Creek	359	PFC	0.5
West Creek	Cocanougher Ind	386	PFC	0.3
Red Rock River	Cocanougher Ind	362	PFC	0.4
Hell Roaring Crk	Davis SGC	316	PFC	2.9
Curry Creek trib	Duff Creek	1622	PFC	1.2
Shambo Creek	Duff Creek	1614	PFC	2.3
Duff Creek	Duff Creek	1620	PFC	1.0
Duff Creek trib	Duff Creek	1619	PFC	0.5
Shambow Creek trib	Duff Creek	1616	PFC	1.5

Stream Name	Allotment	BLM Reach ID	Functional Rating & Trend	Miles
Humphry Creek	Duff Creek	1618	PFC	2.4
Matsingale Creek	Duff Creek	1621	PFC	0.4
Metzel Creek	Fish Creek	315	FAR	1.7
Fish Creek	Fish Creek	312	PFC	1.5
Metzel Creek	Fish Creek	314	FAR	1.2
Fish Creek	Fish Creek	313	PFC	0.5
Long Creek trib	Fish Creek	2504	PFC	0.3
Fish Creek trib	Fish Creek	2508	PFC	0.8
Metzel Creek	Fish Creek	2509	PFC	0.3
Lima Reservoir trib	Lima Reservoir AMP	385	FAR Up	0.2
Lima Reservoir trib	Lima Reservoir AMP	382	FAR-Up	1.0
Lima Reservoir trib	Lima Reservoir AMP	383	FAR Up	0.6
Lima Reservoir trib	Lima Reservoir AMP	365	FAR-Up	0.6
Wolverine Creek	Lima Reservoir AMP	364	FAR-Up	0.7
Long Creek	Long Creek AMP	338	PFC	2.6
Long Creek	Long Creek AMP	1604	PFC	0.3
Middle Creek	Long Creek AMP	339	FAR-Up	0.6
West Creek	Long Creek AMP	378	FAR	1.0
Long Creek trib	Long Creek AMP	335	PFC	0.6
Wolverine Crk trib	Long Creek AMP	1600	FAR	0.2
Long Creek trib	Long Creek AMP	336	PFC	0.6
Mohican Crk trib	Long Creek AMP	341	PFC	0.9
Mohican Creek	Long Creek AMP	340	FAR-Up	0.8
Piute Creek	Long Creek AMP	347	PFC	1.1
Crow Creek	Long Creek AMP	309	PFC	1.1
Long Creek trib	Long Creek AMP	334	PFC	0.3
Long Creek trib	Long Creek AMP	1606	PFC	0.5
Long Creek trib	Long Creek AMP	333	PFC	1.0
Long Creek trib	Long Creek AMP	1607	PFC	0.8
Long Creek trib	Long Creek AMP	337	PFC	0.6
Lima Reservoir trib	Monida Hill	322	PFC	0.9
Lima Reservoir trib	Monida Hill	331	PFC	0.4
Corral Creek trib	Morton Individual	1608	FAR-Dn	0.1
Corral Creek, EF	Morton Individual	303	PFC	0.6
Red Rock River	Oxbow	368	FAR-Up	0.3
Red Rock River	Oxbow	361	PFC	1.7
Red Rock River	Oxbow	389	PFC	0.3
Red Rock River	Oxbow	390	FAR-Up	0.5
Red Rock River	Oxbow	363	PFC	0.5
Red Rock River	Oxbow	391	PFC	1.5
Red Rock River	Oxbow	392	FAR-Up	0.8

Stream Name	Allotment	BLM Reach ID	Functional Rating & Trend	Miles
Red Rock River	Oxbow	393	FAR-Up	0.2
Red Rock River	Oxbow	394	FAR-Up	1.3
Peet Creek	Oxbow	1658	FAR-Up	0.3
Bean Creek trib	Passmore	320	PFC	0.4
Peet Creek	Peet Creek	346	PFC	0.9
Peet Creek	Peet Creek	343	PFC	0.6
Peet Creek, EF	Peet Creek	1652	PFC	0.2
Peet Creek, EF	Peet Creek	1653	FAR	0.7
Peet Creek trib	Peet Creek	344	PFC	0.9
Peet Creek, EF	Peet Creek	1654	PFC	1.2
Peet Creek	Peet Creek	345	PFC	0.7
Peet Creek	Peet Creek	1655	PFC	0.8
Peet Creek trib	Peet Creek	1656	PFC	0.9
Peet Creek trib	Peet Creek	1657	PFC	1.9
Bean Creek, WF	Peet Creek	1649	PFC	0.6
Peet Creek, WF	Price Creek	1662	PFC	0.2
Sand Creek trib	Price Creek	373	PFC	0.5
Corral Creek EF	Price Creek	306	FAR-Up	0.3
Price Creek	Price Creek	1674	PFC	1.1
Price Creek, WF	Price Creek	350	PFC	1.1
Peet Creek, WF	Price Creek	1665	FAR-Up	0.8
Sand Creek trib	Price Creek	371	FAR-Up	1.1
Sand Creek	Price Creek	370	FAR-Up	1.5
Sand Creek	Price Creek	1683	FAR-Up	0.4
Price Creek trib	Price Creek	1675	PFC	0.6
Corral Crk, WF trib	Price Creek	308	PFC	0.2
Price Creek, EF	Price Creek	355	PFC	1.0
Price Creek, EF trib	Price Creek	1668	PFC	0.9
Price Creek, EF trib	Price Creek	1667	PFC	0.1
Price Creek, EF	Price Creek	353	PFC	1.1
Price Creek, EF trib	Price Creek	1669	PFC	1.5
Price Creek	Price Creek	354	PFC	1.3
Price Creek trib	Price Creek	1671	PFC	0.6
Price Creek	Price Creek	356	PFC	0.9
Sand Creek	Price Creek	367	FAR-Up	1.7
Price Creek	Price Creek	1681	PFC	1.1
Sand Creek	Price Creek	1693	FAR-Up	0.6
Sand Creek	Price Creek	1686	FAR-Up	0.6
Sand Creek	Price Creek	368	FAR-Up	1.4
Sand Creek	Price Creek	1688	FAR-Up	0.4
Sand Creek	Price Creek	369	FAR-Up	0.5

Stream Name	Allotment	BLM Reach ID	Functional Rating & Trend	Miles
Sand Creek trib	Price Creek	1685	FAR-Up	0.4
Sand Creek trib	Price Creek	372	PFC	0.8
Sand Crk, WF trib	Price Creek	376	PFC	0.7
Sand Creek, WF	Price Creek	374	FAR-Up	1.2
Sand Creek, trib	Price Creek	375	PFC	0.4
Corral Creek, EF	Price Creek	305	PFC	1.0
Peet Creek, springbrook	Price Creek	1659	FAR-Up	1.2
Price Creek	Price Creek	352	PFC	0.9
Peet Creek, WF	Price Creek	1664	PFC	1.5
Price Creek trib	Price Creek	1676	PFC	1.1
Peet Creek, WF	Price Creek	1660	FAR-Up	1.6
Price Creek, WF	Price Creek	351	PFC	0.4
Price Creek, WF	Price Creek	1677	PFC	1.2
Peet Creek, WF	Price Creek	1661	FAR-Up	0.5
Price Crk, WF trib	Price Creek	1678	PFC	0.3
Peet Creek, WF	Price Creek	1662	FAR-Up	1.1
Corral Crk, WF trib	Price Creek	1695	PFC	0.2
Price Creek, WF	Price Creek	348	PFC	0.8
Price Creek, WF	Price Creek	1679	PFC	0.5
Price Creek, WF	Price Creek	1672	PFC	0.7
Price Creek, EF trib	Price Creek	1670	PFC	0.4
Corral Creek, WF	Price Creek	307	PFC	1.2
Price Creek WF	Price Creek	349	PFC	0.4
Red Rock River	Red Rock	380	FAR	0.9
Curry Creek	Shambo Unit	1625	FAR-Up	0.7
Curry Creek trib	Shambo Unit	310	PFC	2.3
Red Rock River trib	Shambo Unit	1628	PFC	0.2
Bean Creek, EF	Shambo Unit	302	PFC	1.5
Winslow Creek	Shambo Unit	349	PFC	1.5
Winslow Creek	Shambo Unit	1634	FAR-Up	0.7
Jones Creek	Shambo Unit	1638	PFC	1.5
Winslow Creek trib	Shambo Unit	1635	FAR-Up	2.3
Curry Creek	Shambo Unit	311	PFC	0.1
Bear Creek	Shambo Unit	1645	PFC	0.3
Curry Creek trib	Shambo Unit	1627	FAR-Up	1.1
Jones Creek trib	Shambo Unit	319	PFC	0.6
Jones Creek trib	Shambo Unit	1637	PFC	0.2
Jones Creek trib	Shambo Unit	318	PFC	1.0
Jones Creek	Shambo Unit	317	PFC	0.4
Bean Creek	Shambo Unit	300	PFC	0.6

Stream Name	Allotment	BLM Reach ID	Functional Rating & Trend	Miles
Tipton Creek	Shambo Unit	395	FAR-Up	1.4
Curry Creek	Shambo Unit	1626	FAR-Up	1.6
Jones Creek trib	Shambo Unit	321	PFC	1.2
Winslow Creek	Shambo Unit	1636	PFC	0.6
Bean Crk, WF trib	Shambo Unit	1651	FAR	1.0
Jones Creek trib	Shambo Unit	1639	PFC	1.5
Jones Creek trib	Shambo Unit	1640	PFC	1.2
Jones Creek	Shambo Unit	1641	PFC	1.1
Jones Creek trib	Shambo Unit	1642	PFC	1.6
Jones Creek	Shambo Unit	2502	PFC	0.6
Bear Creek	Shambo Unit	2505	PFC	0.4
Bear Creek	Shambo Unit	1647	PFC	0.3
Bean Creek, WF	Shambo Unit	301	PFC	0.7
Curry Creek trib	Shambo Unit	1623	PFC	0.9
Lima Reservoir trib	Shineberger	384	PFC	0.8
Tom Creek	Tom Creek	377	PFC	1.2
Corral Creek	Tom Creek	304	PFC	0.8
Tom Creek	Unallotted	1609	PFC	1.5
Tom Creek	Unallotted	1610	PFC	1.4
Red Rock River trib	Unallotted	1629	PFC	0.3
Lima Reservoir trib	Unallotted	1696	PFC ¹	0.4
Odell trib	Unallotted	1611	PFC	1.5
Odell trib	Unallotted	1612	PFC	1.2
Shambo trib	Unallotted	1615	PFC	1.4
Odell trib	Unallotted	1613	PFC	0.5
Shambo trib	Unallotted	342	PFC	0.9
Peet Creek, WF trib	Unallotted	1666	FAR-Up	0.1
Price Ditch	Unallotted	1680	FAR-Up	0.2



Odell Creek in the Davis SGC Allotment, September 2014

Streams

Reaches are discussed in more detail by allotment in the following paragraphs. Additional data for any of the riparian/wetland areas in the CW are available at the Dillon Field Office.

7L SGC Allotment– The allotment is small (340 acres) consisting of four isolated parcels of land. Two of the parcels have wet meadow complexes. One parcel has Blake Pond and the final tract has about 0.5 mile of Red Rock River. All resources were rated PFC (See tables 4 and 5).

Antelope Peak Allotment - There is one lentic reach (#1750) on the west side of the allotment that is about 0.2 mile long. It was rated as FAR by the ID team due to pugging and hummocking of the wetland area. There was also exposed bare ground and excessive trailing in the wetland area.

Bean Place Allotment- This allotment has one wetland complex that was rated PFC.



Lentic Reach in the Antelope Peak Allotment, FAR static Rating

Brundage Bridge Allotment – Two portions of the Red Rock River totaling about a mile flow through this allotment. Both stream reaches were rated as PFC.

Brundage Creek Allotment – Two small portions of Brundage Creek totaling about 0.6 mile flow through this allotment. Reach 359 is about 0.5 miles and was rated PFC. Reach 358 is a short reach about 0.2 mile and was rated as FAR. The reach has some historic hummocking and exposed bare ground which led to its FAR rating.

Cocanougher Individual Allotment – The allotment is a smaller allotment but has both lentic and lotic resources. Portions of West Creek, Red Rock River tributary (lentic) and the Red Rock River all flow this allotment and were all rated PFC.

Curlew Allotment - The curlew allotment has two distinct parcels that make-up the allotment. The northern parcel is all uplands but the southern parcel borders Lima reservoir and this parcel has two lentic reaches that were rated PFC.

Davis SGC Common Allotment – This allotment is near the eastern boundary of the watershed. It has one reach called Hell Roaring Creek, which is 2.9 miles long and was rated PFC (See picture below).



BLM Watershed Assessment ID Team walking Hell Roaring Creek, July 2014

Duff Creek Allotment –Duff Creek is located just south of the Red Rock Refuge. It has seven different stream reaches which include; Duff, Shambo, Humphry and Matsingale Creek. The stream reaches total about 9 miles and all reaches were PFC.

Fish Creek Allotment – There are seven reaches and six miles of stream in Fish Creek allotment. Specific streams in the allotment are portions of Fish Creek, Long Creek and Metzel Creek. Five of the reaches totaling about three miles and were rated as PFC. Two portions of Metzel Creek (reach 315 and 314) were rated as FAR. Both of the Metzel Creek FAR reaches had some bank shearing and over-widening of the creek (See picture below).



Reach 315, Metzel Creek, Fish Creek Allotment, FAR Rating

Jone SGC Allotment- This allotment has one small lentic reach that was rated PFC.

Lima Reservoir Allotment – The Lima Reservoir allotment surrounds most of Lima Reservoir. There are five separate stream reaches on this allotment totaling about three miles. All five reaches were rated as FAR with an upward trend. The FAR ratings were mostly due to historic impacts and improvements since the 2004 watershed assessment were noted. Lima reservoir contains three lentic systems. One lentic reach (1712) was rated PFC while two lentic reaches (1710 and 1711) were rated FAR-Up.

Long Creek AMP Allotment – This allotment has sixteen distinct reaches which include portions of Long, Middle, West, Wolverine, Mohican, Piute and Crow Creek. Twelve of the reaches totaling about 10 miles were rated as PFC. Two reaches, 339 and 340 were rated as FAR-Up. Two additional reaches, Long Creek #378 and a portion of Wolverine Creek #1600 were rated as FAR. Both Wolverine Creek and Long Creek were over-widened with exposed banks in places.

Mata-stib SGC Allotment – This small allotment has one short lentic reach and it was rated as PFC.

Monida Hill Allotment – This low lying allotment borders Lima Reservoir on the south side of the reservoir and contains two lotic reaches (322 and 331) and several lentic systems which are discussed in more detail in table Z. The two lotic reaches rated PFC.

Morton Individual SGC Allotment – There are two separate reaches on this small allotment. One reach, 303, is about 0.6 miles long and was rated as PFC. The second reach, 1608, called

Corral Creek tributary was 0.1 miles long. This reach was rated as FAR due to trampling of stream banks, loss of deep binding root vegetation to grazing and over-widening of the stream.

Mud Lake Allotment –There are three lentic reaches in this allotment. One reach along Corral Creek was rated as PFC. Two other reaches (1694 and 1719) were rated as FAR-Up due to some over-widening of the channel and occasional exposed banks.

Oxbow Allotment – The Oxbow allotment has ten separate lotic stream reaches and one lentic reach in the allotment. These stream reaches are portions of the Red Rock River and Peet Creek. Four of the reaches on the Oxbow River were rated as PFC. The remaining six reaches on the Oxbow river and Peet Creek were rated as FAR with an upward trend. The five reaches on the Oxbow river have some trailing along the banks that may be causing a slight increase in channel movement along the outside of the oxbows. The ID Team noted improvements in willow regeneration and stream bank vegetation since the 2004 watershed assessment on the Red Rock River. The reach on Peet Creek showed some impacts to stream banks in a few isolated areas but improvement since 2004 were evident. The single lentic reach was rated PFC.

Passmore Allotment – The Passmore allotment has one 0.8 mile lotic reach and one lentic system on it. This lotic reach was rated as Non-functional during the 2004 Centennial Watershed assessment. However, the improvement on this reach was phenomenal (See pictures below). All banks were revegetated and the channel was much narrower and deeper. It was rated as FAR with a strong upward trend. The lentic reach was rated PFC.



Jones Creek Comparisons from 1999 and 2014, Passmore Allotment

Peet Creek Allotment –There are twelve reaches on the Peet Creek allotment. Ten of the reaches on both Peet and Bean Creek were rated as PFC. One reach, 320, on Jones Creek was rated as FAR with an upward trend. One reach, 1653, on the East Fork of Peet Creek was rated

as FAR. This reach was over-widened in accessible areas and had some bank shearing due to livestock trailing.

Price Creek Allotment – This allotment has a large number of stream reaches (53). Of these 53 reaches, 49 are lotic and 4 are lentic. This allotment has segments of Corral, Peet and Price Creek all totaling about 40 miles of streams. The majority of lotic reaches (32) and miles (25 miles) of stream were rated as PFC. There were 17 lotic reaches totaling about 14 miles that were rated as FAR with an upward trend. In general, the reaches that were rated FAR with an upward trend have some bank impacts on wildlife and livestock crossings and some over-widening or bank shearing in isolated areas. The portion of the Price Creek Allotment North of the Centennial Valley Road is broad and flat with numerous wetland resources discussed in the section on wetlands. The four lentic systems were rated PFC.

Red Rock Allotment – This small allotment has about 1 mile of the Red Rock River, just below Lima Reservoir Dam, flowing through it. It was rated FAR by the ID Team. The reach has impacts along the banks of the Red Rock River and noxious and invasive weeds were found along the banks. In addition, the wide fluctuation of water flow coming out of Lima dam leaves the banks unstable.

Ritchie Allotment- This allotment has one lentic complex that was rated as FAR-Up. It has some historic hummocking that was well vegetated.

Rody Allotment- This allotment has one lentic reach on it that was rated PFC.

Shambo Units Allotment –The Shambo allotment is a large allotment found along the Continental Divide up to the Idaho border. It has 30 different riparian reaches totaling about 29 miles of streams. Portions of streams found in the allotment include Bean, Bear, Curry, Jones, Tipton and Winslow Creek and their tributaries. Most of the reaches (23) were rated PFC by the ID Team.



Curry Creek, in Shambo Allotment, July 2014

Six reaches (1625, 1634, 1635, 1627, 395 and 1626) were rated as FAR with an upward trend. All of these reaches are located inside the boundary of the Winslow wildfire of 2003 and still recovering from the burn event. One reach, 1651, was rated as FAR by the ID Team. This reach has a large slump caused by natural slumping of the parental material in the area but does have some overwidening of the channel and bank impacts.

Shineberger Allotment – This allotment has one reach about one mile long. The ID Team rated this reach PFC.

Tom Creek Allotment – This allotment includes portions of Corral and Tom Creek. The total length of stream reaches is about 2.6 miles. The ID Team rates all three reaches as PFC.



Tom Creek, July 2014

Unallotted – There are 11 lotic and one lentic reaches in BLM tracts of land that are unallotted to livestock grazing. Ten of the lotic reaches were rated as PFC as was the one lentic reach. One lotic reach, Price Ditch, was rated as FAR-Up.

Table 5. Functional status of lentic reaches within the Centennial Watershed by Allotment

Allotment	BLM Reach ID	Functional Rating & Trend
Mata-Stib SGC	1724	PFC
7L SGC	1632	PFC
7L SGC	1630	PFC
Bean Place	1631	PFC
Passmore	1643	PFC
Oxbow	1644	PFC
Brundage Bridge	360	PFC
Antelope Peak	1750	FAR
Jones SGC	1648	PFC
Mud Lake	1687	PFC
Mud Lake	1694	FAR-Up
Mud Lake	1719	FAR-Up
Price Creek	1691	PFC

Allotment	BLM Reach ID	Functional Rating & Trend
Price Creek	1690	PFC
Price Creek	1689	PFC
Price Creek	1721	PFC
Price Creek	1980	FAR-Up
Lima Reservoir AMP	1710	FAR-Up
Lima Reservoir AMP	1711	FAR-Up
Lima Reservoir AMP	1712	PFC
Monida Hill	323	FAR-Up
Monida Hill	1701	FAR-Up
Monida Hill	329	FAR-Up
Monida Hill	332	FAR-Up
Monida Hill	330	FAR-Up
Monida Hill	1705	FAR-Up
Monida Hill	1698	PFC
Monida Hill	328	PFC
Monida Hill	331	PFC
Monida Hill	327	PFC
Monida Hill	326	PFC
Monida Hill	325	PFC
Monida Hill	322	PFC
Monida Hill	1699	PFC
Monida Hill	324	PFC
Monida Hill	1697	PFC
Cocanougher Ind.	1663	PFC
Ritchie	1692	FAR-Up
Curlew	381	PFC
Curlew	1713	PFC
Rody Ind.	1720	PFC
Unallotted	1696	PFC

Wetlands

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands in the Centennial Valley are unique in that they are affected by the high desert climate. Ralph Tiner (Tiner 1999) describes these wetlands as cyclic wetlands. These are wetlands whose vegetation and hydrology vary greatly over time due to wide variations in annual water availability. During periods of drought, evaporation demands exceed annual precipitation and upland plants begin to dominate. In wet periods hydrophytic vegetation returns and soils take on hydric characteristics once again. Cyclic wetlands are most often found in the Cocanougher Individual, Lima Reservoir AMP, Mata-Stib, Monida Hill, Mud Lake and Price Creek Allotments. A combination of upland and lentic methodologies was used to evaluate these resources. Use of upland methods

to assess wetlands is becoming accepted in the literature (Maskini, M. and H. Hongo 2012). With few exceptions, these wetlands were found to be in Proper Functioning Condition.

Developed Springs

There are stockwater developments in four allotments in the CW. Price Creek allotment has a total of six developments (Beb Willow, Columbine, Price Peet, Quakie Patch, Sand Creek and Tree Frog). Brundage East is located in Brundage Creek Allotment. Metzel Spring, located in Fish Creek Allotment, and Middle Pasture Spring, located in Monida Hill Allotment are the most recently developed stockwater developments. The wetland resources at the springs are in good condition. Flow rates, when and where it was possible to obtain measurements, varied from marginal flows (0.5 gallon per minute) to substantial flows (10 gallons per minute). Enclosures, where they existed, were generally in good condition. The stock water developments ranged from poor to good in terms of BMP effectiveness.

Recommendations

1. Revise livestock management in the following allotments, pastures or site specific areas to mitigate impacts to riparian/wetland habitat: Morton Individual, Antelope Peak, Fish Creek AMP, Long Creek AMP (West pasture), Peet Creek (Upper pasture) and Red Rock. Consider changes in timing, duration, frequency and/or intensity of use as well as number and/or kind of livestock. Incorporation of rest, and where applicable extended rest, into a grazing systems as well as structural projects should be considered to mitigate resource concerns.
2. Consider livestock management revisions to mitigate impacts on the lower reach of Jones Creek, Shambo allotment.
3. Add flow regulation to unregulated stockwater developments as necessary. Repair and maintain infrastructure including enclosures, pipelines and plumbing as needed. Abandon developments with insufficient flow.
4. Add monitoring of cyclic wetlands to the Centennial Watershed monitoring plan.

Water Quality

Western Montana Standard #3: “Water quality meets State standards.”

Procedure to determine conformance with Standard

The Montana Department of Environmental Quality (DEQ), Water Quality Planning Bureau, Watershed Protection Section provides guidance on assessing water quality in relation to non-point source (NPS) water pollution. Montana’s NPS Agricultural Strategy for Pasture and Range Lands supports the BLM’s use of PFC for assessment of streams and wetlands (MTDEQ2007). The BLM’s 2010 “Memorandum of Understanding Regarding Water Quality Management on Bureau of Land Management (Administered) Lands in Montana Between the Montana Department of Environmental Quality and the United States Department of the Interior Bureau of Land Management” documents the BLM’s strategy for managing and controlling NPS water pollution from BLM managed lands and authorizations (USDI 2010). The goal of this strategy is discussed in detail in a paper titled ‘Using watershed function as the leading indicator for water quality’ (Aron et al 2013). There is growing recognition that the objective of the Clean Water Act to ‘restore and maintain the chemical, physical and biological integrity of the nation’s

waters' is not being fully achieved (USEPA, 2012). The BLM's watershed approach of assessing land health, also known as ecosystem function, can help address this concern because uplands, wetlands, riparian areas and biodiversity are addressed. The PFC methodology can be a leading (early) indicator to guide adaptive management as opposed to traditional water quality monitoring which is seen as a lagging indicator. As part of the MOU, the BLM reports to DEQ actions taken to address NPS water pollution as well as effectiveness of Best Management Practices (BMPs). Water Quality Monitoring is conducted on Public Land by Montana DEQ as part of their responsibilities under the Clean Water Act. Additionally, as discussed in the Aron et al (2013) paper, the BLM has entered into a cooperative water quality monitoring agreement shifting some of the workload to Montana DEQ and freeing the BLM to focus more attention to watershed function. The Montana-Dakotas BLM, through a Memorandum of Understanding, works with the State of Montana to control non-point water pollution. The guiding documents are used to direct management and to describe the affected environment are the Montana Nonpoint Source Management Plans (NSMP) which are updated every 5 years (MT DEQ 2007, 2012) and the Montana Water Quality Integrated Reports (WQIR), which are submitted to EPA every 2 years, with the most recent report submitted in 2014 (MT DEQ 2014).

In conducting land health assessments, the BLM evaluates uplands (grasslands, sagebrush /shrub/steppe), wetlands and riparian areas, and forested areas. Uplands are evaluated for land cover (ability of plants, rocks, and litter to protect soil from erosion, promote infiltration and reduce runoff) and soil condition. Riparian vegetation, streams and their associated channels and floodplains are evaluated through the PFC process. Channel morphology, width and depth, bed materials, riffle pool ratios, condition of stream banks and riparian vegetation provide information used to assess stream function, riffle stability, shear stress and sediment loads. The presence of livestock, amount of animal waste, trampling and trailing are noted, since sediment and bacteria from animal waste can be concerns related to water quality. Wetlands are assessed to determine their condition and ability to recharge ground water filter sediments and mitigate flooding. Forest Health is evaluated as part of the assessments as is susceptibility to wildfire. Wells, pipelines and spring developments are recognized as BMPs and are evaluated to determine effectiveness. The assessment team also looks for evidence of current and historic mining, abandoned and/or historic beaver dams, erosion from roads, and concentrated livestock waste.

Affected Environment

The 1987 Amendments to the Clean Water Act require states to develop plans for controlling NPS water pollution. Montana has divided the state into water quality planning areas. The Centennial Watershed is located in the Upper Missouri Basin within the Red Rock TMDL Planning Area (TPA). The Centennial Watershed Assessment Area does not follow all watershed divides. Because of this, some TMDL limited waters are evaluated in other watershed assessments. Clover Creek is an example of this. Montana DEQ has not developed TMDLs or Water Quality Restoration Plans for the Red Rock TPA, however a major effort is expected to get underway within the next several years (Personal Communication Dean Yashan, October 3, 2014). The 2014 WQIR, referenced above, was used to assist in the development of the affected environment section. The WQIR is a statewide document and does not provide specific detail regarding the Centennial Valley. It is useful in its description of water quality issues and concerns, many of which have direct application in the assessment area. Water pollution results

from a wide array of sources. The focus of this section is NPS. NPS pollution is directly related to land use. Some statewide land uses which also occur in the Centennial Valley include agriculture, atmospheric deposition, hydrologic modification, irrigation, mining, recreation, silviculture, transportation including bridge construction and culvert installation.

Nearly a third of the Centennial Valley is forested. Grasslands, sagebrush/shrub/steppe, riparian/mesic shrubs make up most of the remainder. Open water accounts for approximately 4% of the valley.

Findings and Analysis

Since the Dillon Field Office of the BLM does not have a water quality sampling program, the WQIR is useful to paint a broad picture of statewide water quality and impairment. As in years past, the 2014 WQIR lists the top causes and sources of water quality impairment of lakes and streams.

Beginning with streams, for the 2014 WQIR reporting period, the most common causes of impairment include sediment, nutrients, and metals-related pollutants and habitat or stream flow-related pollution listings. Grazing in riparian or shoreline zones is the most common confirmed source associated with impairments. Other confirmed common sources include irrigated crop production, road-related issues, water management, mines and mining-related issues, silviculture, channelization, and natural sources.



Breneman Lake, Shambo Grazing Allotment, Centennial Watershed July 2014

NPS water pollution affects water quality regardless of whether the stream is on the 303d list of streams requiring TMDLs. It should be noted that NPS water pollution needs to be addressed for

waters of the state regardless of whether they are meeting or not meeting water quality standards and regardless of whether they have been evaluated. The BLM recognizes that non-degradation rules apply to waters that meet state standards. Many of the streams within the CW are tributary streams and are not listed.

The 2014 WQIR indicates that the most common causes of impairment to lakes statewide are phosphorus (pollutant), other flow regime alterations (pollution), and salinity (pollutant). The remaining top 10 causes include sediment, nutrients, and metals-related pollutant listings. Eight impairment sources were identified, these include agricultural, point-source/urban, and climate-related sources (atmospheric deposition).

Montana's Clean Water Act Information Center (CWAIC) website was accessed in November of 2014. The CWAIC website contains Summary and Assessment Reports for impaired lakes and streams. The Summary Report was utilized to obtain the information provided in the following table. The CWAIC Assessment Report provides more detailed information and is available at the CWAIC website (<http://deq.mt.gov/wqinfo/CWAIC/default.mcp>).

Table 6: Montana DEQ 2014 303-d listed streams within the Centennial Watershed.

Name	Beneficial Uses	Probable Sources of Impairment	Probable Causes of Impairment
Bean Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Channelization, flow alterations from water diversions, grazing in riparian or shoreline zones	Alteration in streamside or littoral vegetative covers, low flow alterations
Corral Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ¹	Grazing in riparian or shoreline zones, unspecified unpaved road or trail	Alteration in streamside or littoral vegetative covers, phosphorous (total)
East Fork Clover Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Grazing in riparian or shoreline zones	Alteration in streamside or littoral vegetative covers, phosphorous (total), sedimentation and siltation
Fish Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Grazing in riparian or shoreline zones, unspecified unpaved road or trail	Alteration in streamside or littoral vegetative covers, chlorophyll a sedimentation and siltation
Hell Roaring Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ¹	Grazing in riparian or shoreline zones	Alteration in streamside or littoral vegetative covers
Jones Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Grazing in riparian or shoreline zones, irrigated crop production	Alteration in streamside or littoral vegetative covers, excess algal growth
Long Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Grazing in riparian or shoreline zones, irrigated crop production, unspecified unpaved road or trail	Alteration in streamside or littoral vegetative covers, other low flow regime alterations, sedimentation and siltation
Odell Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Agriculture, grazing in riparian or shorelines zones, loss of riparian habitat	Alteration in streamside or littoral vegetative covers, turbidity
Peet Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Animal feeding operations (NPS), grazing in riparian or shoreline zones, irrigation crop production	Alteration in streamside or littoral vegetative covers, nitrogen (total), other low flow alterations, phosphorous (total), sedimentation and siltation

Name	Beneficial Uses	Probable Sources of Impairment	Probable Causes of Impairment
Price Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Flow alterations from water diversions, grazing in riparian or shoreline zones	Alteration in streamside or littoral vegetative covers, other low flow regime alterations, sedimentation and siltation
Red Rock Creek	Aquatic Life ³ , Agriculture ⁴ , Drinking Water ⁴ , Recreation ⁴	Agriculture, grazing in riparian or shorelines zones, loss of riparian habitat	Alteration in streamside or littoral vegetative covers, turbidity
RR River Lower RR Lake to Lima Dam	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ¹	Grazing in riparian or shoreline zones,	Alteration in streamside or littoral vegetative covers, nitrogen (total), phosphorous (total), sedimentation and siltation, temperature (water)
R River Lima Dam to CC Res	Aquatic Life ³ , Agriculture ¹ , Drinking Water ³ , Recreation ³	Grazing in riparian or shoreline zones, impacts from abandoned mine lands (inactive), impacts from hydro-structure flow, regulation modification, irrigated crop production, loss of riparian habitat	Alteration in streamside or littoral vegetative covers, low flow alterations, physical substrate habitat alterations, sedimentation, siltation, temperature (water), zinc
Tom Creek	Aquatic Life ³ , Agriculture ¹ , Drinking Water ¹ , Recreation ³	Grazing in riparian or shoreline zones, irrigated crop production	Alteration in streamside or littoral vegetative covers, low flow alterations, sedimentation and siltation

¹ Fully Supporting, ² Partially Supporting, ³ Not Supporting, Not Assessed ⁴

Section 319 of the Clean Water Act addresses non-point source pollution through the application of Best Management Practices (BMPs). BMPs are used across all programs including Forestry and Fuels, Minerals, Range Management and Realty. In addition to structural BMPs, NPS pollution associated with grazing is addressed by designing Allotment Management Plans (AMPs) to reduce livestock impacts. The BLM uses AMPs developed to improve riparian and upland conditions as an effective BMP to improve water quality. Western Montana Guideline #10 states “Livestock management should utilize BMPs for livestock grazing that meet or exceed those approved by the State of Montana in order to maintain, restore or enhance water quality.”

Some of the BLM’s responsibilities under the 1987 amendments of the Clean Water Act include evaluation of BMP effectiveness. To determine the effectiveness of Allotment Management Plans, the 2004 and 2014 Centennial Assessment Reports were compared. New AMPs were developed and approved as a result of the 2004 Centennial Watershed Assessment and the 2005 Decision. New AMPs were developed and approved for eighteen allotments: Antelope Peak, Fish Creek, Long Creek, Munday, Mud Lake, Munday East, Oxbow, Windmill, Passmore, Phalarope East, Monida Hill, Price Creek, Brundage Creek, Saier, Sand Dunes, Brundage Bridge, Tom Creek and Cook Sheep Camp allotments. Some of these allotments were combined to form new or reconfigured allotments. In addition to AMPs, structural BMPs, such as offsite waters, were also authorized and installed. These BMPs have been effective in reducing impacts of livestock grazing in uplands, streams and wetlands.

In recent years, the BLM has been evaluating stockwater developments for their role as BMPs. When the developments and their associated troughs are strategically located, they may be capable of functioning as BMPs. There are nine stockwater developments whose sources are wetlands in the Centennial watershed. These were evaluated for BMP effectiveness. The evaluation involves assessing the impact of the development on the source, the infrastructure and maintenance. The evaluation determines the water flow, if the trough is regulated by a float and where the trough or troughs are located. The stockwater developments are described in detail in the riparian wetland section of this report. Generally speaking, the wetlands that are the basis for the developments are in good condition. Flow regulation, sufficient flow and maintenance can be concerns for developments.

The Dillon Field Office of the BLM has a history of working with watershed groups, however none currently exist for the Centennial portion of the Red Rock TMDL Planning area. Should a group develop, the BLM will coordinate and serve as a technical representative as requested.

As mentioned above, the Red Rock Planning Area was not included in the 2014 DEQ TMDL Completion Schedule. The Beaverhead Watershed Sediment TMDL has been completed and DEQ's recommendations in preparing a framework for a water quality restoration plans are likely pertinent to the Red Rock and Centennial Watersheds. They are listed below.

- Improve ground protection in disturbed areas on small acreages, develop and implement grazing management plans, reduce the amount of erodible soil and runoff rate from agricultural lands
- Improve and restore streamside vegetation to provide shade, filter sediment, and stabilize eroding stream banks and floodplains
- Install all appropriate BMPs to road and road crossing networks and maintain & upgrade culverts to reduce the risk of failure in large events.

Recommendations

1. Continue working with Montana DEQ and local Watershed Committees as applicable in the development and implementation of water quality restoration plans.
2. Revise Allotment Management Plans to address water quality concerns for the Fish Creek, Morton Individual, Red Rock, Antelope Peak and Long Creek AMP Allotments.
3. Continue BMP implementation and effectiveness monitoring to address NPS pollution.
4. Continue to share watershed assessment findings with DEQ.
5. Continue implementation of Water Quality MOU (BLM-MOU-MT923-1030) between Montana DEQ and BLM, including submission of biannual reports.
6. Initiate management recommendations in the Uplands, Riparian and other sections of this document to improve resource conditions in specified allotments and specific areas will also help improve water quality.
7. Add flow regulation to stockwater developments which are unregulated. Repair and maintain infrastructure including exclosures, pipelines and plumbing as needed. Abandon developments with insufficient flow.

Air Quality

Western Montana Standard #4: *“Air quality meets State standards.”*

Procedure to determine conformance with Standard

The Clean Air Act (CAA) of 1990, as amended (42 U.S.C. 7401 et seq), and Executive Order 12088 require the BLM to work with appropriate agencies to protect air quality, maintain Federal and State designated air quality standards, and abide by the requirements of State Implementation Plans.

The EPA delegated the authority to implement the provisions of the CAA to the State of Montana. Determination of compliance with air quality standards is the responsibility of the State of Montana. To address the issue of wildland fire, the EPA developed the 1998 Interim Air Quality Policy for Wildland and Prescribed Fires which required states to develop smoke management plans. Montana and Idaho responded by forming the Montana/Idaho Airshed Group and by developing the Montana/Idaho Smoke Management Program.

Affected Environment

The United States Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) that limit air pollutant concentrations of six principal pollutants (particulate matter, sulfur dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead). The EPA also regulates additional pollutants such as hazardous air pollutants and greenhouse gases (GHGs), although these pollutants have no regulatory thresholds for ambient concentrations. Emissions of GHGs, including primarily carbon dioxide and methane, contribute to climate change.

Under the Clean Air Act Amendments of 1990, the EPA must regularly review and revise the NAAQS, ensure that the standards are attained (in cooperation with States), require control of hazardous air pollutant emissions, and set standards for air quality monitoring. Installation and operation of monitors is primarily carried out by State and local agencies and the monitors are typically located in population centers or near certain industrial sites. Monitors are rare in rural areas, unless air quality agencies have reason to believe that pollutant concentrations may approach or exceed ambient air standards in rural locations.

Red Rock Lakes NWF and Yellowstone National Park are Class I airsheds within or near proximity to the Centennial Watershed.

For most of the year, air quality in rural southwestern Montana is excellent. Air quality issues in the CW develop predominantly during wildfires and are limited to PM_{2.5} emissions, which can travel hundreds and even thousands of miles. Consequently, air quality in the CW can be affected by fires located far from the CW. Because pollutant emissions associated with wildfires are largely beyond human control, exceedances of air quality standards that are associated with large wildfires are considered to be natural events and are typically exempted from consideration when determining NAAQS compliance.

The closest population to the CW is Dillon, Montana. The 2010 U.S. Census population estimate for Dillon Census County Division was 7880. Beaverhead County's population estimate, also for 2010, was 9246 (<http://epa.gov/airquality/qa/monprog.html>).

Findings and Analysis

Air quality concerns in the planning area are primarily related to smoke. Smoke contributors in the planning area include wildfire, prescribed fires, private debris burning, agricultural burning, slash burning, and wood burning stoves and fireplaces. Wildfire can produce short-term adverse effects on air quality. Air quality and visibility can deteriorate due to temporary air stagnation during wildfire events, which are most common during the months of July, August, and September. Smoke from wildland and prescribed fires are the primary concerns affecting human health.

Prescribed burning is conducted in accordance with the Montana/Dakotas Fire Management Plan and is coordinated with MT DEQ and the Montana/Idaho Airshed Group. During prescribed fire season, the Smoke Monitoring Unit supports the Montana/Idaho Airshed Group to prevent or reduce the impact of smoke on area communities, especially when that smoke could contribute to a violation of national air quality standards. During the summer wildfire season, the Smoke Monitoring Unit assists state and local governments in monitoring smoke levels and providing information about smoke to the public, firefighters, and land managers.

Recommendations

1. Continue to follow burn plans and to coordinate with the Smoke Monitoring Unit.

Biodiversity

Western Montana Standard #5: *“Provide habitat as necessary, to maintain a viable and diverse population of native plant and animal species, including special status species.”*

Affected Environment

The CW is part of the inter-mountain sagebrush steppe ecosystem. The types of wildlife habitat expected in the watershed were evaluated to determine if optimal biodiversity is being achieved. The wildlife habitat niches expected are: grasslands (short and mid grasses), bare ground, small streams, riparian areas, wetlands, sagebrush steppe, conifer forests, aspen stands, and wooded draws. Wildlife uses are enhanced by the interspersed and composition of these habitat components within the watershed thereby providing seasonal and year-long habitat for a wide variety of species. During the field assessment the IDT considered the range of natural variation within this ecosystem. Specific habitat conditions for Upland Health and Riparian and Wetland Health and associated recommendations are described under Standards 1 and 2 above.

Sagebrush Habitats and Sagebrush Dependent Species

Sagebrush and grassland habitat types make up 58% of BLM administered lands in the CW. Of this, 49% is in the sagebrush/mountain shrub cover type and 9% is grassland. This area supports

a significant diversity of sagebrush species and communities, and sagebrush-dependent wildlife species. In the valley, low sage (*Artemisia arbuscula*) and alkali sage (*Artemisia arbuscula longiloba*) are the dominant sagebrush species with intermixed three-tip sagebrush (*Artemisia tripartita*) as elevation increases. This habitat provides breeding and winter habitat for sage grouse, seasonal use by pronghorn antelope and elk and localized, yearlong habitat for sagebrush-obligate species such as pygmy rabbits. The higher elevations transition from a mix of three-tip sagebrush habitat to mountain big sagebrush (*Artemisia tridentata vaseyana*) communities and provide elk calving and sage grouse brood-rearing habitat along with dispersed spring, summer and fall habitat for numerous other species often in association with forested habitat. Occurrences of basin big sagebrush (*Artemisia tridentata tridentata*) and silver sage (*Artemisia cana*) intermingled with mountain big sagebrush, three-tip sagebrush, and several low sages create mixed sagebrush stands that add to the diversity of vegetation and habitat structure within the watershed.

The CW covers Hunting District (HD) 327 for deer and elk with a small portion of the south ends of HD 324 and 325. This larger area is known as the Gravelly Elk Management unit. The CW includes HD 330 for antelope, HD 330, 332, 333 and 334 for moose, HD 317 for black bear and HD 320 for gray wolf. BLM lands within the CW provide seasonal habitat for all of these game species. Table 7 shows the primary game species found in the CW and the habitat used throughout the year.

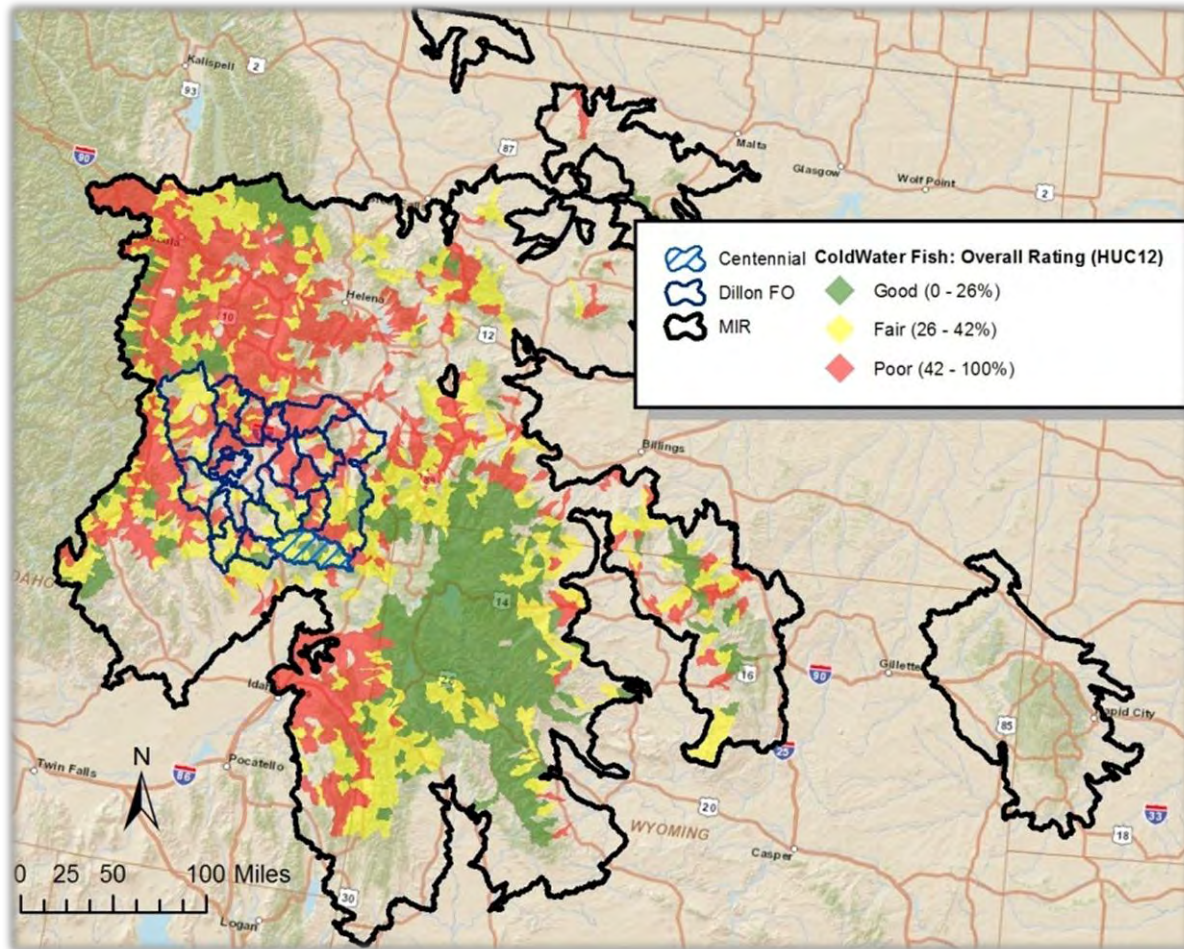
Table 7. Primary Game Species and Habitat Use Within the CW

Species	Forested	Sagebrush	Riparian
Antelope		S,C	
Black bear	Y	S	S
Blue grouse	Y	S,B	Y
Elk	S,C	W,C	Y
Gray Wolf	Y	Y	Y
Moose	Y	Y	Y
Mountain lion	Y		Y
Mule deer	S,C	Y	W
Sage grouse		Y	B
White-tail deer		S	Y

Y = yearlong, S = summer, B = brood rearing, C = calving/fawning, W = winter

Riparian, Aquatic and Wetland Habitat and Associated Species

The Centennial Watershed encompasses about 1% of the total land area of the Middle Rockies REA. Although much of the Middle Rockies REA has poor or fair potential for cold water fish, the Centennial Watershed offers mostly good and some fair ratings for cold water fish assemblages (See Map 4 below).



Map 4 - Middle Rockies REA Cold Water Fish Assemblage Rating

Riparian/mesic shrubs make up 5% of the BLM administered lands in the CW. Riparian, aquatic, and wetland habitat offers habitat diversity and are crucial water sources for wildlife. Succulent forbs, largely found in riparian areas, are a key component of sage grouse brood diets. Wildlife and livestock concentrate in riparian habitat, as it provides green vegetation later into the summer and fall, resulting in a disproportionate amount of use in these areas. Most wildlife species utilize riparian habitat for at least some portion of their annual life cycle. Riparian areas provide important habitat for moose, elk, beaver, migratory songbirds, Columbia spotted frogs and sage grouse brood rearing.

Aspen in the CW is also an important forage, cover, and nesting component for various species including elk, moose, and ruffed grouse. Riparian woodlands support the highest diversity of land bird species of all habitats. Riparian corridors are crucial to several northern-breeding Neotropical migrants and breeding or wintering species, even though they may not carry water year-round (Rich et al., 2004). Most migratory bird species are summer residents that use habitats ranging from lower elevation wetlands to high elevation forests for breeding and raising young. Some species are migratory, but small populations may stay yearlong depending on seasonal conditions.

The Red Rock Waterfowl Habitat Management Plan (HMP) was developed in 1983 and updated in 2005 along with the Centennial watershed assessment to facilitate effective waterfowl management in the Centennial Valley. The Waterfowl Habitat Area analyzed in the HMP stretches for 23 miles along the Red Rock River from the western boundary of Red Rock Wildlife Refuge westward to the impoundment at Lima Reservoir and encompasses approximately 53,000 acres of mixed ownership of which about 24,000 acres are public lands. This total includes the surface area of Lima Reservoir at normal pool (approximately 5,500 ac). The river is a sinuous system with abundant isolated oxbow channels. The adjacent vegetation is typically sedge, rush and bulrush wetland type with very limited riparian woody species along the floodplain which varies from 100 to 200 feet wide with the adjacent benches comprised of sagebrush grassland.

There are 19 water bodies supporting fisheries on BLM administered land within the CW. Westslope cutthroat trout (*Oncorhynchus clarki lewisi*) (WCT), arctic grayling (*Thymallus arcticus*), mountain whitefish (*Prosopium williamsoni*), mottled sculpin (*Cottus bairdi*), longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersoni*), longnose dace (*Rhinichthys cataractae*) and burbot (*Lota lota*) are native fish found in the Centennial Watershed. Rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta*), brook trout (*Salvelinus fontinalis*) and Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) were introduced, probably about the turn of the century within the watershed.

Streams within the assessment area generally do not support popular recreational fishing. The Red Rock River below Lima Dam supports a limited sport fishery for hybrid cutthroat, rainbow trout and an occasional brown trout. Hell Roaring and Odell Creeks support a limited fishery for hybrid cutthroat and brook trout. Wolverine and Middle Creeks also support a limited fishery for brook trout and is popular with some local anglers pursuing hybrid cutthroat and brook trout.

Table 8. Fish species present in streams on BLM-administered lands within the CW

STREAM	SPECIES PRESENT ON BLM	BLM STREAM MILES
Red Rock River (below Dam)	Rainbow trout, hybrid cutthroat trout, rainbow trout, brown trout, long nose and white sucker, mottled sculpin, longnose dace, mountain whitefish, burbot ,mottled sculpin	0.9
Red Rock River (above Lima Reservoir)	Mottled sculpin, longnose sucker, white sucker, burbot, mottled sculpin	8.5
Lima Reservoir	Burbot, mottled sculpin, longnose sucker, white sucker, arctic grayling hybrid cutthroat trout, long nose dace	NA
Price Creek	WCT (92-96 %), mottled sculpin	12.1
Wolverine Creek	Brook trout	0.7
Corral Creek (East end)	Brook trout	2.7
Jones Creek	WCT (96%), mottled sculpin, longnose dace	3.8
Bean Creek	WCT (100%)	4.2
Bear creek	WCT (100%)	1.4
Odell Creek	Hybrid cutthroat , brook trout, mottled sculpin, mountain whitefish	0.9
Tom Creek	Brook trout	4.4
Hell Roaring Creek	Brook trout, hybrid cutthroat trout, mottled sculpin, mountain whitefish	2.9

Corral Creek (west end)	Brook trout	1.3
West Creek	Hybrid cutthroat trout, brook trout, longnose dace, arctic grayling	1.2
Middle Creek	Brook trout, WCT (97%), mottled sculpin	0.6
Peet Creek	<i>WCT restoration in progress currently fishless</i>	10.7
Long Creek	Brook trout, hybrid cutthroat trout, mottled sculpin, longnose sucker, white sucker, longnose dace	2.9
Winslow Creek	Hybrid cutthroat trout	2.9
Breneman Lake	Rainbow trout	NA

Fishery habitat conditions on streams within the Centennial Assessment area are generally in good condition. Several streams have localized issues caused by livestock and/or roads. In many cases, streams were surveyed multiple times over the last 10 years to address data gaps in past fishery related surveys. These include evaluating WCT genetic purity, assessing suitability for WCT restoration and/or surveying for arctic grayling.

Generally, streams supporting special status species have been higher priority for fishery surveys and habitat monitoring in the field office. Non-WCT streams generally have not had fish habitat surveys conducted to date, but were assessed for riparian health during the watershed field assessment and are addressed in the Riparian section above. Streams with surveys are addressed below under Findings and Analysis.

Special Status Species

Special Status Species refers to both plants and animals and includes proposed species, listed species and candidate species under the Endangered Species Act. State-listed species and BLM State Director-designated sensitive species are also included in the Special Status category. Providing habitat for special status plant and animal species is integral to meeting the biodiversity standard. Table 9 lists the special status species that occur within the CW during all or part of the year.

Table 9. Special status species occurring within the Centennial Watershed

Wildlife Species	Current Management Status	Occurrence*	Preferred habitat
Grizzly bear (<i>Ursus arctos</i>)	Threatened	R	All
Greater sage grouse (<i>Centrocercus urophasianus</i>)	Candidate	R	Sagebrush shrubland
North American wolverine (<i>Gulo gulo luscus</i>)	Candidate	T	Alpine forest
American bittern (<i>Botaurus lentiginosus</i>)	Sensitive	R	Riparian/wetland
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Sensitive	R	Forest/Riparian/wetland
Black-backed woodpecker (<i>Picoides arcticus</i>)	Sensitive	R	Forest
Black tern (<i>Chlidonias niger</i>)	Sensitive	R	Riparian/wetland
Boreal/western toad (<i>Bufo boreas</i>)	Sensitive	R	Riparian/wetland/forest
Brewer's sparrow (<i>Spizella breweri</i>)	Sensitive	R	Sagebrush shrubland

Burrowing owl (<i>Athene cunicularia</i>)	Sensitive	T	Grassland
Caspian tern (<i>Hydroprogne caspia</i>)	Sensitive	T	Riparian/wetland
Common tern (<i>Sterna hirundo</i>)	Sensitive	T	Riparian/wetland
Ferruginous hawk (<i>Buteo regalis</i>)	Sensitive	R	Sagebrush shrubland
Flammulated owl (<i>Otus flammeolus</i>)	Sensitive	R	Forest
Forster's tern (<i>Sterna forsteri</i>)	Sensitive	R	Riparian/wetland
Franklin's gull (<i>Larus pipixcan</i>)	Sensitive	R	Riparian/wetland
Fringed myotis (<i>Myotis thysanodes</i>)	Sensitive	T	All
Gray wolf (<i>Canis lupus</i>)	Sensitive	R	All
Golden eagle (<i>Aquila chrysaetos</i>)	Sensitive	R	Riparian/wetland Sagebrush shrubland
Great gray owl (<i>Strix nebulosa</i>)	Sensitive	R	Forest
Lewis' woodpecker (<i>Melanerpes lewis</i>)	Sensitive	R	Forest/woodland
Loggerhead shrike (<i>Lanius ludovicianus</i>)	Sensitive	R	Sagebrush shrubland
Long-billed curlew (<i>Numenius americanus</i>)	Sensitive	R	Grassland
Long-legged myotis (<i>Myotis volans</i>)	Sensitive	R	Forest/riparian
McCown's longspur (<i>Calcarius mccownii</i>)	Sensitive	R	Grasslands
Peregrine falcon (<i>Falco peregrinus</i>)	Sensitive	R	Grasslands/shrublands/riparian
Pygmy rabbit (<i>Brachylagus idahoensis</i>)	Sensitive	R	Sagebrush shrubland
Sage sparrow (<i>Amphispiza belli</i>)	Sensitive	R	Sagebrush shrubland
Sage thrasher (<i>Oreoscoptes montanus</i>)	Sensitive	R	Sagebrush shrubland
Townsend's big-eared bat (<i>Corynorhinus townsendii</i>)	Sensitive	R	Forest/riparian
Trumpeter swan (<i>Cygnus buccinator</i>)	Sensitive	R	Riparian/wetland
Veery (<i>Catharus fuscescens</i>)	Sensitive	R	Riparian/wetland/woodland
White-faced ibis (<i>Plegadis chihi</i>)	Sensitive	R	Riparian/wetland
Fish Species	Current Management Status	Known from BLM lands?	Preferred habitat
Westslope cutthroat trout (<i>Oncorhynchus clarki lewisi</i>)	Sensitive	Yes	Aquatic
Arctic grayling (<i>Thymallus arcticus</i>)	Sensitive	Yes	Aquatic

Plant Species	Current Management Status	Known from BLM lands?	Preferred habitat
Alpine meadowrue (<i>Thalictrum alpinum</i>)	Sensitive	Yes	Moist alkaline meadows
Ballhead Gilia (<i>Ipomopsis congesta</i> ssp. <i>crebrifolia</i>)	Sensitive	Yes	Open, eroding sandy soil of sagebrush steppe
Beautiful bladderpod (<i>Lesquerella pulchella</i>)	Sensitive	Yes	Open mountain mahogany or limber pine woodlands
Fendler cat's-eye (<i>Cryptantha fendleri</i>)	Sensitive	Yes	Sparsely vegetative sites across sand dunes
Hiker's gentian (<i>Gentianopsis simplex</i>)	Sensitive	No	Fens, wet meadows, and seeps
Idaho sedge (<i>Carex idahoensis</i>)	Sensitive	Yes	Moist alkaline meadows
James stitchwort (<i>Pseudostellaria jamesiana</i>)	Sensitive	Yes	Woodland slopes
Large-leaved balsamorhiza (<i>Balsamorhiza macrophylla</i>)	Sensitive	Yes	Sagebrush and grasslands, in the montane zone
Lemmon's alkaligrass (<i>Puccinellia lemmonii</i>)	Sensitive	Yes	Alkaline meadows
Lesser rushy milkvetch (<i>Astragalus convallarius</i>)	Sensitive	Yes	Grasslands in valley and foothills
Many flowered viguiera (<i>Heliomeris multiflora</i> var. <i>multiflora</i>)	Sensitive	Yes	Aspen woodlands and open slopes
Mealy primrose (<i>Primula incana</i>)	Sensitive	No	Saturated often calcareous wetlands
Painted milkvetch (<i>Astragalus ceramicus</i> var. <i>apus</i>)	Sensitive	Yes	Crests and slopes of sand dune blowout areas
Railhead milkvetch (<i>Astragalus terminalis</i>)	Sensitive	Yes	Sagebrush steppe and grasslands
Sand wildrye (<i>Leymus flavescens</i>)	Sensitive	Yes	Sand-deposition areas of sand dunes and sandy roadsides
Simple bog sedge (<i>Kobresia simpliciuscula</i>)	Sensitive	Yes	Montane fens to moist tundra in the alpine zone
Sitka columbine (<i>Aquilegia formosa</i>)	Sensitive	Yes	Moist soil of open coniferous, cottonwood, or aspen forests in montane to subalpine zone
Slender thelopody (<i>Thelypodium sagittatum</i> ssp. <i>sagittatum</i>)	Sensitive	No	Moist alkaline meadows
Whipple's beardtongue (<i>Penstemon shippleanus</i>)	Sensitive	Yes	Open rocky slopes in meadows and scattered timber of subalpine and alpine zones
White-stemmed globe-mallow (<i>Sphaeralcea munroana</i>)	Sensitive	Yes	Open, calcareous soil of sagebrush grasslands in valley and foothill zones
Tree Species	Current Management Status	Known from BLM lands?	Preferred habitat
Whitebark Pine (<i>Pinus albicaulis</i>)	Candidate	Yes	High elevation sub-alpine zone.

*Resident (R) = yearlong or main part of lifecycle including reproduction, Transient (T) = seasonal use or migratory, not expected to be found regularly.

Special Status Wildlife

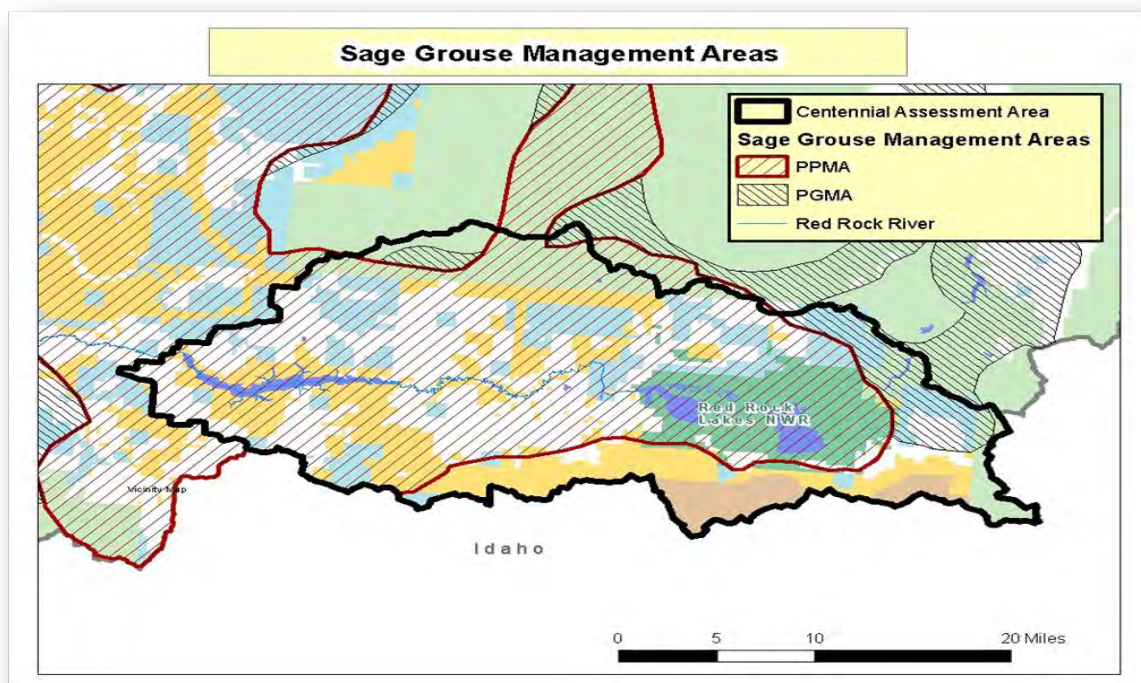
Recent actions under the ESA include the following:

On August 13, 2014, the United States Fish and Wildlife Service withdrew a proposal to list the North American wolverine in the contiguous United States as a threatened species under the ESA (FWS website 12/14). The wolverine, a large but elusive member of the weasel family found in the Mountain West, has made a steady recovery in the past half century after hunting, trapping and poisoning nearly extirpated the species from the lower 48 states in the early 1900s.

Wolverines occur in coniferous montane forest types preferring rugged, isolated habitats. Home range size for females and males averages 422 km² in Montana (Foresman, 2001).

The Northern Rocky Mountain population of gray wolves, including Montana wolves, was removed from the list of Endangered and Threatened Wildlife on May 5, 2011 as part of the Appropriations Act that was signed in April 2011. Therefore, gray wolves are now a BLM sensitive species and are identified as a “species in need of management” under jurisdiction of MTFWP.

Greater sage grouse are currently listed as a candidate species under the ESA (Federal Register March 5, 2010). The FWS determined that listing was warranted but precluded by other priority listing actions. This emphasizes the importance of managing for and maintaining the integrity of all seral stages within sagebrush habitats on public lands for all sagebrush-obligate species. Map 5 depicts sage grouse management areas in the CW. The CW contains 266,583 acres of Preliminary Priority Management Areas (PPMA) which was adopted from MT FWP sage grouse core areas, as well as 27,682 acres of Preliminary General Management Areas (PGMA) for sage grouse which was adopted from *Distribution of sage grouse in North America* (Schreder et.al. 2004).



Map 5 – Sage Grouse Management Areas in the Centennial Watershed Assessment Area

Grizzly bears were delisted in 2007 (USDI 2007) and relisted under court order in 2010 (USDI 2010.) The Dillon Field office is outside the Yellowstone Primary Conservation area but is within the distinct population segment of the Greater Yellowstone Area (GYA). The Centennial Mountains have been identified as suitable habitat within the Conservation Strategy Management Area (USDI 2010).

The bald eagle was removed from the Federal List of Threatened and Endangered Species in August 2007. Bald and golden eagles are still protected under the Bald and Golden Eagle Protection Act and are considered BLM sensitive species.

Special Status Fish

Native westslope cutthroat trout (WCT) in Montana are currently listed as a special status species. WCT populations within the CW are characterized by small isolated populations residing in small stream habitat. It is estimated that WCT populations are genetically unaltered in only 2.5% (McIntyre and Reiman 1995) to 10% (Shepard et al. 2002) of their historical range. The remaining pure populations within the CW are a result of either the extensive irrigation diversions across the valley floor which isolated some streams from non-native trout populations in downstream waters and/or they reside in streams that were not artificially stocked with non-native trout species.

Historically, WCT were likely present in most perennial streams within the assessment area. There are currently five streams that support WCT on BLM-administered lands in the CW. Non-native salmonid introductions circa 1900 are likely the main factor in the loss of WCT populations within the area. Within the CW, Bear and Bean Creeks support genetically pure WCT. Additionally, there are three streams, Jones, Price and Middle Creek, that support slightly hybridized WCT populations. There is currently a WCT restoration project in progress in the Peet Creek drainage that when completed, will restore pure WCT to approximately six miles of historic habitat.

The arctic grayling (*Thymallus arcticus*) was historically found in two areas in the lower 48 states; Michigan and Montana. Today, the Michigan population is extinct. Native populations in Montana have been reduced to about 5% of their native range due to habitat degradation, overfishing and competition with non-native species. Montana has two remaining native populations. One population is found in the Big Hole River drainage and the second is found in the Centennial Valley. A fluvial or river dwelling population has been re-established in the upper Ruby River Drainage. Additionally, over 30 populations have been established in lakes throughout the state. Over the last two decades, the federal status of grayling in Montana has been in question. Below is a timeline detailing status changes for the Montana grayling population during the Threatened and Endangered Species listing process.

<u>Year</u>	<u>Status</u>
1991	Arctic grayling petitioned for listing under the ESA.
1994	The USFWS determined that listing the grayling of the upper Missouri River was "warranted but precluded".
1994 to 2004	Grayling considered a candidate 9 species.

2004	The listing priority was upgraded to three due to continued lack of recovery.
2007	USFWS determined Montana grayling not a listable entity under the ESA because it did not constitute a species, subspecies or Distinct Population Segment.
2010	USFWS determined that listing the “Upper Missouri River basin Distinct Population Segment” of arctic grayling, as threatened or endangered under the Endangered Species Act is warranted, but that listing the fish is precluded at this time by the need to complete other listing actions of a higher priority.
2013	The USFWS initiated a status review under the Endangered Species Act (ESA) for Montana grayling.
2014	USFWS announced that arctic grayling in Montana were deemed unwarranted for federal listing.

Currently, the only documented grayling habitat on BLM administered lands within the assessment area are Lima Reservoir and lower West Creek. However, grayling are present in several creeks downstream of BLM administered land within the watershed. In 2013 and 2014, Montana Fish, Wildlife and Parks surveyed Odell, Long and Tom Creeks within the assessment area with no documented arctic grayling occurrence on BLM administered land. However, grayling were found several miles downstream of BLM administered lands within these drainages.

Special Status Plants

There are currently 20 known sensitive plant species within the Centennial watershed boundary. All but three of these plant species are found on BLM administered land within the watershed. Four of the special status plants exist only in the sandhills of the Centennial Valley. These four species are Fendler



Centennial Sandhills

cat's-eye, painted milkvetch,

sand wildrye, and pale evening primrose. Pale evening primrose does not have the special designation as sensitive but it is worth mentioning because it is a species of concern. All four plant species require early seral habitat within the sandhills. Special management has been implemented in the



Painted milkvetch

sandhills Area of Critical Environmental Concern (ACEC) over the past several years to work at destabilizing these sandhills for the benefit of rare plants. All four of the rare plant species typically decline as perennial, late seral vegetation colonizes areas of formerly open sand. The BLM has partnered with The Nature Conservancy to continue monitoring these plants. Monitoring results have indicated that continued destabilization of the sand dunes is necessary to provide this important habitat.

Alpine meadowrue, hiker's gentian, Idaho sedge, Lemmon's alkaligrass, mealy primrose, simple bog sedge, and slender thelypody all inhabit riparian areas. Although potential habitat exists on BLM administered lands hiker's gentian, slender thelypody, and mealy primrose have only been found on private lands within the Centennial watershed.

Railhead milkvetch and lesser rushy milkvetch both inhabit grasslands and sagebrush steppe habitats. The biggest threat to both of these species is the invasion of noxious weeds. Lesser rushy milkvetch can tolerate some disturbance. Railhead milkvetch seems to be vulnerable to intensive grazing and weed invasion. The only known population of this species in the Centennial valley exists in an unallotted section of BLM administered land.

**Sitka columbine flourishing in completed BLM timber harvest unit.
July 2014**



Sitka columbine is found in open coniferous forests in the Centennial valley. The population in the Price/Peet area was found to be flourishing during the field season of 2014. The BLM completed a commercial timber sale in the winter of 2011 in this area. The opening of the canopy and the ground disturbance from the timber harvest seems to have been beneficial to this sensitive species. All canopy openings were found to have Sitka columbine but the plants were most prolific in timber harvest skid trails.

Ballhead gilia grows on open, often eroding sandy soil of sagebrush steppe habitats. This species is found only in a few areas in the Centennial valley and are the only known populations in Montana. From what BLM has observed in the field and according to the Montana Natural

Heritage Program, who initially documented these populations, potential threats to the known occurrences appear to be minimal or non-existent at the current time.

White-stemmed globemallow is found on the west end of the valley both on BLM administered land and private land. Observations suggest that this species requires disturbance, it has only been documented growing in disturbed areas along roads and two tracks. It appears to be tolerant of, or perhaps benefits from, some disturbance activity.

Beautiful bladderpod, James stichwort, large-leaved balsamroot, many-flowered viguiera, and Whipple's beardtongue all prefer habitat on mountain or foothill slopes. James stichwort and many-flowered viguiera mostly inhabit aspen or woodland sites. Large-leaved balsamroot prefers more sagebrush with outliers scattered throughout forested areas. Beautiful bladderpod and Whipple's beardtongue inhabit harsher sites in the Centennial Mountains. Beautiful bladderpod can be found growing in sparsely vegetated sites in the montane and the subalpine zones. Whipple's beardtongue inhabits open, rocky slopes of subalpine and alpine zones.

Noxious Weeds and Invasive Species

Noxious weeds are defined in the Montana Weed Management Plan as "plants of foreign origin that can directly or indirectly injure agriculture, navigation, fish or wildlife, or public health." Currently there are 35 weeds on the statewide noxious weed list that infest about 7.6 million acres in Montana. Of these 35 there are only two of major concerns in the CW: spotted knapweed and houndstongue. Canada thistle, another state declared noxious weed, is also found in the CW. It is widespread throughout the Dillon Field Office and mostly found in riparian areas making treatment difficult.

Spotted knapweed (*Centaurea maculosa*) is one of the more aggressive noxious weeds in the area administered by the Dillon Field Office. Spotted knapweed is found scattered in small infestations throughout the Centennial Valley primarily along roads and in other disturbance areas. Because of where it is found, the potential is high for knapweed to be spread by vehicles, livestock, wildlife, recreation and other activities.

Houndstongue (*Cynoglossum officinale*), a noxious weed that is toxic to animals due to high levels of alkaloids contained in the plant, is found scattered throughout the CW in moderate sized infestations along roads, trails, and streams. Because of its seeds ability to cling to hair and clothing, the potential is high for it to be spread rapidly within the watershed.

Other noxious or invasive weeds present in isolated locations are cheatgrass (*Bromus tectorum*) hoary cress (Whitetop) (*Cardaria draba*), black henbane (*Hyoscyamus nigar*), common tansy (*Tanacetum vulgare*), and Canada thistle (*Cirsium arvense*).

Invasive Aquatic Species

In 2011, an inventory was done on Red Rock Lakes for curly leaf pondweed and Eurasian watermilfoil but none were found. There are no known populations of any other aquatic invasive species found within the Centennial Watershed.

Forest and Woodland Habitats and Associated Species

Forest and woodland habitats comprise approximately 17% of all ownerships, and approximately 30% of BLM-administered lands within the CW. Effective precipitation and aspect influences the establishment and composition of forests and woodlands. The close association of forests with adjoining sagebrush and riparian habitats supports a broad array of wildlife species. This habitat provides important thermal and hiding cover including security habitat for big game. Forest and woodland habitat offers high protein browse species in the fall and winter, as well as year-round browse for moose. Forests in the CW provide habitat for a large variety of species including mountain lions, dusky grouse, ruffed grouse, northern goshawk, and black bear. Forest-dwelling bird species require suitable nesting and foraging habitat. Bird species such as the hairy and black-backed woodpeckers help protect forests by eating millions of damaging insects, such as the mountain pine beetle and western spruce budworm.

Based upon field reconnaissance, local monitoring data, and LANDFIRE National data, the dominant existing forest types within the CW are shown in Table 10, along with the approximate distributions within the watershed across all ownerships.

Table 10: Dominant Existing Forest Types and Distribution within CW (All Ownerships)

Forest Type	Forested Acres by Type	% of Watershed
Douglas-fir Forest and Woodland	36,827	10%
Subalpine Woodland and Parkland	10,114	3%
Spruce-fir Forest and Woodland	7,011	2%
Lodgepole Pine	5,472	1.5%
Aspen Forest and Woodland	3,008	<1%
Other Forest/Limber Pine Woodland	56	<1%
	CW Forested Acres: 62,488	

Rapid Ecoregional Assessment (REA) Input

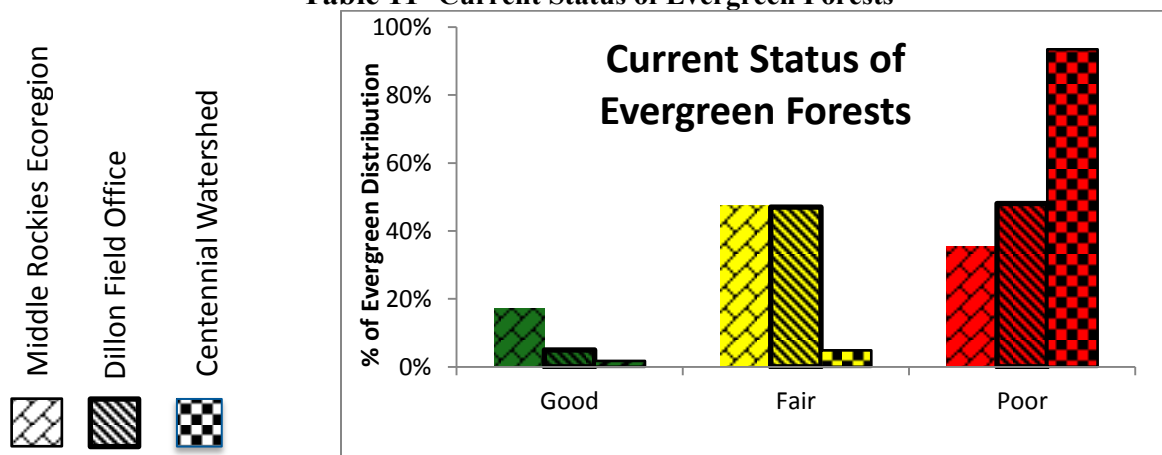
The evergreen forest woodland vegetation system encompasses nearly 25 percent of the Middle Rockies ecoregion. The BLM REA summarizes data from numerous sources to show the current status of evergreen forests, and to forecast future threats. Table 11 shows the current status of the forest in the entire Middle Rockies ecoregion, the Dillon Field Office, and the CW. The REA assigned a ranking of Good, Fair or Poor based on forest insect infestations and departure from simulated historical vegetation reference conditions.

The United States Forest Service Aerial Detection Survey polygon data from 1994-2010 were used to map insect presence in the evergreen forest, and to describe landscape condition. Mountain pine beetle is recognized as the most serious insect threat in the ecoregion so it was analyzed separately from other beetles. Western spruce budworm is a defoliator having

widespread impacts, and was also analyzed separately. The higher the percent insect infestation calculated, the poorer the score.

For landscape structure, the LANDFIRE Vegetation Condition Class (VCC) data were used to show changes in vegetation and fuels from their historical condition. Three condition classes describe low departure (VCC 1), moderate departure (VCC 2), and high departure (VCC 3). For the Middle Rockies, a group of subject matter experts went through an exercise to illustrate fire regime (frequency and severity) departure. The historic biophysical setting (BpS) was attributed with a current fire severity and frequency and then compared with the reference (historic) fire frequency and severity for each type. From these data, maps were developed to show fire frequency departure and fire severity departure, and then merged into a composite map (which took the highest of either departure). This modified composite layer was used as the best indicator for potential threat to the evergreen forest from an uncharacteristic fire. A VCC departure=1 is Good, VCC departure=2 is Fair, and VCC departure=3 is Poor.

Table 11- Current Status of Evergreen Forests

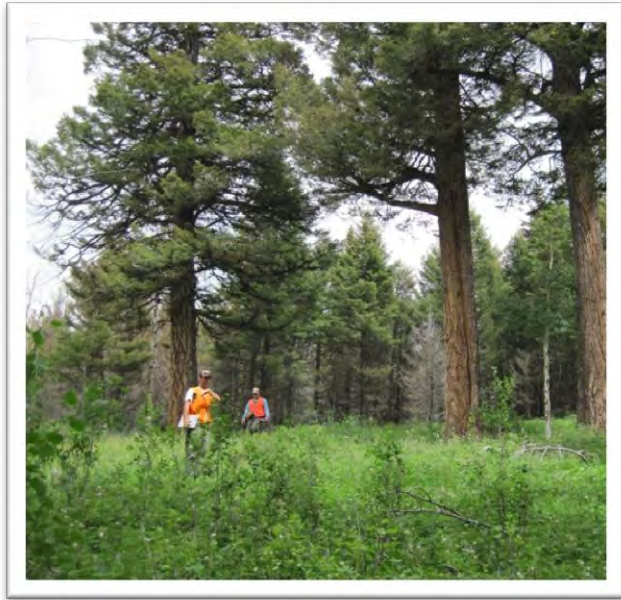


Currently, approximately 36% of the evergreen forest in the Middle Rockies ecoregion is rated as Poor, compared to 93% of the Centennial watershed evergreen forest in the same rating. Though forest insect activity appears to be decreasing in recent years, the ongoing infestations, combined with high VCC departure, contribute to the 93% Poor rating.

Douglas-fir Forest

Douglas-fir forest is abundant on the south side of the valley extending from the forest-grassland ecotone to mix with wetter, higher elevation spruce-fir and lodgepole forest. On the north side of the valley Douglas-fir is found in isolated forest patches, occasionally mixing with lodgepole pine. The lower elevation, drier Douglas-fir forests throughout the Centennial Valley were historically influenced by the relatively short fire return interval of the adjacent sagebrush/grassland. This is evidenced on both sides of the valley by large diameter, widely spaced relic Douglas-fir trees with multiple fire scars. Trees less than 150 years old without evidence of past fire have filled in around these relic trees creating dense, multi-storied stands in abundance today. Without the regulatory effects of fire, much of the lower elevation Douglas-fir forest is currently departed from historic fuel loading, structure, species composition, and biodiversity. Tree density has more than tripled in the Baldy Mountain area since pre-

EuroAmerican settlement (Korb, 2005), and this young age class of trees has expanded into sagebrush/grassland and aspen. Douglas-fir forest expansion has replaced once prevalent aspen-dominated communities that depended on periodic disturbance by fire. Research indicates that greater than 70% of the area historically occupied by aspen has been lost in mid-to lower-elevation forests of the eastern Centennial Mountains, much of which is attributed to conifer encroachment and eventual species conversion (Gallant et al. 2003). Aspen remnants, or skeletons, are common throughout Douglas-fir forests in the CW.



Douglas-fir bark beetle has been active in Douglas-fir stands throughout the valley at varying levels over the past 10-15 years killing many relic, large-diameter Douglas-fir, as well as co-dominant trees stressed by drought and repeated spruce budworm defoliation. The current unnaturally dense, multi-storied stand structure of these forests exaggerated effects of these native insects. In the past few years, Douglas-fir beetle activity appears to be moderating, confined primarily to individual large-diameter trees. Spruce budworm defoliation and top-kill is still evident throughout the forests in the CW, but the summer larvae dispersion and the adult moth hatch appear to have slackened in the past few years. Repeated defoliation events can decrease tree growth, cause mortality, or increase susceptibility of trees to other damage agents such as bark beetles.

Between 2011 and 2013, the BLM completed approximately 870 acres of commercial timber harvest in the Price and Bean Creek drainages. Harvest treatments were primarily located in the low to mid-elevation Douglas-fir forest, but also included some salvage of dead/dying lodgepole pine and subalpine fir. The harvest objectives included: restoring the historic structure of Douglas-fir forest, thus increasing the health and resiliency of the residual stand; promoting aspen regeneration and expansion; and reducing fuel loading and continuity to allow a greater range of opportunities to safely manage fire. Post-harvest, the treated Douglas-fir stands consist of open-growing trees of varying sizes and age classes, replicating a more historic, fire-maintained structure. Grasses and forbs have flourished since harvest with more resource availability. Aspen is beginning to regenerate due to ground disturbance from harvest and increased sunlight.



Mixed Conifer Forest

Upslope of the drier Douglas-fir dominated forest, Douglas-fir and lodgepole pine mix with scattered aspen clones present. Englemann spruce is found on moist sites, particularly on cool, shady aspects and in stream bottoms. Subalpine fir becomes more common at higher elevations, generally above 7500 feet. Historically, fire played a role in shaping these forests, though with less frequency and often higher severity than the lower elevation Douglas-fir stands. Consequently, many of the dense, multi-storied forest stands with heavy downed fuel accumulations are within the historic range of variation, but also subject to stand replacing wildfire.

Widespread outbreaks of mountain pine beetle have killed mature lodgepole pine throughout the northern Rockies over the past 10-15 years, including the Centennial Valley. As suitable host trees decline, the beetle population also returns to endemic levels. Currently, mountain pine beetle activity in the CW is limited to remaining pockets of mature lodgepole pine. The standing dead trees killed in the past decade will contribute to ground fuel loading as they fall over the next decades. Mountain pine beetle and white pine blister rust have killed most mature whitebark and limber pine trees (five-needle pines). Young five-needle pines are primarily found as isolated individuals or clumps at the mid-elevations. Dwarf mistletoe is present, particularly in lodgepole pine, but does not appear to be affecting tree growth or vigor to a large extent. Spruce budworm has affected all conifer species except lodgepole pine, but activity is currently declining. The evidence of the recent past spruce budworm and balsam bark beetle outbreak is still very apparent in subalpine fir, particularly on the eastern end of the Centennial Mountains. The multi-storied stand structure and mixed species conifer stands contributed to near complete defoliation, and in some areas mortality, of understory subalpine fir. Spruce beetle is present at endemic levels and is causing mortality of mature spruce trees where they occur. Spruce-dominated drainages on the eastern end Centennial Mountains appear to be the most affected.



Subalpine Forest



Above approximately 7500 feet elevation, the dominant timber type shifts to subalpine fir with scattered lodgepole pine, and concentrations of Engelmann spruce in moist areas. The highest elevations are occupied by krummholz subalpine fir and five-needle pines. A variety of insects are affecting suitable host trees on the lower fringes of the subalpine forest type, though site conditions and varied stand structure limit activity. Whitebark pine is present but approximately 90% of the mature population has been killed by a combination of white pine blister rust and mountain pine beetle. Young whitebark pine is found growing amongst the standing dead trees, and some trees are producing cones. White pine blister rust is continuing to cause branch and stem cankers of many of the live trees, which will likely result in eventual top-kill or complete girdling. The higher elevation forest types may still be within their historic fire return interval, though fuel accumulations are currently present to support fire spread, as evidenced by the 2003 Winslow Fire. The Winslow Fire exhibited higher burn severity, larger stand-replacing patch sizes, and an absence of surviving trees compared to historic fire patterns (N. Korb, 2005).

Aspen

Most existing aspen stands include some conifer component in varying stages of succession. Within some aspen clones, young, shade-tolerant conifers have established in the understory but are not yet shading-out the mature parent stand. The young conifers will begin to affect aspen regeneration as they restrict sunlight from reaching the ground. More commonly, existing aspen stands are mixed with conifers that have overtopped the aspen trees, shading them and causing overstory aspen mortality. The aspen clone root systems may continue to remain viable with only several live stems, potentially capable of reproduction following a disturbance that stimulates the root system and/or once full sunlight is allowed to reach the ground.

In 2012 and 2013, approximately 500 acres of aspen/mixed conifer forest in Price Creek and Bean Creek were treated to remove conifers and stimulate aspen regeneration. Within the treatment areas, conifers of all species within proximity of live aspen were cut and/or girdled to allow sunlight to reach the ground. The conifer slash and eventual blow-down of girdled trees will be left in place as an ungulate browse deterrent, allowing aspen and/or willow regeneration to grow above browse height. The results of these treatments will be monitored closely by the BLM.

2003 Winslow Fire Regeneration



In 2003, the Winslow Fire burned over 13,000 acres in the Centennial Mountains of Montana and Idaho, including 6,111 acres of BLM-managed land within the CW. The fire burned over the course of several months, resulting in a mosaic of burn severities. Though not all area within the fire perimeter experienced severe, standing replacing fire, the severely burned areas in the 2003 Winslow Fire were greater in size and proportion than those which occurred in 1863, the last extensive active fire year in the Baldy Mountain area (Korb, 2005). Stimulated by the Winslow Fire, aspen regeneration is abundant and robust. In 2014, the United States Geological Survey (USGS) sampled aspen regeneration density within the Winslow Fire burn area and

found the smaller size class of aspen (less than 2 meters in height; less than 5 cm in diameter) in excess of 8,000 trees per acre (Shinneman, unpublished data, 2014). In Curry Creek, most young aspen is now above browse height and sight distances are limited to several feet. Lodgepole pine is not regenerating as would be expected following a stand replacing fire. Seedlings are isolated and most are less than four feet in height. The cones/seeds from the previous stand appear to have not responded favorably to fire, possibly indicating the previous lodgepole pine stand was a non-serotinous or semi-serotinous cone producing population. Whitebark pine regeneration within the burned area is uncommon. Site conditions are ideal for natural regeneration but the whitebark pine seed source is very limited due to widespread insect and disease caused-mortality.

Fire Ecology and Fire Regimes of the Centennial Watershed

As a prominent disturbance process in southwestern Montana, fire is directly tied to land health by affecting seral stage diversity, age classes, and landscape vegetation structures.

Understanding the historic role of fire helps inform decisions on ecological status, trend and treatment needs. Recently, fire regimes for most terrestrial communities have been mapped and textually described for vegetation types across the entire U.S. (LANDFIRE, 2011a). These descriptions give context for assessing land health, reference conditions, and functioning ecosystems.

Biophysical Settings (BpS) are most simply defined as the native vegetation communities present in the pre-Euro-American era, and therefore developed under the influence of natural disturbances such as fire. BpS's describe vegetation communities at a larger scale than Ecological Sites, and as such can be applied to characterize broad areas such as watersheds. Each BpS description describes the historic composition and dominance of seral stages for that type, as well as the historic fire frequency and severity. Together, this information describes a reference condition, or a standard against which current conditions may be compared. Comparing Biophysical Settings to current conditions is useful for identifying trends in forest and non-forest vegetation communities. Based upon field reconnaissance and LANDFIRE National data, the dominant BpS's found in the entire Centennial watershed include several species of big sagebrush, Douglas-fir forest, and subalpine conifer forests. Many other individual BpS's are present within this watershed that are isolated or comprise a small percentage of the total area; these BpS's are grouped in the "other" category in the table below.

Successional processes, seral stage descriptions, and historic fire regimes for these types are described in the LANDFIRE BpS description documents for Map Zone 19 & 21 (LANDFIRE 2011a). These descriptions of historic conditions were compared with current conditions to depict landscape trends in vegetation and fire regime departure. The approximate distribution of the dominant BpS(s) in the watershed, are presented in Table 12.

Table 12: Distribution of Dominant BpS (All Ownerships)

Biophysical Setting	Acres in CW	% of CW
Mountain Sagebrush-Bluebunch Wheatgrass-Idaho Fescue	172608	48%
Black Cottonwood-Narrowleaf Willow	67368	18%

Engelmann Spruce-Subalpine Fir	37450	11%
Douglas Fir-Ninebark	22785	7%
Whitebark Pine	12561	6%
Engelmann Spruce-Subalpine Fir-Menziesia	10247	4%
Quaking Aspen	5385	2%
Engelmann Spruce-Subalpine Fir	3410	1%
Fleabane-Lupine	2647	>1%
Wyoming Big Sage-Indian Ricegrass	2198	>1%
Other	9,465	2%

Fire Regimes in the Centennial Watershed

The fire regime concept is used to describe the fire frequency, behavior, ecological effects, seasonality, pattern, and type for a given ecosystem or vegetation type. Based upon the most current fire regime classification system, each BpS corresponds to a unique fire regime (Schmidt et al., 2002). Table 13 outlines fire regime and descriptions.

Table 13: Natural Fire Regimes and Descriptions

Regime	Frequency	Severity	Severity Description
I	0-35 years	Low/Mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory.
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation.
III	35-200 years	Mixed/Low	Generally mixed-severity; can also include low-severity fires.
IV	35-200 years	Replacement	High-severity fires.
V	200+ years	Replacement/ Any severity	Generally replacement-severity; can include any severity type in this frequency range.

Mountain Big Sagebrush (BpS 1911260)

Fire Regime:

Mountain big sagebrush dominated communities are found above about 7000 feet in elevation, and on sites that annually receive 12-20 inches of effective precipitation. This vegetative community is characterized by Fire regime Group I. Fire is a major disturbance factor for mountain big sagebrush and likely played a large role in maintaining this habitat as a sagebrush/grassland. Periodic fire restricted conifer establishment on sites capable of supporting trees, and held in check the conversion of sagebrush habitat to forest habitat. Mountain big sagebrush has the fastest recovery rate of the three subspecies of big sagebrush. Fire size for this type is larger than other big sagebrush species because of greater fine fuel load, but some unburned pockets remain after fires, often resulting in a patchy mosaic. The fire return intervals vary from 10-200 years. However, estimating historic fire regimes for sagebrush ecosystems is tenuous at best and often based on fire scar and age structure data from adjacent forest types,

shrub age structure and fuel characteristics. Fire regimes also vary considerably across the range of mountain big sagebrush, based on factors like elevation, soil depth, slope, aspect, adjacent vegetation, frequency of lightning and climate. While the majority of fires were likely stand-replacing, some mixed severity fire may have occurred. Mixed severity fires were likely small in area, but ignitions may have occurred as frequently as 5-20 years. There were probably also portions of this system that never carried fire because of sparse fuel. Historic fires likely occurred during the summer months and were wind driven events. Lightning ignitions are variable and affect fire frequency on regional landscapes in the Northern Rockies. Fire may spread from adjacent forested communities. Mountain big sagebrush does not re-sprout following fire and re-colonization of burned areas must come from either a short-lived seed bank or seed dispersed by plants in unburned patches or adjacent stands.

Current Conditions:

The mountain big sagebrush stratum is moderately departed from reference conditions due to fire exclusion and the effects of conifer expansion. There is three-tip sagebrush interspersed with mountain big sagebrush throughout the watershed. Three-tip sagebrush re-sprouts after fire. The proportions of mid- to late-development mountain big sagebrush are near reference conditions, however the early development sagebrush component is lacking throughout the watershed. Douglas-fir trees are establishing in areas where conditions are suitable for conifers and are converting former sagebrush habitat into closed canopy forest habitat.

Douglas-fir Forest (BpS's 1910451 and 1911661)

Fire Regime: The Douglas-fir forest in this watershed is best characterized by Fire Regime Groups I and III. Fires were predominantly surface and mixed-severity, with a mean fire interval of 7-80 years. The drier sites with more frequent fire return intervals support relatively open stands, while wetter sites support more closed stands. Occasional stand replacement fires may also occur. Much of the Douglas-fir forest on dry, south-facing slopes at the sagebrush-forest interface was historically affected by fires in adjacent vegetation. Abundant evidence of past fires is present in the lower elevation, mature Douglas-fir timber stands, primarily in the form of fire scars on large diameter relic trees. The low frequency and wide spacing of existing relic trees and stumps in these stands indicate historic low-severity fires likely promoted and maintained a fairly open Douglas-fir forest. Mixed-severity fires occurred primarily in denser stands, and at higher elevations. The mean fire interval in these stands was lengthened, with slightly more late-development, closed-canopy forest structure.

Douglas-fir increases in canopy density in the absence of fire disturbance. Much of this landscape today has canopy cover denser than the historic range of variability. Canopy closure >80% in this forest type is considered uncharacteristic. Many of the lower elevation, dense Douglas-fir stands (<100 years old) found near the present sagebrush-forest eco-tone have sagebrush skeletons on the ground, which indicate these sites were previously dominated by sagebrush.

Current Conditions:

The Douglas-fir forest stratum is highly departed from reference conditions due to altered stand structure. The lower elevation dry sites exhibit greater departure than moister, higher elevation sites. Past timber harvest on adjacent private lands, followed by more than a century of fire

exclusion, have promoted an increase of dense, closed canopy Douglas-fir forest. Herbaceous understory vegetation is sparse in many stands due to nearly complete canopy closure.

Dry Mesic Spruce-Fir Woodland

Fire Regime: The Spruce-fir dominated forests are found at higher elevations or on cooler, moister aspects than Douglas-fir forests. This forest type is characterized by Fire Regime Groups IV or V; primarily moderately long-interval mixed and stand-replacement fires. Lightning strikes are frequent, but will often result in small, patchy spot fires. The low elevation extent of this forest type was likely affected by the more frequent fire intervals of the adjacent, drier Douglas-fir forest. More moist sites, or sites protected from fire by topographic features have much longer fire intervals, possibly up to 600 years. Fire sizes ranged widely from single tree spot fires, to many thousands of acres. Variability of climate, topography and other site factors can result in a wide range of representation of successional stages on the landscape. Fire regimes in this system are strongly related to climatic cycles. Long-term changes in climate as well as inter-annual climate variability will affect the frequency of fire in this system and its distribution along an elevation gradient.

Current Conditions:

The Spruce-fir forest stratum is moderately departed from its natural fire regime. Fire has not recently affected large portions of this forest type in this area. The current fuel loading is sufficient to propagate stand replacing fire in many areas, but only under very dry, and windy conditions. Fuel loading is anticipated to increase in lodgepole pine-dominated stands as a result of recent beetle-caused mortality.

Rocky Mountain Subalpine/Upper Montane Riparian Systems

Fire Regime: The highest elevation forest types in this watershed are dominated by five-needle pines, subalpine fir, Engelmann spruce and lodgepole pine. This forest type is characterized by Fire Regime Groups III and IV, primarily long-interval (100-200+ year) mixed severity (25-75% top kill) and stand replacement fires. Ignitions are frequent due to lightning, though fires seldom carry due to lack of fuel from the slow-growing vegetation. Nonlethal surface fires may be possible where short grasses provide a continuous ground fuel; individual tree torching is more common. Climate variability and slow fuel loading could extend the stand-replacing fire interval to many hundreds of years.

Current Conditions: The subalpine forest stratum is within the range of variation for its natural fire regime. Fire has not recently affected large portions of this forest type in this area, which has led to predominantly mid to late-development stands. However, most of the whitebark and limber pine is being affected by both white pine blister rust and mountain pine beetle. White pine blister rust is not a native disease agent, therefore the current whitebark pine die-off is creating an uncharacteristic condition. Mortality caused by these agents will increase fuel loading and will lead to more open stands dominated by tree species not susceptible to blister rust or pine beetle. Even with increased fuel loading, many fires that start in these high elevation stands will continue to be inhibited from spreading by rock, scree and green and/or sparse vegetation. Fires that start in lower elevation, drier forest types may affect the fringes of the subalpine forest.

Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a general index providing two pieces of information: the historic fire regime group, and the condition class. Fire Regime Groups are described in the previous section and summarized in Table 16 below. Condition class reflects the degree of ecological departure when current conditions are compared against modeled reference conditions in terms of two main ecosystem components: fire regime and associated vegetation. This departure is from changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and disease mortality, grazing, and drought).

Three fire regime condition classes have been defined (Schmidt et al. 2002) based on the following criteria: FRCC 1 represents ecosystems with low (<33 percent) departure and that are still within an estimated historical range of variation as determined by modeling for the pre-Euro-American era; FRCC 2 indicates ecosystems with moderate (33 to 66 percent) departure; and FRCC 3 indicates ecosystems with high (>66 percent) departure (Hann and Bunnell 2001; Hardy et al. 2001, and Schmidt et al. 2002). A low departure indicates current conditions are characteristic of those occurring in the natural fire regime and associated vegetation. A high departure indicates uncharacteristic conditions that did not occur within the natural fire regime. Condition classes were assessed using the FRCC Software Application.

Table 14: FRCC Summary (all ownerships) in the CW

Biophysical Setting	Fire Regime I-V	Condition Class 1 (acres)	Condition Class 2 (acres)	Condition Class 3 (acres)	Total Acres
Mountain Sagebrush-Bluebunch Wheatgrass-Idaho Fescue	IV	35222	121471	15915	172608
Black Cottonwood-Narrowleaf Willow	III	13385	27547	26436	67368
Engelmann Spruce-Subalpine Fir	V	865	34299	2286	37450
Douglas Fir-Ninebark	III	6974	14078	1733	22785
Whitebark Pine	III	1928	6520	4113	12561
Engelmann Spruce-Subalpine Fir-Menziesia	V	2135	6725	1387	10247
Quaking Aspen	IV	1736	2883	766	5385
Engelmann Spruce-Subalpine Fir	IV	763	2618	29	3410
Fleabane-Lupine	IV	41	0	2606	2647
Wyoming Big Sage-Indian Ricegrass	IV	12	2001	185	2198
Total Acres		63061	218142	55456	336659
Percent of Watershed in each condition class (excluding other BpS acres)		19%	64%	17%	

Findings, Analysis and Recommendations

Procedure to Determine Conformance with the Standard

This Standard is an overall assessment of biodiversity and plant and wildlife habitat. The present state of each allotment and habitat type was compared to the natural and historic condition. The indicators described under the definition of Standard #5, as well as condition/function of the other standards, specifically uplands and riparian, were considered to determine whether or not the Biodiversity Standard was met. The IDT considered the range of natural variation within this ecosystem as well as the species composition, condition of available habitat, and forest health to determine the condition/function of biodiversity.

Findings and Analysis

Sagebrush Habitats and Sagebrush Dependent Species

During winter 2013-2014 survey efforts in the Gravelly Elk Management Unit, which includes the Centennial Mountains, over 10,000 elk were observed. Of this 10,000 elk an estimated 4,400 spent the summer and fall in the Centennial Mountains. During winter these elk migrate to winter ranges in Basin Creek, Sage Creek, the west slope of the Snowcrest Mountains and the west side of the Madison Valley (Personal communication Waltee 2014.) No data was available on mule deer population trends, but observations from BLM personnel during the past ten years show the population to be on the increase.

Antelope populations are doing well as August 2014 surveys located a minimum of 2,407 antelope. Of these antelope observed, over 2,000 were found west of Lima Reservoir in the Centennial Valley (Personal communication Waltee 2014). These antelope migrate out of the valley and winter in Sage Creek, Basin Creek and on the slopes east of Interstate 15.

A minimum of 193 moose were observed during winter and spring 2014 surveys of HD 330, 332, 333 and 334. Of that total, 124 were observed in HD 333 and 334 which are primarily located within the CW. With winter migrations occurring for all other big game species, moose are the only big game species to winter in the CW.

The USFWS has a list of “Birds of Conservation Concern” (BCC) for Bird Conservation Region 10 (BCR 10 Northern Rockies U.S. portion only). Many of these birds depend on riparian habitat for all or part of their lifecycle (U.S. Fish and Wildlife Service, 2008). Birds of Conservation Concern 2008, encompasses three distinct geographic scales including at the National level (United States in its entirety, including island "territories" in the Pacific and Caribbean), at the North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs) level, and at U.S. Fish and Wildlife Service Regions level. This is primarily derived from assessment scores from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan.

The overall goal of the BCC is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent

the highest conservation priorities. Bird species considered for inclusion on lists in this report include nongame birds, game birds without hunting seasons, Endangered Species Act candidate species, proposed endangered or threatened species, and recently delisted species. Table 15 lists the 23 BCC species that are known to occur within the CW. These species can be found throughout the CW in all habitat types. A few of these species reside in the CW year-round, but most of them are migratory and just spend the summer or breeding season in the CW.

Table 15: USFWS Birds of Conservation Concern, BCR 10

American Bittern (<i>Botaurus lentiginosus</i>)	Bald Eagle (<i>Haliaeetus leucocephalus</i>)
Brewer's Sparrow (<i>Spizella breweri</i>)	Burrowing Owl (<i>Athene cunicularia</i>)
Calliope Hummingbird (<i>Stellula calliope</i>)	Cassin's Finch (<i>Carpodacus cassinii</i>)
Ferruginous Hawk (<i>Buteo regalis</i>)	Flammulated Owl (<i>Otus flammeolus</i>)
Fox Sparrow (<i>Passerella iliaca</i>)	Golden Eagle (<i>Aquila chrysaetos</i>)
Greater Sage Grouse (<i>Centrocercus urophasianus</i>)	Green-tailed Towhee (<i>Pipilo chlorurus</i>)
Lewis's woodpecker (<i>Melanerpes lewis</i>)	Long-billed Curlew (<i>Numenius americanus</i>)
McCown's Longspur (<i>Calcarius mccownii</i>)	Olive-sided Flycatcher (<i>Contopus cooperi</i>)
Peregrine Falcon (<i>Falco peregrinus</i>)	Rufous hummingbird (<i>Selasphorus rufus</i>)
Sage Thrasher (<i>Oreoscoptes montanus</i>)	Short-eared owl (<i>Asio flammeus</i>)
Swainson's Hawk (<i>Buteo swainsoni</i>)	Williamson's Sapsucker (<i>Sphyrapicus thyroideus</i>)
Willow Flycatcher (<i>Empidonax traillii</i>)	

Riparian, Aquatic and Wetland Habitat and Associated Species

Many of the management actions identified in the Red Rock Waterfowl HMP were implemented between the 1980s and early 2000s. This includes, but is not limited to, pothole blasting, oxbow excavations, fence modifications and the construction of three wetlands in partnership with Ducks Unlimited. Implementing deferred and rest rotation grazing systems have also improved nesting cover for waterfowl. Much of what has not been implemented in the plan may not be pertinent or feasible today. A few of these include constructing water control structures to maintain pool levels in the arms of Lima reservoir where BLM does not have water rights, constructing raptor perches in sage grouse habitat and planting willows along Lima reservoir, where the high water fluctuations and drawdowns do not permit for long term willow establishment.

In the Centennial Valley, 32 trumpeter swan nesting territories have been identified west of the Red Rock Refuge. Compared to other regional subpopulations, they are as productive as any other in the GYE (Roscoe 2011.) However, almost all of these territories have influences outside of the control of the BLM (primarily water fluctuations for irrigation.) In 1985, eighteen of the 32 territories were active. In 2011, 26 territories were monitored for nest production. Eleven of these 26 territories were initially occupied with six having active nests. However, only two successfully fledged cygnets, although most nesting territories were still occupied in late September (Roscoe 2011.)

Current beaver activity was noted on many streams scattered throughout the CW. Beaver play a keystone role in creating and maintaining riparian habitat and associated wetlands and can have a profound effect on habitat. Feeding and constructing dams and lodges affect species composition and abundance of trees, changes water table, creates meadows and ponds, and thereby affects other wildlife species. Beaver activity is known to have positive and negative effects on fish, waterfowl, migratory birds and small mammals. Cycles of periodic resource depletion and renewal coupled with movements result in a mosaic of habitats spread over a larger area than that occupied at any time (Boyle 2007.) Beaver populations were historically much higher as evidenced by the number and size of breached beaver dams within the headwaters of the Red Rock River. Beaver distribution is dependent on the abundance of deciduous woody vegetation. The decline in aspen throughout the watershed has no doubt played an important role in the decline of beaver, as this was the primary material used in construction of the remnant dams. Many of these sites are now converted to conifer forest.

Special Status Fisheries

WCT habitat surveys were conducted on BLM administered lands during the 2012, 2013 and 2014 field seasons. Surveys were conducted on random 500 foot reaches in selected streams. In-stream habitat was identified to type (pool, riffle, run) with habitat length, width and residual pool depth measurements taken. Stream substrate data was collected using a 500 point “zig zag” pebble count method in riffle habitats within each reach.

Overall, riparian habitat condition on streams surveyed was in good condition with stable banks and low levels of bank disturbance. Throughout the assessment area sediment levels in streams were an identified concern. It is apparent that most streams in the assessment area carry a high natural sediment load. Most of this is likely due to high levels of ash and clay present in the soil within the watershed. The roads along Bean Creek and Long Creek were noted as point sources for some sediment. Additionally, Bean and Bear Creeks have identified areas of natural slumps that are chronic sediment sources.

Several studies have indicated that cutthroat trout reproduction can be impacted by low levels of fine sediment (Ringler and Hall 1975; Irving and Bjornn 1984; Weaver and Fraley 1991; Horan et al. 2000; Ireland 1993). Bjornn et. al (1977) found that as the percentage of fine sediment exceeds 20% to 30% in spawning riffles, salmonid reproduction begins to decline. Bryce, et al. (2010) evaluated fine sediment impacts on fish and macro-invertebrates and found that sediment impacts begin at 13% for fish and 10% for macro-invertebrates. As indicated in table 16 below, sediment levels in surveyed streams are higher than optimum. With the sediment levels observed, it is probable that salmonid spawning success and pool quality is being impacted to some extent.

Using baselines identified in the “**Beaverhead Sediment Total Maximum Daily Loads and Framework Water Quality Protection Plan**” (Montana DEQ. 2012), streams < 15 foot wetted width would be expected to have a minimum of ≥ 90 pools per stream mile while streams 15-30 feet bankfull width would be expected to have ≥ 52 . Residual pool depth would be expected to be approximately 10 inches and % fines (<6mm) would be expected to be between 10% and 30% depending on stream gradient and channel type. Steeper gradient “B” channels would be

expected to have slightly more or less than 10% fines < 6mm while lower gradient “E” type channels are expected to have up to 30% fines < 6mm. Stream size and gradient will affect pool number, residual depth and the percentage of fine sediment present. Generally, as stream size decreases pool frequency increases and pool depth decreases. Using the data in Table 16 below, the surveyed streams are likely within the natural range of variability expected based on stream size with the exception of elevated sediment levels. These elevated sediment levels are likely inhibiting pool frequency and quality to some extent.

Table 16: Pool frequency, depth and stream bed particle size

Stream	Primary Channel Type	Pool Frequency (per mile)	Residual Pool Depth (inches)	% Fines (<6mm)	Riparian Habitat Condition Trend 2003 vs 2013
Bear Creek	B	122	8	20%	Low PFC / low PFC
Bean Creek	B	180	8	24%	Low PFC / low PFC
Price Creek	E	158	12	17%	PFC /PFC
WF Price Creek	E	190	7	24%	PFC /PFC
Jones Creek	B	118	11	21%	PFC /PFC
Long Creek	C	75*	22	20%	FAR /PFC

*Long Creek has a wetted width generally greater than 15'

Throughout the west, the threat of increasing water temperatures on fisheries habitat due to climate change is a growing concern. Studies have linked water temperature with lower cutthroat performance in water temperatures >59F (DeStatso and Rahel 1994; Dunham et al. 1999; Novinger 2000). Water temperature monitoring within the assessment area was initiated in 2009 on some streams to track potential changes in summer stream temperatures. Data collected to date shows that both average and summer peak temperatures have remained relatively consistent since temperature monitoring began (see Table 17 below). However, several streams have shown an increase in the number of days where water temperatures reached or exceeded 60 degrees. In most cases this can likely be attributed to variations in summer temperatures. With only a few years of temperature data, it's difficult to say whether this is normal climatic fluctuation or the beginnings of a long term trend. In most cases where temperatures reached or exceeded 60 degrees F, it was for short periods of a few hours during the day with temperatures in most streams dropping back into the 40 or 50 degree range overnight. However in the case of Long Creek, it would appear that the high stream temperatures within the drainage may be the norm rather than the exception. However, again with only two years of data it's difficult to determine.

Table 17 - Centennial Valley Stream Temperature Data

Stream/Year	Avg.	Peak temperature	# of days stream
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	temperature 6/1-9/1	6/1-9/1	temperatures reached or exceeded 60 f
Bean Creek-2009	52	61	7
Bean Creek-2012	48	59	0
Bean Creek-2013	49	60	1
Bean Creek-2014	49	58	0
East Fork Bean Cr- 2014	44	52	0
Bear Creek- 2011	45	58	0
Bear Creek- 2012	49	61	7
Bear Creek- 2013	50	65	33
Bear Creek- 2014	49	61	30
Price Creek- 2009	47	59	0
Price Creek-2013	51	63	29
Price Creek- 2014	50	64	28
West Fork Price Cr-2011	48	57	0
West Fork Price Cr-2013	50	59	0
West Fork Price Cr-2014	49	59	0
Jones Creek-2013	50	64	30
Jones Creek-2014	48	61	38
Odell Creek-2014	47	58	0
Peet Creek- 2014	51	67	36
Long Creek-2013	59	76	74
Long Creek-2014	57	72	61
Hell Roaring Creek-2014	43	54	0
Middle Creek- 2014	46	56	0

Bear Creek

Bear Creek is one of two relic Westslope Cutthroat Trout (WCT) populations remaining within the CW. MTFWP first collected genetics on this population in 1993 with results indicating a low level of hybridization. However, review of the results indicated that the hybridization level may have been an error. MTFWP re-tested the population in 2001 and in 2006 with no sign of hybridization. The BLM began monitoring this population in 1998. Habitat was noted as being in fair condition with a large number of beaver dams in the lower reach on private property. The stream was noted as carrying a relatively high sediment load that seemed to originate in a small

land slide in the upper ½ of the drainage. Initial population estimates found approximately six WCT 3 inches or longer per 100 feet of stream with an average size of 6.25 inches. In 2011 BLM established two population monitoring reaches that were in close proximity to two of the 1998 monitoring locations. Monitoring data from 2011 indicated that the population had decreased to approximately three WCT/100' with an average size of 6 inches. However, 2013 data indicated that the population had increased to approximately 11 WCT/100' with an average size of 3.75 inches. These population fluctuations can likely be attributed to climatic conditions which can change fish distribution within the drainage in response to higher or lower stream flows. The drought conditions experienced through the early 2000s certainly had an impact on WCT recruitment. The increase in the population seen in 2013 was heavily influenced by a strong cohort of one and two year old WCT indicating improved recruitment recently. Sometime around 2000, a beaver colony in the lower reach was removed or died out. Then around 2002 the remaining beaver dams were removed. This likely negatively impacted the resident WCT in two ways. First, it greatly reduced available habitat for WCT specifically overwintering pools. Second, it forced a large amount of sediment into the lower portion of the stream which has still not fully stabilized. Habitat assessments conducted in 2013 indicated that Bear Creek is still carrying a relatively high sediment load with fine sediment making up approximately 20% of the substrate. A large portion of this appears to be originating in an area of unstable slumps in the middle reaches of the drainage. Pool habitat is abundant with a pool to riffle ratio of 1:1. Banks were found to be well vegetated.

Bean Creek

Bean Creek supports one of two genetically pure WCT populations remaining within the CW. MTFWP first collected a 10 fish genetic sample on this population in 1992 with results indicating a genetically pure population. A subsequent genetic test with a larger sample size in 2001 indicated a low level of hybridization. However, review of the results indicated that the hybridization level may have been an error. In 2006 and 2012 the Bean Creek population was re-tested with both samples results showing no sign of hybridization.

In 2013 BLM initiated a conifer treatment within the Bean Creek drainage adjacent to 1.3 miles of riparian and 298 acres of upland habitat to help restore aspen, riparian and fishery habitat conditions. Prior to the start of treatment, BLM fisheries personnel conducted pre-treatment population estimates on two reaches of Bean Creek. One reach was within the conifer treatment boundary and one reach was outside the treatment area to assess the health of the population and monitor any changes in the population resulting from the conifer treatment. The survey indicated there were approximately four WCT per 100 feet of stream within the conifer treatment boundary and 7/100 feet in the reach outside the conifer treatment boundary. The low number of WCT collected in the upper reach may have been indicative of low stream flows experienced in 2013. Higher stream flows and better conditions were found in downstream habitat. Habitat assessments conducted in 2013 indicated that Bean Creek is carrying a relatively high sediment load with fines making up approximately 24% of the substrate. Pool habitat is abundant with a pool to riffle ratio of approximately 1:1 with slightly more pools than riffles. Banks were found to be well vegetated in meadow type habitat and poorly vegetated in timber type habitat. A landslide in the upper reaches of the main stem was found to be a point source for fine sediment in the drainage. Additional sediment is being contributed from the road that is adjacent to the stream for several miles. In 2009 the undersized road culvert on the East Fork was replaced with

a larger fish passable culvert. In 2014 the undersized road culvert on the main stem was also replaced with a larger fish passable culvert. In the fall of 2014 the USFWS, The Nature Conservancy and partners restored approximately 950 feet of channelized stream back to the historic channel with 37 pools, constructed a hardened crossing, installed a larger culvert on the county road and replaced one irrigation diversion in the lower reaches of Bean Creek on private property.

Price Creek

There have been several fishery surveys conducted in the Price Creek drainage. Ambiguous genetic results over the last decade had placed the status of this stream's WCT genetic status in question. In 2011 BLM fishery personnel submitted 100 genetic samples from all forks of the drainage for testing. Results determined this population supported a population of WCT hybridized with Yellowstone cutthroat trout ranging in purity from 91 to 97%. Habitat is in good condition. Overall banks are heavily vegetated with sedges and willow. There are several active beaver dams within the drainage providing excellent over-winter fishery habitat. A 2008 WCT population estimate conducted within the middle portion of the main stem found the stream supported approximately 14 WCT 3 inches or larger per 100 feet of stream with an average size of 6.5 inches.

Peet Creek

In 2012 Peet Creek was identified as a priority stream for WCT restoration/conservation efforts within the Centennial watershed due to amount of habitat, accessibility, and having a suitable location to construct a fish barrier. A 2012 MT Fish Wildlife and Parks population estimate within the middle reaches of Peet Creek found the stream supported approximately 12 salmonids per 100 feet of stream. Fish distribution surveys found salmonids occupied approximately six miles of habitat within the drainage. In 2013, a fish barrier was constructed in the lower reaches of the drainage on private land to support restoration efforts within the drainage. In the summer of 2013, a multi-agency cooperative non-native removal was begun using a chemical piscicide. A second treatment was conducted in 2014. A final treatment is planned for 2015 to ensure all non-natives have been eliminated. Once completed, re-introduction of genetically pure WCT from populations within southwest Montana will start in 2016.

Long Creek

The portion of Long Creek which flows through BLM lands was sampled on two occasions for arctic grayling by Montana Fish Wildlife and Parks (MTFWP) and by Dillon BLM fishery personnel during the 2014 field season. On both occasions, similar species composition was observed. The primary species collected was longnose dace with lower numbers of eastern brook trout, hybrid cutthroat trout, white sucker and mottled sculpin. No arctic grayling were collected or observed during surveys. In addition to the above electro-fishing surveys, Dillon BLM fishery personnel performed two additional ocular surveys along the entire BLM reach looking for grayling staging in pools. No grayling were observed on these surveys. Elevated water temperatures (see Table 17 below) are a likely factor in the low numbers of cold water salmonids observed in this portion of the drainage. With the exception of elevated water temperatures, overall habitat was in very good condition. Stream banks were well vegetated with sedge, rush and scattered willow with stable undercut banks. Active beaver are present with impounded water behind dams providing excellent overwinter pool habitat. Sediment levels were

somewhat higher than preferred. In addition to natural sediment sources, a county road that runs adjacent to Long Creek is a likely sediment source.

Hell Roaring Creek

During 2014 fishery personnel from MT Fish, Wildlife and Parks and Dillon BLM conducted fish distribution and abundance surveys in three reaches spanning the entire drainage. Hybrid cutthroat trout and brook trout were found in low abundance in the lower and middle reaches. No fish were found in a third reach located in the upper 1/3 of the drainage. Macro-invertebrates were noted in the lower and middle sample reaches, but were not observed in the third. Stream temperatures taken at the time of fish surveys showed stream temperatures in the middle 40 degree range in the 3rd reach. BLM and MT FWP fishery personnel postulated that high spring flows and low stream temperatures were a likely reason for low fish abundance within the drainage. Ocular surveys found habitat conditions to be in excellent condition. Stream banks were found to be stable and well vegetated with sedge, willow and herbaceous plants throughout the drainage.

Odell Creek

In 2012, fishery personnel from MT Fish, Wildlife and Parks and Dillon BLM conducted fish distribution and abundance surveys spanning the entire drainage. Hybrid cutthroat trout and brook trout were found in relatively high abundance in the upper 2/3 of the drainage. Brook and hybrid cutthroat trout, mountain whitefish and arctic grayling were found in the lower reaches located on the Red Rock National Wildlife Refuge. Ocular habitat surveys found excellent habitat conditions throughout the drainage. Macro-invertebrates were abundant with the exception of one cold sterile headwater tributary which also had very low fish abundance. Odell Creek has been identified as a potential WCT restoration drainage. Potential barrier locations have been identified, but will require additional engineering surveys to determine feasibility and design. Additionally, barrier locations are located within the Centennial Wilderness Study Area (WSA) boundary and would require compliance with WSA regulations for construction.

Corral Creek (East End)

A two-pass depletion estimate for species presence and abundance was conducted in mid July 2014. Two 300 foot stream reaches, located about a mile apart, were surveyed. A total of five brook trout were collected. Stream temperature was found to be 47 degrees at time of survey. The low stream temperature is likely a factor in low fish abundance. An ocular survey of stream and riparian habitat within the survey reaches found habitat to be in good condition with stable banks vegetated with herbaceous plants, sedge and scattered willow. Macro invertebrates were noted as present but in low abundance.

Corral Creek (West End)

BLM fishery personnel conducted a species presence survey in mid Aug 2007. Non-native brook trout and native mottled sculpin were the only species collected. Sculpin densities were low with limited upstream distribution. Brook trout were common and found throughout the BLM portion of the stream. An ocular survey of stream and riparian habitat within the survey reaches found habitat to be in good condition with stable banks vegetated with herbaceous plants, sedge, scattered willow and conifers. The 2014 watershed assessment survey found habitat conditions to be similar to those observed in 2007.

Lima Reservoir

In 2010, MT FWP conducted a species presence survey in Lima Reservoir. Species collected included cutthroat trout, white and long nose sucker, burbot and arctic grayling. A 1951 gill net surveys produced similar results with the exception of cutthroat trout, which were absent in the collection in 1951. However, rainbow trout were noted as being collected, which could be a recording or classification error.

Red Rock River below Lima Dam

A 1951 survey on the river below the dam recorded three arctic grayling being collected. A 1971 survey recorded cutthroat trout, white sucker, long nose sucker and burbot being collected. In 2007 a survey for western pearl shell mussel was conducted adjacent to the BLM reach below Lima Dam with no mussels located.

Winslow Creek

In 2004, one year after the Winslow fire, BLM fishery personnel surveyed fish distribution and collected potential WCT genetic samples from the drainage. However, genetic samples were not submitted for analysis as high levels of hybridization were visually apparent including lack of slash (cutthroat) marks on several fish. Fish were found to be abundant throughout the drainage. As expected after a high severity fire, habitat was found to be severely degraded with entrenched channels and large sediment depositional areas present throughout the drainage. In 2009, BLM fishery personnel performed an ocular habitat survey to assess conditions. Habitat was found to have improved substantially since 2004. Elevated sediment levels were still present in the lower reaches of the drainage, but overall there was a strong upward trend in observed conditions vs those observed in 2004.

Special Status Wildlife Species

Important sage grouse seasonal habitat is centered on breeding and winter complexes. Brood rearing habitats require a mix of forbs and insects for a high protein diet, usually in association with riparian habitats adjacent to sagebrush habitat. Winter diets consist of almost 100% sagebrush. Sage grouse populations and sagebrush habitats have declined in the Western United States on a regional basis due to significant habitat losses range-wide: from habitat agricultural conversion, urbanization, poor livestock grazing, and wildfire leading to annual grassland conversion. This emphasizes the importance of maintaining the integrity of all seral stages of sagebrush habitats on public lands.

Daubenmire range monitoring trend studies were read in 2013 throughout the CW. These occur primarily in alkali sage, three tip sage and mountain big sage habitats; the average sagebrush canopy cover (CC) was 13%, herbaceous CC was 19% and forb CC was 12%. Data was collected at twenty one sage grouse vegetation monitoring plots during 2014 in similar habitat types. This data averaged 36% CC of sagebrush and shrub height averaged 28cm. Herbaceous CC averaged 55% and 11 cm in height. The canopy cover and heights of shrubs and herbaceous vegetation is highly variable based on species composition and soil types. The discrepancies in this data relate to the location of permanent range study sites that were established in locations to document potential changes in range condition and may or may not have sage grouse use. The sage grouse vegetation plots were selected based on known sage grouse uses (telemetry re-

locations, near leks, or personal observations) and is more representative of habitat actually used by sage grouse in the CW.

Historically there were large flocks of sage grouse that migrated and wintered in Idaho. Telemetry data from 2005-2006 have shown that some migration still occurs into Idaho as grouse migrate southwest across Interstate 15 to winter in Idaho or in the Snowline area in southwest Montana. This telemetry data has also documented sage grouse seasonally migrating north into the Basin Creek area. However, many sage grouse do stay and winter in the Centennial Valley. This migration may be dependent on annual snow pack conditions. Yearly counts of displaying males on leks in the CW have remained relatively stable in the past 10 years and in 2014 the average male attendance per lek was the highest since 2007 (District files.) Several potential new leks have been identified in the CW in the past few years by the BLM and TNC.

Pygmy rabbits are found throughout the CW in suitable sagebrush habitat. Pygmy rabbits are endemic to sagebrush and are the only rabbit on the continent to dig their own burrows. Pygmy rabbits require sagebrush for forage and cover, as well as deep alluvial soil to dig burrows. Sagebrush comprises nearly 100% of their winter diet and over half of their summer diet. Estes-Zumpf (2008) recently documented that the ID and MT populations are genetically linked and much more mobile than previously thought. Pygmy rabbits still occupy all of its historical range in Montana and the Dillon Field Office. Montana Heritage program has documented occurrences outside of the historic range in Montana in past years (Hendricks et al. 2007). Pygmy rabbit populations that were documented by Rauscher (1997) as well BLM personnel in 2004-05 were still active throughout the CW in 2013 and 2014.

Wolverines occur in coniferous montane forest types preferring rugged, isolated habitats. Home range size for females and males averages 422 km² in Montana (Foresman, 2001). Wolverines can be found on National Forest lands adjacent to BLM lands and most likely use the Centennial Mountains as a dispersal corridor.

Gray wolves are now a BLM sensitive species and are identified as a “species in need of management” under jurisdiction of MTFWP. Gray wolf populations continue to increase throughout Montana. According to MTFWP 2013 Annual Wolf Report, the estimated minimum number of wolves in MT in 2013 was 627 with a minimum of 152 verified packs. In southwest MT, including the GYA, there is an estimated minimum of 92 wolves and 22 packs. There are no verified packs in the CW although sightings continue to increase. No confirmed depredations occurred in 2014 in the CW.

Bald and golden eagles are still protected under the Bald and Golden Eagle Protection Act, and are BLM sensitive species. There are several known bald and golden eagle territories in the CW that continue to reproduce fledglings. BLM personnel continue to monitor bald eagle nesting territories and document new nests every year within the Dillon Field Office. The number of bald eagles observed during the mid-winter bald eagle counts are increasing as well.

The peregrine falcon was delisted in 1999. In the mid-1980s there were no breeding pairs documented in Montana. Statewide Montana populations have gone from 14 active eyries in 1994 to 140 known eyries that were monitored in 2014 (Montana Peregrine Institute 2014.)

Peregrine falcon management in the CW has centered on re-establishing natural eyries or territories. In the mid-1980s three hack towers were built in the valley along with a hack box placed in Hell Roaring Creek to assist with re-establishing peregrine falcons in the CW. This has been a success as they are still using the hack towers. Natural eyries have been established in the Centennial Mountains. BLM personnel assist the Montana Peregrine Institute with monitoring of six active eyries in the CW yearly.

The CW borders the Beaverhead – Deerlodge National Forest to the north and Caribou – Targhee forest to the south. The area surrounding the CW has been identified as occupied habitat for grizzly bear distribution outside the Yellowstone Recovery Zone. Public lands in the CW provide secure linkage habitat and protection for grizzly bears moving between recovery zones. The population estimate for grizzly bears in the GYA in 2010 was 582 and the population was increasing at approximately 4.2% annually in 2009 (USDI 2011). A Montana state management plan is being developed that would direct grizzly bear management if future delisting were to occur.

The Centennial Mountains are identified as a linkage zone for Canada lynx between the Beaverhead Mountain Range and the Pioneer Mountains; however USFWS has not identified Beaverhead County as a county where lynx is reasonably expected to occur. Potential Canada lynx habitat is limited on BLM lands in the Centennial Mountains along the ID border on the south side of the valley. Lynx analysis units were identified in the CW in 2005 but are now obsolete since no lynx critical habitat has been designated in southwest Montana (USDI, 2014). The Centennial Mountains has been designated as secondary habitat unable to sustain lynx populations but may enable successful dispersal (USDI, 2005.) Snowshoe hare are the primary prey for lynx and winter snowshoe hare habitat is a limiting factor for lynx persistence. Snowshoe hare habitat consists of early succession, dense, young, regenerating forests or multistory forests that have trees whose limbs come down to snow level. In contrast, late succession mature stands are required for lynx denning habitat (Ulev. 2007).

The Priority Linage Assessment completed by American Wildlands in 2008 identified the CW as one of the highest linkage corridors in the High Divide. This includes habitat for all big game species as well as large carnivores such as black bears, grey wolves, grizzly bears, mountain lions and wolverines. The MR REA used the American Wildlands Corridors of Life (ACLCL) model to depict grizzly bear habitat suitability for the CW. Based on habitat quality, the Centennial Mountains rate out as core and sub core habitat with the valley rating out as secondary habitat acting as a corridor for connectivity between occupied habitats. This is depicted by shortest distance and high centrality to occupied habitat and has the highest landscape condition based on grizzly bear habitat requirements.

Forest and Woodland Summary

Forest structure, density and species composition has notably shifted in the low to mid-elevation conifer forests of the CW. This shift, largely the result of fire exclusion, has allowed recent insect outbreaks to affect multiple tree species over large areas causing mortality, defoliation and susceptibility to other stressors. It has also changed the characteristics of fuels available to wildfire, potentially increasing the extent or severity of future fires, compared to those that occurred prior to Euro-American settlement. Aspen decline due to the absence of disturbance,

conifer expansion, and drought has reduced overall habitat biodiversity and negatively affected hydrologic cycles. High elevation whitebark pine communities have experienced widespread mortality from a combination of non-native white pine blister rust and mountain pine beetle. The lack of mature seed-producing white bark pine trees and lack of suitable habitat for natural regeneration may reduce the regional persistence and distribution of this keystone tree species.

Higher elevation lodgepole/spruce/subalpine fir forest provides summer habitat for mule deer and elk, and yearlong habitat for moose. Most wildlife species utilizing this habitat are seasonally migratory or have adapted to cope with significant winter snowfall accumulations. Mid-elevation forests dominated by Douglas-fir provide a wider array of habitat that is generally drier and more available throughout the year. The dry Douglas-fir habitat types have expanded in recent history, enlarging existing stands, and pioneering into adjacent sagebrush habitats. The lack of recent fire in much of this habitat has created conditions that support wildlife species dependent on later-seral conditions. Enlargement of timber stands has created improved “linkages” between larger forested blocks of habitat. Douglas-fir colonization into aspen along the perimeter and within many of these stands provides a dense, multi-storied security habitat between open sagebrush and tall conifer forest that may be more available now than historically. The resulting habitat conversion to Douglas-fir has reduced forage availability, aspen and shrub steppe habitat on a localized basis.

Timber treatments completed in the past five years have promoted aspen regeneration and increased forage for big game. Although the removal of trees reduced hiding cover, the increased forage and aspen regeneration outweighs this loss of cover. The size and juxtaposition of the harvest units along with the remaining un-harvested timber improved the biodiversity within the watershed. As the lodgepole pine stands re-generate, snowshoe hare habitat will improve in areas that were no longer providing habitat prior to harvest.

Fire Regime Condition Class Summary

The FRCC Table 14 above shows when considering the top 10 dominant non-riparian BpS's, 81% of the CW is in Condition Class 2 or 3, which corresponds to a moderate-high departure from pre-European settlement conditions. Fire exclusion has caused many big sagebrush and low elevation forest communities to stall in mid to late-development succession classes. This has resulted in little representation of early seral classes, and continued conifer expansion into mountain big sagebrush communities. The non-native blister rust affecting high elevation whitebark pine also contributes to this departure.

Noxious Weeds Summary

Noxious or invasive weeds that could present a threat to the CW in the future include; dyer's woad, yellow starthistle and rush skeletonweed. Dyer's woad, a highly competitive biennial, can form large dense colonies that displace desirable rangeland species. Infestations of this invader have been found along the railroad tracks from Monida to Lima, MT. Large infestations also occur in the southern and eastern parts of Idaho. Yellow starthistle, a winter annual, is highly competitive and typically develops dense, impenetrable stands that displace desirable vegetation and causes chewing disease in horses. An infestation of starthistle was found in the Limekiln

Canyon area in 2010 and large infestations are known to be in areas of Idaho. Rush skeletonweed, a perennial, reproduces through adventitious root buds and seeds that are transported by wind over distances of up to twelve miles. An infestation of skeletonweed was found in 2014 eight miles north of the Idaho border along Interstate 15. The infestation consisted of three plants that had gone to seed the previous year. Other infestations with the potential to spread into Montana from Idaho have been found in Clark County and within twenty miles of the Montana - Idaho border in Lemhi County. All of these plants could be a major threat to the CW if allowed to spread. In 2007, the BLM became involved in the Continental Divide Barrier Zone project which works to improve communication between counties and agencies within Idaho and Montana concerning noxious weed locations. The goal of this partnership project is to stop the spread of yellow starthistle and rush skeletonweed before they become established in Montana.

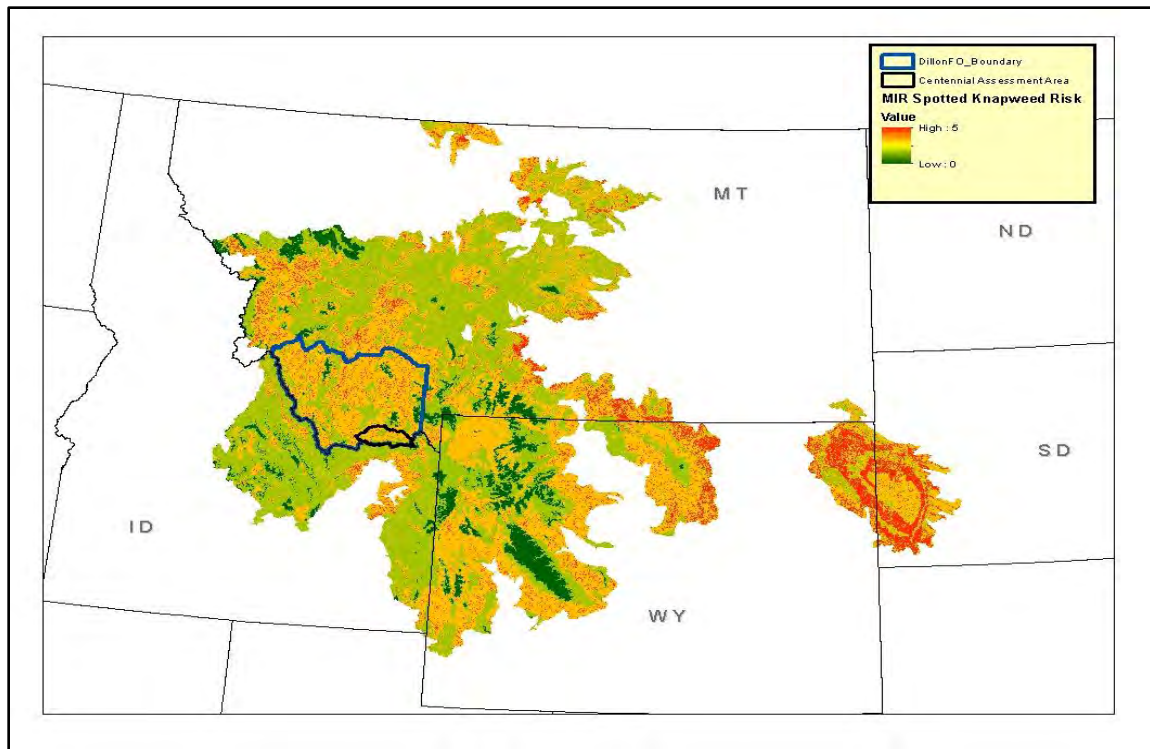
Since 1989, BLM has been involved in cooperative control efforts with Beaverhead County. In 2009 a cooperative effort by Beaverhead County, The Nature Conservancy, Red Rock Lakes National Wildlife Refuge and the BLM was started where each entity took a section of the Centennial Valley to inventory and treat for noxious weeds. Throughout this period the goal has been to prevent new noxious weed infestations and control or eradicate existing infestations within the CW using Integrated Pest Management.

Table 18: Recent Weed Inventories and Treatments in the Centennial Watershed

Year	Acres Treated	Acres Inventoried
2009	65	2500
2010	45	1950
2011	60	2100
2012	50	2600
2013	80	2000
2014	60	2200

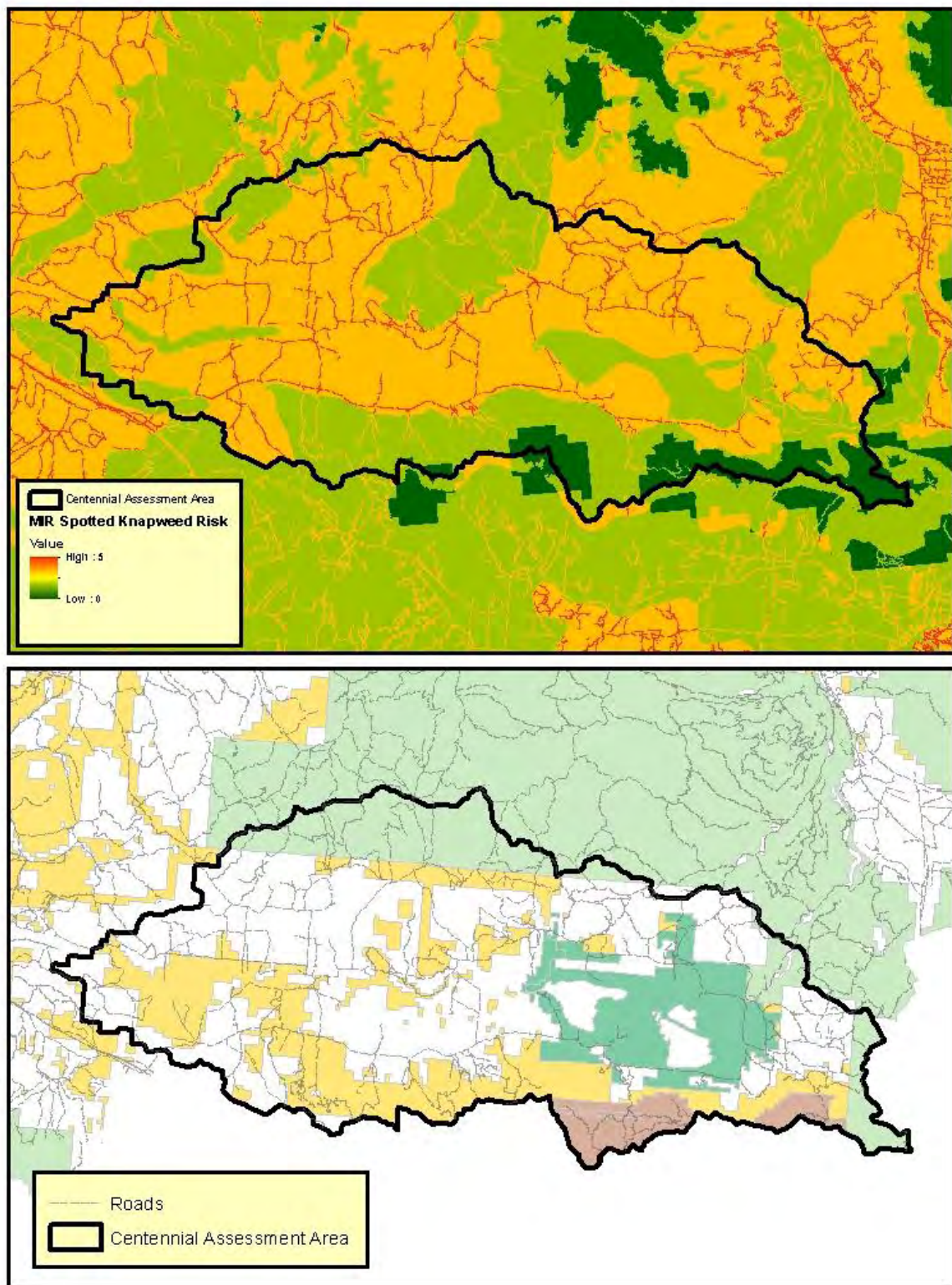
Rapid Ecoregion Assessment (REA) Input

Using data from the MR REA map shows which areas within the REA are most vulnerable to infestation by spotted knapweed. The model looked at the factors that were most likely to influence knapweed establishment such as: elevation, precipitation, vegetation types, soils and proximity to roads. The map below shows the entire Middle Rockies REA's risk to knapweed invasion. Red is the area of highest risk of invasion with yellow being moderate and green the lowest area of risk.



Map 6- Areas in MR REA Most Vulnerable to Spotted Knapweed Invasion

The following Maps 7 and 8 show the MR REA zoomed in to the CW. The top map is the risk assessment of spotted knapweed invasion in the CW, while the bottom shows the main roads within the Centennial Valley. Comparison of the two shows that the areas where roads are present align almost exactly with the areas of highest risk to invasion. While roads are one of the main factors to determine risk of noxious weed establishment, it takes all the factors present to make the highest risk category. Some of the CW has the highest risk for noxious weed establishment. In these areas, it would only take a disturbance, i.e. new road, to begin the noxious weed invasion.



Map 7 and 8- Centennial Watershed Roads and Risk of Spotted Knapweed Invasion

Recommendations for Biodiversity

1. Continue to address localized weed infestations cooperatively with Beaverhead County, The Nature Conservancy, other landowners and partners as appropriate. Continue the existing education effort on weed identification with permittees and other people who use this area. Continue, through participation in the Borders program, to identify and eradicate any new infestations of rush skeletonweed or yellow starthistle moving into Montana from Idaho.
2. Limit any ground disturbance activities that may increase the risk of noxious weed invasion. Where disturbance does occur, use BMPs to mitigate the chance of noxious weed establishment.
3. Consider commercial harvest and non-commercial mechanical treatments to make progress towards shifting forest vegetation back to historic composition, structure and density.
4. Consider use of mechanical and/or prescribed fire treatments to address conifer expansion in sage/grasslands and aspen.
5. Consider commercial harvest to salvage timber stands currently affected by forest insects and diseases, and sanitation treatments to reduce future insect and disease impacts.
6. Explore opportunities to recover the economic value of dead/dying timber resources, and to supply forest products where the demand exists.
7. Explore opportunities to enhance/improve/protect “Priority Habitats” such as aspen, whitebark pine and limber pine.
8. Explore opportunities for protection, conservation and restoration of whitebark pine through application of pheromones, cone/seed collection, and whitebark pine seedling planting.
9. Continue to monitor insect activity in and/or near forest restoration treatments. Consider pheromone applications to prevent insect outbreaks.
10. Maintain a six inch herbaceous/sedge stubble height along greenline and/or three inches on the floodplain by reach, whichever occurs first to provide a sediment buffer on currently occupied WCT streams not managed under a grazing rotation that provides two rest years during a three year period.
11. Maintain meadow habitat along Bean Creek by removing conifer encroachment in portions of T.15N, R.3W, Section 31.
12. Initiate riparian willow/sedge restoration on Bean Creek within the riparian treatment area.
13. Remove the remains of the old logging bridge on Bean Creek in section T 15N, R. 3W, Section 31 and restore the stream channel to natural configuration
14. Continue stream temperature monitoring on a two year alternating basis on Bean Creek to track potential changes due to the riparian conifer treatment.
15. Continue WCT population monitoring on a five year basis in Bean Creek to track potential changes resulting from the riparian conifer treatment.
16. Continue to work with MT Fish, Wildlife and Parks and BLM Wilderness Specialists on survey and design of the Odell Creek fish barrier.
17. Remove Peregrine Falcon Hack towers in the Centennial Valley that are in sage grouse PPMA’s.
18. Maintain adequate cover to protect nesting sage grouse from predators, within identified nesting areas. Implement monitoring of sage grouse nesting habitat per Management Plan and Conservation Strategies for Sage Grouse in Montana.

19. Maintain an early succession forb community on mesic sites that occur near brood rearing areas for sage grouse.
20. Continue to monitor trumpeter swan oxbow excavations to determine occupancy and continue monitoring territories to document nest success.
21. Continue coordination efforts with FWP and MT Audubon Society for yearly sage grouse lek monitoring.
22. Continue coordination efforts with TNC and USFWS on sage grouse research.
23. Work with MT FWP to explore opportunities to re-introduce beavers into drainages with adequate habitat to sustain the reintroduction.
24. Use mechanical means (primarily hand tools) to destabilize sand dunes on a small localized basis to create and maintain early seral habitat for sensitive plant species.

Additional Programs, Issues and/or Concerns

Abandoned Mine Lands

The AML program is an ongoing program which has been addressing legacy mining issues throughout southwest Montana. AML work will continue until all environmental and physical safety issues that can be resolved have been completed. Reclamation will be prioritized by the magnitude of the environmental problem, the severity of the safety risk, funding available, and/or the partnerships available to conduct the work. It will be conducted on a watershed or district scale when possible.

To determine the best reclamation method for each mine a detailed field evaluation must be conducted. Sites with potential water quality issues are reviewed under the CERCLA process, those with physical safety issues only are addressed under the National Environmental Policy Act process. Site assessment includes, but is not limited to, a review for a potentially responsible party (PRP), the geochemical character of the waste rock and tailings impoundments, delineation of the extent of contaminant transport, a cultural inventory and clearance through State Historical Preservation Office, evaluation of the sites for potential animal habitat, and a sensitive plant species review. The reclamation method chosen for each mine is based on the relative importance of the critical components of the site as well as the accessibility/workability of the area. As work progresses, mining areas which have not been sufficiently inventoried will be assessed. To date, significant reclamation work has been conducted at Ermont, southwest of Dillon, and at isolated open mines with safety issues throughout the DFO area. At this time there are no major environmental hazards within the watershed known to exist on public land as the result of historic mining.

Recreation

Recreational use on BLM lands in the Centennial Watershed is generally light to moderate with the exception of the big game hunting season when use increases substantially. Hunting use levels fluctuate dramatically in this area with changes in snow and weather conditions as well as changes in hunting regulations. Antelope hunting is very popular in the valley, while elk and mule deer hunting is the dominant use in the mountains. The limited amount of motorized vehicle access in the Centennial Mountains seems to be attracting additional elk hunting pressure as off-road vehicle violations in other areas seems to be increasing and disrupting more hunting

opportunities displacing the more traditional hunters from those areas into the Centennial Mountains.

Another recreational attraction to this area includes the Continental Divide National Scenic Trail (CDT), which traverses the high country through the Centennial Mountains, luring horseback riders, hikers, and backpackers to some of the spectacular scenic and recreational opportunities available during the summer months. The CDT meanders back and forth across the divide as well as multiple land managing agency boundaries; including USFS, Agricultural Research Service (ARS), and BLM. The primary access to the trail on the Montana side of the divide is by way of tributary trails maintained and managed by the BLM (except Odell Creek Trail managed by the USFWS). Maintenance on some of the trails in the Centennials has been neglected over the years, and additional work is needed to restore them to more sustainable and functional condition. The Centennial Mountains Travel Management Plan completed in 2001 identified which trails in the Centennials would be maintained by the BLM over the long term. Those decisions were carried forward and adopted in the 2006 RMP.

Also very popular throughout the summer is use of the valley roads for bicycle and motorcycle touring. These popular recreation activities draw many visitors to the valley, though their use of BLM lands is relatively minimal off of the county roadways. Most cyclists, both motorized and non-motorized use the USFWS campground at Upper Red Rock Lake, though a few may use roadside camping on undeveloped BLM lands adjacent to the county roads on both the north and south valley roads.

Travel Management

As a result of the 2006 Dillon Field Office RMP, public motorized wheeled vehicle use is limited to those routes designated as open. All other routes are considered closed, with few exceptions to accommodate administration of permits, to access private lands, or other limited circumstances. Corrections of mapping errors in the original route designations in the RMP, and other minor adjustments to route designations will be made through this watershed assessment process and specified in the environmental assessment and decision record.

Travel Management Recommendations

1. Analyze, and make necessary adjustments to route designations where concerns were documented.
2. Consider installing up to four culverts on the main access road in the Fish Creek allotment.
3. Consider the following changes to the designated routes within the watershed as indicated
 - Bean Creek (new gate location) – several years ago, a new gate was installed on the Bean Creek Road to reduce extensive rutting and erosion during the hunting season.
 - Routes around Lima Reservoir – several of the routes identified as designated routes around Lima Reservoir were incorrectly mapped and should be corrected in this assessment.
 - Antelope Flats area – several routes in the Antelope Flats area were also incorrectly mapped and designated as open. Corrections should be made in this assessment.
 - Wolverine Creek Road – BLM has held an access easement across State Lands on this road for many years, but the route is in very poor condition, and has been modified

through user traffic. This route has also been affected by the closure of segments across adjacent private property, resulting in loss of public access to public lands in this area. The DNRC and BLM continue to consult regarding modification of the existing easement to improve the road access, minimize resource impacts, and restore public access to this area of public lands.

- Corral Creek Road – this route was closed in the 2001 Centennial Mountains Travel Management Plan in exchange for an easement to provide for parking on private property adjacent to the WSA. The road segment that was closed at that time had historically provided public access to nearly one mile of additional public lands outside of the WSA, providing camping opportunities and additional recreational access for hunting and hiking. This was very controversial at the time, and has been recommended that this issue be reconsidered within this assessment.
- Blair Lake Loop Trail added to maintenance list – this back country trail was originally designated as part of the Continental Divide National Scenic Trail. The location of the CDT was changed in 2007 to route it around Lillian Lake, and provide a better, more sustainable trail. The Blair Lake Loop Trail was identified to be left unmaintained, but has been used and maintained by the public and the BLM to provide a desirable loop trail in this area of the Centennials.

Lands and Realty

The Lakeview Ski Chalet is located approximately one mile southwest of Lakeview at T. 14 S., R. 2 W., Sec. 26: NE¼NW¼. There is no public or legal access to the ski chalet except by foot through the Red Rock Lakes National Wildlife Refuge.

The Ski Chalet building is a 30 feet x 30 feet two-story, wood frame structure with a wraparound deck situated on seven foot high concrete foundation, and covered by a wood shingle roof. The building was constructed in 1965 through a BLM special use permit for a ski operation. The ski operation was later discontinued and eventually was abandoned in 2001. The BLM acquired the building in 2003, by default, when the owner of the building and lessee of a BLM Commercial Lease failed to comply with the law, regulations or terms and conditions of the lease. In 2004, two proposals were received by the BLM requesting to lease the chalet. An appraisal to determine fair market rental was completed. The appraiser was unable to make a rental determination because the building was unleaseable in its current condition. A Condition Assessment was then completed to determine the necessary repairs and costs associated in order to meet International Building Code requirements in order to lease the building to prospective applicants. The estimated cost of repairs to the structure in which the BLM did not have legal access to was not in the best interest of the public and therefore was not pursued. However, the two interested parties amended their applications to include making the necessary repairs to operate and maintain the facility.

While reviewing the proposals for use of the chalet, it was discovered that the “official” boundary map for the Centennial Mountains WSA showed the ski chalet to be within the WSA. This is in spite of a 1978 IBLA decision that directed BLM to remove the building (and surrounding lands covered by a commercial lease) from the “primitive area” boundary which was designated in 1975. This appears to have been a mapping error that is both on the topographic map and within the Centennial Mountains Wilderness EIS. The intensive inventory

file described the leased lands as being excluded, and the master title plat was amended shortly after the Interior Board of Land Appeals decision to exclude the leased tract and an additional 40 ± acres. We are currently working to resolve this mapping error. The applications were rejected because the scope of the proposed project was not compatible with management criteria of the area (Centennial Mountains ACEC/WSA). One of the applicants appealed the BLM decision and was allowed to reapply in 2007, receiving authorization in 2008 to repair, operate, and maintain the ski chalet. The Land Use Permit expired August 31, 2011 and was not reissued as the terms and conditions of the permit were not fulfilled as required. An inspection of the building was completed in August 2011 documenting the building has deteriorated significantly as a result of required repairs not made as agreed upon by the permit holders. The rodent infestation is highly susceptible to concerns of Hantavirus exposure. On July 16, 2012 an Asbestos-Containing Materials survey (L1823447) was conducted which concluded the building contains asbestos.

On December 6, 2013 a BLM Interdisciplinary (ID) Team examined the structure and determined the building to be hazardous and a threat to public safety due to the severity of the structure's deterioration and an abundant presence of vermin and rodent feces.

On August 7, 2013, the BLM authorized officer signed a Decision to demolish and remove the building and associated infrastructure from public lands. Pending currently ongoing legislative review, the BLM intends to continue with the Decision to demolish and remove the building and associated infrastructure and clean up and restore the site.

In August, 2014 the BLM installed keep out signs to warn the public as well a gate on public land along the road accessing the site (the road originates on private land off the South Centennial road). The BLM also boarded up the doors and windows so that members of the public cannot access the building and be subjected to the safety risks identified above until the legislative review has been completed and/or the safety hazard removed.



Lakeview Ski Chalet – photo taken December, 2012

Interdisciplinary Team Composition

Core IDT members for the CW Assessment include:

Ryan Martin, Rangeland Management Specialist (IDT Leader)
Kelly Bockting, Wildlife Biologist
Paul Hutchinson, Fisheries Biologist
Kipper Blotkamp, Forester
Stephen Armiger, Hydrologist (Soil, Water & Air)
Pat Fosse, Supervisory Natural Resource Specialist
Joe Sampson, Fuels Specialist

Support IDT members include:

Michael Mooney, Weeds Specialist
Jason Strahl, Archaeologist
Laurie Blinn, GIS Specialist
Rick Waldrup, Outdoor Recreation Planner
Kelly Savage, Rangeland Management Specialist (Special Status Plants)
Bob Gunderson, Geologist
Dave Williams, Geologist, Butte Field Office
Ashley Wells, Forestry Technician

Other resource members involved:

Mike Philbin, Supervisory Physical Scientist, Montana/Dakotas BLM State Office
Weston Miller, Forestry Technician
Berett Erb, 2014 Range Technician
Leea Anderson, 2014 Range Technician
Haleigh Lichtenberg, 2014 Range Technician
Melanie Finch, 2014 Wildlife Technician
Lucas Magee, 2014 Wildlife Technician
Jed Berry, Fisheries Technician
Cari Forsgren, 2014 Range Technician
Leah Murray, 2014 Range Technician
Ashley Wells, 2014 Forestry Technician
Lindsey Schmidt, Range Specialist, NRCS

GLOSSARY OF TERMS

Animal Unit- A 1000-pound cow, with or without an un-weaned calf, with such a cow consuming 26 pounds of forage dry matter per day.

Animal Unit Month- The amount of forage needed by an “**animal unit**” (AU) grazing for one month.

Anticline: In structural geology, an anticline is a fold that is convex up and has its oldest beds at its core.

Anthropogenic: Caused or influenced by humans.

Bankfull stage: “The bankfull stage corresponds to the discharge at which channel maintenance is most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing the work that results in the average morphologic characteristics of channels.” Dunne and Leopold (1978).

Census County Division: Census county divisions (CCDs) are geographic statistical subdivisions of counties established cooperatively by the Census Bureau and officials of state and local governments in states where minor civil divisions (MCDs) either do not exist or are unsatisfactory for census purposes.

Channel stability: the ability of the stream, over time, to transport the flows and sediment of its watershed in such a manner that the dimension, pattern and profile of the river is maintained without either aggrading nor degrading.

Critical Shear Stress: For a fluid to begin transporting sediment that is currently at rest on a surface, the boundary (or bed) shear stress τ_b exerted by the fluid must exceed the critical shear stress τ_c for the initiation of motion of grains at the bed. This is typically represented by a comparison between a dimensionless shear stress (τ_b^*) and a dimensionless critical shear stress (τ_c^*). The nondimensionalization is in order to compare the driving forces of particle motion (shear stress) to the resisting forces that would make it stationary (particle density and size). This dimensionless shear stress, τ^* , is called the Shields parameter. Critical shear stress: the Shields diagram empirically shows how the dimensionless critical shear stress required for the initiation of motion is a function of a particular form of the particle Reynolds number, Re_p or Reynolds number related to the particle.

Desired Condition: A desired condition is a description of specific social, economic, and/or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates (36 CFR 219.7(e)(1)(i)).

Diatreme: A diatreme, sometimes known as a maar-diatreme volcano, is a volcanic pipe formed by a gaseous explosion. When magma rises up through a crack in the Earth's crust and makes contact with a shallow body of ground water, rapid expansion of heated water vapor and volcanic gases can cause a series of explosions.

Ecological Sites: a distinctive kind of land with specific characteristics that differs from other kinds of land in its ability to produce a distinctive kind and amount of vegetation. (USDA Definition).

Entrenchment: the vertical containment of river and the degree to which it is incised in the valley floor.

Entrenchment ratio: a quantitative expression of the ratio of the flood prone width to the bankfull width.

Flood prone width: width measured at an elevation which is determined at twice the bankfull depth.

Forest land: land that is now, or has the potential of being, at least 10 percent stocked by forest trees (based on crown closures) or 16.7 percent stocked (based on tree stocking).

Functional at risk (FAR): riparian wetland areas that are functional, but an existing soil, water, or vegetation attribute makes them susceptible to degradation.

Greenline: that specific area where a more or less continuous cover of vegetation is encountered when moving away from the center of an observable channel. The greenline is often, but not necessarily, located at the water's edge.

Hummocking: a form of micro-topographic relief characterized by raised pedicels of vegetated soil as much as 0.6 m (2ft) higher than the surrounding ground which results from long term large animal trampling and tracking in soft soil. Vegetation on the pedicels usually differs from that on the surrounding lower area due to moisture difference between the two levels. Hummocking is also caused by abnormal hydrologic heaving.

Hydric soil: soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrophyte: Any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hydrologic Unit: The USGS has developed a system of geographic units based upon watersheds. These units were originally subdivided to four levels. Subsequently two additional subdivisions have been developed. Currently there are six levels, with the sixth being the smallest unit.

Kerogen: Kerogen is a complex waxy mixture of hydrocarbon compounds that is the primary organic component of oil shale. Kerogen is thought to have originated from compacted organic material, such as algae and various forms of plant life, that accumulated at the bottom of ancient lakes and seas and was buried at great depths over long periods of geologic time.

Krummholz: the shrubby, multistemmed form assumed by trees and other woody vegetation near the treeline.

Lacustrine: from the French “lacustre” or lake. Permanently flooded lakes and reservoirs, generally over 20 acres, exhibiting wave-formed or bedrock shoreline features. (Cowardin *et al.*, 1979).

Lands with Wilderness Characteristics: those lands that have been inventoried and determined by the BLM to contain wilderness characteristics as defined in Section 2 (c) of the Wilderness Act. These are separate from lands already designated as Wilderness or wilderness study areas.

Lentic: standing or still water such as lakes and ponds.

Lotic: flowing or actively moving water such as rivers and streams.

Nonpoint source pollution: pollution originating from diffuse sources (land surface or atmosphere) having no well-defined source.

Palustrine: from the Latin “palus” or marsh. All non-tidal wetlands dominated by trees, shrubs, persistent emergent plants, emergent mosses or lichens. (Cowardin *et al.*, 1979)

Preliminary General Sage-grouse Management Areas (PGMA): Is occupied (seasonal or year-round) habitat outside of priority habitat. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Preliminary Priority Sage-grouse Management Areas (PPMA): Areas that have been identified as having the highest conservation value to maintaining sustainable sage-grouse populations. These areas would include breeding, late brood-rearing, and winter concentration areas. These areas have been identified by state fish and wildlife agencies in coordination with respective BLM offices.

Proper functioning condition (PFC): Lotic riparian-wetland areas are considered to be in proper functioning condition when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid floodplain development;
- Improve flood-water retention and ground-water recharge;

- Develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses;
- Support greater biodiversity

Riparian –wetland areas can function properly before they achieve their potential. The PFC definition does not mean potential or optimal conditions have been achieved.

Pugging: the small depressions and areas of compaction in saturated soils caused by the hoof action of animals.

Resource Reserve Allotment: A unit of public land that will not have term grazing permits issued. Such an allotment would only be grazed on a temporary nonrenewable basis. The use of this allotment would be to provide temporary grazing to rest other areas following wildfire, habitat treatments, or to allow for more rapid attainment of rangeland health.

Riparian zone: the banks and adjacent areas of water bodies, water coursed, seeps, and springs whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a moister habitat than that of contiguous flood plains and uplands.

Rosgen Classification System: A classification system for natural rivers in which a morphological arrangement of stream characteristics is organized into relatively homogeneous stream types. Morphologically similar stream reaches are divided into 7 major stream type categories that differ in entrenchment, gradient, width/depth ratio, and sinuosity in various landforms. Within each major category are six additional types delineated by dominant channel materials from bedrock to silt/clay along a continuum of gradient ranges.

Spring brook: a channel that carries water from a spring. Where there is sufficient flow, the channel forms a perennial stream. Frequently in arid environments, the flow is insufficient to create a perennial stream. Groundwater emerges at the springhead, flows a short distance within the spring brook, and then submerges.

Spring province: a group of springs in close geographical proximity.

Stream power: **Stream power** is the rate of energy dissipation against the bed and banks of a river or stream per unit downstream length. It is given by the equation: $\Omega = \rho g Q S$ where Ω is the stream power, ρ is the density of water (1000 kg/m³), g is acceleration due to gravity (9.8 m/s²), Q is discharge (m³/s), and S is the channel slope. **Unit stream power** is stream power per

unit channel width, and is given by the equation: $\omega = \frac{\rho g Q S}{b}$ where ω is the unit stream power, and b is the width of the channel. Stream power is used extensively in models of landscape evolution and river incision.

Total Maximum Daily Load (TMDL): The goal of the Clean Water Act (CWA) is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Under section 303(d) of the CWA, states are required to develop lists of impaired waters. The law requires that states establish priority rankings for waters on the lists and develop TMDLs for

these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards.

TMDL Planning Areas: Montana DEQ is using a watershed approach to address TMDLs based on the premise that water quality restoration and protection are best addressed through integrated efforts within a defined geographic area. DEQ has divided the state into 91 watershed planning areas to facilitate development of TMDL/water quality restoration plans.

Wilderness Characteristics: These attributes include the area's size, its apparent naturalness, and outstanding opportunities for solitude or a primitive and unconfined type of recreation. They may also include supplemental values.

Woodland: forest communities occupied primarily by noncommercial species such as juniper, mountain mahogany, or quaking aspen groves. All western juniper forest lands are classified as woodlands, since juniper is classified as a noncommercial species. Woodland tree and shrub canopy cover varies, but generally individual plant crowns do not overlap.

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