UPPER COLORADO RIVER BASIN
RAWLINS FIELD OFFICE
STANDARDS AND GUIDELINES ASSESSMENT
2011 Field Season

Document for Agency, Permittee, and Interested Public Review

September 2012

BLM

High Desert District – Rawlins Field Office, Wyoming

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Bureau of Land Management

Rawlins Field Office

2012 Standards and Guidelines Assessment

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I have reviewed the Standards and Guidelines Assessment for the Upper Colorado River Watershed. I concur with the evaluation procedures and with the conclusions and recommendations of the review team with respect to each of the six Rangeland Standards. Based on this report, a determination will be prepared and transmitted to the appropriate parties.

Dennis Carpenter, Field Manager	**Date** 9/19/12

INTRODUCTION **4**

BACKGROUND **4**

MANAGEMENT CHANGES BETWEEN 2001 AND 2011 ..... **10**

CLIMATE BETWEEN 2001 AND 2011 ..... **10**

SUMMARY OF STANDARDS THAT FAILED IN 2002 ..... **12**

STANDARD 1 – WATERSHED **14**

Upper Muddy Creek **14**
1) Characterization: 14
2) Issues and Key Questions: 17
3) Current Conditions: 17
4) Reference Conditions: 20
5) Synthesis and Interpretation: 20
6) Recommendations: 23

Barrel Springs Draw **25**
1) Characterization: 25
2) Issues and Key Questions: 25
3) Current Conditions: 26
4) Reference Conditions: 26
5) Synthesis and Interpretation: 27
6) Recommendations: 28

Lower Muddy Creek **28**
1) Characterization: 29
2) Issues and Key Questions: 29
3) Current Conditions: 29
4) Reference Conditions: 32
5) Synthesis and Interpretation: 32
6) Recommendations: 34

Savery Creek **35**
1) Characterization: 32
2) Issues and Key Questions: 32
3) Current Conditions: 32
4) Reference Conditions: 38
5) Synthesis and Interpretation: 38
6) Recommendations: 39

Little Snake River – Willow Creek & Powder Wash Draining Areas **40**
1) Characterization: 40

2) Issues and Key Questions: 40
3) Current Conditions: 40
4) Reference Conditions: 40
5) Synthesis and Interpretation: 41
6) Recommendations: 42

Sand Creek **43**
1) Characterization: 43
2) Issues and Key Questions: 44
3) Current Conditions: 44
4) Reference Conditions: 45
5) Synthesis and Interpretation: 45
6) Recommendations: 46

Shell Creek **47**
1) Characterization: 47
2) Issues and Key Questions: 47
3) Current Conditions: 47
4) Reference Conditions: 47
5) Synthesis and Interpretation: 47
6) Recommendations: 48

STANDARD 2-RIPARIAN/WETLANDS **48**
1) Characterization: 48
2) Issues and Key Questions: 49
3) Current Conditions 50
4) Reference Conditions: 55
5) Synthesis and Interpretation: 58
6) Recommendations: 61

STANDARD 3 – UPLANDS **62**
1) Characterization: 62
2) Issues and Key Questions: 62
3) Current Conditions: 63
4) Reference Conditions: 66
5) Synthesis and Interpretation: 66
6) Recommendations: 71

STANDARD 4 – WILDLIFE/THREATENED AND ENDANGERED SPECIES/FISHERIES HABITAT AND WEEDS **75**

Wildlife/Threatened and Endangered Species **75**
1) Characterization 75
2) Issues and Key Questions 84
3) Current Conditions: 89
4) Reference Conditions: 96
5) Synthesis and Interpretation: 96
6) Recommendations: 99

Fisheries **100**
1) Characterization 100
2) Issues and Key Questions 101
3) Current Conditions 104
4) Reference Conditions 105
5) Synthesis and Interpretation 105
6) Recommendations 106

Weeds **107**
1) Characterization: 107
2) Issues and Key Questions: 108
3) Current Conditions: 108
4) Reference Conditions: 110
5) Syntheses and Interpretation: 110
6) Recommendations: 111

STANDARD 5 – WATER QUALITY **111**
1) Characterization: 111
2) Issues and Key Questions: 111
3) Current Conditions: 112
4) Reference Conditions: 113
5) Syntheses and Interpretation: 113
6) Recommendations: 114

STANDARD 6- AIR QUALITY **115**
1) Characterization: 115
2) Issues and Key Questions: 115
3) Current Conditions: 116
4) Reference Conditions: 116
5) Synthesis and Interpretation: 116
6) Recommendations: 117

SUMMARY **118**
Standard 1 – Watershed 118
Standard 2 – Riparian/Wetlands 118
Standard 3 – Uplands 118
Standard 4 – Wildlife/Threatened and Endangered Species/Fisheries Habitat, Weeds 119
Standard 5 – Water Quality 119
Standard 6 – Air Quality 120
Allotments described in this report that do not meet Standards due to Livestock Grazing: 120
Standards not being met due to causes other than livestock grazing: 120

REFERENCES **121**

EXHIBIT "A" **125**

Acknowledgments

The Bureau of Land Management (BLM) Rawlins Field Office (RFO) would like to thank the Little Snake River Conservation District (LSRCD) for their long-term commitment to resource enhancement and partnering with the BLM in management, monitoring, and project development. The BLM would also like to thank the Wyoming Game and Fish Department (WGFD) for their long-term collaboration with the BLM in fisheries and wildlife management, riparian monitoring, and supporting needed research. In addition, there are other individuals, groups and agencies that the BLM work with or have given funding to support management, monitoring or improvements that the BLM thanks you for your assistance to improve the public lands the BLM administers.

INTRODUCTION

The original watershed assessment for the Upper Colorado River Basin within the (RFO) administered by the (BLM) was completed 10 years ago (2002). This document is available for review online at:http://www.blm.gov/wy/st/en/field_offices/Rawlins/range/standards01.html.

Paper copies of the assessment are available for review at RFO. It will be referenced and portions briefly summarized (but not repeated) in the following document.

This watershed assessment is the beginning of the second round of these assessments for the seven different areas the (RFO) has been divided into. There were approximately 230 transects and 50 channel cross-sections read and over 800 photo-points retaken; these are also available to review at the RFO. The watershed assessment process on the scale of the RFO, which spans 3.5 million surface acres, forces an approach different than from an allotment level assessment, but in the minds of this BLM office it has many more benefits. First, every region within the RFO gets reviewed every 10 years, so the BLM can evaluate what was accomplished, what still needs to be done, and what new issues have arisen that need to be addressed. Second, the larger and more important issues to address are focused upon, with time to take corrective action and monitor results. Third, the landscape scale works for all disciplines, from watersheds for hydrologists to herd areas for wildlife biologists to allotments for range specialists, as well as for the variable mixture of BLM partners. Fourth, it provides a priority for planning the BLM future workloads and monitoring in order for the BLM to secure funding, as well as give BLM partners a look at our path ahead, and accountability to the public the BLM works for.

BACKGROUND

The RFO has been divided into seven watershed units which are being assessed every 10 years, with the Upper Colorado River being the first watershed report completed in each cycle (Map #1). The Upper Colorado River Basin occupies 1,711,621 acres in Carbon and Sweetwater counties in south-central Wyoming, of which 1,504,775 acres are within the RFO. Land ownership consists of 73% federal lands, 22% private lands, and 5% state lands. Federal ownership includes 929,881 acres administered by the BLM and 165,029 acres administered by the U.S. Forest Service (Map #2).

This watershed contains the Adobe Town Wilderness Study Area (WSA), Adobe Town Wild Horse Herd Management Area (HMA), Sand Hills/JO Ranch Area of Environmental Concern (ACEC), Upper Muddy Creek Watershed/Grizzly Wildlife Habitat Management Area, Cow Butte/Wild Cow Wildlife Habitat Management Area, High Savery Dam and Reservoir Site, part of the Continental Divide National Scenic Trail, and three Historic Trails – Overland, Cherokee and Rawlins-to-Baggs (BLM 2008). There are multiple gas field developments including Atlantic Rim, Creston-Blue Gap, Desolation Flats, South Baggs,

and Continental Divide (Wamsutter). There are 104 allotments permitted for grazing use split between cattle (92%) and sheep (8%) (Map #3 and Exhibit "A").

The 1996 rangeland reform process modified the grazing regulations to address the fundamentals of rangeland health. In August 1997, the *Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for the Public Lands Administered by the Bureau of Land Management in the State of Wyoming* were approved by the Wyoming State Director. The objectives of the rangeland health regulations are to "promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions…and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands." The fundamentals of rangeland health combine the basic precepts or physical function and biological health with elements of law relating to water (and air) quality and plant and animal populations and communities. Initially the standards focused on livestock grazing on the BLM-administered lands, but the standards were developed to apply to all uses and resources.

In January 2001, Instruction Memorandum No. 2001-079, Guidance for Conducting Watershed-Based Land Health Assessments, was issued. This IM transmitted the 4180 Manual Section and 4180-1 Rangeland Health Standards Handbook and provides guidance for conducting assessments and evaluations for ascertaining rangeland health on a watershed basis. Under Policy/Action it states: "The Field Offices are to consider all assessment requirements for the watershed being assessed and select methods which will provide information needed to fulfill those requirements. When a field office invests its resources in an assessment, the end product should substantially meet all assessment needs to avoid conducting multiple assessments for multiple needs. For example, a well-planned, watershed-based assessment can provide the information needed for allotment evaluations, biological assessments for Section 7 Endangered Species Act consultation, and developing habitat management plans, Water Quality Improvement Plans for Total Maximum Daily Loads on impaired waters, and watershed restoration actions."

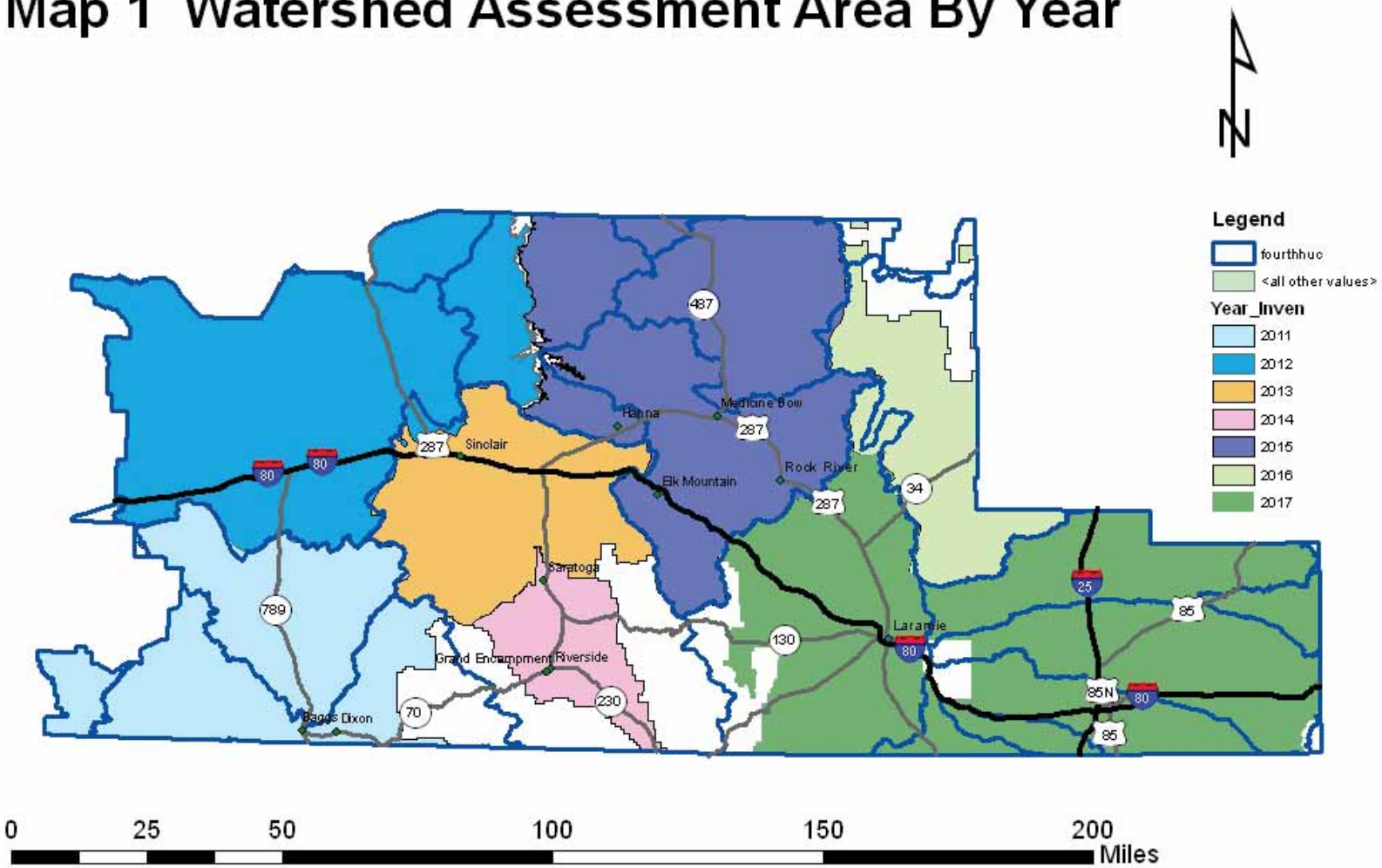
The standards are the basis for assessing and monitoring rangeland conditions and trend. The assessments evaluate the standards and are conducted by an interdisciplinary team with participation from permittees and other interested parties. Assessments are only conducted on the BLM-administered public land, however, interpretation of watershed health and water quality may reflect on all land ownerships within the area of analysis. The six standards are as follows:

<u>Standard 1 – Watershed Health</u>: *Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.*

> The standard is considered met if upland soil cover generally exceeds 30% and obvious signs of soil erosion are not apparent, and stream channels are stable and improving in morphology.

<u>Standard 2 – Riparian/Wetland Health</u>: *Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel success and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.*

Map 1 Watershed Assessment Area By Year



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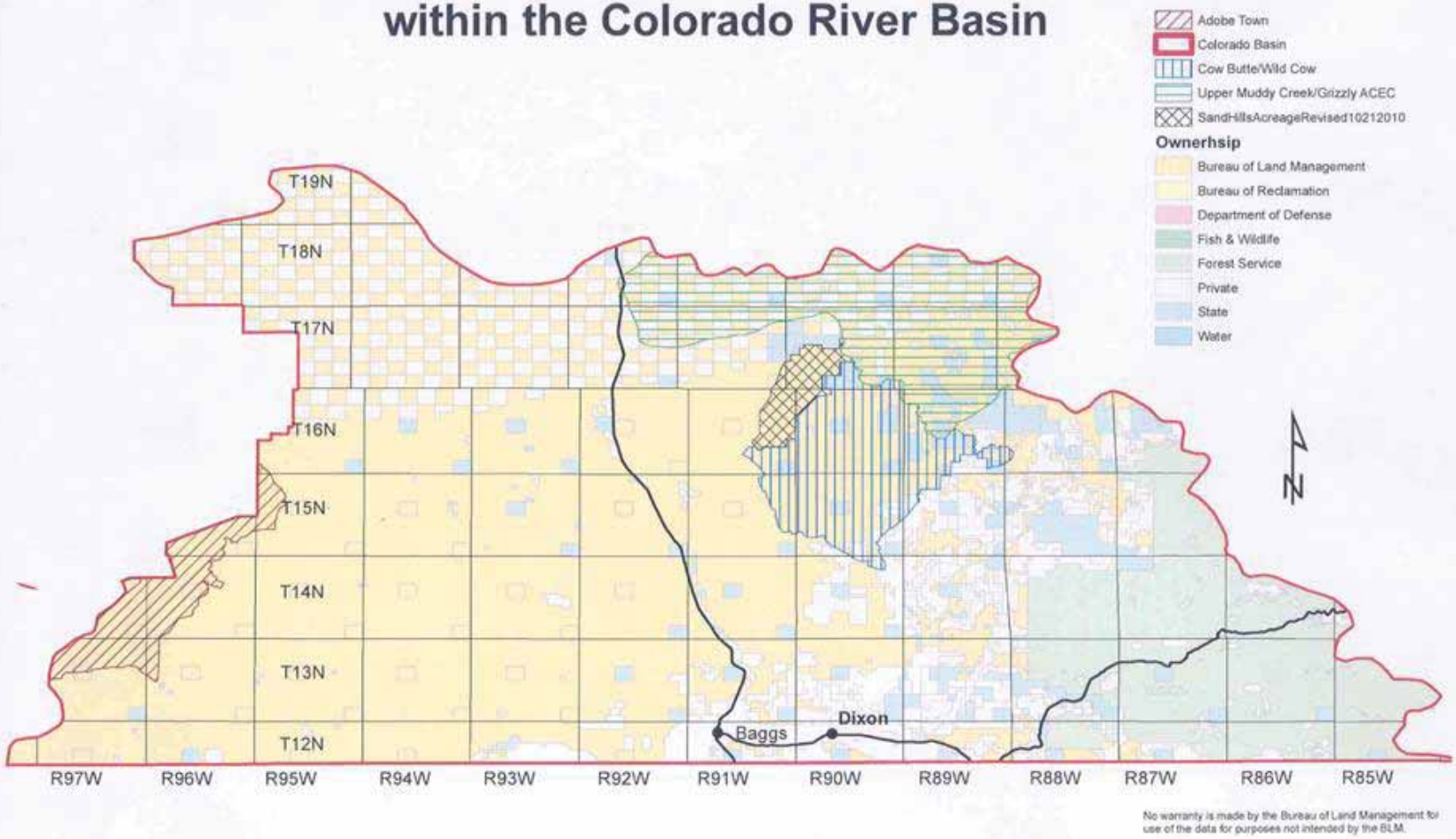
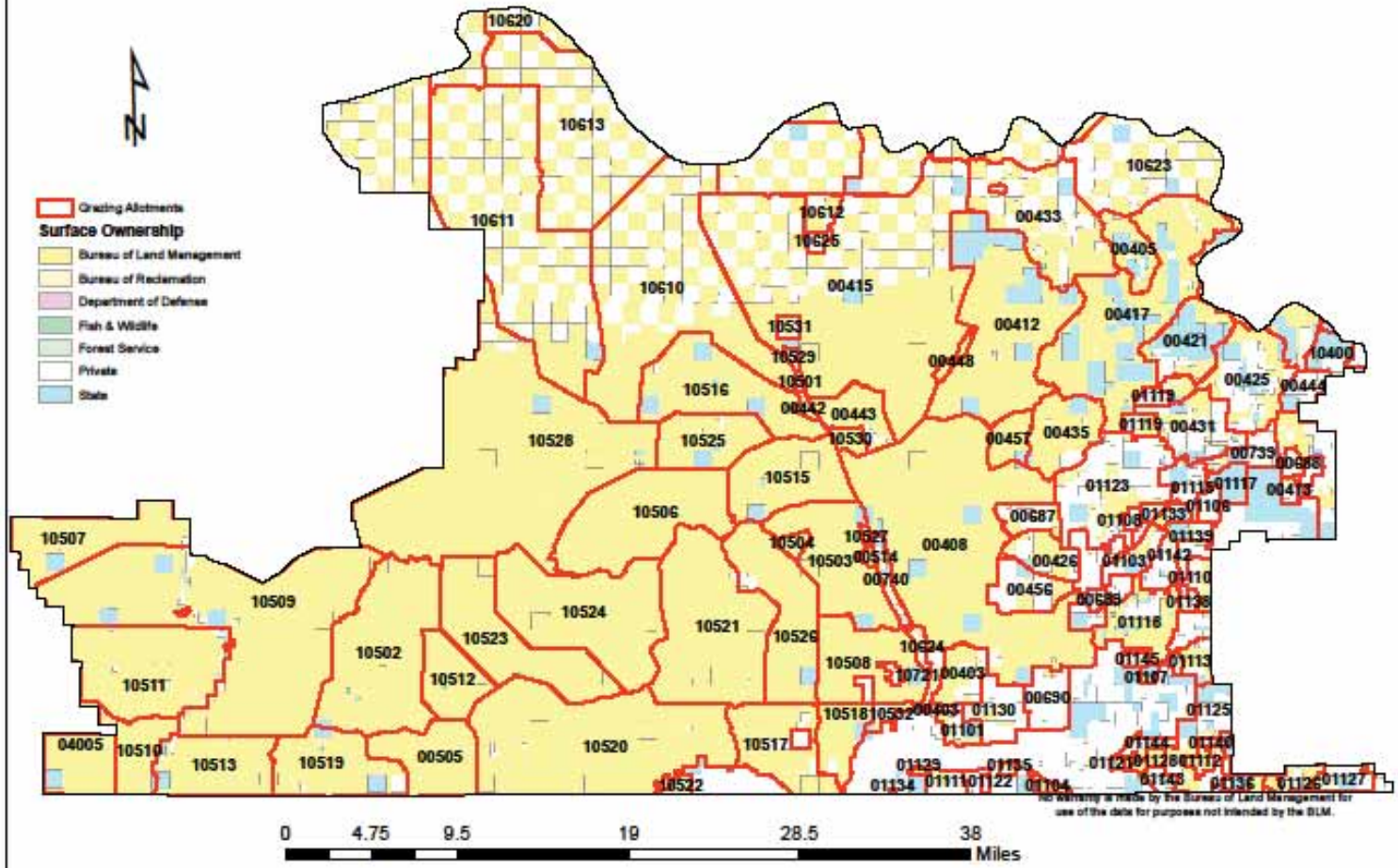
Map 2 Land Ownership and Special Management Areas within the Colorado River Basin



Map 3 - Livestock Grazing Allotments Within the Colorado River Basin Watershed Assesment Area



The standard is considered met if riparian/wetland habitat is rated in Proper Functioning Condition (PFC) and existing management will lead to maintaining or improving resource conditions.

Standard 3 – Upland Vegetation Health: *Upland vegetation on each ecological site consists of plant communities appropriate to the site which are resilient, diverse, and able to recover from natural and human disturbance.*

The standard is considered met if plant communities are sustaining themselves under existing conditions and management.

Standard 4 – Wildlife/Threatened and Endangered Species Habitat Health, Fisheries, Weeds: *Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.*

The standard is being met if habitat needed to support wildlife and fishery species is being sustained under existing conditions and management. Existing populations or new locations with weeds are being treated in a timely manner.

Standard 5 – Water Quality: *Water quality meets state standards.*

The standard is considered unknown unless information provided by the State of Wyoming determines the status of a water body as impaired (not meeting) or is meeting its beneficial uses.

Standard 6 – Air Quality: *Air quality meets state standards.*

The standard is considered met or impaired based on information provided by the State of Wyoming.

If an assessment shows that a standard(s) is not being met, factors contributing to the non-attainment are identified and management recommendations developed so the standard may be attained. If livestock are contributing to the non-attainment of a standard, as soon as practical but no later than the start of the next grazing season, management practices will be implemented to ensure that progress is being made toward attainment of the standard(s). The rangeland standards established a threshold; however, the desired resource condition will usually be at a higher level than the threshold.

The framework for this report will be a discussion of each rangeland standard in the order described above. The outline of the discussion for each standard will follow the six-step process for ecosystem analysis at the watershed scale. The six steps are: 1) Characterization of the watershed, 2) Identification of issues and key questions, 3) Description of current conditions, 4) Description of reference conditions, 5) Synthesis and interpretation of information, and 6) Recommendations. Core topics will be discussed under the appropriate standard, with erosion processes, hydrology, and stream channels under Standard 1; vegetation split into wetland/riparian or upland under Standards 2 and 3; species and habitats along with weeds under Standard 4; and water quality and air quality under Standards 5 and 6. Human uses would be discussed under each Standard where appropriate. Standard 1- Watershed Health has been split into seven descriptions for different hydrologic units, while Standards 2 through 6 are each described as one unit for the entire upper Colorado River watershed.

MANAGEMENT CHANGES BETWEEN 2001 AND 2011

Red Wash Wetlands – In the early 2000's the LSRCD completed construction of Red Wash wetlands in cooperation with the BLM and City of Cheyenne as mitigation for earlier water diversions from the Little Snake River drainage. This project and later additions have created approximately 360 acres of riparian/wetland habitat in an area previously dominated by greasewood. This habitat supports local wildlife and many species of migratory waterfowl and shorebirds.

High Savery Dam – In 2004 this project was completed (3 years of construction) and filled to capacity within two years, constructed by the State of Wyoming Water Development Commission. The earthfill dam is 165 feet high and created a reservoir (at normal pool) of 482 surface acres and holds 22, 432 acre-feet of water. It provides more reliable late season irrigation water to the Upper Little Snake River area, a managed fishery containing Colorado River cutthroat trout, tiger trout and kokanee, and recreational fishing.

JO Ranch – In 2006 the BLM acquired the JO Ranch via a land exchange with Midway Land & Coal Company. The exchange led to 600 acres along Cow Creek in the Muddy Creek watershed becoming public land administered by the RFO, including the historic JO Ranch headquarters, which has been added to the Sandhills ACEC that bordered it to the north. This site has been registered as a historic site with the future objective of showcasing both its' historic use in the sheep industry and current component in an active cattle ranch.

Atlantic Rim Natural Gas Field Development Project – In 2007 the Record of Decision was signed by the BLM for future development of both methane gas from coal deposits and deeper natural gas. This project approved drilling approximately 1,800 coalbed natural gas wells and 200 conventional well to recover energy resources. There have been 430 (including interim drilling wells) drilled by the end of 2011, with a general slowdown in projected drilling due to the current low prices for natural gas.

Wyoming Landscape Conservation Initiative (WLCI) – In 2007 the WLCI was implemented following initial discussions by Wyoming BLM, the U.S. Fish and Wildlife Service (FWS), and WGFD. The WLCI is a long-term science-based effort to assess and enhance aquatic and terrestrial habitats at a landscape scale in Southwest Wyoming, while facilitating responsible development through local collaboration and partnerships. Within this watershed, the WLCI has funded projects involving fence conversions, aspen habitat and mule deer crucial winter range enhancement, fish barrier removal and modification projects, fish barrier construction, weed control, and road improvements to reduce soil erosion.

Rawlins Resource Management Plan (RMP) – In 2008 the Record of Decision was signed by the BLM for implementing a new comprehensive plan for the nearly 3.6 million acres of public land within the RFO. It replaces the original RMP completed in 1990 and added several new management areas, including High Savery Dam, Cow Butte/Wild Cow, the Upper Muddy Creek Watershed, and expansion of the already existing Sandhills Area of Critical Environmental Concern (ACEC) to include the JO Ranch acquisition. Examples of management actions or guidance that improve resource conservation from this plan are: Surface disturbing activities would be avoided in identified 100-year floodplains, within 500 feet of perennial waters, springs, wetlands and riparian areas, and within 100 feet of ephemeral channels. Within the reclamation policy was a requirement for soils testing prior to site disturbance that has since been modified to soils testing those areas with low reclamation potential.

Sand Hills ACEC – In the 2008, the Rawlins RMP retained the designated Sand Hills ACEC and expanded it to include the JO Ranch. The management goals established for the ACEC are to: (1) Manage the resources in the Sand Hills/JO Ranch ACEC to protect the unique vegetation community complex, maintain wildlife habitat values, minimize soil erosion, and promote recreational opportunities, (2) Manage and protect the JO Ranch for historical and cultural values.

Upper Muddy Creek/Grizzly Wildlife Habitat Management Area (WHMA) – In 2008, the Rawlins RMP designated The Upper Muddy Creek Watershed/Grizzly WHMA and was established with the goals to: (1) manage habitat for the Colorado River fish species unique to the Muddy Creek watershed, (2) manage crucial winter habitat for elk and mule deer, and (3) seek the cooperation of owners of adjacent property in management of the habitat. This area contains portion of the Daley/Grizzly habitat but has a boundary based on the watershed and extends from the headwaters to Wyoming Highway 789.

Cow Butte/Wild Cow Wildlife Habitat Management Area – In 2008, the Rawlins RMP designated the Cow Butte/Wild Cow WHMA and was established with the goals to: (1) Manage to protect crucial winter habitat for elk, mule deer, and important habitat for Columbian sharp-tailed grouse, (2) Manage to maintain or enhance aspen and mountain shrub complexes. This area adjoins a portion of the Sand Hills ACEC and the Upper Muddy Creek Watershed/Grizzly WHMA.

Antler Collection Regulation (WGFD Chapter 61) – This policy was established in 2009 by the WGFD which made it illegal for people to collect shed antlers west of the Continental Divide from January 1 through April 30 to reduce stress and harassment to big game on crucial winter ranges when the animals may be weakest. Since many people collect antlers using Off-Highway Vehicles (OHVs), a side benefit should be reduced off-road driving during wet periods in the late winter and early spring when it is more likely to create ruts and increase soil erosion.

Daley/Grizzly Habitat Management Areas – In April, 2010 a revised Memorandum of Understanding (MOU) was signed with the WGFD, BLM and Conservation Districts which modified management strategies in these two areas. The primary goal of managing these areas as wildlife habitat/livestock grazing demonstration areas has continued but has expanded to broaden the benefits to fish and wildlife habitat beyond the Daley/Grizzly borders.

Greater Sage-Grouse Management Policy – This policy has been evolving based on on-going research over the last 20 years and more recently due to Wyoming State implementation of a core area strategy and the FWS 2010 "Warranted, But Precluded" status for the bird. The Sage-Grouse Habitat Assessment Framework issued in 2010 is being used, in addition to Wyoming policies that address energy development, livestock grazing, vegetation treatments, water developments, and other actions that can potentially affect this species. . In 2011, the state of Wyoming released an executive order (EO 2011-005) outlining the protection of Greater Sage-Grouse under a core habitat area concept. The BLM then released Information Memorandum (IM) WY-2012-019 providing further guidance to Wyoming (BLM WY) Field Offices (FOs) regarding management consideration of Greater Sage-Grouse habitats including the core area concept for proposed activities.

CLIMATE BETWEEN 2002 AND 2011

The following discussion of climate from 2002 to 2011 is based on National Weather Service (NWS) data for Rawlins and BLM rain gauges spread across the watershed. It would be preferable to use NWS data from Baggs (within the Upper Colorado River watershed); however, there were too many gaps in that data to be usable (other than long-term average). The Rawlins NWS data is averaged from 1952 to the present, with BLM rain gauges established in 1960, 1967 or 1986. Although the BLM rain gauges are not as accurate as the NWS to compare exact amounts, the general annual trends in precipitation from year to year are likely adequate enough.

The long-term average annual precipitation at Baggs and Rawlins is 11.4 and 9.2 inches, respectively. BLM rain gauges in the desert generally fall within the 7 to 9 inch NRCS ecological site descriptions (ESD) for the area, with sites in the foothills falling into the 10 to 14 ESD area. Figure 1 shows the annual precipitation for Rawlins NWS, BLM-Poison Buttes-juniper (located a few miles west of Baggs), and BLM-Mexican Graves (located 24 miles north of Baggs). At middle to higher elevations, wind-blown snow

deposition occurs on north to east facing slopes within areas normally receiving 10 to 16 inches annually that can increase moisture levels up to 20 inches.

The last 60 years of Rawlins NWS data was used as a base for comparison and the range of 95-105% was considered normal; from 2002 to 2011 there were five years that were wetter than normal, four years were below normal and one year received normal or average levels of precipitation. The BLM rain gauges varied from as many as seven years above normal to as few as two years with above normal precipitation. In general, 2002 and 2006 were the driest years and 2009-2011 was a three year wet period with either 2009 or 2011 the wettest varying on location. In Rawlins the wettest year was 2009 with 16.1 inches or 175% of normal (wettest year ever recorded), and the driest year was 2002 with 4.94 inches or 54% of normal (second driest ever recorded). In the vicinity of Baggs 2006 was slightly drier than 2002, but most rain gauges across this watershed recorded 2002 as the driest year. What it actually felt like in 2002 was also affected by 2001 also being a very dry year.

Temperature trends from Rawlins have been slightly higher in terms of average yearly temperatures, particularly over the last 18 years. What the author has observed are fewer real cold nights, particularly over this same time period. During the 1980's it was common to see two to four weeks a winter of below 0 F. and with a week or more of below -20 F. During a number of the more recent years the severe cold doesn't occur at all and the number of nights below 0 F. have been very few.

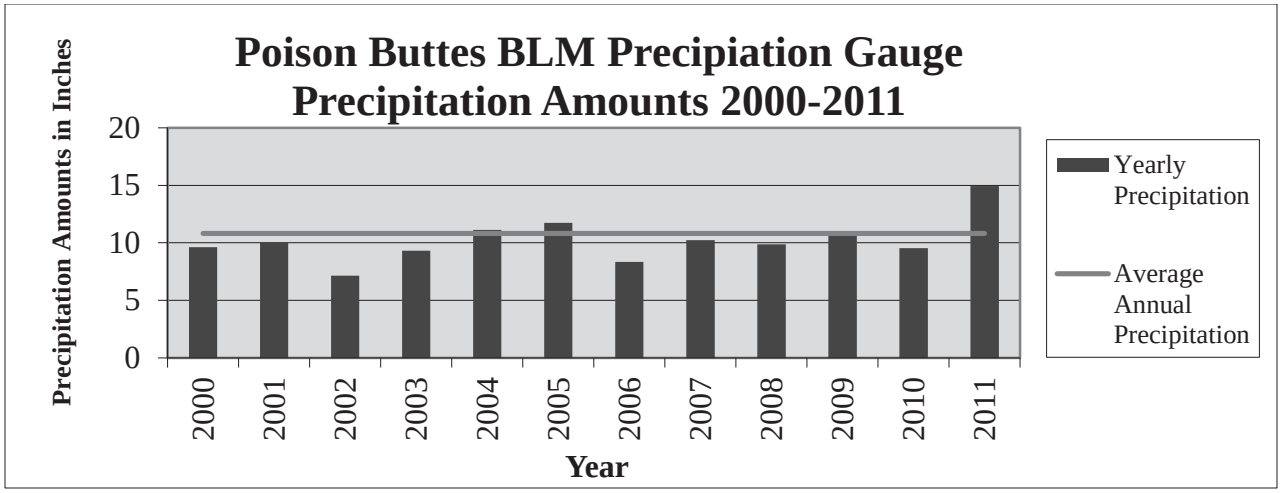
Relating precipitation and temperatures to stream runoff, 2011 had the latest high flows (late May to early June) in the Little Snake River valley since 1984. This year probably had the highest out of bank flows during the 10 year period that are important in scouring channels and building streambanks. Ephemeral creeks like Muddy Creek and Cottonwood Creek north of Dixon ran the entire year. The years 1993 and 1984 may be the only other years that this has occurred. Lower Muddy Creek was dry in 2002 when several channel cross-sections were established, and required chest-waders to re-read the same locations in 2011.

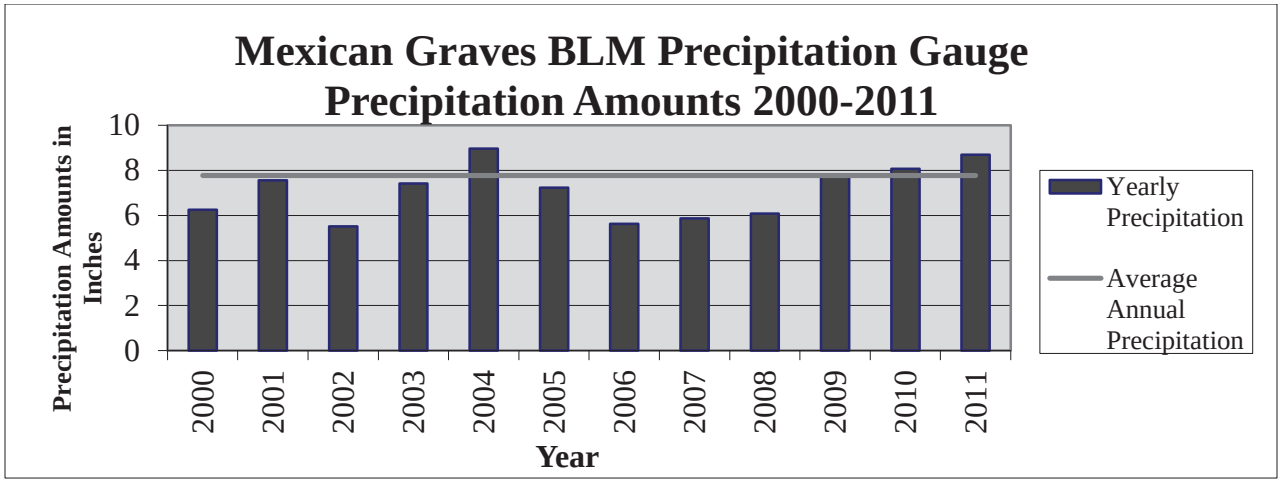
SUMMARY OF STANDARDS THAT FAILED IN 2002

Standard #1 (Watershed health) was failed due to head-cuts on Cottonwood Creek, Little Robbers Gulch, Holler Draw, Upper Muddy Creek and Wild Horse Draw.

Standard #2 (Riparian/wetland health) was failed due to livestock grazing for the following allotments: Adobe Town, Beaver Dams, Cherokee, Cow Creek, Espitalier, Morgan-Boyer, Pine Grove/Bolton, Powder Mountain, Powder Rim, Rasmussen Subunit, Sage Creek, Standard, Sulphur Springs, and West Loco. This standard was also failed due to wild horse use at the following locations: Kinney Rim Seeps, Moonshine Spring, Grindstone Spring, Hartt Cabin Seep and Artesian Well, Hangout Draw Seep, Rotten Springs, Chimney Spring, and Upper Powder Spring.

Standard #3 (Upland Plant health) was failed for all aspen plant communities and for the sagebrush, juniper and mountain shrub communities that lie within the mule deer crucial winter range between Horse Mountain and Poison Basin and along Muddy Creek north from Baggs.





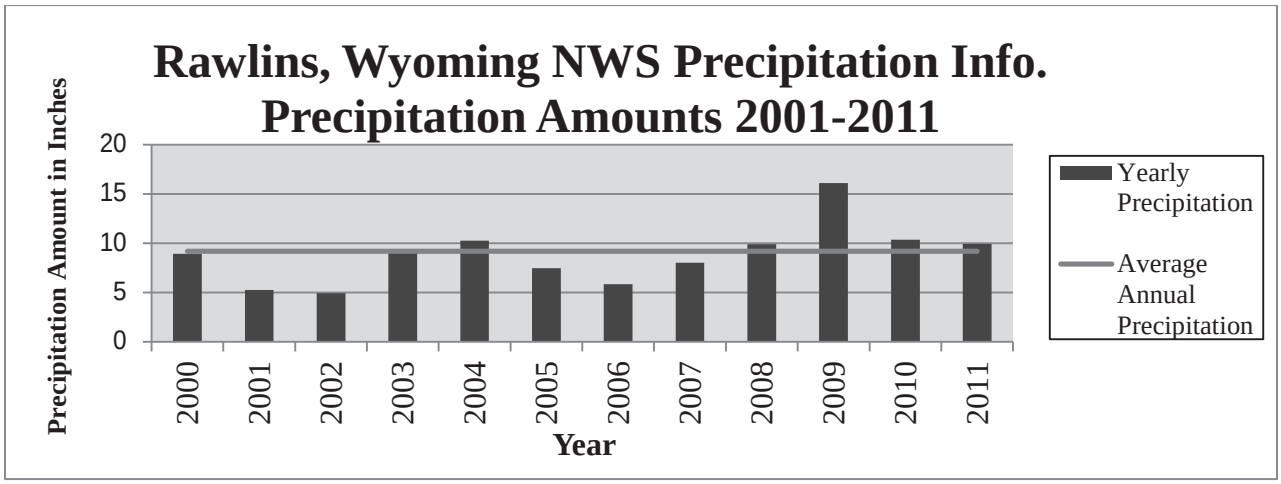


Figure 1: Recorded Precipitation at Rawlins, Wyoming (National Weather Service) and BLM Locations

Standard #4 (Wildlife, T&E Species Habitat, Fisheries, Weeds) was failed for the mule deer crucial winter range between Horse Mountain and Poison Basin and along Muddy Creek north from Baggs, for fisheries habitat in areas listed as impaired on the Wyoming 303(d) list, and due to halogeton expansion into rangelands from industry roads in the Sand Creek drainage.

Standard #5 (Water Quality) was failed for those areas listed as impaired on the Wyoming 303(d) list: Loco Creek (west fork) in the Morgan-Boyer and West Loco allotments, McKinney Creek (confluence with Eagle Creek down to Muddy Creek) in the Pine Grove/Bolton and Sulphur Springs allotments, Muddy Creek (confluence with Littlefield Creek down to confluence with Alamosa Gulch) in the Sulphur Springs allotment, and Muddy Creek (confluence with Barrel Springs Draw down to confluence with the Little Snake River) in the Cherokee allotment and due to the energy development industry.

STANDARD 1 – WATERSHED

> *Within the potential of the ecological site (soil type, landform, climate, and geology), soils are stable and allow for water infiltration to provide for optimal plant growth and minimal surface runoff.*

The Upper Colorado River Basin in this watershed assessment consists of three fourth order Hydrologic Unit Code (HUCs) watersheds: Muddy Creek, Little Snake River, and Vermillion Creek (Map #4). All of Muddy Creek is included in this assessment. The portion of Little Snake River in Wyoming and excluding U.S. Forest Service lands is included in this assessment. The only portion of Vermillion Creek included is the portion of Shell Creek drainage located in Wyoming. Table #2 and Map #5 depict the 5th Order HUCs, acreages, and groupings of these watersheds that will be discussed below.

Table # 2 – Upper Colorado River Basin 4th and 5th Order Hydrologic Unit Code (HUC)

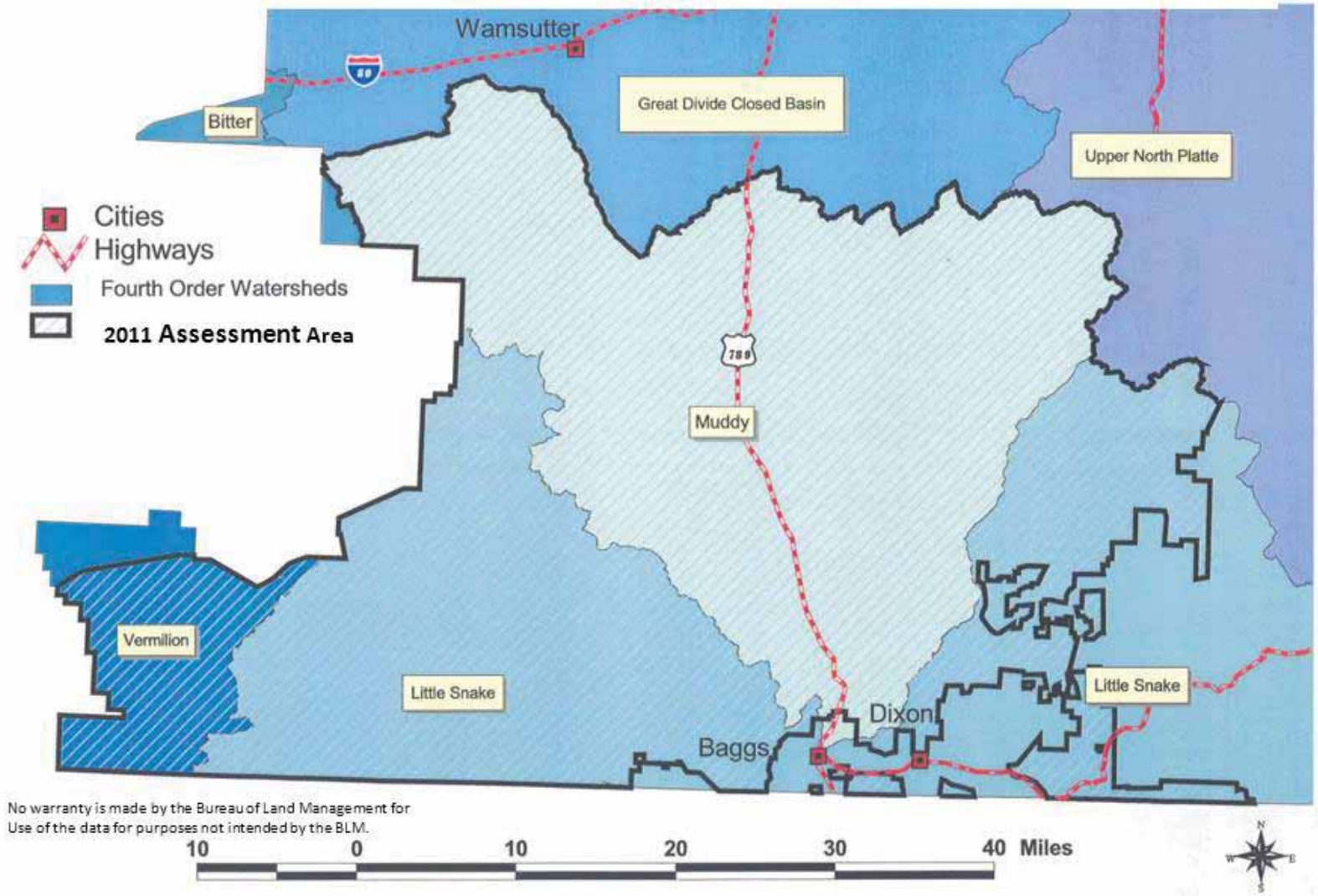
4th Order HUC	Acreage	5th Order HUC	Acreage	Assessment Name
Muddy Creek	630,446	Upper Muddy Creek	135,232	Upper Muddy Creek
		Barrel Springs Draw	241,238	Barrel Springs Draw
		Lower Muddy Creek	253,976	Lower Muddy Creek
Little Snake River	909,479	Savery Creek	225,616	Savery Creek
		Battle Creek	110,577	Savery Creek
		L. Snake River- Willow Cr	92,243	Little Snake River
		L. Snake River- Powder W	56,863	Little Snake River
		Lower Sand Creek	299,946	Sand Creek
		Upper Sand Creek	124,234	Sand Creek
Vermillion Creek	171,696	Shell Creek	171,696	Shell Creek
Total	1,711,621			

Upper Muddy Creek

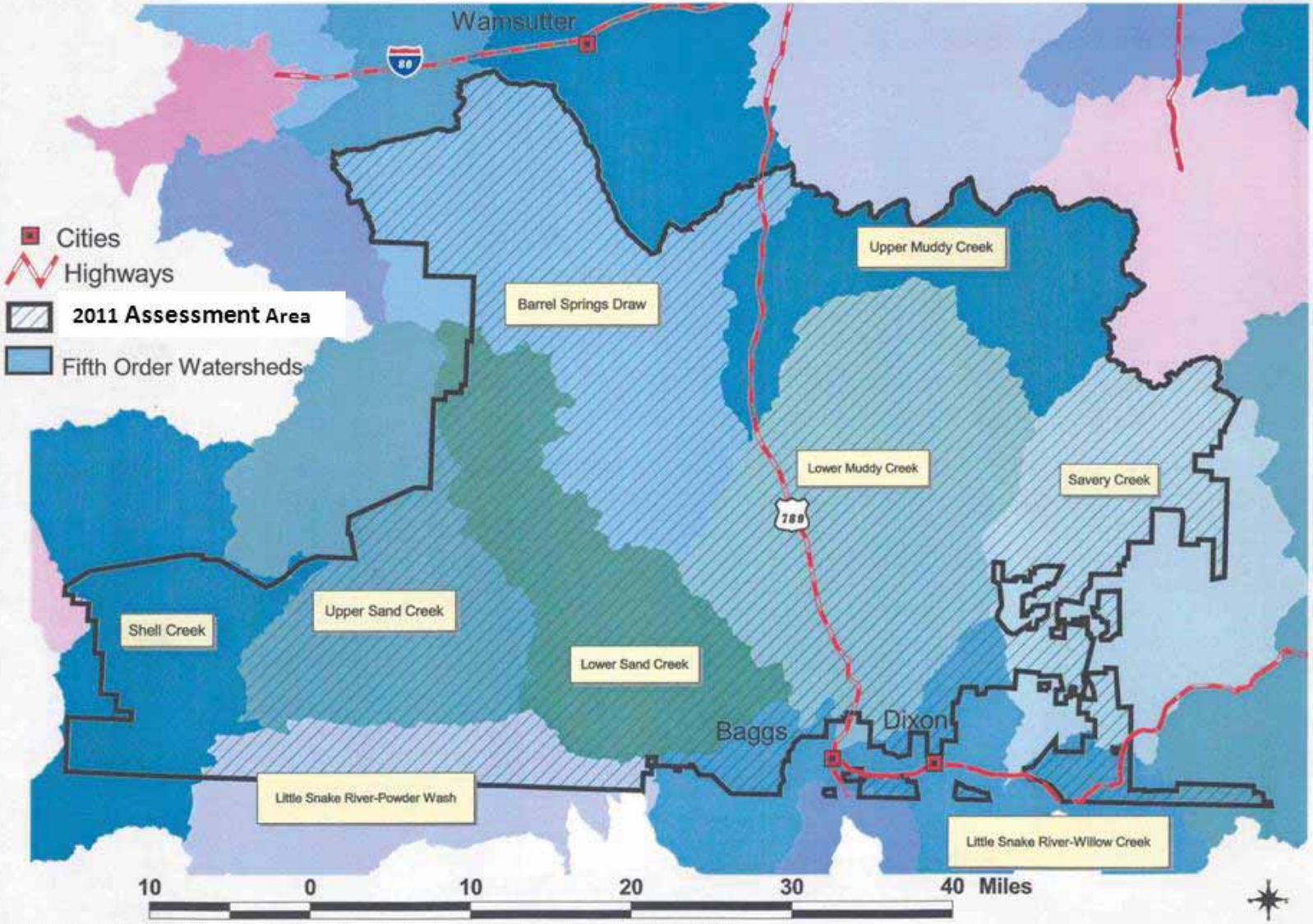
1) Characterization:

Upper Muddy Creek contains the perennial headwater streams of Muddy Creek, Littlefield Creek, McKinney Creek, and several other smaller tributaries with its' lower boundary located at the confluence of Barrel Springs Draw and Muddy Creek. It has a hydrologic unit code (HUC) of 1405000401. Precipitation varies from 12 to 18 inches annually in the upper half of this watershed,

Map 4 Fourth Order Watersheds in Assessment Area



Map 5 Fifth Order Watersheds in Assessment Area



versus 8 to 12 inches in the lower half. Approximately two-thirds of the area is in a checkerboard land ownership pattern, with about half of the watershed consisting of BLM-administered public lands.

This watershed consists primarily of C6 or E6 stream types. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs along most of the perennial headwaters of Muddy Creek, in the Muddy Creek canyon, and below the George Dew meadows. The E6 stream type is found where incisement has occurred. Here it is laterally contained in an entrenched valley and evolves to a channel within a previous channel (Rosgen 1996). This stream type occurs just above the Muddy Creek canyon, from Sulphur Springs ranch to the George Dew meadows, and from the Johnson Ranch to the Barrel Springs draw confluence. There are also two other stream types found in this watershed. The B4 stream type is found on steeper sloped portions of Littlefield Creek and McKinney Creek. The B4 stream type is considered relatively stable and is not a high sediment supply stream channel (Rosgen 1996). The D6 stream type is found at and above the George Dew Meadows where man-made spreader-dikes and irrigation systems have created broad depositional areas. The D6 stream type is a multiple channel system found within broad alluvial valleys consisting of cohesive silt-clay depositional materials (Rosgen 1996).

Principal human uses continue to consist of livestock grazing, recreation and gas field development. Livestock grazing is primarily by cattle (sheep in one allotment), with rotation or short duration use followed in all allotments. Recreation use is still primarily by hunters in the fall and antler hunting in the spring, along with people walking the Continental Divide National Scenic Trail in the summer. Gas field development occurs in the lower half of the watershed, with conventional natural gas activity adjacent to Wyoming Highway 789 and about three sections developed for coalbed natural gas just south and west of the Sulphur Springs ranch.

Although a wide variety of wildlife occur in this watershed, several of higher significance include mule deer, elk, Greater Sage-Grouse, and four sensitive fish species. Refer to the discussion under Standard 4 for more details.

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012, with some slight variations. The issues still remain as livestock grazing, erosion, gas field development and plant cover (formerly woody plant health). However, there has been extensive research completed in this region over the last 10 years on mule deer, Greater Sage-Grouse, and sensitive fish species, which has provided new and valuable information that will affect management decisions concerning the four issues listed above. For example, the key question for livestock grazing is: What further refinement in best management practices (BMPs) for livestock grazing need to be made to improve watershed and fisheries habitat health and meet desired resource conditions? For erosion the key question is: How will wildlife and fisheries habitat needs be addressed along with erosion from roads in implementing a travel management plan? For gas field development the key question is: How does development and reclamation of leased gas fields need to improve to meet watershed and wildlife habitat health standards? For woody plant health the key question is: How does the BLM improve plant cover within the confines of the Greater Sage-Grouse management policy?

3) Current Conditions:

Trend data was collected from Pace Frequency transects established in the late 1970's in two allotments with allotment management plans (AMPs), Grizzly and Sulphur Springs. Browse transects, vegetation treatment transects, channel cross-sections, and photo-points primarily established in the late 1980's or 1990's (3'x3' photos actually date back to 1968) were repeated, and combined with personal observations of staff that have worked in this area over the last 20 to 40 years. In 2010, the United

States Geological Survey (USGS) installed a new stream gage (USGS 09258050) on Muddy Creek above Olson Draw and below Alamosa Gulch, which is just below the Sulphur Springs allotment and accessed through the Doty Mountain allotment on Atlantic Rim natural gas project roads. This site with near year-round access should provide more reliable stream flow data from the upper watershed.

Channel morphology was re-evaluated in approximately 25 locations within this watershed and compared previous morphology that dates back to the late 1980's and early 1990's. Channels continue to narrow, but have slowed down in the rate of improvement compared to the first 5-10 years. However, most locations have narrowed from 50% to 75% compared to the original measurements. Banks are mostly vegetated with perennial species with sedges dominating along the water edge and where more precipitation occurs, and more of a mixture of grasses, rushes, forbs and willows where it is drier. Willows have continued to improve and along with sedges provide the deepest and dense root masses for more stable banks. Point bars are vegetating in with perennial species as well. Figure 2 and photos (Standard #1 – page 1 photos at the back of the document) from the Doty Mountain allotment illustrate the long-term improvement in channel morphology that has been documented throughout this watershed

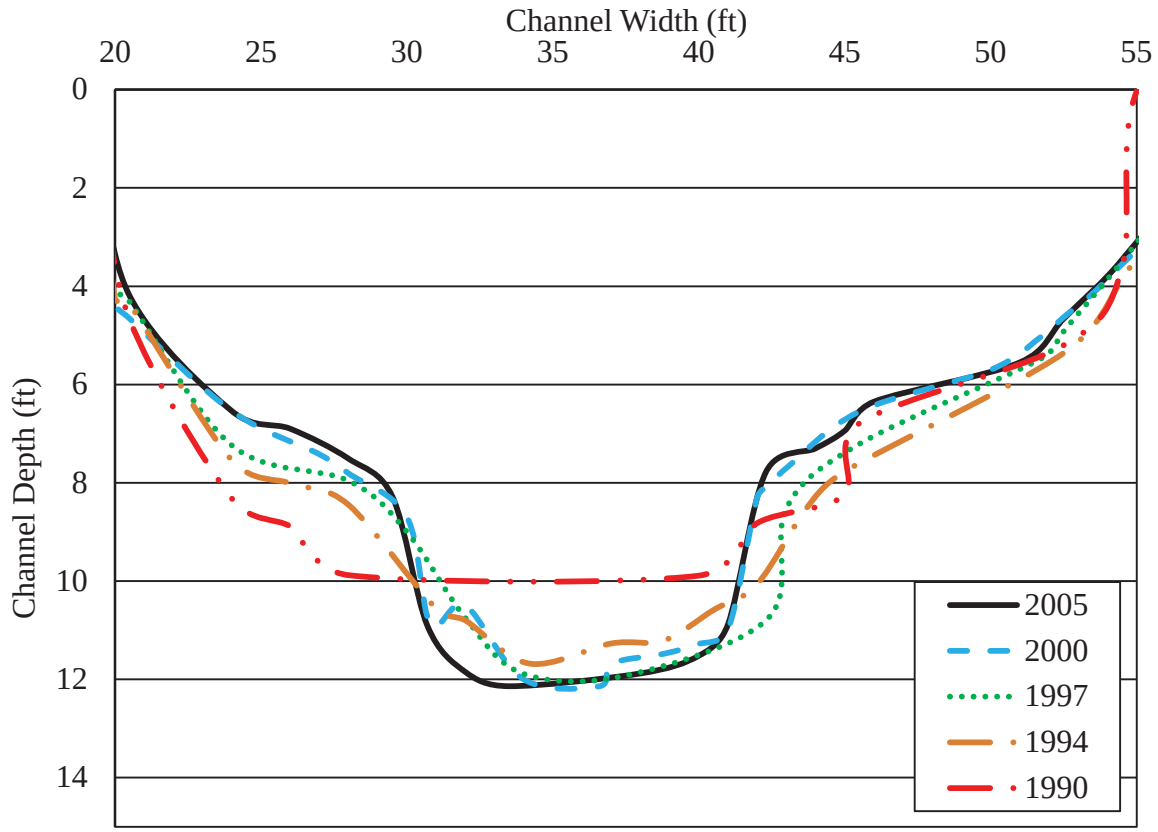


Figure 2. Channel cross section of Muddy Creek near photo point #741.

Although it was one of the early AMP's established, Sulphur Springs allotment continued to have late spring through fall cattle grazing from 1968 to 1988. At that time, earlier proposed upland water sources were completed and pasture fencing constructed over the next four years to implement rotation grazing on uplands and controlled season and duration of use on riparian habitat. In addition, there were four prescribed burns between 1987 and 1998 affecting nearly 1,700 acres (approximately 7% of the allotment). Twelve pace frequency transects showed an average decrease in bare ground

from 35% in 1979 (range of 17 to 77) to 11% in 2011 (range of 1 to 40), within mountain big sagebrush/mixed grass plant communities. Two of these transects were influenced by the prescribed burns, although all transects showed decreased levels of bare ground (Standard #1 – page 2 photos at back of document). Photo-points in the prescribed burns also showed increased herbaceous cover, particularly basin wildrye, which has increased in all locations in this watershed once spring through fall duration use was changed to shorter duration, and rotational livestock use. Photos also show healing of gullies following prescribed burns as steeper banks slope out and plant cover increases.

Pace frequency transects in the Grizzly allotment, using two pastures that have seen the most consistent use by livestock, also showed drops in bare ground, changing from 26% to 5% between 1977 and 2011 (also in mountain big sagebrush plant communities). This allotment has rotated cattle use with prescribed seasons, duration and amounts of cattle use prescribed for each pasture to meet resource objectives. Prescribed burns and chemical applications of tebuthiuron conducted in four locations between 1987 and 1999 affected approximately 3,000 acres and have led to greater herbaceous plant cover. Similar results have been observed in the Beaver Dams allotment (prescribed burn in 1992) and the Pine Grove/Bolton allotment (tebuthiuron application in 2002). Trend transects from two locations in the Doty Mountain allotment at the lower end of this watershed show a decrease in bare ground from 49% in 1993 to 20% in 2011. This allotment was expanded from two pasture fences in the mid-1980's to four upland and five riparian pastures to control season and duration of cattle grazing.

Trends in upland erosion indexes are more qualitative than quantitative, and methods have changed over time, so direct comparisons are not possible. In the late 1970's, what was known as soil surface factors (SSF), were rated along the pace frequency transects, with generally five factors (out of 7) evaluated which included: soil movement, surface litter, surface rock, pedestalling, and flow patterns. Rills and gullies were usually not rated. In comparison, the "Interpreting Indicators of Rangeland Health" (Technical Reference 1734-6, Version 4 – 2005) evaluates 17 indicators, which include many of the same ones used in SSF. In the late 1970's the evaluation tended to all or mostly fall in the second category (5's and 6's) for some or slight amounts of movement of soil, litter, flow patterns and pedestalling. Using the more current TR1734-6, pedestalling remains in a similar category of Slight to Moderate rating, described as "Active pedestalling or terracette formation is rare; some evidence of past pedestal formation, especially in water flow patterns on exposed slopes". However, the categories for soil movement, water flow patterns and litter movement fall within the None to Slight rating, and generally match what is expected for the site. The remainder of the 17 indicators also tends to fall in the None to Slight rating, however, in locations where increaser species of rhizomatous wheatgrass and little bluegrass dominant with fewer large perennial bunchgrasses, the "Plant Community Composition and Distribution Relative to Infiltration and Runoff" was also given a Slight to Moderate rating.

The large 15 foot head-cut on Muddy Creek above the Adams Ranch (Henry Baer homestead) was stabilized with a large drop structure in 2002-03 by the LSRCD, Natural Resources Conservation Service (NRCS) and private landowner. It consists of steel sheet-piling, rock gabions, rock and concrete slurry, with dirt berms to either side (Standard #1 – page 3 photo). This head-cut had been monitored since 1983, with low-tech attempts made to stop it while it was moving about ¼ mile, but potentially threatened thousands of acres if it were to move further upstream. It is originally believed to have started by the straightening of the stream channel at Highway 789, and influenced by the cessation of irrigation at the Baer homestead and poor grazing management in the 1970's. Grazing was changed to rest and/or short duration use with horses in the 1980's. At the head of Muddy Creek the WGFD constructed a fish passage structure on Muddy Creek on state land to stop a small head-cut. There were also several small head-cuts identified in the Sulphur Springs allotment, three associated with overflow spillways from upland pit water sources. Overflow pipes were added to the berms of these projects and one new berm and drop-pipe constructed that has stopped the accelerated erosion from these sites and is now allowing vegetation to recover.

Vegetation treatments that occurred in this watershed over the last 10 years included application of tebuthiuron to thin mountain big sagebrush on 3500 acres at Miller Hill in the Pine Grove/Bolton allotment in the upper portion of the watershed, and a similar treatment to 3000 acres at Doty Mountain and mechanical thinning of juniper from 140 acres at the Dad junipers, both in the Doty Mountain allotment in the lower portion of the watershed.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report. It stated that information from photo-points, channel cross-sections, and personal observations show that the trend for watershed values is upward. At the time of this report, nearly all allotments in this watershed had implemented changes in livestock management during the previous five to fifteen years. In addition, gradient control structures had been constructed (re-constructed at the George Dew meadows) during the 1990's to stabilize locations with headcuts or to maintain floodplain function. Vegetation treatments were also being implemented that were improving upland herbaceous cover and species composition, as well as livestock distribution of use. These factors had cumulatively led to more stable and improving conditions, but with expectations for further improvement.

5) Synthesis and Interpretation:

Livestock grazing has primarily consisted of continuation of existing management, using multiple pastures and rotated livestock use, to maintain or improve watershed and soils health. The principle change in livestock grazing has been the use of the Grizzly allotment by multiple permittees, in exchange for resting other pastures from grazing use. In this watershed, the McKinney Creek and Upper McKeal pastures in the Sulphur Springs allotment and the Upper and Lower McKinney Creek pastures in the Pine Grove/Bolton allotment have not been grazed for varying time periods to improve riparian habitat and provide for recovery time after channel restoration (Upper McKeal pasture).

The continuation of existing management, which all provide for shorter duration of livestock grazing (compared to historic use) and at least partial rest from grazing during the growing season, has promoted both upland and riparian watershed improvement. The long-term drop in bare ground observed in both the Sulphur Springs and Grizzly allotments, along with lower levels of erosion condition factors (surface litter, pedestalling, and flow patterns) indicate improving watershed and soils health. It is important to emphasize management compared to livestock use. In the Sulphur Springs allotment, from 1968 to 1988, actual use was 62% of permitted use, compared to the period of 1989 to 2010 when actual use averaged 83% of permitted use after implementation of more intensive (shorter duration and rotated) livestock management. Fluctuation in livestock use can vary considerably due to climate, economic conditions, and changes in the ranch operation. However, improved management and range condition can help moderate those fluctuations.

The data from channel cross-sections and support from photo-points show maintenance or continued improvement in channel narrowing and bank stability. Some of this change is affected by the activity of beaver in cutting willow and building small dams that usually only last a season or two before washing out and the beaver move on to a new location. Another factor is the initial improvement in channel width/depth ratios happens quickly and then slows down as sedges recover and sediment sources for bank-building become more limited. In addition, high flow events (out of bank flooding) only occur periodically, such as 2011, which greatly affect the rate of change in channel morphology. Besides the channel shape, photos show increasing amounts of willows, sedges, and other deep-rooted vegetation that is improving bank stability. Even with vegetative plantings and rest from cattle grazing, it is often an eye-opening experience at how slow a process this can be. Based on this experience, to restore a more diverse, mixed-age class woody plant community that can support a permanent (rather than transitional) beaver population is likely to take 30 to 50 years to accomplish. Therefore, continuation of

good livestock management, whether it is the existing management or an improvement upon it, needs to be a long-term commitment by the BLM, permittees, and the partners in the management of this watershed.

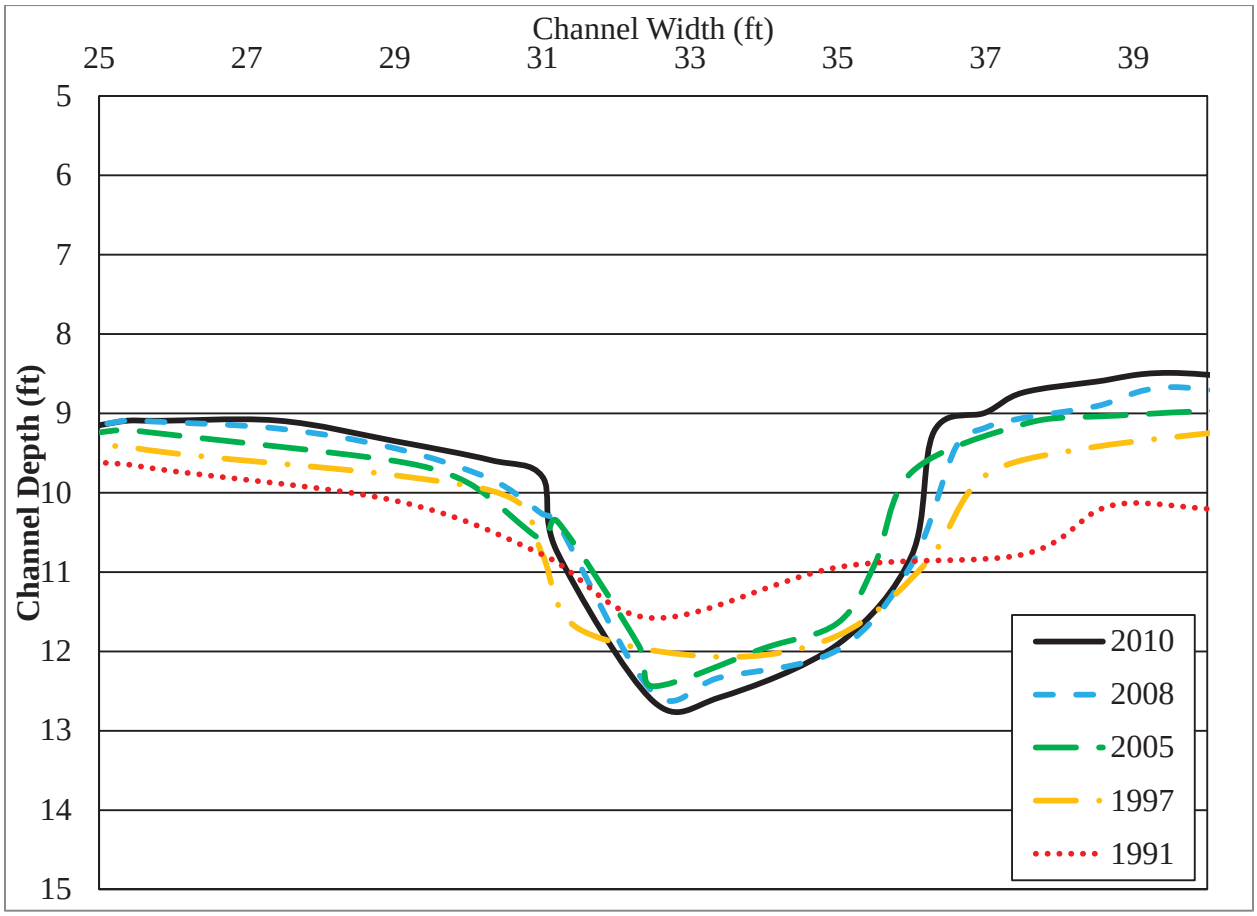


Figure 3. Channel cross section of Upper Muddy Creek near photo point #379.

An assessment of BMP effects on surface water quality using multi-variate statistical techniques was completed as part of a graduate thesis in 2008, involving C.A. Ellison, Q.D. Skinner, and L.S. Hicks. In this study water quality data collected by LSRCD between 1994-2004 was subjected to various analyses to determine whether the livestock management BMPs and other practices improved the water quality of the watershed. Temporal discriminant analysis identified positive trends in total dissolved solids (TDS), turbidity, total taxa, and channel morphology during the study period despite the onset of drought. TDS concentrations declined 25% across years even though streamflow diminished, counter to what is widely observed from typical flow dilution relationships between TDS and discharge, suggesting that improved riparian zones and stabilized streambanks are enhancing the nonpoint buffering capacity in the upper watershed. Turbidity was reduced by 75%, macroinvertebrate total taxa increased by 30%, and stream morphology significantly improved via expansion of riparian zones and stable/narrower channels (Ellison et al, 2008). This data supports the photos and channel cross-section transects that show long-term improvement in riparian bank cover and channel shape over the last 20 years. The lower reaches within this study area were delisted from the State of Wyoming's 303(d) list of impaired waters in 2012.

During the last 10 years in the wetland complex along Muddy Creek north of Dad, there has maintenance work and rock rip-rap placed along spreader-dikes where wave-wash erosion was occurring, as well as several new ponds constructed on private and state lands. This area continues to

act as both a water storage and sediment collection area for the entire upper watershed. Livestock use has continued to consist primarily of fall and winter cattle use, with short duration summer cattle and horse use in the Dad area. Water quality data collected from 1985 to 2006 were used to investigate whether livestock grazing and channel/floodplain BMP's improved the water quality of the watershed. Following BMP implementation, reductions in specific conductivity, TDS, and turbidity among years were observed in the impaired stream section (Ellison et. al. 2008). In this case the impaired stream section is that portion of Muddy Creek located west of Highway 789.

In 2010, the first major fish passage project to reconnect fish habitat was completed. Improper sizing and placement of a culvert/road crossing across Muddy Creek led to vertical stream instability downstream of a culvert, causing down-cutting and head-ward erosion. As a result of this instability, a vertical drop and large plunge pool formed which inhibited fish passage and degraded riparian habitat downstream of the culvert. In order to expand native fish population and reconnect important habitat the culvert was removed and a new channel was constructed to allow fish passage (Standard 1 – Page 4 photos). This project was a continuation of an effort started in 2007 when the BLM approved and constructed a new road crossing upstream of the existing culvert.

The stabilization of head-cuts at the Baer homestead and in Sulphur Springs and Grizzly allotments helped to stabilize the Muddy Creek channel and ephemeral drainages and reduce sediment loading into this watershed. Continued movement of the large head-cut upstream would have produced many lateral head-cuts into uplands that would have greatly increased sediment loading into Muddy Creek. There is still a lot of sediment that will be available for bank-building downstream due to in-channel bank sloughing as the E6 channel continues to naturally widen and form a new floodplain within the tall incised banks. The only remaining head-cut is located on the lower end of Holler Draw, about three to four feet in height, and is moving slowly upstream. It is perhaps ¼ mile below the principle road (and historic Overland Trail) that follows up Muddy Creek for access by the BLM, permittees, landowners, and recreationists, so it should be a priority to address.

Plans are underway to address the sediment delivery into McKinney Creek from the county road (on both sides of the culvert crossing) and into Muddy Creek from the BLM road that parallels it in the Grizzly allotment. This primarily involves adding additional culverts to drain water away from the roads rather than having water run down or along these roads that results in a lot of soil being added to each stream. These problems have been recognized since the early 1990's and are the last major road/sediment issues to be resolved. Recreational use of roads is increasing, although, the greater use of Utility Task Vehicles (UTV's) (compared to motorcycles and three/four wheelers) appears to have less impact upon soils and plant cover than four-wheel drive pickups. Earlier attempted closures of roads in the upper watershed on public lands were not always successful; however, the amount of private land in the watershed with more controlled public access has helped to control the impact of off-highway vehicle use. The closing of crucial winter range to antler collecting should also help improve watershed and soils condition in the long-term with reduced rutting and soil erosion caused during wet conditions.

Vegetation treatments have been limited during the last ten years, with only tebuthiuron applications to mountain big sagebrush in the upper watershed and around Doty Mountain, and juniper thinning in the Dad juniper area in the lower watershed. The use of tebuthiuron at Doty Mountain was based upon past prescribed burns in lower elevation mountain big sagebrush communities that were slow to recover and where the annual alyssum had increased. Results have been much more favorable with the chemical application at a thinning rate. The BLM use (or support) of prescribed burns, tebuthiuron, and mechanical treatments have increased herbaceous cover and led to better distribution of livestock grazing use that has increased cover and stability along streambanks and lower adjacent slopes. Higher sagebrush cover and juniper encroachment into shrub communities is due to plant succession, lack of wildfire in the ecosystem, and higher use of grasses than shrubs by grazing livestock and big game. The

use of treatments and implementation of grazing systems has helped to change this trend. However, the recently adopted Greater Sage-Grouse policy has had a dampening effect on the use of prescribed fire. Since the upper half of this watershed is within Greater Sage-Grouse core area habitat, the policy will need to be addressed in the coming years to still allow the use of fire to improve watershed values and achieve greater herbaceous cover, reduced runoff and sediment delivery, and healthy aspen woodlands to support beaver.

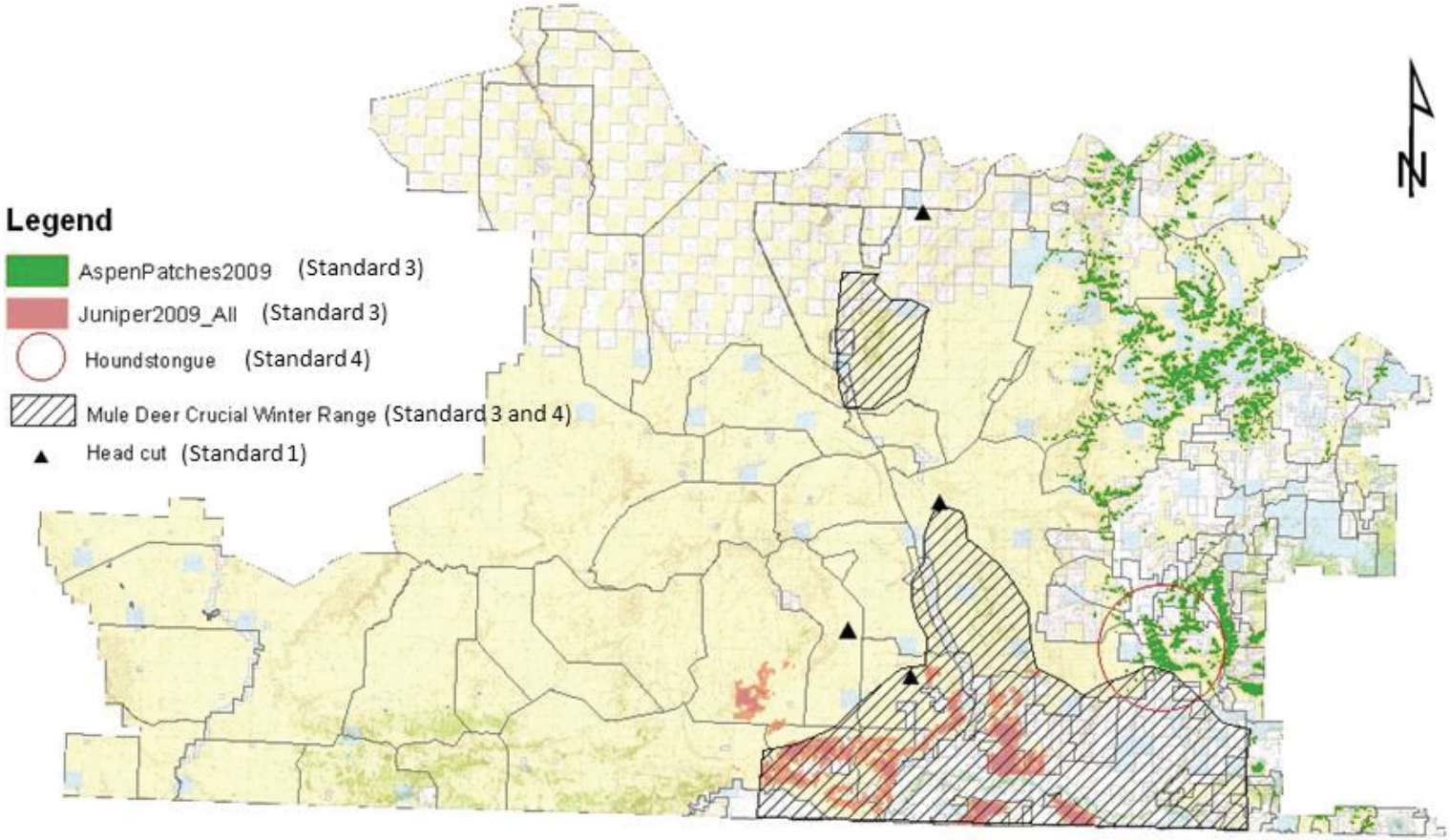
6) Recommendations:

Due to the existing diversity and amount of ground cover on uplands and existing low levels or declining levels of bare ground, the trend to low upland condition class ratings, existing and improving trend in riparian vegetation and channel morphology, the continued cooperation exhibited by permittees to work on a watershed basis, it is determined that the majority of Upper Muddy Creek watershed is meeting Standard #1. The one location not meeting Standard #1 is a remaining active head-cut on lower Holler Draw affecting approximately 1400 acres (See Map #6). This head-cut is due to long-term gradient readjustment processes and current livestock management is not contributing to the non-attainment of this standard. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments. Off-creek watering locations in pastures along Muddy Creek where the creek is the principal water source should be developed to further maintain or improve streambank stability and channel narrowing. Additional crossing points on streams may need to be considered where width/depth rations make it difficult for animals to get across anymore.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan.

Map 6
Areas That Currently do Not Meet Standard #1 (Watershed), Standard #3 (Upland Vegetation) and Standard #4 (Wildlife, T&E, Fish and Weeds)



No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by the BLM.

Continue to eliminate or control active headcuts, including modification of historic gradient control structures using a channel restoration philosophy, in consultation with all necessary parties (specifically must include hydrologists and fisheries biologists). Include any required changes in livestock management, in order to promote long-term, vegetative stabilization of these sites.

Continue to implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities.

Barrel Springs Draw

1) Characterization:

Barrel Springs Draw is a large ephemeral watershed, containing numerous draws and the Red Lakes enclosed basin, that empties into Muddy Creek about 20 miles north of Baggs, Wyoming. It has a hydrologic unit code (HUC) of 1405000402. The entire area is in a 7 to 9- inch precipitation zone with predominantly shale derived clay-loam soils, which can produce high runoff with moderate to severe erosion potential. Topography is flat to gently rolling landscape for the most part, becoming moderately-steep to steep close to rims and badlands. Flows are erratic and short-term, with no recording of perennial flows. Approximately half of this watershed lies within the checkerboard land ownership pattern, with about three-quarters of the area being BLM-administered public land.

The only sites with stream flow where channel classification was determined were a two-mile stretch of Middle Barrel Springs Draw, which is a C6 stream type, and a mile stretch of North Barrel Springs Draw, which is an E6 stream type. The C6 stream type is a slightly entrenched, meandering, silt/clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). The E6 stream type is found where incisement has occurred. Here it is laterally contained in an entrenched valley and evolves to a channel inside a previous channel (Rosgen 1996). Streambanks are stabilized with riparian vegetation similar to C6 stream types.

Principal human uses in this watershed are natural gas development, livestock grazing, and recreation. Natural gas development has occurred in the area for many years. However, it has expanded in scope of area as well as in-field drilling over the last 20 years. On the north end of the watershed closest to Wamsutter, well density is reaching an 80-acre spacing, whereas in most areas 160-acre spacing is more common. Livestock use is a combination of spring through fall cattle use and winter sheep use. Recreation is largely related to hunting, primarily during the fall (September through October).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012. Issues involved oil and gas development, livestock grazing, erosion, and plant cover (formerly woody plant health), please see the discussion in Upper Muddy Creek watershed. For gas field development, the key question is: How does development and reclamation of leased gas fields need to improve to meet watershed and wildlife habitat health standards?

3) Current Conditions:

Due to the ephemeral nature of this drainage, no quantifiable data about stream flows is being collected, and range condition and trend are being assessed through photo-points, upland transects, and personal observations.

The principle trend data is from the south end of the watershed on saltbush steppe key areas in the Mexican Graves and South Barrel allotments. The former is primarily used with winter sheep grazing and the latter is used for short duration spring cattle grazing. From 1995 to 2011 for both allotments, the bare ground changed from 56% to 52% in Mexican Graves and from 64% to 50% in South Barrel. Current bare ground percentage on the adjacent Mexican Flats allotment that is also in a saltbush steppe site shows similar values at 55% that is used for summer cattle use. North LaClede allotment, which is located at the upper end of the watershed and is used for summer cattle and winter sheep shows a decline in bare ground from 73% to 63% between 1995 and 2010 on a saltbush steppe plant community. An adjacent allotment is North Barrel, which is used for winter cattle use, and visually has good cover, particularly along the draws and bottoms.

Most channels are dry except during runoff events that last from a few minutes to a few days in the spring, and are moderately vegetated with rhizomatous wheatgrass, bluegrass, basin wildrye, big sagebrush, and other upland species. A channel cross-section on the lower end of Barrel Springs Draw shows little change since it was established in the late 1980's. Just below this location, overflow water from the Red Wash wetlands has converted vegetation to more wet type species like spike-sedge. This has increased the root mass and vegetation cover, making it more resistant to erosion during high flow events.

The "Interpreting Indicators of Rangeland Health" (Technical Reference 1734-6, Version 4 – 2005) evaluates 17 indicators, with pedestalling being the principle factor rising above the "None to Slight" category, varying between "Slight to Moderate" or "Moderate". However, active pedestalling is not common and historic pedestals are rounded over and healing. Gullies observed are also generally well vegetated and healing. Flow patterns and litter movement on steeper slopes and less vegetated sites (shale, saltbush steppe, and shallow loamy) will sometimes also be rated as Slight to Moderate, but this is due more to topography and soils than to impacts from livestock grazing. The area near the lower end of this watershed used to be a major sheep trail on the north side of Barrel Springs Draw leading to the sheep shearing sheds at Dad. Soil compaction is higher here along the sheep trail and where herds used to be held waiting their turn to be sheared. Winter sheep grazing in this area over the last 50 years or more have promoted recovery of saltbush, Indian ricegrass and bottlebrush squirreltail, all desirable species in this ecological site.

Development of natural gas in this area has greatly increased disturbance from the road network and drill pads, although many of the drill pads have now been reclaimed. Within the Upper Colorado River watershed that is west of Highway 789 and north of Powder Rim, the road network from 1994 to 2011 has nearly doubled, rising from 2,869 acres to 5,404 acres affected. About half of this disturbance is within the Barrel Springs Draw watershed where extensive gas development has occurred. Evaluation of the interstate pipelines through this area showed additional need for weed control and reseeding in some locations.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The account described in the 2002 watershed report is similar to what could be observed today in terms of landscape and vegetation. The principle changes are an increase in roads, gas wells, and pipelines relating to the existing land uses. In the upper portion of this watershed, there is a trend towards building larger well pads with multiple wells drilled from a single pad. On some pads, up to 16 wells are proposed from a single pad; reducing the amount of land disturbed for roads and well pads up to 75%. The near doubling of the road network is a large effect, but is muted by the gentle topography and increased use of culverts and wing-ditching. Erosional problems with roads still exist, but are often related to older roads that still need the same attention as the new roads are receiving. The BLM is working with companies currently on the Standard Road on the north slope of the Flat Tops to address both sharp corners and additional culverts that are needed for diverting runoff away from roads.

The continuing problem with roads is the inability to address the accelerated soil erosion that occurs once water passes through a culvert in a road. Where culverts simply pass the water from a drainage under a road is not the issue. In many instances, roads act as dams that catch runoff water from hillsides above the road, that is separate from or in addition to the water from a (or multiple) small drainage(s). The water is funneled through a culvert, and then released all in one location below the culvert, rather than spreading it back out (like it was above the road). This results in increased soil erosion in the channel downstream and desertification of upland vegetative cover located below the road that is no longer receiving the same amount of moisture as it was before the road was constructed.

The other visible change has been the reclamation efforts. Companies have conducted studies on ways to improve reclamation success on low reclamation potential soils within this watershed. Gypsum has been added to the soil to reduce sodicity and wood chips or mulch added to reduce soil crusting. Both of these have helped improve plant establishment on clayey and salty sites. Soil testing of low reclamation potential sites (required by State and Office policy) has increased the awareness of salvaging topsoil with better chemical characteristics than before. More careful salvage and handling of topsoil has led to increased reclamation success.

Livestock grazing effects within this watershed are varied due to both the season and type of use that is occurring. About half of the watershed is used by winter sheep or cattle grazing during the dormant season for plant growth, which promotes good plant species, vigor and soil cover. About one-quarter of the watershed is used with spring cattle grazing, with adjustments made in duration of use to ensure maintenance of soil and adequate vegetation cover and trend in desired species is occurring. The remaining quarter of the watershed is used for summer cattle grazing, with one allotment in a long-term rotation management system and two other allotments using water and herding to manage forage use and livestock distribution to provide for desirable plant trend. An initial concern was the short duration spring cattle grazing, which led to trend monitoring on it as well as the adjacent winter sheep grazing allotment as a comparison. The trend changes in percent bare ground for the South Barrel and Mexican Graves allotments would indicate very comparable results and that adequate time for plant regrowth on the spring grazed allotment is occurring. The amount of winter sheep grazing in this area has dropped along with the increase in gas field development, primarily due to the increase in halogeton (poisonous to sheep) in disturbed areas. Ten years ago this was much more of a problem, however, recent photos of gas well pads and observations along roads show much better reclamation and control of weed species like halogeton (Standard #1 – Page 5 photos). Further long-term monitoring, particularly linking both reclamation and livestock grazing, would be helpful in assessing the long-term trends in watershed health in this drainage.

The majority of this watershed does not support dense stands of mountain big sagebrush; however, there are more dense stands on the north slopes of the Flat Tops where vegetation treatments have been considered to improve herbaceous cover.

See the Lower Muddy Creek watershed discussion below relating to on-going work in the historic watershed work area between Red Wash and Baggs on the west side of Muddy Creek.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands and declining levels of bare ground, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Barrel Springs Draw watershed continues to meet Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Identify and correct problems with improved roads, which affect safety, water quality, channel stability, soil erosion, and sedimentation. Two-track roads are too numerous to deal with as a whole, however, problem areas should identified and fixed or the road should be closed and reclaimed. All oil and gas companies should implement stormwater control as well as reclamation practices on active and dry hole locations, roads, and pipelines which would minimize the amount of bare ground exposed to wind and water erosion.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments.

Implement vegetation treatments where needed to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities.

Lower Muddy Creek

1) Characterization:

Lower Muddy Creek is a large, mostly-ephemeral watershed, which begins at the confluence of the Upper Muddy Creek and Barrel Springs Draw watersheds and ends where Muddy Creek empties into the Little Snake River at Baggs, Wyoming. It has a hydrologic unit code (HUC) of 1405000403. Muddy Creek is intermittent to perennial, depending on annual and long-term climate conditions. The lower elevations are in a 7 to 9 inch precipitation zone, while on the southern border and at higher elevation the precipitation increases into the 10 to 14 inch zone. Soils are predominantly shale derived clay-loam soils which can produce high runoff with moderate to severe erosion potential. Land ownership is primarily BLM-administered public lands with isolated private and state lands located along creeks in the valleys.

At the upper ends of drainages, floodplains are broad and gentle with no channel confinement. However, the lower portions of side drainages and the entire Muddy Creek channel are confined within incised high banks; these reach 12 to 15 feet in height. Stream channels in this watershed are classified as either a C6 stream type, typical of upper headwater drainages, or an E6 stream type, characterized by Muddy Creek.

Principal human uses in this watershed are oil and natural gas development, livestock grazing, and recreation. Oil and gas development has expanded in the last 10 years with moderately deep gas development in the west half of the watershed and more shallow, coalbed natural gas development in the eastern-lower elevations associated with the Atlantic Rim EIS. Livestock use is primarily cattle, employing both cow/calf and yearling operations. Sheep use still occurs on a few allotments. Seasons of use for livestock will vary by allotment and range from spring through fall. Recreation is mostly related to hunting, primarily during the fall (September through October).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012. Issues described include livestock grazing, oil and gas development, erosion, plant cover, and gradient adjustment.

3) Current Conditions:

The principle streamflow data is being collected by the USGS from the station located near the lower end of Muddy Creek. Range condition and trend are being assessed through photo-points, upland transects, channel cross-sections, and personal observations.

Range condition from upland transects on multiple allotments all show decreased levels of bare ground. On the Doty Mountain allotment, average bare ground changed from 44% to 20% in four different pastures with Wyoming big sagebrush/mixed grass sites between 1993 and 2011. This allotment was fenced in the late 1980's and early 1990's to increase from three to ten pastures in order to implement shorter duration grazing and controlled season grazing along Muddy Creek during the eight month grazing season. On the Cherokee allotment, bare ground along the sagebrush benches just east of Muddy Creek has dropped from 26% to 16% between 1993 and 2011. This allotment had pasture fencing implemented following the last watershed assessment along with additional management changes in 2007 to address riparian habitat issues. Internal pastures with more recently established upland monitoring show current bare ground of 44%, 17%, and 40% in the three pastures along Wild Cow Creek, Cherokee Creek, and Deep Creek, respectively. Higher bare ground levels occur where there is saltbush steppe and alkali sagebrush stands, which is typical when compared to similar habitats in other allotments.

In other allotments along Muddy Creek with more recent monitoring, bare ground has decreased from 2003 to 2011 in the following allotments: Big Robber 64% to 45%, Big Robber Spreaders 68% to 51%, V Spreaders 57% to 41%, and Dad 88% to 55%. These sites are all in saltbush steppe sites that will have higher amounts of bare ground than big sagebrush/mixed grass sites will have. Recent transects established in the Mexican Flats allotment with sagebrush and mixed grass have averaged 38% bare ground. For comparison, a recent transect established in a 1960's crested wheatgrass seeding (also contour furrowed) in the South Flat Top allotment averaged 37% bare ground. These sites are all primarily occupied with native perennial species (except the approximately 3,500 acres in old seedings), with very low amounts of invasive plants like alyssum, halogeton, and/or cheatgrass, which could if present, greatly inflate litter values.

There is no historic range data pertaining to SSF within this watershed. However, the "Interpreting Indicators of Rangeland Health" (Technical Reference 1734-6, Version 4 – 2005) evaluates 17 indicators, which are being completed at upland transect locations. The most striking factor is pedestalling, which in the western portion of this watershed will vary from "Moderate to Extreme", while overall ratings tend to be "Moderate". Associated with pedestalling in an historic sense was the loss of the soil surface, which is why plant spacing was so high in the 1950's that early BLM watershed stabilization projects focused on the area west of Muddy Creek and from Cottonwood Draw north to South Barrel Springs Draw. Other factors relating to a moderate evaluation include water-flow patterns, bare ground (even though declining), and litter movement. On the eastern side of this watershed the upland watershed health is much better (with exception of lower Wild Cow Creek) with fewer active signs of erosion. Plant cover and litter are higher, particularly as you rise in elevation above 6800 feet and change to mountain big sagebrush dominance (and higher precipitation). Pedestalling is less evident and primarily historical in origin, with healing evident by the smoothing out of edges and expansion of plant and litter cover. General ratings in these areas are in the "None to Slight" departure from expected category.

Stream channels are continuing to narrow, as banks becoming more stable with perennial, deep-rooted vegetation. As the channels narrow, the active floodplain width expands, including within incised banks where the upper slopes continue to widen and become more stable with vegetative cover. Figure 4 and photos show how a section on Muddy Creek in the East Muddy allotment has changed over the last 22 years. Banks are building and a more accessible floodplain is forming (Standard #1 – Page 6 photos). In-channel bank sloughing on outer corners and gradient adjustment of ephemeral side drainages are still the primary sources of erosion. As a result, hydrologic function is improving due to the changes mentioned above in stream channels and floodplains. However, the confinement of channels within incised banks limits flow access to floodplains as well as the size of floodplains and contributes to higher flow velocity and reduced water storage for late-season stream flow. Sites further downstream also show narrower channels with more vegetated, stable banks. With shorter duration of grazing and reduced grazing during the growing season, there has been an expansion of coyote willow particularly, which has a very dense root system that provides for more stable banks.

Where detention dams have been constructed on ephemeral channels, either for watershed purposes or livestock waters, active head-cuts have been stopped and healing of these channels is occurring. On drainages without any changes made the active head-cutting continues. Wild Horse Draw in the Cherokee allotment and Little Robber's Gulch both had sites where head-cuts were stopped with the placement of a burm and drop-pipe below the active head-cut. However, head-cuts remain along several locations on Cottonwood Creek and one location on lower Wild Cow Creek (will need to provide for fish movement), several of which moved upstream during the high spring runoff flows in 2011 (Standard #1 – Page 7 photos). An abrupt change in the elevation of the channel bottom is present and is migrating up the stream channel. Head-cuts are causing the channels to become more channelized, with limited access to their floodplain as well as a loss of channel stability, loss of localized riparian vegetation, in channel erosion and downstream sedimentation.

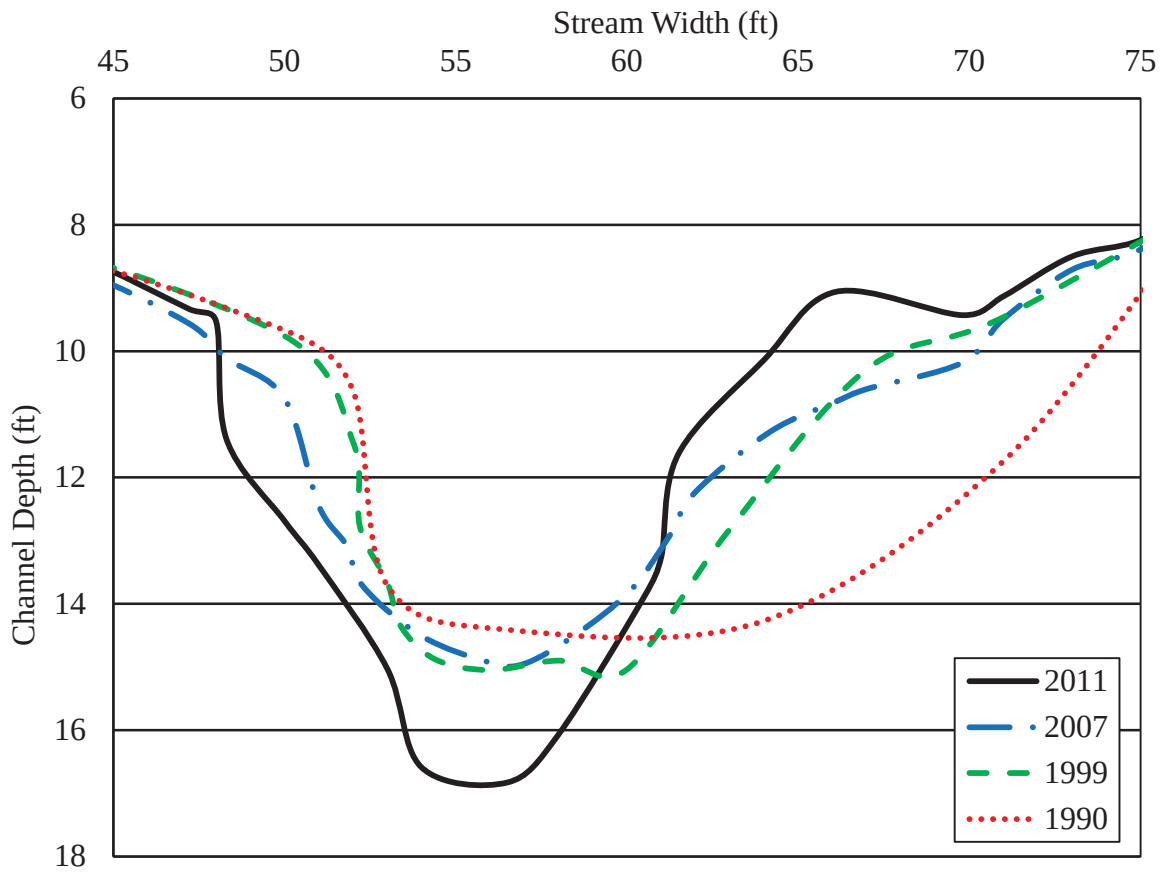


Figure 4. Channel cross section of East Muddy #2.

Road expansion related to oil and gas development has nearly doubled on the west side of Highway 789 (also see discussion under Barrel Springs Draw watershed above). Although numbers were not calculated for the Atlantic Rim EIS project area east of Highway 789, the 80 acre well spacing with road access in the Cow Creek drainage has seen an effect even larger. The requirement for engineered road designs and mostly gentle terrain has helped minimize soil erosion from this project.

Maintenance periodically is occurring on the old detention dams constructed by BLM for watershed purposes in the 1950's and 1960's. These structures have served their purpose and have largely filled up with sediment that otherwise would be moved downstream into Muddy Creek and the Colorado River drainage. In many cases risers have been added to the overflow pipes and pits dug on the sides to provide water for livestock and wildlife. However, these often become "boggy" and trap animals in the soft mud when they try to water at them. As a result, water sources are being developed away from these sites to better distribute animals and forage use and reduce the potential for animal stress or mortality at these sediment collection sites.

Vegetation treatments affected nearly 12,000 acres within this watershed over the last ten years, primarily in mountain big sagebrush plant communities. Four prescribed burns totaling 7,200 acres were completed at Cow Creek, Flat Top, Deep Creek, and the Red Wash wetlands. The latter was a spring training burn with the objective of reducing cattail density. In addition, there were four applications of tebuthiuron to thin sagebrush totaling 4,700 acres, two in upper portions of the watershed and two in mule deer crucial winter range close to Baggs.

Additional off channel water development in lower Muddy Creek would reduce grazing pressure in areas were the only water source is the creek itself. There may also be off-site water developed from tributaries to further reduce livestock impacts by providing water for drinking away from higher priority riparian habitat (i.e., fisheries and recreation).

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The impact of historic livestock use and following watershed improvement practices implemented by the BLM in the west side of this watershed were previously documented in the 2002 watershed assessment. Since then there have been stocking rate reductions based on range surveys in the 1960's, further stocking rate reductions with sheep to cattle conversions (1,179 AUMs in Cherokee allotment), reduced trailing of sheep along Muddy Creek and more use of trails away from Muddy Creek, and over the last 20 years greater emphasis on duration and timing of livestock use, with all these actions taken to improve rangeland health. Nearly all allotments are now used in a rotation with shorter duration of use to provide for more rest for plants during the growing season, rather than with spring through fall continual use. In addition, is the new consideration of the value of riparian habitat which only became a focus of range management in the mid-1980's. These factors are all influencing the changes documented under the "Current Conditions" above, and although conditions are improving, "when will" recovery occur and "what" will it look like is a question that must be asked. There are no reference sites in this region to compare to, and it is doubtful that the Muddy Creek E6 channel type will ever return to a C6 channel type. On the other hand, very positive change has and continues to occur.

Sid Weber, described to the author in the early 1980's, that Sid as a young man prior to the 1920's (when Muddy Creek started to severely head-cut and widen) used to be able to jump his horse across the Muddy Creek channel in the Cherokee and Baggs Subunit allotments where his family ran a few cattle. During the 1980's, the BLM was involved with the University of Wyoming range staff working on Muddy Creek, when channel widths ranged between 20 to 30 feet in width. Photo-points, channel cross-sections, and PFC evaluations recently completed for this assessment all show significant channel width reductions that in some places have reached or are approaching the width a person could jump with a horse (estimated six feet). Another example of long-term improvement is the expansion of sagebrush and other non-saline species into saltbush steppe plant communities. Dick Larsen, an experienced BLM soil scientist, discussed how historic livestock grazing had removed surface vegetation in the Muddy Creek drainage and most or all of the "A" horizon was eroded away, leaving a "B" horizon that was dominated by saltbush. However, Dick hypothesized that with proper stocking rates and grazing management, the "A" horizon would re-form and the increasing presence of non-saline tolerant species like Wyoming big sagebrush within saltbush steppe was an indicator of this process in action.

These two examples simply underscore the importance of monitoring, for the revision and development of accurate ESD's for this region, and for professionals to be asking tough questions about the key issues of the day and making sure to try and find the answers to them. The last step, and most important, is how to incorporate all of this into everyday management on the ground.

The historic watershed improvements on the west side of this watershed continue to need periodic review and maintenance, particularly the detention dams and spreader-dikes. Although the dams were good sources of water initially, they have become death-traps for animals and further development of

small livestock waters in more upland locations would not silt in as much and promote better distribution of livestock grazing. Pits constructed in, or at the base of badlands, have been very reliable, have a small effect on water depletions, and result in very little loss of vegetation. The contour furrowing and crested wheatgrass seedings have held up fairly well, and are still largely dominated by crested wheatgrass. These areas have been fenced separately for more intensive use as spring pastures when the crested wheatgrass is more palatable to cattle, which may also promote more recovery by native species.

The other significant and increasing resource use is oil and gas development. This has resulted in a large expansion of roads and soil surface disturbance from well pads and pipelines. Greater emphasis on reclamation (also see discussion for Barrel Springs Draw watershed) has led to improved revegetation of disturbed areas. Devon Energy Inc. has acquired a high proportion of the gas development on the west side of this watershed and vastly improved the reclamation of their well pads (Standard #1 – Page 5 photos). Anadarko and Double Eagle energy companies began to use slender wheatgrass as a cover crop in the reclamation efforts associated with the Atlantic Rim natural gas project and have had good short-term success in stabilizing sites and reducing weed infestations. Engineered road designs with more culverts and wing-ditching have reduced impacts to watershed values from roads; however, the issue of affecting runoff hydrology below roads is still not being addressed. Road surfacing with gravel and dust reducing agents on the main roads has also helped reduce impacts. The BLM has partnered with energy companies and Carbon County to add culverts and reduce erosion caused by main roads on both sides of this watershed. Similar to other watershed discussions, there is still a need for more culverts, wing-ditching, and/or other improvements on the older, existing roads.

As roads are upgraded and improved, problems associated with them are generally reduced. Main roads have begun to be graveled to reduce long-term maintenance. Simple practices such as wing ditching have generally become the standard operating procedure. Water flows are flared out into the vegetation where it benefits plant growth and infiltrates the soil instead of running down the middle or side of the road until it reaches a stream. Greater use of culverts prevents water from running along the road and creating gullies. There is still a large need for further work on nearly all improved roads to reach an adequate level of stormwater control in order to minimize or eliminate overland flow alterations, erosion and sedimentation within channels caused by roads. This issue has continued to grow with the increased creation of roads due to the expanding development of oil and gas fields.

Recreational use of roads is increasing, although, much of this occurs on the improved energy development roads and private land access along the south-eastern side of the watershed has limited road expansion. In addition, the greater use of UTV's (compared to motorcycles and three/four wheelers) appears to have less impact upon soils and plant cover than four-wheel drive pickups. The closing of crucial winter range to antler collecting should also help improve watershed and soils condition in the long-term with reduced rutting and soil erosion caused during wet conditions.

Although several head-cuts were stopped by range improvements, several still exist that need to be addressed. Planning for the lower head-cut on Cottonwood Draw and the Wild Cow Creek head-cut which needs to incorporate fish passage is on-going. The two higher head-cuts on Cottonwood Creek are slowly moving into old spreader-dikes at the head of the draw.

The vegetation treatments completed have resulted in improved herbaceous cover and plant litter, stimulated aspen regeneration in one location, and is diversifying species and age-class distribution which is a key wildlife habitat objective. The prescribed burn along the upper Cow Creek drainage was designed as a landscape scale project to remove dense and tall mountain big sagebrush. Due to the nearly 4,000 acres burned, water flow down Cow Creek is up, which has filled up the large reservoir on

state land for the first time in many years, extended the length of seasonal water flow into the irrigated meadows at the JO Ranch downstream, and created a more defined stream channel through the Nebraska sedge meadows that make up the upper riparian zone of upper Cow Creek. Similar results are also being observed in the Deep Gulch tributary of Cow Creek after it was prescribed burned in 1996. Removal of dense big sagebrush results in more snow laying on the ground to melt in and augment stream aquifers, rather than being caught on top of shrubs where it sublimates back into the atmosphere. This has been observed in most, larger prescribed burns that were implemented in mid-to-high elevations with greater than 10 inches of annual precipitation. All vegetation treatments have occurred in allotments with rotational grazing systems, in order to promote prompt recovery of desired vegetation by both initial deferment from grazing as well as long-term management that provides partial growing season rest each year. The recently adopted Greater Sage-Grouse policy has had a dampening effect on the use of prescribed fire. Since the eastern portion of this watershed is within Greater Sage-Grouse core area habitat, the policy will need to be addressed in the coming years to still allow the use of fire to improve watershed values and achieve greater herbaceous cover, reduced runoff and sediment delivery, and healthy aspen woodlands to support beaver.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands and declining levels of bare ground, the existing condition of stream channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the cooperation of livestock permittees in implementing BMP's, it is determined that the majority of the Lower Muddy Creek watershed is meeting Standard #1. The few locations that do not meet Standard #1 are located on Cottonwood Creek and Wild Cow Creek which contain large, active head-cuts due to gradient readjustment processes (See Map #6). These areas cumulatively affect approximately 300 and 2000 acres, respectively. Current livestock grazing practices are not contributing to the non-attainment of Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments.

Continue to eliminate or control active headcuts, including modification of historic gradient control structures using a channel restoration philosophy, in consultation with all necessary parties (specifically must include hydrologists and fisheries biologists). Include any required changes in livestock management, in order to promote long-term, vegetative stabilization of these sites.

Identify and correct problems with improved roads, which affect safety, water quality, channel stability, soil erosion, and sedimentation. Two-track roads are too numerous to deal with as a whole, however, problem areas should identified and fixed or the road should be closed and reclaimed. All oil and gas companies should implement stormwater control as well as reclamation practices on active and dry hole locations, roads and pipelines, which would minimize the amount of bare ground exposed to wind and water erosion.

Implement vegetation treatments where needed to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives.

Expand education to the public about its role in public land management, particularly regarding impacts from road and off-highway vehicular activities.

Savery Creek

1) Characterization:

Savery Creek is a perennial stream system, with perennial and intermittent tributaries, which headwater on the Medicine Bow National Forest (MBNF) or the foothills to the Sierra Madre mountain range. It has a hydrologic unit code (HUC) of 1405000304. The entire drainage is in a 12 to 18 inch precipitation zone with well-developed loamy soils. Average annual flow contributed by the Savery Creek watershed is around 89,000 acre-feet. Land ownership, consisting of intermingled parcels of primarily private and state lands, with the BLM-administered public land, only make up about 20% of the watershed.

The majority of stream channels in this watershed are a C4 stream type, with C6 and B4 stream types also present. The C4 stream type is found in broad, gentle gradient alluvial valleys, with predominantly gravels and lesser amounts of cobble, sand, and silt/clay. They are slightly entrenched, meandering, riffle/pool channels with well-developed floodplains. These systems are characterized by the presence of point bars and other depositional features. Rates of lateral adjustment are influenced by the presence and condition of riparian vegetation (Rosgen 1996). Headwater streams on steeper gradients are B4 stream types. This stream type is found in narrow, moderately steep colluvial valleys, with gradients of two to four percent and channel materials composed predominantly of gravel with lesser amounts of boulders, cobble, and sand. The B4 stream type is considered relatively stable and is not a high sediment supply stream channel (Rosgen 1996).

Principal human uses in this watershed are livestock grazing, hay production, timber production, and recreation. Livestock use is primarily cattle, along with a low amount of sheep use and horses. Recreation is primarily related to hunting, fishing, or using the Continental Divide National Scenic Trail. The highest use period is during the fall hunting season (September through October). Associated with this use is an improved/unimproved road network and off-highway vehicle use. High Savery Dam was constructed in 2006 by the State of Wyoming just below the confluence of the three upper forks of Savery Creek to provide reliable irrigation water to the Snake River valley, as well as a conservation pool of water for fisheries management of Colorado River Cutthroat Trout, and recreational use (boating and fishing).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012, with issues including livestock grazing, erosion and plant cover (formerly woody plant health), along with the addition of management of High Savery Dam. The release of irrigation water later in the summer results in high water flows leading to lateral cutting and sediment added to the stream at an un-natural time of the year for an extended hydrologic event. How can these releases be managed differently or how does the Savery Creek channel need to be improved or armored to withstand the late season high water releases from High Savery Dam?

3) Current Conditions:

Quantifiable data about current erosion levels and stream flows are not available. However, information is available from upland transects, photo-points, channel cross-sections, and personal observations show that the trend for watershed values is upward. Specific management implemented along with

range improvements and vegetative treatments, at least indirectly, should also relate to improved resource conditions.

The only allotment in this watershed that had an early AMP implemented on it was Hartt Creek, at the upper end of the watershed and adjacent to the MBNF. It has a rotational grazing system used with cattle that rotate through pastures in one to two weeks. A prescribed burn was conducted on the north end in 1996. More recently, work was completed with NRCS on improving water sources and a cooperative mechanical treatment (BLM, LSRCD and private landowner) to remove encroaching conifer from aspen stands. Pace-frequency transects established in the late 1970's had an average bare ground of 30% (range of 21% to 49%) that has been reduced to an average of 3% (range of 0% to 7%) in 2011. Litter amounts during this same time period rose on an average from 51% to 79%.

Trends in upland erosion indexes are more qualitative than quantitative, and methods have changed over time, so direct comparisons are not possible. In the late 1970's, what was known as soil surface factors (SSF), were rated along the pace frequency transects in the Hartt Creek allotment, with generally three factors (out of seven) evaluated which included: soil movement, surface litter, and pedestalling. Rills, gullies, surface rock, and flow patterns were not rated (probably not present on site). In comparison, the "Interpreting Indicators of Rangeland Health" (Technical Reference 1734-6, Version 4 – 2005) evaluates 17 indicators, which include many of the same ones used in SSF. In the late 1970's the evaluation tended to fall either in the first or second category (2's, 3's or 4's) for some or slight amounts of movement of soil and litter, and pedestalling. Using the more current TR1734-6, pedestalling remains in a similar category of Slight to Moderate rating, described as "Active pedestalling or terracette formation is rare; some evidence of past pedestal formation, especially in water flow patterns on exposed slopes". However, the categories for soil and litter movement (as well as the remainder of the 17 indicators) fall within the None to Slight rating, and generally match what is expected for the site.

Due to its' higher elevation and precipitation, this watershed has not been affected as much during drought years. Livestock turnout is later than the lower elevation watersheds so plant growth gets well started before grazing occurs. Five other small allotments with recently established transects averaged 8% bare ground and estimates of bare ground on seven other small allotments averaged 16% bare ground. Some of these transects are associated with vegetation treatments which have improved herbaceous cover as well as that of mountain shrubs (snowberry, bitterbrush, mountain mahogany, and serviceberry). Overall amounts of bare ground in this watershed are very low.

Most stream channels are narrowing, with banks becoming more stable with perennial, deep-rooted vegetation. As the channels narrow, the active floodplain width expands, including both lateral expansion on gravel-bottomed streams and within incised banks of silt/clay-bottomed streams where the upper slopes continue to widen and become more stable with increased vegetative cover. In-channel bank sloughing on outer corners and gradient adjustment of ephemeral side drainages are the primary sources of erosion. Figure 5 shows one example of the long-term trend of channel morphology along Loco Creek where grazing management was changed to a rotation in 1992. Photos of Savery Creek below High Savery Dam show continued improvement in channel narrowing and vegetation recovery dating back to high flows in 1984 (Standard #1 – Page 8 photos). However, lateral cutting in this system and gradient control structures are maintaining an artificially shallow and wide channel that is not natural (Standard #1 – Page 6 photos).

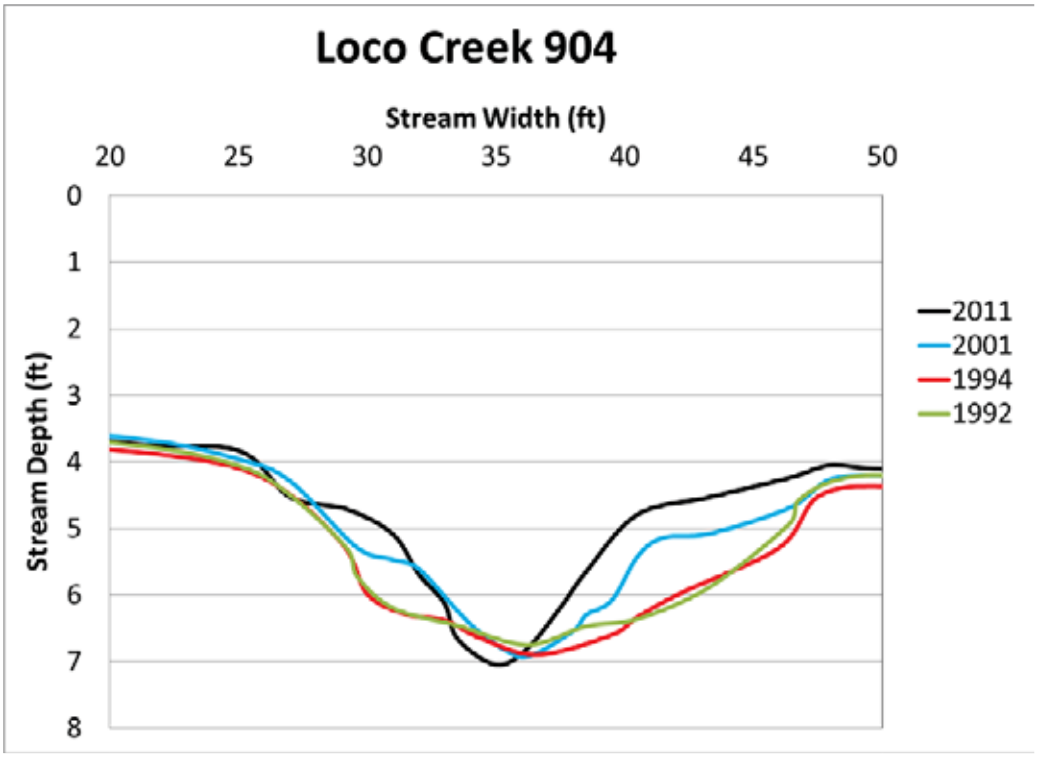


Figure 5. Channel cross section of Loco Creek near photo point #904.

In contrast to this location is the channel restoration work being completed just downstream by the LSRCD, FWS, NRCS, and private landowners. Although mostly on private land (small amount on the BLM-administered public land), this new approach to restoring natural channel conditions heals quickly and looks more natural with boulders and tree trunks compared to steel and concrete. It also stands up to the summer releases of water from High Savery Dam without the lateral side-cutting observed just upstream. Livestock management has also had to change to shorter duration of use to promote riparian plant growth and bank stabilization in the allotments where this type of work is occurring (or had already changed earlier to a rotation system).

The BLM worked with the permittee in the Hartt Creek allotment to improve access off the county road for recreationists using this area for hunting, the NCDST, and access to MBNF. Previously, this route had evolved into three lanes of eroded two-tracks that were replaced with a single, raised, graveled road. The county road in McCarty Canyon, where it follows Little Savery Creek, was re-constructed by the Carbon County Road and Bridge Department with material assistance from the BLM. One spring along the road was protected, stream corners hitting the road moved or armored, and sediment delivery into the creek has been substantially reduced. Beaver have been trapped at the large culvert on Little Savery Creek and moved to other streams to conduct their watershed improving work without plugging culverts. Although beaver are slowly increasing in numbers, the general lack of beaver ponds in this system results in faster movement of flow events and reduced water storage for late-season stream flow.

Over the last 10 years, the BLM associated projects included: approximately 4300 acres were treated with prescribed burns in mountain big sagebrush and mixed mountain shrublands, 3600 acres were treated with tebuthiuron to thin mountain big sagebrush, and an on-going mechanical treatment project on 800 acres is removing conifers from aspen woodlands. They are mostly occurring in the upper portion of the watershed, with around 1000 acres of treatment taking place in the lower half of the watershed. The objectives for treatment include diversification of species, age-class, and structure of shrublands, improved herbaceous cover, and improved health of aspen woodlands.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

Livestock grazing continues to be the dominant resource use and impact within this watershed, with the construction of High Savery Dam having a localized impact on the Savery Creek channel downstream. These factors are distantly followed by roads and off-road vehicle use associated with recreation that can increase sediment delivery into streams, along with plant succession and lack of wildfire in the ecosystem. Although most of this watershed consists of private and state lands, the management of livestock grazing across all lands has shifted to shorter duration and/or rotated use. This relates to the different agencies associated with permittees having a similar message and working together to resolve problems, fewer in-common grazing areas so livestock owners take better care of their lands, and more communication between the various partners involved in improving livestock grazing management. The other principle change in livestock grazing has been the use of the Grizzly allotment by multiple permittees, in exchange for resting other pastures from grazing use. In this watershed, McCarty Canyon (multiple pastures) allotment and North Rasmussen allotment, which both include portions of Little Savery creek, have not been grazed for varying time periods to improve riparian habitat.

The data described earlier and photographs do show vast improvement in watershed condition as a result of changes in livestock management. However, this management needs to be continued or improved since recovery of mixed age stands of willows and waterbirch, which are important in streambank stability, may take 30 to 50 years to achieve. Reductions in bare ground are also a positive reflection of the changes in grazing management, however, now the need is to monitor and adjust management to improve desired plant species. This may be easier said than done, and will need the updating of ESD's, research assistance, and more in-depth monitoring.

The negative impacts of High Savery Dam need to be resolved by working with the State of Wyoming, LSRCD, WGFD, and other interests to reduce the lateral channel cutting and determine if the vertical gradient control structures can be replaced with a natural channel restoration.

The improvement in the county road through McCarty Canyon addressed the most serious concerns relating to an improved road that had was resulting in high sediment delivery into an adjacent stream (Standard #1 – Page 10 photos). However, there is still a need for further work on other improved roads to reach an adequate level of culverts and wing-ditching to minimize or eliminate overland flow alterations and erosion caused by roads. Examples like the Hartt Creek road, whether it involves an upgraded road or simply water-barring, is needed to stop water from running down two-tracks, deepening them, and forcing people to create a new road to the side. By working together the limited road funds of several agencies can still make a difference in resolving erosion problems associated with roads. Expansion of roads in this watershed has been limited, due to both the lack of energy development as well as the high amount of private land ownership. Recreational use of roads is increasing, although, the greater use of UTV's (compared to motorcycles and three/four wheelers) has far less impact upon soils and plant cover than four-wheel drive pickups. The closing of crucial winter range to antler collecting should also help improve watershed and soils condition in the long-term with reduced rutting and soil erosion caused during wet conditions.

Vegetation treatments have historically occurred more on private and state lands through chemical applications to remove sagebrush and mountain shrubs. Agency shifts to the use of tebuthiuron has led to greater remaining sagebrush and less impact to forbs and shrubs (which are not as susceptible

compared to the use of 2, 4-D) post-treatment. The BLM's use of prescribed burns, tebuthiuron, and mechanical treatments have increased herbaceous cover and led to better distribution of livestock grazing use that has increased cover and stability along streambanks and lower adjacent slopes. Higher sagebrush cover and conifer encroachment into aspen is due to plant succession, lack of wildfire in the ecosystem, and higher use of grasses than shrubs by grazing livestock and big game. The use of treatments and implementation of grazing systems has helped to change this trend. However, the recently adopted Greater Sage-Grouse policy has had a dampening effect on the use of prescribed fire. Since most of this watershed is within Greater Sage-Grouse core area habitat, the policy will need to be addressed in the coming years to still allow the use of fire to improve watershed values and achieve greater herbaceous cover, reduced runoff and sediment delivery, and healthy aspen woodlands to support beaver.

6) Recommendations:

Due to the existing diversity and amount of vegetative cover on uplands versus low amounts of bare ground, the trend to low upland condition class ratings, the existing and improving trend in stream vegetation and channel morphology, the cooperation exhibited in livestock management by permittees, as well as by all the partners involved in resolving the small number of management issues still remaining to be dealt with, it is determined that the majority of the Savery Creek watershed is meeting Standard #1. The one exception is the roughly two mile stretch of Savery Creek below High Savery Dam, where the BLM, LSRCD, and the State of Wyoming need to meet to determine long-term management necessary to help this stretch of creek meet this standard. This is not related to livestock grazing management. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments. Off-creek watering locations in pastures along Savery Creek or its' tributaries where the creek is the principal water source should be developed to further maintain or improve streambank stability and channel narrowing. Additional crossing points on streams may need to be considered where width/depth rations make it difficult for animals to get across anymore.

Continue to identify and correct impacts from improved and un-improved roads which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan.

Continue to implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives. Coordinate more closely with WGFD and LSRCD, including more definition for treatments and where and when they need to occur to resolve conflicts over conducting vegetative treatments within Greater Sage-Grouse core habitat.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities.

Little Snake River – Willow Creek and Powder Wash drainage areas

1) Characterization:

These two fifth order watersheds follow the main stem of the Little Snake River, and except for Willow Creek, which is primarily located in Colorado, the tributaries and side-drainages are small and ephemeral in nature. The entire area is in a 10 to 14-inch precipitation zone with predominantly sandstone and shale derived soils, which can produce high runoff with moderate to severe erosion potential. Land ownership is primarily private land along the Little Snake River valley and side drainages, with the BLM-administered public land occurring on uplands across approximately 20% of the watershed.

Average annual flow contributed by the entire Little Snake River watershed (recorded at the lower Colorado state line) is around 449,000 acre-feet, with May and June being the peak flow months and September being the lowest flow month. The small drainages and draws are not large enough to have been individually gauged for stream flow. The only site with stream flow where channel classification was determined is the Little Snake River, which is a C6 stream type. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs in broad valleys with gentle gradients of less than two percent. Rates of lateral adjustment are influenced by the presence and condition of riparian condition.

Principal human uses in this watershed are livestock grazing, grass and alfalfa hay production, oil and gas development, and recreation. Livestock use is primarily cattle, employing both cow/calf and yearling operations. Sheep use still occurs on a few allotments. Oil and gas development has occurred in localized areas for many years. There is continuing development in these locations, such as just west of Baggs, and interest in further development of areas such as Muddy Mountain and Powder Rim. Recreation is mainly related to hunting, primarily during the fall (September through October).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012, which include livestock grazing, erosion, oil and gas development, and plant cover (formerly woody plant health).

3) Current Conditions:

Stream monitoring on public lands does not exist due to the ephemeral nature of channels here. These channels are moderately vegetated with rhizomatous wheatgrass, basin wildrye, big sagebrush and other upland species. Data is primarily available from upland transects and photos. The only long-term trend is from the Powder Rim allotment that lies in both this watershed and the Sand Creek watershed. This allotment was one of the first AMP's developed by the RFO, following stocking rate reductions in the 1960's. It includes four pastures originally used by summer cattle and winter sheep in a rest-rotation system. Although this system was modified in the late 1990's to a livestock rotation with shorter duration of use by summer cattle, the reduction in bare ground is being observed in every pasture. Pace-frequency transects established in 1977 were re-read in 2011, and show an average decline across 12 transects from 81% to 36% bare ground. The range of bare ground in 1977 was from 97% down to 39%, compared to a range of 58% down to 17% observed in 2011. As bare ground decreased, average litter cover increased from 15% to 48%, basal plant cover increased from 2% to 9%, and shrub canopy cover increased from 1% to 12%. Recently established transects in seven other allotments higher in this watershed show an average bare ground of 21% and estimates of bare ground across ten other allotments in the upper portion of this watershed show an average of 24% bare ground.

Trends in upland erosion indexes are more qualitative than quantitative, and methods have changed over time, so direct comparisons are not possible. In the late 1970's, what was known as soil surface factors (SSF), were rated along the pace frequency transects, with generally five factors (out of seven) evaluated which included: soil movement, surface litter, surface rock, pedestalling, and flow patterns. Rills and gullies were usually not rated. In comparison, the "Interpreting Indicators of Rangeland Health" (Technical Reference 1734-6, Version 4 – 2005) evaluates 17 indicators, which include many of the same ones used in SSF. In the late 1970's the evaluation from Powder Rim allotment included eight transects that tended to fall in the middle category (seven through nine) for moderate amounts of soil visible, litter movement, and plant pedestals occurring in flow patterns, with four transects falling in the second category (five and six) for some or slight amounts of movement of soil, litter, flow patterns and pedestalling. Using the more current TR1734-6, all sites have improved by one category or more. The most prevalent factor still visible is pedestalling that ranks out in a Slight to Moderate rating, described as "Active pedestalling or terracette formation is rare; some evidence of past pedestal formation, especially in water flow patterns on exposed slopes". However, the categories for soil movement, water flow patterns and litter movement fall within the None to Slight rating, and generally match what is expected for the site.

Vegetation treatments on public lands within this watershed consist of approximately 400 acres of brush-beating in a mountain shrub plant community in the Cottonwood Creek drainage, 15 to 18 acres of dense juniper cut down in two trial treatments, one west of Baggs and one east of Savery, and recent application of tebuthiuron to 5,000 acres of mountain big sagebrush plant communities on the west side of Powder Rim. Photos show good recovery by mountain shrubs consisting of bitterbrush, serviceberry and snowberry, with a little slower recovery by mountain big sagebrush. Where the juniper was cut and left to catch litter and snow and protect young plants from use by wintering mule deer, the bare ground dropped from 34% to 20% west of Baggs, and from 23% to 15% east of Savery. Over the seven year period of this study, cheatgrass did increase on half of the sites but desirable native plants are also increasing. Shrub canopy, which is a particularly important value for mule deer, increased from 32% to 42% and from 19% to 25%, at Baggs and Savery, respectively. Monitoring changes following the application of tebuthiuron have not yet been recorded.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The construction of High Savery Dam provides more reliable late season water to irrigators to re-apply water after hay is put up for increased forage quality and quantity on private hay meadows. Many of the small allotments in this watershed lie adjacent to these hay meadows, and are usually used in the spring and/or fall. The improvement of hay meadows described above has increased permittee grazing flexibility, with many removing calves or both cows and calves earlier from public rangelands, particularly in dry years. This should continue to maintain or improve the litter and plant residue while reducing levels of bare ground described earlier. In turn, this should result in improved organic matter accumulation in soils, improved soil and hydrologic function, and increased plant vigor and cover. The other factor that has changed with respect to livestock grazing is the shift from longer duration of use to shorter, rotated periods of use that provide for some time during the growing season for plant growth and energy replacement into roots to occur. The continuation of this practice should maintain or improve the watershed and soil properties described above.

Vegetative cover and litter on uplands vary with the soils, slope, aspect, elevation, and precipitation. Research conducted in Wyoming indicated that upland plant communities often can be maintained with ground cover of 30 percent, while sediment yield increased dramatically when cover declined to less than 30 percent (Linse, Smith and Trlica, 1992). This research was based on a 10 to 14 inch rainfall simulation on a sagebrush/mixed grass plant community which is similar to the dominant vegetation occurring in this watershed. The levels of bare ground currently observed in the Powder Rim allotment following the implementation of a management plan are not below this 30 percent threshold, although visible signs of erosion have decreased when looking at the SSF data comparison to the TR1734-06. This is probably in part (in addition to stocking rate reductions and rotational management) due to the sandy "A" horizon commonly found on soils in this area that promotes greater water infiltration and plant growth even on dry years when compared to more fine textured soils. Further reduction in the percent bare ground in Powder Rim allotment will be monitored and is expected to occur. The recent three year wet period led to many new seedling plants observed along all transects, with a broad range of perennial species including grasses, forbs and shrubs. The bare ground observed in smaller allotments higher in this watershed all fell below this 30% threshold and should indicate good current soil and hydrologic function. Continued monitoring and refinement of long-term livestock management should result in maintaining current plant and litter values or improving them.

Vegetation treatments in this watershed occurred primarily on private land due to the large extent of private land in the valley and a focus on forage production for livestock. In some instances this led to a lower likelihood to treat vegetation on adjacent public lands in order to maintain shrub habitat for wildlife. However, decadence in shrub communities, encroachment of juniper into these plant communities, and increasing amounts of bare ground and cheatgrass has led to more recent vegetation treatments on public land. While there is still concern about conducting treatments in big game crucial winter range, there is also a need to address declining range conditions in this area. Vegetation treatments often don't result in improved plant cover, since reductions in shrub or tree cover maybe off-set by increased herbaceous or shrub cover. However, the amount of bare ground is likely to go down and desired species are likely to be improved. The initial results from mechanical treatments in mixed mountain shrubland habitat and juniper mixed shrubland are encouraging with regard to both the reduced levels of bare ground observed and increase in desired shrub canopy. These and additional monitoring needs to occur to ensure desired vegetation species improve while cheatgrass does not. The use of tebuthiuron to thin sagebrush density and cover hold much promise to improve plant vigor, production and litter, while not leading to increased levels of cheatgrass or alyssum. This also needs sufficient monitoring to evaluate if these objectives are being met.

Roads and off-highway vehicle use continue to expand, but perhaps are not as detrimental as observed in the past. There is still a need for further work in some locations on improved roads to reach an adequate level of improvement practices (gravelling, additional culverts, wing-ditching, water-bars) to minimize or eliminate overland flow alterations and erosion caused by roads. The more common practice to fully engineer and design new roads is helping to reduce this issue, particularly associated with further development of oil and gas resources. Recreational use of roads is also increasing, although, the greater use of UTV's (compared to motorcycles and three/four wheelers) has far less impact upon soils and plant cover than four-wheel drive pickups. The closing of crucial winter range to antler collecting should also help improve watershed and soils condition in the long-term with reduced rutting and soil erosion caused during wet conditions.

6) Recommendations:

The trends in declining or low levels of bare ground and improved in erosion condition classes are positive signs that watershed and soils health is also improving. The change to rotated or shorter

duration grazing use with nearly all permittees should maintain or improve the long-term function and health of watershed and soils in this watershed. Although the existing condition and vegetative cover on uplands could be improved, it is adequate for watershed function. Considering that the number of management issues still needing to be addressed are limited, the existing condition of primarily ephemeral channels, and the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, it is determined that the Little Snake River watershed is meeting Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan.

Continue to implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives. Due to the amount of private land and the sensitivity towards projects in big game crucial winter range, it is extremely important to coordinate vegetation treatments between the BLM, LSRCD, WGFD, Wyoming State Land Board, and private landowners in this area. Ensure adequate monitoring of the long-term effects of vegetation treatments is occurring and information learned is disseminated to all parties.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities. Work closely with other partners in this area, including the WGFD in regards to the seasonal closure for antler collecting and the potential long-term benefit to watershed and soil values.

Sand Creek

1) Characterization:

Sand Creek is a large ephemeral watershed, which contains numerous drainages and draws that empty into the Little Snake River about 10 miles west of Baggs, Wyoming. The majority of the area is in a 7 to 9 inch precipitation zone, rising to a 10 to 12 inch precipitation zone along Powder Rim and the Flat Tops. Soils are predominantly shale and sandstone derived soils, which can produce high runoff with moderate to severe erosion potential. Sandy soils and small sand dunes occur in some areas. Due to low topographic relief and infrequent flow events, channel formation varies widely. Land ownership is almost entirely BLM-administered public lands with just a few isolated parcels of private and state lands.

The only site where channel classification was determined was the main stems of Sand Creek and Willow Creek, which are both D5 stream types. The D5 stream type is described as a braided stream, found within broad alluvial valleys, with predominantly sand channel bed material, interspersed with silts and clays. The braided system consists of interconnected distributary channels formed in depositional environments. Channel gradients are generally less than 2% with very high width/depth ratios of 40 to 50 up to 400 or larger. The braided channel system is characterized by high bank erosion

rates, excessive deposition occurring as both longitudinal and transverse bars, and annual shifts of the bed location (Rosgen 1996).

Principal human uses in this watershed are natural gas development, livestock grazing, and recreation. There is also a large wild horse herd. Natural gas development has occurred in the area for many years. However, it has slowly expanded into this watershed over the last 30 years, with increasing development over the last 10 years. Livestock use is a combination of summer cattle and winter sheep grazing. The Adobe Town wild horse herd management area has an appropriate management level (AML) of 700 wild horses (range of 610 to 800). Recreation is mainly related to hunting, primarily during the fall, along with summer visitation to the Adobe Town Wilderness Study Area (WSA).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012, with a change in the order to Wild Horses, Oil and Gas, Livestock Grazing, Plant Cover (formerly Woody Plant Health), and Erosion. Similar key questions are still valid for wild horses, livestock grazing and erosion. Additional key questions for oil and gas are: What changes in reclamation practices will be necessary to be successful when disturbing the low reclamation potential soils in this watershed? And for plant cover, the key question is: What amounts of juniper cover are needed in mule deer crucial winter range while addressing the encroachment of juniper into important shrublands that is negatively affecting species composition and herbaceous plant cover?

3) Current Conditions:

See the discussion for the Powder Rim allotment in the Little Snake River watershed. Although Powder Rim was the principle AMP developed in this watershed, there were also 3'x3' plots established in most allotments in the mid-1960's, with most of these having pace-frequency transects added in the late 1970's. These transects have been partially re-read in 2003 and/or 2011 with the following results in bare ground change. Cow Creek allotment declined from 65% to 43%, Grindstone Springs allotment declined from 59% to 37%, Rotten Springs allotment declined from 87% to 41%, four sites in Sand Creek allotment declined from an average of 62% to 43%, and Willow Creek declined from 80% to 48%. However, in the Adobe Town allotment the trend is flat (mid-30%). Additional transects established in the Red Creek and Rotten Springs allotments in 1999 and re-read in 2011 showed flat trend in bare ground, with current bare ground averaging in the mid-50% on saltbush sites, low-20% on big sagebrush/mixed grass sites, and mid-40% on a site that is a shale and sagebrush mixture.

The population of wild horses has continued since the last watershed assessment to be on the high side, even though gathers occurred in 2002, 2003, 2005, 2007, and 2011. A total of 4,406 wild horses were removed from the HMA or adjacent to it during these gathers, compared to less than one thousand should have needed to be gathered if wild horse numbers were at AML and on a three year gather cycle. The gather in 2002 was entirely outside the HMA, with over 200 in Wyoming and 500 in Colorado that had moved there in search of water during one of the driest years on record.

As discussed in the Barrel Springs Draw watershed, road expansion due to oil and gas development has nearly doubled between 1994 and 2011, with more recent development primarily in the eastern two-thirds of this watershed. Much of this is occurring in soils that have a low reclamation potential.

The only recent vegetation treatment within this watershed was a 600 acre tebuthiuron application to thin mountain big sagebrush on the south side of the Flat Tops. Encroachment of juniper into shrublands along Powder Rim and east of Sand Creek is being considered for future treatments.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

Although the principal changes currently most observable compared to the last assessment are the increased numbers of roads, gas wells, and pipelines associated with oil and gas development, the high numbers of wild horses continue to be a variable without consistency and with little data to determine their impact. The wild horse gather shows over 3,000 more wild horses were removed from this area than should have been there. There needs to be much greater consistency in keeping this herd within the ranges of the AML in order to evaluate if this number is right for the land, and to accurately assess and separate impact analysis between the three major groups of ungulates using the area: wild horses, livestock, and big game.

Due to both the high numbers of wild horses and drought years in 2002 and 2006, the RFO asked permittees to take voluntary non-use as much as they could. Several permittees have limited flexibility and still made some livestock use. However, out of the 20,575 AUMs of permitted livestock use, actual use from 2002 through 2007 averaged only 18% of allowable use to help maintain range conditions (See Figure 6). This affected both summer cattle and winter sheep operations. Summer cattle operations are believed to have more competition for the same forage with wild horses, therefore, BLM has worked with permittees to use rotational and/or shorter duration grazing to maintain or enhance range conditions. Winter sheep grazing is not considered an issue except in dry years if there is a shortage of available forage. The only change-in-kind (of livestock) conversion occurred on the Willow Creek allotment, where 5,362 winter sheep AUMs were converted to 400 active spring cattle AUMs and 1,280 active winter sheep AUMs. This conversion reflected both the type of country/vegetation found in the allotment and its' location within a wild horse HMA.

The fact that the amount of bare ground has declined substantially between the late 1970's and 2011 is a credit to improved livestock management, voluntary non-use by livestock permittees, and the wild horse gathers. It also may be another example of the resiliency of the desert ecosystem, despite the common belief that it is not. Regardless of the positive trends in reducing bare ground and thereby increasing amounts of litter and plant cover, the discussion above about more expanded and consistent monitoring is still needed. Although perennial plants make up the majority of plants observed, there is still more need to evaluate the trend in annuals, primarily cheatgrass, halogeton and alyssum.

Reclamation of oil and gas development on soils with low reclamation potential is the primary long-term concern. The use of slightly larger pads with multiple wells drilled from the same pad should help, but won't eliminate this issue. These soils have very thin topsoil over either a fractured, rocky, saline substrate, or a sandy substrate that early efforts in reclamation have not been very successful on.

Roads and off-highway vehicle use continue to expand, but perhaps are not as detrimental as observed in the past. There is still a need for further work in some locations on improved roads to reach an adequate level of improvement practices (gravelling, additional culverts, wing-ditching, water-bars) to minimize or eliminate overland flow alterations and erosion caused by roads. The more common practice to fully engineer and design new roads is helping to reduce this issue, particularly associated with further development of oil and gas resources. Recreational use of roads is also increasing, although, the greater use of UTV's (compared to motorcycles and three/four wheelers) has far less impact upon soils and plant cover than four-wheel drive pickups. The closing of crucial winter range to antler collecting should also help improve watershed and soils condition in the long-term with reduced rutting and soil erosion caused during wet conditions.

Vegetation treatments are not common and if within the wild horse HMA may receive year-round use. The use of tebuthiuron which is aerially applied for minimal impact and takes effect over several years while leaving protective shrub stems is the best solution where thinning shrub canopy and density is desired. Future treatments to remove juniper encroachment should not be affected by wild horses or livestock grazing.

6) Recommendations:

Due to the existing condition and observed trend of vegetative cover on uplands, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Sand Creek watershed is meeting Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Maintain wild horse populations in the Adobe Town HMA at the AML of 700 wild horses (range of 610 to 800). Ensure adequate monitoring of distribution, diet, and other important factors to determine if this AML is the appropriate level to manage for with regard to watershed and other values, as well as other multiple uses of the public lands. Develop additional water sources to improve wild horse distribution, reduce pressure around natural water sources, and reduce the potential of wild horses moving outside the HMA due to lack of adequate sources of water.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan. All oil and gas companies should implement reclamation practices on active and dry hole locations, in order to minimize the amount of bare ground exposed to wind and water erosion.

Continue to implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Promote composition and/or cover of plant communities and litter that will minimize surface runoff and soil erosion while meeting other resource objectives. Due to the sensitivity towards projects in big game crucial winter range, it is extremely important to coordinate vegetation treatments between the BLM, LSRCD, and WGFD in this area. Ensure adequate monitoring of the long-term effects of vegetation treatments is occurring and information learned disseminated to all parties.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities. Work closely with other partners in this area, including the WGFD in regards to the season closure for antler collecting and the potential long-term benefit to watershed and soil values.

Shell Creek

1) Characterization:

Shell Creek is a large ephemeral watershed, just to the west of Sand Creek and is a tributary of Vermillion Creek, which empties into the Little Snake River in Colorado. Small, ephemeral side draws contribute seasonal flows into Shell Creek. The majority of the area is in a 7 to 9-inch precipitation zone, rising to a 10 to 12-inch precipitation zone along Powder Rim and Kinney Rim. Soils are predominantly shale and clay-loam soils, which can produce high runoff with moderate to severe erosion potential. Sandy soils and small sand dunes occur in some areas.

The only site where channel classification was determined was the main stem of Shell Creek, which is a C6 stream type. The C6 stream type is a slightly entrenched, meandering, silt-clay dominated, riffle-pool channel with a well-developed floodplain (Rosgen 1996). It occurs in broad valleys with gentle gradients of less than two percent. Rates of lateral adjustment are influenced by the presence and condition of riparian condition.

Principal human uses in this watershed are livestock grazing, natural gas exploration, and recreation. There is also a large wild horse herd. Livestock use is a combination of summer cattle and winter sheep. Natural gas exploration has occurred in the area for many years. Current exploration is on state land north of Cow Creek Ranch. Recreation is mainly related to access into the Adobe Town WSA during the spring and summer, and hunting during the fall.

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012.

3) Current Conditions:

Please refer to the discussion for the Sand Creek watershed. The Cow Creek allotment overlaps both watershed. One new transect in the Espitalier allotment has existing bare ground at 38% in a shale ecological site with birdsfoot sagebrush the most dominant species. The new exploration on state land is the principle oil and gas development, along with upgrading the road access to the site from the north across public lands. There have been no vegetation treatments conducted in this watershed, nor are any planned.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

Please reference the discussion under Sand Creek watershed. Livestock use is primarily by one permittee who uses both cattle and sheep in a rotation system. Expansion of use in Colorado has increased their flexibility and resulted in reduced amount and duration of use on public rangelands in Wyoming. The current levels of bare ground depicted on transects in this area are adequate for these ecological sites. Natural gas interest is picking up but not any permanent development currently in this area. There has been some discussion about improving the BLM road to Colorado south of Adobe Town WSA to improve access into the area but no change in current management has been made.

6) Recommendations:

Due to the existing condition and vegetative cover on uplands, the existing condition of primarily ephemeral channels, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, and the generally small number of management issues that need to be dealt with, it is determined that the Shell Creek watershed is meeting Standard #1. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Maintain wild horse populations in the Adobe Town HMA at the AML of 700 wild horses (range of 610 to 800). Ensure adequate monitoring of distribution, diet, and other important factors to determine if this AML is the appropriate level to manage for with regard to watershed and other values, as well as other multiple uses of the public lands. Develop additional water sources to improve wild horse distribution, reduce pressure around natural water sources, and reduce the potential of wild horses moving outside the HMA due to lack of adequate sources of water.

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, and water developments.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities. Work closely with other partners in this area, including the WGFD in regards to the season closure for antler collecting and the potential long-term benefit to watershed and soil values.

STANDARD 2 – RIPARIAN/WETLANDS

> *Riparian and wetland vegetation have structural, age, and species diversity characteristic of the state of channel success and is resilient and capable of recovering from natural and human disturbance in order to provide forage and cover, capture sediment, dissipate energy, and provide for ground water recharge.*

1) Characterization:

Riparian/wetland habitat consist of a variety of plant communities, including riparian grassland, willow-waterbirch riparian shrublands, and cottonwood and aspen riparian shrublands; although the first two listed are the dominant types found in the Upper Colorado River Basin. These habitat types are critical in supplying water, forage and habitat for wildlife and fisheries, livestock grazing, wild horses, irrigation, and use by recreationists. Riparian/wetland habitat makes up less than one percent of the landscape, and approximately 10 percent is located on public lands administered by the BLM. As a result, the RFO works with its partners on a landscape basis to improve this habitat as it benefits both public and private interests and values.

The primary method used in evaluating this standard is through a qualitative assessment procedure called Proper Functioning Condition ((PFC). This process evaluates physical functioning of riparian/wetland areas through consideration of hydrology, vegetation, and soil/landform attributes.

PFC assessments are used along with other existing information such as photo-points, stream cross-sections, grazing use and other relevant history, and other habitat or population assessments to evaluate this standard of rangeland health. It is important to note that the PFC assessment provides information on whether an area is physically functioning in a manner that allows maintenance or recovery of potential values (e.g., fish habitat, vertical structure for song birds, or specific species for forage) over time. However, PFC is not desired or future condition (TR 1737-15, 1998). Other methods used include Multiple Indicator Monitoring (MIM; Burton et al. 2011) and Habitat Quality Index (HQI; Bins 1979).

It is important to realize that livestock management of riparian/wetland habitat has only developed since the mid-1980's. Rangeland management evolved during the early to mid- 1900's with a focus on uplands, primarily looking at stocking rates, range readiness and proper utilizations rates on upland species. Allotment Management Plans (AMPs) implemented by the BLM prior to 1980 did not recognize or discuss riparian values or management. Although this has changed, restoring the species and structural diversity within these communities will take considerable time.

2) Issues and Key Questions:

The issues and key questions from the 2002 document are still valid at this time. This included animal use by livestock, wild horses, and wildlife, hummocks, natural succession, vegetation plantings, vertical instability, roads, and effects from coalbed methane development. Livestock management is still the most dominant influence upon riparian/wetland habitat. The following text is in addition to the earlier discussion.

The value of riparian/wetland habitat to grazing permittees and landowners is still not as well understood as it should be. How can this information be made better quantifiable or disseminated to help these people make more informed grazing management decisions?

Development of spring/seep exclosures, riparian pastures, and deferment of livestock grazing on riparian habitat has promoted recovery of sedges and other deep-rooted species that are important in stabilizing streambanks. However, domination of these species may crowd out desirable forbs (e.g., clovers) and in the case of exclosures will reduce species diversity, forage production, and increase composition of Canada thistle by the lack of removal of vegetation through grazing. How can the adverse effects of protecting these important habitats be quantified and suitable, limited grazing occur that would still maintain desirable species and prevent expansion of Canada thistle?

Wild horse populations in the Adobe Town HMA have been close to 3000 animals (AML of 700) on several occasions during the last 10 years, resulting in higher levels of impact on the limited natural seeps and springs located within the HMA. How can the BLM analyze and manage impacts from wild horses upon riparian/wetland habitat with such a wide range and variation in wild horse populations?

Elk populations have risen substantially over the last twenty-five years and current numbers are estimated at 12,000 animals in the Baggs herd unit (eastern half of watershed) with a population objective of 4200 animals. A current proposal is to raise this population objective to 7000 animals. The primary impact observed of elk use on riparian habitat has been late winter/spring browsing on willow in the upper Muddy Creek watershed, where a major goal has been to increase willow composition and age class/vertical structure. How does the potential raising of this elk population objective affect willow or other woody plant populations and the goal of improving woody species in the Muddy Creek watershed?

In the west, hummocks have for a long-time been associated with excessive livestock grazing in riparian/wetland habitat. However, additional research has shown that the creation of hummocks is

extremely complicated and not specifically tied to livestock grazing and/or trampling. Hummocked areas tend to be associated with fine soils and adequate moisture and are found all over the world's colder climates. In fact, hummocks commonly occur where large ungulates are absent. Recent research by Colorado State University on several Colorado hummock sites has only raised more questions about how hummocks are formed.

Although Muddy Creek down-cut during the 1920's to 1930's (personal communication with Sid Weber), there is still vertical instability present today that is due to natural gradient adjustments following the historic events of nearly 80 years ago. Some of these nick-points are known and some are not. How can the RFO better quantify their locations and effects, and separate them from impacts from livestock grazing, energy development, recreation (OHV) use, or other land uses?

Coalbed methane development has very limited direct impact to riparian/wetland habitat due to stipulations on distance spacing of development and no net loss of this habitat where impacts such as road crossings of drainages have to occur. However, studies coinciding with development did show that projections of lack of connectivity between underground water zones were not correct. The slowing of development of the Atlantic Rim natural gas field due to low gas prices has decreased water removal from underground coal-beds which also has reduced the potential for impacts to water resources and associated riparian/wetland habitat in this area. How will future gas prices and field development affect these resources?

Prescribed burns conducted in the Upper Colorado River Basin since 1985 in decadent mountain big sagebrush, mountain shrub, and aspen communities have resulted in increased stream flows and expansion of sedges and willows. The new Wyoming and BLM greater sage-grouse core area policy (IM WY-2012-019 and State of Wyoming EO 2011-5) places a five percent cap on vegetation treatments based on research involving gas field development impacts to greater sage-grouse within Wyoming. This insinuates that energy development that reduces usable habitat and vegetation treatments that diversify habitat have the same impact upon Greater Sage-Grouse and will be managed similarly. The current interpretation of this policy has put a severe damper on conducting future vegetation treatments within core area habitat for Greater Sage-Grouse. How can core area habitat for Greater Sage-Grouse be properly managed without reducing the capability of the RFO to improve water yield and supporting riparian habitat and restore aspen riparian woodland?

3) Current Conditions: Stream Rating Changes for the last ten years are shown on Map #7.

Lotic areas not meeting PFC that are livestock related:

Cherokee allotment

The Cherokee allotment is located in the lower Muddy Creek watershed and contains portions of Cherokee, Cottonwood, Deep, Muddy, and Wild Cow Creeks that were not meeting riparian health standards due to season and duration of cattle grazing. An AMP developed in the 1990's, development of upland water sources and six pastures, two prescribed burns, permittee numbers lowering from thirteen down to six, permitted AUM use dropping by 1,179, and a grazing decision in 2007 have led to improvement in stream condition and function. The original number of stream miles not meeting riparian health standards have been lowered from approximately 50 down to 11, including two miles of Wild Cow Creek in the Wild Cow Creek pasture, six miles of Muddy Creek and three miles of Wild Cow Creek in the Muddy Creek pasture. The current grazing management of spring cattle use in the Muddy Creek pasture has improved condition and function but needs additional time to allow channel width-to-depth ratios to decrease in order to meet proper functioning condition (Standard #2 – page 1 photo). A headcut on lower Wild Cow Creek in the Muddy Creek pasture needs to be stabilized but is not being attributed to current livestock grazing management. Cattle grazing use along Wild Cow Creek in the

Wild Cow Creek pasture needs to be shortened to occur less during the hot season period of mid-June to mid-September to improve channel morphology and bank stability(Standard #2 – page 2 photo).

Deep Gulch allotment

A small portion of the Deep Gulch allotment along Cow Creek is not meeting the minimum standard for riparian health due to its' use' as a water gap for the adjoining Sandhills pasture. The approximately 300 foot reach on what was formerly private land acquired as part of the JO Ranch exchange is used by cattle for four to six weeks in June/July as part of a large five pasture grazing rotation. Instead of continuing this practice, the RFO is planning to install a solar pump/array on Cow Creek to drinking troughs a short distance away and fence off Cow Creek to allow it to heal and meet riparian health standards.

Morgan-Boyer allotment

The Morgan-Boyer allotment is located in the Savery Creek watershed, and contains most of the Loco Creek drainage totaling about 12 stream miles. An AMP was initiated in 1992 to address poor riparian conditions caused by season-long cattle use, lack of upland water sources, dense mountain big sagebrush, and trespass cattle from adjacent lands. Initial improvement led to reintroduction of brook trout into this drainage and delisting of the main stem of Loco Creek from the State of Wyoming 303(d) list of impaired waters prior to the 2002 watershed assessment. One mile of the west fork of Loco Creek remains on that list, with recent review by the BLM of potential management changes with grazing permittees. Although photo-points through time show a narrowed channel and building streambanks, the vegetation is still dominated by shallow-rooted species that don't result in stable banks (Standard #2 – page 3 photo). Time and season of cattle grazing must be changed to allow expansion of Nebraska sedge to provide for stable banks that are more resistant to hoof shear from livestock use. A change in the rotation from early/mid-summer use to fall use would provide the needed deferment, with sheep use early instead that tends to stay more on the upper slopes and plateau tops. Monitoring would need to occur to ensure location of sheep use, maximizing cattle use on plateau tops, and controlling duration of cattle use on the lower portion of Loco Creek to maintain existing good conditions observed (Standard #2 – page 4 photo).

Rasmussen Subunit allotment

The Rasmussen Subunit allotment in the Savery Creek drainage was historically shared by four permittees with drift use from adjoining unfenced grazing lands. Development of allotment fencing in the 1980's and 1990's and a transfer in 2006 has resulted in one permittee, Stratton Sheep Company. This permittee constructed an interior pasture fence to defer and shorten the duration of grazing use along Bird Gulch where the riparian habitat on public land occurs. In addition, upland water development, the Cherokee prescribed burn in 1998, and rotational grazing with adjoining lands has helped to reduce grazing use in the Bird Gulch drainage. The result has allowed for the expansion of sedges, grasses, willows and cottonwood to stabilize the channel and stream banks (Standard #2 – page 5 photo). Continuation of the existing management should result in proper functioning condition in the near future.

Sulphur Springs allotment

The Sulphur Springs allotment is located in the upper Muddy Creek watershed and includes the confluences of the principal perennial streams of Muddy, Littlefield and McKinney Creeks. An AMP was revised in 1990 to address riparian management concerns, and the pasture fencing, upland water development, rotational grazing, prescribed burns, instream structures, and riparian plantings have resulted in long-term improvement in riparian condition. Originally, all of the 12.5 miles of riparian

habitat would have not met riparian health standards due to wide, shallow channels, poor bank formation, and little to no riparian vegetation in most locations. However, the management actions above have provided for bank building, point bar stabilization, and plant recovery consisting of Nebraska and beaked sedge along with waterbirch, Booth and yellow willow. There is currently only one-half mile in the Muddy Creek canyon that does not meet proper functioning condition. This reach has improved as evidence of the willow and sedges present, compared to sections of the creek that were previously denuded of vegetation (Standard #2 – page 5 photo). Greater bank cover of desired perennial species and narrower channel width should occur with improved management, which has been observed on other pastures that are now in proper functioning condition (Standard #2 – page 6 photo). This area is intended to be deferred from cattle grazing until later in the year, but there is limited fencing to preclude drift from adjoining pastures. Additional fencing is not desired to maintain ease of movement by mule deer and elk through this rougher terrain. Two additional water wells were recently developed by the permittee, LSRCD, WGFD and NRCS in the Alamosa Gulch pasture north of Muddy Creek to reduce cattle drift into the canyon pasture seeking water. Monitoring of the effect of these new waters along with herding will occur to determine if these actions are sufficient to improve stream health and achieve proper functioning condition.

Lotic areas not meeting PFC that are not livestock related:

Savery Creek for two miles below High Savery Dam.

This stream location is just below the confluence of the North Fork, East Fork, and Dirtyman Fork of Savery Creek, and just below the newly constructed High Savery Dam. Approximately 40 percent of the 22,432 acre-feet of water collected by this dam is released in July and August for late season irrigation of hay meadows along the Little Snake River valley. These high water releases are resulting in excessive lateral channel movement and bank instability. In addition, vertical gradient control structures in this stream reach as part of the High Savery Dam project, are maintaining a wide, shallow channel morphology that is not a natural or desired condition for stream function (Standard #1 – page 9 photo).

In addition to PFC, photo-points, and channel cross-sections, the following monitoring is also being used in this watershed assessment.

Multiple Indicator Monitoring of Stream Channels and Streamside Vegetation (MIM) was designed to be objective, efficient, and effective for monitoring impacts from livestock and other large herbivores on smaller streams (Burton et al. 2011). In 2008, a total of nine permanent MIM locations based on riparian pastures were established in three main allotments (Grizzly, Beaver Dams, and Sulphur Springs) to provide additional data for management of grazing activity. These sites were resurveyed in 2010, and 2011. In 2011 a site on East Muddy Creek was also established. In general, every site monitored indicated stable or improving stream conditions. Every site indicated a “good” wetland rating with most reaches improving their erosional rating index and ecological status. However, every site indicated a low percentage of woody plant species presence. Wetland ratings are based on Reed’s Wetland Indicator Status (Reed 1988). A report of the MIM monitoring is available at the RFO upon request

Canary Grove- Two monitoring sites were established in 2008 along this stream. The stream had a “good” wetland rating and an ecological status of early successional. MIM results indicated and overall improving trend in the stream condition. The presence of woody riparian species is very limited along this stream.

Little Muddy Creek was not sampled in 2011, but had stable banks in 2008 and 2010 as well as an increase in percent hydric species from 63 to 96 percent. In 2010 the site had a “good” wetland rating and an ecological status of PNC (Potential Natural Plant Community). Overall, the stream shows an

improvement in condition, further shown by an increase in erosion index from 5.98 to 8.02 in 2008 to 2010.

Littlefield Creek Riparian had the site had a “good” wetland rating and an ecological status of PNC. MIM results indicated and overall improving trend in the stream condition.

Littlefield Canyon - An increase in stubble height was shown from 2010 to 2011 and its ecological status was PNC. The stream had a site wetland rating of “good and showed an increase in greenline width. Overall, the stream appears to be in good condition and improving

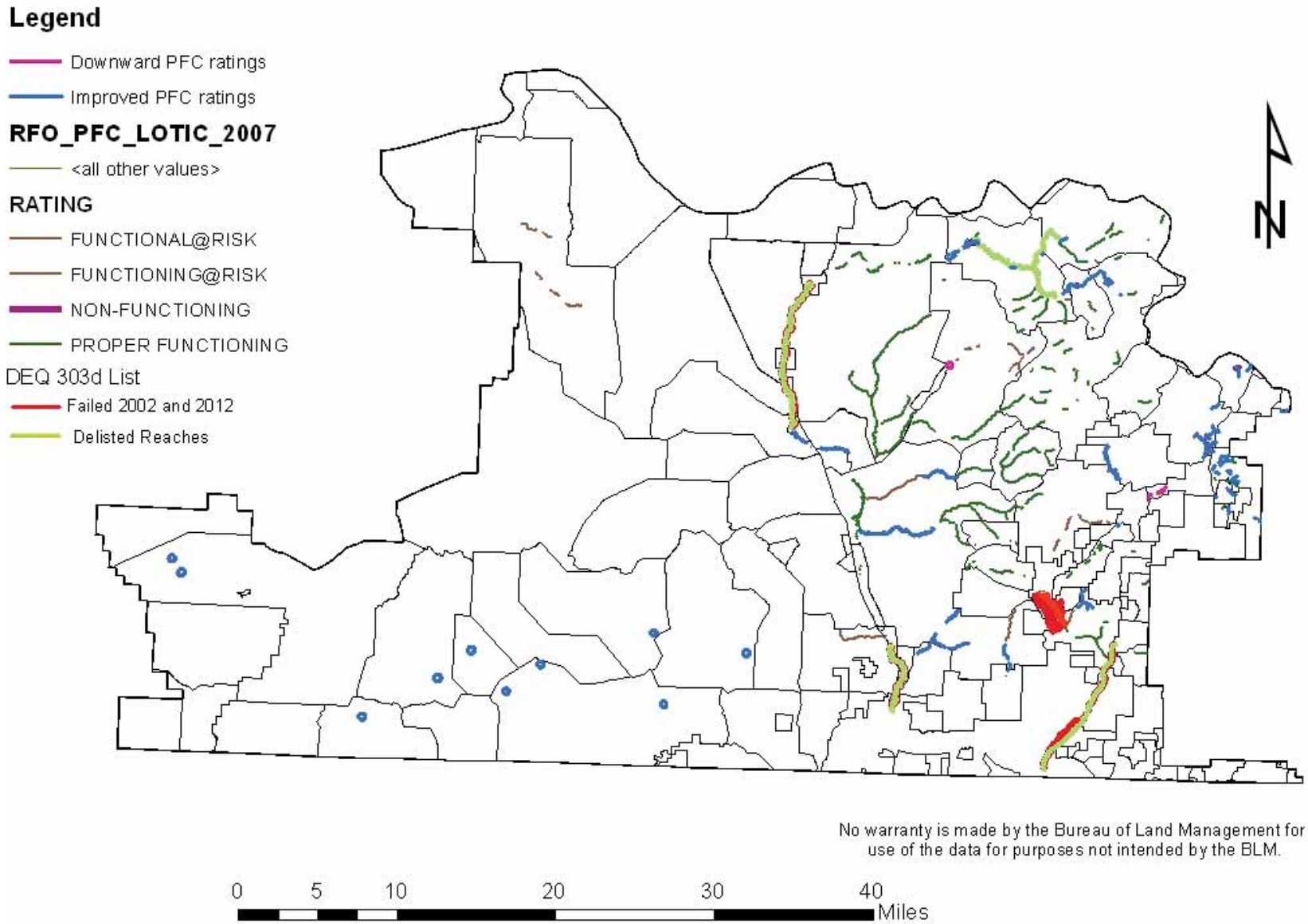
Littlefield Exclosure had an ecological status of PNC (92) and a good site wetland rating of 98. The percent hydric species was 100 and its erosion resistance index was 7.57. Stubble height along the reach stayed relatively constant, but greenline width increased from 1.43 meters to 2.26 meters from 2010 to 2011, which is a factor that should be closely monitored in the future. Other than greenline width, the overall condition of the reach has improved over the past three years.

Upper Muddy Creek Riparian showed a decline in ecological status to Late (77) in 2011 after a steady increase over the previous two years. The site wetland rating was good (83) and has stayed relatively constant in the past three years. The percent hydric species of 83 2011 was consistent with the 2010 data and the greenline-greenline width slightly increase from .91 meters to 1.10 meters in 2010 and 2011, respectively. Overall, the stream showed little change over the past three years despite its decline in ecological status.

East Muddy Creek was sampled for the first time in 2011 and had 85 percent stable banks. It had an erosion index of 7.61 and contained 82 percent hydric species. It had an ecological status of PNC (84) and a site wetland rating of 91. Greenline width was 1.33 meters and should be monitored closely in the future due to evidence of erosion and channel cutting in the reach. However, a trend cannot be established at this time due to only one sample being taken.

Upper Muddy Creek at Bridge showed a large increase in average stubble height of six inches over the past three years. An increase was shown in ecological status and site wetland rating with values of Late (69) and 87, respectively. Greenline-greenline width decreased from 1.22 meters to .49 meters in the past three years.

Map 7 Stream Rating Changes (PFC) and DEQ 303d List Changes from 2002 to 2012



The WGFD has established permanent Habitat Quality Index (HQI) monitoring sites and greenline vegetation transects within the Muddy Creek watershed. Six riparian vegetation greenline trend transects were last surveyed during 2010 at stations along Littlefield, Little Muddy, and Muddy creeks on the Grizzly HMA. Greenline trend data between 2004 and 2010 showed positive or stable trends in both the ecological status and stream bank stability rating based on riparian vegetation and species composition. Overall, the riparian vegetation greenline data suggests that grazing rest and limited early season grazing use of riparian pastures on the Grizzly WHMA between 2004 and 2010 improved riparian habitat conditions (WGFD 2010).

In 2010, five HQI transects were monitored in the upper Muddy Creek watershed. The upper and lower Muddy Creek HQI stations measured stream attributes were similar between 2003 and 2010. Estimated Trout cover increased substantially between 2003 and 2010, coincident with stable undercut banks and increased trout cover. However, this reach of stream does not provide all the life stage components for good trout habitat. The upper and lower Littlefield Creek HQI stations Stream showed improvements with decreased width and increasing stream depth between 2003 and 2010. Adult trout cover increased since 2003, but was lower than what was measured in 2001. Estimated HQI scores and habitat units at the upper Littlefield Creek station were slightly higher in 2010 than in 2003 and similar to estimates in 2001. Stream width decreased and stream depth increased between 2003 and 2010, and stream discharge was the highest measured during the 2001-2010 surveys. Gravel substrate improved from 40% in 2001 to 60% in 2010, suggesting improved trout spawning substrate. The Little Muddy Creek HQI station showed a decrease in stream width and an increase in stream depth. Adult trout cover was similar to 2003, but was 15% less than what was measured in 2001. Gravel substrate was similar to slightly improved from 67% in 2003 to 70% in 2010. Estimated HQI scores and habitat units at the Little Muddy Creek station remained unchanged.

4) Reference Conditions:

In addition to information in the 2002 watershed assessment, the following areas that previously failed PFC and are now meeting PFC are described, with allotments listed that were livestock related and locations listed that were due to wild horses.

Adobe Town allotment

The Adobe Town allotment is located 30 miles west of Baggs in the Sand Creek watershed. Moonshine Spring is the only riparian habitat in this allotment. An earlier initiated exclosure was completed in 2004 with an outside trough provided for livestock grazing and wild horse use.

Beaver Dams allotment

The Beaver Dams allotment is located in the upper Muddy Creek watershed and was historically grazed with sheep, then switched to summer-long cattle use that resulted in a failure to meet the riparian health standard. During the 1990's there were a number of range improvements implemented, including a 2500 acre prescribed burn, two pasture fences, upland water development and spring protection, instream structures and riparian plantings, and rotational grazing that have led to the healing of riparian habitat along Littlefield and East Muddy creeks. Colorado River Cutthroat Trout were re-introduced to Littlefield Creek in 2001 and it has just been a matter of time to allow sedges and willows to stabilize the channels and banks while following the current grazing system. When the allotment was reassessed by the PFC team, riparian areas were determined to be meeting the riparian health standards (Standard #2 – page 7 photo).

Cow Creek/Espitalier allotments

The Cow Creek and Espitalier allotments are located 40 miles west of Baggs in the Shell Creek watershed. The only riparian habitat in these allotments is several seeps that occur at the base of Kinney Rim that are used by both livestock and wild horses (historically year-round). These seeps are fairly extensive in size, occur on public, private and state lands, and are alkali in nature. The latter may help discourage use (along with the deerflies) and the size and location of seeps makes it more difficult to consider fencing them out as a viable management option. The Raftopolous Family acquired the grazing use in the mid-1990's that resulted in both cattle and sheep grazing, shortened the duration of use due to their winter and spring use on Colorado lands, and implemented rotational grazing with adjoining Wyoming allotments. These factors should help improve riparian habitat health, and when the PFC team re-assessed this area in 2011 it did meet the riparian health standard.

Pine Grove/Bolten allotment

Since the last assessment the Bolten and Pine Grove allotments have been combined into one. This allotment includes a small portion of the Upper Colorado River Watershed, namely the headwaters of McKinney, Stoney and Grove Creek. An intensive management plan has been implemented on this allotment for over 15 years and has resulted in greatly improved riparian conditions. While the majority of the riparian areas within the Muddy Creek portion of the allotment were found to be properly functioning in the last assessment. Lower McKinney Creek was not. Lower McKinney is greatly influenced by shale and heavy clay geologic units and had not stabilized adequately during the last assessment. Over the last five years, through cooperative management of the Grizzly allotment, the permittee has been able to intermittently rest this area of McKinney Creek from livestock. Although the naturally erosive soils continue to influence site potential, riparian vegetation composition and density has greatly improved with sedges now the dominant bank vegetation (Standard #2 – page 8 photo). When this area was reassessed by the team it was determined to be meeting the riparian health standard. The majority of this allotment is located in the Platte River watershed, therefore, it will not be assessed for S&Gs until 2014.

Powder Mountain allotment

Powder Mountain allotment is located 30 miles west of Baggs in the Little Snake River watershed. Upper Powder Spring is the only riparian habitat in this allotment which is used with summer cattle and winter sheep grazing and by wild horses year-round. The spring area was excluded from all use by livestock and wild horses within a four acre exclosure in 2002 with a pipeline and troughs provided outside the fence when needed. Sedges, rushes, grasses and forbs have recovered and stabilized the site (Standard #2 – page 9 photo).

Powder Rim allotment

Powder Rim allotment is located 20 miles west of Baggs in the Sand Creek and Little Snake River watersheds. Chimney Spring and Rotten Springs were developed many years ago and an exclosure constructed below Rotten Springs to protect riparian habitat that had fallen into disrepair. Both of these springs have been reconstructed and the riparian exclosure modified to a wood post/rail top design to exclude livestock and wild horses while minimizing injury to big game that use this area.

Sage Creek allotment

A small portion of the Sage Creek allotment is located in the Upper Colorado River watershed and consists of Fish Creek which drains into Savery Creek. Fish Creek was assessed in the mid 1990s, and portions were found to be Functioning-At-Risk either with a downward or static trend, and one portion was identified as non-functioning. Since that time, overall riparian condition has improved primarily due to variation in livestock use. For the last 10 years, livestock management has changed significantly and includes an annual grazing plan with riparian objectives. Short duration grazing which take place late or after the growing season has resulted in phenomenal riparian improvement. All of the reaches that had failed the riparian standard during the last assessment are now meeting the standard (Standard #2 – page 10 photo). The majority of this allotment is in the Lower North Platte River watershed; therefore, it will not be assessed for S&Gs until 2014.

Standard allotment

The Standard allotment is located in the Savery Creek watershed and includes part of Savery Creek and lower Coal Gulch. Although most of Savery Creek is not on public land, approximately 10 acres on the north end of the allotment was on public land that was not meeting riparian health standards due to summer-long cattle grazing. The construction of High Savery Dam approximately five miles upstream has also led to changes in natural steam function due to high flow releases during the summer for irrigation in the Little Snake River valley. The permittee constructed pasture fencing to implement rotational grazing in 2005. In addition, the LSRCD in conjunction with two permittees, USFWS, WGFD, State of Wyoming, and the BLM, reconstructed several miles of stream channel in 2008 to improve condition and function, in part due to summer irrigation releases of higher volumes of water. The channel reconfiguration, rock veins, bank protection, and vegetation plantings, along with proper grazing management, have led to improved riparian habitat condition that is now meeting proper functioning condition (Standard #2 – page 11 photo). Sedges and bulrush now comprise the dominant bank vegetation rather than the sloughing banks dominated by Kentucky bluegrass observed in the previous assessment.

Grindstone Spring

Grindstone Spring is one of several, widely spaced natural seeps located along the base of the north slope of Powder Rim, which was previously developed and in need of repair. This area is used extensively by wild horses. The spring was reconstructed in 2007 and the exclosure expanded to include the spring source and provide outside water via a tire trough (Standard #2 – page 12 photo).

Hartt Cabin Artesian Well & Seep

These two areas were reconstructed and fenced to protect riparian habitat.

Kinney Rim Seeps

See discussion under Cow Creek/Espitalier allotments above.

Moonshine Spring

See discussion under Adobe Town allotment above.

North Prong of Red Creek Seep

This natural seep was being heavily trampled from wild horse use that led to it being protected with fencing and a water trough developed in 2005.

Rotten Springs

See discussion under Powder Rim allotment above.

5) Synthesis and Interpretation:

Muddy Creek continues to be a focal point of attention for the RFO and its' partners, although the Coordinated Resource Management Group is no longer active. A wide variety of collaborative efforts have begun or are on-going, for various resource issues such as livestock grazing, migratory shorebirds and waterfowl, fish habitat or migration enhancement, and locations with impaired water quality, which all influence riparian/wetland habitat. Some of these efforts have also expanded into the Little Snake River and Savery/Battle Creek drainages. Examples of them are discussed below.

Management changes initiated in the 1980's and 1990's continue to be monitored with adjustments made in livestock grazing as needed. In most areas, it is now more a matter of time, particularly in shrub and woodland types, for a more diverse age-class and vertical structure to develop. Along upper Muddy Creek and its' tributaries the expansion of Geyer, Booth and yellow willows and in some locations waterbirch continue to expand in height and density. Lower in this watershed coyote willow is the dominant woody component that has improved, along with lesser amounts of yellow willow and woods' rose. Other dominant forbs like wild licorice and goldenrod continue to expand as well. Whiplash willow and narrow-leaf cottonwood have grown along lower Loco Creek to the point that several photo-points established in 1991 are "taken over" and no longer useful in trend monitoring. The WGFD and LSRCD planted aspen in riparian habitat along upper Muddy Creek on state land to create new clones of riparian aspen woodland. Additional vegetation plantings are occurring and will likely continue, including waterbirch, golden currant, dogwood, and honeysuckle (and possibly other species), to improve woody species diversity and habitat structure. Similar plantings are occurring in a riparian pasture along Cottonwood Creek north of Dixon and along portions of Savery Creek.

Although the trends described above are very encouraging, the ability to restore beaver as a major component of this ecosystem is still a ways away. Beaver are present in portions of the Savery Creek drainage and the middle portion of Muddy Creek, with limited numbers in the upper Muddy Creek area. Improved willow and waterbirch stands do help support beaver; however, long-term dam stability requires larger trees such as aspen and cottonwood, which are slower to return to dominance in riparian habitats. Relating to the issue of wildlife and riparian management is the elk herd that has been well beyond its' WGFD population objective throughout this assessment period. In the upper Muddy Creek area, high use of willows in the spring by elk is a factor to be considered when evaluating progress made towards achieving resource objectives involving riparian shrub and tree expansion.

Herbaceous riparian vegetation continues to change towards more mid-to-late seral composition, dominated by Nebraska and beaked sedge in perennial stream locations. In intermittent stream locations the vegetation is more dominated by various grasses (streambank wheatgrass, northern reedgrass, redtop, Kentucky bluegrass, meadow barley, basin wildrye, alkali cordgrass, common reed, reed canarygrass, and tufted hairgrass), Baltic rush, spike-sedge, and American bulrush. Early seral species such as strawberry potentilla, foxtail barley, povertyweed, and cocklebur have become very low in abundance or disappear from riparian habitat, while species including wild licorice, goldenrod, and sunflower have increased and even become dominant in certain locations. Grazing resistant species like Kentucky bluegrass, redtop, mat muhly, and red clover have been reduced in composition and occur on

the floodplain and along the drier edges of riparian habitat (rather than along the streambanks) (Standard #2 – page 13 photo).

Management of the Grizzly allotment was changed in 2006 from being leased to one livestock operator to how it could be used by multiple livestock operators to improve riparian and upland habitats across a larger landscape perspective. This approach has continued to meet resource objectives on the Grizzly allotment by following prescribed season, duration, and amount of livestock use, while enhancing recovery of riparian and/or upland habitats by providing rest or deferment of livestock use on other allotments (generally within the watershed). Riparian habitat has improved as a result along portions of Cow Creek, Littlefield Creek, Little Muddy Creek, McKinney Creek, upper and lower Muddy Creek, Savery Creek, and Wild Cow Creek.

Associated with livestock management (and wild horses in the Adobe Town HMA) has been the protection of springs and seeps by fencing and often the development of off-site water sources, to reduce trampling, soil compaction, and potentially reduced water flows. In the drier portions of the watershed these water sources and associated riparian habitat are few in number and small in size, making them extremely important to wildlife and vulnerable to impacts from large ungulates. Although most of these projects have been completed, there may still be a few that would be implemented in the future. Additional water development in the Adobe Town HMA would reduce grazing pressure by wild horses around these traditional watering sites. There may also be off-site water developed from creeks to further reduce livestock impacts by providing water for drinking away from higher priority riparian habitat (ie.- fisheries/recreation).

Aside from livestock management, another major change has been the adoption of a channel restoration philosophy by the RFO and its' partners rather than the continued use of gradient control structures to maintain or enhance riparian habitat. This concept was initiated by the LSRCD and USFWS working with private landowners along portions of Battle and Savery Creeks. It has been expanded to other portions of Savery Creek and to upper Muddy Creek where a large road crossing culvert (with an eight foot gradient drop) was replaced by lengthening the stream channel. This restored and widened the functioning floodplain that will increase riparian habitat area, as well as improving vegetation diversity by the creation of several off-channel water ponds of variable depths.

The reconstruction and new development of spreader-dikes during the 1990's in the George Dew area has expanded the riparian/wetland habitat from 260 to 402 acres on public land (over 1500 acres in entire complex), in addition to the 360 acres of new habitat created in the Red Wash area that was previously primarily a mixture of greasewood and saltbush. In their place are a combination of riparian grassland, willow shrubland riparian, emergent, and aquatic habitats due to both the water spreading out more and variable water depths behind the dikes ranging from zero to 12 feet deep. Species that have increased as a result include American and alkali bulrush, tulerush, cattails, Nebraska, beaked, and wooly-pod sedges, spike-sedge, various rushes and grasses, arrowhead, chara, and water-milfoil (Standard #2 – page 14 photo). The LSRCD was also the lead in design and construction of several larger (than normal livestock ponds) reservoirs that create greater emergent and aquatic habitat and species diversity. These were constructed on upper Cherokee, Loco, and Wild Cow Creeks.

During the 1960's five reservoirs north and west of Baggs were partially fenced by the BLM as wildlife exclosures to provide riparian habitat for wildlife that was not grazed by livestock. Through the years since that time four sites have been continued to be maintained, although the wing-fences that extend into the water required periodic reconstruction and in dry years when water levels dropped it was not possible to keep livestock from using these areas. During the last 10 years, the sites at Highwater Reservoir and Wild Horse Reservoir were modified to completely enclose each reservoir, with off-site water provided via a pit at the first location and using a solar pump/array to a trough at the later

location. This vastly improved the shoreline, emergent and aquatic vegetation in plant vigor, diversity and area (Standard #2 – page 15 photo).

The RFO has continued to work with the Carbon County Road and Bridge Department to reduce sedimentation from roads into riparian habitat. The McCarty Canyon road reconstruction completed by Carbon County was supported with culverts provided by the RFO. This project resulted in the protection of one spring and reduced sediment delivery into Little Savery Creek. These projects may not always be located on public lands, however, they affect riparian/wetland habitat on public lands downstream. A more recent project with Carbon County reduced sediment delivery into Cherokee and Wild Cow Creeks. Roads associated with energy development are also being upgraded with more culverts and wing-ditching added to reduce the soil erosion that often occurs below culverts and roads that lack adequate number and sizing of culverts. Most new projects are being engineered and designed to reduce soil erosion caused by roads from being delivered into riparian habitat. The value of riparian/wetland habitat is also being carried forward into new energy development documents, with the Atlantic Rim Natural Gas Development EIS providing for "no net loss" of riparian habitat as a result of this field. Additional project areas have been identified involving both the BLM and county roads that would reduce runoff and sedimentation from roads into riparian habitat and creeks. These include Deep Creek, Littlefield Creek, McKinney Creek, and upper Muddy Creek.

With the public acquisition of the JO Ranch, nearly half of the 600 acres are riparian habitat maintained by Cow Creek and the historic ditches created to expand the meadows across the valley floor. Although in need of some maintenance, the two water control structures and most low gradient ditches are intact. The RFO would like to manage to maintain most of the riparian habitat to benefit greater sage-grouse and other wildlife which utilize this area. A short-term stabilization plan was completed to reconstruct the artesian well and water trough below the ranch headquarters, construct a new reservoir below a large head-cut to reduce its' potential movement up the drainage, and develop an off-site water source on Cow Creek above the ranch headquarters to replace the water gap and restore this section of stream to proper functioning condition. The majority of vegetation consists of native species, however, there are considerable amounts of smooth brome at the upper end of the meadows and areas have been treated to remove perennial pepperweed and thistle. A long-term ACEC plan will be developed in the near future.

During the 2002-2011 assessment timeframe, there have been 33,300 acres treated within the watershed, including prescribed burns, chemical applications of tebuthiuron, and mechanical treatments. These treatments occur in mountain big sagebrush, mountain shrub, and aspen/juniper woodlands, so they primarily affect upland plant health (versus riparian). However, one larger landscape treatment was implemented in 2002-03 in the upper Cow Creek drainage (Muddy Creek watershed) in which about 4,100 acres were prescribed burned in the fall. This treatment and previous large treatments in the Cherokee Creek, Deep Gulch, East Muddy Creek, Hartt Creek, Loco Creek, and Jep Canyon (Separation Creek in Great Divide Basin watershed) have resulted in increased water yields, expansion of riparian habitat, channel development through sedge-dominated meadows, and improved riparian plant vigor and species composition. Other observations of the benefits of prescribed burning have included the healing of gullies with more rounded-off upper banks and greater herbaceous cover on the bottoms and side-slopes. The more open areas after treatment improve livestock distribution across hillsides and reduce time spent in and walking along riparian habitat in the valley floor. The delineation of core habitat for Greater Sage-Grouse in 2008 was not regarded as having a high impact on prescribed burning, however, implementation of the policy at the state level is resulting in a dampening effect on any treatments. If similar implementation restrictions continue in the future, potential benefits to riparian habitat would not occur (including restoring riparian and upland aspen stands to support beaver) and benefits from past treatments will shrink as natural plant succession occurs.

Vegetation plantings continue to occur, primarily involving willows and shrub plantings along streams, and to a lesser extent plantings at reservoirs and wetlands. Plantings of Booth willow in the late 1990's along Muddy Creek have expanded in height and area when re-photographed in 2011 (Standard #2 – page 16 photo). Whiplash willow is also being used more frequently since it has a larger diameter base that in the long-term will provide greater sized building material for beaver and their dams which should be more durable. Plantings are the only sure method known today to increase the rate of willow expansion once sedges have effectively minimized the bare ground available for seedling willow establishment. Other plantings primarily along Muddy Creek include waterbirch and several shrubs like dogwood, currant and honeysuckle, which are now being protected from livestock and wildlife with steel panels. Plantings of bulrush (primarily) and other species along the dams of reservoirs and in wetlands help improve bank stability and protection from wind-blown wave-wash along shorelines and provide greater species diversity than simply letting them come in on their own (often doesn't happen).

6) Recommendations:

There has been continued improvement in riparian/wetland condition within the assessment area over the last 10 years, considering that management of riparian habitat only started about 25 years ago. Photos illustrate change from mostly bare banks or sloughing banks dominated by Kentucky bluegrass to well vegetated banks dominated by sedges and grasses with willow recovery in many areas. Although PFC may have been reached in most areas, there will likely continue to be improvement in channel width, bank stability, and desired species like willows and sedges. However, there are still some specific areas that need improvement and others that will just take more time to reach a desired future condition. Allotments containing riparian/wetland habitat that do not meet this standard have been described previously and include: Cherokee (11 miles), Deep Gulch (1/16 mile), Morgan-Boyer (1 ½ mile), Rasmussen Subunit (3 miles), and Sulphur Springs (1/2 mile). In addition, the reach on public land below High Savery Dam (2 miles) is not meeting this standard. Most seeps within the Adobe Town HMA have been protected; however, those along the base of Kinney Rim warrant continued monitoring for both wild horse and livestock use and impact. Specific recommendations include the following:

Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis. Methods to achieve this include, but are not limited to: herding, fencing, water developments, and vegetation treatments. Off-creek watering locations in pastures along Muddy Creek where the creek is the principal water source should be developed to further maintain or improve streambank stability and channel narrowing.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion into riparian/wetland habitats.

Continue vegetation plantings within the watershed to improve species and structure diversity.

Continue to protect spring and seep water sources from trampling and compaction due to livestock and wild horses.

Continue to develop, enhance and/or maintain riparian/wetland habitat when consistent with other resource objectives, including the two wildlife exclosures that have not yet been developed with off-site water sources.

Continue to work cooperatively with permittees and landowners, as well as with local, state and federal agencies to improve management of riparian/wetland habitat.

STANDARD 3 – UPLANDS

Upland vegetation on each ecological site consists of plant communities appropriate to the site which are resilient, diverse, and able to recover from natural and human disturbance.

1) Characterization:

The descriptions of plant communities, common species, and where they occur within this watershed, are still accurately portrayed in the 2002 watershed assessment, with one small exception. Mountain big sagebrush was described as ranging in height from 10 to 30 inches, and with canopy cover reaching up to 50 to 60%. Through the use of black-lighting, much of the taller sagebrush growing on side-slopes at mid-to-higher elevations which was believed to be basin big sagebrush, is actually mountain big sagebrush. Therefore, heights of this sub-species may reach up to six feet and canopy cover can reach up to 80%. This method of distinguishing between sub-species based in their luminescence has also defined the elevational transition from Wyoming big sagebrush to mountain big sagebrush as occurring between 6800 and 7200 feet.

2) Issues and Key Questions:

Although much of the discussion in the 2002 watershed assessment is still valid and should be reviewed, factors have changed over the last 10 years that lead to new and valid questions. For livestock grazing, the need to manage for new species of concern like the pygmy rabbit raises the question of what types of BMP's for livestock grazing will adequately provide habitat for the pygmy rabbit? In terms of species of heightened concern such as Greater Sage-Grouse, what type of livestock management will provide for expansion of large perennial bunchgrasses like Indian ricegrass, bottlebrush squirreltail and bluebunch wheatgrass without just increasing the little bluegrass and thickspike wheatgrass already there to improve visual security in nesting habitat for greater sage-grouse? In terms of wild horses in Adobe Town HMA and the data that shows their winter diets are more in common with sheep than with cattle, how will this information be helpful in documenting forage use between livestock, wild horses, and wildlife, to prescribe number of animals for proper range stocking and objectives for forage use for each of these groups?

In terms of vegetation treatments the creation of core area habitat for greater sage-grouse has had the side effect of reducing the potential to prescribe burn to improve aspen health and to address shrub decadence in mountain big sagebrush and mountain shrub habitat important for mule deer, so how do biologists and range managers work within the guidelines of this policy to still be able to use prescribed fire in the ecosystem? Due to the greater sage-grouse issue and slow recovery of mountain big sagebrush at lower elevations, the BLM has increased the use of tebuthiuron to "thin" big sagebrush stands, will the use of this chemical have the desired effect and is it an adequate replacement to the use of fire?

In terms of wildlife, the increase in the Baggs elk herd from 2000 in 1980 to between 10,000 and 12,000 currently, raises the question of what is the proper size of this elk herd in terms of forage, competition with livestock and other wildlife for forage, and where there won't be elk trying to cross Interstate-80, moving into the City of Rawlins, or dying from eating lichen during the next tough winter? Mule deer are the species of concern (between elk, mule deer and antelope) for being below population objectives and with habitat health a concern, what habitat management or other steps such as reducing competition from elk, need to be taken to improve mule deer populations and their winter habitat?

In terms of oil and gas development, there has been increased use of slender wheatgrass as a cover crop, with good success in stabilizing the soil and reducing weed infestations, but questions remain on how long will it persist and can lower initial seeding rates still achieve similar short-term success but

allow understory native species to recover faster? In Greater Sage-Grouse core area habitat or perhaps in any suitable habitat, where native forb seed sources are still totally inadequate, should the BLM relax its use of native plant guidelines to include desirable legumes in the reclamation seed mixtures that would benefit this sensitive species? In low reclamation soils, what level of reclamation will be accepted if restoration of the native plant community is not achievable?

3) Current Conditions:

The one trend observed at nearly all monitoring transects across the watershed is the inverse of the bare ground trend described in Standard One, that litter and plant cover have increased substantially over the last 20 to 40 years. And more recent trend transects show levels of litter and plant cover that compare with current levels observed in allotments with long-term trend transects. On a more specific basis, three historic AMP allotments with fairly consistent long-term livestock use provide a look at vegetation trends. All trends are based on pace frequency transects established in the late 1970's and re-read in 2010-11. More intensive management has occurred in each allotment within the last 20 years. Powder Rim allotment is on the south side of the Adobe Town area west of Baggs with a 9 to 11 inch precipitation zone and has four pastures. Sulphur Springs allotment is in the upper Muddy Creek watershed with a 10 to 12 inch precipitation zone and originally two pastures that is now seven. Hartt Creek is at the head of the Savery Creek watershed next to the MBNF in a 14 to 18 inch precipitation zone with originally three pastures that is now seven.

For Powder Rim, the 12 transects span multiple range sites, so the only general statements are that litter and plant cover rose an average of 17% to 57%, shrub canopy cover increased an average of 1% up to 12%, and native perennial species dominate the area. There are several sandy sites in which needle-and-thread grass has increased from an average of 2% to 23%, with no presence of warm season grasses to now 10% and 9% of sand dropseed and galleta grass, respectively, on two different sites. On one saltbush steppe site, saltbush has increased from 20% to 48% and Indian ricegrass from 0% to 17% while the original dominant daisy (38%) has disappeared. On an impervious clay site birdsfoot sagebrush has declined from 56% to 26% while saltbush has increased from 4% to 13% and Indian ricegrass increased from 7% to 17%. On two sites the saltbush species have declined in what looks to be more of a conversion to a better sagebrush/mixed grass site. On another site previously dominated by sagebrush and mat forbs (goldenweed and Hooker sandwort), the new dominant species are little bluegrass, thickspike wheatgrass, and needle-and-thread grass. Prickly-pear cactus on two sites is declining (Standard #3 – page 1 photo).

For Sulphur Springs, the 12 transects also span several range sites but are generally dominated by mountain big sagebrush and native perennial species. Two sites were affected by 2-4,D chemical treatments in the late 1960's and two by prescribed burns conducted in 1992 and 1999. General trends are an increase in litter and plant cover from an average of 70% to 81%, shrub canopy has increased from an average of 13% to 24%, and average number of species (all perennial and native) has increased from 13 to 22. Thickspike wheatgrass has declined an average of 38% to 22% while a mixture of desirable bunchgrasses is trending flat or increasing (bluebunch wheatgrass, Indian ricegrass, needle-and-thread, bottlebrush squirreltail, mutton bluegrass, Idaho fescue, green needlegrass, king-spike fescue). On one old chemical treatment and one prescribed burn the thickspike wheatgrass increased (Standard #1 – page 2 photo).

For Hartt Creek, the seven transects were in mountain big sagebrush and one in aspen plant communities, with a prescribed burn completed in 1996 on the north end and a smaller area treated with tebuthiuron in 2002. Litter and plant cover has increased from an average of 69% to 95%. The one thing in common with all is that Kentucky bluegrass has increased across the board. This is now the dominant species on five sites and on four of them exceeds 50%. Photos show a conversion from upland to meadow on these sites due to increased moisture retention on site (with no irrigation). Three

of these sites were affected by the prescribed burn, but the other two were not (Standard #3 – page 2 photo). Elk sedge is the dominant grass under the aspen and thickspike wheatgrass is the dominant species on one site.

For other allotments trend data has not been collected over as long a period of time or there are more variables involved. In Doty Mountain allotment, a more recently established AMP, litter and perennial plant cover are up substantially, average species diversity is up from 10 to 12, and change in the major key species (needle-and-thread grass) is mixed, with three sites flat, two site up and two sites down. In saltbush steppe plant communities in five different allotments with varying type and seasons of use, desirable bunchgrass species (Indian ricegrass and bottlebrush squirreltail) all declined and desirable shrubs (saltbush, bud sage, and winterfat) all increased within the last 8 to 15 years. In the Big Robber area some trends are flat in terms of species composition change, while other trends show greater species diversity and increases in desirable bunchgrass like Indian ricegrass. In the Adobe Town area there have been more up and down fluctuations, with a lot driven by climate. But re-reads of the pace frequency data show some up trends in perennial grasses such as saltgrass, thickspike wheatgrass, and basin wildrye, as well as greater amounts of cheatgrass observed. In the Mexican Flats allotment where permittees were switched by decision, the visual amount of grass cover and litter has improved with less concentrated spring cattle use (historical).

Vegetation trend relating to antelope and mule deer crucial winter range along Muddy Creek north of Baggs (22 sites) and Poison Buttes west of Baggs (2 sites) has been collected since 1988 and was re-read in 2011. These transects lie on both sides of Muddy Creek and Highway 789, with 20 in primarily Wyoming big sagebrush and four in mountain mahogany mountain shrub sites. This data is summarized on pages 94 and 95 in the wildlife section of this assessment. For six of the sagebrush sites with plant trend data collected in addition to browse, the litter and plant cover was up at all sites with improvement in desirable bunchgrasses.

Vegetation treatments over the last ten years within this watershed totaled 33,300 acres, split out into prescribed burns (11,500 acres), tebuthiuron applications (20,400 acres), and mechanical cutting or mowing (1400 acres). Treatments have primarily occurred in mountain big sagebrush, and to a lesser extend in mountain shrub, aspen, and juniper plant communities and woodlands. Some results from past projects of long-term recovery or change in composition are as follows discussing mountain big sagebrush communities unless otherwise noted. The 1986 West Wild Cow burn has sites with 42% and 18% canopy cover (Standard #3 – page 3 photo), the 1987 West Rendle burn has 32% and 63% (mountain shrub) canopy cover, the 1987 Hay Gulch burn has 33% canopy cover, the 1992 Beaver Dams burn has 19% and 37% canopy cover, the 1992 Bridger Pass burn has 36% and 1% canopy cover, and estimates at the 1994 Loco Creek burn and 1998 Cherokee burn are around 30%. There are few large wildfires in this region compared to other locations such as the Laramie Peaks north of Laramie or the Flaming Gorge area south of Rock Springs. However, recovery on the 2900 acre wildfire in the Sandhills (1993) stood at 20% in 2010 averaged over four transects. Pre-burn shrub canopy cover generally ranged between 40% and 70%. Photos of other burns in mixed mountain shrub at Savery Creek (2003) and Little Sandstone (2004) show excellent recovery by bitterbrush, snowberry and serviceberry (Standard #3 – page 4 photo). Tebuthiuron projects have resulted in increased herbaceous cover and forage production. On the Miller Hill (2002) project grass and forb production comparison in 2009 showed a difference of 855 pounds per acre on untreated sites versus 2,142 pounds per acre on treated areas(Standard #3 – page 5 photo). The Hangout project (2005) resulted in litter and plant cover rising from 81% to 97%, with sagebrush canopy cover declining from 32% to 12% and thickspike wheatgrass becoming the dominant species on site at 48%. Mechanical treatments involving juniper cutting in small patches west of Baggs and east of Savery (2005) has shown over six years the following changes: bare ground declined from 34% to 20% and from 23% to 15%, aerial plant cover increased from 18% to 44% and from 12% to 45%, number of species increased from 10 to 15 and from 11 to 18, and shrub canopy

increased from 32% to 42% and from 19% to 25%. Cheatgrass has increased on some sites as well. Aerial photo comparison by Sam Cox from the Wyoming State Office of juniper expansion between 1938 and 2009 for the Baggs to Savery area (area that failed Standard 3 in 2002) showed lower increases in stand size for dense (3%) and moderately dense (21%) juniper woodland, and substantial increase (90%) in light density stands, or a change of juniper encroachment in shrub lands from 11,105 acres to 21,050 acres. On the plateau northeast of Baggs the increase in juniper can be seen in photos taken in 1983 versus 2011 (Standard #3 – page 6 photo). The juniper cutting project at Dad juniper was designed as a thinning on north slopes compared to the earlier cutting by Baggs which were small clear-cuts on south slopes. The mechanical removal of conifers from aspen stands adjacent to the MBNF will improve 800 acres and is being completed for BLM by the LSRCD. Mowing of mountain shrub habitat in north of Dixon has both good herbaceous cover and with excellent regrowth of mountain shrubs and re-sprouting by mountain big sagebrush. The principle large wildfire in this watershed occurred in the Sandhills in 1993, and across four transects is now averaging 20% canopy cover (range of 11 to 29%), with silver sagebrush, rabbitbrush, chokecherry, bitterbrush, and snowberry the major species of shrubs. Bitterbrush recovery was generally better along the edges of the wildfire compared to internal areas.

Long-term trend data for reclamation of disturbance from oil and gas energy development is not available, but more short-term data is being collected by the BLM and energy companies. Although the amount and timing of precipitation in the desert can greatly affect vegetation growth, the effort put into reclamation has greatly improved. This is primarily based on personal observations and photographs of pipelines and well pads that are better vegetated, primarily with grasses, than in previous years. Forbs are still lacking, but much of that is due to a lack of seed sources for this precipitation zone and region. A drive through the Barrel Springs Draw country in 2011 showed vast improvement in reclamation of well pads and very little halogeton on them. The use of slender wheatgrass as a cover crop has also increased initial vegetation cover that is quickly stabilizing soils and reducing weeds, leaving only the question of how fast will the slender wheatgrass fade out and will native perennial species in the seed mix and/or adjoining native range fill in like expected.

The other vegetation related trend relates to wild horse diets in the Adobe Town HMA during the winter. Due to high wild horse numbers and drought conditions in 2002, fecal samples were collected and analyzed for wild horse diets in November 2002, January and March of 2003, from two locations in the Adobe Town HMA and one location in the Lost Creek HMA (north of I-80) (as a control where wild horse numbers were not excessive and forage conditions closer to normal). Results for Adobe Town averaged 88% shrubs at Sand Creek compared to 45% shrubs at Lost Creek. While the Sand Creek site was dominated by saltbush with lower amounts of sagebrush and winterfat, the Lost Creek site was primarily winterfat with some saltbush. Resource specialists wanted to compare the above results with improved moisture conditions and wild horse numbers at AML, so additional fecal analysis was conducted for the winter of 2007-08 and 2010-11. The 2007-08 data resulted in Adobe Town averaging 91% shrubs at Sand Creek and 60% at Willow Creek compared to 23% at Lost Creek. The 2010-11 data resulted in 82% shrubs at Sand Creek compared to 25% shrubs at Lost Creek. Composition in 2007-08 was similar to earlier, however, in 2010 the composition at Sand Creek was dominated by winterfat and saltbush, compared to mostly saltbush at Lost Creek. Long-term trend photos from Grindstone Springs within the Adobe Town HMA has shown recovery of vegetation over the last ten years when compared to the 2002 drought year and despite high numbers of wild horses (and little sheep use) during this period (Standard #3 – page 7 photo).

Populations of Gibben's beardedtongue (Penstemon gibbensii) were resampled in 2011 (original monitoring started in 1985) along with the establishment of new monitoring on populations along lower Sand Creek. The original population at Cherokee basin on Powder Rim was mostly fenced for protection in 1984, with population counts starting at 149 (1985), rising to 922 in 1991 and a high of 1045 in 2001,

crashing to a low of 22 in 2007 following severe drought in 2002 and 2006, and rising to 89 in 2011. The majority of these plants are within an eight foot high exclosure. The two most common species within this study area are buckwheat (Eriogonum brevicaule) and Indian ricegrass (Achnatherum hymenoides) showed a much different response, with buckwheat not appearing to be much affected by drought and increasing throughout the same time period from 175 up to 486 plants and Indian ricegrass showing a slight decline following drought but overall rising from 64 up to 88 plants over the same 26 year period. There were slightly different results looking at frequency, with buckwheat not showing much change but Indian ricegrass varied from 83% in 1985, 77% in 2001, 47% in 2007, and 70% in 2011 (30 plots).

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The general context of discussion from the 2002 watershed assessment is still largely valid and won't be repeated here. Grazing and browsing by livestock, wildlife, and wild horses continues to have the most direct effect on vegetation, however, drought, vegetation treatments, oil and gas development, and recreation use also are significant factors. Monitoring for livestock use and trend is the most common, and even though the current direction of trend is positive, there are still many questions relating to rate of change, understanding how to effect change in desirable bunchgrasses, and gaining more knowledge of site characteristics and how they affect changes in species composition. Additional monitoring is needed to better quantify forage availability and vegetation trend to support the Adobe Town wild horse HMA and the Baggs elk herd, as well as to incorporate the effects of climate swings into interpretation of all data collected. In general, vegetation trends are good, from the changes observed with livestock management and oil and gas reclamation, to rejuvenating shrublands and aspen woodlands. Juniper encroachment into shrublands will need to get more attention in future years.

Livestock grazing continues to have the largest impact upon vegetation of all resources users, however, much has been changed with grazing practices and range improvements to improve vegetation vigor and composition. This has primarily occurred through adjusting the duration and season of use by livestock to provide for time during each growing season for plant growth, root expansion, and energy replenishment to happen. Levels of livestock grazing use during the assessment period has fluctuated between 46% and 56% of the total permitted use levels of approximately 88,000 AUMs (see Figure 7). The same figure also shows the low livestock use (18% between 2002 and 2009) within the allotments in the wild horse herd area. A high proportion of the non-use was requested on a voluntary basis by the BLM due to two periods of drought and the high wild horse numbers in the Adobe Town HMA. Some of the livestock nonuse is also due to avoiding the natural gas field development and high amounts of halogeton to reduce mortality in winter sheep operations. Permittees, in general, have become more conservative in their stocking rates, particularly responding to drought years and the need to provide for plant vigor and recovery and to better understand the value of leaving forage and litter for soils improvement. Over time there has also been a reduction in the smaller sized operations, probably relating to the economics of what number of livestock it takes for a ranch family to survive, so more operations currently in business are the medium to large sized ranches. There is still a lot of work or refining of current management that needs to be done in future years, but the 2010-11 monitoring showed vast improvement compared to 20 to 40 years ago. Whether analyzing the reduced bare ground or the inverse of litter and plant cover, the numbers have improved to be more in acceptable ranges of under 40% bare ground in sagebrush communities and around 50% in saltbush steppe communities. These numbers are likely to decrease with long-term monitoring needed to establish a natural range that incorporates climate affects. Since the majority of grazing is by cattle, trend of desired bunchgrasses is important to follow. Just looking at sagebrush sites, desirable bunchgrasses

(primarily needle-and-thread grass, Indian ricegrass, bottlebrush squirreltail, bluebunch wheatgrass) did increase in many areas and thickspike/western wheatgrass did decline on some sites. But in other locations wheatgrass increased as did little bluegrass in many areas. Is little bluegrass just more prolific in responding to three wet years better than the other grasses, or will young little bluegrass give way to the bigger grasses? Most livestock producers are working with the BLM and following good rotations, so at this point, accurate monitoring and feedback to these permittees to make small corrections and let them know what is happening is the most important task for the RFO to complete. This also must incorporate the needs of sensitive species like Greater Sage-Grouse or fisheries in riparian habitats to further refine management changes already implemented.

Wildlife management relates to vegetation directly in terms of forage and habitat use by big game, which in this area is elk, mule deer and antelope, and indirectly in terms of management implications upon vegetation, such as the greater sage-grouse core area habitat policy. The principle concern raised in the 2002 watershed assessment and still present currently is the sagebrush, mountain shrub, and juniper plant communities in the Little Snake River valley and north along Muddy Creek. The 23 year trend along Muddy Creek shows sagebrush hits and canopy cover staying about the same, but the mature plants that are eight to 12 inches tall are being replaced by young plants two to four inches tall. With average utilization on the east side of Highway 789 at 71% (long-term browse levels above 60% will kill plants), the question becomes how do the young plants which get browsed almost as heavy as the mature plants, ever grow up to the size of the current mature plants? It's fortunate that past and more recent wet cycles produced a lot of seedling sagebrush that are available to grow up and fill in as older plants die. However, with high browse use and rotational livestock management that is promoting more herbaceous plant vigor and cover, can the current levels of sagebrush in this portion of the winter range be maintained? On north facing slopes NE and NW of Baggs that tend to snow in for short periods, 2200 acres of sagebrush was recently treated with tebuthiuron to thin stands and improve species composition. Bitterbrush was seeded at the same time as the chemical, so monitoring the results over the next several years will tell if this practice was successful in providing a more varied and nutritious diet for mule deer. The two new highway underpasses north of Baggs may also help reduce mule deer use of sagebrush and mountain shrubs NE of Baggs by allowing more animals to move west across the highway. However, a high percentage of the browse use north along Muddy Creek is by antelope that will not use underpasses. Either use of the let-down fences or an overpass in the future would help reduce concentrated browse use by antelope along Muddy Creek. Juniper treatments to benefit plant community health and mule deer are discussed under vegetation treatments. The expansion of elk populations is also affecting vegetation, but data is lacking on filling in the details of this impact. Although WGFD is increasing hunter pressure to reduce herd size, they are also working with the BLM to collect more data to determine if the population objectives for this herd can be raised. This will likely take a year or two, but is the right action to take in order to biologically make the right decision. As long as the BLM can manage for healthy sagebrush communities, antelope needs will likely be addressed. However, much of the browse use along Muddy Creek is from antelope that cannot move west across Highway 789. Whether the highway let-down fence could actually be used or whether an overpass for wildlife could be constructed in the future, this would be the principle benefit to reducing antelope forage use along Muddy Creek to maintain healthy sagebrush communities. The issues with Greater Sage-Grouse are discussed under livestock grazing and vegetation treatments.

Wild horse effects on vegetation relate to their population levels, distribution of use, and diet selection. Population levels over the last 10 years have varied from AML of 610 to 800 wild horses up to around 3000. This kind of variation makes it impossible to ever assess if the AML is a good number for range health along with incorporating use and impacts from livestock and wildlife. It's imperative that the BLM keep wild horse numbers at AML during the next 10 years, and establish more monitoring to distinguish impacts between the grazers and browsers. The winter fecal data for wild horses shows a higher diet overlap with sheep, mule deer and antelope, rather than with cattle and elk. Summer fecal

analysis may be necessary to see if this trend continues through the rest of the year. In the meantime, it throws a whole new wrinkle into the monitoring needed and animal species involved in the comparisons and management implications. Distribution of use by wild horses is quite variable with the major issues affecting it being location and reliabilities of water sources and possibly energy development activity. There has long been a need for more water sources in the Adobe Town HMA, both to keep wild horses from moving within or outside the HMA in search of water and to reduce grazing pressure around the few reliable water source during drought years. Although no new water sources for wild horses have been developed in this HMA, there are several current options to work with energy companies to provide long-term water and other locations that the BLM could develop. Additional aerial distribution flights and other monitoring may be needed to evaluate if current energy development activities are affecting wild horse distribution, however, the intensity of well drilling on the eastern half of this HMA is quite high and potentially will increase.

The effect of climate swings, whether it is drought (gets the most attention) or wet years on vegetation is part of species evolution and natural selection. Much of the recent effects have been through personal observations. Drought In 2002 resulted in the death of basin big sagebrush in ephemeral draws and valley floors compared to Wyoming big sagebrush on hillsides because there was no runoff or additional moisture to support plants with higher water needs. Sand dunes in Adobe Town in 2010 had a high proportion of dead hopsage compared to other shrubs, possible due to the 2002 or 2006 years where lower precipitation was observed. Bitter brush was also observed dying off in the Powder Rim area during this period of time. Prickly-pear cactus has also been observed dying off but whether this is drought related is unknown. The best drought data involves the long-term Gibbens' beardtongue study on Powder Rim. The numbers described above show a dramatic decrease from over 1000 plants to only 22 in six years with slow recovery since, within though the site is within a tall exclosure with no browsing or grazing use. The comparison with buckwheat and Indian ricegrass show quite variable responses from no effect to buckwheat to partial effect to Indian ricegrass. It raises the question of how many other plants are as sensitive to drought as Gibbens' beardtongue, and/or do site conditions have something to do with the impacts observed in this location? Its' was also interesting that there are as many Gibbens' beardtongue plants in one transect at Sand Creek (81) as there are on the entire site at Cherokee basin (89). The other area drought seemed to have a big effect was on desirable bunchgrasses found on saltbush steppe sites. At Rotten Springs, Red Creek, Dad, South Barrel Springs, and Mexican Graves, the levels of Indian ricegrass and/or bottlebrush squirrel tail dropped significantly. These sites are spread over 20 miles apart and include areas used by spring cattle, summer cattle, winter sheep, and practically no current grazing use. The desirable shrubs all increased so it wasn't that any site was used too hard. The only explanation is that the tap-rooted shrubs probably have a deeper root and therefore, survived compared to the more shallow, fibrous rooted grasses. On the other hand, the three year wet period from 2009-2011 resulted in the establishment of many new young plants in all different vegetation communities. While re-reading trend transects over the last two years, many seedlings of grasses, forbs and shrubs were observed and noted in the record. For grasses the most notable was all the sand dropseed, a warm season grass that was seen on Powder Rim and not noted in past monitoring at all. Bottlebrush squirreltail and Indian ricegrass was observed in saltbush steppe and needle-and-thread on sandy sites. Hood's phlox was the most common forb with a lot of new starts, but others like buckwheat and clover were also seen. One Gibbens' beardtongue transect had 22 mature plants and 59 new seedlings! Sagebrush and rabbitbrush were the most common shrubs observed, with really strong numbers of new sagebrush. Production was obviously good as was litter on the ground, but other benefits to upland vegetation probably occurred but were not as noticeable. Future and more intensive monitoring may yield more light on the effects of climate swings on vegetation in the RFO.

Vegetation treatments have totaled approximately 55,000 acres within this watershed over the last 25 years during which prescribed burning was the principle form of treatment prior to 2001 and over the last 10 years the use of tebuthiuron has evolved. Treatments during the 1950's to 1960's primarily

involved the use of the chemical 2,4-D, which will kill all broad-leaved plants including forbs and the target species big sagebrush. The use of tebuthiuron has seen more use recently due to concerns with Greater Sage-Grouse habitat and the ability to "thin" big sagebrush rather than kill a high amount of it. Tebuthiuron has also proven to be more beneficial in terms of easier application and wider "window" for treatment than prescribed burning, and annual species like alyssum don't increase as much in low elevation mountain big sagebrush treatments. Treatments in dense mountain big sagebrush have occurred in about 40% of the potential habitat within this watershed. Recovery to pre-treatment levels is averaging about 30 years at higher elevation sites with deeper soils and 50-60 years at lower elevation sites with lower precipitation and more moderate soil depth. Only a couple of prescribed burns have been in basin big sagebrush and they are also recovering in a 30-50 year period of time. As with many burns, the more herbaceous competition there is with big sagebrush, the slower it will return. Where understory vegetation is poor and sagebrush reseeding is good, sites many return to pre-treatment levels in as little as 20 years. Mountain shrubs are often species of concern with burning, particularly bitterbrush, but recovery has been good with cooler, fast-moving fires. The site in a mixed mountain shrub in the Grizzly allotment burned in 1987 (West Rendle) that is above a pasture fence and receives overall light use, is already recovered to 63% canopy cover compared to a control unburned site 100 feet west that has 79% canopy cover (Standard #2 – page 8 photo). Black sagebrush tends to not respond to fire well (long recovery), however, cotton horsebrush tends to be an early seral species and do well after fire. Recent prescribed burns at Little Sandstone and Savery Creek have had excellent bitterbrush recovery. Snowberry also responds well after fire but in some burns doesn't last more than 20 years (West Wild Cow in 1986). Some of this could relate to wildlife use, snowberry was the highest shrub component in spring mule deer diets on Green Mountain north of Rawlins. Aspen health in general is still decadent in many stands, with only half the acreage compared to 1938 aerial photos. However, leaf blight effects documented during the 1980's and 1990's seem to not be as severe, with most trees with dead tops but very good suckering. Competition from competing shrubs like serviceberry and big sagebrush are still management issues. Principle prescribed burns with benefits to aspen were Hartt Creek in 1996 and Cow Creek in 2002, both drought years, so burning occurred later in the season and good under-burning in stands was possible (Standard #3 – page 9 photo). Several other prescribed fires, like Beaver Dams in 1992 and Cherokee in 1998, burned through small stands and around the edges of larger aspen pockets and stimulated suckering. Aspen burning is most effective on dry years and the concerns over the amount of area burned in greater sage-grouse core area habitat are not supportive of burning under these conditions. Mechanical treatments are not as effective but may get the job done in limited cases, with mowing of sagebrush around aspen worth a try to see if it will stimulate suckering and expansion of these stands. Juniper encroachment into shrublands is starting to get more attention, with the LSRCD working on private and state lands with landowners in both cutting and mulching type of treatments to remove them, in addition to the work by the BLM described above. This is a very important issue in maintaining or enhancing winter habitat for mule deer, and raises the question of how much juniper cover do mule deer need, and by removing cover will deer and elk spend less time in these areas that will allow for shrub recovery after mechanical treatment has occurred? Although these areas are critical to supporting the Baggs deer herd, the high cost of mechanical treatment will limit the amount of area treated and the long-term decline in mountain mahogany shrublands warrant management actions to reverse this trend as well as in other shrublands in mule deer crucial winter range. Greater Sage-Grouse research shows nesting hens seeking out more dense big sagebrush than previously reported, which between birds moving to higher elevations and sagebrush canopy and height selection, indicates most hens are nesting in mountain big sagebrush plant communities. This along with other factors will need to be considered in planning future vegetation treatments, along with following the new policies regarding Greater Sage-Grouse. The current and future status of this species will also require more intensive monitoring of livestock grazing to ensure residual and new vegetation is adequate for nesting habitat used by Greater Sage-Grouse (Standard #3 – page 10 photo). Few large wildfires have occurred in this watershed, with two on Powder Rim in the

1980's with around 1,500 acres total and the Sandhills wildfire in 1993 which burned 2,900 acres. Good herbaceous plant growth has occurred with sand dropseed very noticeable that is probably due to reseeding. Resprouting species like silver sagebrush, cheatgrass, chokecherry, snowberry and wild rose have recovered the most, while species like bitterbrush, serviceberry and mountain big sagebrush recovery is slower (Standard #3 – page 11 photo).

Oil and gas development is primarily guided by avoidance of other management resource values, such as cultural, wildlife, hydrology, soils, and engineering. Therefore, most surface disturbing activities occur around these values and usually in the most common vegetation plant communities of Wyoming and mountain big sagebrush, saltbush steppe, and to a lesser extent in greasewood flats. Primary concerns relate to post-disturbance reclamation and weed control. As discussed above, general reclamation practices have improved, due in part to obtaining better soils information prior to disturbance, more prompt reclamation due to stronger enforcement of On-Shore Order #1, use of cover crop species, and greater industry commitment. For instance, Devon Energy bought out Snyder Oil Company and has done a superb job of catching up on a lot of delinquent reclamation on well pads. The requirement of soils testing has helped to avoid more problematic soils or to take the steps necessary before and after disturbance for more successful reclamation. Joint industry-agency workshops conducted over the last 10 years have helped identify common problems, discuss solutions, and disseminate information among all parties involved. Although reclamation has improved a lot, there are a few problem areas to work on. In general, there is still a lack of native forb seeds to use in reclamation, so restoring vegetation to a native plant community is mostly relying on forb reseeding from adjacent rangelands. While most local pipelines are not an issue, the interstate pipelines have been difficult to communicate with and address issues, including some areas that need reseeding and more particularly a lack of adequate weed control. This has been a major problem regarding halogeton, which is poisonous to sheep, and since these pipelines crossed multiple winter sheep grazing allotments. The principle local pipeline of concern is a Williams pipeline that follows the Standard road both south of West Flat Top and east of the junction with the Windmill Draw road where weed control issues have not been addressed (Standard #4 – page 9 photo). There is also one spot along the Anadarko pipeline in Atlantic Rim where it crosses Wild Cow Creek where vegetation recovery is not occurring, the rest of the pipeline has excellent stabilizing vegetation. Dust from roads is always present, but the expansion in roads and disturbance from drilling creates most potential dust sources that can coat vegetation up to one-quarter mile away, with may be affecting plant vigor, production and palatability. Roads along drainages continue to capture and re-direct runoff, increasing desertification effects to vegetation below the road that is not receiving as much moisture. As a whole, the energy industry has greatly improved its' reclamation and weed control practices over the last 10 years, with just the few areas mentioned above that need resolution.

Off-road travel impacts upon vegetation are primarily based on personal observations of more two-track roads to seeing where people drive across vegetation (rather than walking) to riparian meadows or stream banks that get torn up where people shouldn't be driving. These observations in some areas are increasing, probably a result of fewer people wanting to use their legs to get around. In areas with steeper slopes or private land that can control access, there appear to be few of these observations. The "Walk In" program of the WGFD working with private landowners has been very helpful in promoting people using their legs and reducing vehicle impacts. Two other factors may also be helping to reduce the off-road vehicle impacts upon vegetation. The first is the expanded use of UTV's that appears to have a lighter impact than four-wheel drive pickups, four-wheelers or motorcycles. The second is the shed antler collection closure during the winter and early spring months when conditions may be wet and muddy and the land more easily torn up by vehicle use. The RFO is scheduled to write and implement a travel management plan that should help address current problem areas. However, the people that use our public lands will need to support it to be successful, and that will take a lot of time, meetings, education, signing and enforcement in order to implement such a plan. For two-track roads that will be kept open there is a great need for water-barring to reduce erosion, as well as

reclamations costs for roads that become closed. As more people choose to recreate on the the BLM-administered public lands, this issue may come to dwarf all the others discussed above.

6) Recommendations:

Due to the diversity, vigor, productivity, high native species composition, the current trends documented or observed in plant communities, the current livestock management, current wildlife populations and wild horse numbers, and management responsibility shared and demonstrated by the various agencies, industry, and agricultural businesses in this watershed, it is determined that the majority of upland vegetation in the Upper Colorado River watershed is meeting Standard #3 – Upland Plant Health, with the following exceptions. Aspen stands, although healthier than they appeared 10 years ago, still so not meet the standard for vegetation health due to their reduced acreage (compared to historical), competition from big sagebrush and serviceberry within and adjacent to existing stands or in locations where historical stands occurred, decadence within stands, and concerns over persistence of disease within this plant community. Total acreage of these stands is approximately 14,000 acres within this watershed. Sagebrush, mountain shrub, and juniper plant communities within mule deer crucial winter between Horse Mountain west to Poison Basin and north along Muddy Creek, still do not meet this standard due to continued encroachment of juniper into shrub lands, continued decline in shrub canopy and heavy utilization in mountain shrub communities, and continued low diversity in big sagebrush stands. Total acreage of these areas is approximately 40,000 acres within the watershed (See Map #6). Livestock grazing is a component in the management scenario of these plant communities, but it is not the principle factor in non-attainment of this Standard. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue to implement vegetation treatments to restore plant communities with diverse species, age classes, and cover types. Inventory and prioritize aspen stands for treatment, explore more use of mechanical cuttings, summarize effects of past treatments and what was learned, and work more closely with HDD and WGFD to continue to use prescribed fire for aspen health within the Greater Sage-Grouse core area habitat. Due to the sensitivity towards projects in big game crucial winter range, it is extremely important to coordinate vegetation treatments between the BLM, LSRCD, and WGFD in this area. Ensure adequate monitoring of the long-term effects of vegetation treatments is occurring and information learned disseminated to all parties.

Maintain wild horse populations in the Adobe Town HMA at the AML of 700 wild horses (range of 610 to 800) (Map #10). Ensure adequate monitoring of distribution, diet, and other important factors to determine if this AML is the appropriate level to manage for with regard to vegetation and use by livestock and wildlife, as well as other multiple uses of the public lands. Develop additional water sources to improve wild horse distribution, reduce pressure around natural water sources, and reduce the potential of wild horses moving outside the HMA due to lack of adequate sources of water.

Continue to work closely with WGFD and LSRCD, in monitoring effects of wildlife on vegetation, response of vegetation to treatments and changes in wildlife populations or management, to promote healthy vegetation in crucial winter ranges and across the entire watershed.

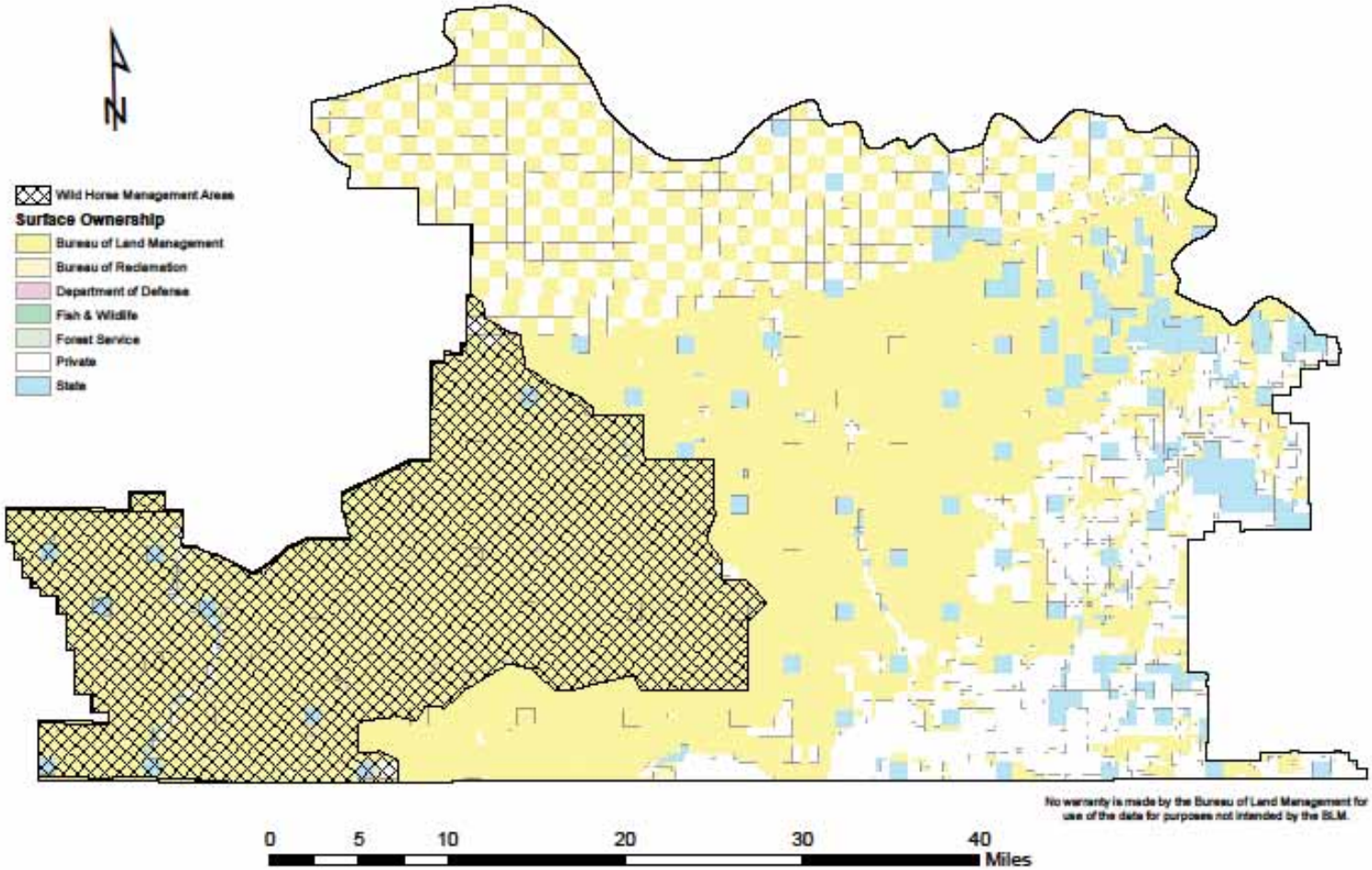
Continue to manage using BMP's for livestock grazing. This primarily relates to manipulating the season, duration, and distribution of livestock use to meet desired resource objectives for riparian/wetland habitats. Specific dates and timing of use must be determined on a case-by-case basis for the plant community involved, method of treatment(s), specific plant community objectives, or other pertinent factors.

Continue to identify and correct impacts from improved and un-improved roads, which affect water flows and/or soil erosion. Incorporate watershed and soils management needs into implementation of the RFO travel management plan.

Continue to work closely with energy development companies on the successful reclamation and monitoring of vegetation after surface disturbing activities have occurred. Work with NRCS, LSRCD, WGFD, and other involved parties in revising ESDs, incorporating what is already known, gathering additional information, and using it all to help describe desired plant communities and what it will take to achieve this RMP objective.

Expand education about the public's role in public land management, particularly regarding impacts from roads and off-highway vehicular activities. Work closely with other partners in this area, including the WGFD in regards to the season closure for antler collecting and the potential long-term benefit to upland vegetation health.

Map 10 - Adobe Town Herd Mangement Area (Wild Horse) Within the Colorado River Basin Watershed Assesment Area



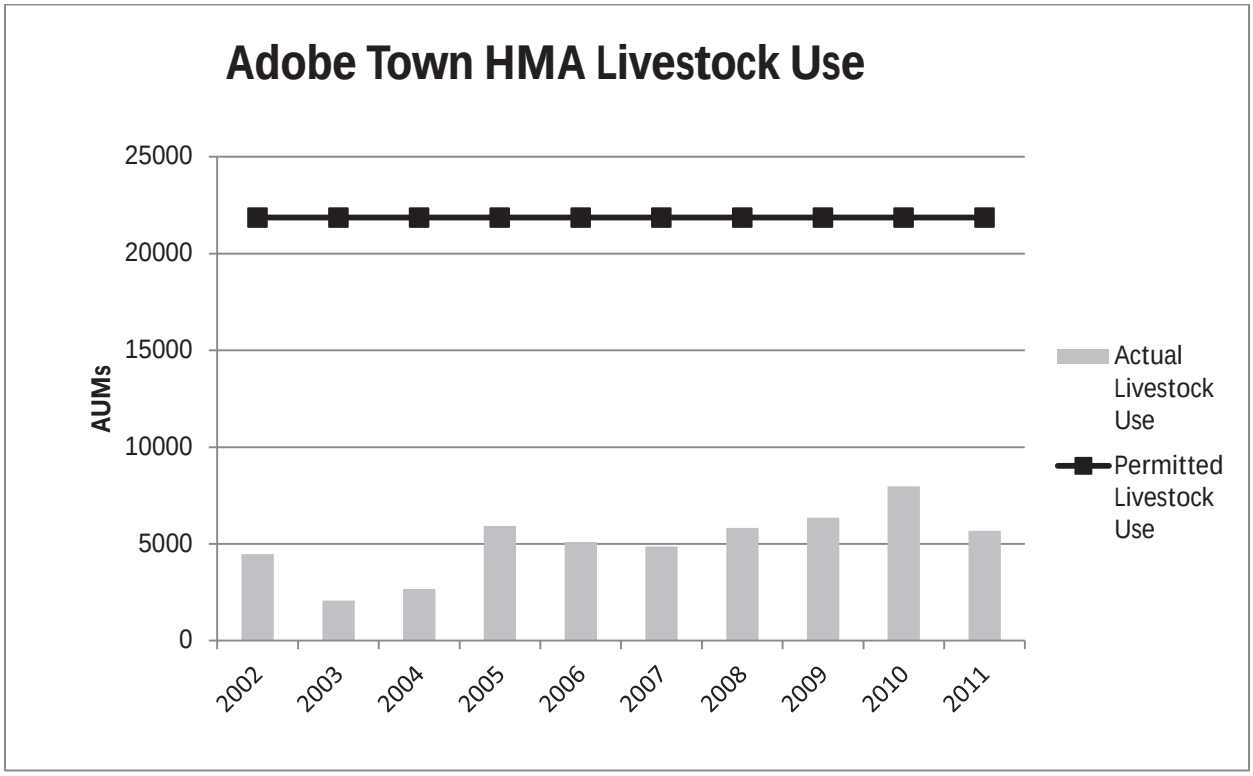


Fig. 6: Livestock Use in Allotments within the Adobe Town Wild Horse HMA

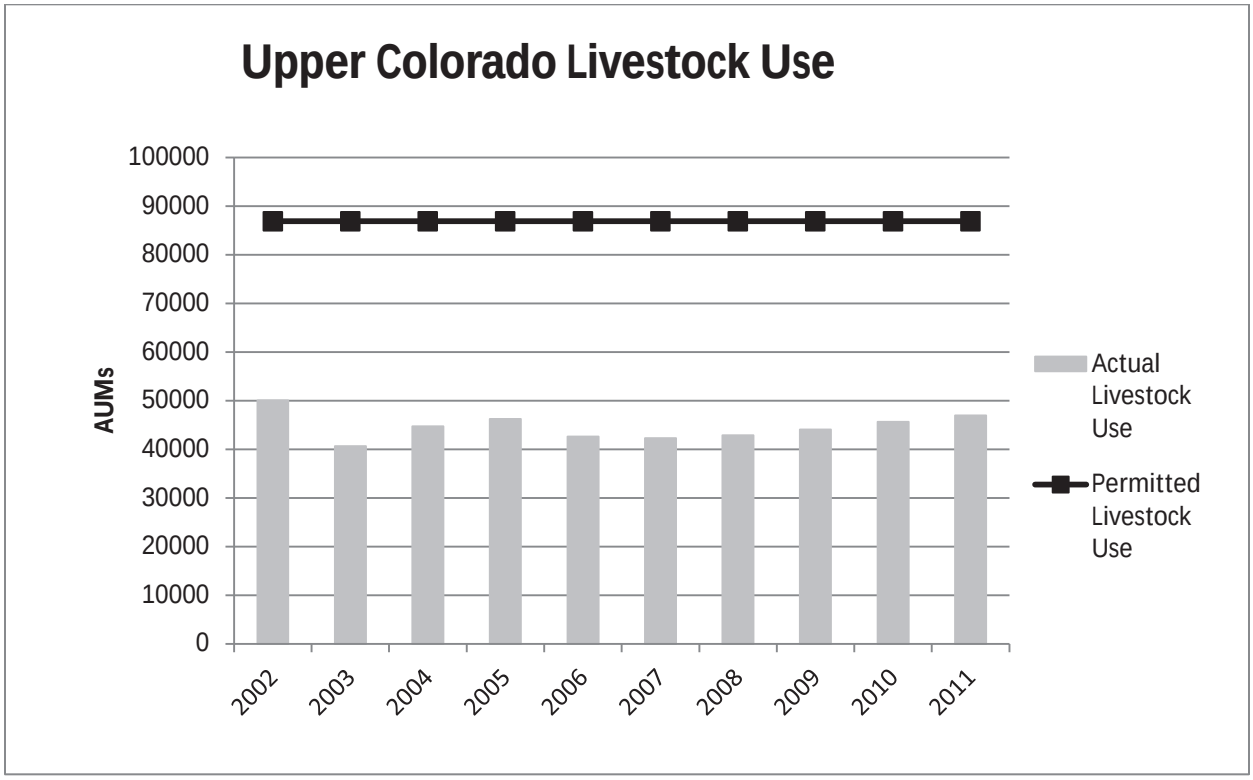


Fig. 7: Livestock Use in the Upper Colorado River Basin Allotments.

STANDARD 4 – WILDLIFE/THREATENED & ENDANGERED SPECIES HABITAT HEALTH/FISHERIES, WEEDS

Rangelands are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to the habitat. Habitats that support or could support threatened species, endangered species, species of special concern, or sensitive species will be maintained or enhanced.

Wildlife/Threatened and Endangered Species Habitat Health

1) **Characterization:**

General Wildlife:

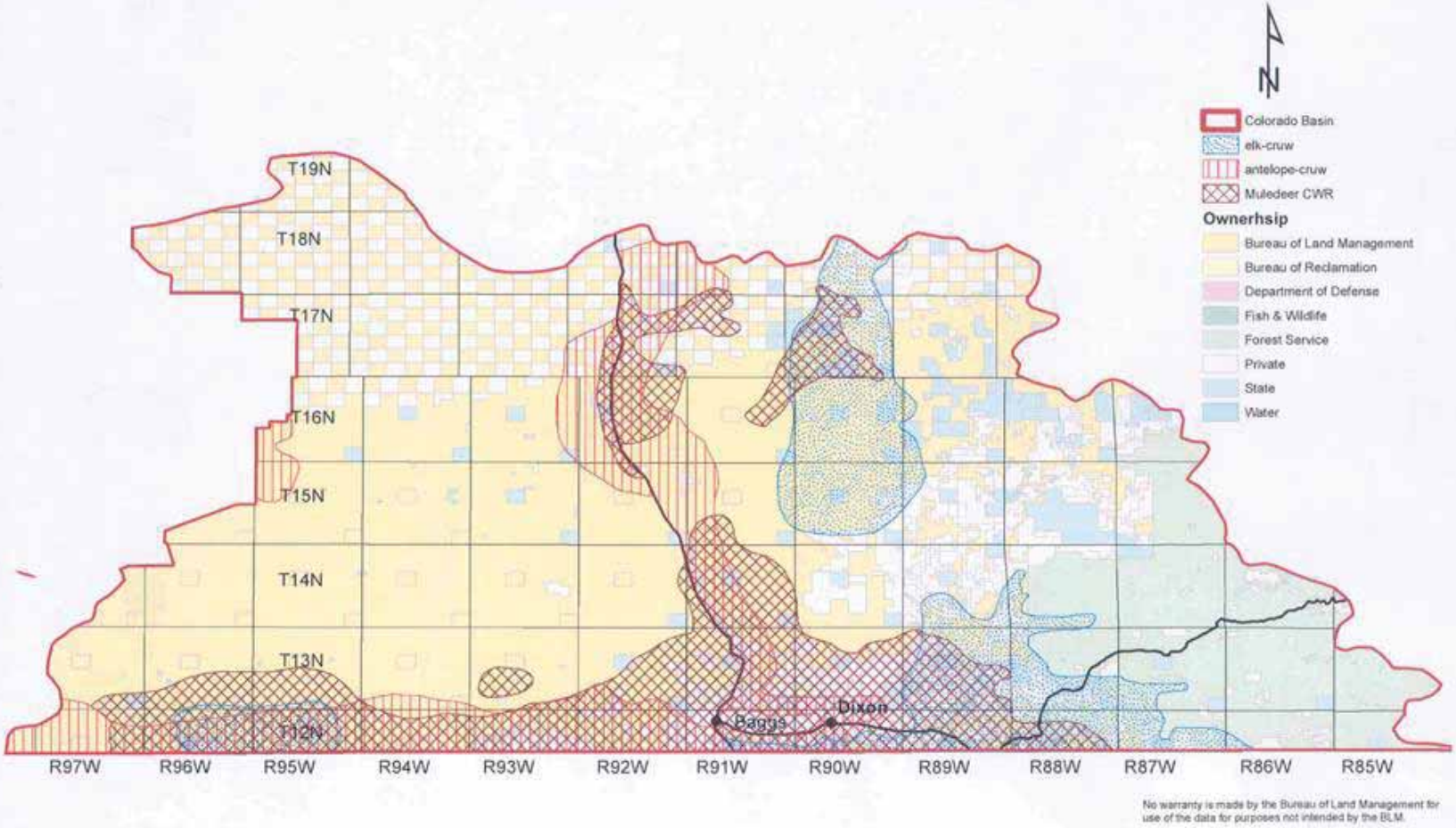
The plant communities/habitat types that occur within this watershed have been described under the Characterization section of Standard 2 (Wetland/Riparian Health) and Standard 3 (Upland Plant Health) in the *Upper Colorado River Basin Rawlins Field Offices Standards and Guidelines Assessment 2001 Field Season*. There are approximately 374 species of wildlife, including birds, mammals, reptiles and amphibians, within this watershed and while some wildlife species use several to many habitat types, other species are very specific in their habitat needs, and are known as obligate species. In general, aquatic habitats support the greatest diversity of species (up to 165) and are the least common type of habitat (about 1% of landscape); aspen woodlands are next in terms of supporting the greatest diversity of species; big sagebrush; conifer; mountain shrub; juniper woodland habitat types (about 4% of landscape); and sand dunes, badlands, and rock outcrops (which support the lowest number of wildlife species). Management of all habitats to be healthy in terms of diverse species, cover, age classes and structure, will ultimately provide the most optimum habitat for all wildlife, rather than trying to manage for each particular species or priority species.

Species of Interest or Concern

Mammals: The mule deer herd designation in this watershed is the Baggs Herd Unit, which includes the area south of Interstate 80, north of the Colorado-Wyoming state line, west of the Continental Divide to Sage Creek and then north to Rawlins and east of the Bitter Creek Road. Of the three commonly found big game species in the watershed, deer habitat, and particularly crucial winter range, is of the highest concern (Map #8).

The antelope herd designations in this watershed are the Baggs and Bitter Creek Herd Units. The Baggs Herd Unit is bounded by Interstate 80 to the north, the Colorado-Wyoming state line to the south, Highway 789 on the west, and Atlantic Rim and the Continental Divide to the east. Crucial winter range is located primarily along Muddy Creek between Dad and Baggs and on Red Rim along ridges that blow free from snow. The area along Muddy Creek overlaps with crucial winter range for mule deer. Antelope move farther west or south into Colorado during severe winters. During more mild winters, antelope make more extensive use of transition habitat adjacent to crucial winter range. While winter range is more limited, summer habitat for antelope extends across the entire herd unit except for the areas supporting forest woodland habitat. The Bitter Creek herd unit is bounded by Interstate 80 to the

Map 8 Crucial Winter Range within the Colorado River Basin



north, the Colorado state line to the south, by Highway 789 to the east, and Highway 430 to the west. Antelope are the principal big game species observed here, with mule deer and elk found in the Flat Tops and Powder Rim areas along the southern border.

The elk herd designations in the watershed are the Sierra Madre and Petition Herd Units. The Sierra Madre Herd Unit is bounded on the north by Interstate 80, Wyoming Highway 71, Sage Creek and the North Platte River, on the east by Wyoming Highways 130 and 230, on the south by the Colorado-Wyoming Stateline, and Wyoming Highway 789 on the west. This means that only about half of this management unit is contained within the upper Colorado River watershed. Elk will summer in the MBNF and surrounding foothills where there is aspen or other habitat to provide hiding cover. Elk move to lower elevations off the forest, with distances traveled often dictated by the availability of forage. Crucial winter ranges include the wind-blown rims south of Rawlins, stretching south along Atlantic Rim, the Sand Hills, and slopes bordering the Browns Hill plateau to the Little Snake River valley and Horse Mountain area. The Petition herd unit is bordered by Wyoming Highway 430 on the west, interstate 80 to the north, Wyoming highway 789 to the east, and the Colorado-Wyoming state line to the south.

Amphibian and Reptile Species

Information regarding amphibian species presence and distribution is relatively limited throughout Wyoming. In 2009 and 2010 the RFO surveyed amphibians throughout the office with the majority of the effort occurring within the Colorado River basin. Species found within the assessment area include the northern leopard frog and boreal chorus frog, tiger salamander and great basin spadefoot toad.

Fish Species

Threated, Endangered, Proposed, and Candidate Species
Threatened, Endangered, Proposed, and Candidate species for listing that occur, or may occur, within this watershed include the Greater Sage-Grouse, black-footed ferret, Canada lynx, blowout penstemon, Ute ladies'-tresses, and yellow-billed cuckoo. Also, since this watershed is a subset of the Colorado River System, any projects that lead to a water depletion greater than 0.1 acre/ft. annually in the system will affect the following fish species: bonytail chub, Colorado pikeminnow, humpback chub, and the razorback sucker.

Greater Sage-Grouse

Status: The current status of the Greater Sage-Grouse is candidate.

Habitat: Greater Sage-Grouse populations have exhibited long-term declines throughout North America, 33% over the past 30 to 40 years (Braun 1998). In 2004, Schroeder et al. revised distribution maps of potential presettlement habitat and current populations for Greater Sage-Grouse (*Centrocercus urophasianus*) and Gunnison Sage-Grouse (*C. minimus*) in North America. The resulting presettlement distribution of potential habitat for Greater Sage-Grouse encompassed 1 200 483 km2, with the species' current range 668 412 km2. The dramatic differences between the potential presettlement and current distributions appear related to habitat alteration and degradation, including the adverse effects of cultivation, fragmentation, reduction of sagebrush and native herbaceous cover, development, introduction and expansion of noxious weeds, encroachment by trees, and excessive grazing by livestock (Schroeder 2004). Therefore, no one causal factor has been solely identified for these declines. Wyoming supports the largest populations of greater sage-grouse, more than all other states combined (USDI-BLM 2002). However, this population decline is also happening in Wyoming. Greater Sage-Grouse are a sagebrush obligate species. Throughout the life cycle of the species, sagebrush plays an

important role; from breeding habitats of open areas surrounded by sagebrush to nesting sites under sagebrush to wintering habitat in sagebrush, each aspect of the life cycle requires slightly different elements within the sagebrush communities. It appears that during nesting, grass height and cover play an important role in the nesting success of greater sage-grouse. Early brood-rearing habitats may be relatively open stands of sagebrush with greater than 15% canopy cover of grasses and forbs. (Lyon 2000). Great plant species diversity with abundant forbs and insects characterize brood areas (Klott and Lindzey 1990). As summer progresses, grouse move to more mesic sites rich in forbs. Movements to winter range are slow and meandering and occur from late August to December (Connelly et al. 1988). During winter, greater sage-grouse feed almost exclusively on leaves of sagebrush (Patterson 1952).

Watershed Occurrence: This watershed supports fairly large populations of Greater Sage-Grouse. In 2012, Wyoming BLM established a Greater Sage-Grouse habitat management policy (IM WY-2012 -019). This guidance adopted the Core Population Area Strategy established by the Wyoming Governor's Executive Order (EO) 2011-5 while a state-wide Greater Sage-Grouse plan amendment is being completed. The BLM has identified 1,137,158 acres of Greater Sage-Grouse habitat within the watershed (see Map 9), of which 307,705 acres has been identified as Core Habitat. This plan will determine what additional management protection measures, if any, would be necessary within the RFO planning area to afford adequate protection to Greater Sage-Grouse.

Black-footed Ferret

Status: The black-footed ferret is considered the rarest and most endangered mammal in North America and receives full protection under the Endangered Species Act of 1973.

Habitat: The close association of black-footed ferrets and prairie dogs is well-documented. The ferrets rely on prairie dogs for both food and shelter. The original range of the black-footed ferret corresponded closely with the prairie dog, extending over the Great Plains area from southern Canada to the west Texas plains and from east of the 100th Meridian to Utah and Arizona (USDI-BLM, 1984).

Watershed Occurrence: This watershed supports fairly large populations of white-tailed prairie dogs towns. Therefore, there is still the potential that the watershed may support black-footed ferrets. There are no known populations within the watershed. Currently the USFWS has areas across the state designated as non-block cleared areas where the potential still exists that a wild black-footed ferret could be found. Within this watershed there are four such areas. They are: the Dad Complex, Continental Divide Complex, Bolton Complex and the Desolation Flats Complex. These areas are known to contain enough white tailed prairie dog complexes to support black-footed ferrets. The USFWS and the WGFD are currently working on an effort to clear the state for wild ferrets. Once this is completed all the complex designations will be removed and efforts will begin to reintroduce black footed ferrets around the state.

Canada Lynx

Status: The current status of the Canada lynx is threatened.

Habitat: Lynx occur in the boreal, sub-boreal, and western montane forests of North America. Snowshoe hares are the primary prey of lynx, comprising 35-97% of their diet throughout the range. Other prey species include red squirrels, ground squirrels, mice, voles, porcupines, beaver, and ungulates as carrion or occasionally as prey. Lynx seem to prefer to move through continuous forest and particularly use ridges, saddles, and riparian areas. In studies in Montana and Wyoming, adult lynx made exploratory movements outside their home range, and lynx have been found to cross large rivers

and lakes and have been documented in habitats such as shrub-steppe, juniper, and ponderosa pine (USDI-FWS, 1999a).

Watershed Occurrence: Although it is highly unlikely that lynx use the habitat types in which the watershed occurs, it is always possible that this animal may travel through the watershed, specifically using riparian habitats for cover.

Blowout Penstemon

Status: The blowout penstemon is considered an endangered species and receives full protection under the Endangered Species Act of 1973.

Habitat: The blowout penstemon is located in areas of sparsely vegetated shifting sand dunes or wind carved depressions (blowouts). In Wyoming, so far, this species is found primarily on sandy aprons or the lower half of steep sandy slopes deposited at the base of granitic or sedimentary mountains or ridges.

Watershed Occurrence: No known population occurs in the watershed. There is potential habitat for the plant in the blowout areas of the Sand Hills between Cow Creek and Muddy Creek. Walt Fertig from WYNDD spent one day in this watershed looking for blowout penstemon in 2000.) Survey results were negative. In addition, the USFWS in 2012 conducted an analysis using Geographic Information Systems (GIS) to update the Section 7 range for blowout penstemon. The analysis compiled and analyzed geology and land cover data to delineate the range of suitable habitat. That range was combined with National Agriculture Imagery Program (NAIP) imagery and infrared bands to remove any features that were not identified as dunes. This information was combined with existing survey data which resulted in the determination that it is highly unlikely that blowout penstemon occurs with in this watershed.

Ute Ladies'- Tresses

Status: The Ute ladies'- tresses is considered a threatened species under the Endangered Species Act of 1973.

Habitat: The Ute ladies'- tresses is a perennial, terrestrial orchid with stems two to five dm tall, narrow leaves, and flowers consisting of few to many small white or ivory flowers clustered into a spike arrangement at the top of the stem. It blooms from late July through August; however, depending on location and climatic conditions, orchids may bloom in early July or still be in flower as late as early October. This plant is endemic to moist soils in mesic or wet meadows near springs, lakes, seeps, and riparian areas within the 100-year flood plain of perennial streams ranging from 4,300-7,000 ft. in elevation. It occurs generally in alluvial substrates along riparian edges, gravel bars, old oxbows. The orchid colonizes early successional riparian habitats such as point bars, sand bars, and low lying gravelly, sandy, or cobble edges, persisting in those areas where the hydrology provides continual dampness in the root zone through the growing season. The plant seems generally intolerant of shade and is found primarily in open grass and forb-dominated sites where vegetation is relatively open and not dense or overgrown.

Watershed Occurrence: The Ute's lady's tresses have not been found in this watershed. The plant occurs in all of the states that border Wyoming, so the USFWS has concluded that the plant may occur about anywhere in the state that meets the habitat requirements.

Yellow-billed Cuckoo

Status: The yellow-billed cuckoo is a candidate species at this time.

Habitat: This species generally inhabits open woodlands and streamside habitat with willow, cottonwood, and alder groves; however, it has been observed in riparian areas west of the Continental Divide.

Watershed Occurrence: Within the watershed, the best habitat for yellow-billed cuckoos appears to be found on private lands. There may be a few relatively-small isolated parcels of habitat occurring on the BLM lands.

Colorado River System Species

Colorado Pikeminnow

Status: The Colorado pikeminnow was listed as endangered in 1967.

Habitat: This fish evolved as the main predator in the Colorado River system. The Colorado pikeminnow is the largest cyprinid fish (minnow family) native to North America. The decline of the fish can be closely correlated with the construction of dams and reservoirs during the 1960s, the introduction of nonnative fishes, and the removal of water from the Colorado River system (USDI-FWS, 1992).

Potential Effects: Migration cues such as high spring flows, increasing river temperatures, and possible chemical inputs from flooded land are all factors that signal the onset of the reproductive cycle in Colorado pikeminnow. These factors, including high spring flows, are critical to maintain successful reproduction. In the summer, water flow requirements change, and a gradual decline of summer flows following spring scouring maintains the natural sediment transport equilibrium, prevents siltation of spawning substrate, aids downstream drift of larvae, and creates productive nursery areas. High flows in late summer and fall reduce availability of nursery habitat for young Colorado pikeminnow. Stable flows in the winter reduce ice scouring of the shoreline habitats that are used by overwintering adults and young (Tyus, 1989).

Any water depletions that would occur as a result of a project may affect, and is likely to adversely affect, the range, distribution, and reproductive success of the Colorado pike minnow, which has the potential to decrease the likelihood of the species' survival and recovery.

Humpback Chub

Status: The humpback chub was listed as endangered in 1964.

Habitat: The humpback chub inhabits narrow, deep canyon areas and is relatively restricted in distribution. Although this fish has been regularly found dispersed in the Green and Yampa Rivers, the only major populations of humpback chub known to exist in the upper Colorado River basin are located in Black Rocks and Westwater Canyons of the Colorado River (USDI-FWS, 1992).

Potential Effects: Humpback chub spawning occurs shortly after highest spring discharge. There may be competition between this fish and channel catfish (Tyus, 1989). Water depletion that would occur as a result of projects may affect, and is likely to adversely affect, the range, distribution, and reproductive

success of the humpback chub, which has the potential to decrease the likelihood of its survival and recovery.

Bonytail Chub

Status: The bonytail is listed as endangered. On January 22, 1988, a recovery plan for this species was established.

Habitat: Little is known about the biological requirements of the bonytail chub, as the species greatly declined in numbers in the upper basin shortly after 1960. Until recently, the FWS considered the species extirpated from the upper basin; however, a specimen which exhibited many bonytail characteristics was collected prior to 1992, possibly indicating that a small extant population exists. Large river reaches in the Colorado River are probably used by this species (USDI-FWS, 1992).

Potential Effects: This fish may exhibit the same water flow requirements as the Colorado pike minnow and the humpback chub; therefore, any water depletion that occurs as a result of a project may affect, and is likely to adversely affect, the likelihood of the reproductive success and survival of the bonytail.

Razorback Sucker

Status: The razorback sucker was listed as endangered in Colorado in 1979.

Habitat: The current distribution and abundance of the razorback sucker has been significantly reduced throughout the Colorado River system. The largest population of razorback suckers in the upper Colorado River basin is found in the upper Green River and lower Yampa River. Specific information on biological and physical habitat requirements of the razorback sucker is very limited, and habitat requirements for juvenile fish are also unknown (USDI-FWS, 1992).

Potential Effects: Spawning of the razorback sucker occurs with increasing flows associated with highest spring runoff. Curtailment of spring runoff in the mainstream Green River may be associated with loss of recruitment to the juvenile stage (Tyus, 1989). This fish may exhibit the same water flow requirements as these three fish listed above; therefore, any water depletions that occur as a result of projects may affect, and are likely to adversely affect, the likelihood of the reproductive success and survival of the razorback sucker.

Bald eagle is the only species that occurs within the watershed that was removed from the endangered species list since the previous assessment. This is accredited to the recovery efforts across the nation for the species.

BLM state sensitive species:

Many wildlife and plant species populations are declining, and though there may be many reasons for this, one of the causes of this decline is loss of suitable habitat from the landscape. The objective of the sensitive species designation is to ensure that the BLM consider the overall welfare of these species when undertaking actions on public lands and that these actions do not contribute to the need to list the species under the provisions of the Endangered Species Act. The lack of demographic, distribution, and habitat requirement information compounds the difficulty of taking management actions for many species.

It is the intent of the BLM state sensitive species policy to emphasize the inventory, planning consideration, management implementation, monitoring, and information exchange for the sensitive

species on the list in light of the statutory and administrative priorities. In 2010, the Wyoming BLM updated their sensitive species list.

The BLM state sensitive species occurring in the watershed include: Greater Sage-Grouse, Columbian sharp-tailed grouse, ferruginous hawk, white-faced ibis, long-billed curlew, burrowing owl, sage thrasher, loggerhead shrike, sage sparrow, Brewer's sparrow, white-tailed prairie dog, swift fox, Colorado River cutthroat trout, roundtail chub, bluehead sucker, flannelmouth sucker, bald eagle, pygmy rabbit, northern leopard frog and Gibbens' beardtongue. Species thought to occur within the watershed are: Baird's sparrow, boreal toad, great basin spadefoot. Wyoming pocket gopher, long-eared myotis, Spotted bat, Fringed Myotis and Townsend's big-eared bat.

Species Common Names	Scientific Name	Habitat
Greater Sage-Grouse	*Cenrocercus urophasianus*	Basin-prairie shrub, mountain-foothill shrub
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	Grasslands
Ferruginous Hawk	*Buteo regalis*	Basin-prairie shrub, grassland, rock outcrops
White-Faced Ibis	*Plegadis chihi*	Marshes, wet meadows
Long-Billed Curlew	*Numenius americanus*	Grasslands, plains, foothills, wet meadows
Burrowing Owl	*Athene cunicularia*	Grasslands, basin-prairie shrub
Sage Thrasher	*Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub
Loggerhead Shike	*Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub
Sage Sparrow	*Amphispiza billineata*	Basin-prairie shrub, mountain-foothill shrub
Brewer's Sparrow	*Spizella breweri*	Basin-prairie shrub
White-tailed Prairie Dog	*Cynomys leucurus*	Basin-prairie shrub, grasslands
Swift Fox	*Vulpes velox*	Grasslands
Colorado River Cutthroat Trout	*Oncorhynchus clarkipleuriticus*	CO River drainage, clear mountain streams
Roundtailed Chub	*Gila robusta*	CO River drainage, mostly large rivers, also streams and lakes
Bluehead Sucker	*Catostomus discobolus*	Bear, Snake and Green drainages, all waters
Flannelmouth Sucker	*Catostomus latipinnis*	CO River drainage, large rivers, streams and lakes
Gibbens' Beardtongue	*Penstemon gibbensii*	Sparsely vegetated shale or sandy –clay slopes 5,500-7,700'
Baird's Sparrow	*Ammodramus bairdii*	Grasslands, weedy fields
Great Basin Spadefoot	*Spea intermontana*	Spring seeps, permanent and temporary waters
Northern Leopard Frog	*Rana pipiens*	Beaver ponds permanent and temporary waters
Mountain Plover	*Charadrus montanus*	Short-grass & mixed- grass prairie, openings in shrub

		ecosystems, prairie dog towns
Bald Eagle	*Halacetus leucocephalus*	Primarily along rivers, streams, lakes and waterways
Pygmy Rabbit	*Brachylagus idahoensis*	Basin-prairie and riparian shrub
Wyoming Pocket Gopher	*Thomomys clusius*	Meadows with loose soil
Long-Eared Myotis	*Myotis evotis*	Conifer and deciduous forests, caves, and mines
Townsend's Big-Eared Bat	*Corynorhinus townsendii*	Forests, basin-prairie shrub, caves, and mines
Limber Pine	*Pinus flexilis*	Timberline and at lower elevations with sagebrush. Associated species are Rocky Mountain lodge pole pine. Engelmann spruce, Rocky Mountain Douglas-fir, subalpine fir, Rocky Mountain juniper, Mountain Mahogany, and common juniper.
Spotted Bat	*Euderma maculatum*	Cliffs over perennial water, basin-prairie shrub
Fringed Myotis	*Myotis thysanodes*	Conifer forests, woodland-chaparrel, caves and mines

Sensitive Mammal & Bird Species of concern additions or removals since the 2001 assessment

Pygmy rabbit is one wildlife species that was not addressed in the last assessment. Not until this species was petitioned several years ago for listing were surveys began to be conducted and habitat identified. This led to pygmy rabbits being found within the watershed. Loss of dense sagebrush habitat is the greatest concern for the species. Currently, not much is known about the level of disturbance this species can withstand, research is being conducted within the gas fields in this watershed to learn more about the tolerance and adaptability of the species.

Mountain plover is currently a Wyoming BLM sensitive species. This species is found primarily west of Highway 789 within the watershed in short grass/ saltbush habitat (saltbush steppe) on somewhat flat to gentile rolling topography, sometimes associated with prairie dog towns. Nest disturbance is the greatest concern for this species. BLM and oil and gas companies within the watershed worked together through the monitoring without borders program to identify and map potential and occupied mountain plover habitat within the Continental Divide EIS area. This information contributed to the USFWS decision to not list the bird. In addition, the BLM and USFWS worked together to develop stipulations for the protection of potential and occupied mountain plover habitat which are incorporated in the 2008 Rawlins RMP.

Wyoming pocket gopher is another species that was not considered in the last assessment. Not until this species was recently petitioned for listing were surveys begun to identify habitat and populations of the species. Thorough surveys have not been conducted yet within the watershed. It currently is not known if habitat exists in this watershed, although on-site inspections of proposed gas wells, roads and pipelines have not identified any areas with this species.

Limber pine was added to the sensitive species list since the last assessment. Limber pine has been undergoing a downward trend and it is estimated that approximately 50% of stands currently are dead

or dying in Wyoming. The major threats to the species include white pine blister rust, dwarf mistletoe, mountain pine beetle, fire suppression, and climate change.

Nelson's milkvetch which is found within the watershed was removed from the sensitive species after numerous surveys identified the species to be more common than previously thought across the state.

Greater Sage-Grouse – (See above)

Sensitive Amphibian Species

Great Basin spadefoot have been documented within the assessment area and occur within sagebrush communities. Spadefoots are adapted to arid habitats and burrow into soil to prevent desiccation, forage at night, and breed irregularly through the summer in response to periods of heavy rain.

Northern leopard frog sightings have been documented in all counties of Wyoming and this species has been documented in the watershed area. Northern leopard frog has been undergoing and is predicted to undergone a downward trend. Since the last assessment the northern leopard frog was petitioned for listing under the endangered species act of 1973 (as amended by the 108th congress) and in 2011, the USFWS determined that the listing was not warranted. The major threat to the species is loss and degradation of habitat from livestock grazing, urban development, oil and gas development, poor forestry practices, groundwater pumping, mining, invasive plant species, and non-native predators; diseases; road impacts, water pollution, air pollution, and effects due to climate change.

Sensitive Plant Species

Gibbens' penstemon **-** Survey and monitoring of Gibbens' beardtongue (*Penstemon gibbensii*) was conducted in 2007-2008 to update the status of the species in Wyoming as treated in two prior status reports. Data on new occurrences from intervening years were incorporated, a potential distribution model and photointerpretation were used as the basis for expanding systematic surveys, and one new occurrence was documented. The area of occupied habitat has been greatly expanded to 270 acres, but at least three of the six known occurrences have experienced significant declines in population numbers. The total population numbers in Wyoming are estimated at 6000-9000 plants. Prolonged drought appears to be responsible for the population declines in the state, as documented at two monitored sites and estimated at a third. Population declines exceed an order of magnitude at Cherokee Basin, where they appear to be associated with extreme erosion (WYNDD 2009). In 2008, the species was proposed for listing, however in February 2009 the species was found not warranted by the USFWS.

2) Issues and Key Questions:

(A) *Livestock Management*

a. Livestock competition with wildlife has always been a concern. Livestock compete with wildlife for forage, water, and space. Livestock management can affect species composition, vegetative health and production, and vertical and horizontal structure of habitats that wildlife depends upon. Tools used in livestock management, such as water developments, fencing, and treatments, may have positive and negative impacts depending on the species of wildlife, habitat requirements, or the cumulative impacts of these management tools. The most visible issue with livestock grazing is cattle impacts on riparian habitat. These areas support the greatest diversity of wildlife species and occur on only about one percent of the landscape; therefore, they must be managed for all beneficial uses. Sometimes unexpected impacts may occur by shifting livestock

utilization use patterns across the landscape to improve riparian areas. This shift may lead to increased forage utilization in areas that were once only used by wildlife, thereby shifting wildlife use patterns or reducing important forage for wildlife such as on crucial winter range. On the other hand, during droughts water improvements provide additional water for wildlife that may be essential to their survival.

b. Since 2001, riparian habitat analysis (PFC assessments) has demonstrated that the use of rotational grazing, implementation of new fencing and other range improvement projects including spring developments, wells and pipelines have led to substantial habitat improvements within most of the riparian areas (PFC documents located within the HDD, RFO Range Department) . In 2011, there still remain several grazing allotments that have still failed this assessment based on proper function and condition assessments. However, a majority of the allotments that have failed in the past assessment are now meeting standards. Improved riparian areas provide for more forage and cover for terrestrial wildlife as well as improved fisheries with more shade, improved stream banks for cover and reduced sediment loading leading to cleaner gravel bed for spawning.

c. During the assessment of the 2001 Upper Colorado Watershed fencing was addressed as an important issue. This included location, design, and cumulative impacts that fences can have on big game movements, migration corridors, and within crucial winter ranges. Within the last ten years 60 miles of older style design fences have been converted to the BLM standards within this watershed. In 2012, an additional 20 miles of fence will be converted. There still remain additional older style fences within the watershed that need to be converted. The BLM will continue to convert these fences based on prioritization criteria (i.e. migration corridors, fence corners, etc.) and as funding becomes available. Another issue regarding fences that was not addressed in the last watershed assessment was migratory bird collisions, especially Greater Sage-Grouse, with fences. Recent research has shown that Greater Sage-Grouse fence collisions occur under poor lighting condition in close proximity to Greater Sage-Grouse leks in the spring. Currently, all new fences within two miles of a lek (four in core areas) are being required to be marked with reflectors to make the fences more visible to the birds.

d. Water development in crucial winter range was an issue discussed in the previous assessment. Using water developments to better distribute livestock grazing in crucial winter range can reduce available forage for big game that previous was available. Livestock use within big game crucial winter ranges can directly affect the amount of residual forage left for big game. This may lead to increased losses of wildlife especially during severe winters when residual forage is essential for big game survival. There have been two sheep to cattle conversions along Muddy Creek, as well as shifting of sheep trailing out of this area, that should reduce competition for forage in the antelope and mule deer crucial winter range. There has to be a balance between wildlife and livestock numbers and the habitat that supports them.

(B) *Big Game and wild horse competition*

a. Second to livestock in directly competing with wildlife are wild horses, which occur in the western third of the evaluation area. While they don't tend to congregate around water sources as much as cattle, wild horses compete with wildlife on a year-round basis for water, forage, and space. During times of drought, which is the current situation, there is reduced forage and water and increased competition. Studies over the last ten years show that winter fecal data for wild horses identify a higher diet overlap with sheep, mule deer and antelope, rather than with cattle and elk.

b. Wild horse populations over the last ten years have varied from being within AML (610-800) to nearly 3000. Wild horse populations have been within appropriate management levels since the last wild horse gather in 2010. It appears that many horses relocated from the Adobe Town HMA into the Salt Wells HMA this last winter (2011-2012), likely due to drought conditions and lack of water. Human activity such as mineral development may also have influenced horse location. During drought years, wild horse numbers in Adobe Town were typically greatly above AML. Many of the grazing permittees have voluntarily taken non-use, reducing livestock use to an average of 18% of allowable use from 2002 through 2009.

(C) **Mineral***/oil and gas development /uranium/ renewable resources/wind projects & transmission lines)*

a. An issue that continues to expand within this watershed at a rapid rate is mineral/oil and gas development, both in the scope of area in which impacts occur and the scale, particularly with in-field drilling and coal bed natural gas. Wildlife concerns involve fragmentation of habitat, which breaks undisturbed vegetation into smaller and smaller units. This is usually caused by roads, pipelines, utility corridors, and other facilities constructed in or across previously undisturbed habitat. Road development also results in increased human presence or activity, either by industry or public recreation. Since 2001, the amount of road acreage within the watershed has doubled, mostly due to natural gas development. Wildlife may be negatively impacted by these activities due to increased stress, movement and energy loss during critical seasons, and total loss of habitat through avoidance of these areas (Sawyer et. al. 2011). With some species like Greater Sage-Grouse, noise and dust from industrial developments may also be an impact deserving greater recognition. In addition to the traditional forms of energy development, renewable energy projects plans of development are being considered for this watershed. This would also include the infrastructure to transport the electric power out of the state through large transmission lines. There is currently one proposed wind project within the watershed, Choke Cherry/ Sierra Madre. Choke Cherry/ Sierra Madre will consist of one thousand turbines in which 1 to 2 percent of the project will fall within this watershed. Two transmission lines are being proposed that will run through the watershed, Gateway South and Transwest Express. Both are 115 kV lines and Gateway South will be AC line while Transwest Express will be DC line. Once these two transmission lines are constructed, the watershed may see additional wind energy proposals that may tie into these lines. As wind projects are proposed and constructed within the watershed, wildlife will see continued habitat fragmentation from roads and turbine strings and there may be additional impact to bats and birds (including raptors) from turbine collisions. A new addition to energy development within the watershed is an exploratory uranium project located within the Poison Basin Mule Deer Crucial Winter Range (west of Baggs) called the Juniper Ridge project.

Habitat alteration and fragmentation can alter species composition as demonstrated in some of the energy development areas (Sawyer et. al 2001, Sawyer et. al. 2011). Since 2001, the watershed has seen an increase in the raven populations. Ravens are opportunists that take advantage of new food sources, such as increases in road kill animals and human trash, when the situation presents itself. Once habitat communities such as continuous sagebrush blocks of habitat are fragmented, predators and scavenger species take advantage roads and pipeline right of ways to hunt which may alter the dynamics of how other species continue to use the habitat. This may lead to increased nest predation, including Greater Sage-Grouse, from this species in association with increased human activities.

How can mineral development proceed without creating impacts to wildlife and their habitat? Should additional measures be implemented to reduce impacts from mineral development and associated recreational use, such as seasonal road closures in crucial winter ranges or requiring industry to use new technologies that may reduce disturbance and disruption to wildlife population even in situations that may be more costly? Can resources be developed in such a way as to minimize fragmentation of habitat?

b. In addition to increasing vehicular access by the public through road development, there is also an expanding off-highway vehicular impact from people driving their pickups, motorcycles, and three/four-wheelers anywhere they can. Whether for hunting, joy-riding, or collecting antlers, these activities can cause the same types of impacts to wildlife as described above: stress, energy loss with movement, and loss of habitat through avoidance of activity areas. Laws and enforcement cannot work everywhere at all times. How can members of the general public be educated or informed to make better decisions about where and when they use their off-highway vehicles?

c. Elk numbers within the Sierra Madre herd unit are well over the population objective of 4,100 animals, and the WGFD has implemented liberal harvest seasons and licenses to reduce the herd. It would likely be beneficial to reduce herd numbers and minimize elk use in the juniper woodlands and other deer crucial winter range habitat with the current levels of use by pronghorn and mule deer. Within twenty browse transects along Muddy Creek, elk pellet groups were first observed in 2000 along one transect, in 2011 pellet groups have appeared on 10 of 12 sites east of Muddy Creek. Vegetation treatments within the watershed include burning, cutting or mulching juniper, and chemical applications of tebuthiuron (at thinning rates) in mountain big sagebrush. The goal of these treatments has been to maintain or enhance the mountain shrub communities (mountain mahogany, bitterbrush, serviceberry, and snowberry) within crucial winter range. Monitoring data collected to date within juniper treatments have shown increases in plant cover and litter (personal communication with Mark A. Warren).

d. Big Game crucial winter range conditions (heavy browsing and juniper encroachment), have continued to be an issue of concern specifically within the Baggs, Savery and Poison Basin big game crucial winter range areas). Efforts over the last ten years within these three crucial winter ranges have focused on juniper removal to enhance habitat by allowing the understory vegetation to flourish. Removal of juniper reduces vegetative competition for water, nutrients and sunlight (personal communication with Mark A. Warren). It has been observed, however, that juniper removal in inappropriate locations (i.e., south facing slopes) can also increase cheatgrass

encroachment, decrease thermal cover and produce negative impacts to big game species.

e. Severe winters and summer drought conditions have had an impact on big game animals within this watershed over the past 10 years. During this period the area has experienced two severe winters and mule deer and pronghorn numbers have declined due to winter mortality. In addition the watershed has experienced several years of drought. The drought conditions have further led to increased competition for resources (forage and water) between livestock, wild horses and different species of big game. All of which may lead to lower recruitment rates, reduced body weight conditions of animals going on to winter range and an increased number of animals in poor health.

f. Healthy plant communities are an important component of supporting healthy wildlife populations. Plant diversity is one of the key components of supporting healthy wildlife populations. Diversity of plant species within communities and diverse amounts of plant cover and age structure lead to healthy diverse wildlife populations. Many plants, and plant communities, require some sort of disturbance, such as disease, fire, or climate change to provide the mechanism to set back succession and create diversity. Aspen and chokecherry are two species which require fire to stimulate regeneration and reduce competition from other species. Wildlife requires both early successional and late successional habitats in order to support the greatest number of wildlife species. The recent arrival of European settlement (200 +years) has led to the lack of fire or other forms of disturbance which can result in more late successional habitats with too many old plants and not enough young ones. The objective of resource managers within this watershed is to strike a balance between early and late successional habitats supporting as many T&E and sensitive species as the habitat will allow and to meet the demands brought upon the resources.

g. Mule Deer: The principal area that continues to not meet standard #4 is the mule deer crucial winter range located between Horse Mountain and Poison Basin and north from Baggs Wyoming, along Muddy Creek through the Wild Horse and Dad juniper woodlands. Observed habitat concerns in the mule deer crucial winter range include heavy to severe use of desired shrub species and low composition of forbs on deer ranges used first in the spring. Winter conditions were harsh that hit the Baggs area during the winters of (2007-2008) and (2010-2011). Heavy snow fall early followed by several warm ups and subsequent extreme cool downs left several layers of snow, topped with ice. The WGFD expected higher than normal mortalities with mule deer numbers falling below objectives.

h. Pronghorn: Pronghorn numbers within the Bitter Creek and Baggs herd units have been on the decline. The Bitter Creek herd unit has been declining in numbers for the past 10 to 20 years, while the Baggs herd unit has only showed severe declines in the 2007/2008 winter and this herd has shown recently that they are slowly recovering. There is a combination of factors as to the cause for the decline including two severe winters, several drought years, and an incremental increase in habitat fragmentation from energy development. This herd unit has seen significant increases in gas field development during the last 10 years with a projected increase of up to 15,000 more deep gas wells in the next 10-20 years. Currently there are three major gas fields in the herd with at least three smaller fields currently operating. While most of the drilling has been for deep gas, some smaller coalbed methane fields are starting to appear. While a single gas well impacts little habitat, several thousand wells and the related

infrastructure (roads and pad visits) are a major impact to the habitat and the animals, and hundreds of acres of habitat are lost each year (WGFD 2010 Annual Report). The Baggs herd also has seen a decline in numbers and is below herd objectives. The winters of 2007-2008 had an unknown number of pronghorn migrate over fences (due to deep snow) along Highway 789 into the Bitter Creek Herd Unit and were then unable to return because the snow melted and they were unable to cross fences. The southern portion of the Baggs Herd has not recovered from the 2007-2008 winter mortality and emigration. However the northern portion of the herd seems to have made a much better recovery. The WGFD currently estimates the population is below the objective of 9,000 pronghorn by about 2,000 (personal communication with Tony Mong, WGFD). Winter conditions were extremely difficult in 2007-2008 and 2010-2011. The winter of 2007-2008 had higher than normal snow fall and 2010-2011 saw high snow fall amounts, along with a warming period in December which led to layers of snow/ice making foraging for food difficult (WGFD 2010 Annual Report).

In addition, wild horse herd numbers have been above their AML within the last 10 years leading to potential competition for resources, specifically space and water, between pronghorn and wild horse. This may also be a contributing factor to the decline in pronghorn numbers.

i. Elk: Elk have been of recent concern with numbers exceeding well over herd objectives. The Sierra Madre Herd continues to be a very productive herd; however, the WGFD has stated that the herd has shown a 20% decline 3 out of the last 5 years (personal communication Tony Mong, WGFD). The Petition elk herd primarily occupies suitable habitats on Flat Top Mountain, Powder Rim, Kinney Rim, Rifes Rim, Black Butte, and Delany Rim. The population objective and estimate for this herd is about 300 animals (WGFD 2010 Annual Report). Based on changes in the watershed since 2001, the WGFD are evaluating elk herd numbers to determine potential adjustments to the population sizes. This elk herd is increasing and expanding and the WGFD has issued additional licenses for the 2012 hunting season to decrease elk numbers (personal communication Tony Mong, WGFD).

3) Current Conditions:

Since the first watershed assessment for the Upper Colorado River Basin was completed in 2001, there has been a substantial increase of monitoring data collected. Most of the data has been collected in reference to changes that have been observed in the watershed. The following discusses changes that have occurred due to the implementation of the Atlantic Rim Coal Bed Natural Gas Field Environmental Impact Statement (EIS) including mule deer, Greater Sage-Grouse, raven, and shrub-dependent song bird monitoring studies; the implementation of the Desolation Flats EIS and the Continental Divide/Wamsutter II EIS, the 2011 Browse Monitoring Trend Report-Lower Muddy Creek watershed; the Greater Sage-Grouse Framework Analysis-2001 through 2011; and the Wyoming State Highway 789 Underpass Project.

Atlantic Rim Coal Bed Natural Gas Field Environmental Impact Statement (EIS): In 2007, the Atlantic Rim Coal Bed Natural Gas Field Environmental Impact Statement (EIS) was signed. The EIS area lies to the east of Highway 789 from Rawlins to Baggs Wyoming. The record of decision included four upland wildlife performance goals to be addressed. These performance goals included the following: big game migration routes, big game crucial winter range, Greater Sage and Columbia sharp-tailed grouse habitat, and shrub dependent song bird habitat. In the spring of 2005, Phase I of a mule deer collaring project to identify migration routes began within the EIS project area by Hall Sawyer with West Inc. and as a Graduate student under Matthew Kauffman with the University of Wyoming. Upon completion of the

migration corridor identification study in 2007, Phase II of the study began which involved monitoring change in mule deer response along migration routes to gas well and road development from 2008 through 2010. (See the phase 1 and phase II reports (Sawyer 2008, 2011))for a detailed description of findings.) In addition, a vegetation analysis study was also completed comparing vegetation species composition between stop-over sites and transition sites within the migration corridors by West Inc.(Flaig 2011).

Greater Sage-Grouse is another species of interest within the watershed. In 2008, as part of the Atlantic Rim EIS monitoring requirement, a Greater Sage-Grouse telemetry study began to establish a sink/ source model quantifying habitat importance for population persistence of Greater Sage-Grouse within the Atlantic Rim EIS area. This study was based on the nesting and brood-rearing portion of the life cycle of the bird. The Thesis study was conducted by Christopher Kirol a University of Wyoming Graduate Student under Jeffrey L. Beck. (Refer to the Thesis report (Kirol 2012)). In addition, a winter habitat mapping is also under way with the University of Wyoming using BLM mapped bird locations collected from monthly telemetry flights collected over three years. (Report is not available at the time of this assessment). As part of this research a vegetation component of percent cover selected by nesting and early brood-rearing Greater Sage-Grouse in the area was established. Results showed that birds selected sagebrush with mean of 39 inches for nesting and a mean of 35 inches for brood-rearing.

Raven Study: An analysis was completed to determine the impacts of the common raven depredation on nests of the Greater Sage-Grouse. The study has been finalized. The objectives of the study were to compare avian predator densities, evaluate raven removal, and evaluate the effect of raven removal on Greater Sage-Grouse nest success. The analysis concluded that Greater Sage-Grouse nest away from avian predators, there are mixed results for raven removal by study sites, and the intensity and proximity of removal may increase Greater Sage-Grouse nest success.

Shrub-Dependent Song Bird Monitoring: The Atlantic Rim EIS also had a shrub-dependent song bird performance goal. Monitoring was established to tract trends in song birds across the EIS area. Currently, there are four years of data collected. While the data being collected is robust there have not been enough years of data collection to establish trend in song bird populations. What has been collected up to this date shows a stable population of song birds, which includes Wyoming BLM State Sensitive species of sage sparrow, logger head shrike, Brewer's sparrow, sage thrasher and mountain plover.

Desolation Flats EIS and the Continental Divide/Wamsutter II EIS: The *Monitoring without Borders* program has been ongoing within the High Desert District Rawlins Field Office (RFO) since 2000 for these two EIS area. Wildlife biologists implement the approach for monitoring potential impacts to wildlife and associated habitat from oil and gas operations. The program is a joint coordination effort among the BLM, WGFD, the USFWS, and industry (Anadarko, BP America, Conoco Phillips, Devon Energy Production Co., Double Eagle, Kaiser Francis Oil Co., Marathon Oil Co., Samson Resources Co., Yates, et. al.) to monitor the potential effects to wildlife and associated habitats from natural gas development, identify mitigation measures that may be required, and summarize the results of implementing proposed actions within numerous natural gas development areas. Species analyzed to date include the black-footed ferret, mountain plover, Greater Sage-Grouse, pygmy rabbit, raptor species, mule deer, and the Wyoming pocket gopher. The team focuses on identifying actions required to reduce and/or eliminate effects and implement monitoring to determine if these actions are effective. To date, monitoring efforts have provided data to support non-listing of the mountain plover and the Wyoming pocket gopher, as well as provided for joint efforts to monitor for the Candidate Greater Sage-Grouse and BLM sensitive raptor species.

The 2011 Browse Monitoring Trend Report-Lower Muddy Creek watershed: In 1988/89 BLM established twenty permanent big game trend study transects within mule deer and pronghorn crucial winter range along Muddy Creek north(eight to thirty miles) of Baggs, Wyoming. Highway 789 has a major effect on animal browsing. Animals west of the highway move to the south and west when winter conditions get worse, whereas, animals (particularly pronghorn) on the east side of the highway largely stay put. In the past all transects were averaged together, which was continued except at the end for utilization. Twelve sagebrush transects are on the east side and eight transects are on the west side. Also, in addition to averaging all data, data is presented by the number of transects trending up or down.

Results:	1988-1989	2011	Transect Trend
Wyoming Big Sagebrush Hits	52	72	16 Up, 3 Down, 1 Flat
Big Sagebrush Hits of Total Shrubs (%)	82	81	
Wyoming Big Sagebrush Cover Range(%)	6-24	6-23	10 Up, 10 Down
Wyoming Big Sagebrush Cover Average (%)	14.5	16.1	
Mature Big Sagebrush Plants (%)	71	59	5 Up, 15 Down
Young Big Sagebrush Plants (%)	5	18	15 Up, 3 Down, 2 Flat
Utilization of Wyoming Big Sagebrush (%)	57	49	72 East Hwy, 21 West Hwy
Dad Juniper Mountain Mahogany Hits	34	30	2 Down
Dad Juniper Mountain Mahogany Cover (%)	23	20	2 Down
Poison Buttes Juniper Mahogany Hits	23	20	1 Up, 1 Down
Poison Buttes Juniper Mahogany Cover (%)	11	7	2 Down

The principle change in the initial set of data above is the greater number of Wyoming big sagebrush plants and a shift in age class distribution that includes more young plants. The total percentage of mature and young plants (versus decadent and dead plants) is about the same. Although cover is up slightly, the even split between those transects increasing or decreasing depicts the varied results. The increase in cover is primarily seen in four transects (three on east side of highway) that snow in more due to aspect or elevation, and therefore, are not as available to browsing animals. Utilization continues to be much heavier on the east side of Highway 789 than on the west side. However, change in plant cover was evenly split up and down on both sides of the highway. A principle concern is the high level of utilization that is now being placed on young plants that are half (or less) the height of mature plants. Overall, sagebrush cover is staying about the same even with high use levels on the east side of the highway over the last 23 years.

The data for mountain mahogany as an understory component of Utah juniper woodland is from a very small number of transects (data available at the HDD, RFO). However, personnel observations in both these regions would indicate that where stands of mountain mahogany occur on south and west slopes in areas with high concentrations of mule deer, their condition is not particularly good. Plants are heavily browsed with many dead branches and few young plants. The bright spot of all observations is good leader growth of three to six inches on most plants the last couple of years, probably as a result of higher than normal precipitation.

Wyoming big sagebrush along lower Muddy Creek overlaps portions of both pronghorn and mule deer crucial winter range. The WGFD 1992 fecal analysis study in this area documented a 74% overlap in the winter diets of these two species. The location of most of these transects are likely to be more affected by pronghorn than mule deer, except for the closest ones to Baggs and mule deer migration corridors. Herd unit population objectives for pronghorn were raised on both sides of Highway 789 in the mid 1990's (data available at the HDD, RFO).

Greater Sage-Grouse Framework Analysis-2001 through 2011: As part of the watershed assessment, 30 Greater Sage-Grouse nesting habitat transects were established using the established protocol outlined in the 2010 Sage Grouse Habitat Assessment Framework that was originally drafted in 2001 (2 re-reads from ten years before) Since the BLM is required to manage for sensitive species wherever they occur, 20 of these transects were established in core area habitat (designated by the State of Wyoming) and 10 transects were established in suitable habitat outside of the currently designated core area habitat (Map #9). General criteria for locating transects was originally based on the first two criteria of the Assessment Framework protocol, which is the range in canopy cover and shrub height that greater sage-grouse were documented as using (in Wyoming from 2001 draft and later from National final in 2010). For the 30 transects evaluated, 27 were found to be meeting and three were found to be marginal in meeting the needs of nesting greater sage-grouse. The three marginal sites are lacking in desirable forb species and one site was lacking in new grass/forb growth height. All three of these sites exceeded the desired canopy cover and height of sagebrush; however, this is not unusual when compared to data for mountain big sagebrush. Twenty of the 30 transects exceeded the canopy cover range and 8 exceeded it for height, but would be in the range of data based on local research. For this reason, none of the transects were considered marginal if they met the local research data standards. In addition, nine transects were considered marginal for forb availability. A few sites just had very few forbs, and therefore, are marginal for this one parameter. However, a lot of the native forbs found in this area are not on the list, and a number of weedy or non-native species like alfalfa are on the list that are not a desired species of native rangelands. The three sites that were marginal were all in core area habitat. In addition, the 30 transects were located in 24 different allotments, and multiple transects within the same allotment were located in different pastures with varying livestock management. The two transects re-read were suitable habitat both times, but had both improved at the second reading (data available at the HDD, RFO).

In addition to these transects, part of the livestock grazing strategy in the Wyoming sage grouse guidance is to leave a patchy utilization pattern. Visually, this means that when you look at the community, there should be understory vegetation under some shrubs that has not been grazed or lightly grazed, in a patch work pattern across the landscape that will provide the adequate residual cover for nesting sage grouse.

Wyoming State Highway 789 Underpass Project: Since 2000 traffic levels have increased along Wyoming State Highway 789 north of Baggs, Wyoming. The first new highway underpass and five miles of eight foot fencing was completed in 2009. During the fall of 2009, winter of 2009 to 2010 and spring of 2010, there were an estimated 5,423 crossings using the newly constructed mule deer underpass (3,927 East to West and 1,496 West to East, data up to March 29, 2010). As anticipated, one major challenge that arose after the first year of the implementation of the crossing was an aggregate of mule deer that got "hung up" or did not immediately find the single constructed underpass. This was a very visible problem that led to complaints from the public. The WGFD, Wyoming Department of Transportation (WYDOT), LSRCD and the BLM have partnered to fund an additional underpass, and WYDOT is currently building a second underpass located in the southern region of the fence.

The Baggs Mule Deer Herd Unit area is one of few in Wyoming that supports deer harvest to manage deer numbers at objective levels. This is a reflection of the productivity of this deer herd and the quality

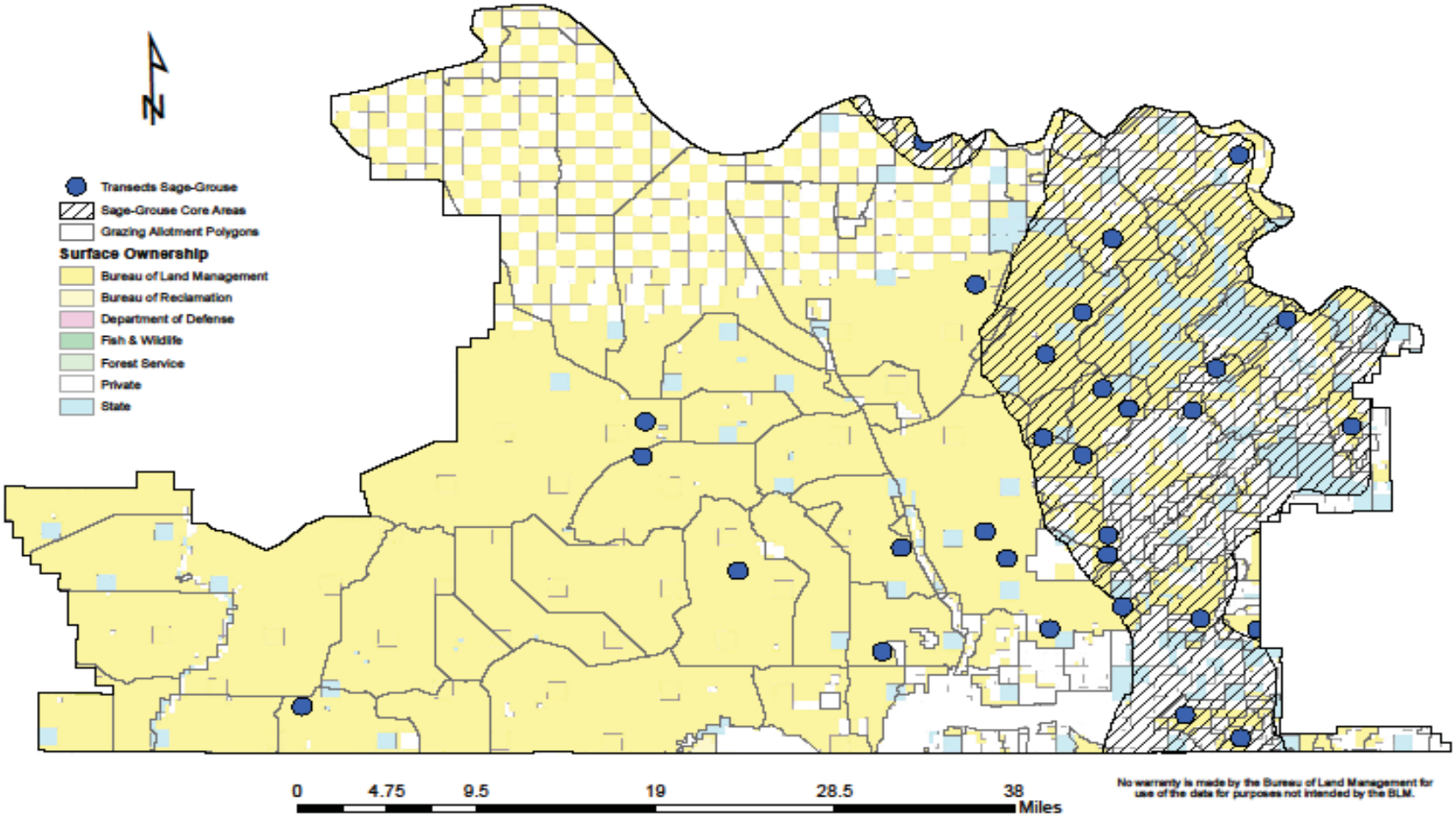
of spring/summer/fall habitat that supports them. As stated above mule deer did not meet standard #4 (Wildlife Habitat Health) in the 2001 Upper Colorado River Basin Assessment and continues to fail in this assessment. The area of concern is the crucial winter range located between Horse Mountain and Poison Basin and north from Baggs along Muddy Creek through the Wild Horse and Dad juniper woodlands. Although not all of this area is in poor condition and some vegetation treatments have occurred, the improvement is slow to occur due to natural succession, climate, and high big game numbers and browsing levels within this area. Crucial winter range further to the east and west were not identified because the habitat has higher vigor, improved species composition, and does not receiver heavy browsing on nearly an annual occasion. Habitat concerns within the area include: encroachment of juniper into shrublands, single species dominance by Utah juniper and big sagebrush species, mature-to- decadent-aged shrub communities, poor vigor, and heavy-to severe use of desired shrub species and low composition of forb on deer ranges used first in the spring. In the future energy development may compound the problem. Habitat treatments such as juniper removal and habitat reclamation are essential if the BLM is going to maintain this mule deer herd into the future. The LSRCD, BLM, and private landowners are beginning to focus more on juniper control, particularly where they are encroaching into shrublands in the vicinity of the Little Snake River valley. Recently completed treatments will need to be monitored to see if desired changes in plant composition are being achieved. Actions need to be taken to expedite shrub and forb recovery in crucial winter ranges in areas of energy development. In addition, additional deer highway underpasses in the area may be needed (following monitoring of the two completed underpasses) to provide for greater east-west movement by mule deer across Highway 789 and to improve their distribution and browse utilization.

Pronghorn numbers are down within the watershed. This in part may be due to several factors including two severe winters over the last two years, several years of drought, competition for forage (diet overlap) and water with wild horses and livestock, energy development, and climate change. Maintaining healthy habitat for pronghorn and reducing competition with feral horses and livestock is essential. Reclamation in energy development areas is essential if the BLM is going to maintain pronghorn herds into the future. Actions need to be taken to expedite shrub and forb recovery in crucial winter ranges in areas of energy development. Highway fences may also be a problem in the future for pronghorn east of highway 789 as energy development continues to grow. Let down fences in the future or maybe an overpass may be required for animals to move to the west.

PRONGHORN RESPONSE TO FENCE MODIFICATION AND ENERGY DEVELOPMENT ON CRUCIAL WINTER RANGE IN SOUTH-CENTRAL, WYOMING: The influence of oil and gas development on pronghorn habitat selection and migration patterns within the Atlantic Rim, desolation Flats, and Continental Divide/Wamsutter II EIS areas remains largely unknown. Evaluating the influences of energy development for pronghorn on winter ranges is particularly critical given that they occur at higher densities and encounter elevated energetic demands during this time of year. Better understanding these relationships will be very beneficial in providing information to assist in making future conservation and management decisions. A proposal to analyze potential impacts to pronghorn has been developed to evaluate and compare pronghorn population response to habitat use in relation to potentially impermeable fences in 1 control area and 2 study areas with differing densities of oil and gas well pads on crucial winter range in south-central Wyoming across 1 winter; identify areas of crucial pronghorn winter range in south-central Wyoming in 1 control area and 2 study areas with differing densities of oil and gas well pads where habitat effectiveness can be improved through fence modifications in summer of year 1; evaluate and compare pronghorn population response to habitat use in relation to modified fences in 1 control area and 2 study areas with differing densities of oil and gas well pads on crucial winter range in south-central Wyoming across 2 winters; and estimate pronghorn population survival in relation to fence modification in areas with differing densities of oil and gas well pads and in a control area without oil and gas well pads before and after modification.

Elk numbers of the Sierra Madre Herd Unit are well over objective. Wyoming Game and Fish is considering raising the elk herd objective. It would likely be beneficial to reduce the Sierra Madre elk herd numbers to a level were the habitat can support not only elk but other grazers as well. Elk diets are similar to cattle, with a preference for grass and forb species, but with increasing amounts of shrubs during the winter. The population of elk in this herd unit is also a reflection on the health of the habitat that supports them. Elk are more sensitive to human activities than pronghorn or mule deer, and may be displaced as energy development within the watershed expands in the future. WGFD Sierra Madre Elk Study: The WGFD has been analyzing elk use in the Baggs area. Collars were deployed on elk on Friday Feb. 17 and Saturday Feb. 18, 2012 and there was an adequate distribution of collars. No animals were injured during capture and the WGFD collared elk cows ranging in age from one year to older than ten years. The GPS collars are scheduled to get a fix every 1.5 hours from Nov. 16 to Sept. 14 and then during the main portion of the hunting season (Sept. 15 to Nov. 15) they will take fixes every 45 minutes. The collars are scheduled to drop off on in Dec. of 2014.

Map 9 - Greater Sage-Grouse Core Areas Habitat Monitoring Locations (Transects)



4) Reference Conditions:

Refer to reference conditions addressed in the 2001 Upper Colorado River Basin Rawlins Field Office Standards and Guidelines Assessment**.**

5) Synthesis and Interpretation:

Habitat conditions continue to improve within the Upper Colorado River Basin as a result of rotational grazing systems and vegetation treatments. Since 2001, PFC data has shown that the watershed has seen improvements on grazing allotments especially within riparian area as a result of implementing rotational grazing systems from season long grazing. Improvements within woody vegetation along riparian areas will provide additional forage and cover for wildlife. Increased vigor and health of grasses and forbs will protect streams and water sources within the watershed as well as provide additional forage and cover for wildlife. Vegetation treatments within the watershed include prescribed burning, chemical applications (Spike) and mechanical applications (Juniper removal) to create mosaics in even age stands of sagebrush. In addition, this improves the forb and grass components of the habitat by removing competition from the shrub over story and also creates edge effect for wildlife. Juniper removal on north and west slopes within big game crucial winter range opens up the understory and releases mountain shrubs that are competing with Juniper for moisture. Juniper stands on southern slopes are left to provide cover for big game.

Of greatest concern, within the watershed is habitat fragmentation caused by the increase of energy development to include new roads, well pads, pipelines, and transmission lines projects which re-distribute wildlife use areas and may interfere with migration corridors; as well as future wind development, livestock use in identified grazing allotments and fences.

Energy development has occurred and will continue to occur within the watershed. The BLM and WGFD have worked together for many years to identify and monitor lek locations, and protect them from past and continued energy development disturbance with management actions. In addition, the RFO has focused on the seasonal needs of this bird, from winter habitat to late brood-rearing habitat in or adjacent to riparian areas, to more recently evaluation of nesting habitat. Winter habitat has been identified in part since the late 1990's (when conditions permitted), as part of pre-project development for both energy development and vegetation treatments. These areas have then been avoided or mitigation measures applied to minimize impacts to Greater Sage-Grouse. Research has also been conducted as part of the Atlantic Rim Natural Gas project to better define the attributes of selected winter habitat to identify and protect other similar habitat that may be important to this species. The Greater Sage-Grouse Core Habitat areas were established by the State of Wyoming in an attempt to keep the bird from being listed. A team of professionals and stake holders were put together by the governor of the state to establish areas where Greater Sage-Grouse might be protected based upon the highest densities of birds on leks during the breeding season. The team also removed areas in potential Core Habitat where development was or would be occurring from further consideration. This watershed contains several large oil and gas EIS areas which contain high concentrations of Greater Sage-Grouse leks and excellent habitat. Since these leks occur within EIS areas they will not be afforded the protections of leks within the core areas. The BLM is currently honoring the State of Wyoming designated Core Habitat areas and is in the process of amending all of the resource management plans within the state to comply with the Core Habitat area concept.

One concern with the Core Habitat area concept is that it was based on nesting and breeding habitat alone and did not take into consideration the other parts of the bird's life cycle such as winter habitat. Research on the Atlantic Rim EIS has shown that not all the birds in this watershed are non-migratory. Birds in the southern half of the EIS area are migratory and spend their winters south of the Little Snake River in Colorado some 20-plus mile away. This brings up the question of whether birds in these Core Habitat areas are migratory or not and whether the Core Habitat areas provide all the needed protections to sustain the Greater Sage-Grouse populations? Another question is how much genetic interchange is occurring between Greater Sage-Grouse populations and how will the Core Habitat concept affect this over time? The BLM still needs to provide protections outside of Core Habitat areas to maintain healthy populations within this watershed as well. The Atlantic Rim EIS boundary is much larger than what the project proponents are planning to develop. Therefore, in the future, expanding the Core Habitat area should be considered for the northern and southern portions of the Atlantic Rim EIS area.

Mule deer habitat concerns within the area include encroachment of juniper into shrub-lands (single species dominance by Utah juniper); mature-to- decadent-aged shrub communities; poor vigor and heavy-to severe use of desired shrub species; and heavy mule deer use in the early spring resulting in low composition of forb species. Continue energy development may compound these problems.

Pronghorn numbers are down within the watershed and may, in part, be due to several factors including two severe winters over the last 10 years, several years of drought, energy development, and climate change. Successful reclamation in energy development areas, including the expediting of shrub and forb recovery in crucial winter ranges, is essential if the BLM is going to maintain pronghorn herds into the future.

Elk are more sensitive to human activities than pronghorn or mule deer, and may be displaced as energy development within the watershed expands in the future.

Current and future wind development projects that are located within the watershed will continue to add impacts to a diversity of wildlife species. The Choke Cherry/ Sierra Madre project, the Gateway South and Transwest Express transmission lines, and future wind energy projects will continue to cause habitat fragmentation and disruptive impacts that will negatively affect wildlife species. The watershed has been identified as an area of high wind potential and the implementation of several transmission line projects may encourage future development. In addition turbine collisions will continue to impact both bird and bat species. Monitoring will be required and adaptive management applied to reduce impacts to these species. This is a new field of development and research and continued monitoring will be changing as diverse needs reflect to minimize identified impacts to species within the watershed.

Livestock use can impact riparian habitats and the management of riparian habitat has been a priority of the RFO for over 25 years, with the concept that improved riparian habitat will benefit all resources. This is particularly true for Greater Sage-Grouse, which primarily use these areas for brood-rearing in the late summer and fall. The long-term improvement in function, stability, and species composition of riparian habitat following changes in livestock management is illustrated in the photos and descriptions within this document. However, as sedges and grasses respond to this improved management, it is important to manage for retention of succulent forbs as a component of these plant communities that are sought out by Greater Sage-Grouse. Draft descriptions of desired Greater Sage-Grouse nesting habitat were originally identified in 2001 by Holleran and Rinkes, with similar final descriptions located in the 2010 Sage-Grouse Habitat Framework Assessment. Past and recently established transects followed the protocol in these documents, and as modified by the recent research in this area (Kirol and Dinkens) relating to higher canopy cover and height selected by Greater Sage-Grouse in mountain big sagebrush plant communities. These transects were placed in habitat within and outside of the Core Habitat areas, and in various allotments and pastures with different management strategies, to evaluate in a representative manner, if current grazing management was providing adequate nesting habitat for Greater Sage-Grouse. The data from these transects would support that livestock grazing management is in most cases, providing new and/or residual plant cover and composition to support the needs of nesting Greater Sage-Grouse. Although there is riparian habitat that still needs to improve, and continued monitoring of livestock management to make adjustments as needed, the current approach by RFO described above appears to be meeting the seasonal requirements of Greater Sage-Grouse. These actions provide habitat for other species as well such as neo-tropical migratory birds, small mammals, amphibians, and big game species.

Pronghorn in this watershed may be affected by severe winters, drought, competition for forage and water with excessive numbers of wild horses, and energy development. Maintaining the number of wild horses at AML in the future is critical, while evaluating this and other factors upon antelope. Research is beginning to look more closely at antelope distribution and movement within energy development areas. Reliable water sources in low elevation areas could be developed to help animals survive (or maintain better distribution) through drought years. The primary vegetation concern is the overlapping crucial winter range with mule deer along Muddy Creek with high browse utilization, which will need continued monitoring.

The Sierra Madre elk herd has grown to a population four to five times that observed in the early 1980's, with monitoring needed with elk numbers closer to population objectives to determine vegetation carrying capacity. The population of elk in this herd unit is also a reflection on the health of the habitat that supports them. Vegetation

treatments over the last 25 years have promoted more grass and forb composition, as well as rotational livestock management that also improves herbaceous plant vigor and over, which benefit elk. The most visible sign of this is the increased presence of basin wildrye along drainages and in canyons where additional moisture occurs. Basin wildrye and bluebunch wheatgrass found on steep south and west-facing slopes that stay open in the winter, both are more stiff grasses that stay upright and more available to elk as forage during the winter. Improved forage on uplands as well as in riparian habitat have helped support the growth in the Sierra Madre elk herd. The BLM needs to work with the WGFD to assess and compare the elk level changes from the Study of Elk in the Little Snake River Known Recoverable Coal Resources Area (KRCRA) of Southcentral Wyoming (Ward 1985) completed during the early 1980's to the current situation by repeating this Study's trend vegetation composition analysis, assessing utilization levels, and elk fecal analysis. In addition, monitoring needs to be completed to distinguish livestock utilization from elk utilization to better evaluate species composition and diet selection to determine what the habitat can sustain, especially during drought situations. Also, further understanding is needed within the watershed when it comes to competition between elk and mule deer for space especially where crucial winter ranges overlap.

Fences also continue to be an issue relating to big game movement and bird collisions, including that of the Greater Sage-Grouse. Coordination with the WGFD and use of research data on deer migration corridors have led to the completion of fence modification (primarily on public land) on the eastern approaches to the highway underpass north of Baggs and west along Powder Rim for 30 miles. The two principle areas that still require additional fence conversions are the Grizzly and Powder Rim allotments, both of which were historical large sheep allotments and have had about half of their fences converted in the more critical areas. In addition, there are short stretches of fence in the Badwater and Sulphur Springs allotments that have been identified for conversion. Other lower priority conversions would consist of replacing the bottom barbed wire on four-wire fences with a barbless wire. There have also been several areas where fence conversion to a wood post and rail-top design was used to make fences more visible and reduce injury to animals crossing them. Monitoring of the effectiveness and maintenance of this fence design should occur in future years to evaluate whether additional fences of this type of fence conversion should be considered. Also, fences are being marked with reflectors to make them more visible to reduce collisions, part of this is in coordination with implementation of the NRCS/permittee Greater Sage-Grouse programs.

With the second highway underpass completed in 2012 north of Baggs, additional deer highway underpasses in the area may be needed (following monitoring of the two completed underpasses) to provide for greater east-west movement by mule deer across Highway 789 and to improve their distribution and browse utilization. Highway fences may also be a problem in the future for pronghorn east of highway 789 as energy development continues to grow. Let down fences in the future or maybe an overpass may be required for animals to move to the west.

6) Recommendations:

Habitat needed to support healthy wildlife populations and listed or proposed threatened and endangered species are generally in good or acceptable condition. Composition of native plant species is good and photos and other data show improving condition of both upland and riparian plant communities that support wildlife and species of interest. Vegetation treatments in a portion of the mountain big sagebrush, mountain shrub and aspen communities have begun to diversify the species, age-class, and structure of plant communities that will benefit and support healthy wildlife populations. On the other hand, energy development continues to reduce or modify native habitats, particularly habitat fragmentation through the increase in roads that reduce habitat value for wildlife. Due to mostly positive trends observed in riparian and upland plant communities, and the current knowledge of wildlife and listed or proposed threatened and endangered species in this watershed, the majority of the Upper Colorado River watershed is meeting Standard #4 with respect to wildlife. The principal area that is not meeting Standard #4 for wildlife is the mule deer crucial winter range located between Horse Mountain and Poison Basin and north from Baggs along Muddy Creek through the Wild Horse and Dad juniper woodlands (See Map #6). This area encompasses about 40,000 acres of public land. Although steps have been taken to improve habitat values in this area, there is still more actions to be taken and time allowed for long-term habitat improvement. Livestock grazing is not a principle factor in the non-attainment of this Standard. The following recommendations address actions to help meet this Standard as well as future desired conditions:

1. Mitigate pronghorn ranges lost or negatively impacted by energy development including converting fences to pronghorn friendly fencing.

2. Develop research focusing on fence impediments and the effects of gas/oil production on pronghorn behavior and survival.

3. Manage wild horses at population objectives within the Adobe Town HMA.

4. Evaluate migration and movements between Colorado and Wyoming with WGFD for Mule Deer, Elk and pronghorn.

5. Continue to gather additional seasonal distribution data as additional gas development occurs.
6. Start to explore potential research objectives to address habitat fragmentation in partnership with BLM and Industry. Base line data will also be useful if/when wind energy development occurs.

7. Continue to develop partnerships with gas companies for research and mitigation.

8. Evaluate the loss of animal unit months (AUM's) from energy development disturbances (roads, well pads, wind turbines, etc.) and possibly adjust allotment forage allocations for livestock and wildlife.

9. Development of Habitat Management Areas (HMAs) and Areas of Critical Environmental Concern (ACECs) for further guidance of management.

10. Evaluate impacts to Raptors and migratory birds from future wind projects.

Fisheries: Aquatic Populations and Viability

1) Characterization:

Crucial aquatic habitat areas for both sensitive native fish species and recreational fisheries occur on substantial portions of BLM administered lands within the assessment area (WGFD 2010a). Crucial aquatic habitat areas include the Upper Muddy Creek watershed, Hell Canyon Creek, and Upper Dirtyman Creek. These crucial habitat areas also provide recreational fishing opportunities with the exception of the lower portions of Muddy Creek. Recreational fishing opportunities within the area are specific to Salmonid (trout and salmon) fishing. Recreational streams include the headwaters of the Muddy Creek watershed, and Savery Creek and its tributaries although only small portions of these streams occur on BLM administered lands. Other recreational fishing opportunities include High Savery Reservoir (22,432.9 Acre-Feet), constructed in 2005, and numerous small Impoundments distributed throughout the assessment area**.** However, based on the descriptions below, there is now a broader approach to fisheries and habitat management for both cold and warm-water fish species.

BLM Sensitive Fish Species

Colorado River Cutthroat Trout

The Colorado River cutthroat trout (CRCT) is a BLM sensitive fish species that historically occupied cold-water habitats within the Colorado River basin in Wyoming, Colorado, Utah, Arizona, and New Mexico. This range likely included portions of large rivers such as the Green, Yampa, White, Colorado, and San Juan Rivers as well as small headwater streams. CRCT evolved in the absence of other trout species. This evolutionary path has left this subspecies, like other inland forms of the species, vulnerable to hybridization with rainbow trout and to displacement by brook trout and brown trout (Behnke 1992). Currently CRCT occupies less than 13% of its historic range in Wyoming (Young 2008). Since

the last assessment the CRCT was petitioned for listing under the Endangered Species Act of 1973 (as amended by the 108th congress) and in 2007, the USFWS determined that the listing was not warranted.

Land use practices that may affect populations of CRCT including overgrazing (Binns 1977), willow spraying (Little Snake River Working Group 1994), removal of beaver, heavy metal pollution (and water depletion and diversion (Oberholtzer 1987, Quinlan 1980), Since the last assessment, two new CRCT management guidance documents have been released including: (1) Conservation Agreement for Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*) in the states of Colorado, Utah, and Wyoming (CRCT Conservation Team 2006a) and (2) Conservation Strategy for Colorado River Cutthroat Trout (*Oncorhynchus clarkii pleuriticus*) in the states of Colorado, Utah, and Wyoming CRCT Conservation Team 2006b) The goals and objectives of this conservation agreement and strategy currently guide management of CRCT in the states of Colorado, Utah, and Wyoming.

Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub (Three Species)

Since the last assessment, conservation and management of the Bluehead Sucker, Flannelmouth Sucker, and Roundtail Chub (collectively referred to as the "Three Species") has become a range wide priority. Currently management of the three species is guided by the Range-Wide Conservation Agreement and Strategy for Roundtail Chub *Gila robusta*, Bluehead Sucker *Catostomus discobolus*, and Flannelmouth Sucker *Catostomus latipinnis* (Utah Department of Natural Resources 2006). In addition, several studies researching the three species were conducted in the Muddy Creek watershed. Bower (2005), conducted the first study identifying Distributions and habitat associations of bluehead suckers, flannelmouth suckers, and roundtail chubs in the upper Muddy Creek watershed. This study identified a "core population" within the upper portion of the upper Muddy Creek watershed and also identified a strong association of native fish species occurrence in pools with rock substrates. The second study looked at the fish assemblage within the lower portion of the Muddy Creek watershed (Beatty 2006). Results from this study indicated that native fish migrate into Muddy Creek from the Little Snake River and that lower Muddy Creek is dominated by non-native fish species. A third study was completed that conducted a population estimate for the three species in the upper portion of the Muddy Creek watershed, identified barriers to fish movement, and determined that non-native white suckers were the most abundant species in the watershed (Compton 2007).

Other Fish Species

Additional non-sensitive fish species that occur on BLM lands throughout the watershed include brook trout, brown trout, tiger trout, common carp, creek chub, fathead minnow, kokanee, mottled sculpin, mountain sucker, mountain whitefish northern pike, plains killifish, rainbow trout, redside shiner, sand shiner, speckled dace, and white sucker.

Summary of Fish Management

The Muddy Creek watershed has been identified by state and federal agencies as a high priority watershed for conservation of aquatic organisms, especially native Colorado River Basin fish species (BLM 2008, WGFD 2010a). Numerous conservation projects to improve native fish habitat have been or are in the process of being implemented as part of the large conservation effort between the Bureau of Land Management (BLM), Little Snake River Conservation District (LSRCD), Trout Unlimited (TU), Wyoming Game and Fish Department (WGFD) and private landowners. These efforts have included fish passage, non-native fish removal, and riparian enhancement projects.

Since the last assessment, several fish barriers were constructed to help conduct non-native fish removal efforts. As a result of these removal efforts, native fish assemblages have been restored in all of Littlefield Creek, East Muddy Creek, and the main-stem of Muddy Creek to just above the confluence with McKinney Creek. To date, approximately 31 miles of stream within the Muddy Creek watershed have been chemically treated to remove non-native fishes. Of the 31 miles of treated streams, 11 miles were stocked with native Colorado River cutthroat trout in the fall of 2001 and annual stockings have occurred in the treated area since.

To improve fish habitat, there have been several efforts to increase beaver activity within the watershed through supplemental aspen feeding. These efforts have resulted in increased beaver dam activity and colonization.

In 2010, the first major fish passage project to reconnect fish habitat was completed. Improper sizing and placement of a culvert/road crossing across Muddy Creek led to vertical stream instability downstream of a culvert, causing down-cutting and head-ward erosion. As a result of this instability, a vertical drop and large plunge pool formed which inhibited fish passage and degraded riparian habitat downstream of the culvert. In order to expand native fish population and reconnect important habitat the culvert was removed and a new channel was constructed to allow fish passage (Standard #1 – page 4 photo). This project was a continuation of an effort started in 2007 when the BLM approved and constructed a new road crossing upstream of the existing culvert. There are approximately 15 additional fish barrier structures that have been identified in the watershed that will require future management actions.

2) Issues and Key Questions:

Although there are numerous concerns with the fish assemblage in the assessment area, competition and hybridization with non-native fish species is the largest threat to BLM sensitive fish persistence. On February 3, 1999, Executive Order 13112 on Invasive Species was signed. This order directed federal agencies to:

> "use relevant programs and authorities to: (i) prevent the introduction of invasive species; (ii) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them…" as well as "…not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions."

To this point, non-native fish removal efforts have been successful at maintaining and restoring native fish assemblages throughout portions of the watershed until more permanent actions take place. Additional fish barriers are needed, methods for salvaging and holding native species during chemical treatments needs to be honed, and a series of chemical treatments to remove non-native fish need to take place. The key question is "will non-native fish removal efforts be completed in a manner that is timely enough to maintain suitable abundances and genetic diversity of three species populations throughout the Muddy Creek drainage to provide the necessary resources to successfully repopulate the watershed following reclamation efforts"?

Although temporary and site-selective prevention of upstream fish movement is necessary to meet fish management objectives in the drainage, there are numerous barriers to upstream fish migration that are not serving to meet management objectives and that subsequently fragment fish habitat. As early as the 1850s, pioneers reported having to ford cut-banks and battle sagebrush along the banks of Muddy Creek. Some suspect that over-trapping of beaver may have resulted in dam failures and destabilization of stream habitats. These conditions were likely further complicated by a high level of livestock utilization with in the watershed. Consequently, Muddy Creek experienced channel incision, diminished water tables, increased erosion, and vertical adjustment of the creek channel. To address this degraded channel condition, galvanized sheet piling structures were installed with the intent of raising the water table, slowing down flow, and aggrading the incised and degraded channel of Muddy Creek. Although the installation of these structures has improved the riparian condition of Muddy Creek, they did not consider the upstream passage of aquatic organisms. In order for native fish to move freely throughout the Muddy Creek watershed, these structures must be removed and the stream reclaimed to allow fish passage. The biggest issues with habitat fragmentation is "what is the

most cost effective way to create fish passage and maintain the function/purpose of the exiting grade control structure"? In addition, consideration should be given to prioritizing the opening of passage with a risk assessment of how increased movement potential could impact native fish restoration efforts.

For a summary of energy development activities within the watershed, refer to the section "Management Changes between 2001 and 2011. Impacts to fisheries are typically related to surface disturbing activities that can lead to increased sedimentation and changes in the hydrology of the watershed. Careful consideration should be given to the season of livestock use, and stocking rates as surface disturbance from energy development increases. Another issue or concern associated with fisheries and energy development is the use of produced water from CBM production. Currently, the majority of produced water is re-injected into aquifers lower than the aquifer it is being extracted from. Additional information is needed to determine the beneficial and negative impacts to the watershed if this water is to be used on the surface.

Since the last assessment the road network has increased substantially, having nearly doubled in some areas. This expansion of road networks is mainly attributed to increased energy development in the assessment area. The design of an effective transportation network within the assessment area that considers the effects of road design criteria on fish habitat conditions and the benefits of increased public access to popular recreational fisheries should become a major focus of land management activities within the assessment area.

Transportation management planning to remove duplicative or unnecessary roads should be considered to reduce impacts. In addition, designing road crossings that simulate natural stream processes would allow for the passage of aquatic organisms and allow fish to move freely among required habitats. This can be accomplished by using a number of designs including bridges, bottomless culverts, and baffled culverts. Road designs should also consider energy dissipation and appropriate drainage in order to limit the concentration of overland flows and resulting sedimentation.

The potential impacts of livestock grazing on stream processes and fish habitats have been well documented (Armour et. al 1994, Belsky et al. 1999). They include the loss of stabilizing riparian vegetation which can lead to stream instability and an associated loss of habitat complexity, the loss of shading vegetation which can lead to elevated stream temperatures, increased sediment delivery, and loss of stream channel complexity provided by fluvial processes and woody debris. Rest or deferment from grazing has resulted in vast improvement in many locations of stabilizing banks with sedges, rushes and grasses. Willows in this area are all bunch-type species that reproduce by seed and require bare ground areas in which to establish. With the expansion of sedges and other herbaceous species, and lack of disturbance for creation of bare areas for seeding and establishment of new willows, the overhead shading and bank stabilization provided by these species is still lacking. Plantings have occurred with varied success, but this is a slow process for re-establishment of woody species. In general, there is a need for more woody riparian plants and improved aspen stands throughout the watershed.

Directly related to the need for more woody riparian plants and aspen is the need for beavers. Beaver activity can have several benefits to aquatic ecosystems including elevated water tables that enhance riparian vegetation, reduction of stream water velocities that reduce erosional forces, stabilization of stream flows throughout the summer and droughts, improvement of fish habitats, and improvement of terrestrial wildlife habitats (Olsen and Hubert 1994). The historic distribution of beaver colonies throughout the assessment area is unknown, but is an important component of fish habitat given the stream types in the watershed. Limited availability of aspen and willow in the majority of the assessment area does limit the suitability of the area for beaver colonization. Determining how much beaver activity the watershed can support while increasing woody plant species should be evaluated.

Current distribution of warm-water fish species shows habitat use into lower McKinney Creek and well up Muddy Creek toward the confluence with Littlefield Creek. Historic sightings of "speckled trout" by Stansbury in 1850 were made at the lower end of Muddy Creek canyon by Alamosa Gulch. As riparian habitat continues to improve in the upper watershed (including cooler temperatures and more competition with trout), will the management reaches critical to the support of warm-water fish species need to be adjusted further downstream, and will this put them at greater potential impact from energy development in the lower portion of this watershed?

3) Current Conditions:

Since the last assessment, a large effort has been placed in identifying general life history characteristics and distribution of sensitive fish species in the watershed. Bower (2005), identified the distribution and habitat associations of the bluehead sucker, flannelmouth sucker, and roundtail chub in upper Muddy Creek. Another study looked at the fish assemblage and spawning migrations of fish in lower Muddy Creek (Beatty 2005). A third study conducted a population estimate and looked at the impacts of fish barriers in upper Muddy Creek (Compton 2007). From the information collected from these cooperatively funded research projects, management efforts to remove non–native fish species and reconnect fragmented habitat have been the management focus in the Muddy Creek watershed. Over 30 miles of headwater streams in the Muddy Creek watershed have been chemically treated to remove non-native fish species. In addition, the WGFD has initiated a large effort to mechanically remove non-native fish in the lower portion of the watershed (WGFD 2009, 2010, and 2011). The Muddy Creek watershed contains one of the last intact, viable native Colorado River fish assemblages found throughout the four species' (including CRCT) historic ranges. Although native roundtail chub, bluehead sucker, and flannelmouth suckers can be found throughout warm water portions of the watershed including Muddy Creek, Savery Creek, and the Little Snake River, Conservation efforts are focused on portion of the upper Muddy Creek watershed. Rational for prioritizing sub drainages and focusing on headwaters is spelled out in WGFD administration report (Senecal et al. 2010 and the Short-term Plan for the Three Species in the Green River Drainage of Wyoming; 2009-2014.

In the lower Muddy Creek watershed, general questions about fish assemblages and distribution have been answered but conservation efforts for BLM sensitive fish species are limited. This is likely a result of the high number of non-native species that occur throughout the wetlands (Beatty 2005) and the top down restoration approach that is being taken. This portion of the watershed is also influenced by the majority of energy development within the assessment area. Consequently management is primarily mitigation (e.g., BMP's) of impacts associated with energy development. The tributaries to lower Muddy Creek also support fish assemblages dominated by non-native species. One area of particular concern is a large head-cut on Wild Cow Creek that is actively degrading the channel.

In 2001, the CRCT was reintroduced to approximately 11 miles of its native range in Littlefield Creek. Since 2001, CRCT have also been re-introduced into the main-stem of Muddy Creek and over 30 miles of stream in the Muddy Creek watershed now contain wild, native CRCT populations. Non-native brook trout still occur in McKinney Creek and its tributaries. Future management efforts will aim to restore CRCT to this portion of the watershed as well.

A pure population of CRCT can also be found in Hell Canyon Creek within the Little Snake River watershed, as well as many streams draining the MBNF. New fish barriers to protect genetically pure CRCT in Dirtyman Creek and Hell Canyon were constructed in 2012.

Since the last assessment, portions of the Loco Creek drainage have also improved. Sampling in 2011 indicated a cold-water fishery in the lower portion of the watershed and a warm water fish assemblage in the upper portion of the watershed. The cause for this reverse assemblage is likely attributed to the lack of woody riparian plants in the upper portion of the watershed and the vast increase in cottonwood and willow in the lower portion. A small head-cut is also located in the headwaters of loco creek, although it doesn't appear to be actively moving at this time.

Recreational fishing opportunities in the assessment area expanded with the construction of High Savery Reservoir and the associated tail-water fishery. Savery Creek below High Savery Reservoir is still adjusting to the new flow regime associated with water releases from the reservoir and consequently water temperatures and in-stream habitat are limiting productivity of the fishery. Numerous small streams and impoundments throughout the watershed provide recreational salmonid fisheries.

4) Reference Conditions:

Colorado River Cutthroat Trout
The distribution and abundance of CRCT have declined from historical levels (Martinez

1988, Binns 1977, Behnke and Zarn 1976, Young 2008). It has been stated that CRCT currently occupy less than 13% of their historical range in Wyoming (Young 2008). Within the Muddy Creek watershed, historical accounts of "speckled trout"(CRCT) date to 1850. Reference was also made to beaver dams at short intervals in the vicinity of the "speckled trout."

Catostomid and Cyprinid Fishes

By comparing the results of surveys completed in 1965 by Dr. George T. Baxter with those completed during 1995-1996, Wheeler (1987) was able to determine distributional changes of fishes in Wyoming west of the Continental Divide. Each of the species native to the Muddy Creek and Little Snake River watersheds were found to be in various stages of decline throughout their range in Wyoming. Three of these species, the bluehead sucker, flannelmouth sucker, and roundtail chub, were restricted to a fraction of their native ranges in Wyoming. These species have also experienced a dramatic decline in distribution and numbers range-wide. Mountain sucker are also showing early signs of decline. The non-native white sucker and creek chub had greatly increased its geographic range in western Wyoming between 1965 and 1996.

5) Synthesis and Interpretation:

After suffering from periods of instability, habitat conditions within the upper Muddy Creek watershed continue to improve as the result of rotational grazing systems, barrier removal, spawning habitat enhancement, and head-cut stabilization. The implementation of rotational grazing systems in the Little Snake River watershed has also resulted in marked improvements in stream habitat conditions. Though much time and effort has been spent on the restoration of CRCT habitats, this work can be viewed as ongoing. In addition to CRCT efforts, similar conservation efforts are being made for bluehead sucker, flannelmouth sucker, and roundtail chub. There is still a large amount of work to be done to remove non-native species and re-connect habitats by removing barriers to enable fish movement and genetic exchange.. There is also work to be done to increase the amount of woody vegetation in these streams in order to increase stream shading and habitat complexity. The management of streams in the upper Muddy Creek for late successional habitats would improve the suitability for CRCT. Finding a balance between native and non-native fishing opportunities will continue to be a challenge, as they are often mutually exclusive.

The lower Muddy Creek watershed has experienced a large increase in the amount of energy development since the last assessment. This area is still managed for native BLM sensitive fish species but has not received the same level of effort to date. Increased road density and surface disturbances have disturbance has resulted in the need for heightened erosion control efforts. A large head-cut on Wild Cow Creek has resulted in channel incision and will need to be addressed in the near future.

Since the construction of High Savery Reservoir, Savery Creek below the dam has experienced large adjustments associated with a new reservoir-release hydrograph. In addition, I-beam weir structures were installed in Savery Creek to assist in the vertical stability of the channel. The combination of increased sustained flow and weir structures have resulted in unstable banks and increased width to depth ratios. This portion of stream did not obtain functioning standards and will likely need instream habitat work to improve stream condition and the associated tail-water fishery.

In 2012 fish barriers were installed on Dirtyman and Hell Canyon Creeks to protect populations of Native CRCT above each structure. Stream conditions were PFC and likely have the best woody species component in the assessment area. Each stream should be monitored to ensure that these structures do not negatively impact riparian habitat or channel morphology.

Historically, Loco Creek experienced heavy livestock utilization that nearly caused a complete loss of riparian habitat. Although a portion of the stream did not obtain PFC standards in 2012, riparian habitat conditions are improving and the lower portion of the stream supports some salmonids. As riparian habitat continues to improve, the potential for a larger area of the stream to support a fishery will increase.

6) Recommendations:

The improved management of riparian habitats and successful reintroduction of Colorado River Cutthroat Trout into upper Muddy Creek, as well as other cold water fisheries that exist within the watershed indicate both an upward trend and meeting Standard #4 for fisheries. Areas that currently are in proper functioning condition and meeting Standard #2 (Riparian/wetland) are also meeting Standard #4 for fisheries. However, many sites that should support fisheries currently only support marginal fisheries due to a lack of woody species that provide shading and greater bank stability. Standard #4 for fisheries is not being met on streams, which currently fail Standard #2 – Riparian/Wetland Health and/or Standard #5 – Water Quality (See Map #6).

Historical range of CRCT in the upper Muddy Creek watershed included Littlefield, McKinney and Muddy Creek downstream to Alamosa Gulch. The reintroduction of CRCT into McKinney Creek and the removal of fish barriers to reconnect the upper watershed should receive a high priority in coming years. The management of stream habitat beyond proper functioning conditions to a later successional stage and to a desired future condition as guided by the RMO should be considered throughout the upper Muddy Creek watershed.

The native warm water fish of the Colorado River basin have also witnessed dramatic population declines. Many of these fishes are nearing extinction and some have already been extirpated from Wyoming. Competition and hybridization with invasive species, as well as changes to the natural habitats of these fishes are the principal factors causing this trend (Rinne and Minckley 1991). The importance of conserving native species, and limiting the number of species listed under the Endangered Species Act should be considered when making land management decisions. A priority should be placed on the removal of non-native fish species and removal of fish barriers. To prioritize these conservation efforts a management plan for the Upper Muddy Creek watershed /Grizzly WHMA should be developed.

Existing populations of CRCT and their habitats within the Little Snake River watershed in Hell Canyon Creek and Dirtyman Creek should be monitored to ensure that habitat conditions remain suitable.

Continue to control the season, duration, and distribution of livestock use to meet desired resource objectives for both riparian and upland habitats. Objectives more specific to fisheries should include restoring riparian function while reducing stream width/depth ratios and increasing the abundance and cover of riparian shrubs and trees to improve bank stability and stream shading. Methods used to improve fish habitat conditions, should be chosen based on the life history requirements of the fish species.

Continue to eliminate or control active head-cuts, along with the necessary livestock management, in order to promote long-term, vegetative stabilization of these sites.

Reduce soil erosion entering streams from surface disturbing activities, eroding banks and side-hills.

Implement vegetation treatments to restore plant communities and to increase base flows in streams to meet fish habitat objectives where appropriate. Promote composition of communities to maximize herbaceous cover and litter, and therefore, minimize surface runoff and soil erosion. Continue to plant riparian species to stabilize banks and increase overhead cover for shading. Continue exploring options like supplying aspen to beaver, in order to heal and restore riparian habitat. A priority should be placed on these efforts in the Muddy Creek watershed and Loco Creek.

In areas of high energy development, specifically allotments in the lower Muddy Creek watershed, efforts to reduce utilization in riparian habitats should be made. Actions may be needed given the increase in surface disturbance and habitat loss associated with increased land uses associated with these activities. Changes should be made based on monitoring efforts within this portion of the watershed. Possible management actions would include development of off-site water in pastures where the main channel is the only water source, changes in season/duration of use, and potentially the number of animals stocked in an allotment.

Remove or modify, where needed, barriers to fish migrations. A series of small drop structures or rock ramps may still be used to stabilize banks, catch sediment and woody debris, raise or maintain water tables, and create pool habitat but should consider the passage of catostomid species.

Identify and correct problems with improved roads, which affect water flows and contribute soil erosion into streams and reservoirs. A transportation management plan for the watershed should be developed to address problem areas. Roads should be identified and fixed or closed and reclaimed.

An implementation plan should also be developed to address the degraded sections of Savery Creek below High Savery Reservoir. Efforts should be made to restore a width depth ratio and stabilize stream banks to reduce water temperatures. A cooperative management approach will be necessary to successfully stabilize and improve this section of stream.

Weeds:

1) Characterization:

Weeds, or invasive non-native plants, threaten natural ecosystems and greatly impact natural plant communities throughout the West. These invaders can reduce biodiversity, affect threatened and endangered species, change habitats and natural plant/animal associations, and prevent native species from remaining or encroaching upon a site. Unlike many areas of the West, overall the Rawlins Field Office has a comparatively smaller weed problem than other areas in the Rocky Mountain region. The analysis area is relatively noxious weed free, with just small problem areas. Within the analysis area, weed species are predominantly found along roadways and other disturbed areas associated with energy development, recreational use, and livestock grazing activities. Road building, development, grazing, fire suppression, and other activities can directly increase weed establishment and/or maintain their presence within the ecosystem.

The main noxious species present within the area are whitetop, saltcedar, houndstongue, musk thistle, and Russian knapweed. Other noxious species include Canada thistle, spotted knapweed, leafy spurge, and burdock. There are also several invasive species present which are normally restricted to disturbed areas. These include halogeton, cheatgrass, Russian thistle, bull thistle, black henbane, and several annual mustards like madwort (Alyssum spp.). Halogeton and black henbane stand out in this group as being poisonous to livestock. Descriptions and photographs can be found in the original watershed report.

2) Issues and Key Questions:

The issues and key questions from the 2002 document are still valid at this time. These included reclamation practices to reduce weed expansion, and monitoring efforts to identify new weed infestations before they spread into undisturbed rangeland. The area is still seeing an expansion of some of these species as new disturbances are continually being created, and as species are moved around by recreationists, wildlife, livestock, and energy development. Are there adequate mitigation measures in place to address weed control in development areas, and is enforcement of existing stipulations occurring? In addition, are rules concerning certified hay requirements appropriate for controlling livestock issues? Is livestock management adequate to keep weed species from encroaching into native rangelands? Is more direct action needed, especially in allotments where livestock movements are possibly increasing weed presence? Are high populations of wild horses reducing conditions of native rangelands, making them more susceptible to invasion by weeds? In the isolated cases where recreation is a factor in weed establishment, are adequate measures being taken to address this problem?

3) Current Conditions:

Weed locations are primarily restricted to disturbed areas associated with oil and gas development, recreational use, and livestock grazing activities such as water developments. Most noxious weed locations associated with manmade disturbances are being treated either by lease/ROW holders, Carbon County Weed and Pest District, or BLM. There are

only a few areas where the noxious weeds have spread into the native rangeland. Most improved roadways are being treated for noxious weeds. Oil and gas activity and recreation areas are being treated for weeds and are the main source of weed introduction and spread. The continued oil and gas activity has resulted in expansion of some of these species as development-related disturbance continues.

As stated earlier, the principal noxious species found within the analysis area include houndstongue, musk thistle, Russian knapweed, whitetop, and saltcedar. Houndstongue is primarily in the lower Savery Creek drainage, including Loco Creek (Standard #4 – page 8 photo), and the north Flat Top Mountains area. It is a biennial plant, with a small sticky seed, which sticks to anything it touches and, therefore, is easily moved around by animals and people. Improved livestock management practices to increase native plant cover, along with chemicals and hand pulling can be used to control this species. Musk thistle occurs in rangeland and along highways and is spreading into adjacent native rangelands. It is being treated both chemically and biologically through the release of beetles whose larvae eat the developing seeds or mine out the roots. Russian knapweed and whitetop primarily occur in disturbed areas along roads in small patches initially. The knapweed is aggressively treated, but the whitetop is not. Saltcedar (or tamarisk), occurs along drainages like Sand Creek and Muddy Creek, and around reservoirs. It has received a lot of attention in the past ten years (Standard #4 – page 8 photo), and is now mainly found along the Little Snake River and on isolated reservoirs. The other common species is Canada thistle, which occurs in and along riparian habitat, and in some cases along roads. As long as the riparian habitat is being properly managed, Canada thistle is not expanding and just occupies the niche between the riparian and upland habitats. It is being treated along roads. Other species, which occur in very isolated patches, include spotted knapweed, leafy spurge, perennial pepperweed, and burdock. One other noxious species in the watershed is only known to occur on Forest Service lands--oxeye daisy.

Invasive species of concern are halogeton, black henbane, cheatgrass, and alyssum. Halogeton is widespread throughout the developed oil and gas areas, lining roadways and pipeline corridors, and in some cases dominating inadequately reclaimed sites. Many well pad locations have been regularly treated and the halogeton occurrence in these areas is much reduced since the previous assessment. It has also invaded into nearby native rangelands on numerous allotments from historically untreated oil and gas disturbances, and livestock concentration areas. Halogeton is poisonous and continues to cause sheep losses due to its prevalence in certain areas, and, in some instances, has resulted in altered winter sheep use patterns to avoid heavily infested areas. Since the sheep numbers have declined, fewer losses due to halogeton poisoning have occurred. However, it is still a high priority for control along trail routes and in the remaining sheep allotments. Halogeton has also been known to kill cattle. It often provides lush forage due to the late summer flowering habit when most other vegetation is past seeding and dried out. Although it is a stipulation on oil and gas APDs and ROW grants to treat and control weeds, in many cases this is still not occurring, particularly in the winter sheep allotments west of Highway 789. There are at least 10,000 acres (professional judgment) of rangeland infested by halogeton spreading out from roads, pipelines, and other disturbances mostly in Lower Sand Creek, Barrel Springs Draw, and Lower Muddy Creek watersheds. Black henbane is also poisonous and can expand rapidly in disturbed areas, so it is targeted for treatment, primarily along energy related disturbances. Cheatgrass has not been inventoried, but further monitoring is needed to confirm whether populations are changing over time. Current observations and transect data do not show marked changes in population size or density. An alyssum project was initiated in 2008-09, along with increased Oil and Gas company treatments, to monitor the trend and native vegetation response. Subsequent monitoring has shown marked decrease in alyssum presence with very low rates of chlorsulfuron, and an associated increase in native plant cover. This trend has not persisted over time, with alyssum rebounding somewhat, but not to pre-treatment levels. Native grass species have maintained an increased presence. Most other invasive species are not treated unless they are interfering with reclamation or are a fire hazard around well locations.

Specific areas within the analysis area with noxious weeds and the status of treatment are as follows:

- ✓ Hangout Road/Standard Road: houndstongue and henbane—mostly being treated, but still expanding
- ✓ Sand Creek watershed: saltcedar—treated 75+ miles and numerous reservoirs; in monitoring phase
- ✓ Muddy Creek/Deep Creek: saltcedar, Russian olive—treated 20+ miles; in monitoring phase

- ✓ Robber Gulch/Blue Gap/Dad/Flat Top area Reservoirs: saltcedar— treated as found (40+ reservoirs); in monitoring phase
- ✓ Windmill Draw Road, most gas field roads: whitetop—mostly not treated
- ✓ North Barrel Springs, Barrel Springs, South Barrel Springs, Shallow Creek, Windmill Draw: whitetop along roads and down drainages in rangeland—mostly not treated except some along roads
- ✓ Gas field in Smiley Draw and along Wild Horse Road: houndstongue, Russian knapweed, musk thistle—being treated
- ✓ JO Ranch: perennial pepperweed, saltcedar, Russian olive—treatments ongoing
- ✓ Baggs/Dixon/Savery area: perennial pepperweed, leafy spurge, musk thistle—some treatments are ongoing
- ✓ Savery Creek/Loco Creek/Carbon County roads: houndstongue, spotted knapweed, burdock—treated along county roads only
- ✓ Battle Mountain: houndstongue, musk thistle, burdock, whitetop—not treated
- ✓ Upper Muddy Creek roads—mostly ROW: henbane, spotted knapweed, cheatgrass, whitetop, Canada thistle—areas treated as found and funding allows

A large portion of the watershed still has not been inventoried for weeds, but it is assumed that unless there are disturbances, there probably are not any invasive species present. General range condition is good to excellent, with good vigor and cover of native species. As native vegetation is reestablished, many of the invasive species will be crowded out. The species of long-term concern within the assessment area are the noxious species and halogeton, along with cheatgrass and alyssum.

4) Reference Conditions:

Please refer to the conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The highest priorities for treatment are the aggressive weed species, such as Russian knapweed, houndstongue, and leafy spurge, which are able to spread throughout stable native plant communities. These should be promptly treated and monitored, and are not specifically related to livestock grazing. Where livestock grazing is contributing to the invasion or expansion of weed species, then management must be changed, as in what happened in the Morgan Boyer allotment containing Loco Creek.

Due to the BLM's multiple use philosophy, oil and gas development will continue to occur and provide increasing areas for sites of additional weed establishment. Practices to control noxious weeds will continue to be necessary. In addition, the presence of roads and their associated maintenance will also continue to provide additional disturbed areas for weeds to infest. Although many pipelines have excellent reclamation, locations along interstate pipelines and along the Standard Road still need additional treatments (Standard #4 – page 9 photo). Some annual weed species are initially beneficial in terms of providing cover on reclaimed pads and pipelines that trap snow, reduce runoff, and shade young perennial grasses. However, these species should not continue to be the dominant species several years after reclamation has occurred.

The invasive species of halogeton, alyssum and cheatgrass will require more monitoring in the future to assess the long-term trend of these species across the watershed. While halogeton is more related to new disturbance that should be actively controlled by the BLM, counties, and energy companies; alyssum and cheatgrass are found in most native species dominated rangelands. Both of these species are fall sprouting annuals which over-winter and then grow and produce seed the following year. The warmer winters experienced over the last 18 years in this area may have benefitted the growth of these species, particularly alyssum, which has increased on most rangelands compared to personal observations in the 1980's. This was a principle reason to shift vegetation treatments in low elevation mountain big sagebrush from prescribed burning to tebuthiuron with much better success. Observations in the Baggs Subunit where the private landowner conducted small prescribed burns also resulted in early increases in alyssum, followed by long-term increases in native perennial plant species where a short duration grazing system was in place. Cheatgrass has been present in this watershed for many years, but doesn't appear to be increasing at the rate seen for alyssum. In wetter years it is much more obvious when it turns red, and is much less visible during dry years. In photos

of prescribed burns along Deep Gulch (1996) and Upper Wild Cow (1998) the cheatgrass initially increased, but following the recent wet three years, is greatly reduced in abundance with native grasses now dominating like basin wildrye, green needlegrass, bluebunch and thickspike wheatgrass. At lower elevations and on south and west-facing slopes with warmer environments, cheatgrass continues to be present and should be monitored to determine the long-term trend of this species within rangelands dominated with native perennial plant species.

Some areas have weed problems that are spread by animals, people and vehicles. The highest priority areas related to livestock grazing include Baggs, Dixon, Savery, and eastward. The species involved are musk thistle, Canada thistle, houndstongue, leafy spurge, perennial pepperweed, and burdock. These are either eaten or physically spread by livestock movements.

6) Recommendations:

Due to the existing good condition of native vegetation and the weed treatment program in place to control and/or eradicate weed problem areas as they are identified, it is determined that the majority of Upper Muddy Creek watershed is meeting Standard #4 with respect to weeds. There is one known area of noxious weeds that are expanding and not being treated. The location that does not meet 'Standard #4-Weeds' is in the Savery Creek watershed containing approximately 3000 acres of mostly houndstongue and some spotted knapweed invaded native rangeland (See Map #6). The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Continue inventory and treatment efforts in the area to identify and contain or eradicate noxious weeds. Continue to work with ROW/lease holders in their treatment of weedy species, as well as work with landowners on concurrent treatments with private lands. Enforcement of stipulations on APDs/ROWs to control weeds must occur. Most importantly, reduce disturbance due to development as much as possible, thereby reducing weed spread potential.

Continue to implement "best management practices" for livestock grazing to maintain or improve the health of rangeland plant communities so that fewer opportunities for weed invasion or expansion exist.

The BLM must maintain wild horse populations within appropriate management levels. Current high numbers of wild horses reduce plant vigor and cover, and may lead to expansion of weed species in native rangelands within the Adobe Town herd management area.

Identify invasive weed species that need to be treated throughout the assessment area. Although they are not a major focus for treatment, they can be a significant problem within localized areas.

Address road maintenance equipment movement procedures to address the spread of noxious weeds from/to other areas. Procedures such as cleaning equipment from one site to the next, minimizing disturbance of native vegetation, and prompt reseeding after construction are important.

Continue to support a certified weed-free hay program for those recreational and livestock grazing users that bring in livestock and hay from other areas. In addition, there may be a need to address livestock movement from pasture to pasture to curtail weed spread within an allotment. There may also be a need to monitor livestock shipped into the area from other states, a potential source of noxious weeds.

Continue to support a certified weed-free seed and mulch program for reclamation of disturbed lands.

STANDARD 5 – WATER QUALITY

Water quality meets state standards.

1) Characterization:

The State of Wyoming determines water quality status, and the BLM works with state agencies to correct identified issues regarding water quality where they occur on the BLM-administered public lands. Muddy Creek has historically been identified as a major source of sediment and salinity into the Little Snake River. Reducing sediment discharge into the Little Snake River from Muddy Creek is crucial because the Little Snake River contributes 60% of the total basin sediment yield to the Yampa River basin, although it represents less than 35% of the area and supplies less than 3% of the stream flow (Andrew 1978).

2) Issues and Key Questions:

The issues and key questions discussed in 2002 are still relevant in 2012.

3) Current Conditions: WDEQ 303(d) List Changes for the last ten years are shown on Map #7.

The following stream segments in the Upper Colorado River basin, which occur on BLM-administered public lands, are listed as water bodies with threats on the current Wyoming State 303(d) list due to physical degradation, and for some excessive sediment, temperature, Total Dissolved Solids (TDS) and /or other nutrients:

- Loco Creek (west fork), above the confluence with the main fork, Savery Creek drainage
- Muddy Creek, west of Highway 789 between the two bridges
- Muddy Creek, from the confluence with Deep Creek down to the confluence with Youngs Draw
- Savery Creek, from the confluence of Little Sandstone Creek down to the Little Snake River

The first two sites have livestock grazing identified as an impairment factor, with the first identified as a Class II water although it does not currently support cold water fisheries, and the second is identified as a Class III water that non-game fish use on a seasonal basis. The third site on lower Muddy Creek is not related to livestock grazing, and is also identified as a Class III water that non-game fish use on a seasonal basis. The last site on lower Savery Creek is related to livestock grazing but does not include any public land.

Livestock management for stream segments on the State of Wyoming 303(d) list of impaired water bodies.

- Loco Creek (west fork), has been used with early summer cattle/fall sheep since AMP inception in 1992, in order to use the lower half of Loco Creek canyon with a spring sheep/late summer cattle rotation. Originally, the lower half of the canyon was rated in poorer condition and has more hydrologic energy to disperse (higher flows further downstream) and historic sheep trailing use. Initial trend was good throughout the drainage and the main stem of Loco Creek was delisted earlier by the WDEQ (Standard #5 – page 1 photo). Improvement on the west fork of Loco Creek has slowed, primarily due to duration of cattle use as small numbers drift down from the aspen woodlands above, but are difficult to round up at one point to move to a different location. The stream channel has narrowed and deepened, but the dominant bank cover still consists of shallow rooted species like Kentucky bluegrass, redtop, and clover (rather than Nebraska sedge) which do not provide for stable banks or withstand hoof shear by cattle.
- Muddy Creek, west of Highway 789, consists of six different allotments with varying seasons of use, duration of use, and livestock type. The historical portion of concern was on the north end of this stream segment in the Doty Mountain allotment with spring cattle grazing. This was fenced off and converted to fall cattle use(usually November) in the late 1980's, with photo-points showing vast improvement. The next allotment downstream, George Dew, is a winter cattle allotment with excellent wetland meadows, ground cover and species composition. The next two allotments, Headquarters Ranch and Adams Ranch have little public except right below a water diversion structure. Originally the west ditch blew out and caused considerable erosion into Muddy Creek, but that was repaired and not been a problem since the early 1990's. These allotments are used with horses and/or cattle for short duration use at varying seasons. Dad allotment below the county road is used for a week or two with cattle usually in June or July before livestock are moved to higher country for the summer. Historic cattle use was much longer until this operation changed in the mid-1990's. The construction of Dad reservoir around 2003 provided a new, easier to use watering area that has helped reduce bank damage from cattle trying to water at the creek (Standard #5 – page 2 photo). Mexican Graves is the lowest allotment, with winter sheep grazing, and mostly on state land.

The LSRCD has collected macro-invertebrates within the upper Muddy Creek watershed since 1994, with the most recent data collected in 2010. A total of six sites have been sampled, with four along Muddy Creek and one site each on lower Littlefield Creek and lower McKinney Creek. Benthic Aquatic Macroinvertebrate Metrics evaluated for these six locations include: Taxa Richness, Total Abundance, EPT Abundance, Hilsenhoff Biotic Index (HBI), and Clinger Taxa. Taxa Richness is a component and estimate of community structure and stream health based on the number of distinct taxa. Taxa Richness normally decreases with decreasing water quality. Total Abundance is the abundance, density, or number of aquatic macro-invertebrates per unit area and is an indicator of habitat availability and fish food abundance. EPT Abundance is a summary of the taxa richness and abundance among the insect Orders Ephemeroptera, Plecoptera, and Trichoptera (EPT), which are commonly considered sensitive to pollution. The Hilsenhoff Biotic Index (HBI) summarizes the overall pollution tolerances of the taxa collected. Families were assigned an index value from 0 – taxa normally

found only in high quality unpolluted water, to 10 – taxa only found in severely polluted waters. Samples with HBI values of 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched, and 7-10 polluted. Clinger taxa typically cling to the tops of rocks and are thought to be reduced by sedimentation or abundant algal growths.

Long-term trends across all six sites were up in terms of Taxa Richness, Total Abundance and EPT Abundance, but with lowered numbers most recently at the uppermost sites at Muddy Creek-Grizzly and Lake Draw following chemical treatments to remove non-native fish. These sites at the head of Muddy Creek will take longer for insect expansion after chemical treatment since there are not "bugs" in the stream above to help replenish this site as there was at the other sites downstream following similar treatment during this same period of macro-invertebrate sampling (Standard #5 – page 3 photo). The HBI has had a decreasing (positive) trend over time with most sites starting out in the 4-5 range (enriched) and moving into the 3-4 range (slightly enriched). Clinger taxa increased on most sites except the Muddy Creek-Lake Draw site (again due to chemical treatments) and at Muddy Creek-Doty Mountain it is only slightly upward. This last site is located at the end of the upper perennial watershed and will dry up here during the driest years, to then be replenished in wet years from "bugs" upstream. Because of this, this site has the overall lowest abundance numbers compared to the other five sites that never dry up.

4) Reference Conditions:

The following stream segments in the Upper Colorado River basin, which occur on the BLM-administered public lands, were listed as water bodies with threats on the Wyoming State 303(d) list due to physical degradation, and for some excessive sediment, temperature, Total Dissolved Solids (TDS) and /or other nutrients:

- Loco Creek (west fork), above the confluence with the main fork, Savery Creek drainage
- McKinney Creek, from confluence with Eagle Creek down to Muddy Creek
- Muddy Creek, from confluence with Littlefield Creek down to confluence with Alamosa Gulch
- Muddy Creek, from confluence with Barrel Springs Draw down to confluence with Little Snake River

The first three sites have livestock grazing identified as an impairment factor and are identified as Class II waters, although they currently do not support cold water fisheries. The last site on lower Muddy Creek has both livestock grazing and oil and gas development identified as impairment factors and is identified as a Class III water. Non-game fish species use it on a seasonal basis.

5) Synthesis and Interpretation:

For the six different sites, the McKinney Creek and Littlefield Creek have the highest Taxa Richness, while the Muddy Creek- Grizzly and Lake Fork had the highest Total Abundance (43,159) and EPT Abundance (22,960) prior to the chemical treatments. The HBI across all years was relatively good for a foothills type stream with only slight organic enrichment. However, it should be noted that the majority of streams in the Wyoming Basin Ecoregion rank out substantially lower than upper Muddy Creek. Based on 1685 samples at 75 different locations in the Wyoming basin community biology at this site is substantially better than the area as a whole. It should be further mentioned that because of geology, stream morphology, water alkalinity, sulfates, substrate size, and stream gradient many streams do not have the biological potential to exceed fair to poor ratings under this system. It is highly unlikely that any stream or stream segment in the Muddy Creek watershed will have a HBI of 3.0 or below.

In addition to the data above, supporting indirect data such as channel cross-sections, photo-points (Standard #5 – page 4 photo), upland trend, and grazing management changes discussed under Standards 1, 2 and 3 above all show vast improvement that indirectly support that water quality has and is continuing to improve. An investigation by Ellison et al in 2008 revealed data that demonstrated overall reductions of 25% for TDS and 75% for turbidity among years and a 30% increase in macroinvertebrate total taxa between 1994 and 2004. These factors led WDEQ to de-list the Muddy Creek and McKinney Creek stream segments in the Upper Muddy Creek watershed from the State of Wyoming 303(d) list of impaired water bodies in 2012.

For the west fork of Loco Creek, the BLM and LSRCD met with the cattle permittees to discuss needed livestock management changes to meet this Standard and Riparian Standard #2 that will be implemented during the next grazing season (see section in Standard 2-riparian health). For the portion of Muddy Creek west of Highway 789, the BLM and LSRCD met with WDEQ during the last year to review existing data or additional needs for data for this stream segment. An investigation of water quality data collected from 1985 to 2006 was used to determine whether livestock management BMPs and other practices had improved water quality in this watershed. Following BMP implementation, percents of flow duration intervals between upper and lower boundary monitoring sites were reduced in the impaired stream. During the study period, positive trends in electrical conductivity (EC), TDS, and turbidity were observed (Ellison et al, 2008). Besides changes in livestock management, two major factors/projects influence this reach of the watershed. The first is the maintenance of spreader-dikes completed in the mid-1990's that stopped extensive head-cutting and continuing projects that extended the width and acreage of riparian/wetland habitat that acts as a sediment collector for the watershed above this point (Dad, or just above the confluence of Muddy Creek and Barrel Springs Draw). The second factor was the drop-structure construction in 2003 that stopped the Muddy Creek head-cut nearly 15 feet tall located about 3 miles upstream of the upper Muddy Creek bridge on highway 789. This had been moving since the 1970's and was adding tons of sediment to Muddy Creek during high flow years. Existing photo-points, channel cross-sections, PFC evaluations, fishery inventories, and knowledge of long-term management are being sent to WDEQ that support delisting of this stream segment. BLM is not aware of any management issues that have not been resolved on public land that would prevent the delisting of this stream segment.

6) Recommendations:

Within the assessment area, water quality impairment has not been identified by the State of Wyoming for the majority of the watershed. The following stream segments in the Upper Colorado River basin, which occur on BLM-administered public land, are listed as threatened on the current Wyoming State 303(d) list of impaired waters:

- Loco Creek (west fork), above the confluence with the main fork, Savery Creek drainage
- Muddy Creek, west of Highway 789 between the two bridges
- Muddy Creek, from the confluence with Deep Creek down to the confluence with Youngs Draw

The first two sites have livestock grazing identified as an impairment factor. The first site will have livestock management changes implemented for the 2013 grazing season to address both the water quality and riparian health standards. The second site has had long-term improvement in meeting rangeland health standards, and this data is being forwarded to WDEQ for future delisting of this stream segment.

The BLM will continue to work with livestock permittees and other partners to utilize BMPs for livestock grazing, vegetation treatments, oil and gas development, and off-road vehicle use to maintain or improve water quality conditions across this watershed. Spring and seep water sources would continue to be fenced for protection and off-site watering facilities developed where needed, while providing sufficient flow to support wetland and riparian habitat below these sites.

STANDARD 6 – AIR QUALITY

Air quality meets state standards.

1) Characterization:

The closest and most current air quality information (since 2002 watershed assessment) is obtained from the Continental Divide-Creston (CD-C) Project Area centered at Wamsutter and extending southward into the northern half of the Upper Colorado River basin. An EIS is being completed for continued/expansion of natural gas development in this area, with excerpts of the affected environment section incorporated into this document.

Regional air quality is influenced by a combination of factors including climate, meteorology, the magnitude and spatial distribution of local and regional air pollution sources, and the chemical properties of emitted pollutants. The CD-C

Project Area is located in a semiarid (dry and cold), mid-continental climate regime. The area is typified by dry, windy conditions with limited rainfall and long, cold winters. The nearest meteorological measurements were collected at Wamsutter, Wyoming (1897-2011), located near the center of the project area at an elevation of 6,800 feet above mean sea level.

The annual average total precipitation at Wamsutter is 7.1 inches, with annual totals ranging from 3.8 inches (1979) to 13.6 inches (1983). Precipitation is greatest from spring to summer, tapering off during the fall and winter months. The region has cool temperatures, with average temperature (in degrees Fahrenheit [˚F]) ranging between 7.1˚F and 28.6˚F in January to between 48.9˚F and 84.5˚F in July. The frost free period generally occurs from May to September.

The CD-C project area is subject to strong and gusty winds, often accompanied by snow during the winter months, producing blizzard conditions and drifting snow. The closest comprehensive wind measurements were collected in the project area at the WDEQ meteorological monitoring station located approximately 2 miles northwest of Wamsutter. From the data collected it is evident that the winds originate from the west to southwest nearly 36 percent of the time and from the south to southeast over 37 percent of the time. The frequency and strength of winds greatly affect the transport and dispersion of air pollutants. The annual mean wind speed is 11.4 miles per hour (mph), and that relatively high average wind speed indicates the presence of good dispersion and mixing of any potential pollutant emissions resulting from the CD-C project sources.

2) Issues and Key Questions:

Although much of the discussion in the 2002 watershed assessment is still valid and should be reviewed, a few factors have changed over the last 10 years that lead to new and valid questions. With the near doubling of road acres west of Highway 789 (and obviously additional miles as part of the Atlantic Rim natural gas project, what effects does dust from roads have on reducing plant growth or palatability, and the habitat these plants provide for insects, birds, and other wildlife? With the Atlantic Rim natural gas project, what levels of methane are escaping collection and being released to the atmosphere through methane seeps without production occurring versus that observed at much higher levels with initial production and do these areas need to be fenced off to protect the public or animals in the area? (Standard #6 – page 1 photo).

3) Current Conditions:

Monitoring of air pollutant concentrations has been conducted within both the CD-C Project Area and at the cumulative study area. The study area encompasses five Prevention of Significant Deterioration (PSD) Class I areas and three sensitive Class II areas. The five Class I areas are located within the CD-C cumulative study area are the Bridger, Fitzpatrick, Mount Zirkel, Savage Run and Rawah Wilderness Areas, and the three sensitive Class II areas are; the Popo Agie Wilderness Area, Dinosaur National Monument, and Wind River Roadless Area. Air pollutants monitored at these sites include carbon monoxide (CO) , nitrogen dioxide (NO_2), ozone, particulate matter less than 10 microns in effective diameter (PM_{10}), particulate matter less than 2.5 microns in effective diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). Background concentrations of these pollutants define ambient air concentrations in the region and establish existing compliance with ambient air quality standards. Air quality related values (AQRVs) such as visibility, atmospheric deposition, and the change in water chemistry associated with atmospheric deposition at acid sensitive lakes have been identified as a concern at several Class I and sensitive Class II areas within the study area. Visibility for the region is considered to be very good. Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems.

The Prevention of Significant Deterioration (PSD) Program is designed to limit the incremental increase of specific air pollutant concentrations above a legally defined baseline level. Incremental increases in PSD Class I areas are strictly limited, while increases allowed in Class II areas are less strict. Through the PSD program Class I areas are protected by Federal Land Managers (FLMs) by management of air quality related values (AQRVs) such as visibility, aquatic ecosystems, flora, fauna, etc. The 1977 Clean Air Act amendments established visibility as an AQRV that Federal land managers must consider. The 1990 Clean Air Act amendments contain a goal of improving visibility within PSD Class I

areas. The Regional Haze Rule finalized in 1999 requires the states, in coordination with federal agencies and other interested parties, to develop and implement air quality protection plans to reduce the pollution that causes visibility impairment.

4) Reference Conditions:

Please refer to the current conditions discussed in the 2002 watershed report.

5) Synthesis and Interpretation:

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered to endanger public health and the environment. The NAAQS prescribe limits on ambient levels of these pollutants in order to protect public health, including the health of sensitive groups. The EPA has developed NAAQS for six criteria pollutants:NO_2, CO, SO_2, PM_{10}, $PM_{2.5,}$ ozone, and lead. Lead emissions from CD-C project sources are negligible and therefore, the lead NAAQS is not addressed in this analysis. States typically adopt the NAAQS but may also develop state-specific ambient air quality standards for certain pollutants.

The CD-C Project Area lies entirely within eastern Sweetwater County and western Carbon County in Wyoming; this area is part of the State of Wyoming's Concentrated Development Area and is therefore subject to CDA restrictions on emissions set forth in the WDEQ-AQD's March 2010 "Oil and Gas Production Facilities Chapter 6, Section 2 Permitting Guidance" (WDEQ-AQD, 2010). The Guidance states, "...all new or modified sources or facilities which may generate regulated air emissions shall be permitted prior to start up or modification and Best Available Control Technology (BACT) shall be applied to reduce or eliminate emissions". The Guidance establishes presumptive BACT requirements for emissions from the following source categories for new facilities, affecting tank flashing, dehydration units, pneumatic pumps, pneumatic controllers, well completions, produced water tanks, blow down/venting, and other sources of pollutants.

In addition, the trends in reducing bare ground observed over the last forty years need to be continued or maintained. Greater plant cover and litter help protect soil function and stability, resulting in less bare ground or soil particles that are available to add dust to the atmosphere during wind and storm events.

The U.S. Supreme Court ruled in 2007 that EPA has the authority to regulate greenhouse gases such as methane and carbon dioxide (CO_2) as air pollutants under the Clean Air Act; however, there are currently no ambient air quality standards for GHGs, nor are there currently any emissions limits on GHGs that would apply to sources developed in oil and gas activities. Both the exploration/construction and production phases of energy development will cause emissions of GHGs. Methane comprises much of the chemical composition of natural gas, and nitrous oxide, CO_2 and methane are emitted by engines used for drill rigs, compressor engines, etc. Methane is also emitted from grazing animals through belching and excrement bodily functions.

6) Recommendations:

Within this assessment area there is no air quality criteria pollutant non-attainment areas for either state for federal standards as determined by the Wyoming Department of Environmental Quality-Air Quality Division. Due to prevailing winds and limited pollution within the general area, overall air quality meets this Standard.

BLM will continue to work with energy companies, livestock permittees and other partners to utilize BMPs for oil and gas development, livestock grazing, and off-road vehicle use to maintain or improve air quality conditions across this watershed. Continue to implement mitigation measures on new oil and gas development operations, while attempting to resolve existing issues. Dust abatement due to vehicle traffic is an important concern, both on a resource basis and a public safely basis. Collect information about methane releases through seeps and if those volumes change with future natural gas production from coal beds.

Continue to implement prescribed burning and other vegetation treatment projects to provide for fuel breaks to ensure catastrophic wildfires do not occur. Treatments would greatly reduce the risk of large amounts of particulate matter in the air from larger, landscaped wildfires.

SUMMARY

Standard 1 – Watershed Health

Due to the existing diversity and amount of ground cover on uplands and existing low levels or declining levels of bare ground, the trend to low upland condition class ratings, existing and improving trend in riparian vegetation and channel morphology, the management responsibility by industry and agencies to design and mitigate impacts from roads on hydrologic flow events and soil erosion, the continued cooperation exhibited by permittees to work on a watershed basis, it is determined that the majority of Upper Colorado River watershed is meeting Standard #1. The four locations not meeting Standard #1 are remaining active head-cuts on lower Holler Draw (affecting approximately 1400 acres), upper and lower Cottonwood Creek (affecting 300 acres, and Wild Cow Creek (affecting 2000 acres) (See Map #6). These head-cuts are due to long-term gradient readjustment processes (following historic livestock overgrazing) and current livestock management is not contributing to the non-attainment of this standard.

Standard 2 – Riparian/Wetland Health

There has been continued improvement in riparian/wetland condition within the assessment area over the last ten years, considering that management of riparian habitat only started about 25 years ago. Although PFC may have been reached in most areas, there will likely continue to be improvement in channel width, bank stability, and desired species like willows and sedges. However, there are still some specific areas that need improvement and others that will just take more time to reach a desired future condition. Allotments containing riparian/wetland habitat that do not meet this standard have been described previously and include: Cherokee (11 miles), Deep Gulch (1/16 mile), Morgan-Boyer (1 ½ mile), Rasmussen Subunit (3 miles), and Sulphur Springs (1/2 mile). In addition, the reach on public land below High Savery Dam (2 miles) is not meeting this standard (See Map #7). Most seeps within the Adobe Town HMA have been protected, however, those along the base of Kinney Rim warrant continued monitoring for both wild horse and livestock use and impact.

Standard 3 – Upland Plant Health

Due to the diversity, vigor, productivity, high native species composition, the current trends documented or observed in plant communities, the current livestock management, current wildlife populations and wild horse numbers, and management responsibility shared and demonstrated by the various agencies, industry, and agricultural businesses in this watershed, it is determined that the majority of upland vegetation in the Upper Colorado River watershed is meeting Standard #3 – Upland Plant Health, with the following exceptions. Aspen stands, although healthier than they appeared ten years ago, still so not meet the standard for vegetation health due to their reduced acreage (compared to historical), competition from big sagebrush and serviceberry within and adjacent to existing stands or in locations where historical stands occurred, decadence within stands, and concerns over persistence of disease within this plant community. Total acreage of these stands is approximately 14,000 acres within this watershed. Sagebrush, mountain shrub, and juniper plant communities within mule deer crucial winter between Horse Mountain west to Poison Basin and north along Muddy Creek, still do not meet this standard due to continued encroachment of juniper into shrub lands, continued decline in shrub canopy and heavy utilization in mountain shrub communities, and continued low diversity in big sagebrush stands. Total acreage of these areas is approximately 40,000 acres within the watershed (See Map #6). Livestock grazing is a component in the management scenario of these plant communities, but it is not the principle factor in non-attainment of this Standard. The following recommendations would expand upon the success already achieved and help to meet desired resource conditions in the future.

Standard 4 – Wildlife/Threatened and Endangered Species/Fisheries Habitat, Weeds

Habitat needed to support healthy wildlife populations and listed or proposed threatened and endangered species are generally in good or acceptable condition. Composition of native plant species is good and photos and other data show improving condition of both upland and riparian plant communities that support wildlife and species of interest. Vegetation treatments in a portion of the mountain big sagebrush, mountain shrub and aspen communities have begun to diversify the species, age-class, and structure of plant communities that will benefit and support healthy wildlife

populations. On the other hand, energy development continues to reduce or modify native habitats, particularly habitat fragmentation through the increase in roads that reduce habitat value for wildlife. Due to mostly positive trends observed in riparian and upland plant communities, and the current knowledge of wildlife and listed or proposed threatened and endangered species in this watershed, the majority of the Upper Colorado River watershed is meeting Standard #4 with respect to wildlife. The principal area that is not meeting Standard #4 for wildlife is the mule deer crucial winter range located between Horse Mountain and Poison Basin and north from Baggs along Muddy Creek through the Wild Horse and Dad juniper woodlands (See Map #6). This area encompasses about 40,000 acres of public land. Although steps have been taken to improve habitat values in this area, there is still more actions to be taken and time allowed for long-term habitat improvement. Livestock grazing is not a principle factor in the non-attainment of this Standard.

The improved management of riparian habitats and successful reintroduction of Colorado River Cutthroat Trout into upper Muddy Creek, as well as other cold water fisheries that exist within the watershed indicate both an upward trend and meeting Standard #4 for fisheries. Areas that currently are in proper functioning condition and meeting Standard #2 (Riparian/wetland) are also meeting Standard #4 for fisheries. However, many sites that should support fisheries currently only support marginal fisheries due to a lack of woody species that provide shading and greater bank stability. Standard #4 for fisheries is not being met on streams, which currently fail Standard #2 – Riparian/Wetland Health and/or Standard #5 – Water Quality (See Map #6).

Due to the existing good condition of native vegetation and the weed treatment program in place to control and/or eradicate weed problem areas as they are identified, it is determined that the majority of Upper Muddy Creek watershed is meeting Standard #4 with respect to weeds. There is one known area of noxious weeds that are expanding and not being treated. The location that does not meet 'Standard #4-Weeds' is in the Savery Creek watershed containing approximately 3000 acres of mostly houndstongue and some spotted knapweed invaded native rangeland (See Map #6).

Standard 5 – Water Quality

Within the assessment area, water quality impairment has not been identified by the State of Wyoming for the majority of the watershed. The following stream segments in the Upper Colorado River basin, which occur on BLM-administered public land, are listed as threatened on the current Wyoming State 303(d) list of impaired waters:

- Loco Creek (west fork), above the confluence with the main fork, Savery Creek drainage
- Muddy Creek, west of Highway 789 between the two bridges
- Muddy Creek, from the confluence with Deep Creek down to the confluence with Youngs Draw

The first two sites have livestock grazing identified as an impairment factor. The first site will have livestock management changes implemented for the 2013 grazing season to address both the water quality and riparian health standards. The second site has had long-term improvement in meeting rangeland health standards, and this data is being forwarded to WDEQ for future delisting of this stream segment (See Map #7).

Standard 6 – Air Quality

Withing this assessment area there is no air quality criteria pollutant non-attainment areas for either state or federal standards as determined by the Wyoming DEQ. Due to prevailing winds and limited pollution within the general area, overall air quality meets this Standard.

Allotments Described in this Report That Do Not Meet Standards Due to Livestock Grazing:

Cherokee allotment	Standard 2 – Riparian/Wetland
Deep Gulch allotment	Standard 2 – Riparian/Wetland
Morgan-Boyer allotment	Standard 2,5 – Riparian/Wetland, Water Quality

Rasmussen Subunit allotment	Standard 2 – Riparian/Wetland
Sulphur Springs allotment	Standard 2 – Riparian/Wetland

Areas Described in this Report That Do Not Meet Standards Due to Other Causes:

Headcuts at Holler Draw, Wild Cow Creek	Standard 1 - Watershed
Savery Creek below High Savery Dam	Standard 2 – Riparian/Wetland
Cottonwood Creek	Standard 1 – Watershed, 2 – Riparian/Wetland
Aspen Habitat	Standard 3 – Upland Plant
Sagebrush, Mtn. Shrub, Juniper by Baggs	Standard 3 – Upland Plant
Mule Deer Crucial Winter Range	Standard 4 – Wildlife
Houndstongue in Loco Creek area	Standard 4 - Weeds
Muddy Creek West of Hwy 789	Standard 5 – Water Quality
Muddy Creek, Deep Creek confluence Downstream to Youngs Draw	Standard 5 – Water Quality

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Allotment #	Allotment Name	Auth #	Operator Display Name	AUM'S
00403	BAGGS SUB UNIT	4903003	WEBER, MATT WEBER, SHERRY	264
00405	BEAVER DAMS	4903083	STRATTON SHEEP CO.	682
00408	CHEROKEE	4903003	WEBER, MATT WEBER, SHERRY	1511
00408	CHEROKEE	4903014	COTTON SHEEHAN	1219
00408	CHEROKEE	4903044	THREE FORKS RANCH CORP.	2724
00408	CHEROKEE	4903053	MONTGOMERY LIVESTOCK CO.	284
00408	CHEROKEE	4903075	LADDER LVST. CO. LLC	490
00408	CHEROKEE	4903083	STRATTON SHEEP CO.	1954
00412	DEEP GULCH	4903044	THREE FORKS RANCH CORP.	3597
00413	DIRTY MAN	4903049	KERBS FOUR BAR HEREFORDS	20
00415	DOTY MOUNTAIN	4903102	RAY & KATHLEEN WEBER	1243
00415	DOTY MOUNTAIN	4903103	SOUTHERN CROSS RANCHES	5643
00417	GRIZZLY	4903083	STRATTON SHEEP CO.	860
00418	HARTT CREEK	4903013	DEXTER PEAK LTD.,LLC	641
00421	MCCARTY CANYON	4903087	MCCARTY RANCH COMPANY, LLC.	821
00425	MORGAN CREEK	4903048	SANDSTONE RANCHES	1187
00426	MORGAN RANCH	4903044	THREE FORKS RANCH CORP.	263
00430	SAGE CREEK	4903098	THE OVERLAND TRAIL CATTLE COMPANY LLC	3156
00431	SAVERY CREEK	4903077	TALL GRASS, LLC	606
00433	SULPHUR SPRINGS	4903078	JACK CREEK LAND AND CATTLE COMPANY	2096
00435	WILD COW	4903053	MONTGOMERY LIVESTOCK CO.	1560
00442	DAD	4903082	HOG-EYE RANCH LLC	94
00443	EAST MUDDY	4903000	ADAMS & ADAMS	270
00444	TRUCK DRIVERS CREEK	4903265	KELLEY LAND & CATTLE CO. LLC	30
00448	J O PASTURES	4903044	THREE FORKS RANCH CORP.	61
00456	DEEP CREEK PASTURE	4903044	THREE FORKS RANCH CORP.	635
00457	WEST WILD COW	4903053	MONTGOMERY LIVESTOCK CO.	437
00505	CHEROKEE TRAIL	4903050	RAFTOPOULOS BROTHERS LIVESTOCK	1338
00514	LITTLE ROBBER	4903053	MONTGOMERY LIVESTOCK CO.	250
00687	SMILEY DRAW	4903044	THREE FORKS RANCH CORP.	226
00688	UPPER SAVERY CREEK	4903045	PETER HANSEN RANCH TRUST	40
00689	WEST LOCO	4903075	LADDER LVST. CO. LLC	30
00690	COTTONWOOD CREEK	4903075	LADDER LVST. CO. LLC	34
00740	GRIEVE PASTURE	4903003	WEBER, MATT WEBER, SHERRY	68
01101	AIRHEART PASTURE	4903003	WEBER, MATT WEBER, SHERRY	96
01102	BIG GULCH	4903008	ANTELOPE RANCH, LLC	30
01103	WEST BROWNS HILL	4903017	COBB CATTLE CO	162
01104	CEDAR RIDGE	4903044	THREE FORKS RANCH CORP.	73
01106	CUSHING	4903082	HOG-EYE RANCH LLC	20
01107	DOLAN	4903084	MARTHA PAGE	60

01108	ETHERINGTON	4903083	STRATTON SHEEP CO.	16
01109	FLY CREEK	4903046	STULL RANCHES, LLC	100
01110	HELL CANYON	4903001	STEPHANIE A. ANDERSON	148
01111	HILL PASTURE	4903033	PURPLE SAGE, LLC	31
01112	LITTLE HORSE MTN	4903004	BATTLE MOUNTAIN CO	220
01113	LITTLE SANDSTONE	4903024	C&C CATTLE, LLC.	148
01115	MCCARY	4903082	HOG-EYE RANCH LLC.	102
01117	MEXICAN MEADOWS	4903041	JONS, LEE AND DONNA	15
01118	MORGAN-BOYER SUBUNIT	4903017	COBB CATTLE CO	317
01118	MORGAN-BOYER SUBUNIT	4903058	THE LOCO PLACE LLC	526
01118	MORGAN-BOYER SUBUNIT	4903075	LADDER LVST. CO. LLC	700
01118	MORGAN-BOYER SUBUNIT	4914365	NED MCKEE	160
01119	NORTH RASMUSSEN	4903096	THAYER BRUCE	248
01121	PIONEER DRAW	4903081	ROBINSON, LEE & FRANCELLE	55
01122	POLING ISO TRACT	4903012	ROBERTS FAMILY TRUST	20
01123	RASMUSSEN SUB UNIT	4903083	STRATTON SHEEP CO.	839
01124	READER	4903071	STONEWALL RANCH, LLC.	30
01125	READER BASIN PASTURE	4903024	C&C CATTLE, LLC.	466
01126	ROAD GULCH	4903152	SALISBURY LIVESTOCK CO	213
01127	SHEEP MOUNTAIN	4903152	SALISBURY LIVESTOCK CO	53
01128	SHORT	4903084	MARTHA PAGE	167
01129	SOUTH BAGGS	4903018	DONALD R. JR. AND KATHLEEN J. CORSON	30
01130	SOUTH PASTURE	4903014	COTTON SHEEHAN	89
01132	SPRING GULCH	4903046	STULL RANCHES, LLC	110
01133	STANDARD	4903053	MONTGOMERY LIVESTOCK CO.	92
01134	STATE LINE 40	4903056	HOWARD B. LEE FAMILY LIMITED PARTNERSHIP	4
01135	CEDARS	4903053	MONTGOMERY LIVESTOCK CO.	12
01136	BATTLE MTN ISO TRACT	4903004	BATTLE MOUNTAIN CO	13
01138	M.J. ANDERSON ISO #1	4903001	STEPHANIE A. ANDERSON	9
01139	COBB CAT CO ISO TR	4903017	COBB CATTLE CO	34
01140	GRIEVE RESERVOIR PAS	4903004	BATTLE MOUNTAIN CO	31
01141	M.J. ANDERSON ISO #2	4903001	STEPHANIE A. ANDERSON	8
01142	EAST BROWNS HILL	4903017	COBB CATTLE CO	106
01143	L U GRIEVE PASTURE	4903004	BATTLE MOUNTAIN CO	49
01144	COAL BANK DRAW	4903074	TREVOR KAISLER	64
01145	WALTERS HOMESTEAD	4903054	SAM D. MORGAN	36
10400	NORTH SAVERY CREEK	4903104	ARROW-SHIELD LLC	31
10501	ADAMS RANCH	4903082	HOG-EYE RANCH LLC	6
10502	ADOBE TOWN	4903050	RAFTOPOULOS BROTHERS LIVESTOCK	1820
10503	BIG ROBBER	4903056	HOWARD B. LEE FAMILY LIMITED PARTNERSHIP	1623
10504	BIG ROBBER SPREADERS	4903041	JONS, LEE AND DONNA	114
10506	CONTINENTAL	4903150	THREE MILL-IRON RANCH	2830

10508	COTTTONWOOD HILL	4915036	THOMAS D. AND SAVANAH B. CHANT	1065
10509	COW CREEK	4903050	RAFTOPOULOS BROTHERS LIVESTOCK	2629
10510	CROOKED WASH	4903079	RAFTOPOULOS BROTHERS LIVESTOCK	87
10511	ESPITALIER	4903050	RAFTOPOULOS BROTHERS LIVESTOCK	2420
10511	ESPITALIER	4903079	RAFTOPOULOS BROTHERS LIVESTOCK	355
10512	GRINDSTONE SPRINGS	4903014	COTTON SHEEHAN	413
10513	LITTLE POWDER MTN	4903079	RAFTOPOULOS BROTHERS LIVESTOCK	193
10513	LITTLE POWDER MTN	4903088	SMITH RANCHO INC.	1341
10515	MEXICAN FLATS	4903020	H. B. LEE	600
10515	MEXICAN FLATS	4903056	HOWARD B. LEE FAMILY LIMITED PARTNERSHIP	459
10516	MEXICAN GRAVES	4903028	4-MILE SHEEP	993
10517	OPPENHEIMER	4903109	PILGRIM, MONTY	1084
10518	POISON BUTTES	4915036	THOMAS D. AND SAVANAH B. CHANT	696
10519	POWDER MOUNTAIN	4903152	SALISBURY LIVESTOCK CO	1304
10520	POWDER RIM ROTATION	4903014	COTTON SHEEHAN	2339
10520	POWDER RIM ROTATION	4903051	EVANS, GEORGE R. & SANDRA K.	1516
10520	POWDER RIM ROTATION	4903079	RAFTOPOULOS BROTHERS LIVESTOCK	1984
10521	RED CREEK	4903028	4-MILE SHEEP	2612
10522	RIVER BOTTOM	4903088	SMITH RANCHO INC.	220
10523	ROTTEN SPRINGS	4903028	4-MILE SHEEP	656
10523	ROTTEN SPRINGS	4903050	RAFTOPOULOS BROTHERS LIVESTOCK	622
10523	ROTTEN SPRINGS	4903051	EVANS, GEORGE R. & SANDRA K.	145
10524	SAND CREEK	4903028	4-MILE SHEEP	2839
10525	SOUTH BARREL	4903028	4-MILE SHEEP	195
10525	SOUTH BARREL	4903082	HOG-EYE RANCH LLC	583
10526	SOUTH FLAT TOP	4903033	PURPLE SAGE	1592
10527	V SPREADERS	4903053	MONTGOMERY LIVESTOCK CO.	70
10528	WILLOW CREEK	4903082	HOG-EYE RANCH LLC	1680
10529	HEADQUARTERS RANCH	4903044	THREE FORKS RANCH CORP.	25
10530	SOUTH MUDDY	4903102	RAY & KATHLEEN WEBER	103
10531	GEORGE DEW	4903000	ADAMS & ADAMS	62
10532	44 RANCH	4903004	BATTLE MOUNTAIN CO	59
10601	BADWATER	4903016	FILL-MORE BEEF LLC	74
10601	BADWATER	4903152	SALISBURY LIVESTOCK CO	1127
10610	SOUTH LACLEDE	4903028	4-MILE SHEEP	236
10610	SOUTH LACLEDE	4903067	EUREKA GRAZING AFFILIATES, LLC	3294
10611	NORTH BARREL	4903083	STRATTON SHEEP CO.	2930
10612	NORTH PINE BUTTE	4903000	ADAMS & ADAMS	116
10613	NORTH LACLEDE	4903028	4-MILE SHEEP	2001
10624	NORTH BAGGS	4903069	H & C LLC	24
10625	SOUTH PINE BUTTE	4903000	ADAMS & ADAMS	34
10721	BRIMMER PASTURES	4903003	WEBER, MATT WEBER, SHERRY	28