Rangeland Health Assessment

Standards for Healthy Rangelands
And
Guidelines for Livestock Grazing Management
For
Public Lands Administered by the
Bureau of Land Management
In the
State of Wyoming

LU Allotment No. 00604

February 2015

BLM

Worland Field Office, Wind River/Bighorn Basin District, Wyoming

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PUBLICATION INDEX NUMBER.

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1.0 INTRODUCTION

The Bureau of Land Management (BLM) grazing regulations at 43 CFR 4130.3-1(c) require that grazing permits issued by the BLM contain terms and conditions that ensure conformance with BLM regulations at 43 CFR 4180, which are the regulations under which the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management for Public Land Administered by the Bureau of Land Management in the State of Wyoming were developed. Recently, the Worland Field Office completed an assessment of the achievement of these standards on the LU Allotment No. 00604. The results of this assessment are presented in this report. This assessment will serve to inform the BLM's determination as to whether these standards are being met, and, if they are not met, whether existing grazing management practices contribute to their lack of attainment.

1.1 Standards

The approved standards for rangeland health are as follows:

Standard #1: 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.

Standard #2: Riparian and wetland vegetation has structural, age and species diversity characteristic of the state of channel succession 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 ground water recharge.

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

Standard #4: 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.

Standard #5: Water quality meets State standards

Standard #6: Air quality meets State standards

2.0 Affected Environment – Allotment Description, Resource Values, and Uses

2.1 Location and Land Ownership

The LU Allotment is located approximately 40 miles west of Worland, WY. The entire allotment encompasses approximately 148,500 acres, of which 101,500 acres are public land, 29,000 acres are private land, and 18,000 acres are Wyoming State land (Map 1).

2.2 Climate/Air Quality

Due to the large size of the allotment, the climate varies greatly from the lower to upper elevations. Elevation ranges from a low of approximately 4,500 feet in the winter range, to a high point of 8,784 feet in Upper Grass Creek near the Shoshone National Forest. The allotment falls within the 10 to 14 inch precipitation zone and the 15 to 19 inch precipitation zone.

The following general climate description is provided by the US Department of Agriculture, Natural Resources Conservation Service (NRCS), Ecological Site Description, Loamy Range Site, 10-14" Big Horn Basin Precipitation Zone (Site ID R032XY322WY):

> Annual precipitation ranges from 10-14 inches per year. The normal precipitation pattern shows the least amount of precipitation in December, January, and February, increasing to a peak during the latter part of May. Amounts decrease through June, July, and August and then increase some in September. Much of the moisture that falls in the latter part of the summer is lost by evaporation and much of the moisture that falls during the winter is lost by sublimation. Average snowfall exceeds 20 inches annually. Wide fluctuations may occur in yearly precipitation and result in more dry years than those with more than normal precipitation.
>
> Temperatures show a wide range between summer and winter and between daily maximums and minimums, due to the high elevation and dry air, which permits rapid incoming and outgoing radiation. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring.
>
> Winds are generally not strong as compared to the rest of the state. Daytime winds are generally stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph.
>
> Growth of native cool-season plants begins about April 15 and continues to about July 15. Cool weather and moisture in September may produce some green up of cool season plants that will continue to late October.
>
> The following information is from the "Thermopolis 2" climate station:

	Minimum	Maximum	5 yrs. out of 10 between
Frost-free period (days):	74	149	May 23 – September 16
Freeze-free period (days):	112	180	May 8 – October 1
Annual Precipitation (inches):	7.6	21.9	

> Mean annual precipitation: 12.35 inches
> Mean annual air temperature: 46.2 °F (30.1°F Avg. Min. to 62.3°F Avg. Max.)
> For detailed information visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. Other climate station(s) representative of this precipitation zone include "Grass Creek 1E", "Thermopolis", "Thermopolis 25NW", "Buffalo Bill Dam" and "Black Mountain".

The following general climate description is provided by the NRCS, Ecological Site Description, Loamy Range Site, 15-19" Foothills and Mountains East Precipitation Zone (Site ID R043BY322WY):

> Annual precipitation ranges from 15-19 inches per year. June is generally the wettest month. July, August, and September are somewhat less with daily amounts rarely exceeding one inch.
>
> Snowfall is quite heavy in the area. Annual snowfall averages about 150 inches.
>
> Because of the varied topography, the wind will vary considerably for different parts of the area. The wind is usually much lighter at the lower elevations and in the valleys as compared with the higher terrain. The average winter wind velocity is 8.5 mph while the summer wind velocity averages 7.5 mph. Winds during storms and on ridges may exceed 45 mph.
>
> Growth of native cool-season plants begins about May 1 to May 15 and continues to about October 10.
>
> The following information is from the "Crandall Creek" climate station, at the lower end of this precipitation zone:

	Minimum	Maximum	5 yrs. out of 10 between
Frost-free period (days):	16	80	July 8 – August 20
Freeze-free period (days):	37	120	June 17 – September 5
Annual Precipitation (inches):	10.24	21.23	

> Mean annual precipitation: 14.90 inches
> Mean annual air temperature: 38.16 °F (21.88°F Avg. Min. to 54.66°F Avg. Max.)
> For detailed information, visit the Natural Resources Conservation Service National Water and Climate Center at http://www.wcc.nrcs.usda.gov/ website. There are no other climate station(s) known to be representative of this precipitation zone.

2.3 Soils

LU Low Elevation (Units 4, 5, 6, and 8)

The soils in this low elevation portion of the LU Allotment reflect the high desert environment in which they formed. They are highly variable, reflecting differences in parent material (shale, sandstone and/or mixed alluvium), position on the landscape, elevation, slope and aspect. Elevation ranges from 5000 to 6000 feet. Straddling the watersheds of Lower Fifteenmile Creek, Gooseberry Creek, and Cottonwood Creek, this landscape can be typified as being part of the low piedmont slopes leading up to the Absaroka Mountains, consisting of rolling hills, ridges and escarpments that are dissected by ephemeral drainages. Soil depth ranges from less than 10 inches to over 60 inches. Sandstone and soft shale bedrock are common below the substratum. The soils typically have a light brown surface layer. Reddish hues, visible on satellite imagery, are exposed portions of the Willwood formation which makes up much of the 'badland' ridges.

Soil textures are varied ranging from course sandy loams to fine sandy loams, and clay loams to sandy clay loams and silty clay loams. In many locations, clay content, calcium carbonate and sodium increases increase with depth being expressed as argillic horizon, calcic, natrid and natriargid horizons. Slopes range from 0 to 60 percent but are generally less than 45 percent.

Incised gullies remain a significant feature on the landscape, particularly in these lower elevations. This drainage system that is inscribed into the landscape readily captures overland flow and as a result, water is not being retained on the landscape as it was historically. Many of the modern day gullies are thought to have replaced a system of broad swales which would have more effectively captured and slowed runoff from the uplands. Other gullies are caused by the two-track road network. Overall gullies are healing as evidenced by their rounded shoulders and the establishment of gasses and shrubs in the channels. Most gullies are no longer advancing into the uplands.

Based on NRCS spacial data, this portion of the LU Allotment is within both the 5-9 inch and 10-14 inch precipitation zones. Soil survey data generally places this area within the 10-14 inch precipitation zone.

Based on available soil survey data, the dominant ecological sites found in the low elevations are listed below:

Loamy 5-9 inch pz.	R032XY322WY
Saline Upland 5-9 in. pz.	R032XY144WY
Shale 5-9 inch pz.	R032XY154WY
Loamy 10-14 inch pz.	R032XY322WY
Shallow Loamy 10-14 inch pz.	R032XY362WY
Saline Upland 10-14 in. pz.	R032XY344WY
Sandy10-14 inch pz.	R032XY350WY
Shallow Sandy10-14 inch pz.	R032XY366WY
Clayey 10-14 inch pz.	R032XY362WY
Shallow Clayey 10-14 inch pz.	R032XY304WY

Five rangeland health assessments were conducted at key areas in this portion of the allotment, utilizing the methodology described in *Interpreting Indicators of Rangeland Health, Technical Reference 1734-6.*

LU Mid Elevation (Units 1, 2 and 3)

This mid elevation portion of the LU Allotment is more of a true piedmont slope leading to the Absaroka Mountains. Again the soils are highly variable, reflecting differences in parent material position on the landscape, elevation, slope, aspect and to a great extent precipitation. This portion of the allotment is within the Gooseberry Creek and Cottonwood Creek watersheds. The landscape can be typified as being low mountain ridges dissected by perennial streams and rolling hills. Soil depth ranges from less than 10 to over 60 inches. Sandstone, soft shale siltstone and igneous rock sources are common below the substratum and as on the surface as rock outcrop.

The soils typically have a darker surface textures, particularly to the west. Soil textures consist largely of loams and fine sandy loams. Heavier clay loam and clay textures are common in the subsoil that is expressed as argillic horizons. Slopes range from 0 to 60 percent with the steeper slopes being common.

The gully network described above for the low elevation portion of the LU allotment is applicable here as well. Gullies become less prominent as elevation and precipitation increase. Again, the two-track roads are a significant contributor to gully development.

Based on NRCS spacial data, this portion of the LU Allotment is entirely within 10-14 inch precipitation zone. Soil survey data places all but the eastern part of this region in the 10-14 inch precipitation zone, while placing the western edge in the 15-19 inch precipitation zone.

Based on available soil survey data, the dominant ecological sites found in the in the mid elevations are listed below:

Loamy 10-14 inch pz.	R032XY322WY
Shallow Loamy 10-14 inch pz.	R032XY362WY
Sandy10-14 inch pz.	R032XY350WY
Shallow Sandy10-14 inch pz.	R032XY366WY
Clayey 10-14 inch pz.	R032XY362WY
Saline Upland 10-14 in. pz.	R032XY344WY
Loamy 15-19 inch pz.	R043BY322WY
Shallow Loamy 15-19 inch pz.	R043BY362WY
Clayey 15-19 inch pz.	R043BY304WY
Shallow Clayey 15-19 inch pz.	R043BY358WY
Woodland	(Not mapped as separate ecological sites)

Five rangeland health assessments were conducted at key areas in this portion of the allotment, utilizing the methodology described in *Interpreting Indicators of Rangeland Health, Technical Reference 1734-6.*

LU High Elevation (Unit 7)

This high elevation portion of the LU Allotment extends into the Absaroka Mountains. The soils are variable, reflecting differences in parent material position on the landscape, elevation, slope, aspect and to a lesser extent precipitation. This portion of the allotment is entirely within the Cottonwood Creek watershed. The landscape can be typified as being low mountain ridges dissected by Grass Creek and its tributaries. Soil depth ranges from less than 10 to over 60 inches. Sandstone, soft shale siltstone and igneous rock sources are common below the substratum and as on the surface as rock outcrop.

The soils typically have a dark brown surface layer. Soil textures consist largely of loams and fine sandy loams. Cobble and channery fragments modify soil textures. Heavier clay loam and clay textures are common in the subsoil that is expressed as argillic horizons. Slopes range from 0 to 60 percent with the steeper slopes being common.

The gully system common to the lower elevations in not as prominent is the upper elevations. Where present, gullies are usually tied directly to the two-track road network.

Based on NRCS spacial data, this portion of the LU Allotment is entirely within 10-14 inch precipitation zone. Soil survey data places this portion of the allotment in the 15-19 inch precipitation zone.

Based on available soil survey data, the dominant ecological sites found in the in the high elevations are listed below:

Loamy 15-19 inch pz.	R043BY322WY
Shallow Loamy 15-19 inch pz.	R043BY362WY
Clayey 15-19 inch pz.	R043BY304WY
Shallow Clayey 15-19 inch pz.	R043BY358WY
Woodland	(Not mapped as separate ecological site)

Five rangeland health assessments were conducted at key areas in this portion of the allotment, utilizing the methodology described in *Interpreting Indicators of Rangeland Health, Technical Reference 1734-6.*

2.4 Hydrology

2.4.1 Surface Water/Watershed

Within the LU Allotment there are four different level #5 watersheds that are identified by the United States Geological Survey (USGS) by name and Hydrologic Units Codes or HUC. The watersheds with the most affected acres in order are Gooseberry Creek, Cottonwood Creek, and Lower and Upper Fifteenmile Creek watersheds (Map 6). The percentages of each allotment and their portion of the level #5 watersheds are found in the following table:

Watershed Table

HUC Level #5 Watersheds of the LU Allotment #00604					
Watershed (HUC) Level #5	**Acres (mi²)**	**Allotment Acres (mi²)**	**LU West (Pastures)**	**LU East (Pastures)**	**% of Acres of Watershed within the Allotment**
Cottonwood Creek (1008000706)	267990(418.7)	51787(80.9)	No	Yes	19.3
Gooseberry Creek (1008000707)	230180(359.7)	77359(120.9)	No	Yes	33.6
Upper Fifteenmile Creek (1008000710)	175668(269.7)	6515(10.2)	Yes	No	3.8
Lower Fifteenmile Creek(1008000711)	157937(246.8)	12193(19.1)	Yes	No	7.7

The watersheds in the LU East pastures are divided by east-west trending ridges that separate the Cottonwood/Grass Creek and Gooseberry Creek drainages. The LU West pastures are located at the upper elevations of the lower

ephemeral Fifteenmile Creek watersheds. The Fifteenmile watershed was divided into upper and lower portions due to overall large size of the watershed (>516 mi^2).

Cottonwood/Grass Creek Watershed
The Cottonwood/Grass Creek watershed is located in Hot Springs and Washakie Counties. The watershed is comprised of the combined drainage basins of Cottonwood Creek and its main tributary, Grass Creek (of which the LU allotment is located). The main drainages in the western pastures are Grass Creek (tributary to Cottonwood Creek), that flows in an eastern direction, originating from the upper elevations of the Absaroka foothills. The majority of the main drainages are located on state or private land, with the exception of some meander segments that are located on public land throughout the reaches. There are several smaller perennial and intermittent tributaries that drain into Grass Creek that are located on public land segments. The Cottonwood/Grass Creek Watershed was recently studied by the Wyoming Water Development Commission (WWDC) in 2007 under a level I study and 2011 with a more detailed level II study. The study encompasses the hydrology of the creeks and summarizes the overall water use and availability of surface water in the watershed.

The economy of the watershed is based on agriculture (primarily cattle ranching and associated forage production) and oil and limited natural gas extraction at two larger (Hamilton Dome and Grass Creek) and a number of smaller still active fields (SEH, 2007 p.5).

The perennial stream reaches in the watershed (including the uppermost reaches of Cottonwood and Grass Creeks and their high elevation tributaries) are the result of higher precipitation (including greater snowpack) and greater groundwater recharge that, in turn, results in higher spring time runoff flows and sustain seep and spring discharge to these stream reaches through the summer and fall. As noted by local ranchers and other stakeholders in the watershed, the extent of the upper watershed perennial stream reaches has declined significantly over the course of the current drought, with many smaller springs ceasing to flow and greatly reduced flows in larger springs (SEH, 2007 p.32).

Gooseberry Creek Watershed
Gooseberry Creek, located north of Cottonwood/Grass Creek, is the other main drainage in the allotment. The Gooseberry Creek watershed is located in the Big Horn Basin with portions of the watershed in Park, Hot Springs, and Washakie counties. The main drainages flow in a southeastern and eastern direction and originate in the upper elevations of the Absaroka foothills located to the west. The Gooseberry Creek Watershed is approximately 60 miles long and varies in width from 3 to 14 miles. The basin drainage area encompasses approximately 363 square miles. The elevation ranges from about 10,400 feet near Cottonwood Peak at the upper end of the watershed to about 4,200 feet at the confluence of Gooseberry Creek with the Big Horn River near Neiber. Average annual precipitation for the basin is 8 to 10 inches, with a maximum of 30 inches in the upper headwaters reaches. The growing season for the basin generally runs from April through October.

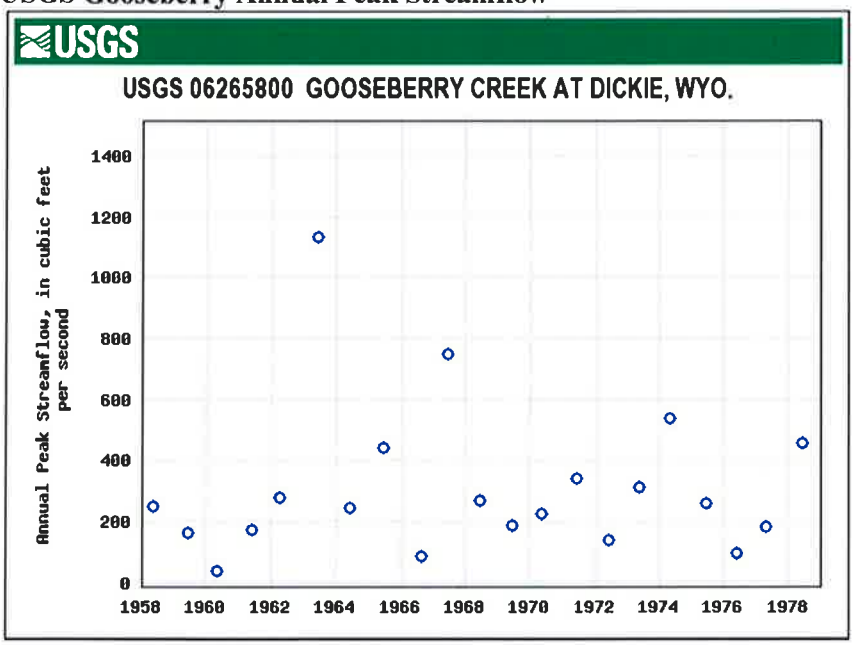
The Gooseberry Creek watershed was recently studied by the Wyoming Water Development Commission (WWDC) in 2005 under a level I study and 2007 with a more detailed level II study. The study encompasses the hydrology of the creeks and summarizes the overall water use and availability of surface water in the watershed. The study contains analysis of different proposed water development projects such as reservoir sites and water well development for increased water use in the watershed.

Streamflow is typical of snowmelt driven systems where there is a high spring runoff, with the peak generally occurring between mid-May to mid-June, followed by a sharp drop in flows during the summer. Eventually this tapers off to a low base flow condition during the fall and winter. The Mean Daily Flow Hydrograph for USGS Gage 06266000, Gooseberry Creek near Grass Creek, illustrates the phenomena. Because a relatively small percentage of the watershed is located within the Absaroka Mountains, the volume of water stored as snow is limited.

The major economic activity in the Gooseberry Creek watershed is cow-calf, cow-yearling, and sheep ranching operations. These ranching operations utilize native rangeland which is supplemented by irrigated pasture and irrigated land producing hay, grain, and silage for winter feed (Western Water Consultants 1984). The LU allotment encompasses approximately 33 percent of the total watershed.

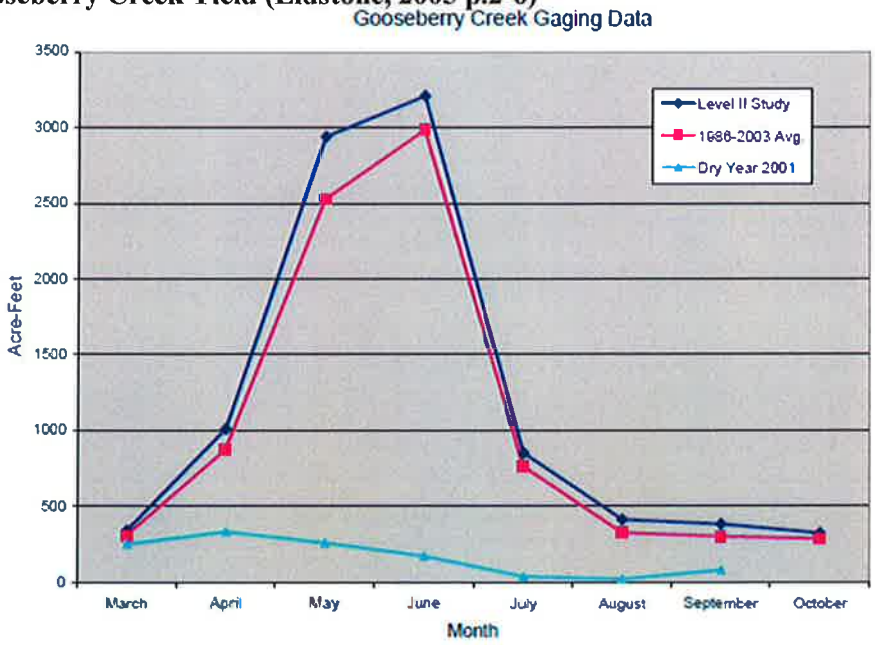
The U.S. Geological Survey (USGS) operated stream flow gaging stations on Gooseberry Creek at various locations for various periods of time. The longest record on Gooseberry Creek was at Dickie (USGS Station no. 06265800), which was operated from 1958 to 1978. Unfortunately, the station was discontinued after the 1978 water year. The graph below represents the annual peak stream flow of Gooseberry Creek at Dickie, Wyoming. On average years a flow peak flow of 200-400 cubic feet per second is expected. This graph is given to represent the magnitude of peak flows in Gooseberry Creek for the LU Allotment.

USGS Gooseberry Annual Peak Streamflow



The following graph represents the average annual runoff volume in acre-feet for Gooseberry Creek in the LU Allotment. The data suggests that peak runoff and maximum water yield of Gooseberry Creek occurs during late March through mid-June. Base flow conditions are present from August through March.

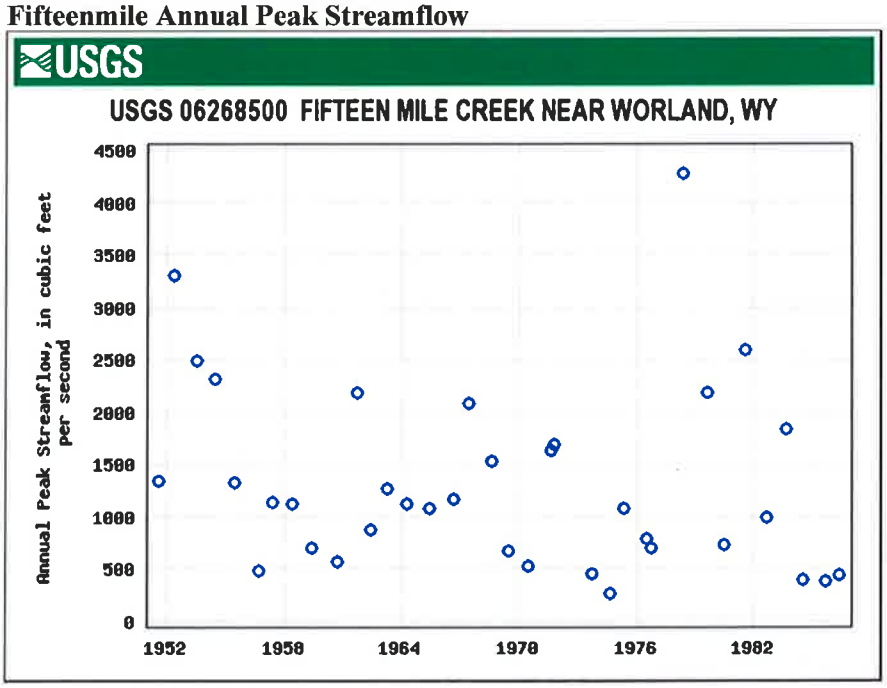
Gooseberry Creek Yield (Lidstone, 2005 p.2-6)



Fifteenmile Watershed
In the Fifteenmile watersheds the average watershed slope ranges from 1 to 2 percent, based upon GIS calculations and the length of the flow path in the watershed. The sub-watersheds within also have a dendritic drainage pattern that indicates ephemeral, short duration events, with high sediment loads that are common from cold desert type watersheds such as Fifteenmile Creek. Stream channel erosion is common in the Fifteenmile watershed with numerous head cuts present. The Fifteenmile watershed has been extensively studied and is considered a semi-arid watershed with very flashy flows that dominate the entire watershed. The LU portions encompass a total of 10.5 percent of the watershed and are considered to be located in the upper ephemeral reaches or the northwest and western areas of the watershed.

There is a USGS gauging station located at just above the confluence with the Bighorn River several miles downstream of the LU Allotment. Although the entire watershed is not represented, the data gives an understanding to the volume and timing of surface water flow in the Fifteenmile watershed, of which the LU West pastures contribute a combined 10.5 percent of the Fifteenmile watershed. The period of record is from 1952-1992 when the station was discontinued by the USGS due to a lack of funding.

Fifteenmile Annual Peak Streamflow



Refer to Map 6 – Hydrology / Riparian / Watershed, located at the end of this document.

2.4.2 Groundwater

Cottonwood/Grass Creek
Groundwater in the Cottonwood/Grass Creek Watershed occurs in both shallow (alluvial) and deeper (bedrock) aquifers and in some locations discharges directly to the ground surface as springs. The quantity and to a large degree the quality of these groundwater sources are directly related to the physical properties and geologic history of the various geologic units comprising the aquifers, and to the current climate of the area (relative to recharge).

The perennial stream reaches in the watershed (including the uppermost reaches of Cottonwood and Grass Creeks and their high elevation tributaries) are the result of higher precipitation (including greater snowpack) and greater groundwater recharge that, in turn, result in higher spring time runoff flows and sustain seep and spring discharge to these stream reaches through the summer and fall. According to the BLM Grass Creek RMP there are 61 springs in the Cottonwood/Grass Creek watershed. According to GIS records and the 2007 inventory of Wyoming State

Engineer's records there are 24 wells that are on public land. The majority of these wells are designated as public water reserves and used for stock watering within the allotment.

Gooseberry Creek
The upper reaches of Gooseberry Creek within the LU Allotment are supplied by various spring and seeps that occur in upper elevations of the watershed. These areas have been identified as tied to climatic conditions and the discharge from such springs is similar in nature to the Grass Creek watershed. These areas frequently provide water sources for grazing within the LU Allotment. According to the BLM Grass Creek RMP there are 48 springs on public land in the Gooseberry watershed. The main drainage is Gooseberry Creek which is supplemented by Enos Creek, Left Hand Creek, and other smaller sized tributaries. There have been water development projects on various spring sources in the allotment.

Fifteenmile
The main sources of ground water within the Fifteenmile area of the LU Allotment are from the Tertiary aged Willwood Formation. There are other isolated springs that are in the watershed that have a flow of less than two gallons per minute. Due to the lower elevation and surficial geology the depth to ground water in the Fifteenmile watershed is much greater that Gooseberry and Cottonwood/Grass Creek watersheds.

2.4.3 Riparian

Cottonwood/Grass Creek
The riparian areas on public land within the LU Allotment in this watershed are primarily lateral tributaries to Grass Creek, described in the table below and in Maps 7 and 8, located at the end of the document. The lateral tributaries generally have higher gradients and an intermittent flow regime.

There are several spring sources that are located on public land at various locations in the draws. These springs provide base flow for the tributary creeks that are mentioned above. The also serve as a water source for wildlife throughout the watershed.

Riparian Areas Cottonwood/Grass Creek Watershed - LU Allotment

ID#	Riparian Area	Flow Type	Township	Range	Sec	Miles	Acres	DEQ_class	Gradient (%)
I0136X	OTTO CK TR	Intermittent	045N	101W	10	0.38	0.2	4	26.00
I0138X	GRASS CK TR	Intermittent	045N	101W	9	0.41	0.5	4	13.00
I0139X	GRASS CK TR	Intermittent	045N	101W	9	0.44	0.5	4	20.00
I0046X	RASPBERRY DRAW	Intermittent	045N	101W	26	0.17	0.2	4	10
I0047X	RASPBERRY DRAW TR	Perennial	045N	101W	27	0.43	0.5	4	22.00
I0048X	RASPBERRY DRAW TR	Intermittent	045N	101W	26	0.29	0.2	4	11.00
I0050X	GRASS CK TR	Intermittent	045N	100W	4	0.36	0.4	4	9.00
I0060X	HESS CK DRAW TR	Intermittent	044N	101W	27	0.23	0.1	4	8.00
I0108X	HESS CK DRAW	Intermittent	045N	101W	27	0.18	0.1	4	24.00
I0110X	RASPBERRY DRAW TR	Intermittent	045N	101W	26	0.25	0.3	4	14.00
P0710Xa	ROACH CK	Intermittent	045N	101W	12	0.21	0.5	4	11.00
I0470X	ROACH CK	Intermittent	045N	101W	12	0.14	0.5	4	11.00
I0413X	SANFORD DRAW	Intermittent	045N	101W	2	0.69	0.8	4	18.00
P0080X	THOMPSON DRAW	Perennial	045N	100W	30	0.26	0.5	4	8.00
P0225X	EGBERT DRAW	Perennial	045N	100W	8	1.07	1.3	4	10.00
P0235X	GRASS CK	Perennial	046N	097W	33	0.43	4.2	2AB	2
P0346X	GRASS CK	Perennial	046N	097W	32	0.23	2.2	2AB	0.00
P0413X	OTTO CK	Perennial	045N	101W	15	0.23	0.3	4	6.00
I0137X	OTTO CK TR	Ephemeral	045N	101W	10	0.28	0.2	4	27
I0412X	ROACH CK	Ephemeral	045N	101W	12	0.4	0.5	4	11.00
P0710Xb	ROACH CK	Perennial	045N	101W	12	0.21	0.5	2AB	11.00
I0049X	MILK CK	Intermittent	045N	101W	35	0.14	0.2	4	16.00
P0286X	EGBERT DRAW TR	Intermittent	045N	100W	8	0.3	0	4	10.00

Gooseberry Creek
The riparian segments located within the Gooseberry Creek watershed are mostly smaller length perennial streams located along upper areas of the watershed. These are riparian areas that are found along Enos Creek, Gooseberry Creek, and Left Hand Creek. There are a few other segments with produced water that are located in the Little Buffalo Basin area. The segments are outlined in the table below and in Map 6 and 7.

Riparian Areas Gooseberry Creek Watershed - LU Allotment

ID#	Riparian Area	Flow Type	Township	Range	Sec	Miles	Acres	DEQ_class	Gradient (%)
T0052X	LITTLE BUFFALO	Produced	047N	099W	7	1	30	3B	1.30
P0208X	LEFT HAND CK	Perennial	046N	100W	15	0.88	1.1	4	3.00
I0174X	ENOS CK TR	Intermittent	045N	100W	6	0.43	0.5	4	12.00
I0033X	ENOS CK TR	Intermittent	046N	100W	35	1.53	1.9	4	3.00
P0205X	ENOS CK	Perennial	046N	099W	19	0.56	2.7	2AB	2.00
I0115X	BUFFALO CK (nr	Intermittent	047N	099W	10	0.43	10.4	4	0.00
I0116X	BUFFALO CK (nr	Produced	047N	099W	4	0.57	13.8	4	1.00
I0143X	GOOSEBERRY CK TR	Intermittent	046N	099W	2	0.24	1.6	4	2.00
P0709X	S FK LEFT HAND CK	Perennial	046N	100W	14	0.4	3.7	4	
P0230Xa	ENOS CREEK	Perennial	046N	099W	17	0.09	0.5	2AB	
P0231X	ENOS CK	Perennial	046N	099W	4	1.22	5	2AB	
P0011X	ENOS CK	Perennial	046N	100W	34	0.15	0.4	2	2.00
P0012X	GOOSEBERRY CK	Perennial	047N	099W	32	0.43	2.1	2	1.00
P0014X	GOOSEBERRY CK	Perennial	047N	099W	35	0.52	9.5	2	0.00
T0021X	ENOS CK TR	Ephemeral	046N	099W	9	0.2	0.2	4	19.00
P0207X	LEFT HAND CK	Perennial	047N	099W	32	0.64	21.5	4	2.00
P0204X	ENOS CREEK	Perennial	046N	099W	8	0.4	4.6	2AB	
I0295X	ENOS CK TR	Ephemeral	045N	100W	5	0.43	0.3	4	14.00
P0230Xb	ENOS CREEK	Perennial	046N	099W	17	0.09	0.5	2AB	

Fifteenmile
There are no identified naturally occurring riparian areas in the LU Allotment part of the Fifteenmile watershed. These are lower elevation areas and generally do not have the available water to support such riparian areas.

2.5 Upland Vegetation

Upland vegetation on the LU Allotment is highly variable. As previously stated, parts of the allotment are within both the 10 to 14 inch precipitation zone and the 15 to 19 inch precipitation zone, and include the majority of the range sites within these precipitation zones. Loamy range sites within both of these precipitation zones provide the majority of the livestock forage, and receive the most livestock grazing use. Most of the vegetation monitoring locations on the LU Allotment are located on these range sites.

Following is the plant community narrative from the NRCS Ecological Site Description for a loamy range site in the 10-14" precipitation zone:

> Potential vegetation on this site is dominated by mid cool-season perennial grasses. Other significant vegetation includes winterfat, big sagebrush, and a variety of forbs. The expected potential composition for this site is about 75% grasses, 10% forbs and 15% woody plants. The composition and production will vary naturally due to historical use, fluctuating precipitation and fire frequency.
>
> As this site deteriorates species such as blue grama, Sandberg bluegrass, and big sagebrush will increase. Plains pricklypear and weedy annuals will invade. Cool-season grasses such as Griffiths and bluebunch wheatgrass, rhizomatous wheatgrasses, needle-and-thread, and Indian ricegrass will decrease in frequency and production.
>
> Big sagebrush may become dominant on areas with an absence of fire and sufficient amount of precipitation. Wildfires are actively controlled in recent times and as a resulted old decadent stands of big

sagebrush persist. Chemical control using herbicides has replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

Following is the plant community narrative from the NRCS Ecological Site Description for a loamy range site in the 15-19" precipitation zone:

> Potential vegetation on this site is dominated by mid cool-season perennial grasses. Other significant vegetation includes big sagebrush, rubber rabbitbrush, and a variety of forbs. The expected potential composition for this site is about 75% grasses, 15% forbs and 10% woody plants. The composition and production will vary naturally due to historical use, fluctuating precipitation and fire frequency.
>
> As this site deteriorates species such as big sagebrush, rubber rabbitbrush, and bluegrasses will increase. Cool season grasses such as Columbia needlegrass, spikefescue, and Idaho fescue will decrease in frequency and production. As conditions deteriorate further, annuals such as cheatgrass will invade.
>
> Big sagebrush may become dominant on areas with an absence of fire and a sufficient amount of precipitation. Wildfires are actively controlled in recent times and as a result old decadent stands of big sagebrush persist. Chemical and mechanical controls have replaced the historic role of fire on this site. Recently, prescribed burning has regained some popularity.

Forest and Woodlands

There are approximately 4,014 acres of lands classified as commercial forestland within the LU Allotment, comprised of approximately 2,076 acres of BLM forestland, 1,082 acres of Wyoming State forestland, and 856 acres of Private forestland. There are no National Forest (USFS) lands within the allotment; however USFS land is adjacent to the western border of the allotment. The mixed land ownership pattern often requires coordination between BLM, State, private, and sometimes USFS to effectively implement forest management treatments.

These stands have an average basal area of 130 square feet per acre. Species include douglas fir, lodgepole pine, englemann spruce, and the occasional subalpine fir, with decadent stands of limber pine and aspen mixed in and scattered throughout.

Due to past and present management practices, natural disturbances such as wildfire have not occurred in the cyclic fashion they historically did. As a result, most aspen stands are remnant stands severely encroached and shaded by live and dead conifers, thus reducing vigorous aspen suckering. Some aspen stands have been treated with conifer removal and/or prescribed burning, many of which have since responded with increased suckering and vigor.

Mountian pine beetle, spruce beetle, and douglas fir beetle outbreaks and infestations are occurring at higher than endemic levels in some conifer stands. Dwarf mistletoe currently remains at endemic levels.

The Enos Creek Wildfire in 2000 removed several hundred acres of limber pine, converting former limber pine stands to grassland. There has been very little natural regeneration since the wildfire. Combinations of mountain pine beetle and blister rust have decreased the remaining limber pine by more than 50%. Many live limber pines are severely infected by blister rust, however there are some individuals that appear to have genetic resistance.

The allotment also has several thousand acres of woodlands. These are mostly juniper and scattered limber pine in the uplands, but there is also a cottonwood and willow component within the riparian areas.

2.6 Livestock Grazing Management

The LU Allotment is permitted to the LU Ranch for yearlong livestock grazing. A total of 16,636 animal unit months (AUMs) of cattle, horse, and sheep grazing use are currently permitted on the allotment. A comprehensive Allotment Management Plan (AMP) for the allotment was completed in 1993. Current permitted livestock grazing, in accordance with the LU AMP, is shown on the following table:

LU Allotment Permitted Livestock Grazing					
Unit	**Name**	**Livestock Number and Kind**	**Permitted Use Dates**	**Percent Public Land**	**Public AUMs**
1	Enos / Lower Grass Creek	894 Cattle	05/01-11/30	50	3145
1	Enos / Lower Grass Creek	6 Horses	05/01-11/30	50	21
1	Holding Pasture	3 Cattle	05/01-11/30	100	21
2	Spring / Fall	30 Horses	03/01-02/28	75	270
2	Spring / Fall	468 Cattle	03/01-12/31	75	3531
3	Buffalo Basin	226 Cattle	03/01-06/01	58	401*
3	Buffalo Basin	278 Cattle	07/01-02/28	58	1288*
4	Buck Buttes	617 Cattle	03/01-06/01	89	1679
5	Rankine Basin	547 Cattle	03/01-04/15	89	736
5	Rankine Basin	547 Cattle	12/01-02/28	89	1440
6	Gillies Draw	624 Cattle	03/01-04/15	63	595
6	Gillies Draw	620 Cattle	12/01-02/28	63	1156
7	Upper Grass Creek	764 Cattle	07/01-11/01	53	1651
8	Fifteenmile HMA	1903 Sheep	11/01-12/31	92	702
				Total Public AUMs	**16,636**

* During the renewal of the grazing permit for the LU Allotment in 2003, the permitted turnout date for the Buffalo Basin Unit 3 was changed from November 1 to July 1. When the new permit was printed, the WFO failed to adjust the number of livestock permitted in Unit 3 to correspond with the earlier turnout date. This resulted in the permitted use in Unit 3 rising from 1118 Public AUMs to 1689 Public AUMs, an increase of 571 AUMs. These AUMs have never been utilized.

Multiple pastures exist within the units of the LU Allotment. According to the LU AMP, the number of cattle may vary within each unit, as long as the total AUMs for each unit are not exceeded. The LU Ranch submits an annual operating plan to the WFO on or about March 1 of each year. Actual livestock grazing use reports are submitted bi-monthly by the LU Ranch, from which actual use grazing bills are generated.

The LU Ranch has not grazed sheep in many years, and has taken voluntary non-use within the Fifteenmile Wild Horse Herd Management Area (HMA) since the HMA was created in 1985. The total permitted livestock grazing use on the LU Allotment in Unit 1 through Unit 7, minus the 571 AUMs that were allocated to Unit 3 in error, is 15,363 AUMs. Actual livestock grazing use that has occurred on the LU Allotment in Unit 1 through Unit 7 since 1993 is shown in the following table:

Livestock Grazing Actual Use (Units 1-7)		
Year	**Actual Grazing Use (Public AUMs)**	**Percent of Permitted Use (Public AUMs)**
1993	10,283	67%
1994	10,837	71%
1995	12,180	79%
1996	12,132	79%
1997	11,723	76%
1998	11,910	78%
1999	10,785	70%
2000	11,055	72%
2001	8,564	56%
2002	7,623	50%
2003	7,091	46%
2004	9,644	63%
2005	9,372	61%
2006	9,232	60%
2007	9,559	62%
2008	10,093	66%
2009	10,409	68%
2010	10,674	69%
2011	10,477	68%
2012	9,141	60%
2013	10,904	71%
Average	**10,175**	**66%**

2.7 Wildlife

The LU Allotment provides habitat, specifically forage and cover needs, for several big game, non-game, and trophy game species, as well as for special status species, BLM sensitive species, migratory birds, and threatened species, some seasonally and some yearlong. As stated earlier, habitats within this allotment range in elevation and precipitation from the low end at 4,500 feet and approximately10 inches of precipitation annually, to a high of 8,784 feet and approximately 17 inches of precipitation annually. For the purpose of this analysis, the wildlife habitat descriptions for the LU Allotment have been loosely divided into three groups based on vegetative communities; the Lower Elevation, Transition, and Upper Elevation groups. The lower being the 10 to 14 inch precipitation zone, the transition located within the mid to upper reach of the 10-14 inch precipitation zone, and the upper located within the lower end of the 15-19 inch precipitation zone (see description in Section 3.4 Upland Vegetation and Management Units in Map 2).

Low Elevation

This portion of the LU Allotment is predominately found in Units 4, 5, and 6 (see Map 2), and provides yearlong and seasonal habitats for numerous species like mule deer and pronghorn antelope, sagebrush obligate bird species like the sage-grouse, sage thrasher, sage and Brewer's sparrow, and white-tail prairie dogs, mountain plover and burrowing owls. In recent years occasional elk use in small numbers, primarily during the winter, but spring and fall use has been observed also. The primary vegetative communities providing wildlife forage and cover needs are the sagebrush communities, grasslands, and juniper/limber pine breaks. The Wyoming big sagebrush (*Tridentata wyomingensis*) communities are typically ≥10% canopy cover sagebrush with a healthy understory composition of grass and forb species. These stands are important to wintering mule deer, antelope, and wintering and nesting sage grouse, as well as other sagebrush obligate passerines. Wintering big game and sage-grouse depend on the sagebrush plants for forage, and the avian sagebrush obligates depend on both the sagebrush and standing herbaceous residue for nesting cover. The majority of Units 4, 5 and 6 are within Core sage-grouse habitat, and this area provides sage-grouse winter, breeding, nesting and brood rearing habitat (see Map 8 – Wildlife Habitat Resources). The grasslands typically comprise ≤5% sagebrush canopy cover with the predominant vegetation being grasses, with a minor component of forbs. These sites can be important foraging areas for mule deer and pronghorn,

particularly in the spring and summer when diets shift from shrubs to grasses and forbs. These areas also contain white-tailed prairie dog colonies, and the colonies themselves provide habitat for other sensitive species like the burrowing owl and mountain plover, as well as foraging habitat for the ferruginous hawk. The juniper/limber pine breaks provide hiding cover for mule deer and occasionally elk, and the trees also provide valuable nesting habitat and forage in the form of cones and berries, for species like Pinyon jays, Townsend solitaire, and mountain blue birds. Elk, like cattle, primarily forage on herbaceous species, and could be expected within all of these habitat types, but as stated above only occasionally use this area.

Other important wildlife vegetative communities provided within the Lower portion of the LU Allotment are the saline upland sites, and riparian/wetland areas associated with reservoirs, seeps and ephemeral drainages. The saline uplands also contain white-tail prairie dog colonies, and provide potential nesting and foraging habitat for burrowing owl and mountain plover. The saltbush component of these sites can be important forage for pronghorn and mule deer at times. Riparian areas and their associated aquatic and wetland vegetation provide forage and cover for shorebirds, waterfowl, passerines and some amphibians like the great basin spadefoot toad at some of the reservoirs, and northern leopard frog along some stream segments. These wet areas with succulent vegetation and abundant insects can be important foraging areas for sage grouse broods, particularly during late brood rearing when most other upland sites have dried up and vegetation has cured out.

Mid Elevation (Transition)

These areas transition from the lower to upper habitats and are predominately found in the lower elevations of Unit 1, as well as Units 2, 3, and the upper portions of Unit 4 (see Map 2). This area is predominantly mule deer crucial winter range dominated by sagebrush bunchgrass communities and juniper/limber pine woodlands. Sagebrush communities transition here from Wyoming big sagebrush to mountain sagebrush (*Tridentata vaseyana*) at around 6000 ft. elevation. From late fall through spring this area provides crucial winter range for larger herds of mule deer and winter range for elk, with a small portion being crucial elk winter range (see Map 8 – Wildlife Map). Winter and spring elk use of this area has been increasing over the past 5 to 10 years. Numbers of mule deer will use the area as transition range in the spring and again in late fall during the rut as well. Antelope can also occasionally be observed throughout the lower portions of this area, particularly in the spring and summer. A small portion of this area is within the core sage-grouse habitat. Other species like the mountain lion, and a variety of other passerines, raptors, small mammals and predator species inhabit this allotment throughout the year.

Upper Elevation

The Upper portion of the LU Allotment consists of Unit 7 and the upper elevations of Unit 1. This portion of the Absaroka Mountain foothills is a mix of mountain sagebrush grasslands with patches of mixed conifer, aspen, Douglas fir and scattered juniper and limber pine. Typically mixed conifer and Douglas fir stands are found on the northern aspects and limber pine and juniper on shallow soil sites. There is substantial limber pine and juniper invading deeper soil range sites and riparian areas as well. Small conifer encroached aspen clones can be found throughout the upper elevations. BLM riparian habitat acreage is small and primarily within the upper tributaries of the Grass and Enos Creek drainages. These sites are typically Engelmann spruce dominated with small conifer encroached communities of narrow leaf cottonwood, aspen and willow. A significant amount of this Upper portion of the allotment has had both wildfire and prescribed fire, with the prescribed fire occurring from 1993 – 2008 throughout Upper Grass, Enos, and Lefthand Creeks, primarily targeting conifer encroachment within range sites, aspen clones and riparian areas.

Throughout the year smaller numbers of resident elk, moose and mule deer use this upper portion of the allotment. From late fall through early spring the majority of this area provides crucial winter range for larger concentrations of elk, and a smaller upper portion crucial winter range for moose (see Map 10 - Wildlife Map). The wintering elk primarily forage on standing herbaceous residue that can be accessed above the snow or on windblown ridges, and wintering moose use browse species like aspen, willow, and to some degree young conifer species. Mule deer will use the area primarily as transition range in the late spring, early summer and again in early fall, moving between summer and winter ranges and foraging on green herbaceous vegetation and woody browse species.

2.8 Threatened, Endangered, Candidate, or Sensitive Species

Special status species found within the LU Allotment include sagebrush obligate species – sage-grouse, sage thrasher, Brewer's and sage sparrow, as well grassland or saline upland species – white-tailed prairie dog, Mountain

plover, burrowing owl and ferruginous hawk, predominantly within the Lower and Transition areas, and the Grizzly bear, gray wolf and Northern goshawk in the Upper more forested habitats.

The sagebrush steppe communities in the Lower and Transition areas mentioned above, in addition to providing big game winter range, provide wintering, breeding, nesting and early brood rearing habitat for a migratory population of sage-grouse. There are several winter concentration areas between the Lower and Transition portions of this allotment that were identified through both aerial and ground surveys. Most of these wintering areas are associated with nearby leks. Both wintering and breeding habitats have been well documented through inventory and monitoring efforts. Nesting and late brood rearing habitats have not been well documented, however in an analysis of sage-grouse studies conducted in 7 areas in Wyoming since the mid-1990s, Holloran and Anderson (2005) found that 45% of nests were located within 2 miles (3km) of the lek where the hen was bred, and 64% of the nests were within 3 miles (5 km) of the lek. Therefore viable nesting habitat surrounding these leks, within and nearby the LU Allotment, are considered occupied nesting habitat. Exact movements between seasonal habitats have not been documented but anecdotal observations lead biologists to believe that these sage-grouse, post hatch, migrate up in elevation as the summer progresses, into Left Hand and Little Grass Creeks in the Transition portion of this allotment, and Middle, Prospect and Cottonwood Creeks to the north and south of the Upper portion of the allotment, for green vegetation during late brood rearing. Upland herbaceous communities around these leks historically have received light livestock use (<20%), and typically there is adequate standing herbaceous residue going into the sage-grouse nesting season in April and May (see Section 3.1.4 Forage Utilization and Section 3.5 Sage-grouse Nesting Habitat Photos). An analysis of sage-grouse nest site selection from 7 study areas in Wyoming indicates that residual grass height should be a minimum of 3.9 inches (10 cm) in Wyoming big sagebrush dominated sites (Holloran et al. 2005) compared to 7 inches (18 cm) minimum live perennial herbaceous vegetation height recommended by Connelly et al. (2000) in breeding habitats. Hens nesting in these cover conditions experience higher nest success rates than those nesting under inferior cover conditions (Delong et al. 1995, Holloran et al. 2005).

Within the entire allotment there are 4 occupied leks; East Ridge, Grass Creek 2, Left Hand, and Red Ridge, one unoccupied lek, Squaw Teats, and another 4 occupied leks and 1 unoccupied lek within 2 miles of the allotment boundary (see Map 8 – for lek locations). Female sage-grouse from all 8 occupied leks are likely using suitable sagebrush habitats within the LU Allotment for nesting habitat. Male sage-grouse lek attendance, as well as the peak and low male counts for the LU Allotment occupied leks is provided in Section 3.5. The unoccupied lek, Squaw Teats, has not seen any activity since 2007 when 2 males were observed, and prior to this the peak male attendance was 7 males in 1979. Sage-grouse habitat assessments were conducted within representative sage-grouse habitats throughout the Lower and Transition areas of the LU Allotment. A total of 14 monitoring sites or transects were selected and run where sage-grouse habitat data was collected (see Map 11 – for transect locations). Data from these assessments is summarized in Section 3.5. These same sagebrush habitats are also likely providing breeding, nesting and foraging habitat for sagebrush obligate species like the sage thrasher, sage sparrow, and Brewer's sparrow. Numerous other raptors, small mammals, passerines, and predators inhabit the area as well.

There is seasonal grizzly bear and wolf occurrence throughout the Upper portion of the allotment, and the upper elevations of the Transition portion of the allotment. Grizzly bear occurrence is primarily in spring and early summer when bears leave den sites at higher elevations (all known den sites are on the neighboring Shoshone National Forest) and move to lower elevations in search of winter kill carcasses and green vegetation. Usually by mid-June most grizzly bears have moved up in elevation, following vegetation green-up as it progresses to higher elevations, and then return in the fall when the higher elevation vegetation starts receiving killing frosts. Wolf occurrence resembles that of the grizzly bear, but is more wide ranging and could be yearlong, but most likely during winter when larger numbers of elk or moose are present on winter ranges. There are numerous migratory bird species that likely use this allotment for breeding, nesting and foraging habitat. Most species are likely nesting in trees like conifers and aspen, and several are likely nesting close to or on the ground in grass or shrub cover. The Douglas fir and mixed conifer stands within this allotment likely provide foraging and nesting habitat for the northern goshawk, and these conifer stands also provide habitat for snowshoe hare and therefore have the potential to provide habitat for the Canada lynx. Mixed conifer stands to the southwest and northwest of this allotment's western boundary are part of a larger Lynx Analysis Unit (LAU) that has been delineated as potential habitat for the lynx. This LAU is primarily composed of Shoshone Forest Service land in the Wood River and Gooseberry Creek drainages and is approximately 168,000 acres. Lynx inventories were conducted by the Wyoming Natural Diversity Database within the LU Allotment and portions of the neighboring LAU during the winter of 2000-2001, and

subsequent winter inventories have been conducted by the BLM periodically in the Upper portion of this allotment and the neighboring Cottonwood and Gooseberry drainages, with no lynx or lynx sign observed. No documented occurrences, travel corridors, or den sites for lynx have been identified in this portion of the southern Absaroka Front.

In addition to the Federally listed threatened grizzly bear mentioned above, and the sage-grouse listed as a Candidate species, the mountain plover, white-tailed prairie dog, burrowing owl, ferruginous hawk, sage thrasher, sage and Brewer's sparrow, northern goshawk, northern leopard frog, great basin spadefoot toad, and the grey wolf are all Wyoming BLM sensitive species. And there are several other raptor and migratory bird species inhabiting this allotment, at least seasonally, that were not mentioned or analyzed.

3.0 Summary of Monitoring Data / Assessments

3.1 Monitoring Data

A variety of vegetation monitoring data has been collected on the LU Allotment. The location of the monitoring sites used for this analysis are shown in the following table, and on Maps 3-5, found at the end of this document.

Monitoring Site Locations			
Name	**Management Unit**	**Location**	**Range Site**
Buck Buttes West	4	T 48 N, R 99 W, Sec. 34 SWSW	Loamy 10-14"
Buck Buttes East	4	T 48 N, R 98 W, Sec. 31 SWSW	Shallow Loamy 10-14"
South Shearing	4	T 47 N, R 99 W, Sec. 10 SWSW	Sandy 10-14"
Rankine Basin	5	T 46 N, R 97 W, Sec. 08 SWNW	Loamy 10-14"
Gillies Draw	6	T 48 N, R 97 W, Sec. 29 NWSW	Loamy 10-14"
East Ridge	8	T 48 N, R 97 W, Sec. 20 NENE	Saline Upland 10-14"
Grass Creek Basin	2	T 46 N, R 98 W, Sec. 06 SESW	Loamy 10-14"
Lower Left Hand	2	T 46 N, R 99 W, Sec. 06 SENE	Loamy 10-14"
South Fork Left Hand #1	1	T 46 N, R 100 W, Sec. 14 NWNE	Loamy 10-14"
Middle Enos	1	T 46 N, R 100 W, Sec. 27 SESW	Loamy 10-14"
Upper Enos #1	1	T 46 N, R 101 W, Sec. 36 NWNW	Loamy 15-19"
Beef	7	T 45 N, R 100 W, Sec. 08 NWSE	Loamy 15-19"
Thompson Draw	7	T 45 N, R 100 W, Sec. 30 NENE	Loamy 15-19"
Carmichel BBQ Bench	7	T 45 N, R 101 W, Sec. 24 NENE	Loamy 15-19"
Upper Sanford	7	T 45 N, R 101 W, Sec. 13 NWNE	Loamy 15-19"
Otto Draw	7	T 45 N, R 101 W, Sec. 15 NWSE	Loamy 15-19"
Hess Creek Draw	7	T 45 N, R 101 W, Sec. 28 NENE	Loamy 15-19"

3.1.1 Vegetative Cover

Line-intercept cover transects were completed in many of the key areas in the summer of 2011. A summary of this data is shown in the table below. Sagebrush canopy cover is shown for the monitoring sites that are located within the core sage-grouse habitat management area.

Vegetative Cover Data				
Monitoring Site	Bare Ground (Percent)	Litter (Percent)	Basal Vegetative Cover (Percent)	Sagebrush Canopy Cover (Percent)
Buck Buttes West	11	44	36	5
Buck Buttes East	25	36	28	27
South Shearing	13	40	40	25
Rankine Basin	19	40	34	4
Gillies Draw	19	45	29	23
East Ridge	36	33	22	
Grass Creek Basin	27	49	19	25
Lower Left Hand	22	52	23	
South Fork Left Hand #1	5	36	59	
Middle Enos	4	75	21	
Upper Enos #1	1	59	41	

3.1.2 Vegetative Trend

Wyoming Permanent 10-Plot Trend Transects were established at two key areas on the LU Allotment in 1991. Vegetative objectives were established for these key areas in the 1993 LU AMP. These transects were reviewed in the summer of 2011 to monitor progress towards meeting these objectives. A summary of the trend data collected at these sites in 1991 and 2011 is illustrated in the following tables.

Carmichel BBQ Bench Key Area Vegetative Trend												
Range Condition			Production (lbs/ac)			Plant Species	Percent Frequency			Percent Composition		
1991	Objective	2011	1991	Objective	2011		1991	Objective	2011	1991	Objective	2011
35	50-75	64	1284	1350	1612	Idaho Fescue	54	I	55	11	15-25	33
						Spike Fescue	1	I	0	T	10-25	T
						Green Needlegrass	1	I	20	10	10-25	15
						Rhizomatous Bluegrass	39	M or D	0	2	M or D	0
						Lupine	13	D		30	D	28
						Big sagebrush	56	D	0	51	5-10	0
Objective: I = Increase M = Maintain D = Decrease												

Carmichel BBQ Bench Key Area Vegetative Cover			
Basal Hits	Percent Basal Cover		
	1991	Objective	2011
Bare Ground	15	D	2
Litter	51	M or I	72
Forbs	15	M	8
Idaho Fescue	10	I	13
Green Needlegrass	3	I	2
Rhizomatous Bluegrass	3	M or D	0
Other Vegetation	1	I	5
Objective: I = Increase M = Maintain D = Decrease			

Hess Creek Draw Key Area Vegetative Trend			
Vegetative Species Group	Percent Composition		
	1991	Objective	2011
Grasses and Grasslikes	38	I	81
Forbs	63	D	19
Woody Plants	1	M	0
Objective: I = Increase M = Maintain D = Decrease			

3.1.3 Forage Production

Forage production studies were conducted at several of the higher elevation monitoring sites in the summer of 2011, which was considered a high precipitation and favorable production year. Production studies were repeated at two of the monitoring sites in the summer of 2012, which was considered a low precipitation and average to below average production year. Production studies involved clipping herbaceous forage, allowing it to air-dry over several months, and weighing it. The results are shown in the table below.

Herbaceous Forage Production (lbs./acre)		
Monitoring Site	2011	2012
Middle Enos	1300	
Upper Enos #1	1600	
Beef	1180	820
Thompson Draw	1060	
Upper Sanford	1160	1200
Otto Draw	1480	
Production shown as lbs/ac of air dry forage based upon clipping completed in August 2011 and 2012.		

The Middle Enos monitoring site is located on a Loamy 10-14" range site. The other monitoring sites are located on Loamy 15-19" range sites. The Ecological Site Guides list a potential total production range of 500 lbs./acre to 1,100 lbs./acre for a Loamy 10-14" range site, and 1,100 lbs./acre to 1,600 lbs./acre for a Loamy 15-19" range site. Considering that the production figures in the above table only refer to herbaceous production, not total production, the production on these sites is within the range suggested by the Ecological Site Guides.

3.1.4 Forage Utilization

Abundant forage utilization data was collected on the LU Allotment prior to development of the LU AMP in 1993. This data was primarily collected in Units 1 and 7. In 2000, the WFO and the LU Ranch entered into a Supplemental Monitoring Agreement for the LU AMP, stipulating that the Grazing Response Index (GRI) would be used to measure forage utilization on the LU Allotment. The purposes of using this method were stated as follows:

- To help BLM and ranch personnel agree on what different levels of utilization on rangeland look like.
- To avoid doing time consuming utilization transects that do not yield information superior to a simple visual estimate.

The Modified GRI (Land EKG Inc. 2009) considers four concepts related to plant health in evaluating the impacts of grazing: **intensity** of defoliation, **season** of grazing use, the **opportunity** for the plant to grow or re-grow, and the **growing season precipitation**. It is used to evaluate annual grazing use, the effects of repetitive defoliation during the grazing season, and to help develop future grazing plans. The following chart is used in determining the GRI.

GRAZING INDEX (add values of 4 boxes below)

A) INTESITY / END RESIDUAL

Use level	% Utilized	Value
•Rest/light	<40%	+1
•Moderate	40-55%	0
•Heavy	>56 -65%	-1

B) REST/OPPORTUNITY
(rest period before or following use)

Days	Rest Period	Value
_____	All Season	+2
_____	Most Season	+1
_____	Half Season	0
_____	Part Season	-1
_____	Little/None	-2

C) SEASON OF GRAZING

Growth	Dates	Value
Spring Dorm.		+1
P1 Initial	_____	+1/0
P2 Veg.		0
P3 Green/Heads	_____	-1
P3+ Curing		0
P3+ Seed Ripe	_____	+1
Fall Dorm.		+1

D) GROWING PRECIP.

Above Avg .... +1
Average 0
Below Avg ....-1

Total GRI

Due in part to the observed resource conditions on the LU Allotment, the large size of the allotment, and other workload priorities, the collection of utilization data has not been considered a high priority by the WFO since development of the LU AMP. In 2010, the LU Ranch, in cooperation with The Nature Conservancy and the WFO, initiated a permittee monitoring program for the entire ranch. Forage utilization data that has been collected through this program to date is shown in the following table:

Forage Utilization						
Monitoring Site	2010		2011		2012	
	Utilization	GRI	Utilization	GRI	Utilization	GRI
Buck Buttes West	Moderate			+1	Light	0
Buck Buttes East	Moderate	+1		+1	Moderate	-2
South Shearing			Light	+3	Light	-1
Rankine Basin	Moderate			+5	Moderate	+2
Gillies Draw	Moderate			+4	Moderate	-1
Grass Creek Basin		+1			Light	0
Lower Left Hand	Moderate	+1	Light	+1	Moderate	-3
South Fork Left Hand #1		+2			Light	-1
South Fork Left Hand #2					Moderate	-1
Middle Enos					Heavy	+1
Upper Enos #1	Moderate	+1			Moderate	-1
Mouth of Sanford	Moderate	+1			Moderate	-2
Upper Sanford			Moderate	+1		
Otto Draw	Light	+3	Light	+3	Heavy	-2
Light Use (< 40%)	Moderate Use (40-55%)		Heavy Use (> 55%)			

The Supplemental Monitoring Agreement for the LU AMP also specifies that additional utilization may be conducted on an as needed basis as determined by the BLM. In the spring of 2012, the WFO initiated forage utilization monitoring studies in the pastures of the LU Allotment that are within the Core sage-grouse habitat management area. The purpose of these studies was to assess the adequacy of residual forage levels to provide the necessary vegetative cover for nesting sage-grouse. Data was collected using the Landscape Appearance Method for utilization monitoring, in late March / early April. The results of these studies are shown in the following table:

Sage-Grouse Nesting Habitat Forage Utilization			
Monitoring Site	**2012**	**2013**	**2014**
Buck Buttes West	No Use	8%	8%
Buck Buttes East	12%	13%	39%
South Shearing	No Use	37%	10%
Rankine Basin	14%	21%	44%
Gillies Draw	3%	23%	9%
Grass Creek Basin	No Use	No Use	34%

In each of these pastures within the Core sage-grouse habitat management area, residual forage cover at the beginning of the sage-grouse nesting period was determined to be adequate for nest concealment.

3.1.5 17 Indicators of Rangeland Health

Rangeland Health Assessments were conducted at multiple monitoring sites by an interdisciplinary team during the summer of 2011 and 2012 using the 17 Indicators of Rangeland Health as described in BLM Technical Reference 1734-6. Individual ratings given for each indicator at the monitoring sites are shown in the following tables:

Rangeland Health Indicators (Units 3, 4, 5, 6, 8)						
Indicator	**Departure from Reference Sheet**					
	Buck Buttes W	**Buck Buttes E**	**South Shearing**	**Rankine Basin**	**Gillies Draw**	**East Ridge**
1. Rills	N-S	N-S	N-S	S-M	S-M	N-S
2. Water-flow patterns	N-S	S-M	N-S	S-M	M	S-M
3. Pedestals and/or terracettes	S-M	S-M	N-S	S-M	S-M	S-M
4. Bare ground	N-S	S-M	N-S	N-S	M	S-M
5. Gullies	N-S	M	S-M	M	S-M	S-M
6. Wind-scoured, blowouts, and/or deposition areas	S-M	N-S	N-S	N-S	N-S	N-S
7. Litter movement	S-M	N-S	N-S	N-S	S-M	N-S
8. Soil surface resistance to erosion	N-S	N-S	N-S	N-S	N-S	N-S
9. Soil surface loss or degradation	N-S	N-S	N-S	S-M	S-M	S-M
10. Plant community composition and distribution relative to infiltration	S-M	N-S	N-S	S-M	S-M	N-S
11. Compaction layer	N-S	S-M	N-S	N-S	N-S	N-S
12. Functional / structural groups	M	N-S	N-S	S-M	N-S	N-S
13. Plant mortality / decadence	M	N-S	N-S	N-S	N-S	N-S
14. Litter amount	N-S	N-S	N-S	N-S	N-S	N-S
15. Annual production	N-S	N-S	N-S	N-S	N-S	N-S
16. Invasive plants	N-S	S-M	S-M	S-M	M	S-M
17. Reproductive capability of perennial plants	N-S	N-S	N-S	N-S	N-S	N-S
Indicator Summary	**Buck Buttes W**	**Buck Buttes E**	**South Shearing**	**Rankine Basin**	**Gillies Draw**	**East Ridge**
Soil / Site Stability (*Indicators 1-9, 11*)	S-M	S-M	N-S	S-M	S-M	S-M
Hydrologic Function (*Indicators 1-5, 8-11, 14*)	S-M	S-M	N-S	S-M	N-S	S-M
Biotic Integrity (*Indicators 8-9, 11-17*)	S-M	S-M	N-S	S-M	S-M	S-M
N-S None to Slight S-M Slight to Moderate M Moderate M-E Moderate to Extreme E-T Extreme to Total						

Rangeland Health Indicators (Units 1, 2)					
Indicator	**Departure from Reference Sheet**				
	Grass Creek Basin	**Lower Left Hand**	**South Fork Left Hand #1**	**Middle Enos**	**Upper Enos #1**
1. Rills	N-S	N-S	N-S	N-S	N-S
2. Water-flow patterns	S-M	S-M	N-S	N-S	N-S
3. Pedestals and/or terracettes	S-M	S-M	S-M	N-S	N-S
4. Bare ground	S-M	N-S	N-S	N-S	N-S
5. Gullies	S-M	S-M	S-M	S-M	S-M
6. Wind-scoured, blowouts, and/or deposition areas	N-S	N-S	N-S	N-S	N-S
7. Litter movement	S-M	N-S	N-S	N-S	N-S
8. Soil surface resistance to erosion	N-S	N-S	N-S	N-S	N-S
9. Soil surface loss or degradation	N-S	N-S	N-S	N-S	N-S
10. Plant community composition and distribution relative to infiltration	S-M	S-M	N-S	N-S	N-S
11. Compaction layer	N-S	S-M	N-S	N-S	N-S
12. Functional / structural groups	S-M	M	S-M	S-M	N-S
13. Plant mortality / decadence	N-S	N-S	N-S	N-S	N-S
14. Litter amount	N-S	N-S	N-S	N-S	N-S
15. Annual production	S-M	N-S	N-S	N-S	N-S
16. Invasive plants	M	M	S-M	M	M
17. Reproductive capability of perennial plants	S-M	N-S	N-S	N-S	N-S
Indicator Summary	**Grass Creek Basin**	**Lower Left Hand**	**South Fork Left Hand #1**	**Middle Enos**	**Upper Enos #1**
Soil / Site Stability (*Indicators 1-9, 11*)	S-M	S-M	S-M	N-S	N-S
Hydrologic Function (*Indicators 1-5, 8-11, 14*)	S-M	S-M	S-M	N-S	N-S
Biotic Integrity (*Indicators 8-9, 11-17*)	S-M	S-M	S-M	S-M	S-M
N-S None to Slight S-M Slight to Moderate M Moderate M-E Moderate to Extreme E-T Extreme to Total					

Rangeland Health Indicators (Unit 7)					
Indicator	Departure from Reference Sheet				
	Beef	Thompson Draw	Carmichel BBQ Bench	Upper Sanford	Otto Draw
1. Rills	N-S	N-S	N-S	N-S	N-S
2. Water-flow patterns	N-S	N-S	N-S	N-S	N-S
3. Pedestals and/or terracettes	N-S	N-S	N-S	N-S	N-S
4. Bare ground	N-S	N-S	N-S	N-S	N-S
5. Gullies	N-S	N-S	N-S	N-S	N-S
6. Wind-scoured, blowouts, and/or deposition areas	N-S	N-S	N-S	N-S	N-S
7. Litter movement	N-S	N-S	N-S	N-S	N-S
8. Soil surface resistance to erosion	N-S	N-S	N-S	N-S	N-S
9. Soil surface loss or degradation	N-S	N-S	N-S	N-S	N-S
10. Plant community composition and distribution relative to infiltration	N-S	N-S	N-S	N-S	N-S
11. Compaction layer	N-S	N-S	N-S	N-S	N-S
12. Functional / structural groups	N-S	N-S	N-S	N-S	N-S
13. Plant mortality / decadence	N-S	N-S	N-S	N-S	N-S
14. Litter amount	N-S	N-S	N-S	N-S	N-S
15. Annual production	N-S	N-S	N-S	N-S	N-S
16. Invasive plants	S-M	S-M	N-S	S-M	S-M
17. Reproductive capability of perennial plants	N-S	N-S	N-S	N-S	N-S
Indicator Summary	**Beef**	**Thompson Draw**	**Carmichel BBQ Bench**	**Upper Sanford**	**Otto Draw**
Soil / Site Stability (*Indicators 1-9, 11*)	N-S	N-S	N-S	N-S	N-S
Hydrologic Function (*Indicators 1-5, 8-11, 14*)	N-S	N-S	N-S	N-S	N-S
Biotic Integrity (*Indicators 8-9, 11-17*)	N-S	N-S	N-S	N-S	N-S
N-S None to Slight S-M Slight to Moderate M Moderate M-E Moderate to Extreme E-T Extreme to Total					

3.2 Soils/Site Stability and Hydrologic Function

Data collected in support of the Rangeland Health Assessments were the primary tool used to evaluate soil and watershed stability on the LU Allotment. Standard 1 for Healthy Rangelands was evaluated based on the attribute ratings for *Soil and Site Stability* and *Hydrologic Function* using rangeland health indicators 1 through 11 and 14. Field observations were compared to the Reference Sheets for the appropriate ecological site to determine departure from normal. To this end, 16 Rangeland Health Determinations were conducted throughout the LU Allotment during the summer of 2011 and 2012.

What follows is a discussion of the rangeland health determinations for each assessment location as they apply to the attributes of *Soil and Site Stability* and *Hydrologic Function.* Those rangeland health indicators with little or no departure will only be discussed briefly or not at all.

LU Low Elevation (Units 4, 5, 6 and 8)

Gillies Draw Key Area

Rill formation was observed in close association with water-flow patterns. The water-flow patterns average 6 feet in length but lengths of 10 to 12 feet are common. Pedestalled vegetation is common. Sagebrush and bunchgrasses are sitting on 1 to 2 inch pedestals. Transect data determined bare ground to be 19 percent which is well within that described in the reference sheet. However, the bare areas are large, 3 to 4 feet in diameter, with excessive connectivity. The ephemeral channels in this low elevation portion of the allotment are channelized. The gully system is healing as evidenced by vegetation becoming established in the drainageways. There was no evidence of wind scour or blowout areas. Litter movement was restricted to fine herbaceous debris. The soil stability index

(SSI), an indicator of the soil surface resistance to erosion, averaged 4.2, which is within the guidelines described in the reference sheet. The presence of soil biological crusts (3 percent surface cover) adds further to soil stability. Historic changes to the plant community composition and distribution have slightly compromised the ability of the plant community to protect the soil surface and capture water. This is evidenced by the distribution and connectivity of bare areas. Infiltration and runoff are being impacted and the soil surface remains susceptible to rain drop impact and overland flow. A small soil pit revealed a 4 inch A horizon which in itself would indicate nominal soil loss. No soil compaction was observed. Given the degree to which runoff and erosion indicators are present on this landscape and vegetative setting, some watershed instability remains.

Rankine Basin Key Area

Rill formation was only observed adjacent to the two-track road. Water-flow patterns were 2 to 3 feet in length with some connectivity. For the most part their presence is in keeping with the 5 percent slope at the assessment area. Pedestalled vegetation is common; sagebrush is sitting on 2 to 3 inch pedestals while the bunchgrasses are sitting on 1 to 1½ inch pedestals. Transect data determined bare ground to be 19 percent which is well within that described in the reference sheet. Due in a large part to a heavy spring rains, water-flow patterns were observable. In places the ephemeral channels were 12 inches deep and still bare from recent runoff events. There was no evidence of wind scour or blowout areas. Litter movement was restricted to fine herbaceous debris. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.5, which is within the guidelines described in the reference sheet. Historic changes to the plant community composition and distribution have slightly compromised the ability of the plant community to protect the soil surface and capture water. A small soil pit revealed a 3 inch A horizon sitting over a well-developed argillic horizon. This abrupt textural change within 3 inches of the surface indicates some degree of historic soil loss. No soil compaction was observed.

South Shearing Key Area

This portion of the allotment is hydrologically stable. Water is being adequately retained on the surface and infiltration is being maximized. All rangeland health indicators are within what would normally be expected for the landscape setting except for gullies. The gully network, common to the entirety of the low elevation portion of the LU Allotment, is often linked directly to the existing two-track road system and roads long since abandoned. This is particularly true in this part of the allotment. Overall observations are that the existing gullies are in the process of healing and stabilizing as evidenced by their rounded shoulders and the establishment of grass and shrub species in the active channels. There is little evidence to suggest that the existing gullies are cutting further into the uplands. In addition there seems to be little evidence of the formation of new gullies.

Buck Buttes East Key Area

At the time that this assessment was conducted, the soil surface was extensively trampled by livestock. This was due in part to the proximity of the key area to a stockwater tank. Above average spring moisture and heavy clay loam surface textures make the soils more susceptible to the surface disturbance from livestock trampling. Rills were not observed. Water-flow patterns were 3 to 4 feet long with little connectivity. Hoof action could have blurred the extent of the water-flow patterns. Hoof action within water-flow patterns was slowing runoff. No terracettes were observed. Bunchgrass species were sitting on 1 inch pedestals. Pedestalling was more pronounced under sagebrush. Though exposed roots were rare, the sagebrush was sitting on 1 to 2½ inch pedestals. Transect data determined bare ground to be 25 percent. This is well within that described in the reference sheet for the Shallow Loamy 10-14 inch pz ecological site which ranges bare ground from 15 to 45 percent. As with the rest of this low elevation portion of the LU Allotment there are gullies in close association with the two-track road network. One six inch nick point was observed in an ephemeral drainage adjacent to the key area. A wet spring and heavy clay loam surface textures contributed to excessive flow in the ephemeral channels. In keeping with the heavy surface textures, no wind scour was observed. There was no obvious litter movement. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.5, which is within the guidelines described in the reference sheet. Biological soil crusts are also adding stability to the soil surface. The plant composition and distribution is favorable to capturing water, maximizing infiltration and minimizing runoff. A small soil pit revealed a 4 inch A horizon which would indicate that there has been little historic erosion on this site. The same soil pit revealed soil compaction evidenced by the formation of weak thin platy structure near the surface. This observation is in keeping with the trampling and hoof action already discussed.

Buck Buttes West Key Area

Due in part to nearly level slopes (0-2 percent), observations at this key area revealed minimal hydrologic instability. Rill formation is nonexistent. Water-flow patterns are barely observable. No terracettes were observed. The sagebrush is sitting on 1 to 2 inch pedestals while the grasses, most notably blue grama, are on 1 inch pedestals. Bare ground at 11 percent is well within that described in the reference sheet. Gullies are not as extensive in this part of the lower elevation portion of the LU Allotment. Minor wind-scouring was observed. The pedestalling discussed above can be attributed to wind-blown sands. Fine litter, consisting of grass species, was observed in small piles having apparently moved 2 to 6 inches. The plant composition and distribution is drastically altered at the key area location. Though erosion indicators are not being strongly expressed, the blue grama and cactus dominated plant community is not favorable to maximizing infiltration and reducing runoff. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.4, which is within the guidelines described in the reference sheet. A small soil pit revealed a 5 inch A horizon which would indicate that there has been little historic erosion on this site.

East Ridge Key Area

This site was first assessed in 1999, with a follow-up assessment in 2012. The soil and hydrologic conditions at this location show considerable improvement since the 1999 Rangeland Health Assessment. Vegetative cover is increasing and bare ground is evenly distributed across the landscape. The 'slick spots' and disturbed areas which were apparent in 1999 have decreased in abundance. Water flow patterns terminate behind stable terracettes. Pedestaled vegetation remains and there is evidence of some historic soil loss. Stable gullies associated with the two-track road network are still present on steeper slopes but are not advancing.

<u>LU Mid Elevation (Units 1, 2 and 3)</u>

Grass Creek Basin Key Area

The rangeland health assessment conducted at this key area followed a wet spring. To some extent, hoof pints from domestic livestock were masking erosion indicators. Rill formation was not observed. Water-flow patterns terminating behind sagebrush tended to only be 2 to 3 feet long with little connectivity, though a few flow patterns in excess of 5 feet long were observed. Sagebrush was observed to be sitting on 1 to 2 inch pedestals while the bunchgrass species were minimally pedestalled. Transect data determined bare ground to be 27 percent which is at the upper end of that described in the reference sheet for the Loamy 10-14 inch pz ecological site. Bare areas were 12 to 18 inches across and evenly distributed across the landscape. Though there were no significant gullies, several small headcuts were observed in the swales and at a nearby reservoir. There was no evidence of wind-scour. Hoof prints were capturing litter being moved by runoff. The sagebrush dominated plant community and high bare ground is not adequately capturing water and slowing runoff; infiltration is not being maximized. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.1, which is within the guidelines described in the reference sheet. Litter cover of 49 percent is also providing protection for the soil surface. A small soil pit did not indicate any significant soil loss.

Lower Left Hand Key Area

This key area is located below a small canyon that, at the time of the assessment, was contributing significant runoff and overland flow adjacent to the assessment location. This feature is clearly visible on recent satellite images. There were no rills observed. Water-flow patterns were short (2-3 feet) and disconnected. Pedestalling was a prominent feature on the landscape. Sagebrush was sitting on 2 to 4 inch pedestals; cactus was sitting on pedestals that were 1 to 2 inches tall while the pedestals beneath bunchgrasses were only ½ inch to 1 inch tall. Transect data determined bare ground to be 22 percent. Bare areas were small and evenly distributed.

There is a significant channel at the base of the small canyon located 1000 feet north of the key area. In its upper reaches, it is poorly vegetated and the banks are bare. It soon develops into more of a swale-like channel before spreading onto the alluvial fan below. This is clearly a natural phenomenon.

There is no wind-scour. Bunchgrasses have been moderately reduced in the plant community. As a result water is not being retained on the surface as it should and infiltration is being reduced. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.6, which is well within the guidelines described in the reference sheet. Litter cover at 50 percent is adding considerable protection to the soil surface from the erosive forces of raindrop impacts and overland flow. A small soil pit did not indicate significant soil loss. Given the proximity of the ephemeral drainage discussed above this is certainly a depositional environment.

South Fork Left Hand Key Area
With the increasing elevation and precipitation, the portion of the allotment represented by this key area is becoming increasingly stable. Erosion indicators are limited to short, 2 to 3 feet in length, water-flow patterns on slopes in excess of 20 percent, which can be viewed as a natural phenomenon. There is limited pedestalling of the bunch grasses of 1 inch to 1½ inches; this could be the result of a wind-blown sands. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 4.6, which is well within the guidelines described in the reference sheet. Litter cover at 36 percent is adding considerable protection for the soil surface from the erosive forces of raindrop impacts and overland flow. Though it is not thick enough to be a mollic epipedon, the surface horizon is dark and rich in organic matter and there is no evidence of soil loss. As with much of the lower elevation portions of the LU Allotment there are many gullies in association with the road network. Some slumping was observed on the ephemeral channels flowing to the South Fork of Left Hand Creek. Though it is not having any effect on runoff and infiltration, wildfire has altered the plant community by removing the shrub component.

Middle Enos Key Area
At 6,600 feet elevation, the portion of the allotment represented by this key area is starting to take on the hydrologic stability more typical of the higher elevations. Erosion indicators (rills, water-flow patterns, pedestals, and terracettes) are absent. Bare ground only accounts for 5 to 10 percent of the surface area. There is no indication of wind erosion. The soil stability index (SSI), an indicator of the soil surface resistance to erosion, averaged 5.1, which is well above the guidelines described in the reference sheet. Though it is not thick enough to be a mollic epipedon, the surface horizon is dark and rich in organic matter and there is no evidence of soil loss. The only sign of instability is the presence of gullies that are tied directly to the road system, including the main Enos Creek Road. The composition and distribution of the species in the plant community is maximizing infiltration and minimizing runoff.

Upper Enos Key Area
At 7,300 feet elevation, the portion of the allotment represented by this key area has all the hydrologic stability of the higher elevations. Erosion indicators (rills, water-flow patterns, pedestals, and terracettes) are absent. Bare ground accounts for less than 5 percent of the surface area. There is no indication of wind erosion. High organic matter and a thatch layer ensure that the soil surface is fully resistant to erosion. The surface soil horizon, which is characterized as being a mollic epipedon, is thick (>16 inches thick), has a dark color and is rich in organic matter. A few small nick-points, approximately 6 inches tall, were observed in an adjacent drainage. These could have been the result of above average spring precipitation. The composition and distribution of the species in the plant community is maximizing infiltration and minimizing runoff.

LU High Elevation (Unit 7)
All of the rangeland health indicators related to *Soil and Site Stability* and *Hydrologic Function* in this portion of the LU Allotment were rated as a "None to Slight" departure from the reference sheet. The soils in this portion of the allotment are clearly stable, and hydrologic function is appropriate for the ecological sites present.

3.3 Hydrology

3.3.1 Surface Water
The upland hydrologic conditions are an important factor in determining the amount and duration of runoff that occurs in the three watersheds of the allotment. In total there were 15 different upland rangeland health assessments as described above with hydrologic indicators for the upland areas rated with none to slight or a slight to moderate departure from the reference state. The amount and type of bare ground is a very important indicator of potential upland sheet and rill erosion that may occur on the landscape. The hydrologic indicators of none to slight rating suggest that sufficient upland cover is present in the upland areas and the erosion and runoff from the allotment are within suggested appropriate levels to minimize runoff and provide for groundwater infiltration within the allotment. Other areas with a slight to moderate departure generally will have slightly elevated runoff with less water being captured in the surface profile when compared to historic conditions. In these areas there is generally increased erosion and down cutting of channels that is observed.

Other monitoring information on the amount of surface water resources within the allotment can be found from the USGS and other agencies. Portions of Grass Creek and Gooseberry Creek that are located below the Grass Creek

Oilfield and the Little Buffalo Basin Oilfield have received produced waste water that is a byproduct from the oilfields. This augmentation of flow from produced water has been occurring since the development of the oilfields. The dominant surface water use from Grass Creek and Gooseberry Creek is from agriculture operations on private land surrounding and below the allotment where shortages in supply are common during drought years.

3.3.2 Groundwater

There was no specific groundwater data collected for this assessment; however there have been other studies by the USGS and Wyoming Water Development Commission that provide data for the main aquifers involved within the LU Allotment area. As mentioned in the soils section, drainages that have been recently entrenched and down-cut, with the channel geometry altered from the original swale bottoms. These areas likely have reduced groundwater infiltration and higher runoff rates than historic conditions. Other groundwater development activity, such as spring development and water well development has occurred and increased groundwater consumption. The other groundwater impact in the allotment area is from oil and gas development that has occurred in the Grass Creek and Little Buffalo Basin Oilfields in the past 100 years.

3.3.3 Riparian

The riparian areas were evaluated for Proper Functioning Condition (PFC) using the BLM Manual 1737-16 and 1737-17 for lotic and lentic riparian areas. These conditional assessments are based on a qualitative method that involves 17-20 yes/no questions regarding the hydrologic, sediment, and biotic conditions of the riparian areas. These assessments were completed by an interdisciplinary team involving various specialists with field experience in the grazing allotment. There were extensive inventories conducted in the area in 2004 and in 2012 and the majority of the segments were assessed in the field.

The riparian areas were assessed at various dates, with the most recent date that is displayed in the riparian table. For riparian areas that were rated as Functioning at Risk (FAR) or Non-Functional (NF), specific comments about functioning condition were made during the evaluation. The table below is a summary of the segments and the conditions of the riparian area.

ID#	Riparian Area	(mi)	Date	Function	Trend	Acres	Rating
I0060X	HESS CK DRAW TR	0.23	8/8/2012	PFC	NA	0.1	17
I0108X	HESS CK DRAW	0.18	8/8/2012	PFC	NA	0.1	17
P0011X	ENOS CK	0.15	8/29/2012	PFC	NA	0.4	17
P0080X	THOMPSON DRAW	0.26	7/8/2012	PFC	NA	0.5	16
P0204X	ENOS CREEK	0.4	8/17/2012	PFC	NA	4.6	15
P0012X	GOOSEBERRY CK	0.43	8/24/2012	PFC	NA	2.1	15
P0014X	GOOSEBERRY CK	0.52	5/31/2005	PFC	NA	9.5	15
P0231X	ENOS CK	1.22	8/16/2012	PFC	NA	4	14
P0207X	LEFT HAND CK	0.64	8/17/2012	PFC		21.5	14
P0413X	OTTO CK	0.23	6/10/2004	PFC	NA	0.3	13

P0225X	EGBERT DRAW	1.07	6/4/2004	PFC	NA	1.3	13	
I0115X	BUFFALO CK (nr Hillberry Rim	0.43	8/22/2012	PFC	NA	10.4	13	
I0412X	ROACH CK	0.4	8/6/2012	PFC		0.5	13	
P0207X	LEFT HAND CK	0.64	8/17/2012	PFC		21.5	13	
P0014X	GOOSEBERRY CK	0.52	8/16/2012	PFC		9.5	13	
I0060X	HESS CK DRAW TR	0.23	7/29/2004	PFC	NA	0.1	12	
I0108X	HESS CK DRAW	0.18	7/29/2004	PFC	NA	0.1	12	
P0205X	ENOS CK	0.56	8/24/2012	PFC	NA	2.7	12	
P0230Xa	ENOS CREEK	0.09	8/17/2012	PFC	NA		12	
I0046X	RASPBERRY DRAW	0.17	9/10/2012	PFC	NA	0.2	11	
P0205X	ENOS CK	0.56	8/23/2012	PFC	NA	2.7	10	
I0116X	BUFFALO CK (nr Hillberry Rim	0.57	8/22/2012	PFC	NA	13.8	10	
I0110X	RASPBERRY DRAW TR	0.25	8/15/2012	PFC	NA	0.3	10	
I0138X	GRASS CK TR	0.41	8/7/2012	PFC	NA	0.5	10	**Total Acres PFC**
I0047X	RASPBERRY DRAW TR	0.43	8/15/2012	PFC	NA	0.5	10	**144**
I0136X	OTTO CK TR	0.38	6/16/2004	PFC	NA	0.2	10	
T0052X	LITTLE BUFFALO BASIN	1	8/22/2012	PFC		30	10	
I0033X	ENOS CK TR	1.53	8/8/1995	PFC	NA	1.9		
P0230Xb	ENOS CREEK	0.09	9/20/2006	PFC	NA	1		
P0709X	S FK LEFT HAND CK	0.4	8/20/2001	PFC	NA	3.7		
I0413X	SANFORD DRAW	0.69	8/6/2012	FAR	UP	0.8	9	
I0139X	GRASS CK TR	0.44	8/7/2012	FAR	NA	0.5	8	**Total Acres FAR UP**
P0346X	GRASS CK	0.23	9/5/2012	FAR	UP	2.2	6	
P0208X	LEFT HAND CK	0.88	8/29/2012	FAR	NA	1.1	5	**4.6**
I0174X	ENOS CK TR	0.43	8/24/2012	FAR	DN	0.5	5	

P0235X	GRASS CK	0.43	9/5/2012	FAR	DN	4.2	3	
P0709X	S FK LEFT HAND CK	0.4	8/29/2012	FAR	DN	3.7	3	
I0143X	GOOSEBERRY CK TR	0.24	7/5/1992	FAR	UP	1.6		
P0286X	EGBERT DRAW TR	0.3	6/4/2004	FAR	NA	1		**Total Acres FAR NA**
I0110X	RASPBERRY DRAW TR	0.25	7/20/2004	FAR	NA	0.3		**6.8**
I0050X	GRASS CK TR	0.36	6/10/2004	FAR	DN	0.4		**Total Acres FAR DN**
I0138X	GRASS CK TR	0.41	6/16/2004	FAR	DN	0.5		**11.3**
I0470X	ROACH CK	0.14	9/8/2006	FAR	DN	2		
P0710Xb	ROACH CK	0.21	9/8/2006	NF	NA	0.5		
I0295X	ENOS CK TR	0.43	7/1/2004	E	NA	0.3		**Total Acres NF**
I0049X	MILK CK	0.14	8/15/2012	E	NA	0.2		**0.5**
I0048X	RASPBERRY DRAW TR	0.29	9/10/2012	E	NA	0.2		
I0136X	OTTO CK TR	0.38	8/6/2012	E	NA	0.2		**Other Acres Ephemeral**
I0137X	OTTO CK TR	0.28	6/16/2004	E	NA	0.2		**1.3**
T0021X	ENOS CK TR	0.2	9/25/2006	E	E	0.2		

PFC- Proper Functioning Condition, FAR- Functioning at Risk, NF- Non Functional
DN= Downward Trend, Up= Upward Trend
NA= Not Apparent or Applicable, U= Unknown E= Ephemeral
Rating Scale= 0- Nonfunctioning, 1-9 Functioning at Risk, 10-19- PFC, 20= Potential Natural Community

To represent the riparian conditions in the allotment representative segments and their associated assessments are discussed below. There are 27 total pastures and riparian areas in many of the pastures. However, many of the riparian areas are similar in topography, grazing patterns, elevation, and flow regime, therefore only a few are discussed in this section in detail. Full details and photos of each individual segment are on file in the Worland Field Office allotment and riparian files.

I0414X - Roach Creek Tributary

This site was chosen as representative of several of the segments due to its similarity to other intermittent segments that are located in the mid to upper elevation pastures in the LU Allotment. The majority of the public land riparian segments in the Grass Creek watershed are located along lateral tributaries to Grass Creek. This segment where functioning has a broad swale like channel and is generally stabilized by herbaceous facultative wet plant species, such as ribes, snowberry and other grasses. In other areas nearer to springs and seeps wetland obligate sedges and rushes dominate the site. There is evidence of some historic instability in the form of channel head cuts that generally migrate upstream from disturbed areas. The photos below contrast the difference between channels above and below head cut areas. This segment was rated as ephemeral due to steep topography and insufficient flow to support a riparian area.

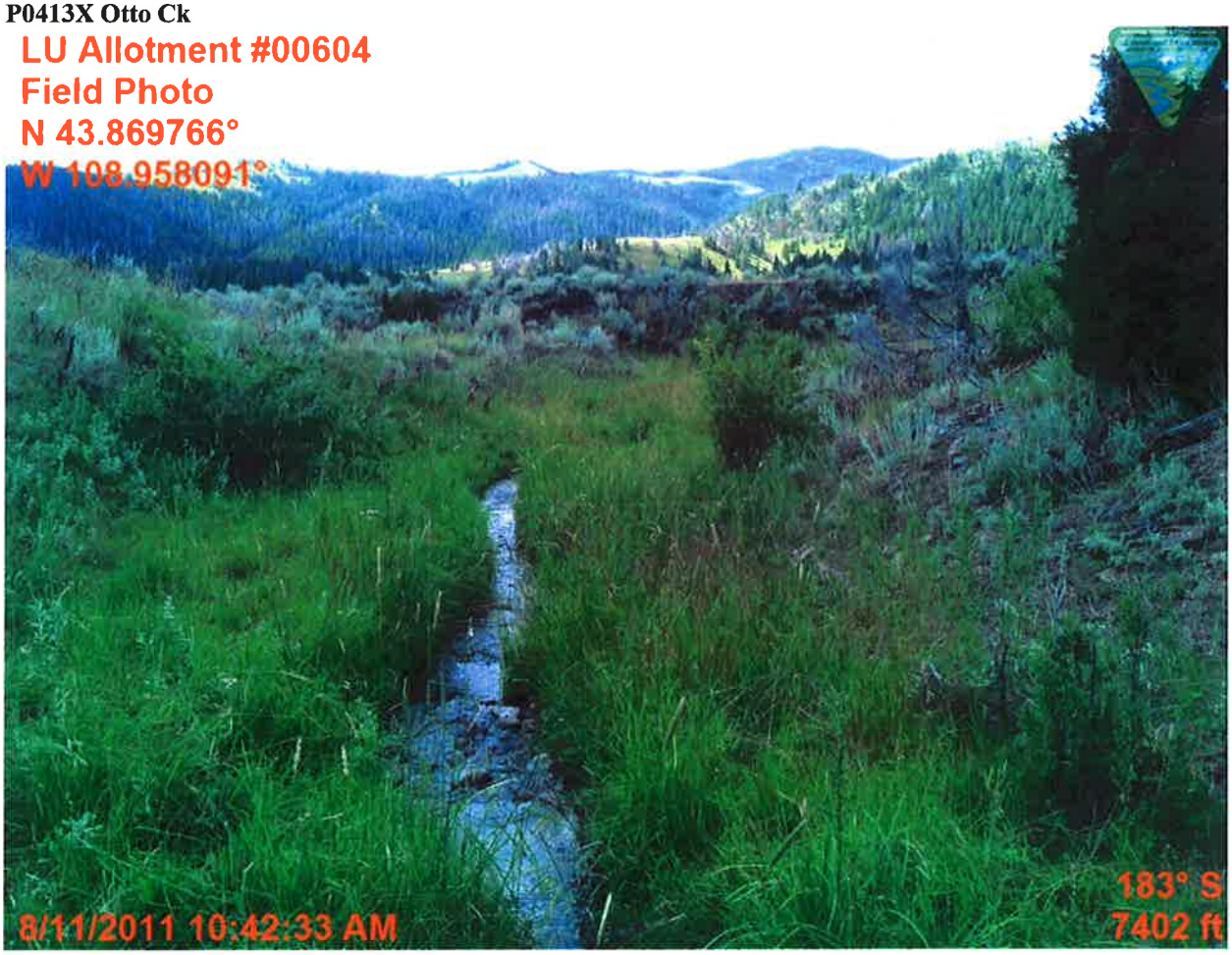
I0414X Roach Ck Tr, Headcut looking up

I0414X Roach Ck TR Headcut looking down

P0413X - Otto Creek

This site was evaluated for PFC in 2004 and reevaluated in 2012. This site on Otto Creek is located in the upper elevation pastures and is situated above Grass Creek. This segment was rated to be in Proper Functioning Condition (PFC) with a dominance of yes answers. There is sufficient vegetation along the banks to provide for proper channel stability, dissipate energy from high flows, and minimize excess erosion and deposition. There is a cobble substrate in the channel and minimal evidence of excess hoof action and use along the banks. In 2012 it was noted growth of Sandbar Willow and Peachleaf Willow species.

P0413X Otto Ck



P0080X - Thompson Draw

This site is located on in T45N, R100W, Sec 30 and represents spring/seep areas that form the origin of lateral tributaries to Grass Creek. This segment is located above use areas at 7400 feet in elevation and generally receives minimal livestock grazing use due to topography, occasional wildlife use is common. There was little evidence of use at the time of the evaluation. The segment has sufficient wetland obligate species in place to minimize erosion and deposition and provide other riparian benefits. This segment was rated to be in Proper Functioning Condition (PFC).

P0080X Thompson Draw

P0207X - Left Hand Creek

This site is located in the Gooseberry Creek watershed and represents broad riparian areas with low slopes and greater width compared to other segments. There is evidence of encroachment of Nebraska Sedge, Beaked Sedge, and Three Square Sedge. There was also noted species of Horsetail, Spike Rush, American Licorice, willow and cattails. There was heavy sign of wildlife use with some livestock use but not sufficient to show degradation of vegetation of channel except for one reach. This site has also received juniper removal mastication treatments where juniper has encroached upon floodplain areas. This segment was rated to be in Proper Functioning Condition (PFC) and meeting Standard 2.

P0207X Left Hand Creek

P0012X - Gooseberry Creek

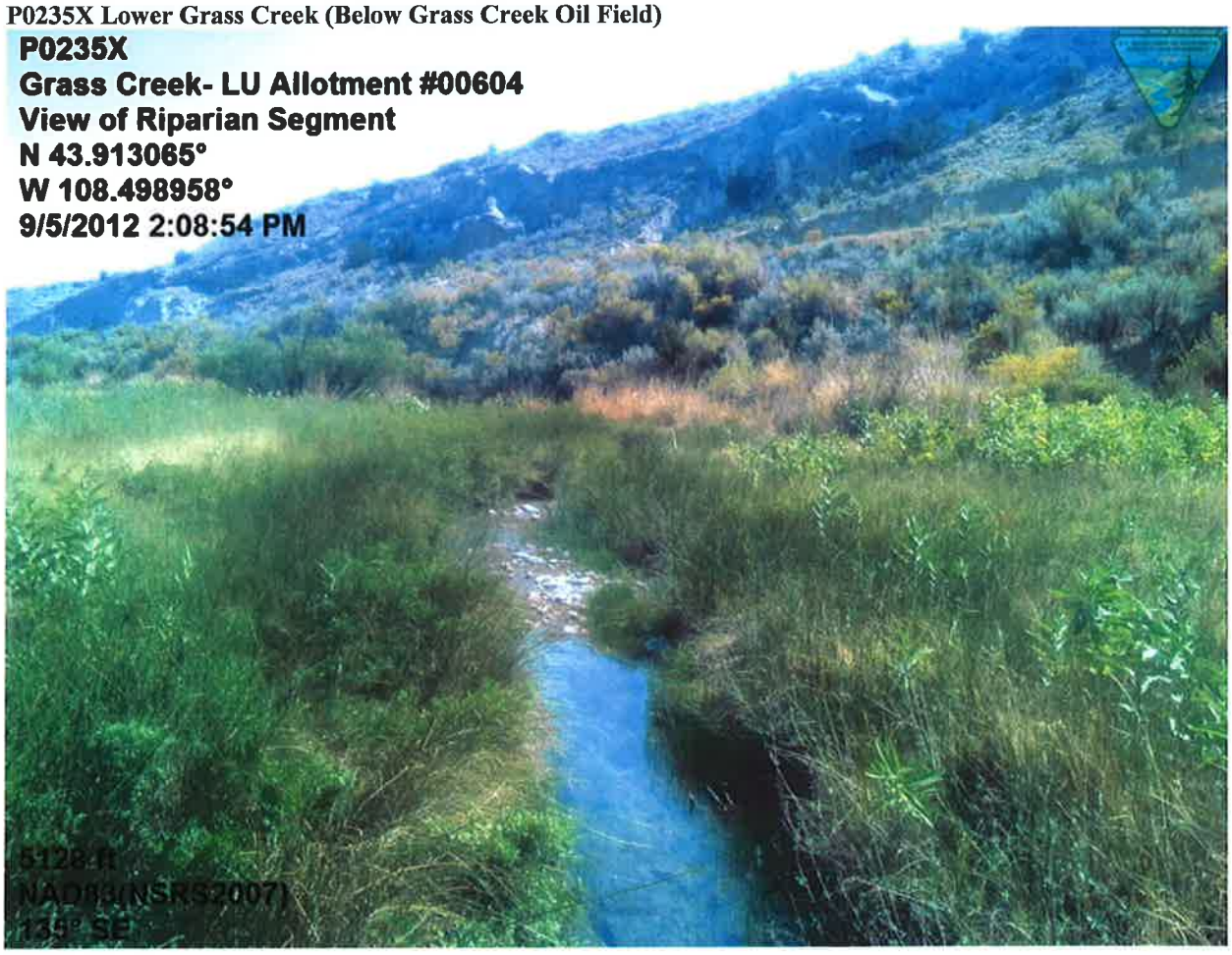
This site is located on the main upper reach of Gooseberry Creek in T47N, R99W, Sec 32. There are three segments, lower, middle, and upper. The lower segment has isolated areas of trailing and the Greenline width depth ratio has slightly increased. The middle segments have sediment deposits and ponded water has increased due to observed beaver activity in the area. The area is dominated by obligate wetland species with some juniper trees that were observed to be drowning out. There is adequate point bar re-vegetation that is occurring throughout the reach. There are fish present. There was heavy use observed on adjacent upland terraces, but the riparian/Greenline area was noted to be in good condition (PFC).

P0012X Gooseberry Creek

P0235X - Lower Grass Creek

This site is located along lower elevations of Grass Creek below the Grass Creek Oilfield in T46N, R97W, Sec 33. This site is below other irrigation diversions as mentioned in the water quality section. This site also receives produced discharge water from the Grass Creek Oilfield. This site was rated functioning at risk (FAR) with no apparent trend (NA). Factors that have caused degradation include road culverts that have increased energy in flows and increased width to depth ratio issues. In deeply incised areas, the riparian Greenline is discontinuous and wetland obligate species such as Juncus Balticus, Wild Rose, and Three Square are missing. There was evidence of nick points and other head cuts throughout the segment. The water table appears to be dropping in areas where down cutting has occurred and is evidenced by Willow species that were observed to be drying out. There is also the presence of Knapweed, American Licorice, Canada thistle, Scarlet Pea, and Milkweed observed throughout. There are also several livestock trails adjacent to the stream.

P0235X Lower Grass Creek (Below Grass Creek Oil Field)



P0710X - Roach Creek Springs
This segment is located in T45N, R101W, Sec 12 and rated NF. This site represents riparian areas that have been impacted from water development and use within the riparian area. There were Nebraska sedge, Baltic Rush, Aspen, and Limber Pine species observed in the area. Other species observed were Foxtail Barley, Brook Grass, Gooseberry and other upland grasses. There has been past channel incision (10ft) but now with some new floodplain development in bottom. Significant livestock use, some wildlife use was observed during the assessment. Hoof action on sedge communities & bank soils is excessive and is the greatest concern with current management. Recovery of the incised channel is inhibited by excessive use of the riparian herbaceous community. There are large (6-8ft) headcuts below seeps that were rated as non-functional.

P0710X- Roach Creek Springs

Restoration Efforts
The following was taken from a Billings Gazette article published in 2012:

> "Over generations, ranchers working this arid country have depended heavily on creeks and riparian areas for livestock water. Thompson said heavy grazing by domestic cattle and sheep in the late 1800s resulted in significant degradation of range health and water quality in the Grass and Cottonwood Creek Watersheds. Combined with fire suppression practices of the past, cone-bearing trees like juniper and limber pine also encroached into aspen stands and riparian zones, further degrading the habitat. But in recent years, project partners have secured more than $500,000 to help restore the area to historic conditions. Thompson said the work wouldn't be possible without the forward-thinking LU Ranch, which remains a willing partner with the Nature Conservancy." Billings Gazette Article 2012

From 2007-2013 the BLM in cooperation with the land owner and Wyoming State Land Office has initiated juniper and other conifer removal projects along the upper reaches and tributaries of Grass Creek, Enos Creek, and Left

Hand Creek. These projects have aided in restoring natural riparian vegetation in the riparian areas. These efforts are an attempt to improve the habitat and improve overall riparian functioning.

Enos Creek areas did experience a severe wildfire in the watershed in 2000. Since the wildfire there have been monitoring and restoration efforts in the sub-watershed as part of the rehabilitation plan for this creek. The rehabilitation has generally been successful and the riparian segments for this area were rated to be at PFC.

3.3.4 Water Quality (Surface)

The main drainages in the allotment that are of sufficient size to be classified by the Wyoming Department of Environmental Quality (WYDEQ) are Grass Creek, Gooseberry Creek and Fifteenmile Creek. These creeks are rated according to the most recent WYDEQ Wyoming Surface Water Classification list (2001). Gooseberry Creek is designated as a 2B, Grass Creek is a 2AB, Fifteenmile Creek has a class 3B designation (Map 11). The supported beneficial use for such designations is found in the table below. All waters such as Grass Creek are shown as having any species of game fish present in the Wyoming Game and Fish Department's *Streams and Lakes Database* as submitted to the Department of Environmental Quality in June 2000 are classified as 2AB. Other smaller undefined segments have the general class 4A rating.

WYDEQ Surface Water Use Classification List

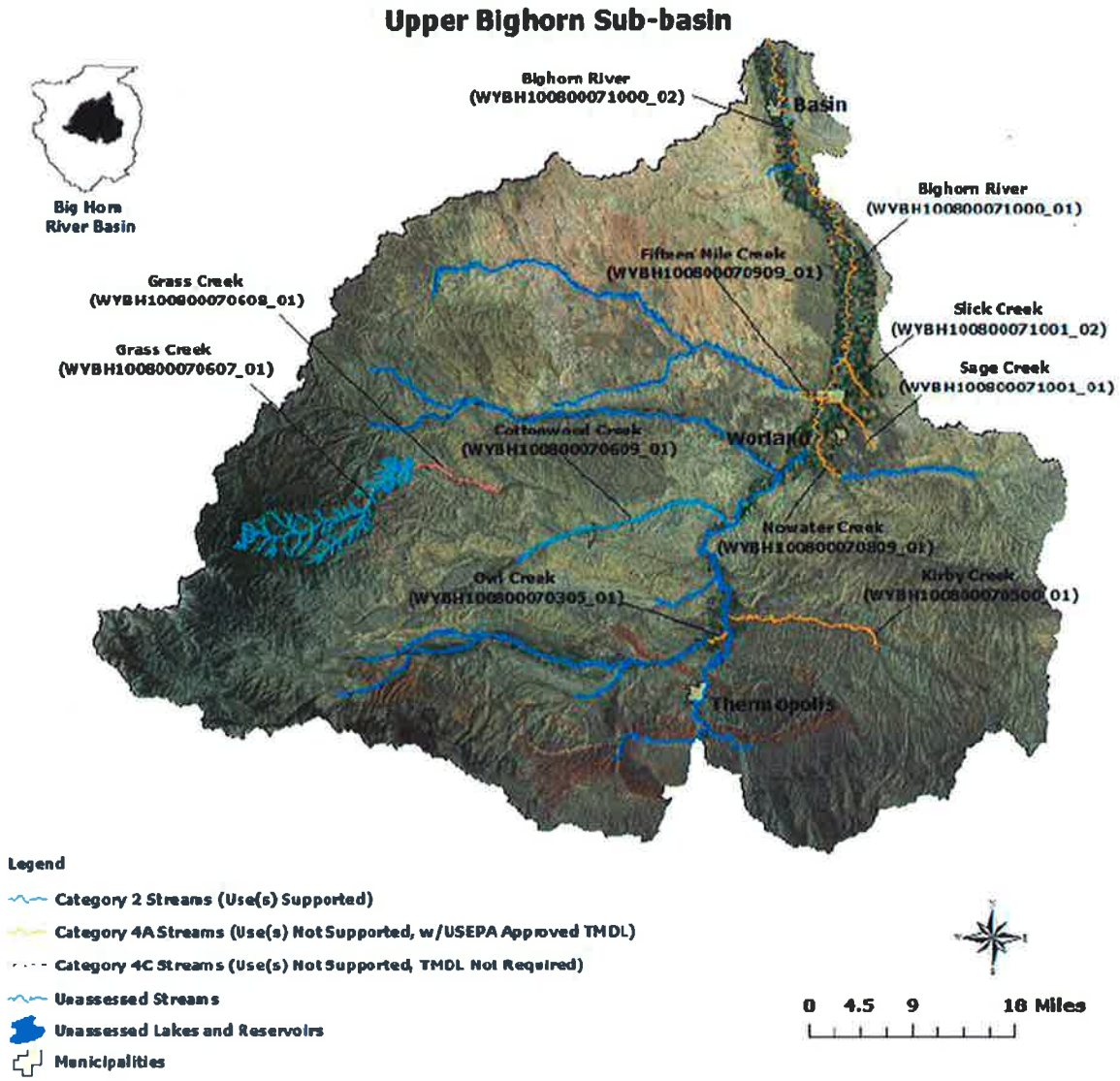
SURFACE WATER CLASSES AND USE DESIGNATIONS

	Drinking Water	Game Fish	Non-Game Fish	Fish Consumption	Other Aquatic Life	Recreation	Wildlife	Agriculture	Industry	Scenic Value
1*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2AB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2A	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
2B	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2C	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2D	No	When Present	When Present	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3A	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3B	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3C	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3D	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
4A	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4B	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4C	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes

Grass Creek, a tributary to Cottonwood Creek, has been monitored and assessed by WDEQ (2003, 2005). These studies indicated that the aquatic life other than fish and cold water fishery uses are not supported in Grass Creek from an irrigation diversion in NENE S23 T46N R99W to a point 14.1 miles downstream. Because these use impairments are caused by flow alterations (i.e. dewatering), this segment of Grass Creek (WYBH100800070608_01) was placed in category 4C in 2006 instead of the 303(d) List of impaired waters requiring TMDLs. Grass Creek (WYBH100800070607_01) above the irrigation diversion supports its aquatic life other than fish and cold water fishery uses, but channel instability and excess sediment were noted. Phase I of a Section 319 Project sponsored by The Nature Conservancy (TNC) was initiated in 2008 with the overall objective of improving physical conditions by improving grazing management in upper Grass Creek. Specific goals included reducing sedimentation, improving in-stream and riparian habitats and lowering water temperatures. BMPs for this project included off channel spring development as an alternative water source for livestock, the construction of fences to protect springs and weed control to improve riparian health. A 2012 final report indicated that these BMPs

had effectively reduced sediment loading and improved the health of riparian vegetation in upper Grass Creek. Phase I also included the collection of baseline comparison data from neighboring Little Grass, Enos and Left Hand Creeks which will be used in Phase II of the project. The results of these projects will ultimately be used to assess whether habitat conditions in the upper watershed are suitable for Yellowstone cutthroat trout reintroduction (WYDEQ, 2014).

WYDEQ 2014 Water Quality Use Class



3.4 Upland Vegetation

For the purpose of this analysis, the vegetative communities found on the LU Allotment have been loosely divided into three groups:

> The winter range pastures are predominately found in Units 4, 5, 6 and 8. They are located within the lower end of the 10-14" precipitation zone. These pastures receive primarily dormant season and early spring livestock grazing use. They are located within the core sage-grouse habitat management area.

Monitoring sites representative of these vegetative communities include the Rankine Basin, Gillies Draw, Buck Buttes East and West, South Shearing, and East Ridge sites.

The transitional range pastures are predominately found in the lower elevations of Unit 1, as well as Units 2 and 3. They are located within the mid to upper part of the 10-14" precipitation zone. These pastures receive livestock grazing during the spring and fall period, as well as some summer use. Some of these pastures are located within the core sage-grouse habitat management area. Monitoring sites representative of these vegetative communities include the Grass Creek Basin, Lower Left Hand, South Fork Left Hand #1, and Middle Enos sites.

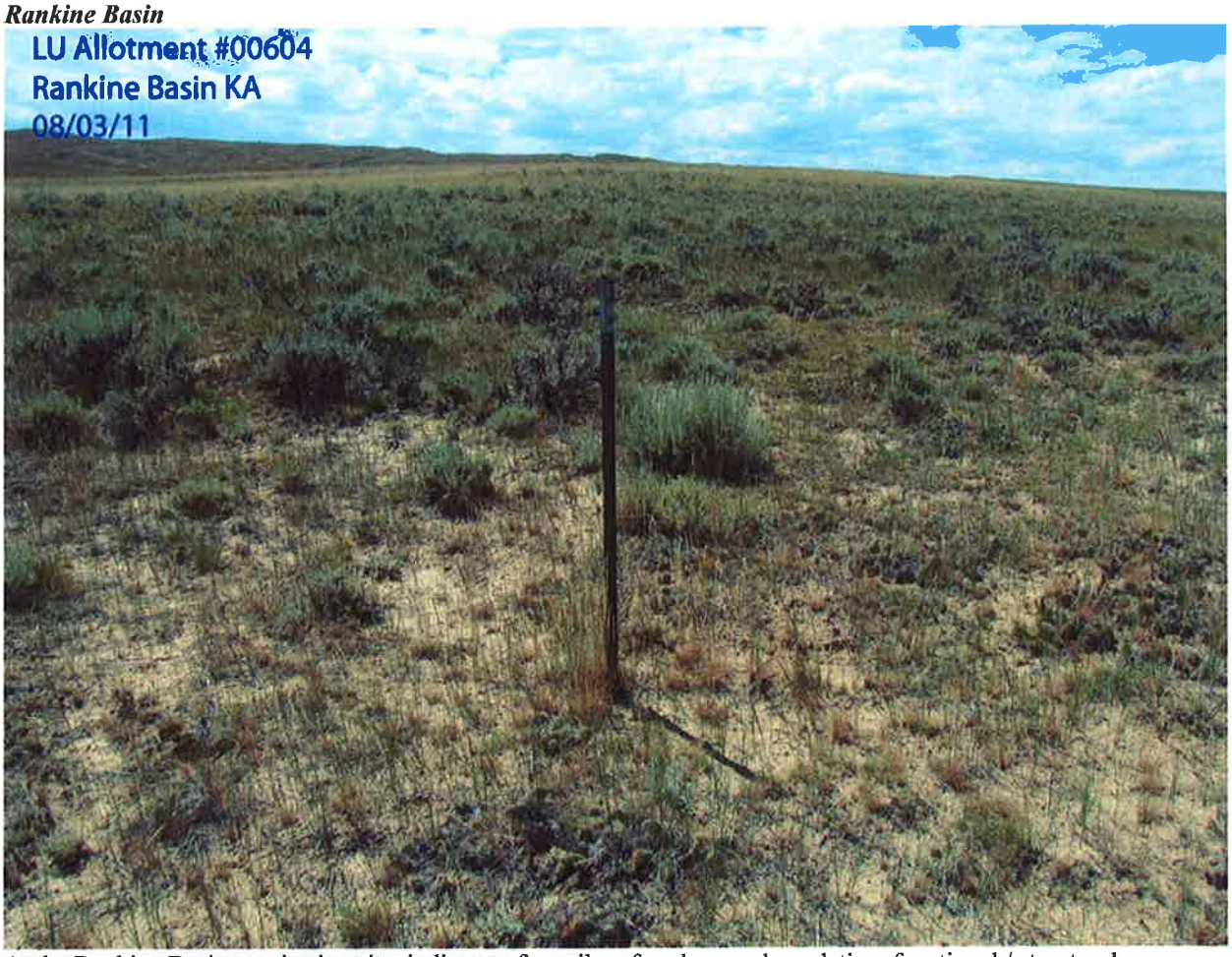
The summer range pastures are found primarily within Unit 7, and the upper elevations of Unit 1. They are located within the lower end of the 15-19" precipitation zone. These pastures generally receive livestock grazing during the summer and early fall period. Monitoring sites representative of these vegetative communities include Upper Enos #1, Beef, Thompson Draw, Carmichel BBQ Bench, Upper Sanford, Otto Draw, and Hess Creek Draw.

This analysis is based upon the monitoring data presented in Section 3.1, above. For the 17 Indicators of Rangeland Health, the rangeland health indicators related to Biotic Integrity are Indicators 8-9, and 11-17. The analysis will focus on any *Biotic Integrity* indicators that are rated as a "Slight to Moderate", or a "Moderate" departure from the reference sheet developed for the site by the NRCS. Indicators that are rated as a "None to Slight" departure from the reference sheet are considered to be appropriate for the ecological site and will not be discussed in detail.

Low Elevation (Winter Range)

The monitoring sites representative of the vegetative communities found in the winter range pastures are the Rankine Basin, Gillies Draw, Buck Buttes East and West, South Shearing, and East Ridge monitoring sites. The Buck Buttes East site is located on a Shallow Loamy range site. The South Shearing site is on a Sandy range site. The East Ridge site is on a Saline Upland range site. The remaining sites are located on Loamy range sites. All of these monitoring sites are within the 10-14" precipitation zone. Following is a discussion of the *Biotic Integrity* Indicators on these monitoring sites, and how the *Biotic Integrity* of the sites differs from expected.

Rankine Basin

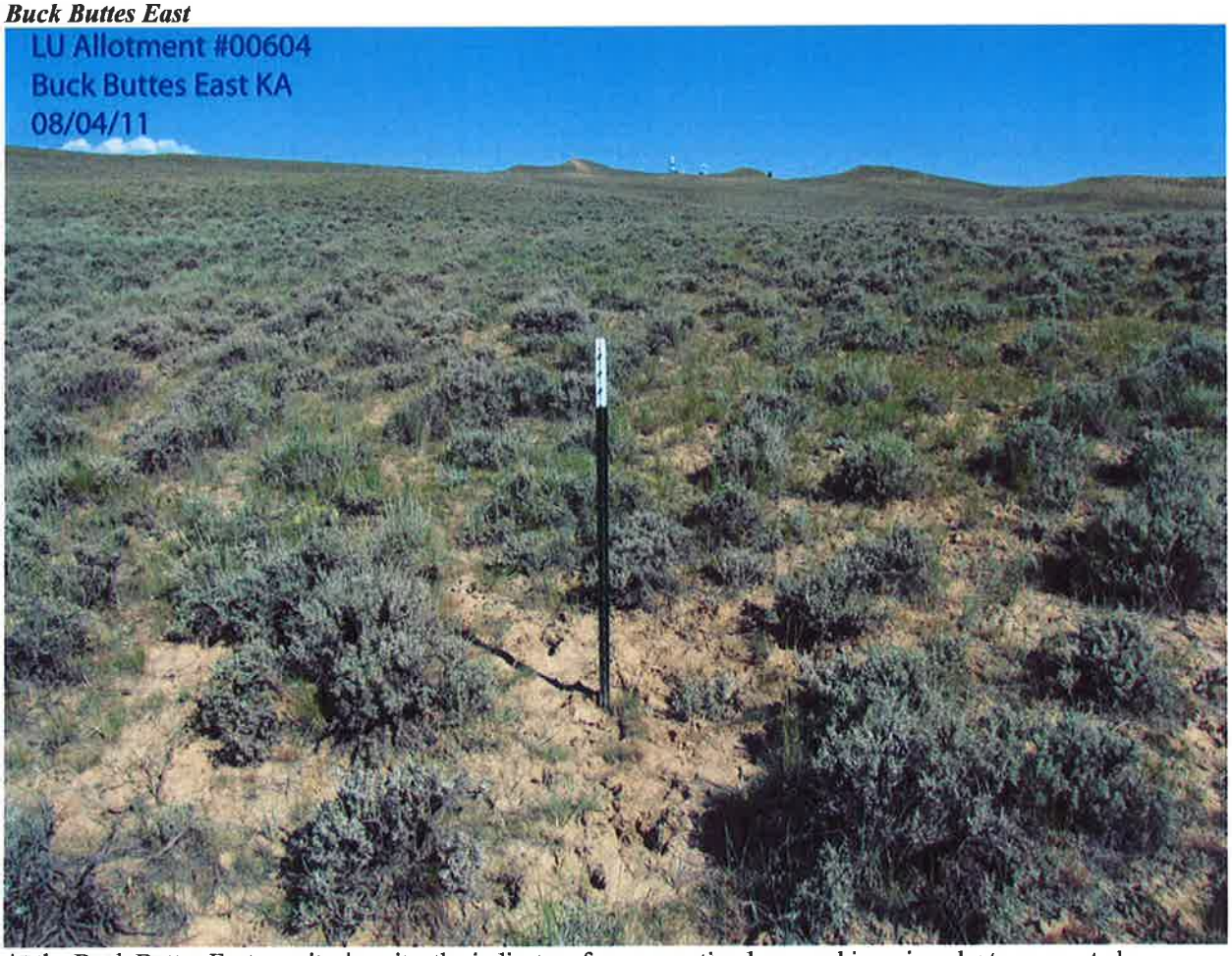


At the Rankine Basin monitoring site, indicators for soil surface loss or degradation, functional / structural groups, and invasive plants were all rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 10-14" range site. Some historic loss of the soil surface was evident at this site. While the observed plant community is dominated by cool-season bunchgrasses, blue grama is a larger component of the plant community than expected for the site. Big sagebrush, while still a conspicuous component of the plant community, is not as prevalent as indicated by the reference sheet. Cheatgrass can also be found in small quantities, primarily in previously disturbed areas, however it does not dominate the site. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

Gillies Draw

At the Gillies Draw monitoring site, the indicator for soil surface loss or degradation was rated as a "Slight to Moderate" departure, and the indicator for invasive plants was rated as a "Moderate" departure from the reference sheet for a Loamy 10-14" range site. Some historic loss of the soil surface was evident at this site. Cheatgrass was also found scattered throughout the site, primarily on disturbed areas and south facing slopes, believed to be largely associated with historic sheep bedgrounds. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

Buck Buttes East

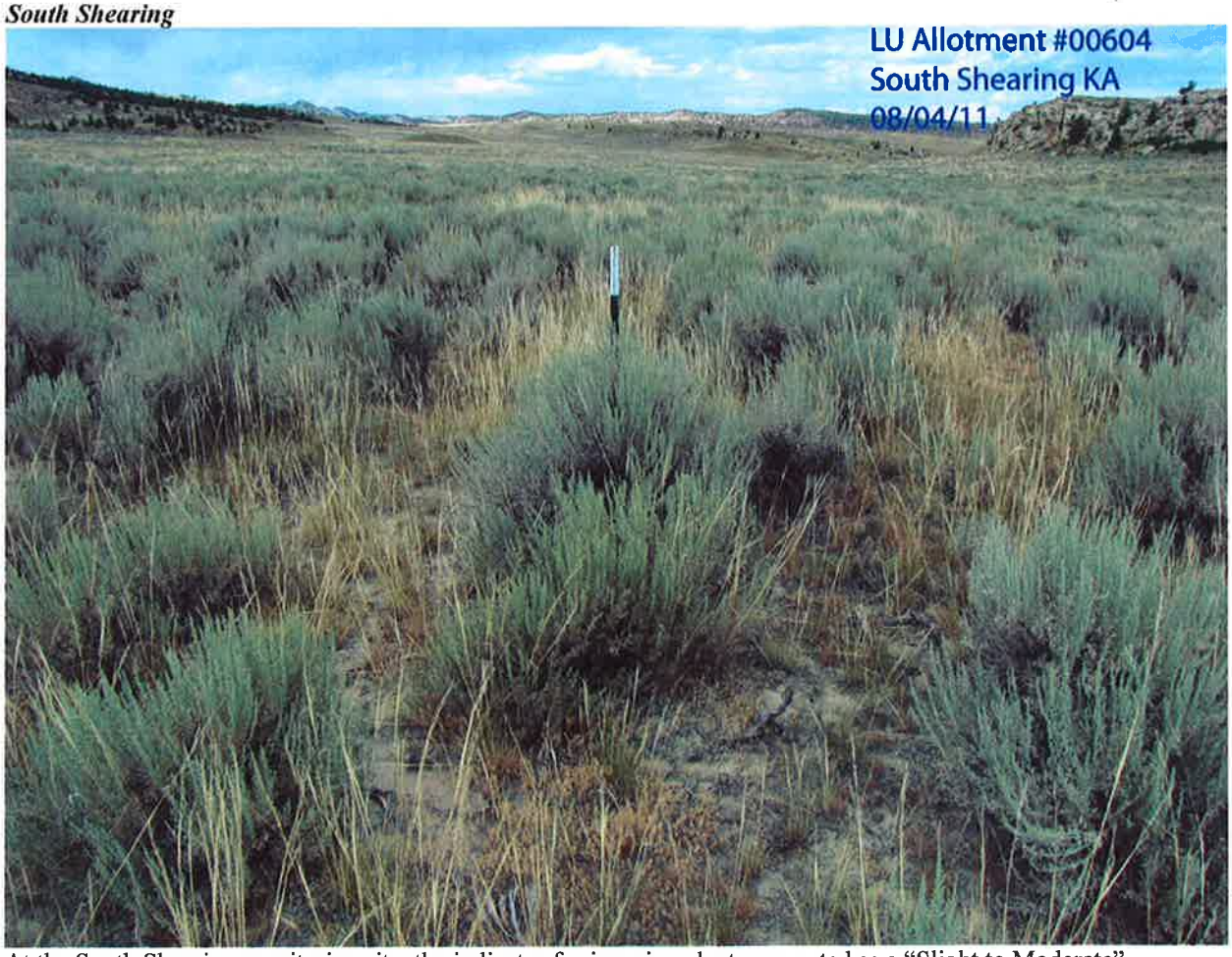


At the Buck Buttes East monitoring site, the indicators for compaction layer and invasive plants were rated as "Slight to Moderate" departures from the reference sheet for a Shallow Loamy 10-14" range site. This monitoring site is located in close proximity to a stockwater tank, and exhibited extensive hoof action from livestock trailing to and from water during the early spring period when the soil surface was wet, resulting in the slight soil compaction observed. The amount of compaction does not appear to be adversely impacting the plant community, as all other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Cheatgrass can also be found in small quantities, primarily in previously disturbed areas, however it does not dominate the area. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet, largely due to the presence of cheatgrass. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Mixed Shrub Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

Buck Buttes West

At the Buck Buttes West monitoring site, indicators for functional / structural groups and plant mortality / decadence were each rated as a "Moderate" departure from the reference sheet for a Loamy 10-14" range site. While the observed plant community at this site is dominated by cool-season bunchgrasses, blue grama and pricklypear cactus are larger components of the plant community than expected. The amount of big sagebrush at this site, and in the overall area, is much lower than expected, and the big sagebrush that is present exhibits very poor vigor and production. This is believed to be the result of heavy to severe browsing by yearlong antelope over much of the area, combined with lingering effects from the severe drought from 2000 to 2004. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community most closely resembles the Perennial Grass / Big Sagebrush Plant Community, even though the amount of big sagebrush is reduced. It is considered stable, intact, and functioning, as well as appropriate for the range site.

South Shearing



At the South Shearing monitoring site, the indicator for invasive plants was rated as a "Slight to Moderate" departure from the reference sheet for a Sandy 10-14" range site. While cheatgrass was not encountered on the vegetative cover transect at the site, it is present in small quantities, primarily in previously disturbed areas and in swales. It does not dominate the site. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

East Ridge

At the East Ridge monitoring site, the indicators for soil surface loss or degradation and invasive plants were rated as a "Slight to Moderate" departure from the reference sheet for a Saline Upland 10-14" range site. Some historic loss of the soil surface was evident at this site. Some cheatgrass was also found scattered throughout the site, primarily in the swales. All other Biotic Integrity indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the Biotic Integrity of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Gardner's Saltbush / Indian Ricegrass / Bottlebrush Squirreltail Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

Mid Elevation (Transitional Range)

The monitoring sites representative of the vegetative communities found in the transitional range pastures include the Grass Creek Basin, Lower Left Hand, South Fork Left Hand #1, and Middle Enos sites. All of these monitoring sites are located on loamy range sites within the 10-14" precipitation zone. Following is a discussion of the *Biotic Integrity* Indicators found at these monitoring sites, and how the *Biotic Integrity* of the sites differs from expected.

Grass Creek Basin

At the Grass Creek Basin monitoring site, indicators for functional / structural groups, annual production, and reproductive capability of perennial plants were all rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 10-14" range site. Big sagebrush was slightly more dominant on the site than expected, with the amount of perennial grasses slightly reduced from expected. The perennial grasses exhibited slightly reduced vigor and production. All perennial grasses exhibited seed production, with the exception of western wheatgrass. The indicator for invasive plants was rated as a "Moderate" departure from the reference sheet. Cheatgrass was present in scattered patches throughout the area, although it does not dominate the site. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

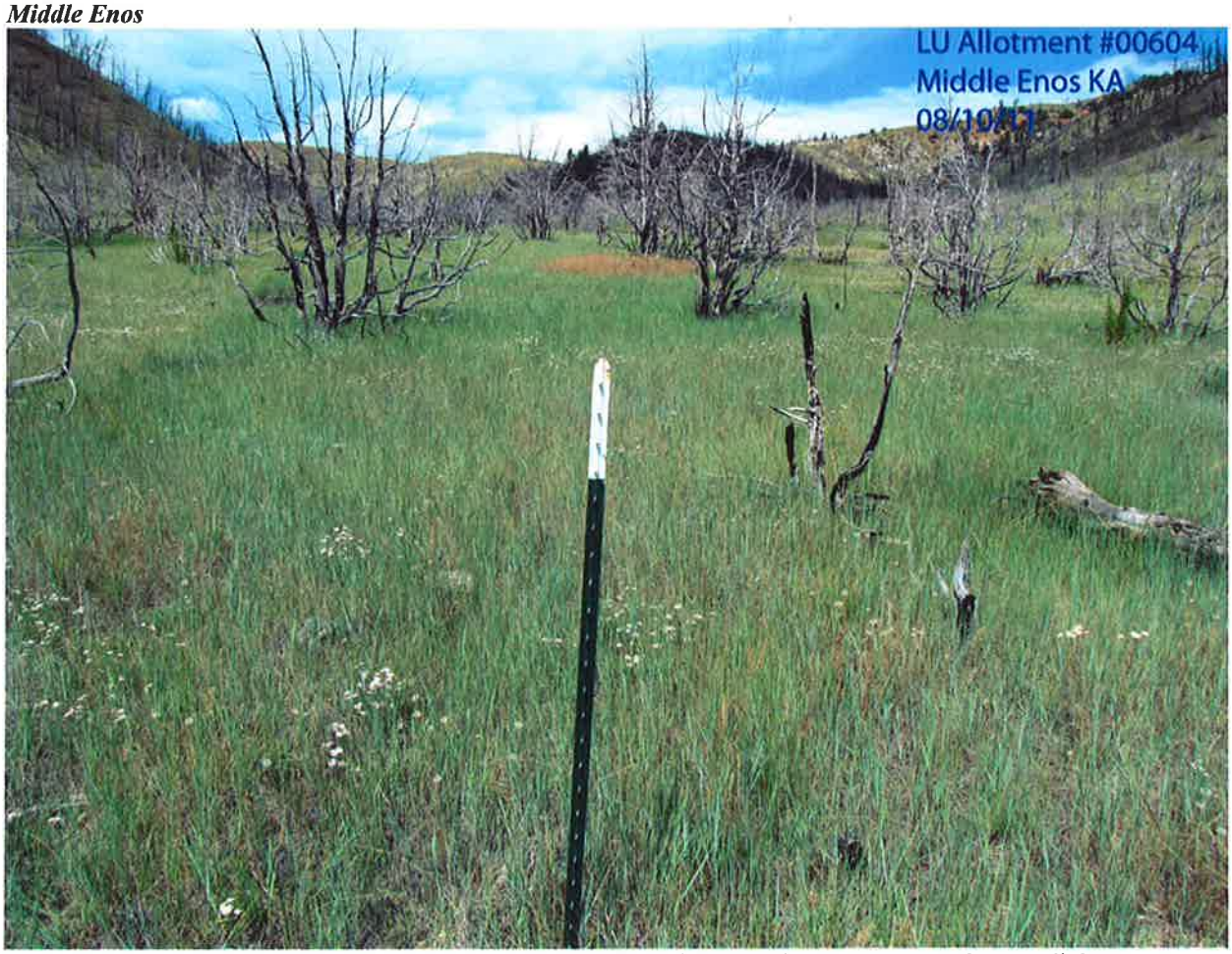
Lower Left Hand

At the Lower Left Hand monitoring site, the indicator for compaction layer was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 10-14" range site. A slight platy structure was observed, indicating some soil compaction in the area. The indicators for functional / structural groups and invasive plants were each rated as a "Moderate" departure from the reference sheet. The amount of pricklypear cactus present on the site was higher than expected. While mid-size cool season bunchgrasses and rhizomatous grasses are present at the site, they are moderately reduced in abundance from expected, with short cool season bunchgrasses being the dominant perennial grass. Cheatgrass was also found scattered throughout the area, and annual weeds were common. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community most closely resembles the Perennial Grass / Big Sagebrush Plant Community. It is considered stable, intact, and functioning, as well as appropriate for the range site.

South Fork Left Hand #1

At the South Fork Left Hand #1 monitoring site, indicators for functional / structural groups and invasive plants were both rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 10-14" range site. Cool season rhizomatous grasses were slightly more abundant than mid-size bunchgrasses, though these species together dominate the site. Big sagebrush and other shrubs have been removed from the plant community due to a wildfire. Cheatgrass was also found in isolated patches scattered throughout the area, primarily on disturbed sites. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community, with sagebrush removed by fire. It is considered stable, intact, and functioning, as well as appropriate for the range site.

Middle Enos

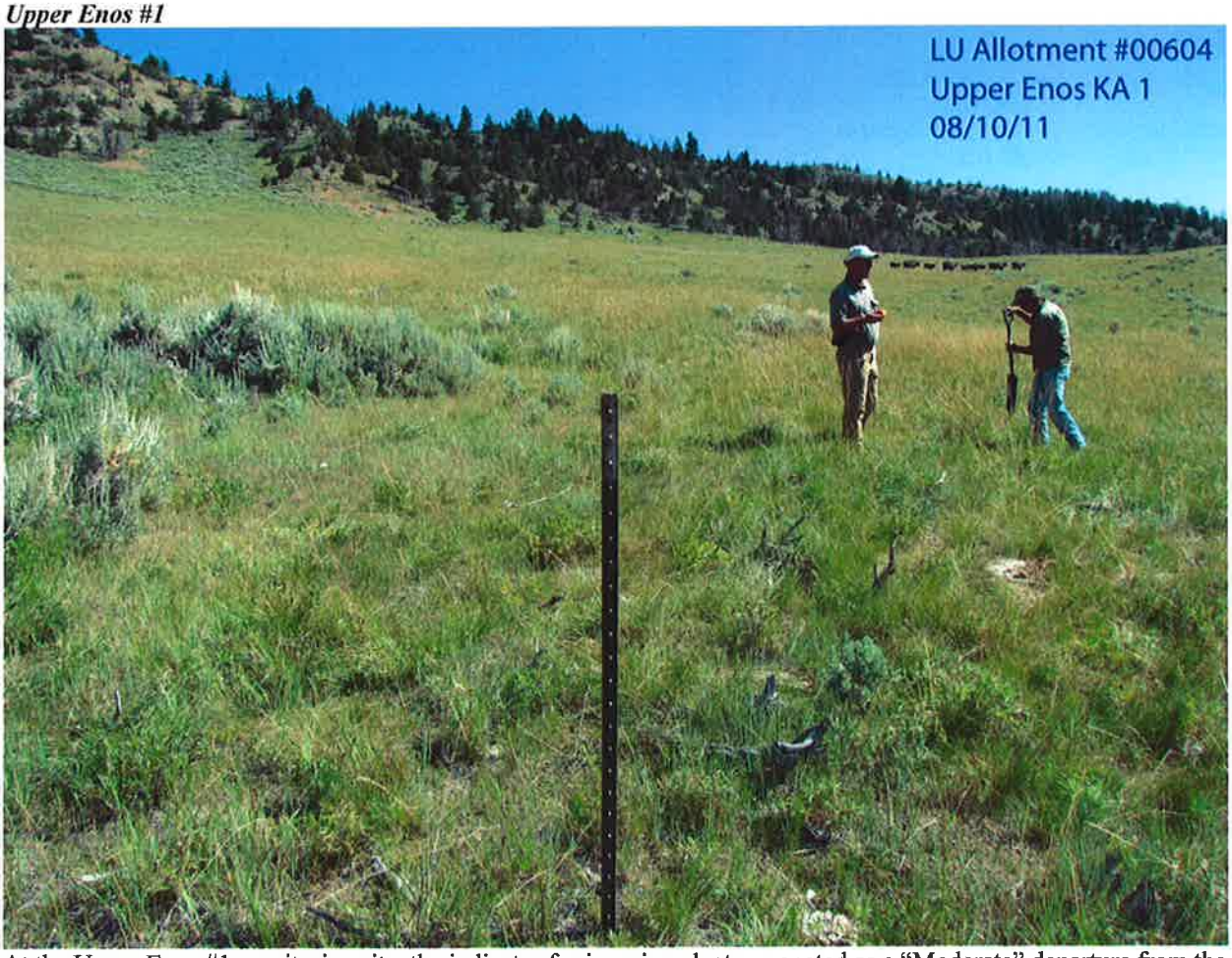


At the Middle Enos monitoring site, the indicator for functional / structural groups was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 10-14" range site. The indicator for invasive plants was rated as a "Moderate" departure from the reference sheet. This site is dominated by cool season rhizomatous grasses, although short and mid-size bunchgrasses are present. Big sagebrush and other shrubs have been removed from the plant community due to a wildfire. Cheatgrass can be found scattered throughout the area, and some scotch thistle was also observed. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Perennial Grass / Big Sagebrush Plant Community, with sagebrush removed by fire. It is considered stable, intact, and functioning, as well as appropriate for the range site.

<u>High Elevation (Summer Range)</u>

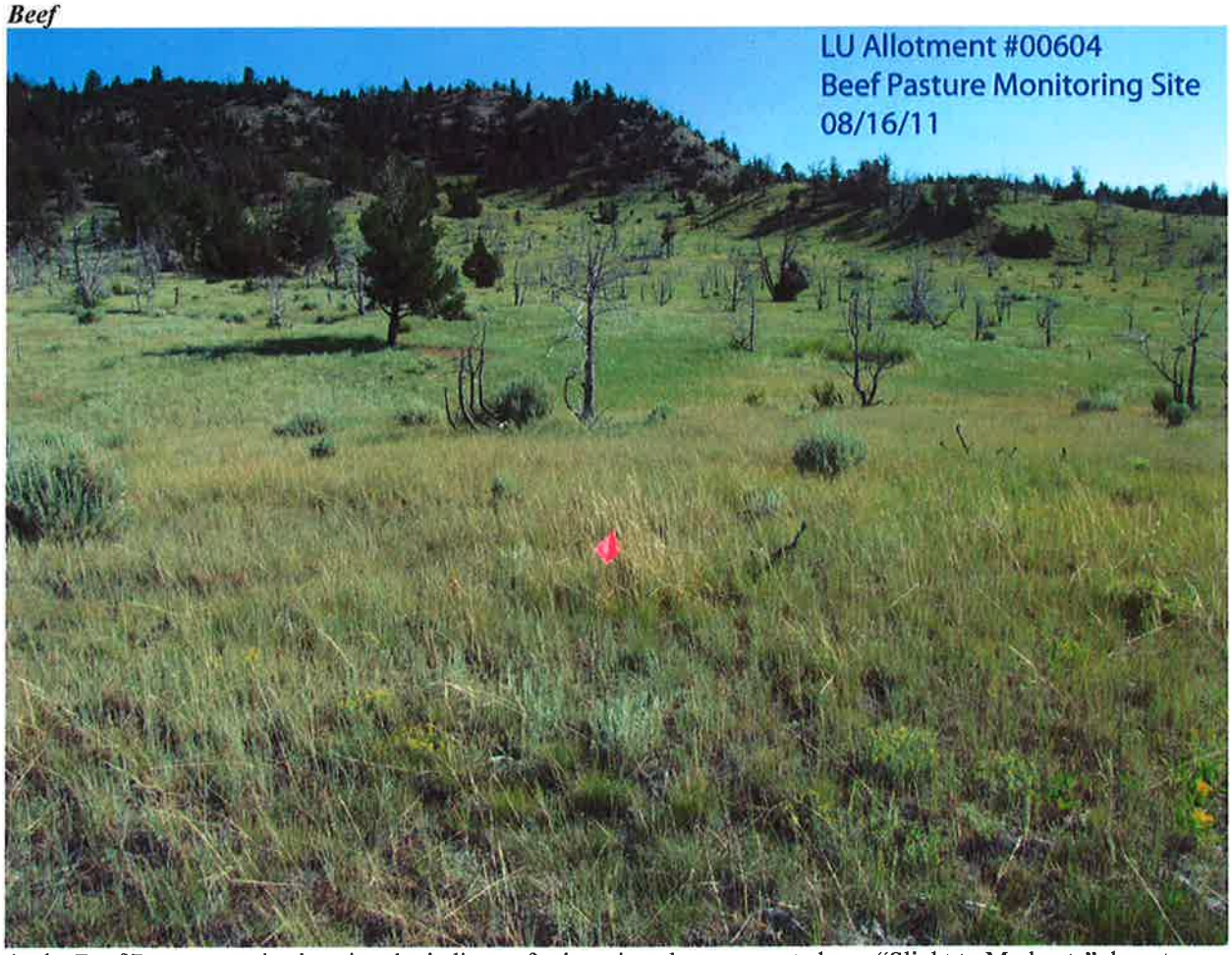
The monitoring sites representative of the vegetative communities found in the summer range pastures include Upper Enos #1, Beef, Thompson Draw, Carmichel BBQ Bench, Upper Sanford, Otto Draw, and Hess Creek Draw. All of these monitoring sites are located on loamy range sites within the 15-19" precipitation zone. Following is a discussion of the *Biotic Integrity* Indicators found at these monitoring sites, and how the *Biotic Integrity* of the sites differs from expected.

Upper Enos #1



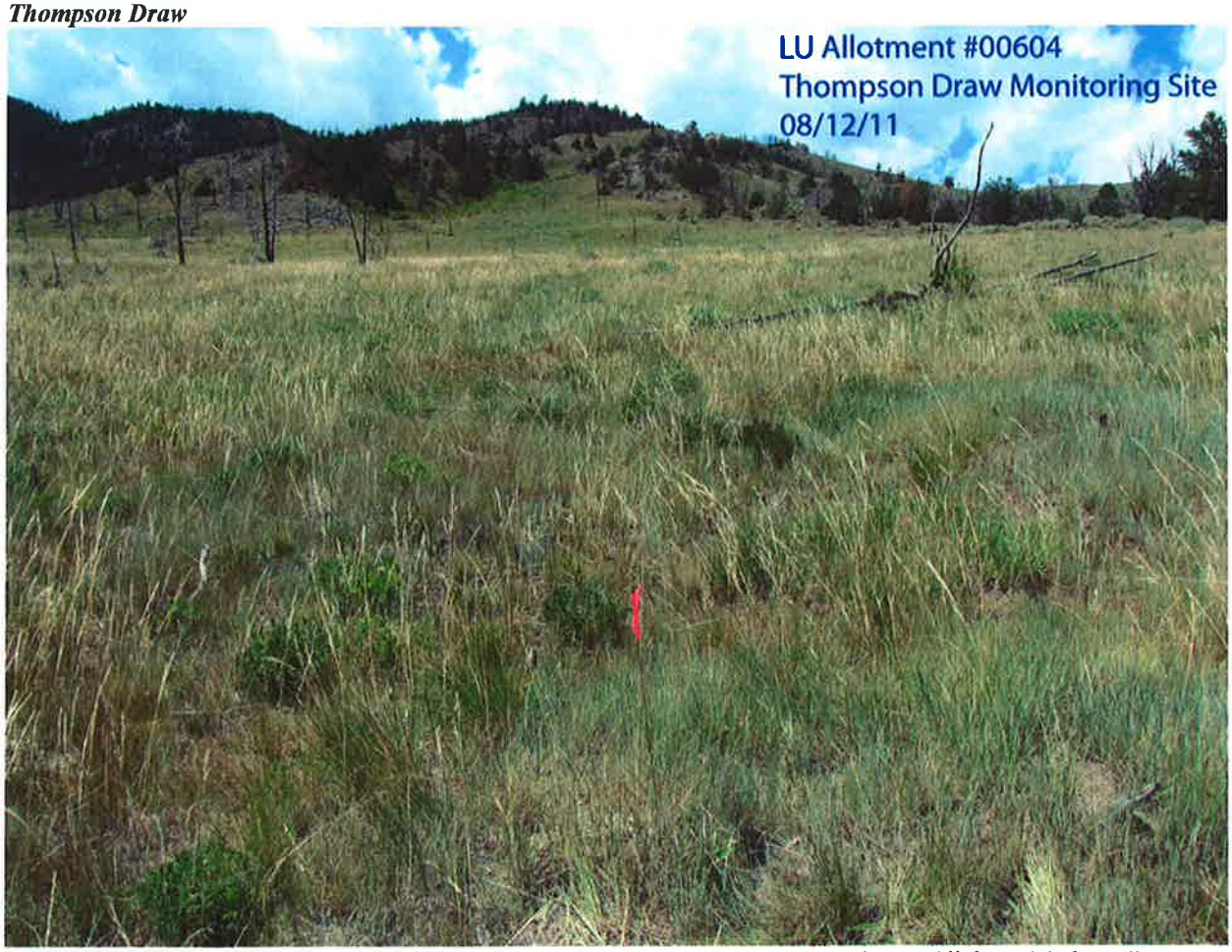
At the Upper Enos #1 monitoring site, the indicator for invasive plants was rated as a "Moderate" departure from the reference sheet for a Loamy 15-19" range site. Scattered cheatgrass can be found throughout the area, primarily on steeper slopes. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "Slight to Moderate" departure from the reference sheet, due to the presence of scattered cheatgrass. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

Beef



At the Beef Pasture monitoring site, the indicator for invasive plants was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 15-19" range site. Cheatgrass can be found scattered throughout the area in isolated patches. Small amounts of musk and Canada thistle can also be found. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

Thompson Draw



At the Thompson Draw monitoring site, the indicator for invasive plants was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 15-19" range site. Scattered cheatgrass can be found throughout the area. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

Upper Sanford

At the Upper Sanford monitoring site, the indicator for invasive plants was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 15-19" range site. Scattered cheatgrass can be found throughout the area, primarily on south-facing slopes. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

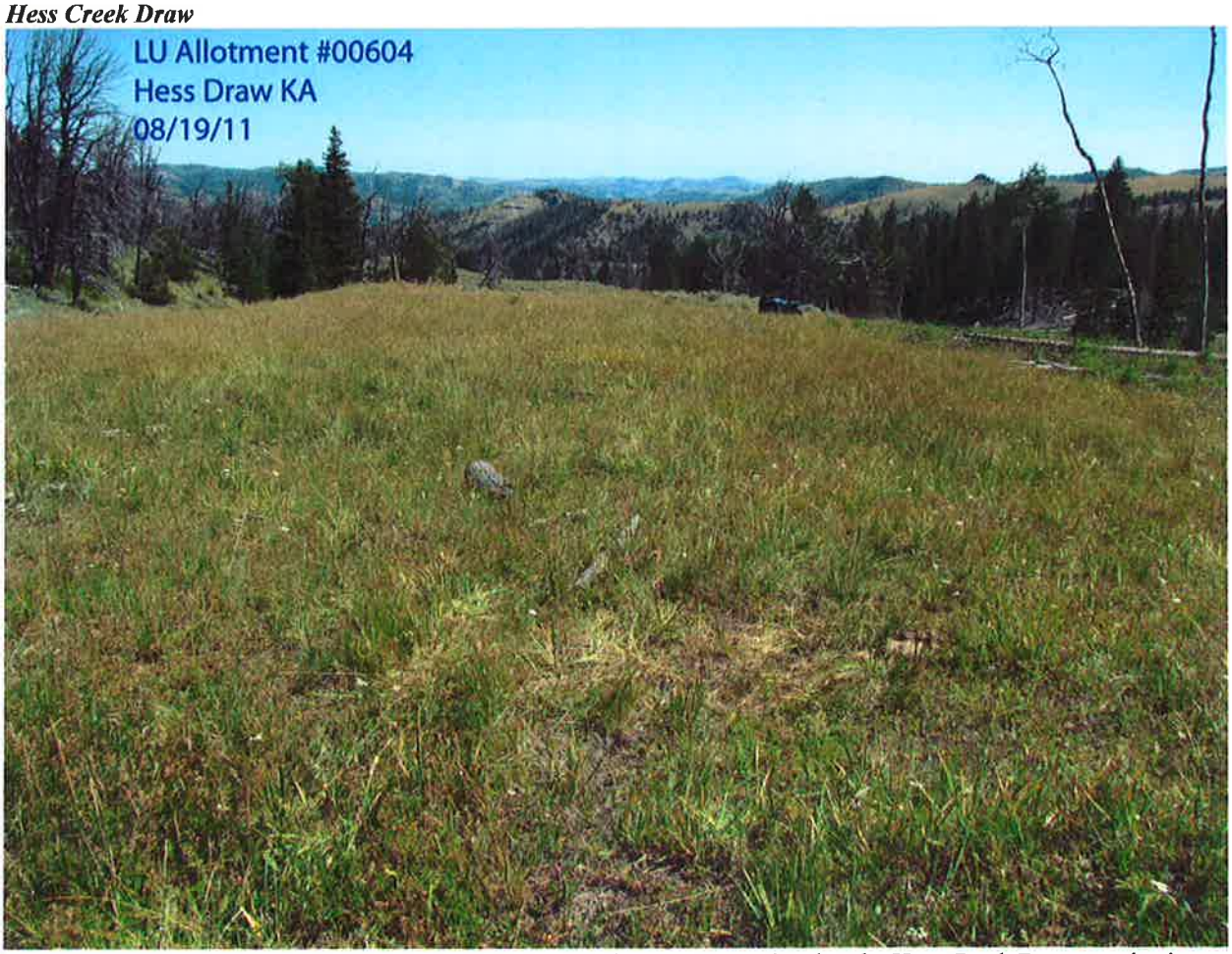
Otto Draw

At the Otto Draw monitoring site, the indicator for invasive plants was rated as a "Slight to Moderate" departure from the reference sheet for a Loamy 15-19" range site. Scattered cheatgrass can be found throughout the area, primarily on south-facing slopes. All other *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet. Overall, the *Biotic Integrity* of this site was rated as a "None to Slight" departure from the reference sheet. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

Carmichel BBQ Bench

At the Carmichel BBQ Bench monitoring site, all *Biotic Integrity* indicators were rated as a "None to Slight" departure from the reference sheet for a Loamy 15-19" range site. Additional vegetative trend data was collected at this site in 1991 and 2011 (Section 3.1.2 Vegetative Trend). Nearly all of the vegetative trend objectives that were established for this site in 1991 were met by 2011. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

Hess Creek Draw



The 17 Indicators of Rangeland Health monitoring method was not completed at the Hess Creek Draw monitoring site. Vegetative trend data was collected at this site in 1991 and 2011 (Section 3.1.2 Vegetative Trend). All of the vegetative trend objectives that were established for this site in 1991 were met by 2011. Vegetative production at this site was estimated to be 3,140 lbs/acre in 2011, which is nearly double the total production estimated in the Ecological Site Guide. In comparing the characteristics of this site to the state and transition models found in the Ecological Site Guide, the plant community closely resembles the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community for a Loamy 15-19" range site. It is stable, intact, and functioning.

3.5 Wildlife Habitat

The following sage-grouse related data is a summary of allotment lek data, data sheets from the 14 Sage-grouse Habitat Assessment transects organized by the Lower and Transition portions of the LU Allotment (see Map 11 for transect locations), sage-grouse nesting habitat monitoring photos, and WGFD Job Completion Report Big Game Population Data Summary from 2011.

Sage-grouse Lek Data Summary for LU Allotment

Lek (C-Core Area)	Average Male Attendance	Peak Male Count & Yr	Low Male Count & Yr	Years of Monitoring
East Ridge (C)	8	17 in 1995	2 in 2005	23
Grass Creek 2	11	17 in 2009	5 in 2011	8
Left Hand	12	13 in 2012	12 in 2011	3
Red Ridge (C)	16	34 in 2000	5 in 2012	22

Sage-grouse Habitat Assessment Transects for Lower portion of LU Allotment
June 13–17, 2011

Line Intercept Canopy Cover						
	Transect 0,1 (Core Area)	Transect 2,3 (Core Area)	Transect 8,9 (Core Area)	Transect 10,11 (Core Area)	Transect 12,13	Transect 14,15
Species	% Cover					
Live Big Sagebrush	28	30	5	16	12	7
Dead Big Sagebrush	7	7	4	4	5	2
Other SPP: (Saltbush)	1					
Other SPP: (Winterfat)			0			
Shrub Species	Average Height in Inches					
Live Big Sagebrush	15	18	16	17	17	17
Other SPP: (Saltbush)	5					
Other SPP: (Winterfat)			5			

Belt Transect						
Species	Transect 0,1	Transect 2,3	Transect 8,9	Transect 10,11	Transect 12,13	Transect 14,15
Big Sagebrush						
%Young		50		3		
%Mature	76	35	33	51	53	41
%Decadent	14	12	40	29	38	53
%Dead	10	3	28	17	9	6
Saltbush						
%Young						
%Mature	100					
%Decadent						
%Dead						
Winterfat						
%Young						
%Mature			100			
%Decadent						
%Dead						

Daubenmire Cover Class & Vegetation Height Data						
Summary of Vegatation Height	Transect 0,1	Transect 2,3	Transect 8,9	Transect 10,11	Transect 12,13	Transect 14,15
	inches					
New Herbacious Mean Height	9	7	11	12	10	12
Residual Herbacious Mean Height	3	4	6	4	5	3
Summary of Cover Class	(%)					
New Perennial Grass	21	8	24	34	20	19
New Annual Grass	12	6	31	11	2	3
Perennial Forb	12	1	3	2	3	3
Residual Herbacious	3	2	4	6	10	6
Other	47	60	42	47	65	69

Browse Utilization						
Species	Transect 0,1	Transect 2,3	Transect 8,9	Transect 10,11	Transect 12,13	Transect 14,15
ATTR	Low	Low	High	Moderate	Moderate	High
Saltbush	Low	Low				
Rabbitbrush						

Sage-grouse Habitat Assessment Transects for Transition portion of LU Allotment
June 13–17, 2011

Line Intercept Canopy Cover								
	Trs 4,5 (Core Area)	Trs 6,7 (Core Area)	Trs 16,17	Trs 18,19	Trs 20,21	Trs 22,23	Trs 24,25	Trs 26,27
Species	**% Cover**							
Live Big Sagebrush	24	4	18	12	15	7	14	5
Dead Big Sagebrush	4	3	4	0	1	3	2	4
Other SPP: (Fringed Sage)		7		3	1	6		
Other SPP: (Winterfat)		0						
Shrub Species	**Average Height in Inches**							
Live Big Sagebrush	13	12	12	14	16	23	9	14
Other SPP: (Fringed Sage)		3		2	2	4		
Other SPP: (Winterfat)		3						

Belt Transect								
Species	Trs 4,5	Trs 6,7	Trs 16,17	Trs 18,19	Trs 20,21	Trs 22,23	Trs 24,25	Trs 26,27
Big Sagebrush								
%Young	20					11		
%Mature	61	41	64	96	82	11	69	31
%Decadent	17	31	31	4	16	56	28	54
%Dead	2	28	6		2	22	3	6
Fringed Sage								
%Young		50		20	7	2		
%Mature		50		80	93	95		100
%Decadent						3		
%Dead								
Winterfat								
%Young								
%Mature		100					67	100
%Decadent							33	
%Dead								

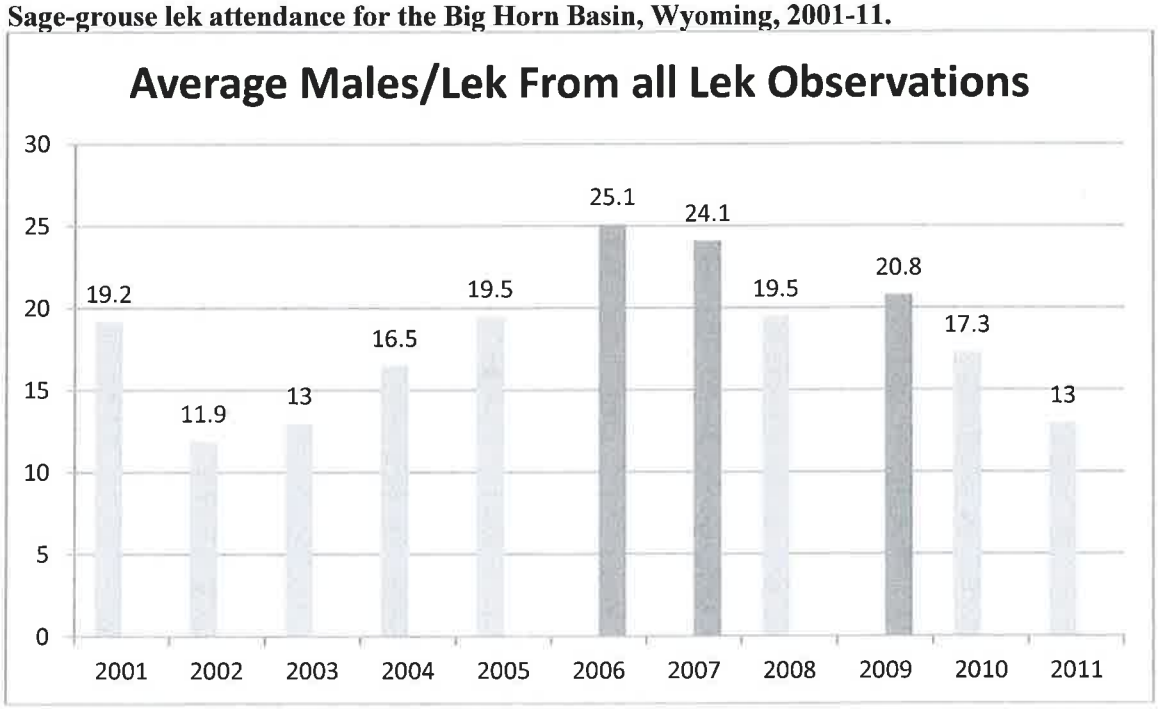
Daubenmire Cover Class & Vegetation Height Data								
Summary of Vegatation Height	Trs 4,5	Trs 6,7	Trs 16,17	Trs 18,19	Trs 20,21	Trs 22,23	Trs 24,25	Trs 26,27
	inches							
New Herbacious Mean Height	9	9	8	9	8	7	10	11
Residual Herbacious Mean Height	7	10	5	8	5	5	7	7
Summary of Cover Class	**(%)**							
New Perennial Grass	26	34	31	33	29	34	26	33
New Annual Grass	6	3	0	1	2	1	17	0
Perennial Forb	7	3	0	7	12	2	1	3
Residual Herbacious	9	13	7	20	12	3	6	17
Other	52	47	62	39	45	60	50	47

Browse Utilization								
Species	Trs 4,5	Trs 6,7	Trs 16,17	Trs 18,19	Trs 20,21	Trs 22,23	Trs 24,25	Trs 26,27
ATTR	Mod	High	Mod	Low	Low	Low	Mod	High
Fringed Sage		Low		Low	Low			Low
Winterfat		Low					High	Low

Sage-grouse nesting habitat photo in SE portion of Unit 4 on 3/29/2011.

Sage-grouse nesting habitat photo near East Ridge Lek on 4/17/2012.

Sage-grouse lek attendance for the Big Horn Basin, Wyoming, 2001-11.



WGFD Annual Sage-grouse Report, Cody Region, 2011

WGFD Job Completion Report Big game Population Data for 2011

Big game Species	Herd Unit Name	Population Objective	Population Size	% Population + or - Pop Obj	Years Over (+) or Below (-) Pop Obj
Antelope	Fifteenmile	4900	4600	-7%	+ 4
Mule Deer	Basin	3600	3200	-11.1%	- 5
Mule Deer	Owl Creek	8000	5400	-32.5%	- 12
Elk	Gooseberry	2700	3400	+26%	+ 10

Wildlife Habitat Analysis

Twenty nine key area transect locations were identified in the allotment for monitoring and evaluation purposes. Fourteen of these transects were primarily for sage-grouse habitat assessment. In late spring early summer of 2011 these sage-grouse habitat key area transects were intentionally located and run in representative sage-grouse habitats with gentle topography and large continuous sagebrush communities, within the Lower and Transition portions of the LU Allotment (see Map 11 Wildlife Map). The other fifteen monitoring locations, where the 17 Indicators of Rangeland Health were assessed, were more representative of the allotment in general (Maps 3, 4 & 5). Sagebrush canopy cover measured at sage-grouse habitat assessment transects were representative of sage-grouse wintering and/or nesting/early brood rearing habitat throughout Wyoming, with the exception of 5 transects that will be discussed later. For those transects in the Lower units sagebrush canopy cover averaged 16% with a high of 30% and a low of 5%. Those in the Transition units averaged 12% with a high 24% and a low of 4%. And for the 6 transects in the Core area, sagebrush canopy cover averaged 18%. Sagebrush canopy cover within sagebrush stands used for nesting generally ranges from 15% to 25%, and winter habitat is generally defined as sagebrush stands with 10% to 30% canopy cover (Connelly et al. 2000*a*). All of the above canopy cover averages were lowered by the 5 exceptionally low canopy cover measurements mentioned above. These 5 transects were in areas where sagebrush had been, or is currently being severely browsed and hedged, primarily by antelope concentrations, but also mule deer to some degree. These transects also had higher prevalence of decadent and dead sagebrush, as opposed to mature sagebrush (see Section 3.5 Browse Utilization and Belt Transect).

The LU Allotment lek monitoring data mentioned above does illustrate fluctuations in sage-grouse populations. As grouse populations decline, the number of males attending leks may decline or the use of some leks may be

discontinued. Likewise, as populations increase, male attendance at leks increases, and old leks may be reoccupied or new leks may be established (Holloran and Anderson 2005). With the exception of the Lefthand Lek which only has 3 years of monitoring data, the remaining 3 leks have had all peak low counts in male lek attendance over the past 7 years, and peak high counts within the last 17 years. Lek monitoring can be quite variable, and is not always the best indicator of habitat quality. Weather and/or predators can often affect lek activity. Following is a discussion from the WGFD Annual Sage-grouse Report on sage-grouse populations in the Bighorn Basin.

> *"Conclusions: Sage-grouse populations in the Big Horn Basin remain stable, despite being at a low in the population cycle. Sage-grouse in the Basin face threats, but are not in danger of foreseeable extinction. On-going conservation efforts are intended to mitigate some anthropogenic impacts. Research and efforts to monitor status and trends of sage-grouse populations and habitats should continue. Data should be used to direct future management efforts across the Big Horn Basin." (Cody Region WGFD, 2011 Annual Sage-grouse Report)*

For the 15 transects evaluated for the Rangeland Health Standards (3.1.5 17 Indicators of Rangeland Health), plant community composition and distribution (Indicator 10), as well as the functional structural groups (Indicator 12), were found to have "None to Slight" to "Moderate" deviation from the ecological range site potential. In the Lower elevation portions of the allotment, the only "Moderate" deviation was at the Buck Buttes West Monitoring Site in Unit 4, where an issue with sagebrush canopy cover and over browsing by antelope was identified in the Sage-grouse Habitat Assessments also. In the Transition portion of the allotment Indicators 10 and 12 were also found to have "None to Slight" to "Moderate" deviation from site potential, with one site, the Lower Left Hand Monitoring Site in Unit 2 having a "Moderate" deviation for functional structural groups. This site, like the Buck Buttes West site in Unit 4, was also a Sage-grouse Habitat Assessment site where over browsing of sagebrush by antelope was noted. For the Upper portions of the LU Allotment, indicators 10 and 12 were found to all have "None to Slight" deviation from site potential.

Big game population data as well as some limited habitat data is collected and monitored by the Wyoming Game and Fish Department on a Herd Unit basis throughout Wyoming. The LU Allotment encompasses only a small portion of these herd units, and therefore data discussed is not specific to this allotment, but to the larger herd unit. Population data for these herd units is summarized in Section 3.5 (WGFD Job Completion Report Big game Population Data for 2011). Overall antelope and elk population estimates are above population objective, and mule deer are below, and have been for these herd units as well as west wide for many years now. As mentioned above antelope concentrations and excessive shrub browsing has resulted in the deterioration of some isolated sagebrush communities important to mule deer and sage-grouse, as well as antelope. Below is discussion from the WGFD Big game Job Completion Reports on mule deer populations and habitat conditions in the Owl Creek Mule Deer Herd Unit. The Grass Creek sagebrush transect mentioned is in the Transition portion of the LU Allotment.

> *"Deer associated with irrigated hay fields and riparian areas may not be experiencing adverse effects from the recent drought as much as those deer utilizing mainly native ranges. Overall, habitat conditions have declined in this herd unit since the onset of drought in the late 1990's. Forage quality and lack of spring forb availability may likely be having the most negative effect on this deer herd. Routine habitat observations the past five years, and data from established sagebrush transects, have indicated minimal sagebrush leader growth. Although sagebrush leader growth improved in 2011, forage quality and quantity have suffered over the long-term, especially forb production and sagebrush vigor. Until normal moisture regimes return, herd growth and survival will continue to be affected by reduced habitat conditions caused by the drought.*
>
> *Two sagebrush browse transects were established in this herd unit in 2004. Transect locations include Grass Creek and Wagonhound Bench. Sagebrush leader growth in 2011 for both the Grass Creek and Wagonhound transects was 4.0cm. These data document some of highest production since starting these transects in 2004, and are about 50% above the 5-year average. The increase in leader growth was the result of good moisture conditions during the 2011 spring period. The 2011/12 utilization was 28% for the Wagonhound transect, which is 60% higher than the 5-year average. This increase in use likely occurred from pronghorn, since numerous pronghorn were observed utilizing the area during the winter period. The Grass Creek transect only received 3% use, which was about average" (2011 Big Game Job Completion Reports, Cody Region WGFD).*

4.0 Conclusions

This section draws conclusions and makes determinations regarding:

A. Progress towards or attainment of the standards for rangeland health, and
B. Whether livestock management is in conformance with the guidelines, and
C. Whether existing grazing management or levels of grazing use are significant factors in failing to achieve the standards or conform to the guidelines.

4.1 Standard 1

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. MET

Rationale:

The high elevation portions of the LU Allotment, roughly demarcated as elevations greater than 6500 feet, are clearly meeting Standard 1 for Healthy Rangelands. At each assessment location, all 12 of the Indicators of Rangeland Health pertaining to *Soil and Site Stability* and *Hydrologic Function* were rated as a "None to Slight" departure from the reference sheets for the ecological sites present.

The mid and low elevation parts of the LU Allotment are also meeting Standard 1 for Healthy Rangelands. The rangeland health indicators used to assess runoff and erosion (rills, water-flow patterns, pedestals, terracettes, and litter movement) are generally depicted as having a "Slight to Moderate" departure from the reference sheets. Areas subject to historic soil loss have also been documented as having a "Slight to Moderate" departure from that described in the reference sheets. Wind-scour, blowouts and areas of wind-blown deposition are rare though the extent to which pedestalling is observed could be due to wind-blown sands on the sandier sites. In the few locations where soil compaction is documented, it is only present to a minor extent, consisting of structural changes only. At all assessment locations, the physical properties of the soils provide sufficient resistance to erosion.

The ubiquitous gully network present throughout the lower elevations of the LU Allotment will continue to be a long-term feature of the landscape. The Rangeland Health Indicator for gullies documented a "Moderate" departure at several locations. Many gullies occur in close association with the two-track road system. Nick points and headcuts were observed at several locations. All indications are that the gully network is stabilizing. Grasses and shrubs are becoming established in the channel bottoms. The sides of the channels continue to slough creating rounded shoulders and there is little evidence the gully system is continuing to advance into the uplands.

4.2 Standard 2

Riparian and wetland vegetation has structural, age and species diversity characteristic of the state of channel succession 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 ground water recharge. ***MET / NOT MET***

Rationale:

The riparian segments in the allotment that were rated to be in proper functioning condition according to BLM Manual 1737-15 and 1737-16 are currently meeting the standard as outlined above. The definition of Standard 2 was derived from the PFC manual as written. These areas are considered to be in a stable condition and have the plant community that is capable of providing for all of the benefits as outlined in Standard 2. The use levels from wildlife and other permitted grazing activities are sufficient to maintain these characteristics and are in equilibrium or moving toward the desired natural community or DNC for these acres.

The other riparian areas that were assessed to be Functioning at Risk (FAR) generally are functioning at a level sufficient to meet Standard 2, however there are certain guidelines that can be implemented to improve the segments and move them into PFC.

The areas that are assessed as non-functional are not meeting the standard as outlined above. The riparian characteristics of these areas no longer exist and are not functioning, under historical or current management conditions in the allotment. In such areas fencing or other off site water developments located at a distance from spring and seep areas would be necessary to implement to meet the riparian standard.

		% Total
Total		
PFC	144	86.1
FAR	22.7	13.6
NF	0.5	0.2
Acres	**167.2**	**100**

There have been collaborative efforts by the LU Ranch and the Nature Conservancy since 2008 to collect data, tree planting efforts, raise water tables, and restore meanders to natural conditions. Many water development projects have been installed to draw livestock away from riparian areas.

BLM Wyoming Guideline #2 & #3 for areas not meeting riparian standard:

Potential guidelines and best management practices to consider are below.

"Grazing management practices will restore, maintain, or improve riparian plant communities. Grazing management strategies consider hydrology, physical attributes, and potential for the watershed and the ecological site. Grazing management will maintain adequate residual plant cover to provide for plant recovery, residual forage, sediment capture, energy dissipation, and ground water recharge.

The development of springs, seeps, or other projects affecting water and associated resources shall be designed to protect the ecological and hydrological functions, wildlife habitat, and significant cultural, historical, and archaeological values associated with the water source. Range improvements will be located away from riparian areas if they conflict with achieving or maintaining riparian function."

Such areas that are identified as Functioning at Risk (FAR) with a downward trend and non-functional (NF) areas will require implementation of these guidelines such as riparian fencing around areas, or other restoration efforts such as planting, and additional monitoring that are currently ongoing to make progress to meet this standard.

4.3 Standard 3

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

Rationale:

The upland ecological sites on the LU Allotment are meeting Standard 3 for Healthy Rangelands. The monitoring data shows that the indicators (vegetative cover, plant composition, diversity and vigor, bare ground & litter, and erosion indicators) are appropriate for the ecological sites found on the allotment. While cheatgrass can be found in small quantities, primarily in previously disturbed areas, it does not dominate the ecological sites, and does not alter the overall plant community states present. The plant communities found at the monitoring sites located in the low and mid elevation portions of the LU Allotment closely resemble the Perennial Grass / Big Sagebrush Plant Community, or Perennial Grass / Mixed Shrub Plant Community. These sites are in a dynamic equilibrium with the Historic Climax Plant Community. This means that at this time these sites have appropriate pathways available to them to respond to proper grazing strategies, favorable environmental conditions, and environmental disturbances.

These sites have a vegetative community that is stable, intact, resistant to change, and provides for soil and watershed stability. The plant communities found at the monitoring sites located in the high elevation portions of the LU Allotment closely resemble the Columbia Needlegrass / Spike Fescue Plant Community, which is considered the Historic Climax Plant Community. They are stable, intact, and functioning.

4.4 Standard 4

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. ***MET / NOT MET***

LU Allotment – Standard 4 Compliance

Acres Meeting Standard	145,265 (98.2%)
Acres NOT Meeting Standard (Map 11)	2,589 (01.7%)
Total Acres	147,854 (100%)

Rationale:

Most all rangelands or habitats evaluated with the Rangeland Health Standards 17 Indicators and the Sage-grouse Habitat Assessments within the LU Allotment are providing wildlife forage and cover needs, or are capable of sustaining viable populations and a diversity of native plant and animal species appropriate to these habitats. The exceptions are the 2 out of 15 Rangeland Health monitoring sites mentioned above with "Moderate" ratings for Indicators 10 or 12 (see Section 3.1.5 17 Indicators of Rangeland Health), and the 5 out of 14 Sage-grouse Habitat Assessment sites having issues with the sagebrush component (see Section 3.5 Sage-grouse Habitat Assessment Transects). While these sites have an adequate sagebrush component to meet the upland vegetation standard, particularly for the sagebrush obligates, the sites with "Moderate" deviations and poor sagebrush health are lacking habitat components important to these species. For these sagebrush dependent species, frequency and composition of sagebrush and key bunchgrass species are particularly important for forage, cover, and nest concealment, as well as for the long term maintenance and health of the sagebrush community itself.

4.5 Standard 5

Water quality meets State standards. ***MET/ NOT MET***

Rationale:

Wyoming's water quality laws are administered by the Wyoming Department of Environmental Quality (DEQ), Water Quality Division (WQD). The water quality is administered by the DEQ Non-Point Source program that oversees section 303d of the federal Clean Water Act. The DEQ publishes an annual 305 (b) report using assessment methodology to determine surface water quality standards and associated uses of different waters as approved by the US Environmental Protection Agency.

The main drainages for consideration of compliance with this standard are Gooseberry Creek is designated as a 2B, Grass Creek is a 2AB, Fifteenmile Creek has a class 3B designation.

According the 2014 305 (b) and 303 (d) WYDEQ integrated report, the lower section of Grass Creek in the allotment has been placed in category 4C, where a non-pollutant is the source of impairment (flow alterations for Grass Creek).

Bighorn River Basin							
Waterbody	305(b) Identifier	Location	Class	Miles/ Acres	Cause(s) of Impairment	Initial 303(d) Listing Date	Date added to Category 4C
Grass Creek	WYBH100800070608_01	From an irrigation withdrawal in NENE S23 T46N R99W to a point 14.1 miles downstream	2AB	14.1 mi.	Flow Alterations	n/a	2006

This flow alteration impairment affects the eastern pastures (RAIDS # P0235X 0.43 miles length and P0346X 0.22 miles length) and is beyond the scope and authority of the BLM. These areas below would be considered not meeting Standard 5 for reasons beyond the control of the BLM.

The areas of Grass Creek above this withdrawal are considered to be meeting their designated beneficial uses and are considered to be meeting this standard.

The segments of Gooseberry Creek and its tributaries are considered by WYDEQ to be meeting their designated uses and are meeting this standard.

The portions of Fifteenmile Creek in the allotment are considered ephemeral and rated as a class 3B stream (WYDEQ, 2001). There was mention of bank instability and excess sedimentation in the watershed (WYDEQ, 2014); however these ephemeral segments are not listed as impaired or included in the 305 (b) report.

The upland conditions indicated a "None to Slight" and a "Slight to Moderate" departure for rangeland health standards that is likely sufficient to avoid detrimental impacts to the water quality of storm water runoff following storm events.

4.6 Standard 6

Air quality meets State standards. ***UNKNOWN***

Rationale:
No information is currently available to indicate that this Standard is or is not being met. An air quality monitoring station was recently established in the Bighorn Basin, but no monitoring data is available at this time. Until specific data becomes available, the determination for this Standard is UNKNOWN, per direction from the BLM Wyoming State Office.

4.7 Previous Assessment (Unit 7, 1998)

A Wyoming Rangeland Standards Conformance Review was completed for the Upper Grass Creek Unit 7 of the LU Allotment in 1998. This review can be found in Appendix A. Following is a brief discussion of the determinations reached during that review, as well as changes that have occurred in Unit 7 since then.

Standard 1 – Not Met
During the review in 1998, it was determined that Standard 1 was not being met due to excessive erosion from a steep, poorly designed road in Otto Draw. This road has since been closed, and the public land portions of the road have been stabilized. As noted above in Section 4.1, this Standard is now being met.

Standard 2 – Met

Standard 3 – Not Met
During the review in 1998, it was determined that Standard 3 was not being met because the vigor and productivity of the perennial bunchgrasses in some areas was below potential. It was also noted that the canopy cover of woody species was excessive in some areas due to a combination of fire suppression and historical livestock grazing practices. The LU Ranch has since implemented a grazing rotation system which has resulted in significant improvement in the upland vegetation conditions in Unit 7. Also, numerous prescribed burns were completed to address the excessive cover of woody species. As noted above in Section 4.3, this Standard is now being met.

Standard 4 – Met

Standard 5 – Met

Standard 6 – Met

5.0 Resource Specialist Signatures

X _____
Cameron Henrichsen
Rangeland Management Specialist

X _____
John Elliott
Supervisory Rangeland Management Specialist

X _____
Tim Stephens
Wildlife Biologist

X _____

X _____
Jared Dalebout
Hydrologist

X _____
Michael J. Phillips
Assistant Field Manager - Resources

X _____
Steve Kiracofe
Natural Resource Specialist, Soils

X _____
Other_____

6.0 DETERMINATION

Based on the information provided in this assessment, ***I have determined that <u>all of the standards ARE NOT being met</u> but that <u>livestock grazing IS in conformance</u> with the standards.***

X

Rebecca Good
Worland Field Office Manager

MAR 1 6 2015

Date

7.0 REFERENCES

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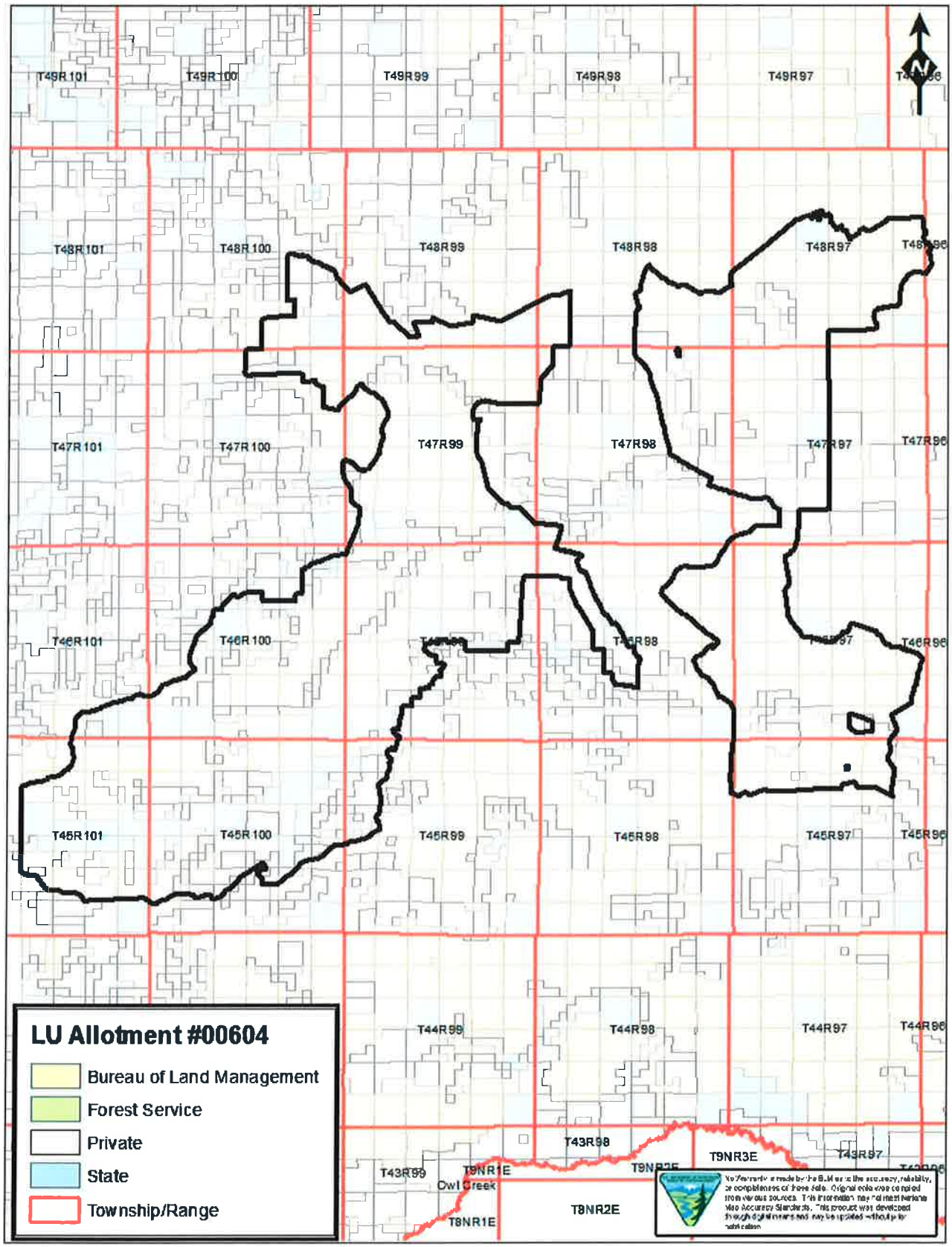
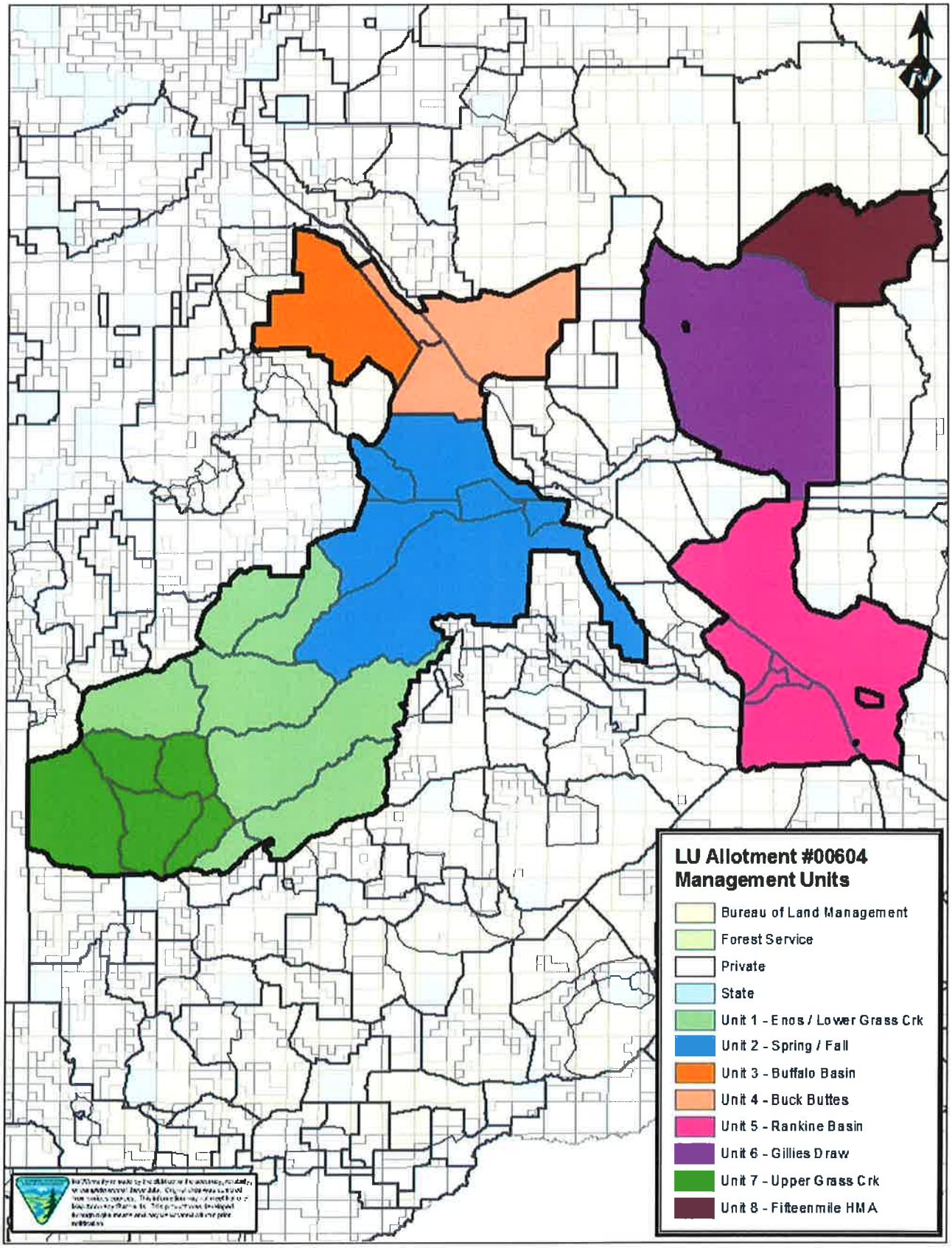
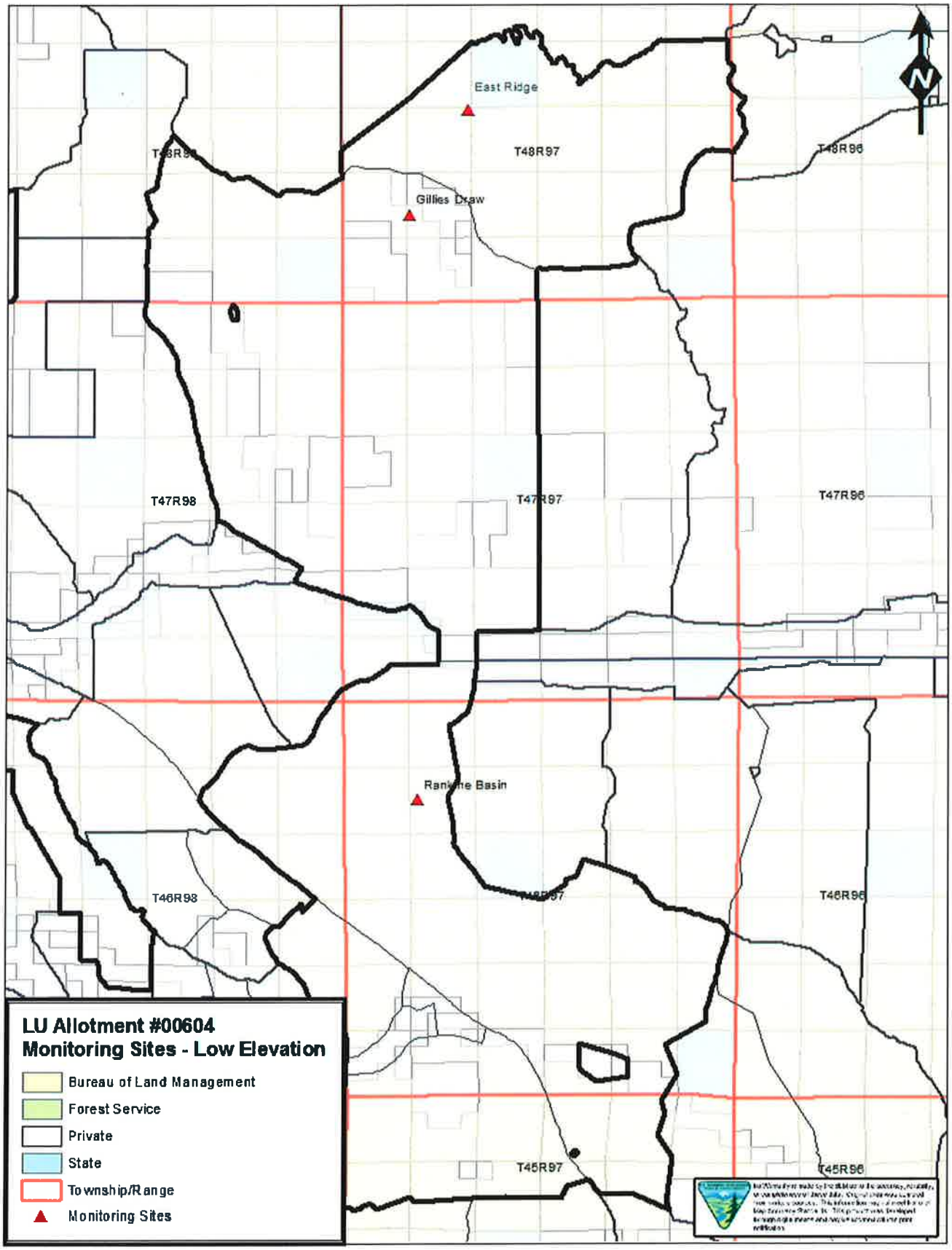
Map 1: Allotment Map – General Location



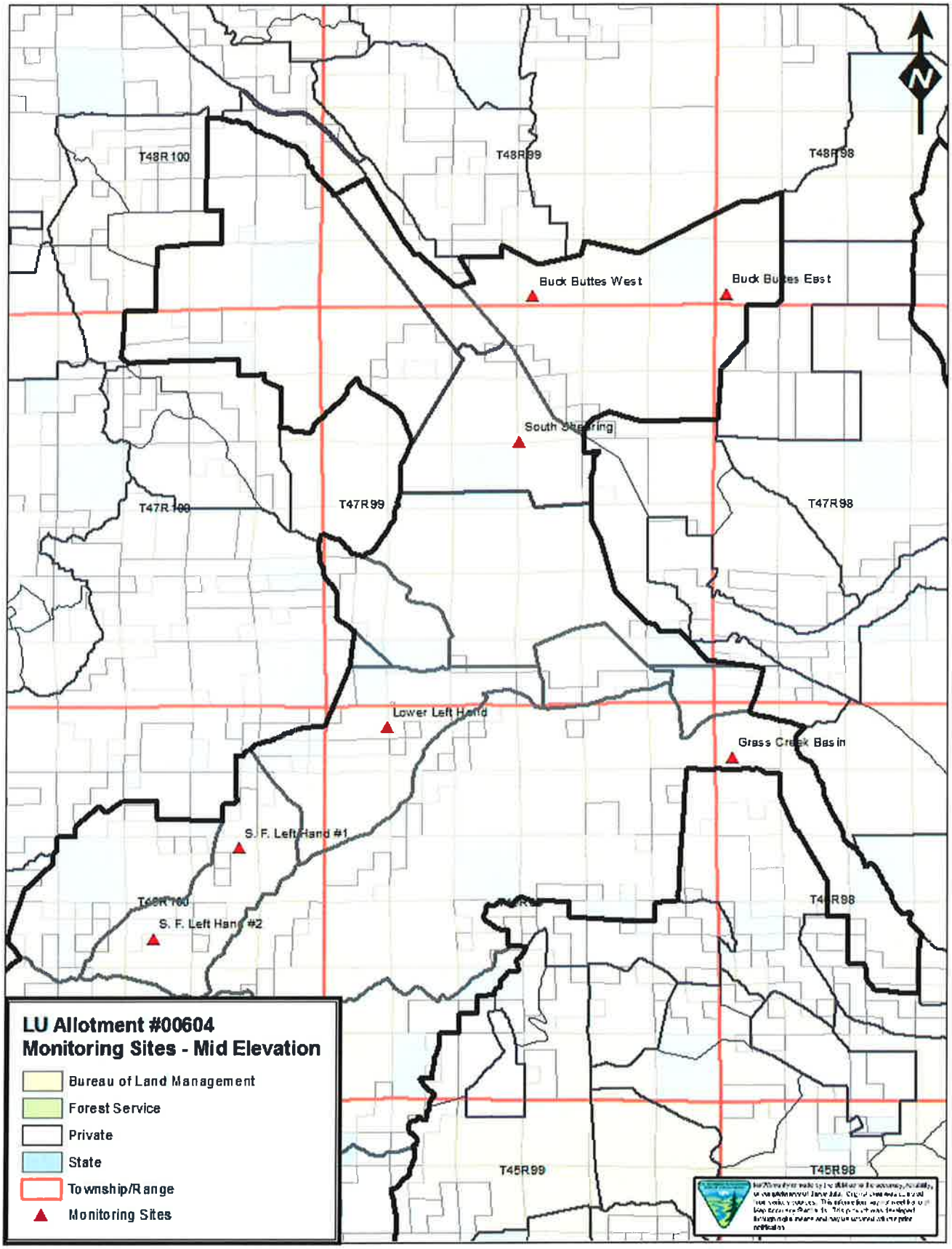
Map 2: Allotment Map – Management Units



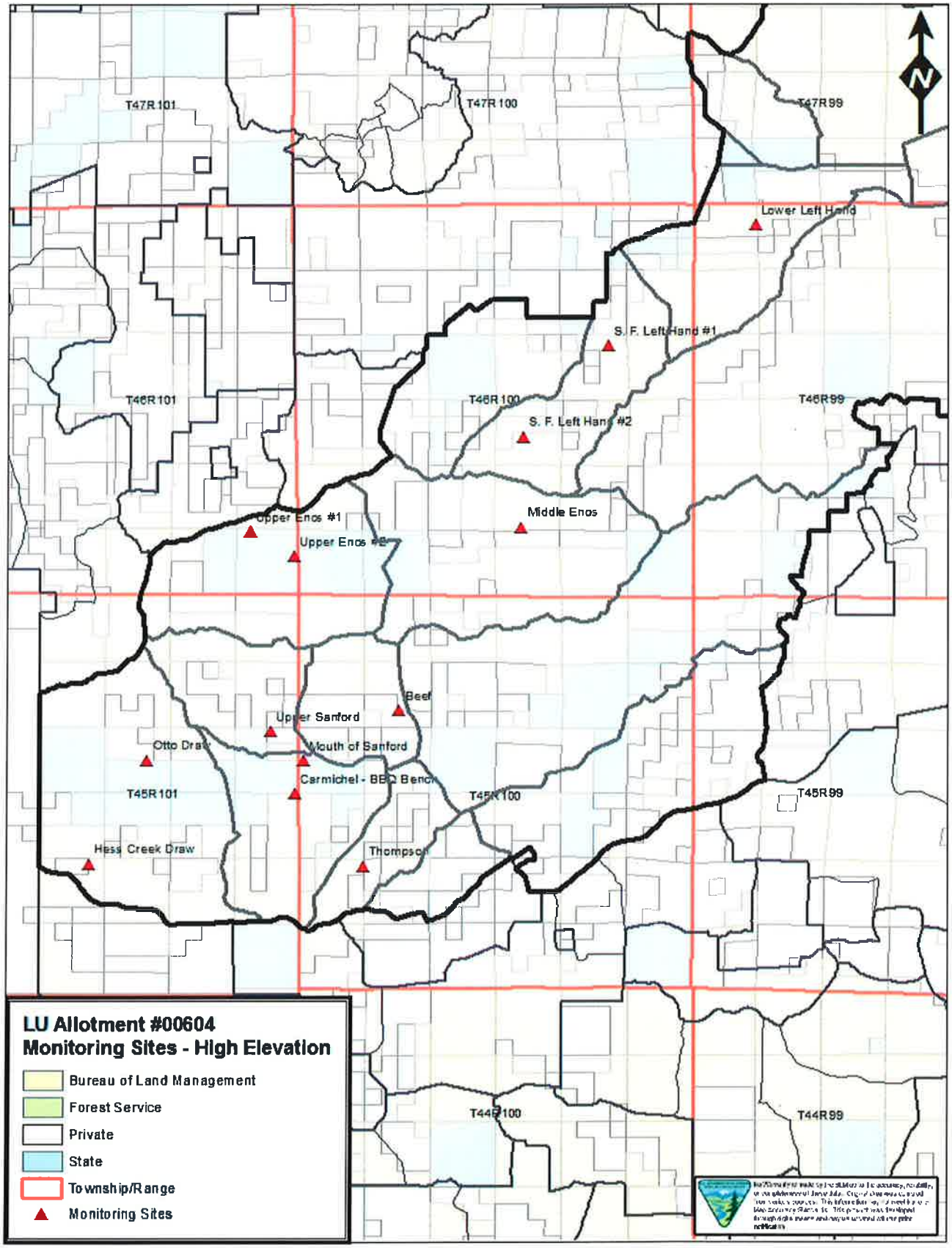
Map 3: Monitoring Sites (East)



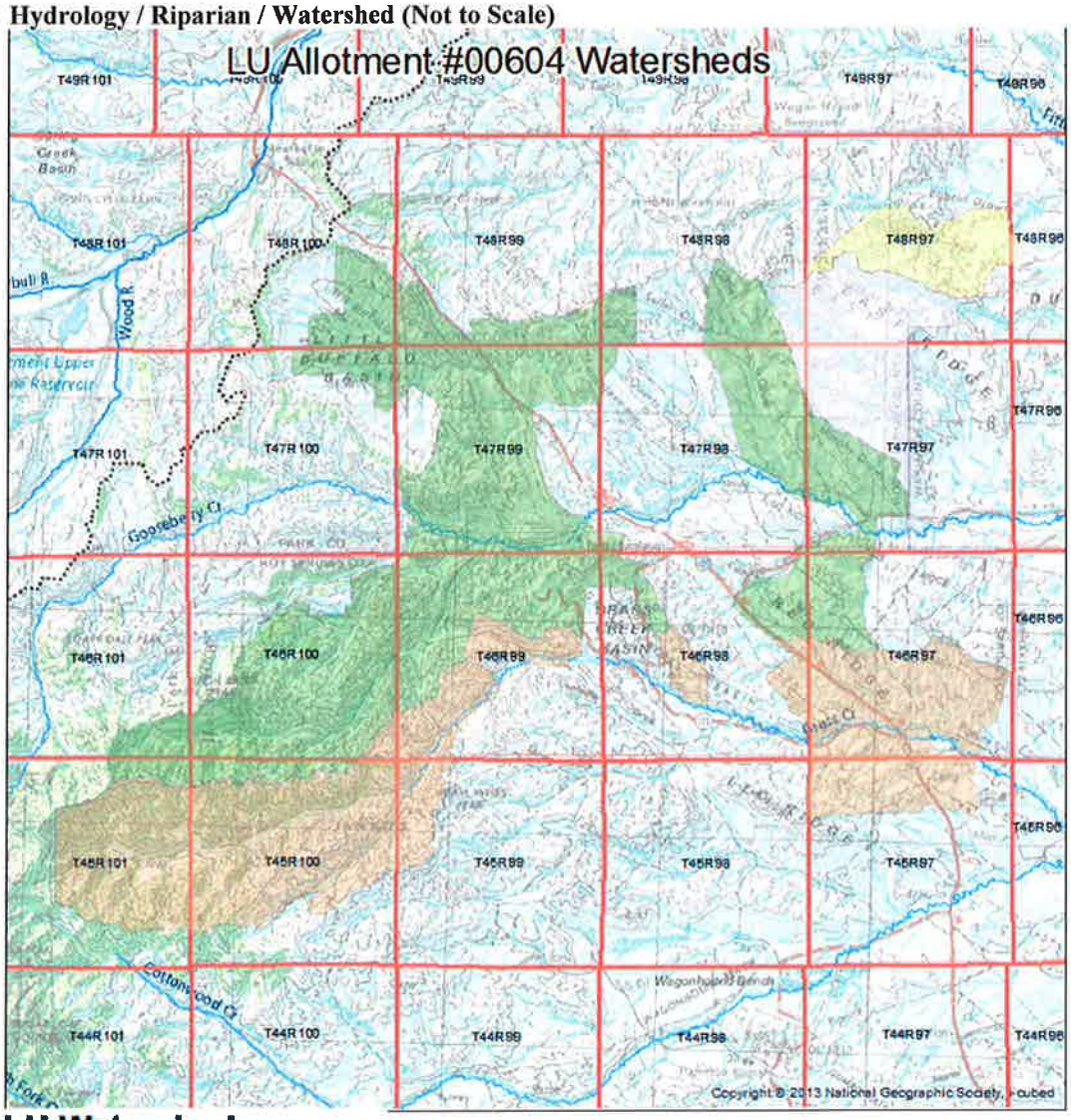
Map 4: Monitoring Sites (Central)



Map 5: Monitoring Sites (West)



Map 6: Hydrology / Riparian / Watershed (Not to Scale)



LU Watersheds

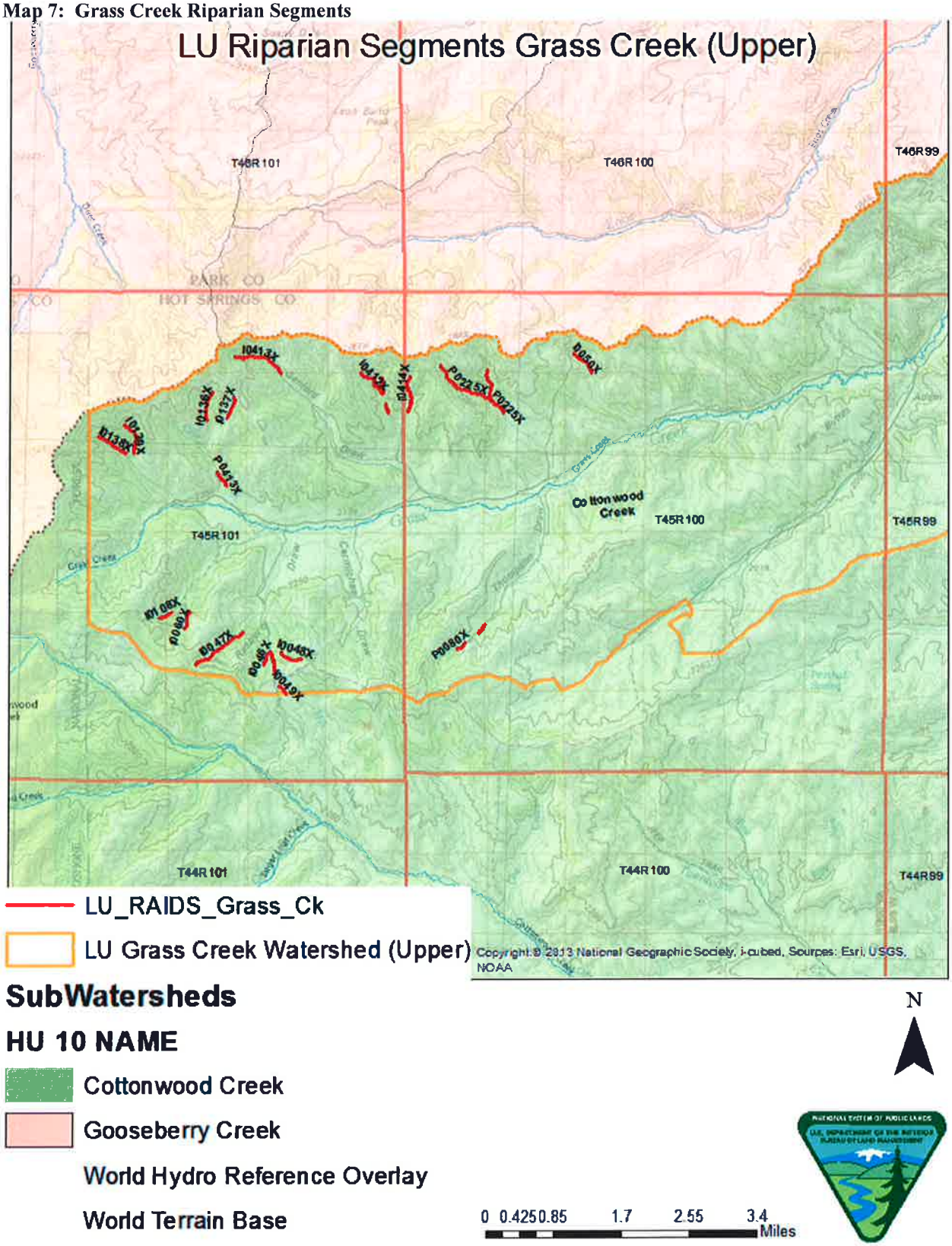
HU 10 Name

- Cottonwood Creek
- Gooseberry Creek
- Lower Fifteenmile Creek
- Upper Fifteenmile Creek

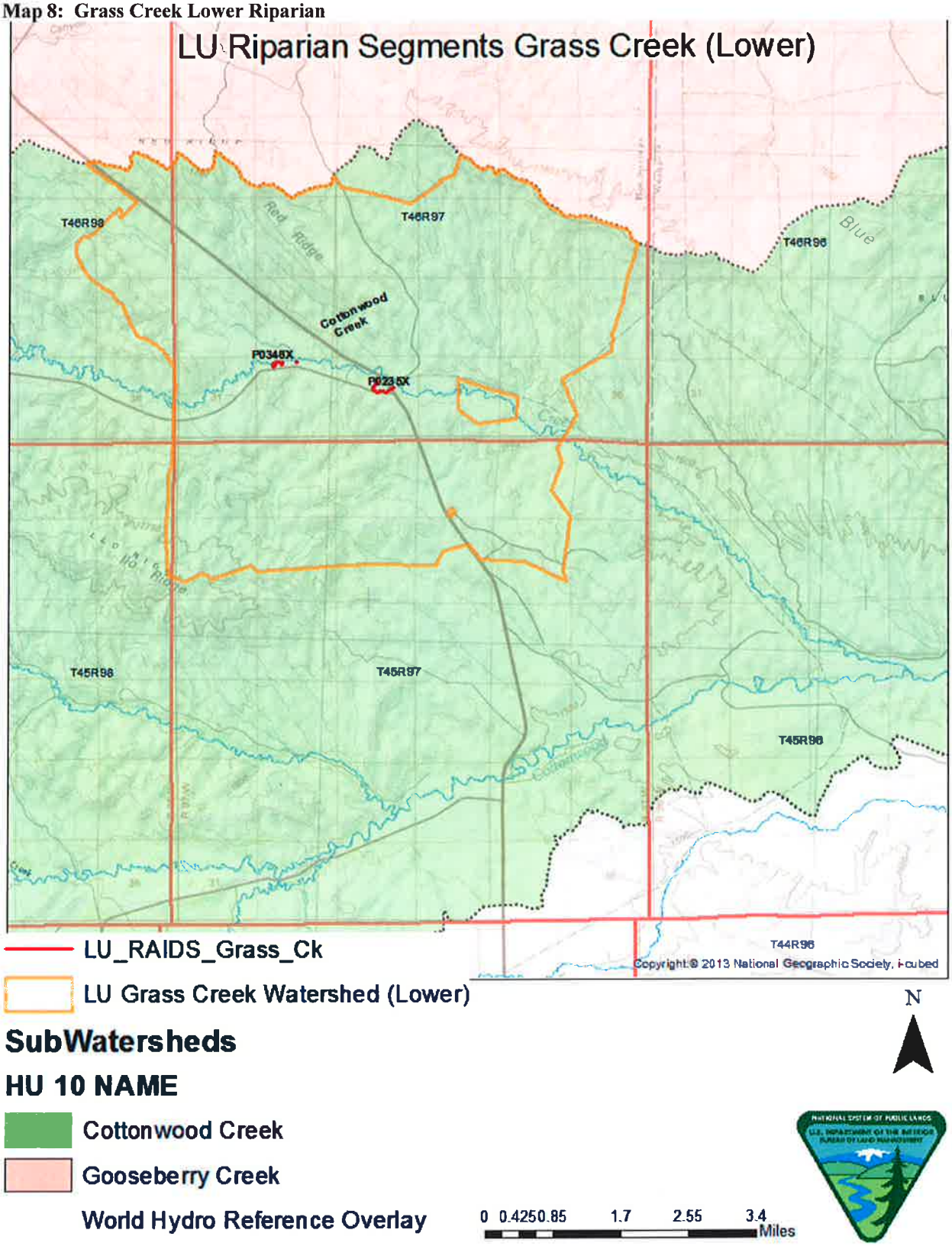
N

0 1 2 4 6 8 Miles

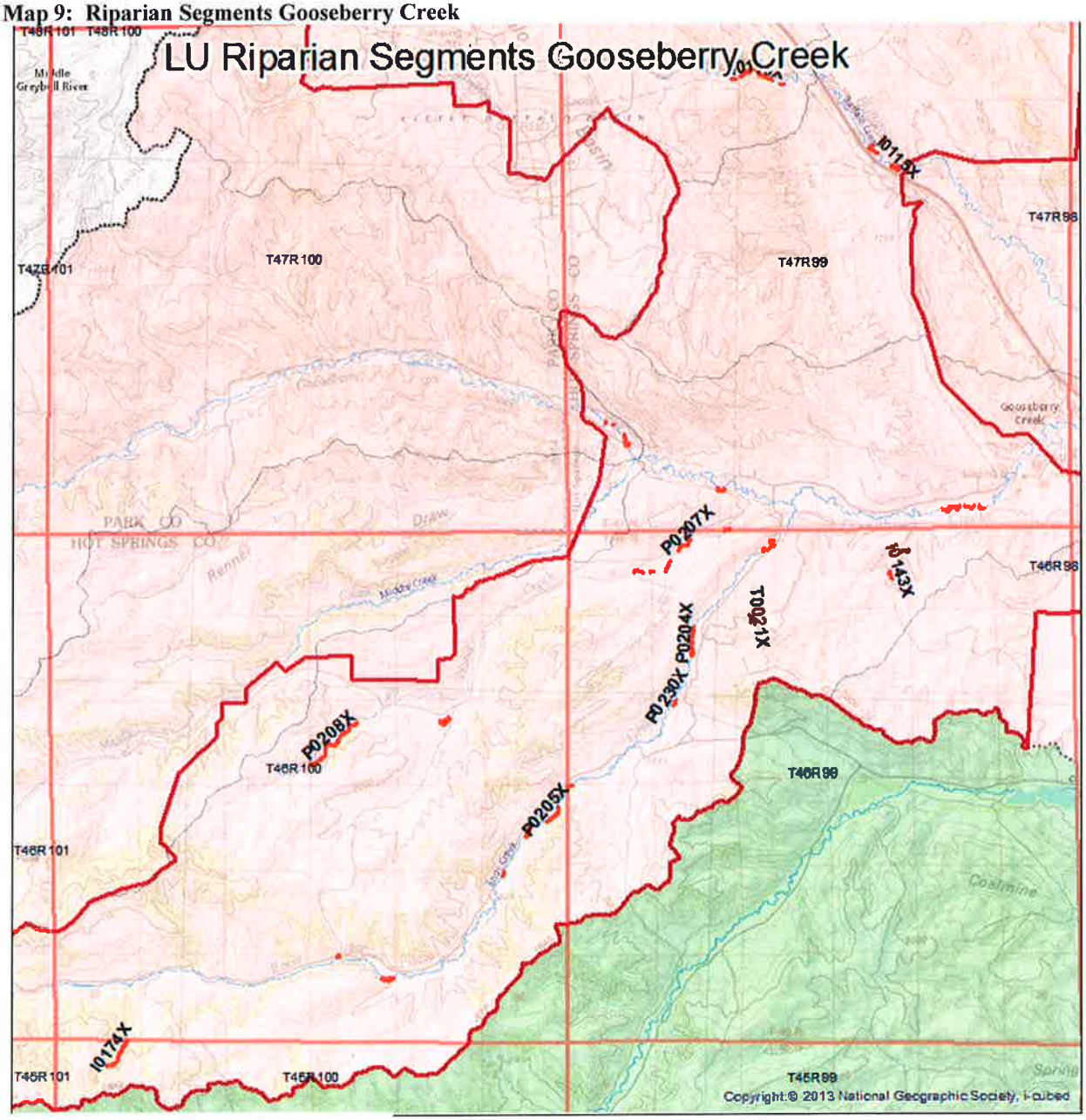
Map 7: Grass Creek Riparian Segments



Map 8: Grass Creek Lower Riparian



Map 9: Riparian Segments Gooseberry Creek



LU_RAIDS_Gooseberry

LU_Gooseberry

SubWatersheds

HU 10 NAME

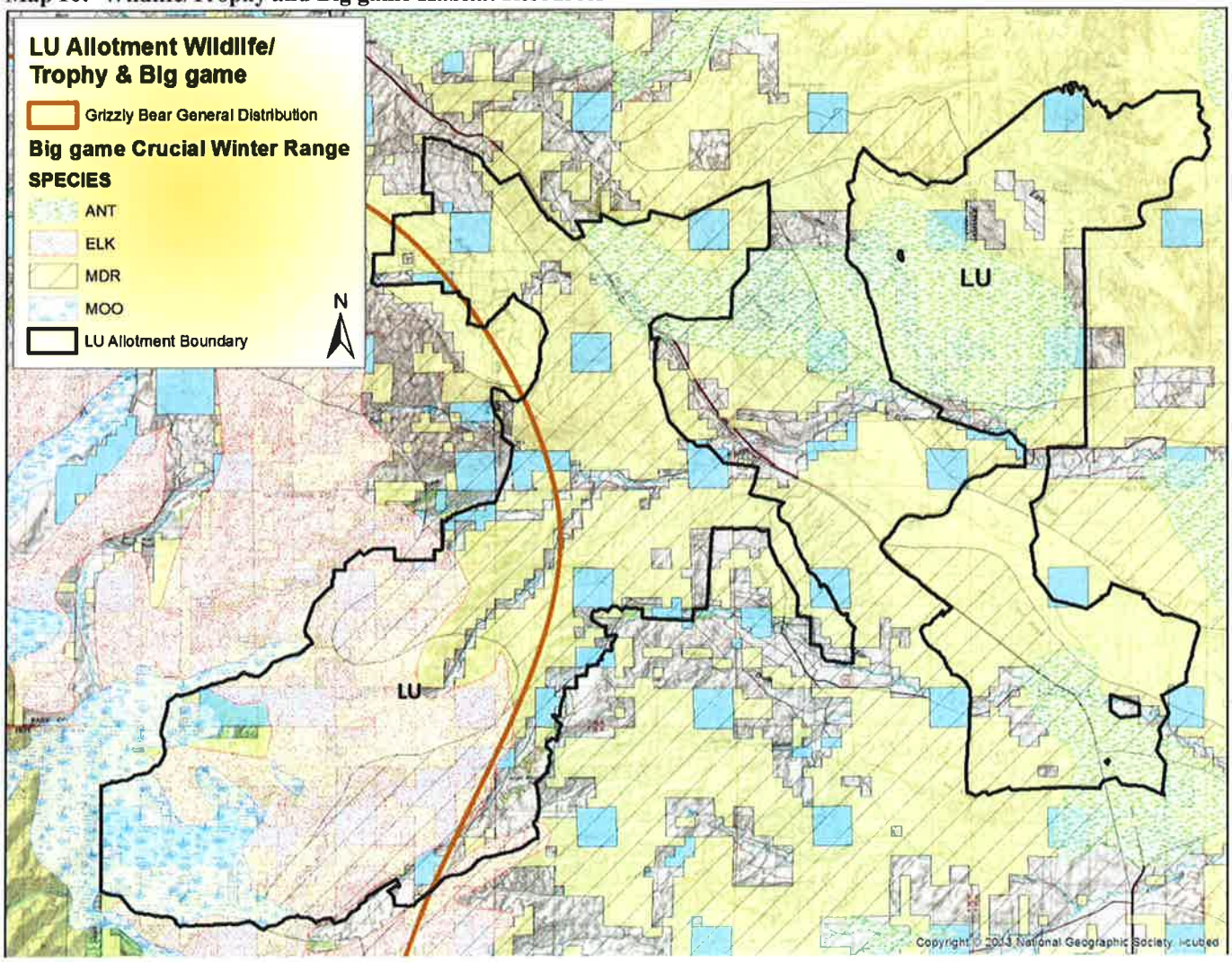
Cottonwood Creek

Gooseberry Creek

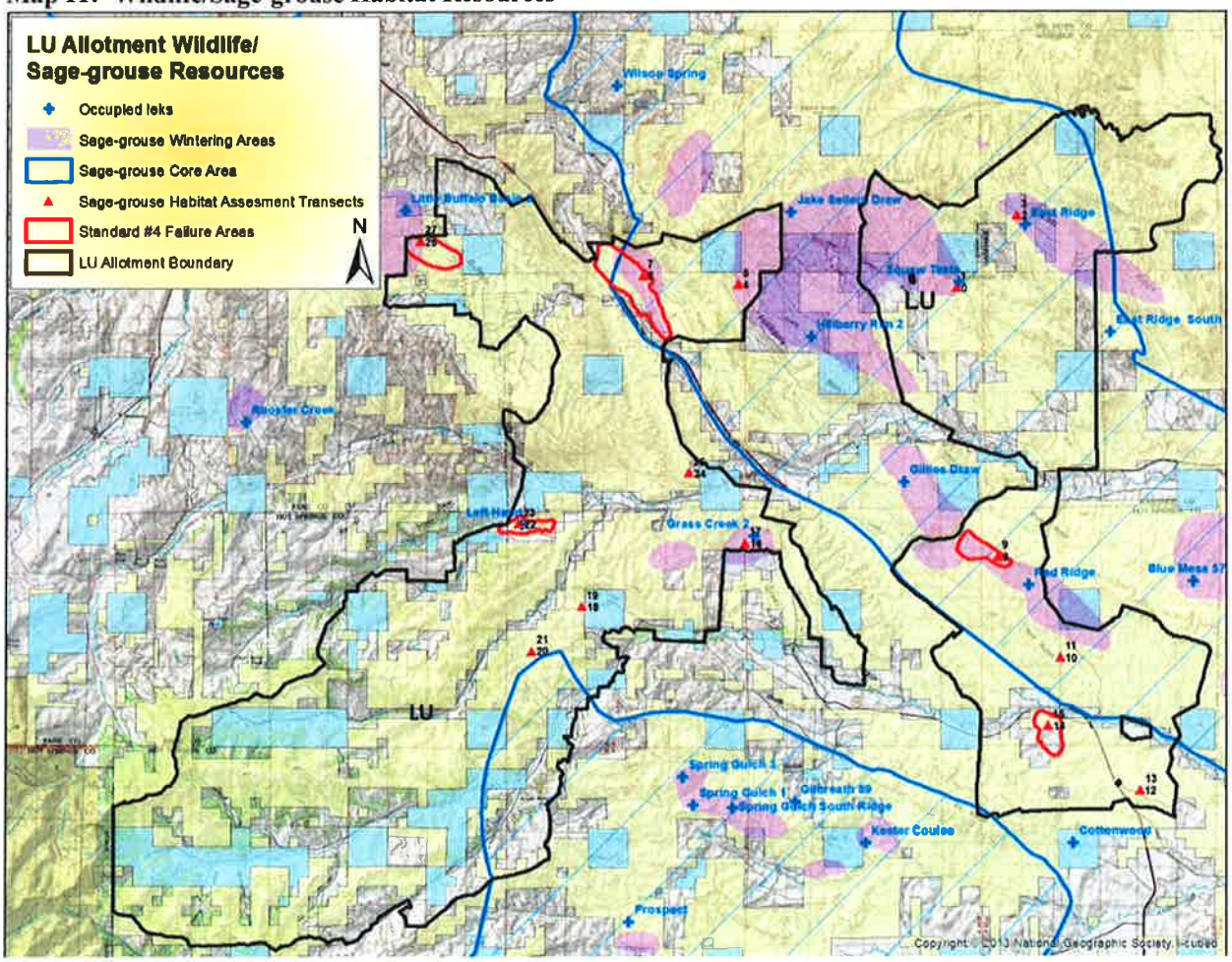
N

0 0.475 0.95 1.9 2.85 3.8 Miles

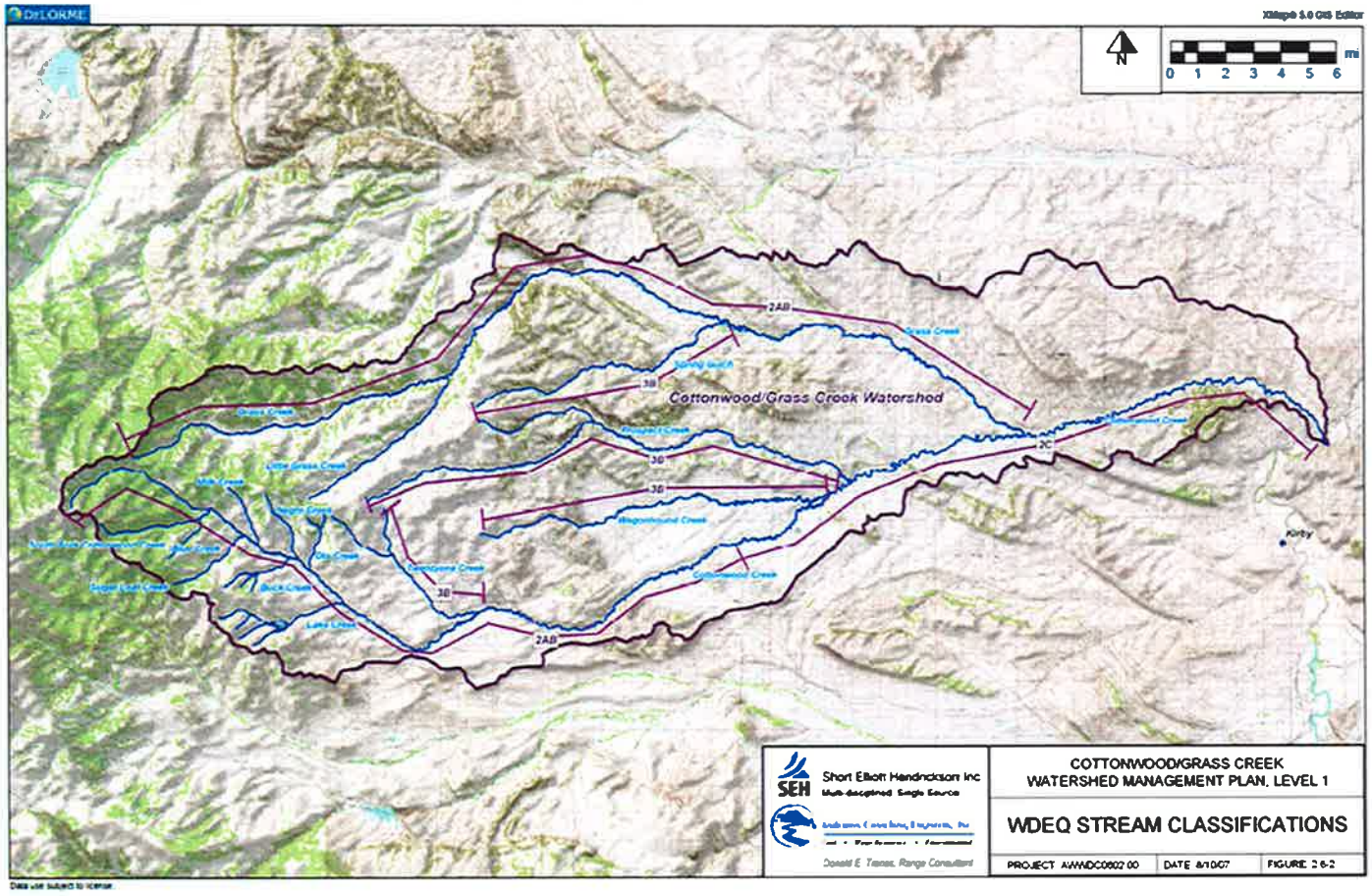
Map 10: Wildlife/Trophy and Big game Habitat Resources



Map 11: Wildlife/Sage-grouse Habitat Resources



Map 12: WYDEQ Stream Classifications 2001 (SEH, 2007)



Appendix A - Standards Conformance Review, Unit 7 (1998)

Wyoming Rangeland Standards
Conformance Review Summary

Allotment: LU Allotment #00604 (Unit 7- Upper Grass Creek Pastures only)
Resource Area: BBRA

Permittees/Lessees: LU Ranch - #00604

Activity Plan: LU AMP

Part 1 - Conformance Review

STANDARD #1: *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.*

Resource conditions in the allotment meet the standard? no

Rationale: The Upper Grass Creek Pastures generally have adequate vegetative cover, litter, and minimal erosion on upland range sites. Excessive soil erosion occurs on public land in Otto Draw due to a very steep, poorly located and difficult to maintain road accessing the Aspen Creek oil field.

STANDARD #2: *Riparian and wetland vegetation has structural, age, and species diversity characteristic of the stage of channel succession 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.*

Resource conditions in the allotment meet the standard? yes

Rationale:

Riparian areas on relatively small public land segments range from functioning at risk to proper functioning condition. The main factors contributing to the functioning at risk designation are vegetative composition and sedimentation from the Otto draw road. These riparian areas could be improved. Overall, however the allotment is considered to be meeting standards at this time because most riparian areas on public lands are meeting the standard.

STANDARD #3: *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.*

Resource conditions in the allotment meet the standard? no

Rationale: The public lands in Beef Pasture and Thompson Draw have plant composition, vegetative cover, production, and diversity that is appropriate for the area. In some areas of the Upper Grass Creek pastures the vigor and productivity of perennial bunchgrasses and aspen is below potential for the site. Examples of such areas include public lands in section 23 and 26 of the Raspberry Draw area and section 10 and 15 of the Otto Draw area. Also, an increase in canopy cover of woody

upland species is reducing the overall forage base for livestock and wildlife which depend on herbaceous vegetation. In addition to the declining forage base the increase of tap rooted woody plants is leading to reduction in habitat quality and a decline in herbaceous ground cover which protects the watershed.

STANDARD #4: *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.*

Resource conditions in the allotment meet the standard? yes

Rationale: The allotment has winter and yearlong habitat elk and mule deer. As described in #3 above the diversity and production of some areas in the western portion of the allotment could be improved. Overall, however, species diversity, production and cover is adequate to maintain the habitat. There are no known threatened species, endangered species, candidate species, species of special concern or sensitive species present on the allotment. Prescribed burning of about 2000 acres has increased the production of buchgrasses and increased the structural diversity of sagebrush habitats on the eastern two thirds of the allotment.

STANDARD #5: *Water quality meets State standards.*

Resource conditions in the allotment meet the standard? yes

Rationale: Overall, field observations indicate water quality is acceptable. The Creek in Otto Draw may have excessive sediment loads at times.

STANDARD #6: *Air quality meets State standards.*

Resource conditions in the allotment meet the standard? yes

Rationale: It does not appear that anything on the allotment is contributing to a decline in air quality.

Part 2 - Factors Related to Non-Conformance with Standards:

STANDARD #1 - The primary factor is the design and maintenance of the Otto Draw road. Livestock grazing management is not a contributing factor.

STANDARD #3: - The increase in woody species is due primarily to a combination of fire suppression and historical livestock grazing practices beginning in the late 1800's.

Part 3 - Selected Guidelines to Implement Change in Grazing Management:

STANDARD #1 - No change in grazing management is recommended. BLM should construct water bars and redesign the road as necessary to eliminate erosion and sedimentation problems associated with the road.

STANDARD #3:

The LU Ranch has implemented a grazing rotation plan and a prescribed fire program. These actions have improved, and continue to improve, resource conditions in the allotment. The program is described in detail in the LU allotment management plan on file in the Worland Field Office.

Part 4 - Identification of Specific Actions Including Permit/Lease Terms and Conditions:

Continue existing management under the LU Ranch AMP.

REVIEWED BY:

Tim Stephens — 10-28-98 Date

[illegible] — 10-28-98 Date

[illegible] — 10-28-98 Date

[illegible], AFM — 10/28/98 Date

_____ Date

_____ Date