U.S. Sheep Station Experiment Station Grazing and Associated Activities Project

Hydrology Report

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for:
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Introduction

The Agricultural Research Service (ARS) proposes to continue ongoing sheep grazing, research and associated activities that have been historically occurring for the last 86 years, at the United States Sheep Experiment Station (USSES). The USSES conducts research to develop integrated methods for increasing production efficiency of sheep and to improve sustainability of rangeland ecosystems (USDA ARS 2009). Currently, the Agriculture Research Station grazes 3000 mature sheep on their land base.

This report will discuss the effects on hydrology and soils of continuing operations of the USDA Dubois Sheep Agricultural Research Station (ARS). The purpose of the analysis is to ascertain whether continued operations would lead to degradation of resources beyond current conditions, and if the current conditions are in violation of appropriate laws and regulations. Field work was performed during June and July 2008 and June and August 2009 to evaluate the current conditions on the ground.

The project area is the collective land of the ARS, collectively 47,340 acres. Lower elevations properties include the Headquarters property, Humphrey Ranch and Henninger Ranch, which total 30,125 acres. In addition, the property includes the East and West Summer Ranges, which total 17,215 acres (Smith 2009). The East and West Summer Ranges are located in the Centennial Mountains, approximately 25 miles due west of Yellowstone National Park (Figure 1).

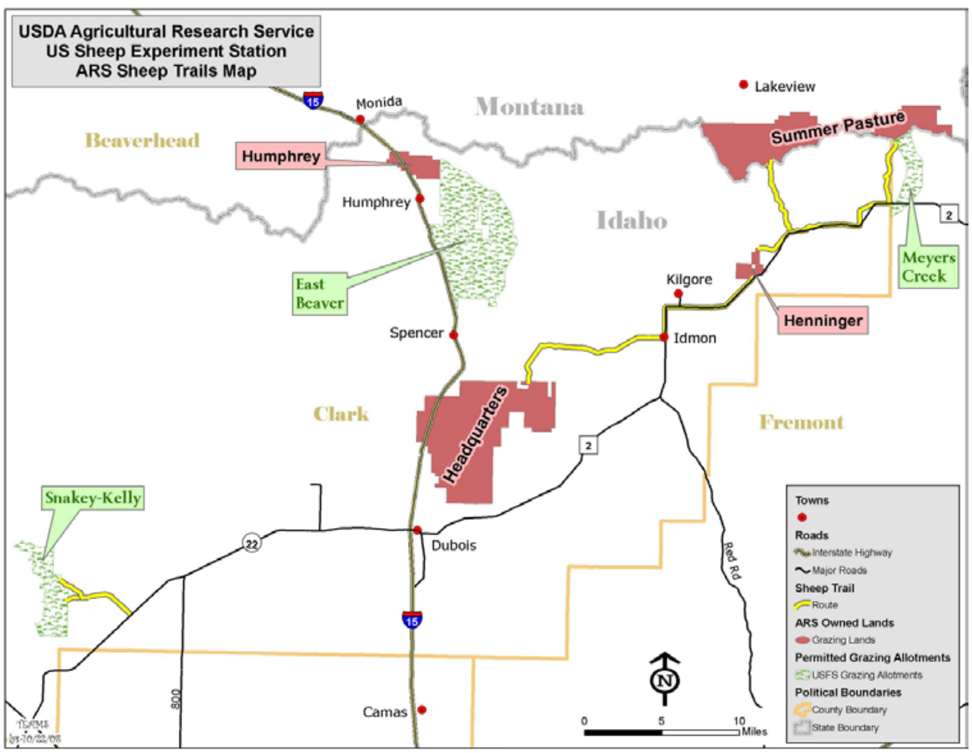


Figure 1. Location of ARS Headquarters and associated properties

Resource Indicators of Effect

Concerns relevant to hydrologic resources were summarized in the 2009 scoping comments table (USDA Forest Service 2009). Identified hydrology-related points of analysis are:

- Impacts on water quality

- Impacts on aquatic resources
- Mitigation measures to reduce the impacts of sheep driveways on water quality and erosion, including bridges, re-routes and closing sensitive sites to sheep
- Potential overgrazing in the North Fork of Toms Creek and associated erosion and potential impacts downstream due to sedimentation

Measurement Indicators

Since the alternatives vary in the pastures that would be grazed and in the number of sheep grazed, measurement indicators were developed to help compare and contrast potential impacts to hydrologically related resources and watershed health. These measurement indicators were chosen as they reflect potential amounts of use within a watershed and the potential for generating areas of disturbance and potential sediment sources. Changes in a measurement indicator would have potential for affecting change in hydrologically related resources.

Each measurement indicator was determined for each alternative and summarized by pasture and 6^{th} level watershed. Measurement indicators for this analysis are:

- Total miles of trail
- Total miles of trail within 300 ft of streams
- Total miles of driveways
- Total miles of driveways within 300ft of streams
- Percent change in number of acres grazed
- Total number of sheep to be grazed

Methodology

During the summer of 2008, field work was done to develop a general impression of existing conditions on ARS Sheep Station properties. Surface conditions were evaluated using soil indicators from the Forest Service Region 4 Soil Management Handbook 25019.18 Chapter 2 (Soil Quality Monitoring) (USDA 2003). Periodic observations were made of ground cover, surface condition and geology. Soil indictors, as defined in the R4 soil quality monitoring protocol were used to help develop interpretations of surface conditions (USDA 2003). A classification of soil condition and cover with ratings 1 through 4 was devised to catalogue observations. These classifications were quantified to portray general conditions and spatial trends. Condition class 1 indicated ground that has severe soil disturbance and in a hydrologically impaired state. Soil conditions follow Forest Service (2003) indications for long term impairments to soil productivity with sparse ground cover, evidence of severe compaction (surface ponding), displacement, or erosion (rills, soil pedestals). Condition class 2 would be ground that also had evidence of soil disturbance with marginal hydrologic functionality, and little or no sign of recent sheet wash, surface erosion. Soil ground cover and understory vegetation are adequate to resist erosion. Condition class 3 indicates conditions with one-time impairment, but recovery to full hydrologic function. Class 4 has minimal sign of impairment with complete soil and hydrologic function.

Where applicable, Proper Functioning Condition (PFC) surveys were conducted to define and document stream channel stability and trend (USDOI 1998).

Additional field work was done in June and August of 2009 to gather supplementary field data. Figure 2 summarizes the location of data points collected 2008 and 2009 respectively. Points were collected using a GPS.

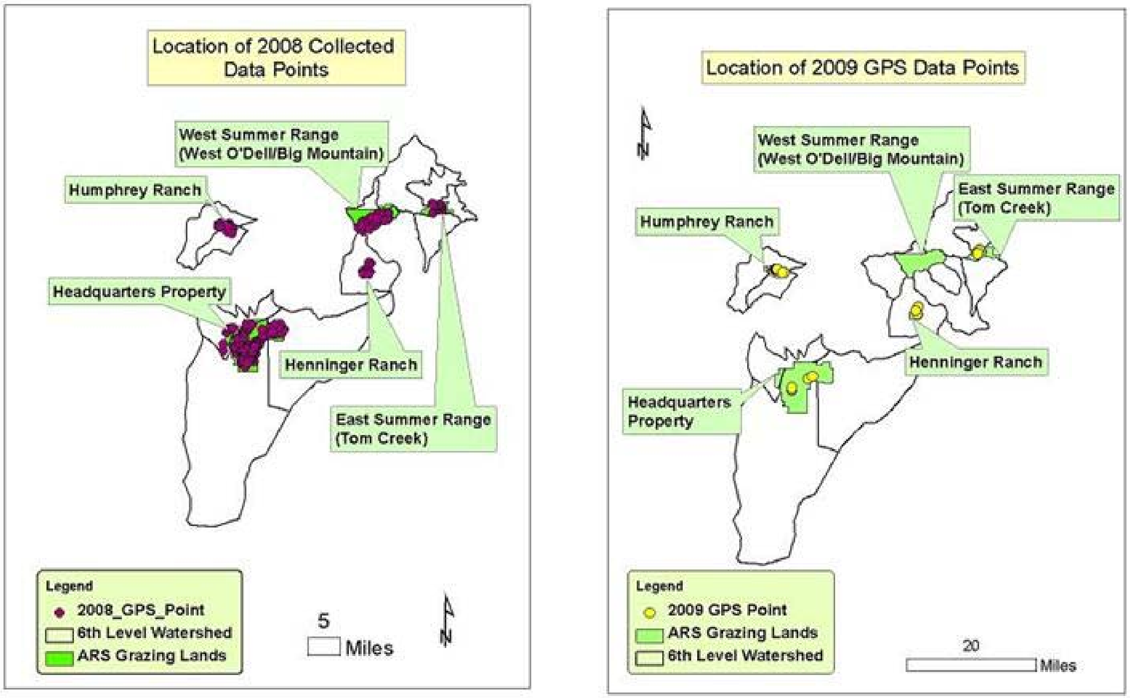


Figure 2. Locations of 2008 (left) and 2009(right) data points

Affected Environment

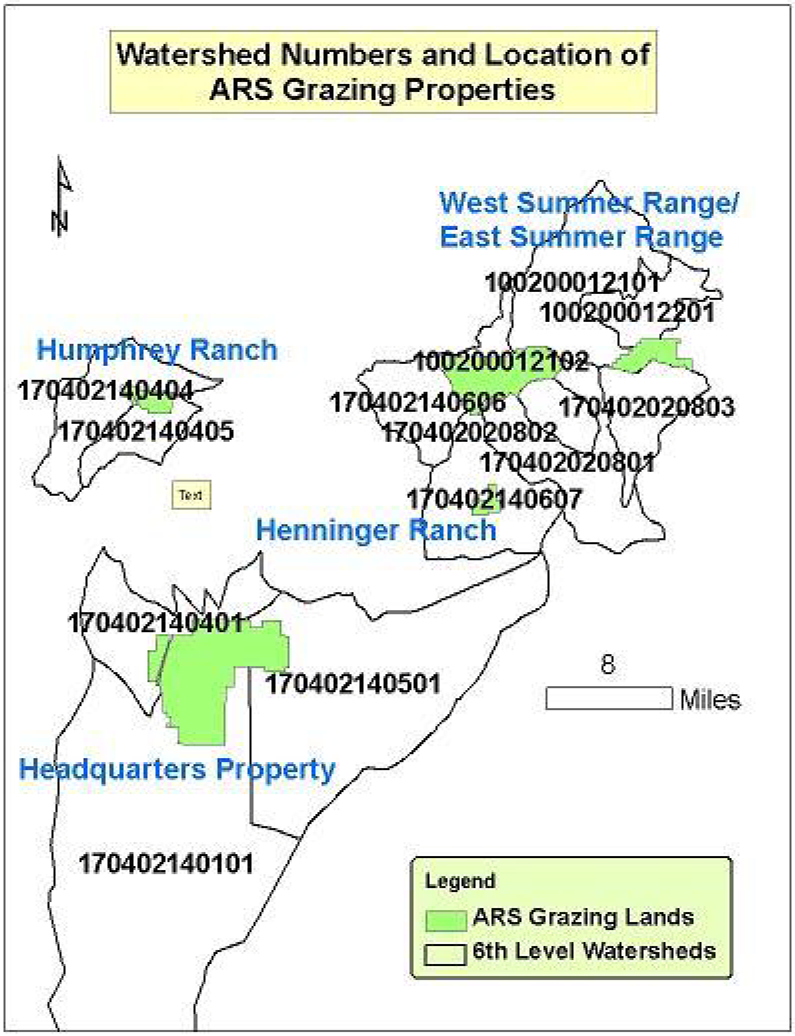


Figure 3. Locations of watersheds involved with ARS grazing lands

Existing Conditions

Climate

Idaho is influenced by Pacific Ocean maritime air borne on the prevailing westerly winds. An exception would be moist air moving from the Gulf of Mexico during the summer months, the situation prevalent in Eastern Idaho and producing the greatest rainfall (Western Regional Climate Center 2008). Maximum monthly precipitation in the region of the ARS allotments for the period of record at area weather stations (Table 1) is usually in June. The spring and summer months of April through September produces more than 50 percent of annual precipitation.

Differences between stations in annual precipitation rate are largely a matter of elevation. Average annual precipitation for the lower ARS allotments (two stations near Dubois, Henninger and Humphrey), range from 12 inches at the Dubois station (NCDC COOP #102707) to 21 inches at Kilgore (NCDC COOP #104908) which is near the Henninger allotment (National Climate Data Center 2008). There are no stations near the higher elevation summer allotments or comparable stations nearby, so estimates for those allotments are determined for this report from isohyetal contours from a precipitation atlas. Total annual precipitation in the summer allotments (Toms Creek, Odell and Big Mountain) in the Centennial Mountains is between 30 and 40 inches per year (USDA-NRCS 2008).

Rainfall intensity rates are relatively low, more similar to coastal than more inland continental, and also quite similar across elevation ranges. High frequency storms, such as the 2-year 6-hour storm, have rainfall intensities between 0.7 and 0.9 inches per hour, and low frequency, 10-year, 6-hour storms, between 1.1 and 1.3 inches per hour, from valley to mountain crest, respectively (NOAA 1973).

Table 1. Summary of climate data for ARS properties

Property/Weather Station	Average Annual Precipitation	Average Precipitation (April-September)	Maximum Rainfall (2 year, 6-Hour)***	Period of Record
Headquarters	11.9	7.0	0.7	1925-2007
Henninger Ranch	21.1	10.4	0.9	1960-1977
Humphrey Ranch	14.0	8.8	0.8	1949-1992
Summer Range/NA[a]	30-40[b]	N/A	0.9	N/A

a - Summer Ranges are Toms Creek, Odell and Big Mountain.
b - USDA—NRCS, National Water and Climate Center (website)
NOAA Atlas 2 Vol. V 1973

Geology

The geology present varies dramatically over ARS Sheep Station properties. Geological discussions in this report are excerpted from Moser et al. 2008, into this report as there has been no change between the interim and final versions of this report for geology.

Summer Ranges

Odell Creek, Big Mountain and Tom Creek

The summer range allotments encompass a terrain within terrain; a complex of hills and valleys between 7500 and 9500 feet interior to the upper reaches of the Centennial Mountains that is created by first by folding of marine sediments then faulting and volcanic intrusions. Slope stability, flow regime and stream pattern throughout Odell, Big Mountain and Tom Creek are controlled by orientation of faulting, and sedimentary bedding on the east side of the Odell fault.

The Odell grazing area is that portion of the ARS Sheep Station land west of Odell Creek, while Big Mountain is east of the Odell Creek and both comprise the West Summer Range (Figure 4). Within both grazing areas the prevailing pattern of northwest to southeast trending stream valleys was created by parallel series of near vertical faults (Witikind and Prostka 1980). These valleys were truncated or bisected in some cases, by an anticline fold, trending from the northeast and plunging southwest, which in turn apparently changed the direction of stream flow to the north and created the present north flowing main stem Odell Creek eventually running out into the Centennial Valley. The large Odell normal fault, somewhat parallel and just to the west of the anticline down dropped the western portion or Odell allotment, leaving the young overlying Tertiary volcanic rock, and uplifted the eastern portion (Big Mountain) until the Mesozoic siltstone, mudstone and limestone were exposed. In the bottom of the lowest stream valleys of the main stem Odell and Spring Creeks have exposed the even older Paleozoic limestone.

The eastern portion of the Odell allotment is broad, gentle slopes of east to southeast aspect, and wide hummocky valley bottoms, which are the result of very large earth flows from the western, upper portions of the ridges. The ground though mostly forested, has large lower slope openings, and relatively open valley bottoms with dense riparian willow. The rock type is Tertiary volcanic of rhyolitic to basalt series on upper ridge slopes and ridge tops over a Cretaceous sandstones that composes the lower slopes. The general orientation of the sandstone bedding is north to south strike dip of 20 degrees to the east.

The massive landslips on the eastern aspect of the allotment are typical of down slope bedding dip in moist temperate climate. The obvious existence of a contact plane between the volcanic above and sandstone below on the mid slope area, in addition to the down slope dip of bedding are reasonable inferences in themselves as the cause of the slumps. Water movement along the contact plane, and parallel to the surface slope creates a failure plane for soil and weathered rock material above.

The bedding orientation of the Big Mountain sedimentary rock east of the Odell fault is a northwest to southeast strike and southwest dip of between 10 and 24 degrees or roughly parallel to the surface slope. The southwest slopes throughout the allotment, including Sheep Mountain, are also characterized by massive slump topography similar to the Odell allotment in cause.

Concommitantly, the northeast aspect of the ridges are moderately steep (40 percent gradient ±), or very steep outcrop bluffs, as is the case with Sheep Mountain.

A series of parallel faults with the same trend as the Odell fault and partially mapped are aligned with tributaries to Spring Creek, including the only perennial source of surface flow in the Spring Creek drainage. The main stem Spring Creek is perpendicular to the faulting and is intermittent.

The eastern half of Tom Creek allotment is mapped as a dark, pyroxene bearing trachyte, a volcanic rock that may be locally a trachyandesite or trachybasalt (Witikind 1976). Underneath the trachyte and exposed on the hilltop bedding area (Points J and K, Figure 4) is exposed Shedhorn Sandstone. The western half is mostly the Madison Group, a light gray cliff forming limestone. The western slopes are steep, with moderate bluffs. At the crest of the hill with bedding area (point Q, Figure 4) is an exposure of the stratigraphically lower Amsden Formations. Along the upper portion, and exposed on the hill top are red siltstone/shales and a limestone pebble conglomerate.

The contact between the Madison and the trachyte may be a fault line, similar to other southwest to northeast trending faults in the Odell and Big Mountain allotments. The alignment of the upper portion of Corral Creek is along this contact. The general orientation of the Madison bedding is striking north and south with a dip to the east of around 20 to 25 degrees. Similarly to the discussion above with Big Mountain allotment, this bedding orientation sets up prominent large slump topography on the eastern aspect of the ridges west of Corral Creek, and steep, bluff outcrops on the west aspect. This scenario is complicated somewhat by an anticline fold trending from the northwest and plunging to the southeast in the northwest corner of the allotment. The plunging southeast nose of the fold, also however creates a down slope dip of bedding and promotes terrain slumping.

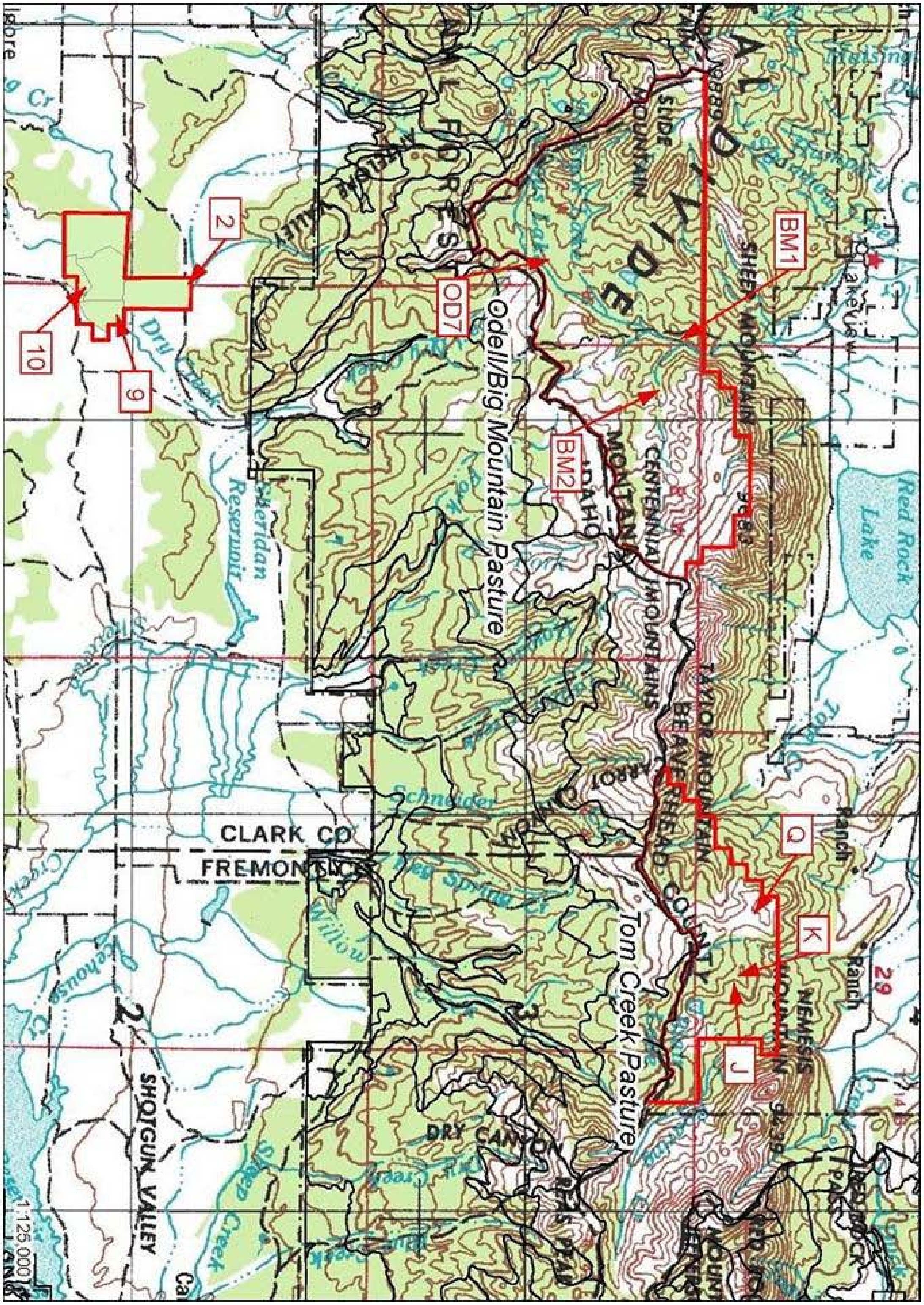


Figure 4. Overview of ARS summer grazing properties

Winter Ranges

Headquarters and Henninger Properties

The large expanse of the experiment station around the headquarters is entirely within Pleistocene flood basalts, lying more or less level, within the Snake River plain province (Link 2008). The terrain is marked by low; broad ridges particularly where the edge of one flow has overlapped a previous one. Lower and more subtle pressure ridges form the upper crust of a flow. Pressure ridges are often a few hundred feet long, but only project upward a few feet with broad crests. One stream may be within the margin of a collapsed lava tube, on the western slope of a volcanic crater, with a thin stringer of aspen.

Henninger is quite similar to the Headquarters property in that the exposed rock is Pleistocene basalt lava flow. Topography within the basalt flow is created by subtle pressure ridges and sharper ridges of flow edges. The topographic lows, shallow valleys with incised stream channels are Quaternary alluvial fill.

Humphrey Ranch

The Humphrey Ranch is mapped within Quaternary fluveolian deposits of the Snake River Group; Pliocene and Pleistocene gravels of lake and stream deposits (Link 2008). Terrain is broad rounded hills composed of alternating beds of weakly cemented sandstone and shale, with the top often composed of unconsolidated alluvial gravels. Valleys are narrow and flat bottom with loamy fine grain surface layers.

Shallow slips on the order of a few tens of feet across and one to two feet deep are consistent in the upper slopes with west aspect. Slumps appear confined to the top 1 to 2 feet of the soil column that has a high content of rounded cobble above weakly cemented (calcareous) sand and silt mixture. Material displaced usually deposits in small fan on lower slopes or at the base of a hill. Slumps scarps are frequently seasonally moist ground or seeps. Swale drainage features on hill slopes are likely very old slump areas that have reached a stable angle.

Figure 5. Views of typical alluvial flats underlain by basalt, Headquarters Property

Watershed Characteristics and Conditions

In general alluvial flats found on lower basin floors are dominated by sagebrush and underlying basalt flows. Areas underlain by basalt flows lack defined drainages due to the basalts high permeability and porosity. Adjacent lower elevation flatlands are very well drained and have moderate grassland productivity (Figure 5). Road densities by 6th level watershed are summarized in Table 2. These are all the watersheds involved in the Proposed Action. Table 3 summarizes the miles of road within 300 feet of streams on the Headquarters property. There also is an existing 2.7 miles of fire break around the Headquarters area. The firebreak is roughly 20 feet wide and is comprised of mineral soil. The total area of the firebreak is 6.5 miles. No streams, springs or wetlands are adjacent to the firebreak.

Table 2. Summary of road densities in all watersheds involved in the proposed action

Watershed	Road Density	Watershed	Road Density
100200012101	0.3	170402140603	1.4
100200012102	0.2	170402140604	1.7
100200012201	0.7	170402140606	0.8
100200012202	0.2	170402140607	1.7
170402020801	1.3	170402150104	1.6
170402020803	1.3	170402150301	3.3
170402140101	2.3	170402150401	1.4
170402140401	1.8	170402150402	0.6
170402140404	0.7	170402160101	0.1
170402140405	1.2	170402160601	1.1
170402140406	1.3	170402170101	0.8
170402140407	2.4	170402170301	0.2
170402140408	1.5	170402170302	0.2
170402140501	2.5	170402171101	0.2

Table 3. Summary of road miles within 300 feet of streams

Headquarters Area	
Road Surface Type	**Miles of Road**
Native Surface	5.4
Gravel	3.0
Paved	0.2

The summer ranges have complex stream networks that dissect the rolling ridges of the Centennial Mountains, and are characterized by relatively high productivity with intermixed grass-forb lands, sagebrush and conifers

The 6^{TH} level watersheds, and associated grazing properties and allotments, are summarized below in Table 4.

Table 4. Summary of 6^{th} level watersheds and associated properties and grazing allotments

Grazing Property/Allotment	6^{th} Level Watershed	Number of Acres	Grazing Property/Allotment	6^{th} Level Watershed	Number of Acres
East Beaver Creek (USFS)	170402140404	10.9	DOE Feedlot	170402150102	33.8
	170402140405	1840.5		170402150104	732.6
	170402140406	7638.7	Headquarters	170402140101	17472.4
	170402140407	9945.2		170402140401	5345.2
	170402140408	1041.0		170402140501	4555.4
	170402140603	309.8	Humphrey	170402140404	868.8
Meyers Creek (USFS)	100200012101	24.4		170402140405	1551.0
	170402020803	3479.0	Toms Creek	100200012101	1583.7
Snakey-Kelly	170402160601	1020.6		100200012201	657.5
	170402150401	4798.5		100200012202	1573.1
Bernice (BLM)	170402160101	265.6		170402020803	166.6
	170402170101	3914.0	West Odell big Mtn	170402140606	77.2
	170402170301	328.9		170402140607	10.7
	170402170302	450.8			
	170402171101	17221.7			

Table 5 Summary of observed surface conditions by ARS property and grazing area

Property/Grazing Area	Watersheds where GPS points were taken	Number of points taken	Range of surface conditions	Range of percent total cover/ average
Big Mountain	100200012102 170402020802	3	2-4	0-80/43
Odell	100200012102	12	2-4	0-100/64
Toms Creek	100200012101 100200012201 10200012202	9	1-4	0-95/64
Humphrey	170402140404 170402140405	23	1-4	25-100/89
Henninger	170402140607	10	2-3	0-95/75.5
Headquarters	170402140101 170402140501	128	1-4	0-100/73.4
DOE Feedlot	No Data Taken-Industrial Area			

Sheep bedding areas are found in all the grazing areas used by the Sheep Station. Traditional bed-grounds are defined only for the West Odell and Big Mountain grazing areas. However, each defined bed is not used annually. The total area used is less than one percent for Big Mountain and Odell grazing areas in Table 5.

Beds have not been mapped with GPS for the other ARS Sheep Station grazing properties. Herders though try to use different sites every night, which minimizes compaction, trampling and loss of vegetative cover. A study by Moffet 2009, studied the hydrologic effects of sheep beds on subalpine ranges. It was determined runoff and erosion is more likely on bed grounds after use, but only under extreme rainfall conditions. In the area, a 100-year 6-hour precipitation event is around 1.9 inches per hour; however to ensure runoff generation the study simulated rainfall at 6.2 inches per hour to ensure runoff generation. For a 30 minute rainfall event at 6.2 inches per hour, the study found erosion increased approximately ten times. Field observations made in 2008 and 2009 at various bedding areas noted no rilling, gully development or upland-associated sediment transport with these bed areas. As a result, it was determined these areas do not impact watershed condition and are not functioning as sources of erosion and sediment transport.

Big Mountain (West Summer Range)

Watershed condition generally appeared consistent throughout this Grazing Area, based on the ride through in 2008. Three data points were taken as the area was very consistent in appearance. Uplands were generally well vegetated with little evidence of surface runoff or erosion (Figure 6). No evidence of desertification was observed in the field. Desertification occurs when the amount of dry-land biological productivity is reduced. There are several reasons why desertification occurs, and grazing can be one of them, or there can be several factors causing this to occur (http://www.britannica.com/EBchedked/topic/159114/desertification).

The average of 43 percent cover is low as only three points were taken. One point had a total cover value of zero as it was taken on the road. The other two values were 80 and 50 percent cover, which are much more representative of watershed conditions in the allotment (Table 5). Three Proper Functioning Condition (PFC) surveys were conducted within this grazing area. Two locations received a rating of PFC and one location received a rating of Functional-at-Risk (FAR). Please refer to the “Channel and Floodplain Conditions” section in this report.

Figure 6. Views of uplands, Big Mountain Grazing Area (western summer range)

Bare soils were primarily associated with steep southwest facing ridges and were largely due to active slip faces, which are a function of the underlying Cretaceous siltstone and sandstone geology (Figure 7). These slumps start with a convex shape, and then evolve into a convex shape, where they appear to stabilize and re-vegetate. No evidence such as trailing, trampling or bed grounds was noted in association with these slumps. As a result, these areas of disturbance are considered to be “natural” and not related to grazing activities. Bare ground was also noted in association with bed grounds (Figure 8).

However, these areas were very limited spatially in there extent. The main bedding area observed had a surface condition rating of two, with soil hydrology and nutrient cycling rated as fair.

Figure 7. Views of slumps originating in Cretaceous sediments, view to the north

There are 2.5 miles of driveway within the West Summer Range. None of the portions of driveway in the Big Mountain grazing area were found to be sources of sediment.

Figure 8. Edge of bedground, Big Mountain Grazing Area, view to northwest

An old road leading to the J.R.Simplot mine is located in the bottom of the Spring Creek drainage. The road is confining the drainage in places, leading to increased downcutting and increased channel confinement. Erosion of the road prism was observed in several places. However, the road surface is generally well vegetated, which acts a sediment filter.

Very little evidence of surface runoff and erosion, related to the road surface was noted (Figure 9). Road reclamation activities, such as culvert removal, were conducted in 1997 (USDA ARS 2009).

Figure 9. Revegetated roadbed leading to closed phosphate mine, bottom of Spring Creek drainage

Figure 10. View of uplands near J.R. Simplot Phosphate Mine, note small drainage in middle ground of photograph

Field work was also done at and near the mine site to assess existing upland watershed conditions (Fryxell 2008). Snow patches were present and melting at the time of the visit, resulting in bare patches of ground, but green vegetation shoots were noted, indicating vegetative growth was slow in the areas, due to melting snow. Ground cover appeared to be consistent in distribution and percentage over the area, ranging from 65-80 percent cover; however in the area of the mine itself ground cover minimal ground cover was much less (estimated down to 25-30 percent). Rock fragments were abundant on the ground surface at this location and formed a type of ground cover, likely reducing soil erosion (Figure 10). At the mine site proper no active areas of erosion were noted, except at where a small drainage exists from the settling pond. Some relatively minor channel widening and downcutting has occurred for a small distance downstream. Down below the mine a small drainage runs roughly east/west, which some very minor amounts of bank trampling. However, large elk herds are known to frequent the area, which are thought to be the cause of this as water is provided for the sheep as this stream is intermittent (Figure 11). The mine road was also viewed from near this location and appeared to be consistently well vegetated and not a source of surface runoff or accelerated erosion (Figure 12).

Figure 11. View of vegetation growth adjacent to water trough

All total there are five water developments within this grazing area. Springs have been developed with permanent troughs, to provide water for ewes and lambs in low-flow areas. In addition, wildlife is known to use these water developments. Four troughs are metal and one is rubber. These troughs cover an estimated 133.3 to 180 square feet per trough. It is estimated that there is ¼ acre, or less of disturbance per trough (Smith and Yurczyk 2008). Based on this estimate the maximum area of disturbance associated is 1.25 acres.

Several developed water sources were inspected during the 2008 field seasons. All appeared to be sprouting health vegetation covers.

This portion of the grazing area was rested in 2007, and shows vegetative recovery similar to that around the water developments, indicating that detrimental compaction and degradation of soil hydrology has not occurred to the extent that it impairs vegetative growth (Figure 11).

Water rights for these developments have been claimed and adjudicated. Efforts are in progress to secure signature on these water rights (Yurczyk 2009b).

Numerous slumps were noted in Cretaceous siltstones and sandstones, as found elsewhere on ARS Sheep Station properties. A large tension crack was noted in the top of one ridge, which like formed due to earth flow, in the Cretaceous sediments.

Figure 12. View of revegetated mine road, near J.R. Simplot Phosphate Mine

Odell (West Summer Range)

Watershed conditions appeared to be good and consistent within the Odell Grazing Area. No evidence of desertification was observed in the field. Twelve GPS points were taken throughout the Grazing Area. Although soil surface conditions varied from a “2” to a “4”, the average was 3.6 indicating fully hydrologic function and almost minimal signs of impairment (Table 5). For the points taken the average total cover approached 64 percent and appeared to be consistent throughout the Grazing Area (Figure 13). No evidence of rilling and gully, or other signs of surface overland flow were noted on uplands. Six PFC surveys were conducted and all received ratings of PFC. Please refer to the “Channel and Floodplain Conditions” section later in this report for additional detail.

Figure 13. West Odell Grazing Area (West Summer Range) looking to the northeast

Slumping and earth flows, again related to the Cretaceous geology, were noted. As in the Big Mountain Grazing Area, grazing activities were not observed to have initiated or enhanced the movement of these features.

The West Summer Range contains 2.5 miles of driveways. Within the Odell grazing area four stream crossings, associated with these driveways, were evaluated (Figure 14). These points are marked as OD 4, OD 5, 0D 7 and 0D8.

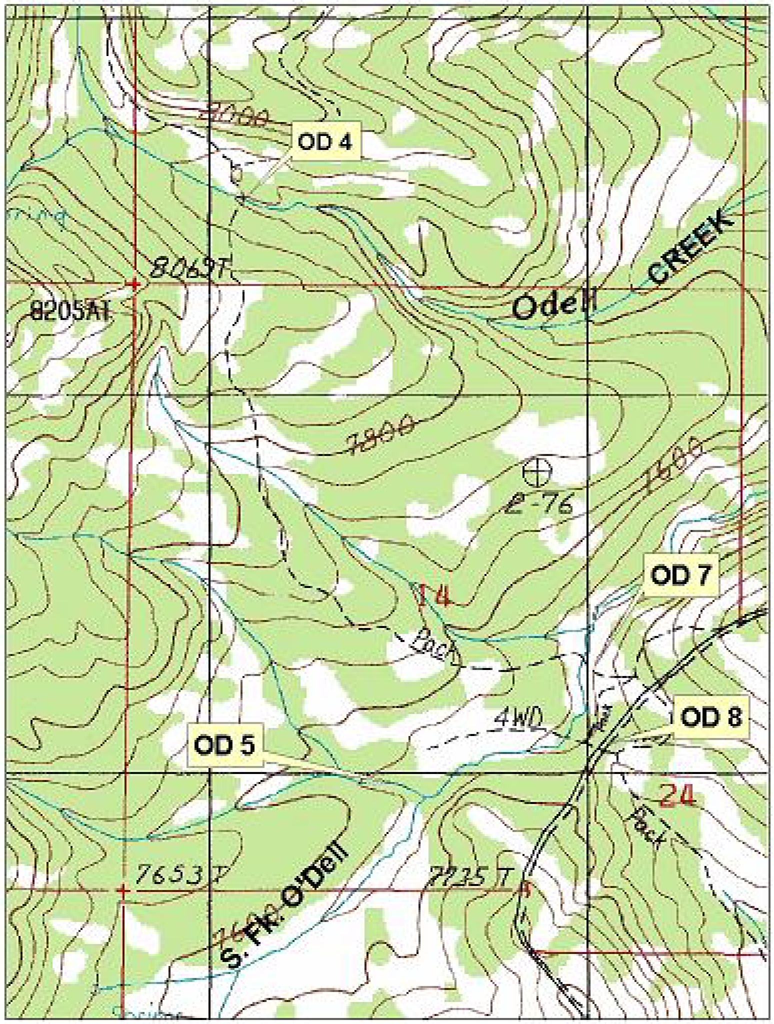


Figure 14. Locations of field observation points OD 4, OD5, OD 7 and OD 89

At all four crossings streams were observed to be in proper functioning condition. No evidence was observed indicating that stream morphology has been impacted, in any significant way, up or downstream of the crossings. There were no overt indications or evidence of excessive sediment within the associated channels. In addition there was no indication of heavy or unusual browsing on associated riparian vegetation. OD 4 is located in SW ¼, Section 11 T15S R2W, and is the major crossing of the four within the Odell grazing area. A secondary crossing lies nearby to the west. At the main crossing bare ground was associated with this driveway and was estimated to be 15 ft wide and 51 ft long on the north side of the Creek, and roughly an estimated 79 ft long and 25 ft wide on the south side of the drainage (Figure 15).

Although soil stability and hydrology and nutrient cycling were rated as impaired in this area, active erosion features were noted only on the far side of the crossing. Rilling and incipient gullying were noted and were adjacent to, and perpendicular to the stream crossing. Minor bank hardening was also noted. Although some extra sediment was being derived from this driveway, no detrimental bimodal distribution of sediment was observed in the streambed.

As a result, it did not appear that sediment contributions are exceeding natural sediment loads being carried by this stream. In addition, bank degradation was confined to where the driveway crosses Odell Creek.

At the secondary crossing the trail is becoming trench-like and confined.

The other three crossings are located to the southeast of OD 4, in the SE ¼ of Section 14, T15S, and R2W. Each of these three sites involves the South Fork of Odell Creek. Disturbance at these three crossings were confined to the crossings proper and vegetation immediately adjacent was in good condition.

Figure 15. Sheep driveway crossing at Odell Creek, upstream to readers right

At OD5 the entry into the stream crossing is an estimated five feet wide with the exit onto a steeper sloped, which is largely bare of vegetation, and somewhat compacted. There were no well developed rills or gullies leading down to the Creek (Figure 16, Figure 17). Substrate in the stream bottom appeared to not be dominated by fines, with sub-angular siltstones to cobbles predominating. There did not appear to be a bi-modal sediment distribution.

Figure 16. Entry to sheep driveway, OD 5

Figure 17. Close up of exit of sheep driveway, OD 5

At OD 7minor bank degradation was present at the two stream crossing areas, with one of the crossing exhibiting revegetation. Minor sediment contributions to the stream are derived from these trampled areas. However, there were no rills or gullies observed and there was no observable bimodal sediment distribution of stream substrate, which would indicate an unusually high percentage of fines for this mountain stream. Adjacent uplands were in good health with a well distributed groundcover of broadleaf forbs and grasses (Figure 18). The driveway crossing at OD 8 was in good shape and had not been recently used and no rilling or gullies on adjacent uplands were noted. Photographs were not taken at this site.

Figure 18. Driveway crossing at OD 7

There are no water developments in this grazing area.

Toms Creek

Toms Creek grazing area comprises the East Summer Range (Figure 19). During the summer of 2008 this grazing area was reviewed for existing conditions.

Figure 19. Views of uplands in Toms Creek Grazing Area

PFC surveys were conducted at three locations; all received ratings of PFC. Please refer to the “Channel and Floodplain Conditions” section later in this report for additional detail.

Observed surface conditions ranged between condition classes 1 and 4. No evidence of desertification was observed in the field. The range of total percent cover varied from 0-95, with an average cover of 64 percent. Nine total GPS points were taken. Uplands were remarkably consistent in vegetative cover. No sources of upland erosion, consisting of rills and gullies were noted. Surface condition class is estimated to between condition class 3 and 4 for the grazing area except for the road to for the observed bedding areas and the road to Blair Lake. Some evidence of overland flow was noted in association with melting snow fields and was confined to within 50 feet of these areas, and no erosional features were noted in association with the melt water. Earth-flows and slumps were occasionally present and are associated with unstable stratigraphic layers.

Figure 20. Vegetation and recovery of trailing, east portion, North Fork Toms Creek (Bighorn Dolomite Area)

Figure 21. Views of intermittent drainage, North Fork Toms Creek, Park Shale Area

One area of uplands was of special interest, which is located at the head of the North Fork of Toms Creek, which has been an area of past debate (Figure 22). This area burned by a forest fire sometime between 1880 and 1930. Burned trees still stand and charcoal is still found in upper portions of the soil horizon. Slopes tend to be steep (over 10 percent) with poor site productivity (Jacobson 2009a). Past debate has been regarding supposed over-grazing practices by the Sheep Station. This area was reviewed with Sheep Station, Soil Conservation Service personnel and University of Idaho staff to review upland conditions. Sheep Station notes on the meeting state: “Soil Conservation personnel believe grazing abuse by the Sheep Station had not occurred, that the site was as good as could be expected, that no current erosion was occurring, and the overall trend was up” (Jacobson 2009a).

Figure 22. View looking west to area underlain by Park Shale, west half of North Fork of Toms Creek

In 2009 field work was conducted to again assess this area (Fryxell 2009). The eastern portion of this headwater supports a consistent vegetative cover, which is being re-established after grazing by both historical and Sheep Station grazing. Relict trailing was noted, but trails are re-vegetating throughout this portion of the headwaters (Fryxell 2009, Figure 20). This area is designated as Unit 8 Toms Creek grazing area (Eastern Summer Range) and has had only incidental grazing since 1994 (Jacobson 2009, Moffet 2009). The 2009 field inspection revealed no evidence of rilling or gullies was noted but evidence of naturally occurring soil creep was, as indicated by trees and snags leaning into the hillslope. Soils are stony and provide a notable measure of cover. This portion of the headwaters is underlain by the Cambrian Bighorn Dolomite.

To the south an abrupt and dramatic change in vegetative cover was observed, as vegetation becomes largely absent on the uppermost and steepest portions of the western half of these headwaters (Figure 21). On the lower portions of this area, where slope gradients are shallow vegetative cover becomes consistent and lush. Trees are sporadic in both the northern and southern portions of these headwaters due to poor site productivity. This area is underlain by the Cambrian Park Shale, which overlies the Bighorn Dolomite (Moffet 2009, Fryxell 2009, Witkind 1976). Even though cover is largely lacking there was no observed evidence of overland surface flow, rills, gullies or mass movement. To the north and west additional trailing was noticed, but as mentioned above these areas are now green due to revegetation. The North Fork of Toms Creek appears to be ephemeral to intermittent. Channel definition increased in a downstream direction, reflecting increased flow volumes. The channel was classified as a Rosgen A3, characterized as a steep, entrenched, cascading, step pool stream, in proper functioning condition. Uplands were not observed to be eroding or contributing excessive amounts of sediment (Fryxell 2009).

Figure 23. Road ruts on road to Blair Lake

Figure 24. Road and erosion, lower portion of road to Blair Lake

Several bedding areas were noted. In these areas vegetative cover was reduced and soil disturbance increased. However, these areas were estimated not to exceed 0.5 acre and were not observed to upland sources of sediment or erosion (Moser and Fryxell 2008).

PFCs were performed on drainages within this grazing area. Four steams were deemed to be in proper functioning condition. This includes one stream crossed by a sheep driveway. After crossing the stream some compaction was observed with minor trailing and soil displacement. The PFC for this stream was conducted immediately below the driveway crossing the stream. The fifth drainage received a Functional-at-Risk rating and will be discussed below.

The only areas receiving a surface condition class rating of 1 was the road, which starts on Forest Service-administered land, which leads towards Blair Lake. The initial portion of the road has been put to bed by the Forest Service in the summer of 2008, when it was ripped and seeded. From the ARS/Forest boundary to near Blair Lake, various degrees of rilling, rutting, and gully development were observed (Figure 23). Near the ARS/Forest Service boundary minimal slash is in place but has not been effective in diverting water from the road. Erosion and gully development are the most severe near the end of the road where there is a 15-20 percent grade. Ruts and gullies are one to three feet in depth. An area of at least 1,000 ft x 10 ft x 3 feet is estimated to be involved (Figure 24). Areas adjacent to the road are used to drive the sheep down to the stream, where they cross on their way to Blair Lake.

The road ends near a Rosgen A4 type stream (Rosgen 1994). The road has functioned as a long term chronic source of sediment to this channel. Based on the proximity of the road to the channel and the contributions of sediment over time, this stream received a functional at risk rating. There are no water developments in this grazing area.

Humphrey Ranch

Humphrey Ranch averaged 89 percent cover with a range of 25-100 percent (Table 5). Surface conditions ranged from condition class 1through 4. No evidence of desertification was observed in the field. A total of 23 GPS points were collected where surface condition was assessed. Only two of these points received a rating of condition class 1 and both of these points were associated with areas of natural disturbance, due to slumping in weakly cemented inter-bedded sand and siltstones underlying the Ranch. These areas typically revegetate after slumping with a grass, which stabilizes the head of the slump, and eliminates these areas as potential sources of erosion. Six PFC surveys were conducted. Five received ratings of PFC and one received a rating of Functional-at-Risk. Please refer to the “Channel and Floodplain Conditions” section later in this report for additional detail.

Figure 25. View of lowlands, Humphrey Grazing Area

For all other points condition class ratings of 3 and 4 were given. For these 21 points the average condition class rating was 3.6. Uplands tended to be well vegetated as indicated by the 89 percent cover. Lushly vegetated lowlands separate the highlands, indicating areas of increased moisture and possible subsurface flow (Figure 25).

Figure 26. Disturbance around watering pond

These low areas "flow" into a major lush lowland which has poorly defined drainage. Some trampling and holding of water within these areas was noted, but was considered very minor.

An earthen dam was formed to develop a watering pond for the sheep. Trailing from "upstream" and "downstream" directions was noted leading to this pond. This pond area is roughly rectangular in shape and covers an estimated 132 sq. feet. Bank trampling is present and has resulted in vertical bank development on the south side of the pond. Bank height was variable ranging from several inches up to 18 inches or so (Figure 26). Bare and compact ground was present immediately around the pond. The pond and associated bare and compact ground is less than an estimated half-acre. No headcutting above the pond was noted and no down cutting below was noted. Areas below the pond were noted to be especially lush and well vegetated and included equisetum or horsetail, indicative of chronically moist soils.

Two bedding area was observed within the grazing area. One area, on the shoulder of a hilltop was an estimated 50 ft by 50 ft with no vegetation. Although vegetation was absent and the surface condition was rated as condition class 2 there were no observable features indicating surface overland flow, erosion and sediment transport (Figure 27).

Figure 27. View of bedding area, Humphrey Grazing Area, view to north/northwest

The second bedding area was noted immediately adjacent to the perennial stream found in the northeastern-most quarter of the grazing area, which is used for watering the sheep. Evidence of use includes bank trampling, some vertical bank development less than ten inches high, trampling in areas next to the stream and some accumulation of fines in areas where water velocity would be less during higher flow. Some channel over-widening was also observed as were small vegetated islands (Figure 28). Despite these indicators of use during watering riparian vegetation was well developed with a variety of age classes, and some hedging due to browsing was noted (Figure 29). Equisetum and iris were also noted. There was no evidence of channel dewatering. Upstream from this area the amount of use varied and channel width decreased.

Figure 28. Perennial stream, Humphrey Grazing Area

Figure 29. Riparian vegetation, perennial stream, Humphrey Grazing Area

Downstream from the area of use channel width also decreased and the absence of excessive fines was observed. Bank incision also decreased both up and downstream from the area of use. The channel was observed to be in proper functioning condition below and above the area of use.

Figure 30. Beaver Creek, Humphrey Grazing Area

The second perennial drainage in this grazing area is located on Beaver Creek, which is in the far western portion of the area. Beaver Creek, where it crosses the road, is a Rosgen E3/E4 channel type, roughly five feet wide, with an anastomosing channel pattern (Figure 30). These channels are defined as low gradient and meandering, characterized by little deposition, and typically found in the bottom of broad low gradient valleys with fine alluvium or lacustrine soils. The banks were stable and well vegetated and show recovery from past over-widening (Rosgen 1994, Moser and Fryxell 2008). No evidence of degradation related to present grazing activities were noted. However, within the length of reach used for watering there was some decline in condition. This portion of the stream was rated as in the lower end of the proper functioning condition due to channel over-widening, development of “vegetated islands” due to trampling, minor vertical bank development and the presence of fines, due to livestock watering.

Flood irrigation is used to water sheep. This water is diverted from Modoc Creek, west of the Humphrey Ranch grazing area. The diversion is located on Modoc Creek, a few hundred yards upstream of the confluence with Beaver Creek and about seven miles upstream of the gage, located on Beaver Creek.

When sheep are moved out of the pasture water diversion canvas dams are removed and the diversion shut off. There are about two miles of irrigation ditch at Humphrey, which has irrigation has rights for

2,623 acre-ft from May 1 to October 31. The water used for irrigation falls under water rights # 31-46, 31-47 and 31-48. The amount appropriated for water right 31-46 is 4.0 CFS, while it is 1.6cfs for water rights 31-47 and 48. These three water rights total 7.2 cfs. Average irrigation season flow is 309 cfs for Modoc Creek and the range of average flow from May 1st through October 31st is 1..21-7.45 (Moser 2011, Table 6).

Table 6. Compilation of StreamStat data for Dry and Modoc Creeks

Watershed	Area (sq.mile)	Average Annual Peak Flow (cfs)	7-day, 2-year Low Flow (cfs)	Average Irrigation Season Flow (cfs)	Range of Average Flow 5/1-10/31
Dry Creek	36.9	141	5.6	7.89	1.77-25.5
Modoc Creek	19.1	35.4	1.62	3.09	1.21-7.45

Modoc Creek is an un-gaged stream and flow statistics were developed using StreamStat, a program which utilizes regional regression models to compute flow frequency statistics for any given drainage basin. For this report StreamStats results for median monthly, bankfull l (1.5 year frequency), and low flow (7-day, 2-year) were used. For the area of the ARS Sheep Station pastures the standard error of estimates was as follows:

- Median monthly—approximately +100 to -50 percent
- Bank full--+165 to -63 percent
- Low flow--+43 to -30 percent

The Humphrey pastures are grazed from May to October.

Some cattle grazing is also conducted on this Ranch to help control vegetation and to improve sheep range conditions. No cattle-related impacts were observed within the grazing area.

Henninger Ranch

This grazing area was bought from private owners in the 1940s. During the time of private ownership it had been a working ranch. Prior to purchase, Henning had been used for livestock production, with some cropland and hay production. Before purchase by the ARS, grazing was done at heavier rates than current Sheep Station rates (USDA ARS 2009). As a result, a small area (less than an acre) was noted to exhibit characteristics of desertification.

Surface conditions ranged from condition class 2 to condition class 3. Ten GPS points were collected and the average surface condition rating was 2.1. Total ground cover ranged from 0-95 percent with an average of 75.5 percent. The condition class rating of 2.1 was due primarily to compaction or soil loss. About one half of the data points were soil condition class 1 or 2 due to compaction or soil loss.

All of these points were on flat irrigated fields (points 2, 9 and 10, Figure 4).

Figure 31. Arrow leaf balsam root field, Henninger Ranch property

In several areas desert-like pavement, consisting of a gravelly surface, was present. These areas lacked any vegetative diversity and consisted of only arrow leaf balsam root (Figure 31). The very low gradient surfaces may lend themselves to the effects of wind erosion (Moser and Fryxell 2008). Two PFC surveys were conducted at this property on Moose and Dry Creeks. Both received ratings of Functional-at-Risk due to flow diversion and rip-rapping.

Much of the rest of the grazing area is covered by sage brush and underlain by basalts, resulting in little natural surface expression of water. The major drainage that does exist on the property is Dry Creek, which was classified as a Rosgen C4 channel type (Rosgen 1994). A PFC survey was conducted, and a rating of Functional-at-Risk (FAR) with no apparent trend assigned. The FAR rating was due to alteration of channel flows due to irrigation which includes ditching, past agricultural practices, historical rip-rapping of the channel, possible influences related to the main road leading into the property.

Irrigation practices were ongoing at the ranch prior to the property's purchase by ARS and a well developed network of irrigation ditches is still present today (Jacobson 2009a). The remains of a historical head-gate, located in the channel proper, are still present. Additional historical management of the channel is evidence by rip-rapping (Jacobson 2009a). The rip-rap has been there so long that portions of it have become entrained as part of the channel bedload and pieces are found deposited within the channels banks (Figure 32).

Figure 32. Historical rip-rapping, Dry Creek, Henninger Ranch

Figure 33. Ditching and maintenance, Henninger Ranch

Today, these ditches are used for irrigation and to flood pastures where sheep graze (Figure 33). Maintenance of these ditches is conducted annually. This activity is covered by an exemption from the requirement of a 404 permit by the Army Corps of Engineers (ACOE) as dictated by 33CFR 323.4(a) (3) (Yurczyk 2009a, http://edocket.access.gpo.gov/cfr_2006/julqtr/pdf/33cfr323.4.pdf). Section 404 of the Clean Water Act establishes programs to regulate discharge of dredged or fill material in waters of the United States, including wetlands http://www.epa.gov/owow/wetlands/pdf/reg_authority_pr.pdf).

Diversion is accomplished through the use of canvas dams. Diverted water is used for watering sheep and for providing green forage for extended periods of time in dry seasons. The numbers of days that are used each year depend on water availability and grazing needs. Diversions are removed once the sheep are moved out of pasture and shut off (Smith and Yurczyk 2008). Water rights at Henninger are Federal Reserved Right Claims (Gough 2009).

Henninger Ranch has the right to use water from May 1 to October 31 of each year. Spring water use is not allowed until the flow in Dry Creek no longer reaches Spring Creek in mid to late June. Average past ten year use is 675 CFS with a high of 1125 CFS in 1999 and a low of 474 CFS in 2000. The average use of 675 cfs translates to 3.7 cfs per day. The low of 474 cfs translates to 2.6 cfs while the high of 1125 cfs translates to 6 cfs per day. The average use of 3.7 cfs indicates that the maximum water right amount of 14.2 allotted for use on Dry Creek is not being used.

The average irrigation season flow for Dry Creek is 7.89cfs and the range of average flow for the period of May 1 through October 31 is 1.77-25.5 cfs (Table 6).

Please refer to the “Channel Conditions” section for additional information.

Some cattle grazing is also conducted on this Ranch to help control vegetation and to improve sheep range conditions. No cattle-related impacts were observed within the grazing area.

Headquarters Property

The Headquarters property is underlain by flood basalts, resulting in an uneven topography, due to multiple flow events, pressure ridges, lava tubes, “blisters” and other surficial expressions of volcanism. In addition there appears to be a pattern of regular jointing or fracturing. As a result, there is little water retention and the area is dominated by sagebrush (Figure 5, Moser et al. 2008).

A total of 128 points were taken to assess surface conditions on the Headquarters property. Surface conditions ranged from condition class 1 to condition class 4. No evidence of desertification was observed. Percent ground cover ranged from 0 to 100 percent, with an average of 73.4 percent. Approximately 10 percent of 128 data points had a soil condition class 1or 2. Half of these points were trails or roads, the remainder were small depressions that held surface water or remained moist due to clayey deposits and were trampled by livestock. Compaction and ponding of surface water were most apparent disturbance (Moser et al. 2008).

No PFC surveys were conducted on this property due to the lack of drainages sustaining surface flow.

Where water is not available on Headquarter lands, water is trucked in to troughs, which are moved as grazing progresses across the area's pastures. An estimated 80 sites are used with up to a quarter-acre of disturbance at each site, for a total of 20 acres of disturbance for the Headquarters property. This is equivalent to less than one percent of the total Headquarters area.

About 160 acres on average has been prescribed burned over the last thirty years (ARS 2008b). Prescribed burn areas are evident in the northern half or one-third of the Headquarters Property. Although these areas have undergone prescribed fire, no open areas of erosion and sediment transportation were observed.

Occasionally, cattle and horses are grazed on Headquarters' property to improve sheep range conditions. Numbers are determined on the area and amount of vegetation which needs to be removed (Smith and Yurczyk 2009). No observable effects, related to cattle and horses, on watershed condition was observed.

Hydrology

Hydrological discussions in this report are excerpted from Moser et al. 2008, into this report as there has been no change between the interim and final versions of this report for hydrology.

Stream gauge stations, operated by the U.S. Geological Survey (USGS 2008) were maintained for various periods of record on Beaver Creek near the Dubois experiment station, on Odell Creek near Lakeview Montana and Tom Creek, also near Lakeview. Beaver Creek is typical of streams in flood basalt geology and its description below is illustrative of the runoff hydrology of the lower elevation allotments of the Headquarters, Henninger and Humphrey properties. Odell and Tom Creeks flow from the Montana side of the summer range allotments in the Centennial Mountains and the gauging information is similarly useful in describing the hydrology of that area. Table 7 provides summary information for the three gauges.

Table 7. Hydrologic descriptions for creeks located in Montana Creeks within Sheep Station summer range

Station	Period of Record	Watershed Area (mi.^{2})	Gauge Elevation	Flow Regime	Average Daily Flow (cfs)[b]	Peak Flow of Record (cfs)
Beaver	1921--1987	220.0	5150	Intermittent	25.6	858
Odell	1994--1998	17.7	6750	Perennial	46.5	506
Tom[a]	1989[a]	6.43	6740	Intermittent	2.8	12

a - Partial year, May through September.
b - Includes dates during which there was no flow.

Peak flows in watersheds influenced by the Centennial Mountains are during late spring snowmelt, usually during May and June for all three gauges. Tom Creek only operated May through September 1989, although it was dry at the station site July through September. Beaver Creek is consistently perennial throughout its period of record from April through June. During drought years, it may be dry at the station site July through March, only running with snowmelt runoff. During wet years the stream flows year round at the gauge site. Odell Creek did not operate through the winter months possibly due to freezing conditions; whether there was flow is not known. Otherwise gauge records show consistent flow spring through fall during all the years of record.

On the Idaho side of the continental divide, the drainage in the Headquarter and Henninger Ranch properties is imprinted with a degree of disorder, with many small depressions that are possibly the result of partial collapse of tubes or blister cones within the flow, and other small basins created between ridges. The deep and regular fracturing, or joint sets, that is frequent in basalts provides excellent downward percolation of precipitation water, and potentially high volume of storage, very often creating the so called “dry mountain” effect: a terrain with marked absence or low density of drainage features, of complete lack of surface scour channels, underdeveloped low order valley form. The regular jointing is caused by shrinkage of the flow due to slow and relatively uniform cooling, and is analogous to shrink cracks in clay. Throughout these two properties, the exposed top surface of flows, usually on very broad, shallow ridges clearly shows well developed hexagonal joint patterns that likely persist deep into the rock of an individual flow layer.

Within the Humphrey Ranch property the subdued topographic relief does not generate enough water-yield to sustain perennial flow in the smaller tributaries to Beaver Creek. These tributaries are ephemeral or have surface water expressed during base flow periods, where there are poorly drained relatively impermeable soils in the valley bottoms. Long Creek and Beaver Creek are probably both perennial based on 2008 field observations.

The summer range properties are divided between bedded sedimentary rock and felsic extrusive igneous mostly either rhyolites or trachytes. Fracturing in the felsic igneous is considerably less regular than that described above for thick basalt flows. In any case stream flow yield from the ridges of extrusive igneous in the upper portion of the Odell and east side of the Tom Creek grazing areas, is evidently high and more analogous to granitic slopes, which because of poor transmissivity of the rock (volume of water that can be transmitted), and typical steepness, are “wet” slopes. Precipitation water does not percolate far into relatively un-weathered rock under the soil mantle, but instead travels down slope as shallow subsurface interflow in the soil to daylight frequently at major breaks in slope or geologic facies into springs and boggy seeps. In addition, the large mass of slump material filling the topographic lows of these properties may provide storage area for release during the summer baseflow. The slump slopes in the other properties have much less displacement and have not collected in such quantity in the steeper and narrow valleys.

The Spring Creek drainage network is ephemeral to intermittent in nature. A single unnamed first order draw provides the only surface flow during summer base flow season to the main stem, which is insufficient to charge the valley fill. By contrast the Odell Creek drainage system contains abundant surface flow throughout the property. There is a clear correlation between fault lines and stream valley alignment (including the perennial tributary to Spring Creek). Un-mapped but inferred faults in the lower reach of Spring Creek act as barrier to flow with surface flow ceasing at a possible intersection of a fault (Point BM1, Figure 4).

Channel, Riparian and Floodplain Conditions

Proper Functioning Condition (PFC) surveys were used to evaluate riparian and stream channel conditions on streams which were visited in 2008 and 2009 (USDI 1998). A total 20 sites were surveyed. 17 sites were rated as in proper functioning condition and three received ratings of Functional-at-Risk. This information is summarized below in Table 8. Additional discussion about these surveys is found under each grazing area.

Riparian vegetation, where present, was noted to have diversity of species and age groups, and was in good condition. More specific detail is noted under each grazing area.

Table 8. Summary of proper functioning condition surveys conducted on ARS Sheep Station grazing areas

Property/Grazing Area	Point ID	Rating	Comments
Big Mountain	BM1	FAR	Stream eroding into road prism at Spring Creek
	BM3	PFC	A3 channel type
	BM4	PFC	A2 channel type
Odell	OD2	PFC	B3 channel type
	OD4	PFC	B3 channel type; North Fork Toms Creek
	OD5	PFC	A/B4 channel type
	OD7	PFC	B3 channel type
	OD8	PFC	C3 channel type
	OD15	PFC	E4 channel type
Toms Creek	Pt M	PFC	Corral Ck; A3/A4
	Pt G	PFC	Stream near Blair Lake (below stream crossing)
	Pt J	PFC	A4
Humphrey	H15	FAR	Ditch-Modoc Creek/Berry Creek
	H14	PFC	E3 channel type
	H2	PFC	E3/34 channel type
	JF2	PFC	E3/34 channel type
	H1	PFC	E3/34 channel type
	JFPT 3	PFC	G4/5 channel type-middle portion of stream at lower end of PFC
Henninger	HEN8	FAR	F4 channel type; Alteration of flow, rip-rapping, irrigation; Dry Creek
	HEN1	FAR	C4 channel type; Alteration of flow; rip-rapping; Moose Creek
Headquarters	No Surface Flowing Drainages		
DOE Feedlot	No Data Taken-Industrial Area		

Overall, channel conditions are good to excellent on ARS Sheep Station grazing areas, with the exceptions noted above in Table 8. Good and excellent are defined are as meaning that bank stability, fine grained sediment (sand size and smaller), apparent water clarity and channel morphology and pattern are within expected and acceptable limits for a given channel type. This means that the given flow regime, valley slope and slope delivery mechanism for sediment to valley bottoms are appropriate for the channel type at each surveyed location.

Exceptions were noted at one location on Spring Creek (Big Mountain grazing area), at the point of diversion just past the confluence of Berry and Modoc Creeks on the Humphrey Ranch and at Henninger Ranch on Moose and Dry Creeks. Diversion has occurred on all four streams for irrigation purposes and at Berry and Modoc Creeks diversion appears to have been used in order to route only one channel under the Interstate. Diversion has resulted in alteration of floodplain and channel function for all four channels and on Modoc Creek small levee type features were on either side of the channel/ditch.

Summer Range

Channels within the East Summer Range (Toms Creek Grazing Area) and the West Summer Range (West Odell Grazing and Big Mountain Grazing Areas) are relatively steep, wide and shallow streams with gravel/cobble substrates. In the Rosgen classification system all channels were estimated as primarily A3 and 4 or B3 and 4, with some reaches of steeper C3b and C4b type in the broader Odell Creek valley. All were rated as proper functioning condition, with the exception of Spring Creek.

West Summer Range-Odell Creek

Odell Creek is a Rosgen A2--3 within the gorge cut into Mesozoic sedimentary at the northern boundary of the ARS range. A disused road, which at one time provided access to the J.R. Simplot phosphate mine, which was active from 1956-1958 (USDA ARS 2009). The road was built in the bottom of the stream valley, but does not appear to have impeded its lateral migration very much due to steepness and natural confinement of its channel and boulder substrate. Within the allotment Odell Creek is primarily a B3 to C3 channel, substrate is fairly well imbricated with particles that are sub-round to round in shape. By nature of its channel type there is not an associated floodplain.

Riparian vegetation is dense willow or forest, depending on valley structure and whether it is influenced by large slumps, which promote open forbs, grassy meadows and brushy riparian corridors. Flow in the main stem was estimated at time of visit (July 29—August 1, 2008) at between 15 and 30 cfs depending on location and watershed area above a point (Moser and Fryxell 2008). Several crossings mapped by Sheep Station staff were examined and all were rated in proper functioning condition. Some minor rutting on hillside leading to a crossing at point OD7 was observed, and bank trampling noted at OD7 and OD8, where sheep driveways crossed the stream (Figure 4, Figure 14). The scale of these disturbances was on the order of tens of feet. There was no evidence that these disturbances impacted stream morphology in any significant way up or downstream of the impact. There was no overt evidence of overburden of sediment in the channel, other than normal particle distribution of the substrate, or heavy, or unusual browse on riparian vegetation.

Degraded banks (from livestock trampling) occur in short sections (10s of feet), where crossings were on sheep driveways. There is no evidence that these degraded sections have had a significant effect on channel morphology or function. No depositional bars were observed downstream of the driveways which would indicate increased levels of sediment contribution. Nor was there the appearance of embedded substrate, which would indicate transport and deposition of excessive amounts of fine sediment.

West Summer Range-Spring Creek

Spring Creek is largely an intermittently flowing channel, probably only reliably flowing during snowmelt in later spring/early summer. A short reach on the main stem of the drainage is fed by a perennially flowing low order draw. Flow is probably fault related. The first 0.4 to 0.5 miles of Spring Creek, up from the confluence with Odell Creek, is dry. The next 0.3 miles is flowing at the time of visit, all water issuing from an unnamed tributary (point BM2, Figure 4). This reach is probably perennial with variation in length year to year depending on precipitation amount and pattern. The channel above the confluence with that tributary is dry.

Along Spring Creek valley bottom is the one-time access road to the Simplot phosphate mine which is located high on the upper slopes of Sheep Mountain. The mine operated from 1956 through 1958, and since then the road has not been used or maintained. The remaining road prism has confined the stream which has led to a small to moderate degree of degradation of the bed (1 to 2 feet) and some erosion of the road fill/bank on the south side. The steam condition was rated functional at risk due to the road prism influence. The same road is on the east side of Odell Creek between Spring Creek and the ARS Sheep Station boundary, but due to the steepness of the canyon, perennial flow in Odell Creek (estimated at 30 cubic feet per second on 7/29/08), and preponderance of bedrock substrate and banks, the channel if it was ever constrained by the road prism, has cleared an adequate and now well vegetated floodplain.

The lower dry portion of the channel was rated functional at risk, due to the presence of the mine access road. The road is inactive, and vegetated over with grassed and forbs, but occupies a large part of the valley bottom, impeding the lateral movement of the channel.

Other Properties

Humphrey Ranch-Beaver Creek

Beaver Creek through the Humphrey allotment is a perennial stream with Rosgen classification of E3 or E4. Gradient is moderate, sinuosity very high and at flood stage, over bank, there is essentially no confinement to flow. The valley bottom/floodplain is occasionally inundated, probably biannual frequency at least over long term and the floodplain is considered to be functioning properly. Banks are loam and floodplain height was about one foot above water level on date of visit (July 12, 2008). Riparian vegetation is primarily grass and forbs although judging from isolated and mature willow clumps was probably at one-time mostly woody species, eliminated through grazing. Ground cover through live vegetation is nearly 100 percent.

Small drainages outside of Beaver and Modoc Creek are intermittent in nature, with small channels narrowly incised in loamy soils, or swales without channeling that is probably wet seasonally or only after very wet, prolonged conditions. Floodplains were not associated with this channel.

In Humphrey Ranch, on the west side of the Interstate, flow from Modoc and Berry Creeks has been diverted from natural channels by road ditches that bisect the creek, diverting flow from the north side into a ditch that parallels the highway on the south side. A high levee on the west of the ditch prevents any water overflowing the now mostly dry natural channel from entering the ditch, or backing up against the highway fill. The ditch is directed under the highway at a single point and hence conveyed to Beaver Creek. The alteration of the streams drainage structure and path may have been part of a highway project whose purpose was to manage flow on the upstream side of the highway into a single discrete underpass. This alteration resulted in a Functional-at-Risk rating for this portion of the stream.

Humphrey Ranch-Long Creek

Long Creek, at the confluence with Beaver Creek is very similar to Beaver Creek in form, though smaller. Long Creek flows into Beaver Creek immediately east of Interstate 15 and the railroad, but of which bisect the western quarter of the property. Flow was estimated at about 0.5 cfs at the time of the field visit, so the stream may be intermittent in the late summer and early fall.

Corral Creek

The upper reach of Corral Creek bisects the primary sheep driveway. The channel is a Rosgen A3—4 stream type. The channel bifurcates just upstream of the crossing, at the toe of a debris fan. Bank height at the crossing was low in stony loamy material. Channel substrate is relatively loose sub-angular gravel/cobble. Long profile was step-pool type with bed control imposed by large woody debris and tree roots. Rating was proper functioning condition. Except for trailing through forest cover there was no detrimental disturbance.

Headquarters Property

There is virtually no expression of surface runoff in valley/swale development or channeling throughout the Headquarters property area, except for the far western portion of the property, where Beaver Creek is located. The area is dominated by flood basalts, which typically have a very regular fracturing pattern, or joint set. Ground level is also frequently the top of the flow. Infiltration into the soil layer, or fracture pattern, along with continued downward percolation of precipitation is probably very rapid, with considerable storage. Drainage for the Headquarters property, with the exception of the northwest corner which contains Beaver Creek in basalt gorge, is akin to deranged drainage patterns found in glacial till.

Low pressure ridges in the basalt flow have created a somewhat random flow path to the area, and frequent small basins without discernible outlets are common.

Beaver Creek flows though the western margin of the Humphrey Ranch property. At the USGS gage site at the bridge (exit 172 from I-15) (Point Q, Figure 4), the stream at the time of the site visit was dry (July 10, 2008). The general appearance and category in the Rosgen classification are the same from this point upstream to just below the gravel pit. The stream is completely confined within a deep basalt gorge. It is a relatively straight channel, with a simple structure of riffles and glides at regular intervals. Bar development is minimal and there are few pools. There is not a readily defined floodplain, rather more of a consistent debris fan at the foot of the cliff walls that is occasionally inundated. Riparian vegetation community is sparse. A visual assessment of Rosgen classification is an F3 (Rosgen 1996).

At a point 1.04 miles upstream of the gage the stream was running at the time of the site visit an estimated 15 to 20 cubic feet per second (cfs), the structure of the channel was similar and valley was similar to the above description. At 1.77 mile upstream of the gage the gorge is less deep and the valley bottom has widened. The Rosgen classification is C3. There is increased channel sinuosity, an identifiable floodplain and riparian vegetation community. At the gravel pit the valley widens out considerably, and gradient decreases, most likely due to control enforced by evident bedrock substrate. Because of gradient change a prodigious quantity of gravel/cobble material has been deposited in this reach. Below the vehicle crossing the stream bifurcates around a large and high gravel island. Upstream of the crossing the channel is a single thread, but with equally elevated floodplain. Riparian vegetation is very dense and high willow. Rosgen classification is C3. Floodplain function was intact.

Henninger Ranch Property

This property is very similar in terms of stream development when compared to the Headquarters property. The Dry Creek channel bisects the property. Headwaters for this drainage are found on the southern slope of the Centennial Mountains. The stream is intermittent through the allotment in a C4 channel, which was rated as functional-at-risk (July 12, 2008). Moose Creek which crosses the northern portion of the Ranch was classified as an F4 channel and rated as functioning-at risk. Floodplains are not associated with this channel type.

Springs and Wetlands

No springs were observed during field work in 2008 and 2009.

Field reconnaissance was conducted during the summer 2008 and 2009. Based on field observations water-influenced soils were only found associated with flowing streams or at Blair Lake. The width of water-influence appeared to be limited and often reflected by the presence of *Salix* spp. and *Equisetum fluviatile*. Wet meadow conditions were observed in the Humphrey Ranch adjacent to Beaver Creek and in several swale areas on the Ranch. These low-lying areas lacked developed channel morphology, but appeared to have seasonally wet conditions or have wet conditions that were sustained after periods of precipitation.

Water-influence soils around Blair Lake were observed to have limited trampling and compaction. These areas were limited to driveway crossings and areas around Blair Lake where sheep access the water for drinking. At driveway crossings and around Blair Lake adjacent vegetation and water-influenced soils did not appear to be disturbed or otherwise compromised.

No bedding areas were observed in areas of water-influenced soils. These field observations support information provided by USSES personnel that sheep prefer to congregate on slopes and ridge tops and avoid wetland and riparian areas.

Water Quality

303(d)/305(b) Report

The Clean Water Act (CWA), of 1972, and subsequent amendments of 1977 and 1987, is the primary federal law that governs water pollution in the United States. Under the act states are required to set water quality criteria standards. A biennial report, under section 305(b), is prepared for congress by the states and Environmental Protection Agency. Within that report a list of impaired water bodies within the state (section 303(d) of the CWA) is required.

Since the project area includes parts of Montana and Idaho both States Integrated Reports for 303(d) and 305(b) information was reviewed. Water quality criteria and standards for both States are tiered to designated beneficial uses. For the State of Idaho these are: aquatic life, recreation, domestic water supply, wildlife habitat and aesthetics (State of Idaho 2009). The State of Montana's designated beneficial uses are public water supplies, wildlife, fish and aquatic life, agriculture, industry, recreation and other beneficial uses (State of Montana 2006a). The State of Montana defines impaired as "a water body or stream segment for which sufficient credible data shows that the water body or stream segment is failing to achieve compliance with applicable water quality standards" (http://data.opi.mt.gov/bills/mca/75/5/75-5-103.htm).

Waters in the integrated 303(d)/305(b) reports are classified by category, denoting their compliance with applicable water quality standards. Table 9 and Table 10 refer to category 4a, 4c and 5. Category 4a waters do not support a standard for one or more designate uses, but a Total Maximum Daily Load (TMDL) is not needed. Category 4a waters mean that the TMDL has been done and approved by EPA. Category 4c indicates that that non-support of water quality standard(s) is not due to a pollutant. Category 5 streams are defined as "waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat." These waters make up the 303(d) list for a state (State of Montana 2010). Each state proposes which reaches would have TMDLs developed and the year to be completed.

The 2008 State of Idaho Integrated 303(d)/305(b) report, and accompanying GIS data, document that 10.4 miles of stream flowing through ARS-administered lands are categorized as 4a (Table 9). A TMDL for temperature has been developed and approved by EPA for Beaver Creek but not implemented and Beaver Creek is still considered impaired. Table 9 summarizes the probable causes and sources of stream impairment and Figure 35 displays the location of these streams (State of Idaho 2009). Fieldwork in 2008 conducted three PFC surveys on Beaver Creek, where it flowed through ARS Sheep Station administered lands. Two of the surveys found the stream in proper functioning condition with abundant riparian vegetation and no signs of upland disturbance. At the third site, a rating of functional-at-risk was given due to the immediate adjacency of an old non-active gravel pit and a road crossing the stream.

On the Humphrey Ranch, surveyed sections of Beaver Creek, and Long Creek, did not show evidence of flow, physical substrate, and habitat alterations during the 2008 and 2009 field seasons. Fieldwork along Beaver and Long Creeks did not provide indications of past riparian harvest or removal. As a result, water temperature alterations may be due to flow alterations. It should be noted that Beaver Creek is listed by the State of Idaho as impaired although PFC surveys conducted on Humphrey Ranch rated the stream as in proper functioning condition. Analysis of the State of Montana's draft 2010 Water Quality Integrated Report (303(d)/305(b) list) documents three streams originating in the Centennial Mountains, are on the 303(d) list or listed impaired, but not requiring a TMDL. Corral Creek, Odell Creek, Tom Creek are listed as Category 5 streams (State of Montana 2010). Hell Roaring Creek is listed as a category 4C. These streams, the causes for impairment and probable sources are listed in Table 10. The location of these streams is displayed in Figure 35. Although Corral, Odell and Tom Creeks have been listed as requiring

TMDLS, and a date has been assigned for TMDL completion, none of these TMDLs have been developed as of yet (State of Montana 2010, Appendices B and F).

Although these streams are listed from headwaters to steam mouths, the listings appear to be based on problem specific to certain reaches lower within the Red Rock Lakes basin, which are not located on ARS administered lands. Discussions with the State of Montana indicated that the listing of the entire reach appears to be more a matter of convenience than impairment (Fryxell 2011a).

The State of Montana 2008-2010 Integrated report describe the upper reaches of Corral and Hell Roaring Creeks, whose headwaters are in the Tom Creek summer range, as in excellent condition (State of Montana 2010). Field observations in July 2008 and August 2009 support these conclusions (Moser and Fryxell 2008, Fryxell 2009). Further communications with the State of Montana document conditions in these two drainages. The upper reach of Hell Roaring Creek is documented as in near pristine/reference condition and that the upper reach of Corral Creek is in mount stream with good cool flow, stabile stream banks, good riparian vegetation and shading and clean substrate (Fryxell 2011b).

In both areas, vegetation appeared consistent and well established, in the areas that were visited. There were no major areas of upland instability or erosion that were observed in these field trips that could be potential sources of sediment. No areas of excessive riparian impacts and browse were observed that could be construed as alteration of riparian vegetative cover (Moser and Fryxell 2008, Fryxell 2009).

The entire length of Odell Creek is listed, due to impairments which were the result of severe erosion from grazing in riparian areas and dewatering due to irrigation (State of Montana 2006d). The report is not specific to where these problems are located and neither of these issues was observed during field work conducted in 2008 on ARS grazing property in this area. However, the last time this reach was assessed was 1999. In addition, during field work vegetation appeared consistent and well established, in the areas that were visited. There were no major areas of upland instability or erosion that were observed in these field trips that could be potential sources of sediment. No areas of excessive riparian impacts and browse were observed that could be construed as alteration of riparian vegetative cover. No areas of streambank degradation were noted except at two minor areas on Odell Creek (OD4 and 5, Moser and Fryxell 2008).

A similar situation exists with Tom Creek. Probable causes of impairment are grazing in riparian or shoreline zones and irrigated crop production Probable causes of impairment are listed as grazing related sources and irrigated crop production (Montana 2009, 2006e). No grazing related sources of sediment and siltation, alterations to flow or to stream side vegetation were observed during the field seasons of 2008 or 2009 in the headwaters of Tom Creek (Moser and Fryxell 2008 and Fryxell 2009). However, the map for this reach indicates that the entire listed segment does not extend beyond the valley floor, in front of the north boundary of the Centennials (Figure 34).

Figure 34. Location of the impaired reach on Tom Creek

Table 9. Summary of State of Idaho impaired reaches on ARS Sheep Station grazing lands

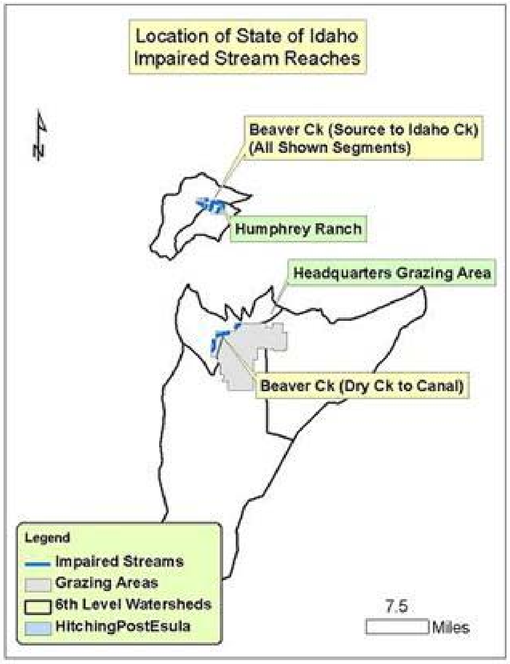
Listed Reach Name	Category	Length (miles)	Use Class[a]	Items Partially (P) or Non-Supported (N)	Probable Cause(s)	Probable Source(s)	Year Completed
Beaver Ck (Beaver Ck-Dry Creek to canal)/(ID17040214SK014_05) (Humphrey)	4A	2.7	DWS; PCR; SS; CWAL	Water temperature (N) Sediment (N)	Flow alteration; physical substrate habitat alterations	Natural and Human related flow alterations Riparian Grazing	2005
Beaver Ck (Rattlesnake CK to Dry Ck)/(ID17040214SK015_05) (Humphrey)	4A	1.5	DWS; PCR; SS; CWAL	Water Temperature (N)	Flow Alteration Habitat Alteration Nutrients Sediment Temperature	Not Documented	2005
Beaver Ck (Source to Idaho Ck)/(Id17040214SK021_02) (Long Creek) (Modoc) (blank) (All Humphrey)	4A	0.8 0.8 4.8	CWAL SS PCR	Water Temperature (N); Fecal Coliform (N)	Cause for water temperature unknown; Presumed to be cattle/wildlife related for fecal coliform	Not Documented	2005
ID17040214SK025_03 (Dry Creek) (Headquarters)	4A	0.1	NA	N	Not Assessed	NA	NA

a - DSW: Domestic Water Supply; PCR = Primary Contact Recreation; SS = Salmonid Spawning; CWAL = Coldwater Aquatic Life

Table 10. Summary of State of Montana impaired reaches on ARS grazing lands

Listed Reach Name	Category	Length (miles)	Use Class[a]	Items Partially (P) or Non-Supported (N)	Probable Cause(s)	Probable Source(s)	Proposed TMDL (Priority)/Year to Be Complete
Corral Ck (Headwaters to Mouth of Red Rock Ck)	5	4.4	B1	Aquatic Life (P) Coldwater Fisheries (P)	Alteration in stream-side or littoral vegetative covers and Total Phosphorus	Grazing in riparian or shoreline zones; Unspecified unpaved road or trail	Phosphorous (Low) Sedimentation/Siltation (Medium)/2006 & 1990
Hell Roaring Ck (Headwaters to Mouth of Red Rock Ck)	4C	9	B1	Aquatic Life (P) Coldwater Fisheries (P)	Alteration in stream-side or littoral vegetative covers and Total Phosphorus	Grazing in riparian or shoreline zones	NO TMDL Required
Odell Ck (Headwaters to Mouth of Red Rock River)	5	14.3	B1	Aquatic Life (N) Coldwater Fisheries (N)	Alteration in stream-side or littoral vegetative covers and Turbidity	Agriculture; Grazing in Riparian or Shoreline Zones; Loss of Riparian Habitat	Turbidity (Low)/2000
Tom Ck (Headwaters to the mouth of Upper Red Rock Lake)	5	6.7	B1	Aquatic Life (P) Coldwater Fisheries (P)	Alteration in stream-side or littoral vegetative covers; Low flow alterations; Sedimentation and siltation	Grazing in Riparian or Shoreline Zones; Irrigated crop production	Sedimentation/siltation (Medium)/1990

a - Waters suitable for drinking, culinary and food processing purposes after conventional treatment; bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural/industrial water supply.



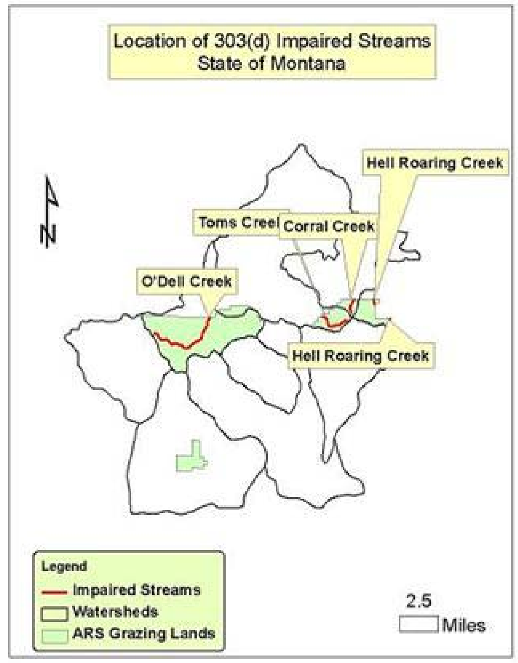


Figure 35. Location of Idaho and Montana 2008 303(d) impaired streams found on ARS Sheep Station grazing lands

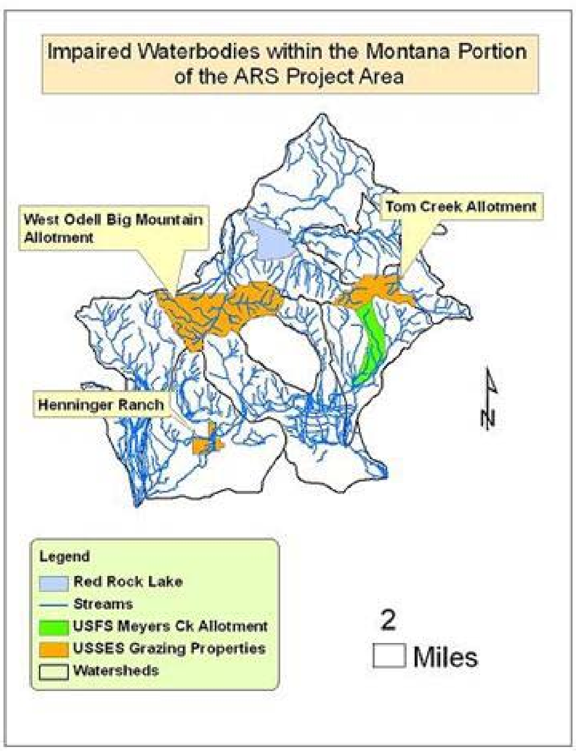


Figure 36. Locations of impaired waterbodies in the Montana portion of the proposed project area

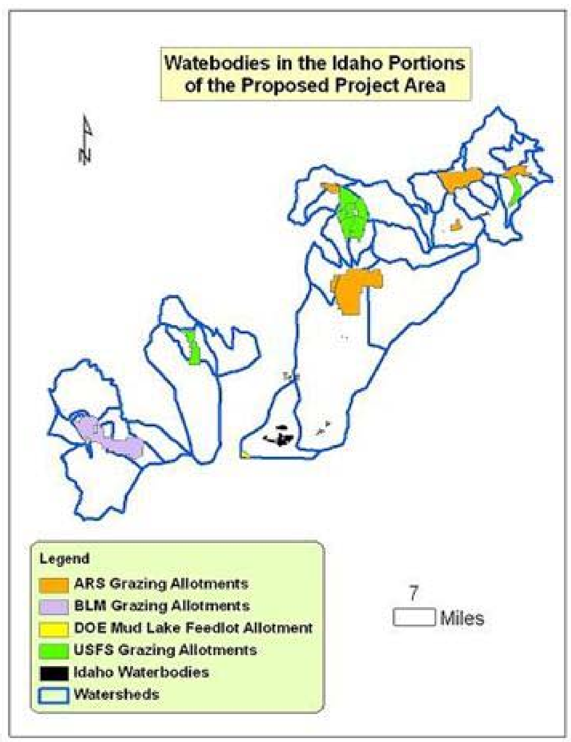


Figure 37. Locations of waterbodies in the Idaho portion of the proposed project area

In Montana there is only one impaired waterbody within the project area. Upper Red Rock Lakes is listed as impaired due to other flow regime alterations and sedimentation and siltation. These problems are due to agriculture, grazing in the riparian or shoreline zones, range land grazing and upland sources (State of Montana 2010, Appendix A, Figure 36). In Idaho there are numerous waterbodies present but they have not been assessed (Figure 37).

All streams, and water bodies, which are not impaired in both Idaho and Montana, are displayed in Figure 38. Impaired streams are included as reference markers, as are the differing grazing allotments.

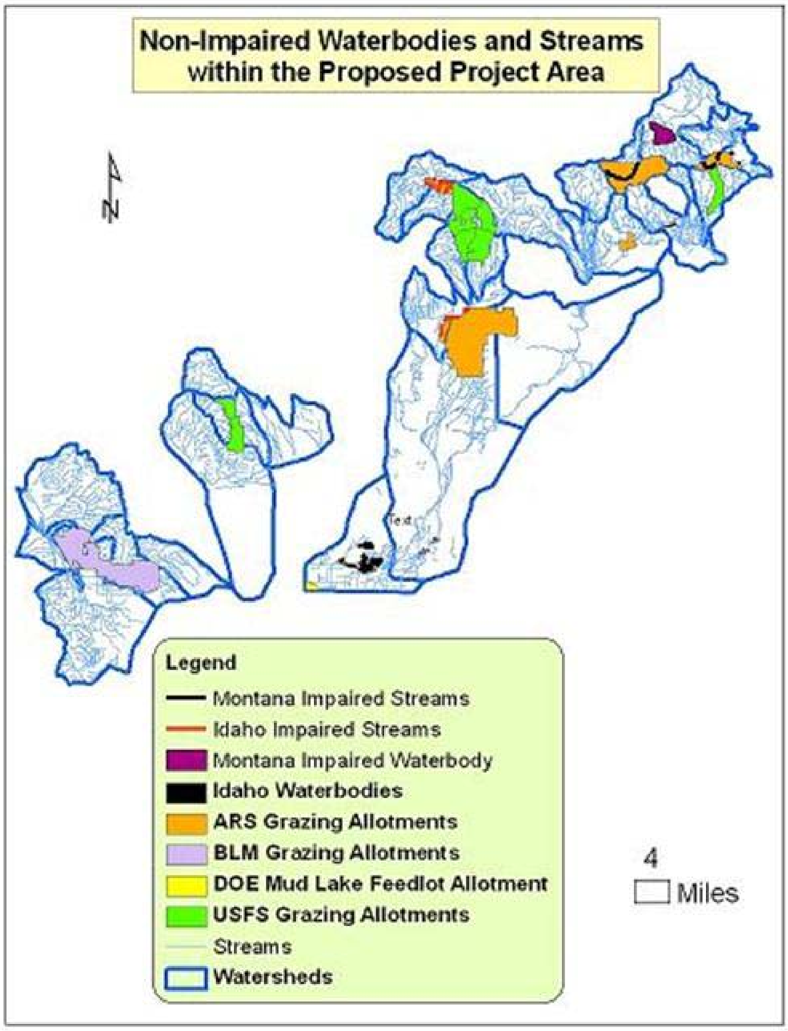


Figure 38. Locations of non-impaired streams and waterbodies in Montana and Idaho within the project area

Water Quality and Sheep Crossings

In 2005 and 2006 a study was conducted on two reach located on Odell Creek by Sheep Station researchers (Lewis et al. 2009). A total of 2, 000 to 2, 500 sheep were crossed each year. The objective of the study was to determine effects of sheep crossing Odell creek on suspended sediment and generic *Escherichia coli* (E.coli). Water samples were collected every two minutes at a point 25 meters above the crossing and at 25, 100, 500 and 1, 500 meters below of the crossing. Samples collected above the 25 meter upstream collection point represents background concentrations for both sediment and E. coli in Odell Creek.

The State of Montana surface water quality standards and procedures, for suspended sediment states "No increases are allowed above naturally occurring concentrations of sediment or suspended sediment (except as permitted in 75-5-318, MCA), settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife (http://www.deq.state.mt.us/dir/Legal/Chapters/Ch30-10.pdf). Data collection indicates that for Total Suspended Solids (TSS), it was 26 minutes from when the sediment plumes first appeared to when they disappeared. Roughly 10-20 percent of TSS measured at 25 meters downstream from the crossing was transported to the 1, 500 meter downstream station (Table 11). Although TSS values are obviously greater than those collected at the -25 meter site these values would not be considered as exceedances as the elevated levels do not create a nuisance or render the water detrimental to its beneficial uses at the 26 minute collection time.

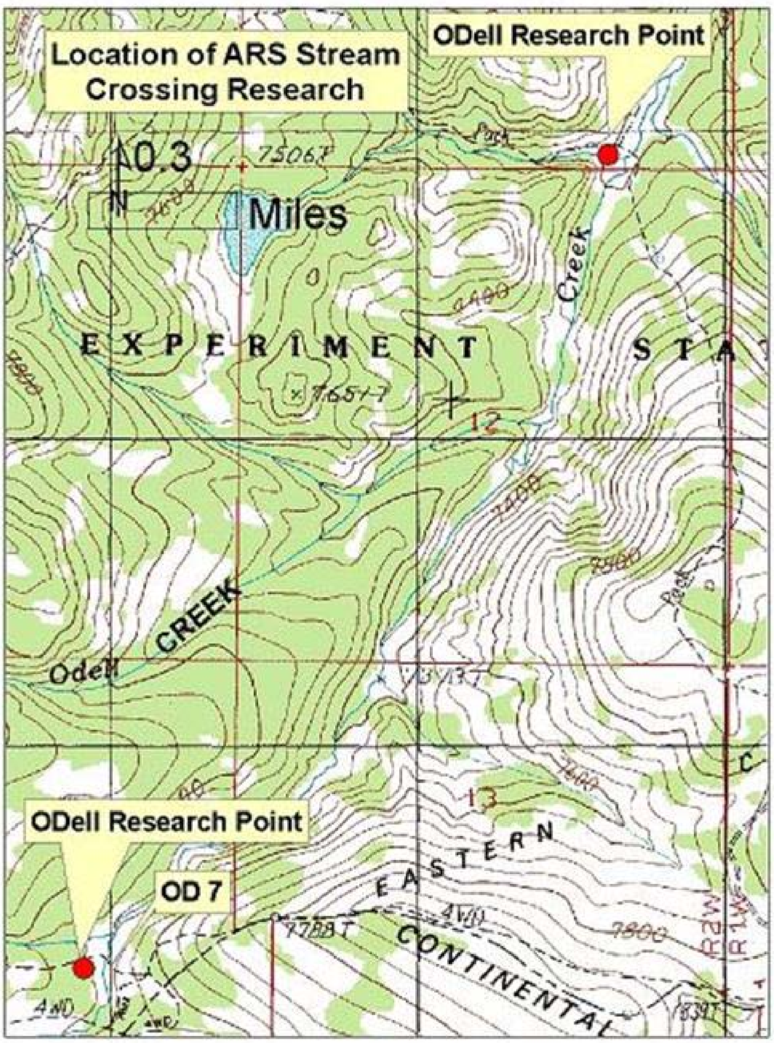


Figure 39. Location of Odell Creek Sheep Station stream crossing research points (OD 7 ties to Figure 14)

Table 11. Summary of total suspended solids (TSS) water quality data collected 2005-2006, Odell Creek

Reach	Distance downstream (meters)	Peak Maximum Concentration (mg/L)	Post-peak Minimum Concentration (mg/L)	Peak Duration (minutes)	Cumulative Suspended Sediment (Kg)
Upper	-25	2[a]	n/a[b]	n/a	n/a
	25	1,566	5.0	6	82
	100	486	3.5	9	34
	500	85	1.9	15	17
	1,500	15	3.1	26	8
Lower	-25	3[a]	n/a	n/a	n/a
	25	483	6.5	10	373
	100	444	5.0	11	246
	500	178	4.1	13	120
	1,500	71	4.9	19	76

a - Mean concentrations for comparisons: No peaks were detected at 25 meters upstream
b - n/a: not applicable

Odell Creek is classified as B-1 drainage. The State of Montana water quality criteria for B-1 classified waters states: The water quality standard for Escherichia coli bacteria (E-coli) varies according to season, as follows: "from April 1 through October 31, the geometric mean number of E-coli may not exceed 126 colony forming units per 100 milliliters and 10 percent of the total samples may not exceed 252 colony forming units per 100 milliliters during any 30-day period; and from November 1 through March 31, the geometric mean number of E-coli may not exceed 630 colony forming units per 100 milliliters and 10 percent of the samples may not exceed 1,260 colony forming units per 100 milliliters during any 30-day period" (http://www.deq.state.mt.us/dir/Legal/Chapters/Ch30-10.pdf) .

E. coli measurement results displayed in Table 11 do not reflect geometric means. As a result, direct comparisons to water quality criteria for the State of Montana can't be made. Data displayed represent discrete points in time. E. coli concentrations were highest at 25 and 50 meters downstream after crossing. E. coli plumes appeared and disappeared within 15 minutes. At 1, 500 meters concentrations were 1.3 percent and 4.8 percent of values documented at 25 meters downstream of the crossing, for upper and lower reaches respectively (Table 12).

Data indicates that for both TSS and E. coli concentrations, effects diminish rapidly with distance downstream and duration of elevated water quality analytes is short-lived.

Table 12. Summary of Escherichia coli (E. coli) water quality data collected, 2005-2006, Odell Creek

Reach	Distance downstream (meters)	Peak Maximum Concentration (MPN/100 mL)	Post-peak Minimum Concentration (MPN/100 mL)	Peak Duration (minutes)
Upper	-25	14[a]	n/a	n/a
	25	2, 808	119	7
	100	768	87	8
	500	484	16	15
	1,500	39	41	13

Reach	Distance downstream (meters)	Peak Maximum Concentration (MPN/100 mL)	Post-peak Minimum Concentration (MPN/100 mL)	Peak Duration (minutes)
Lower	-25	24[a]	n/a	n/a
	25	1, 667	42	9
	100	1, 744	68	11
	500	1, 471	252	14
	1,500	795	101	14

a - Mean concentrations for comparisons: No peaks were detected at 25 meters upstream

Herbicide Applications

Invasive weeds are present and have been addressed through targeted select grazing and localized herbicide use. Herbicides are used to kill or inhibit the growth of invasive undesirable or exotic broadleaf weeds and/or woody plants.

Herbicides have been used along roads, buildings, feedlots and corrals for the past thirty years following manufacturer's directions. No herbicides are applied on rangelands. Herbicides that are used include: clopyralid, triclopyr amine, Imazapyr, Diuron, Picloram, Bromacil, non-aquatic Glyphosate, 2, 4-D amine. Application methods are spot application, hand wand application to control weeds along roadsides, in dry-lots and corrals and near building structures. Four-wheeler-mounted and tractor-mounted boom-sprayer applications are done in small pastures and large dry lots (USDA ARS, Appendix C 2008).

In 2009 a total of 59 acres were treated. 35 acres on the Headquarters property were treated with Curtail which is a combination of Clopyralid and 2, 4 D and another 10 acres were treated on Humphrey Ranch. Two acres associated with feedlots were treated with Krovar, which is a combination of Bromacil and Diuron. Targeted species included spotted knapweed, Downy brome and Leafy Spurge. These herbicides and their relationships to soil and water are summarized in Table 13.

Table 13. Summary of herbicides applied on ARS Sheep Station grazing lands[a]

Herbicide	Comments
2, 4 D amine	Used for both aquatic and terrestrial vegetation control; Binds slightly to soil; Water soluble, Ester forms toxic to fish
Imazapyr	Used for both aquatic and terrestrial vegetation control; Binding to soils is pH dependent; Water soluble and degrades rapidly in sunlight; Low toxicity to fish and algae
Picloram	Used for terrestrial vegetation control; Known surface and groundwater contaminant; Does not bind tightly with soils
Bromacil	Used for terrestrial vegetation control; Mobile in soil; Known groundwater contaminant.
Clopyralid	Weakly adsorbed with moderate leaching potential in soils; Not known to be a common groundwater contaminant and is considered moderately toxic to fish
Triclopyr amine	Weakly adsorbed to soil; Practically non-toxic to fish
Diuron	Used for terrestrial vegetation control; Known groundwater contaminant; Moderately toxic to fish and highly toxic to aquatic plants
Non-aquatic Glyphosate	Used for control of annual and perennial weeds; In water glyphosate is rapidly dissipated through adsorption to suspended and bottom sediments. Half life of 12 days to 10 weeks. Relatively low toxicity to birds, mammals and fish.

a - References: Tu et al.2001 and Thornton and Archer 2009

Review of available GIS layers, obtained from ARS, documenting weed locations, show that herbicides have been applied adjacent to Beaver Creek on the west side of the Headquarters Property and along several intermittent tributaries. Applications are according to product directions and adhere to directions in the MSDS sheets. Herbicide application requirements are defined in Appendix C of the EIS and under Best Management Practices.

Municipal Watersheds

There are two wells located on the Headquarters property. One well, developed in 1918, is estimated to be at least 350 feet deep. The other well, developed in 1937, is 856 feet deep with the water level at 731 feet.

These wells are used for drinking water and are tested quarterly for the presence/absence of coliform and are tested annually for copper and lead. Volatile organic compounds are monitored once every three years as is arsenic. Inorganic compounds are required to be monitored every nine years, as is nitrite. Nitrates are required to be monitored annually. Synthetic organics (herbicides) are required to be monitored every six years. Out of the three compounds known for groundwater contamination, only Picloram is monitored, apparently Bromacil and Diuron are not regulated in Idaho (Feisthamel 2009). Exceedances above maximum contaminant levels are rare, with only one exceedance of MCLs in 2005 for coliform. There have been no detections of Picloram (Feisthamel 2009).

There is also a domestic well on the Henninger Ranch, but that well is not used and is not monitored (Jacobson 2009b, Yurczyk 2009b).

Desired Condition

The USDA Agricultural Research Service (ARS) U.S. Sheep Experiment Station (Sheep Station) is an agricultural research facility whose primary mission is to *"develop integrated methods for increasing production efficiency of sheep and to simultaneously improve the sustainability of rangeland ecosystems".* As a research station they are not required to have a land management plan. As a result, there is no defined Desired Conditions, Standards and Guidelines or Objectives, as typically found in a land management plan which is developed by an agency such as the Forest Service or Bureau of Land Management. However, research activities must adhere to federal laws and regulations such as Executive Orders and Acts. Applicable federal laws and regulations are:

- *Clean Water Act of 1977*: The objective of the Act is to restore and maintain the chemical, physical and biological integrity of the Nation's waters. (Section 101(a)). It also regulates discharge of dredged or fill material into navigable waters (waters of the U.S.) (Section 404). Section 305(b) of the CWA also requires the establishment and implementation of water quality standards and criteria. It also requires each state to conduct water quality surveys to determine a water bodies overall health, including whether or not basic uses are being met. Findings are summarized in the biennial 305(b) report which lists impaired water bodies within that State. States, tribes, and other jurisdictions define appropriate uses for a waterbody and incorporate these uses into water quality standards that are approved by the Environmental Protection Agency (EPA).
- *Executive Order 11990, 1977: Wetlands Management:* E.O. 11990 requires federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. To comply with Executive Order 11990, the federal agency would coordinate with the ACOE, under Section 404 of the Clean Water Act, and mitigate for impacts to wetland habitats. No known wetlands exist within the project area.
- *Executive Order 11998, 1977: Floodplain Management:* E.O. 11998 requires all federal agencies to take actions to reduce the risk of flood loss, restore and preserve the natural and beneficial values in floodplains, and minimize the impacts of floods on human safety, health, and welfare. There are no

stream channels with floodplain characteristics that would be affected by this project. All channels that cross or are immediately adjacent to project activities are intermittent streams and do not have floodplain features.

Best Management Practices

Best Management Practices (BMPs) would be implemented for herbicide application.

Herbicides

- A contingency plan, or emergency spill plan, will document notification requirements, time requirements for notification, spill management, and parties responsible for clean up. Factors to be considered during spill cleanup are the substance spilled, the quantity, and toxicity, proximity to waters and hazard to life, property and environment, including aquatic organisms.
- During pesticide application, an untreated buffer will be left alongside surface waters, wetlands and riparian areas. In determining buffer width the following factors would be taken into consideration: beneficial water uses, adjacent land use, rainfall, temperature, wind speed and direction, terrain, soils, vegetative type and aquatic life. Other consideration would be type of application, persistence on-site foliage, spray pattern and droplets and carrier.

Mitigation Measures and Monitoring Recommendations

Mitigations and monitoring are recommended for Alternatives 1, 3, 4 and 5.

Mitigation Measures

Road to Blair Lake

Mitigations to reduce, and prevent, erosion, are needed on this road from where it crosses on to ARS land to where the road ends, near Blair Lake. Mitigation measures are as follows:

- Blair Lake M1: Close road to all motorized use on ARS Sheep Station lands. Close road effectively where slope begins to increase, shortly after road crosses on to ARS Sheep Station lands. Selectively drop trees such that off-road vehicle traffic cannot detour around closure.
- Blair Lake M2: From crest of hill down to first meadows (Figure 40): Rills and gullies are starting to develop on the compacted road surface. Install water bars at the first gradient breaks to get the water off the road. Install subsequent water bars at gradient breaks until the open meadows are reached. Extend water bar at least six feet into adjacent hillside along contour or at a slight angle to the slopes gradient. Hand crews would be used to implement the recommended measures. Knock rut edges down, and fill in ruts. Place small diameter (four inches or less) brush consistently over the length of the ruts to slow any surface runoff and encourage deposition of fine grained

Figure 40. Road ruts on road to Blair Lake

sediment. Deposition of fine-grained sediment would provide the opportunity for re-vegetation from adjacent sources. If vegetation is not established within three years consider re-seeding.

- Blair Lake M3: <u>From first meadows to major slope break above where road ends: </u>Install water bars at noticeable gradient breaks on ruts and road. Extend water bars at least six feet into adjacent hillside along contour or at a slight angle to the slope gradient. Place small diameter (four inches or less) consistently over the length of the ruts to slow any surface runoff and encourage deposition of fine-grained sediment. Deposition of fine-grained sediment would provide the opportunity for re-vegetation from adjacent sources. If vegetation is not established within three years consider re-seeding.

- Blair Lake M4: <u>From major slope break to where road ends</u>: Install water bars at noticeable gradient breaks on ruts and road to eliminate surface runoff from road. Extend water bars at least 6 ft into adjacent hillside along contour or at a slight angle to the slope gradient. Place small diameter (4 inches or less) consistently over the length of the ruts to slow any surface runoff and encourage deposition of fine grained sediment. Deposition of fine grained sediment would provide the opportunity for re-vegetation from adjacent sources. If vegetation is not established within three years consider re-seeding.

- Blair Lake M5: <u>At road end:</u> Harden the sheep driveway across the stream (to minimize sediment input into stream) with gravel and small cobbles from surrounding area. In addition, harden the last 30-50 feet of the road and place a water bar at the road end to divert surface run-off. This would minimize or eliminate surface runoff and sediment from entering the creek at the road end.

Monitor the mitigated areas after large storms and annually. Conduct maintenance at least seasonally to ensure water bars are kept clean and functioning. Establish key photo points for annual monitoring and document recovery conditions. If monitoring indicates further work is needed address issues through additional restoration efforts

Odell Creek Sheep Crossings

Mitigations are recommended at sheep crossings at points OD 4 and OD 5, found on the North and South Forks of Odell Creek. At the North Fork Creek (OD 4/T15S, R2W, Section 11, SW ¼) these mitigations apply to the main and secondary crossings. The following measures are recommended:

- North Fork of Odell Creek M6: At both crossings place water bars at key gradient breaks or embed 12-inch logs at this gradient breaks about 4-5 inches deep, and at an angle of 20-45 degrees across the driveway to ensure water is diverted off this area into undisturbed vegetated forest floor, which would function as a sediment filter strip.

- North Fork of Odell Creek M7: At the secondary and smaller crossing, harden the stream banks with rock , small logs, pole sized timber, or other locally obtained native material (that can harden stream banks) to prevent further degradation due to sheep crossing the stream.

- South Fork of Odell Creek (OD 5/T15S, R2W, Section 14, SW ¼) M8: The far side of the crossing comes out on to a steep slope, which is largely bare of vegetation. Currently, there are no signs of rilling or gullying, but mitigation will be implemented to prevent further degradation due to sheep crossing the stream.

- South Fork of Odell Creek M9: Harden the far bank with small rock to provide soil cover or consider developing an alternative crossing nearby where the entry and exit would not lend its self to slope issues.

Drainage Exit at Mine Waste Water Pond

At the old phosphate mines waste water pond, the berm has been over topped and a small drainage has developed, with some downcutting, headcutting and incipient channel development.

Mitigation measures are:

- M 10: Enhance berm development
- M11: Place large rocks as roughness elements to slow water velocity and enhance sediment deposition
- M12: Place some 10-12 inch log sections into drainage to develop step pools place larger rocks below log sections. These measures would slow water velocities and minimize erosion from flowing water.
- M13: Place rock on raw meander bank edges to provide protection in conjunction with the above mitigation measures.

Monitoring

- For mitigations prescribed at the Odell sheep crossings, road to Blair Lake and for the drainage at the mine pond exit, inspections would be conducted after high precipitation events and at the beginning of each season of use. Maintenance would be conducted as needed, based on inspections. Established key photo points would be used for annual monitoring and writing a short description of recovery conditions. If monitoring indicates further work is needed address issues through additional restoration efforts.
- Conduct water quality monitoring for herbicides in Headquarters primary and auxiliary domestic water wells.
- Conduct water quality monitoring, using the methods of collection and analysis outline for Idaho and Montana. Conduct monitoring during the summer of 2012 to screen existing water quality conditions for turbidity, stream temperature and fecal coliform (E.Coli) at Beaver Creek, Tom, Odell, Hell Roaring and Corral Creeks and the sheep crossing at Odell Creek. A long term monitoring plan would be developed only if water quality concerns are defined during the screening phase of monitoring.

Environmental Consequences

Methodology

Initial field visits to the project area, to collect data and observations, were done on July 8 through July 12, and August 28 through September 2 of 2008. During these two visits periodic observations were made of ground cover, surface condition, geology, and where applicable stream channel stability and trend. Surface condition used soil indicators from the R4 soil quality monitoring protocol. A rating classification of soil condition and cover, with ratings 1 through 4, was devised to catalogue observations. These classifications were quantified to portray general conditions and spatial trends (USDA 2003, USDA Forest Service 2008).

- <u>Condition class 1</u> indicates ground that has severe soil disturbance and is in a hydrologically impaired state. Soil conditions follow Forest Service (2003) indications for long term impairments to soil productivity with sparse ground cover, evidence of severe compaction (surface ponding), displacement, or erosion (rills, soil pedestals).

- Condition class 2 is ground that also has evidence of soil disturbance with marginal hydrologic functionality, and little or no sign of recent sheet wash, surface erosion. Soil ground cover and understory vegetation are adequate to resist erosion.
- Condition class 3 indicates conditions with one-time impairment, but recovery to full hydrologic function.
- Condition class 4 has minimal sign of impairment with complete soil and hydrologic function.

Proper Functioning Condition (PFC) surveys were also conducted at sites located within the project area. PFC surveys are used to evaluate riparian and stream channel conditions on selected reaches (USDI 1998). Additional locations and site visits were conducted in June and August of 2009 in coordination with other specialists. Additional PFC and site specific information on hydrologic conditions and functions were gathered at this time.

Geographical Information System (GIS) data was used to help determine values for the units of measure. GIS layers were used to define 6th level watersheds, stream courses, grazing areas and allotments, driveways, trails, water developments and roads. Best available science, literature reviews, discussions with local experts and professional judgment were also used in analyzing data and developing interpretations. Field notes and photographs are in the planning file.

Incomplete and Unavailable Information

All available information was used.

Spatial and Temporal Context for Effects Analysis

Two levels of spatial context have been defined for this project. The area of analysis for potential direct and indirect effects and the area of analysis for cumulative effects are displayed in Figure 41. The boundary is defined by those 6th level watersheds involved with any ARS Sheep Station properties, grazing allotments, trails and driveways used in Sheep Station activities. 6th level watersheds in the project area range from typically range from approximately 8, 504 acres to 203, 938 acres. This level of analysis was selected as it provides a good scale for determining potential effects. If a larger scale was used, the amount of area tends to overwhelming and when smaller scales are used the amount of area is too limited in scope. Watersheds' containing only roads used for trucking sheep to various grazing areas where not included in the cumulative effects area, as there are only twelve trips a year, which is the maximum under the proposed action. Maintaining or reducing this number would be inconsequential when comparing to traffic levels on State Highways, County and National Forest System roads, which are used for trucking sheep.

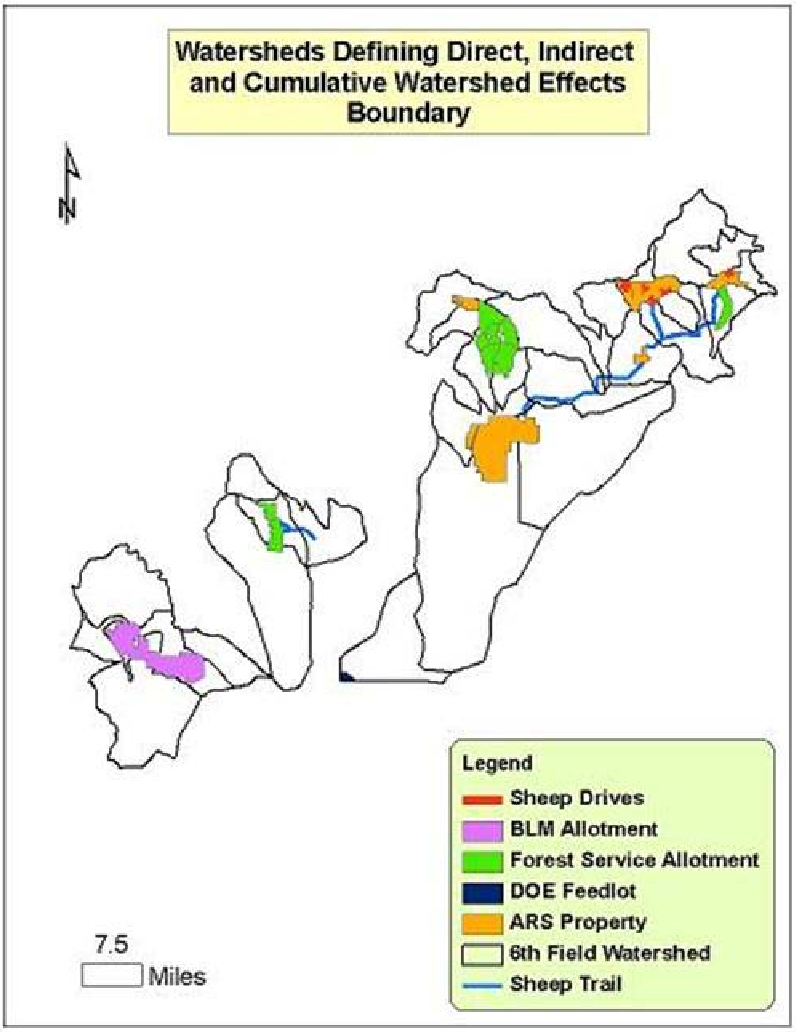


Figure 41. Watersheds defining the area of analysis for direct, indirect and cumulative effects

Two levels of temporal context will be discussed in the effects analysis. The time frame for short term effects is defined as less than 10 years and long term is defined as greater than 30 years. These time frames are based on best professional judgment and discussions with other TEAMS hydrologists.

Sources of information used in this analysis are discussed under “Methodology”.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Northwestern Energy Company from South Dakota is proposing a mountain states transmission intertie or power line. A portion of the route for the proposed action would cross ARS Sheep Station Headquarters property (http://www.msti500kv.com/about/projectoverview/intro.html).

Environmental Analysis

Issue Indicators are summarized below in Table 14. The types of direct and indirect effects are the same for all alternatives.

Analysis Assumptions

The Sheep Station has water rights on Modoc and Dry Creeks. For analysis purposes it is assumed that rates of water use would remain the same for each alternative.

Effects Common to All Alternatives

Climate Change

The U.S. Environmental Protection Agency (EPA) states that scientists have determined with certainty that human activities are modifying the composition of the Earth's atmosphere (http://www.epa.gov/climatechange/). The increase in "greenhouse" gases, such as carbon dioxide (CO^2), methane (CH4) and nitrous oxide (N2O) as well as in hydroflourocarbons has also been documented (http://www.epa.gov/climatechange/). The buildup of these gases, in the Earth's atmosphere, is largely due to the use of fossil fuels. As these gases buildup in the atmosphere they absorb infrared energy, that otherwise would be reflected from Earth. As the infrared energy is absorbed the air surround the Earth is heated and temperatures rise (http://www.arb.ca.gov/cc/cc.htm.

Signatures of recent climate changes include increased land and ocean temperatures, increased frequency of extreme weather event and shifts in seasonal cycle as well as increased vegetative cover and extended growing periods. Increases in land surface temperatures are well documented. Regional trends in land surface temperature results in modification of the hydrologic cycle via changes in the volume, intensity or type of precipitation and through shifts in seasonal timing of stream flow (Regonda et al. 2010). Increased winter temperatures reduce the amount of snow in a basin and higher spring temperatures result in earlier timing of runoff and peak streamflow, when located in snowmelt dominated basins (Regonda et al. 2010). Spring temperature increases are occurring up to 15 days earlier. Such shifts in temperature in turn shift the timing of peak flows Evidence suggests that stream flows are increasing in March and April and decreasing in May and June, which indicates a broad shift in spring peak flow timing.

Furthermore, the shifts in spring temperature spell, winter precipitation and winter temperature are a function of elevation (Regonda et al. 2010). Increases in temperature are expected to be most pronounced inland and at higher latitudes (Furniss 2010). Areas found within the Pacific Northwest (Washington, Oregon and Idaho) are expected to experience continued warming and increased precipitation. Temperatures are predicted to rise by 5ºF by the 2050s. Increased precipitation is expected to result in conditions being wetter on average with increased precipitation in winter and the same or decreased precipitation in the summer (Furniss 2010).

Climate changes at large scales such as national or regional will influence changes at smaller scales, such as a 6^{th} level watershed. However, influences will be greatly modified by topography, elevation, aspect, local airflow patterns, vertical mixing and transport, lapse rates and the tendency for inversions to form (Furniss 2010). Most modeling is done at these larger scales (global, national or regional). However land management activities are typically conducted at a much smaller scale, somewhere between 0.4 and 193 square miles. As a result there are problems with application of model results due to numerous factors not being accounted for or adequately considered at the proper scale (Furniss 2010, Salathe' et al. 2008). As a result, most models are not precise enough at this time to apply them to land management activities at the project level. This limits the analysis of potential effects from climate change and the inter-relationship with proposed land management activities.

As a result, it is not possible to determine specific climate changes and how they would affect implementation of any of the proposed alternatives. However, it is safe to say climate change will continue as will variability. Implementation of any alternative would have to evaluate existing snowpack, snow melt and runoff conditions each year as well as consider changes to stream flows and water supplies for livestock use.

Alternative 1 – Proposed Action

Alternative 1, the proposed action, also represents current operations at the ARS Sheep Station.

The No Action alternative would continue grazing at Headquarters, Humphrey, Henninger, and the East and West Summer ranges. Under this alternative 3,330 sheep would be grazed and the grazing schedule would be the same as what is currently implemented. All properties currently in use would still be used (Headquarters, Humphrey, Henninger, West and East Summer Ranges), Snakey-Kelly (USFS), East Beaver (USFS), Meyers Creek (USFS) and Bernice (BLM), and Mud Lake Feedlot (DOE)). Planned activities that would be conducted in addition to grazing include road and fire break maintenance at Headquarters and Henninger, fence maintenance at Headquarters, Humphrey and Henninger Ranches and in the Summer Range, maintenance of water developments in Humphrey and Henninger Ranches as well as in the summer range. Annually there would be 20 miles of road maintenance and 2 miles of maintenance on the firebreak. Also included are mitigation measures prescribed to limit grizzly bear, and other wildlife interaction, with domestic livestock.

Prescribed burning would continue, with an average of 900 acres burned per year (Grooms et al. 2009).

Table 14. Summary of issue indicators by alternative

Unit of Measure	Alternative 1-Proposed Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total Miles of Driveway	3.1	0	0	2.3	3.1
Total Miles of Driveway within 300 ft of Streams	1.4	0	0	1.2	1.4
Percent change in Number of Acres Grazed Compared to Alternative 1[a]	0 (47, 606 acres total)	-99	-39	-8	-30
Total Number of Sheep Grazed[b]	3, 330	2,165 (65% reduction)	2,660 (20% reduction)	3,330 (0% reduction)	2,330 (30% reduction)
Additional Issue Indicators for Cumulative Effects					
Total Miles of Trail	59.5	0	26.3	49.7	52.9
Total Miles of Trail within 300 ft of Streams	19.8	0	2.71	14.7	17

a - A negative number means reduction in acres grazed on ARS lands

b - This number represents the maximum number of sheep grazed, which would be from late April/early May through early November. This includes ewes with lambs (Smith and Yurczyk 2008)

Design Features and Mitigation Measures

- Continued resting of the North Fork Tom Creek from consistent grazing, but allowing grazing for incidental use. Incidental use would allow sheep to be moved up and out of this drainage to the rest of the Big Mountain grazing area.
- BMPs for herbicide use would be implemented. These measures have been proven effective across the country in managing non-point sources of pollution, and their implementation is required in both Idaho and Montana as part of the Clean Water Act (Seyedbagheri 1996, Schuler and Briggs, USDA Forest Service 2002, State of Idaho 1999, State of Montana 2007).
- Conduct well water monitoring for herbicide contamination.
- Recommended buffer widths are summarized below in Table 15.
- Implement water quality screening by conducting water quality monitoring in 2012.

Table 15. List of herbicides and recommended buffer widths to reduce potential for groundwater contamination

Herbicide	Recommended Buffer Width	Comment
2, 4 D amine	25 ft [a]	If using ester form, toxic to fish
Imazapyr	Up to Edge[b]	Low toxicity to fish and algae; Mobility pH dependent;
Picloram	25 ft[a] 164 ft	Known surface and groundwater contaminant; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Bromacil	25 ft[a] 164 ft	Known groundwater contaminant; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Clopyralid	25 ft[a] 164 ft	Considered moderately toxic to fish; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Triclopyr amine	Up to Edge[b]	If ester form used, can be persistent in aquatic environment
Diuron	25 ft[a] 164 ft	Known groundwater contaminant; Moderately toxic to fish and highly toxic to aquatic plants; 25 ft buffer applies to surface water drainages; 164 ft buffer applies if herbicide applied near Station groundwater wells
Non-aquatic Glyphosate	100 ft[b]	Relatively low toxicity to birds, mammals and fish.

a - Bonneville Power Administration, Date Unknown, Transmission System Management Program (DOE/EIS-0285)-Final EIS, Chapter 6
b - Tu et al.Nature Conservancy Handbook

BMP measures have been proven effective across the country in managing non-point sources of pollution, and their implementation is required in both Idaho and Montana as part of the Clean Water Act (Seyedbagheri 1996, Schuler and Briggs, USDA Forest Service 2002, State of Idaho 1999 and State of Montana 2007)).

Direct Effects

Alternative 1 proposes the largest number of acres for grazing, total miles of driveway, total miles of driveway within 300ft of streams and the largest number of acres proposed for grazing. Alternative 1, and Alternative 4, both propose grazing a maximum of 3, 330 sheep. A sheep is defined as a weaned lamb, a yearling ram or ewe, a mature ram or ewe, pregnant ewe or a lactating ewe with a lamb(s) (Yurczyk 2009b, Table 14).

There would be no change in the type and magnitude of direct effects between existing grazing operations and the proposed action, as Alternative 1 is the same as current management.

Direct effects would include alteration of soil hydrology due to ground disturbance, compaction, loss of vegetative ground cover and in-stream disturbance during sheep crossings. These direct effects would be the same for all proposed alternatives.

Ground disturbance, loss of vegetative cover and compaction would occur primarily around watering troughs, along driveways, bedding areas and corrals. Other areas of compaction include trailing along fence lines. These areas would have the potential for increased soil exposure and erosion. In-stream disturbances would occur as the sheep actually cross a stream. Potential in-stream disturbances would substrate trampling and entrainment of manure into the stream flow.

The type and magnitude of direct effects are generally not expected to change with the implementation of the proposed action, as Alternative 1 is the same as current management, with the exception of reducing localized sources of sediment. Sediment reduction would occur at OD 4 and OD5 and on the road to Blair Lake Figure 14). As current management and Alternative 1 are one in the same, there would be no changes to the Issue Indicators, shown in Table 14. The number of sheep bedding areas would also not be expected to change as numbers of sheep grazed would remain the same as present and there would be no change in the relative amounts of disturbed ground.

The potential amount of ground disturbance, compaction and loss of vegetative cover, due to sheep grazing, in the North Fork Tom Creek, would remain the same. Under present management this area is rested and receives only incidental use as sheep. Field work in 2009 indicated uplands are stable and not actively eroding, and areas of historical trailing are re-vegetated. Alternative 1 and current management are the same. As a result, there would be no expected change in direct effects and areas not involved in incidental use would continue to recover.

Use of the east /west trending stream, in the eastern portion of the Ranch, for watering sheep would continue, as would bedding sheep next to stream. Current levels of use would remain the same as the number of sheep would not change. Consequently, the extent of bank trampling would not be expected to change nor would stream condition be expected to change. No changes to other stream channel conditions and floodplain function would be expected as grazing numbers and grazing duration is not altered from current management.

The potential for increases in localized increases in E. coli would remain the same as the number of sheep involved would not change. These increases would be expected to be short in time as shown in Table 12. No other alterations to existing water quality conditions would be expected.

Ground disturbance would also occur with the maintenance activities listed as part of the proposed action. Maintenance programs are currently implemented and the magnitude and extent of disturbance associated with these activities would not be expected to change under Alternative 1.

Under Alternative 1 grazing would continue at both the Humphrey allotment and at Henninger Ranch where water diversions occur for sheep watering. At the Humphrey allotment water is withdrawn from Modoc Creek, a tributary to Beaver Creek. A flow duration curve for Beaver Creek is displayed below in Figure 42. At Henninger Ranch, water is withdrawn from Dry Creek.

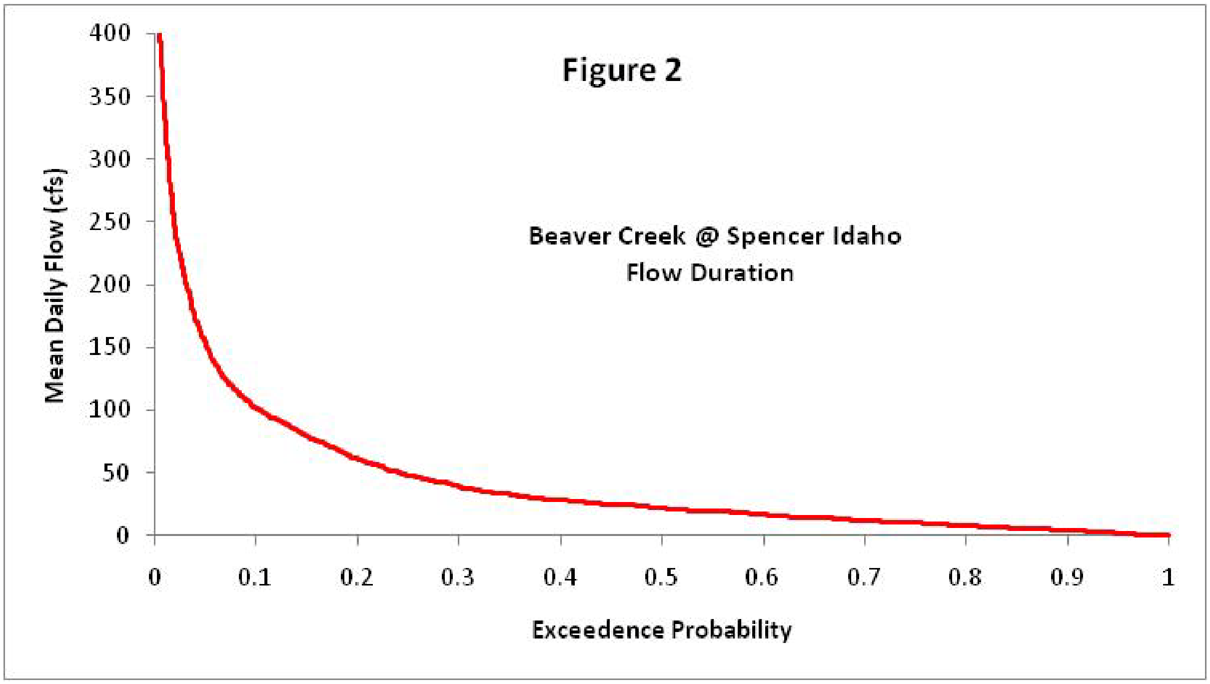


Figure 42. Flow duration curve from the Beaver Creek gage, during irrigation season (May 1st-Oct 31st)

The X axis of the graph is the probability of exceedance of a given flow value. The high values on the steep left hand side of graph are snow melt runoff peak values; the long low tail is mid-summer to fall values. Values from zero to 50 percent exceedance probability represent spring to early summer flows while values from 50 -100 percent exceedance probability represent late summer flows.

Flows in Beaver Creek from June through October are less than 50 cfs, with flows in mid-July less than 20 cfs (Figure 42). The allocated amount of 7.2 cfs per day represents a substantial portion of flow in the later summer months on Modoc Creek compared to the average irrigation season flow of 3.09 cfs and an average flow range of 1.21-7.45 cfs, as estimated by StreamStat (Moser 2011, Table 6). As a result, there is the potential for stream dewatering. However, when considering the proportion of withdrawals to estimated flows at the un-gaged Modoc it should be kept in mind that, as a guide, that flow the values given could be from about +150 to -50 percent different than actual flow (Moser 2011). The large margin in error is likely due to StreamStat as it is a regional model and may not take into account all location conditions, thus affecting low flow and seasonal averages (Moser 2011).

At Dry Creek average irrigation season flow was estimated at 7.89 cfs and range of average flow from May 1-October 31 is 1.77-25.5 cfs with the allocated amount to the Sheep Station being 14.2 cfs (Table 6). As a result, there is the potential for dewatering in Dry Creek.

However, estimates of average irrigation season flow and range of average flow for Dry Creek have the same margin of error as discussed for Modoc Creek. The large margin of error for both streams are likely tied to the fact that StreamStat data are calculated from regression models developed region wide and may not take into account all local conditions (Moser 2011). At Dry Creek the area is dominated by

Quaternary age flood basalts. These basalts consist of lava tubes, compression ridges as well as large areas bisected by cooling joints. All these features combine to allow water to percolate to depth and provide an unusual amount of storage (Moser 2011). With large amounts of storage it would be harder to maintain surface flow. Dry Creek was observed to lack surface flow in the summer of 2009 but it was not possible to determine if this was due to dewatering or due to the influence of the local geology.

Alternative 1 as proposed is the same as existing management. As a result there would be no change in the amount of water needed for the sheep. Existing direct effects would not be expected to change as the amount of water needed for withdrawal would not change.

No wetlands exist. There would be no change in direct effects to water-influenced soils and riparian areas as the number of sheep and grazing locations would not change.

Indirect Effects

The type and magnitude of indirect effects is expected to remain essentially the same between existing operations, and the proposed action, as current operations and the proposed action are the same. Indirect effects would primarily be the entrainment of sediment by overland surface runoff or stream flow.

The potential for ground disturbance, loss of vegetative cover and compaction would be the same under Alternative 1as there is no difference when compared to current operations. Areas of potential erosion and sediment sources would remain the same, except that the areas available for sediment transport into Odell Creek associated with sheep driveways at OD 4 and OD 5 would be reduced with the implementation of mitigation measures to divert water and sediment from directly entering the Creek (Figure 14). The amount of area available for erosion, sediment production and entrainment along the road to Blair Lake would also be reduced with implementation of recommended implementation measures. Downcutting and channel erosion at the exit of the mine pond drainage would be reduced or eliminated with mitigation measure implementation.

Current levels of erosion and sediment contribution to the east/west trending stream (eastern-most Humphrey Ranch) would not be expected to change. The number of sheep, and the duration of grazing, does not vary between current management and Alternative 1. Consequently stream function is not expected to be altered (Table 8). Bedding next to this stream would be expected to continue at present intensities.

Uplands would continue to be used for grazing. The number of sheep would remain the same as would the time periods of use. No changes are expected to ground disturbance, loss of vegetative cover, compaction, or overland flow behavior. This would also be the case in the North Fork of Tom Creek.

Recovery from past prescribed burns would continue and as these areas recover their potential for transport by surface runoff would decline. Approximately 670 acres are burned each year and a total of 2. 680 acres would undergo prescribed burning in the next four years, primarily on the sagebrush steppes. Monitoring has shown that within two years forbs and grass cover returns, minimizing the potential for erosion.

No changes in existing indirect effects, related to sediment transport, is predicted as this number does not change from past yearly burn acreages and prescribed burning is located on the sage brush steppes where there is no perennial water. Field work in 2008 did not find any areas of surface water-related erosion in these recovering burn areas.

Maintenance activities have the potential for generating localized areas of disturbance during road grading, maintaining the firebreak, fence and water development replacements and ditching. Potential direct effects include erosion and the introduction of sediment into streams. Burroughs and King (1989) and Burroughs (1990) document that little sediment beyond 300 feet is transported to streams. 8.5 of the 142.3 miles of road on the Headquarters property occur within 300 feet of streams (Table 3). All stream drainages located on the Headquarters property are intermittent and are underlain by flood-basalts characterized by lava tubes, blisters and jointing. As a result, this material is highly porous and permeable with little evidence of sustained surface flow. As a result, minimal erosion and sediment transportation are expected. Indirect effects would be expected to be short term and associated with initial disturbance. Long term effects associated with roads would be expected to remain the same as no road construction was proposed. Potential indirect effects due to water withdrawal can include alteration of water velocity, stream temperature and dissolved oxygen. However, existing levels of indirect effects due to water withdrawal would not be expected to change as there is no difference in water irrigation needs between current management and the proposed action

There would be no change in potential impact to water quality or floodplain function as the number of sheep to be grazed does not change, nor does the location of grazing, and there is no change in the Issue Indicators summarized in Table 14. The same number of sheep would be involved in stream crossings as this number does not change from existing conditions under Alternative 1 (Table 14). Total Suspended Sediment impacts though are shown to be short in duration and do not result in detrimental impacts (Lewis 2009).

There would be 47 acres of herbicides treated under Alternative 1, which is the same as current management. Herbicides listed in Table 13 are used at the ARS. Picloram, Diuron and Bromacil are all proven ground water contaminants (Gilliom 2007, SERA 2003). Ground water contamination, due herbicide entrainment, is of concern in the Headquarters area due to the under lying geology, which consists of Pleistocene flood basalts and well drained soils. Basalts were observed to have polygonal jointing, vesicular characteristics and flow features, such as pressure ridges, blisters etc that would form conduits for ground water movement. In addition, the flows are faulted to some extent as the area is in a horst and graben setting. Soils on the volcanic plain have moderate to moderately rapid permeability from coarse rock and sandy loam to loam textures. All of these characteristics suggest high permeabilities and porosities, facilitating the entrainment of herbicide into groundwater. Picloram, Diuron and Bromacil all have high solubilities and low soil adsorption thereby transporting readily in storm wash or percolating readily. Bromacil in particular has a high concern for surface water transport. These risks are most pertinent in agricultural situations with irrigation and where rainfall is abundant. Climatic conditions at the Sheep Station border on arid and lack rainfall that would transport herbicides, except from thunderstorms. However, the risks at the feedlots are related to continued use proximate to the domestic well locations. It should be noted though that these areas are not irrigated.

Alternative 1 would implement herbicide BMPs and recommended buffer widths, which would reduce the potential for any future opportunities for ground water contamination. For a discussion of BMP effectiveness the reader is referred to page 43. Additional direction regarding herbicide applications at the Sheep Station is found in Appendix C of the EIS.

There would be no change in indirect effects to water-influenced soils and riparian areas as the number of sheep and grazing locations would not change.

Cumulative Effects

Alternative 1 is the same as what is currently being implemented. There would be no change in existing levels of cumulative effects on ARS Sheep Station lands as there are no changes to grazing schedule or number of sheep used for grazing. There would be no change in cumulative effects related to water use for irrigation and watering sheep. Existing levels of cumulative effects related to road and firebreak maintenance would remain the same. However, there would be increased ground disturbance in watershed 170402140401 associated with the proposed route for NorthWestern Energy's proposed power line.

Grazing would continue on Snakey-Kelly, Bernice, Mud Lake Feedlot, Meyers Creek and Bernice grazing allotments. The number of sheep would not change from what is presently being used. As there were no predicted changes in direct and indirect effects for these allotments, there would be no changes to cumulative effects.

Compliance with Relevant Laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for Alternative 1.

Summary of Effects

There would be no change in the type of direct effects between existing grazing operations and the proposed action as they are the same. The type and magnitude of indirect effects is expected to remain the same except for reductions in localized sediment transportation would be reduced at two sheep driveways and on the road to Blair Lake, where mitigation measures would be implemented.

Alternative 2

Under Alternative 2 No grazing would occur on the Headquarters property, East and West Summer grazing areas or Henninger and Humphrey Ranches. No trailing would occur and no driveways would be used.

Design Features and Mitigation Measures

No mitigation measures and design features, as described under Alternative 1, would be implemented, as none of the ARS lands would be grazed. No herbicides would be applied.

Direct Effects

No direct effects would occur as grazing would not occur on ARS administered lands. Water would not be needed for irrigation. By not withdrawing the allocated water there could be potential improvements to flow but improvements would likely be local in character. Direct effects related to road and firebreak maintenance would occur, but direct effects related to fence and water development maintenance would not.

Indirect Effects

No indirect effects would occur as grazing would not occur on ARS Sheep Staion lands, except for localized sediment contributions. Sediment would continue to be generated from sheep driveways at points OD 4 and OD 5 and along the road to Blair Lake as mitigation and maintenance measures would not be implemented.

Existing indirect effects, related to water withdrawal, would possibly be reduced due to cessation of water withdrawals. Any improvements would most likely be local in character. Indirect effects related to road and firebreak maintenance would occur as described under Alternative 1, but indirect effects related to fence and water development maintenance would not.

Cumulative Effects

There would be no increase in adverse cumulative effects with the implementation of this Alternative. Grazing would continue at the Mud Lake with potential increases in direct and indirect effects as sheep are grazed the longest at Mud Lake under this Alternative. However, cumulative effects would not increase as no other ARS Sheep Station grazing property or BLM or Forest Service allotment are within this watershed and grazing would not be occurring on these allotments.

Watershed conditions on ARS Sheep Station properties are in good to excellent condition. In the absence of grazing, existing levels of ground disturbance, compaction, loss of vegetation and in-stream disturbance stream crossings would be eliminated. Indirect effects such as increases in surface runoff and erosion would also decrease, as areas re-vegetate, surface runoff and any sediment transport decreases. Localized effects related to unauthorized use of the road to Blair Lake would continue, as would present levels of erosion associated with this road as would surface runoff and erosion presently associated with OD 4 and 5.

Water withdrawals from Modoc Creek and Dry Creek would not be needed as sheep would not need to be watered. Decreases in existing levels of cumulative effects, both direct and indirect, may occur but improvements may not be detectable at the 6th watershed level due to scale. Cumulative effects related to maintenance activities would decrease slightly.

Grazing would no longer occur on Snakey-Kelly, East Beaver, Meyers Creek and Bernice allotments, which are located on lands administered by the Caribou-Targhee National Forest and Bureau of Land Management. In the absence of grazing, existing levels of ground disturbance, compaction, loss of vegetation and in-stream disturbance during watering and stream crossings would be eliminated.

Indirect effects such as increases in surface runoff and erosion would also decrease, as areas re-vegetate, surface runoff and any sediment transport decreases. As a result, existing levels of cumulative watershed effects would be expected to be decreased, but may not be measurable at the 6th watershed level.

Compliance Relevant Laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for Alternative 2.

Summary of Effects

Direct effects related to ground disturbance, compaction and loss of vegetative cover would decrease on ARS Sheep Station grazing properties as grazing would not be implemented. However, watershed conditions are good to excellent and streams in proper functioning condition with few exceptions. Improvements would be expected to be subtle.

Compaction and disturbance would increase on the Mud Lake grazing area as the number of sheep and amount of use would increase. Localized disturbance associated with maintenance activities on Headquarters, Henninger, Humphrey and summer range grazing areas would not occur. However, road and firebreak maintenance would continue. The potential for indirect effects on water quality related to sheep grazing and maintenance activities would be eliminated except for at the Mud Lake Feedlot.

Cumulative effects would decrease as no grazing would occur on any grazing area or allotment other than Mud Lake. No increases in cumulative effects would be expected at Mud Lake.

Alternative 3

The only ARS Sheep Station grazing areas incorporated into Alternative 3 are the Headquarters and Henninger areas.

Design Features and Mitigation Measures

The design feature for rest and incidental use of the North Fork Tom Creek would not be implemented as this area would not be grazed. Mitigation measures for sheep driveways at OD 4 and OD 5 (Figure 14), the road to Blair Lake and at the exit of the mine drainage pond would not be implemented, as the West and East Summer grazing areas are not included in Alternative 3.

Well monitoring and recommended buffers would be implemented. BMPs for herbicide application would be implemented on the ARS grazing areas proposed for use. See Alternative 1, Design Features and Mitigation Measures for a discussion of BMP effectiveness.

Direct Effects

The Headquarters and Henninger Ranch grazing areas are the only ARS Sheep Station lands that would be grazed under Alternative 3. There would be a 20 percent reduction in total sheep numbers and 42 percent reduction in the number of acres available for grazing. There would be zero miles of driveways and zero miles of driveway within 300 ft of streams (Table 14).

Grazing would be pushed to carrying capacity in the Headquarters area and the season of use would be significantly increased (Yurczyk 2009d). Utilization at Henninger would decrease as the number of Animal Unit Months (AUMs) is decreased (Yurczyk 2009c).

Alternative 3 has an increased potential for ground disturbance, compaction and loss of vegetative ground cover as the season of use at Headquarters would be increased significantly compared to Alternative 1. This would include around water developments, bedding areas and corrals. However, the use of adaptive management would be implemented as well as supplemental feeding, to mitigate this potential. There are no driveways under this alternative so they would not be a potential source for disturbance, compaction or loss of vegetative cover. Stream crossings would be eliminated as summer ranges would not be grazed.

At Henninger the potential for increased ground disturbance would be expected to be somewhat less than under Alternative 1. Fewer sheep would be grazed on the Ranch and there is a 35 percent decrease in the predicted number of AUMs that would be utilized.

Existing direct effects, related to water withdrawal, would continue at Henninger Ranch. However, grazing would no longer continue at the Humphrey allotment and water would not be withdrawn from the creek. Consequently existing direct effects, on Modoc Creek, due to water diversion would be eliminated.

Ground disturbance, compaction and loss of vegetative cover near the east/west trending stream, used for watering on the Humphrey Ranch, would be expected to quickly recover as existing conditions are not extensively modified (Fryxell 2009). E. coli contributions to streams would be eliminated on those properties not included under Alternative 3. Direct effects would be reduced under Alternative 3 for the North Fork of Tom Creek as fewer sheep would be grazed. However, Alternative 3 proposes to graze only 640 fewer sheep, a difference that would not be expected to result in a measurable difference.

No changes to riparian condition would be expected under this Alternative. Water influenced soils appear to be absent or minimal in nature. Any changes in direct effects to water influenced soils would not be detected.

Prescribed burning would continue and would result in short term loss of vegetative cover.

Maintenance related ground disturbance would consist of road, fence and water development maintenance on Headquarter and Henninger properties. Direct effects related to road and fire break maintenance would be expected to be the same as discussed under Alternative 1.

Indirect Effects

Summer ranges would not be grazed. Stream crossings would not be used. The entrances to the Odell crossings would gradually decompact and re-vegetate with time; however there would not be measurable or discernable differences compared to Alternatives 1, 4 or 5 as differences would not be detectable as crossings are used only several times a year and existing conditions do not show degradation (Moser and Fryxell 2008, Moser et al. 2008). However, mitigation measures for stream crossings would not be implemented as described under Alternative 1 for the stream crossing exits or for the road to Blair Lake. These areas would continue to function as localized sediment sources.

The east/west trending stream at Humphrey Ranch would not be used for watering. Sediment derived from bank trampling would be eliminated and localized channel over-widening would stabilize with the absence of grazing. There would be no measurable change in existing levels of effects for upland conditions in the North Fork of Tom Creek. The area is presently receives only incidental use. Eliminating this level of use would not be expected to result in a measurable decrease of sediment originating from uplands.

Water would not be withdrawn from Modoc Creek. Current levels of indirect effects, due to water diversion, such a stream temperature and dissolved oxygen, would be expected to improve locally, but may be undetectable.

Sheep bedding areas in the East and West summer ranges would re-vegetate and decompact over time, which would further improve existing and healthy watershed conditions. Re-vegetation would not expect to result in measurable changes as these areas are so small.

Short term indirect effects to water quality in the summer ranges would not occur as the summer ranges would not be grazed. Floodplain function in the summer range would not be altered compared to any of the alternatives as no activity is proposed that would change existing conditions. Floodplain areas in the Humphrey Ranch would not be grazed under Alternative 3. Water uses for irrigation would continue at Henninger but not at Humphrey Ranch.

Indirect effects related to maintenance, for both roads and the firebreak, would be expected to be the same as discussed under Alternative 1.

Existing levels of prescribed burning would be expected to continue. No changes in present levels of indirect effects for surface runoff and erosion would be expected as the number of acres proposed for prescribed burning would be the same as Alternative 1 and no upland erosion issues were noted in previously burned areas (Moser and Fryxell 2008). An estimated 318 acres would be proposed for seeding, which is 13 percent less than Alternative 1. No measurable differences in indirect effects would be expected due to the small difference in acreage and the present lack of noted burn-associated erosion at the Headquarters' property.

Refer to Indirect Effects, Alternative 1 for a discussion of ground water susceptibility to herbicide contamination. Herbicide applications would not occur on Humphrey Ranch and the Summer East and West grazing areas. Applications would continue at the Headquarters property and Henninger Ranch, which would total 37 acres. Alternatives 1, 4 and 5 would treat approximately 47 acres with herbicides.

Alternative 3would implement herbicide BMPs and recommended buffer widths, which would reduce the potential for any future opportunities for ground water contamination. Alternatives 1, 4 and 5 would implement the same design features and mitigations.

No changes to riparian condition would be expected under this Alternative. Water influenced soils appear to be absent or minimal in nature. Any changes in indirect effects to water influenced soils would not be detected.

Use of wells for domestic use would continue.

Cumulative Effects

There is the potential for an increase in adverse cumulative effects in 6th level watershed 1700402140401. There is the potential under Alternative 3 for both increased direct and indirect effects related to substantial increases in the season of use and maximizing carrying capacity on the Headquarters property and potential ground disturbance associated with NorthWestern Energy's proposed Mountain States transmission intertie (http://www.msti500kv.com/about/projectoverview/intro.html). Construction of the power line would result in short term increases in cumulative watershed effects related to ground disturbance. Maintenance of roads associated with the power line and increased grazing activity would result in long term cumulative effects increases. However, the magnitude of potential increases would be mitigated for several reasons. Adaptive management would be used to rotate sheep between pastures. The Sheep Station would implement supplemental feeding and water troughs would be moved as sheep are rotated from pasture to pasture. In addition, there is an absence of surface water on the Headquarters property, topography is subdued and the area is underlain by permeable basalt flows. These factors also would minimize any change for increased surface disturbance and erosion.

Cumulative watershed effects would be expected to decrease in watersheds involved with the Humphrey, West and East Summer Ranges, East Beaver Creek and Meyers Creek as these allotments would not be grazed (Figure 41 and Table 1). This conclusion incorporates the direct and indirect effects discussed above. Grazing would continue at the Mud Lake Feedlot, Snakey-Kelly and Bernice allotments. There is the potential for increased watershed impacts as the number of animal unit months are increased under this alternative compared to Alternative 1.

Existing levels of cumulative effects related to water use would decrease slightly as the water right at the Humphrey allotment would not be used. However, improvements would most likely not be detected at the 6th watershed level. Existing levels of cumulative effects related to road and firebreak maintenance would remain the same (See Alternative 1 discussion). Areas of ground disturbance and compaction would be expected to heal relatively quickly as degradation is not extensive. In-stream disturbance would be eliminated. Localized sources of sediment generation, such as Blair Lake and stream crossings at OD4 and OD5 would continue to function. The amount of road used for trailing and amount within 300 ft of streams would decrease (Table 14); however, this would not result in any measurable change due to current activity levels on these roads.

Compliance with Relevant laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Other Relevant Mandatory Disclosures

There are none for Alternative 3.

Summary of Effects

Direct and indirect effects would be eliminated in the ARS Sheep Station grazing properties not included in Alternative 3 with several exceptions. Surface runoff and erosion would continue at the Odell stream crossings and on the road to Blair Lake as mitigative measures would not be implemented. Indirect effects to water quality would be eliminated in the summer ranges.

Elimination of incidental grazing use in the North Fork of Tom Creek would not result in observable improvement to this drainage. Direct and indirect effects associated with road and firebreak maintenance would continue.

Floodplains function would not be changed. Irrigation and alteration of flow would continue at Henninger Ranch but would not occur at the Humphrey allotment. Short term indirect effects related to prescribed burning and seeding would continue. Herbicide use would continue as would use of well water for domestic use.

Grazing would continue at the Mud Lake Feedlot, Snakey-Kelly and Bernice allotments. There is the potential for increased watershed impacts as the number of animal unit months are increased under this alternative compared to Alternative1.

There is the potential for an increase in adverse cumulative effects in 6^{th} level watershed 1700402140401 associated with increased grazing at the Headquarters property and power line construction. Potential increases would not be expected for all other watersheds involved in the cumulative effects area for the project.

Alternative 4

Grazing would occur on Headquarters Property, Henninger Ranch, Humphrey Ranch and the West Summer Range. The East Summer Range would not be grazed. A total of 2.3 miles of driveway would be used and 1.2 miles of the driveways would be within 300 ft of water. There would be an eight percent decrease in the total number of acres to be grazed compared to Alternative 1 and existing management (Table 14). 3,300 sheep would be grazed under this alternative.

Design Features and Mitigation Measures

The design feature for rest and incidental use of the North Fork Tom Creek and for the road to Blair Lake would not be implemented as the East Summer Range would not be grazed. BMPs for herbicide application and recommended buffers would be implemented on ARS Sheep Station grazing areas proposed for use. See Alternative 1, Design Features and Mitigation Measures for a discussion of BMP effectiveness. Mitigation measures for sheep driveways at OD 4 and OD 5 (Figure 14) and at the exit of the mine drainage pond would be implemented.

Direct Effects

Alternative 4 and Alternative 1 propose to conduct grazing on the same areas with one exception. Under Alternative 4 the East Summer Range would not be grazed. As a result, please refer to the discussion under Alternative 1 for direct effects for all areas except for the East and West Summer Ranges.

Alternative 4 would implement consecutive year grazing, of 3, 300 sheep, on the West Summer Range as the result of the East Summer Range being closed to grazing. Currently this pasture is rested every third year. Consequently, grazing pressure would potentially increase in the West Summer Range with a concomitant increased potential for ground disturbance, compaction, loss of vegetation and in-stream disturbance as sheep cross streams; with increased grazing pressure there is the potential for a decline in range due to concentrated use in bedding areas, development of trailing, soil trampling and loss of vegetative cover (Grooms et al.2009). However, adaptive management would be used to mitigate the increased potential for ground disturbance, compaction and loss of vegetative cover (Yurczyk 2009g).

Although grazing pressure would increase, pressure on riparian areas in the West Summer pasture is not expected to result in measurable increases of direct effects, as sheep prefer high exposed ridge tops. Loss of riparian vegetation adjacent to stream crossings would not be expected measurable due to the implementation of adaptive management. The increased potential for compaction and trampling of water loving soils would be expected to be in stream crossing areas. As stated above the use of adaptive management would be expected to mitigate this increased potential.

There would be no difference between Alternative 4 and Alternative 1 in terms of water needs to irrigate and water sheep. The number of sheep does not differ. Direct effects for water withdrawal would be the same as Alternative 1. Please refer to Alternative 1 for that discussion.

Direct effects related to road and firebreak maintenance would be the same as discussed under Alternative 1. Direct effects related to other maintenance activities would decrease slightly as no activities would occur on the East Summer Range.

Indirect Effects

Indirect effects would be the same for Alternative 4 as Alternative 1 except for those potential indirect effects that would occur in the East Summer Range. Please refer to Alternative 1, Indirect Effects for that discussion. These discussions include implementation of mitigation measures, which would reduce localized sources of erosion and sediment generation at the Odell sheep crossings and at the drainage flowing from the waste water pound at the old phosphate mine.

With the elimination of the Eastern Summer Range incidental sheep grazing would not occur. Elimination of incidental grazing use in the North Fork of Tom Creek would not result in observable improvement to this drainage.

In the West Summer Range there would be the potential for increased instream disturbance, sediment generation, and incorporation of sheep manure into the water with increased grazing pressure. Adaptive management would be used in association with stream crossings. As a result, no discernable increases in indirect would be expected.

Indirect effects, related to water withdrawal for irrigation and water sheep would be the same as described under Alternative 1. Both the Humphrey allotment and Henninger Ranch would still be used and the same number of sheep would be involved. Please refer to the discussion of indirect effects for Alternative 1.

Indirect effects, related to maintenance or Headquarter roads and the firebreak, would be the same as discussed under Alternative 1, but the magnitude would be decreased slightly as no maintenance would occur on the East Summer Range.

Cumulative Effects

Cumulative effects would be the same for all watersheds involved with ARS Sheep Station grazing areas as described under Alternative 1.This conclusion incorporates the direct and indirect effects discussed above. Cumulative effects for water withdrawal and diversion would be the same as under Alternative 1. Existing levels of cumulative effects related to road and firebreak maintenance would be decreased slightly as maintenance on the East Summer Range would not be conducted, but would not be expected to result in a measurable improvement, due to small amounts of disturbance involved.

Cumulative effects would remain the same for the Mud Lake Feedlot, Snakey-Kelly-Bernice and East Beaver allotments as they were described under Alternative 1. Grazing would not be conducted on the Meyers Creek allotment. With this loss there is not there is a loss of flexibility in adaptive management and increase utilization at Henninger (Grooms et al. 2009). However, utilization under Alternative 4 increases only by 0.8 percent when compared to Alternative 1. Alternatives 3 and 5 propose less utilization at Henninger than Alternative 4. With such a small increase in utilization it is unlikely any increase in direct and indirect effects would be detectable. As a result, no measureable increases in cumulative watershed effects would be expected.

Compliance with Relevant laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Other Relevant Mandatory Disclosures

There are none for Alternative 4.

Summary of Effects

Alternative 4 and Alternative 1 propose to conduct grazing on the same areas with one exception. Under Alternative 4 the East Summer Range would not be grazed. Alternative 4 would utilize consecutive year grazing with 3, 300 sheep on the West Summer Range. As a result there would be increased potential for direct and indirect effects. However, adaptive management would be used in order to provide the ability to conduct research and avoid measurable and negative increases in watershed condition (Yurczyk 2009g). No adverse increases in cumulative watersheds effects would be expected. Cumulative effects would remain the same for the Mud Lake Feedlot, Snakey-Kelly-Bernice and East Beaver allotments as they were described under Alternative 1 but reduced on the Meyers Creek allotment.

Direct and indirect effects related to road and firebreak maintenance would be the same as discussed under Alternative 1 but the magnitude would be decreased slightly as no maintenance would be done in the East Summer Range. Direct and indirect effects for water diversion would be the same as Alternative 1.

Alternative 5

Grazing would occur on Headquarters Property, Henninger Ranch, Humphrey Ranch and both the East and West Summer Range. There would be a total of 3.1 miles of driveway with 1.4 of the miles within 300 ft of streams. 2, 331 sheep would be used for grazing compared to 3,300 under Alternative 1.

Design Features and Mitigation Measures

Design features and BMPs would be implemented for Alternative 5. BMPs, design feature for grazing limitations in the North Fork of Tom Creek, well monitoring and recommended buffers for herbicide applications would all be implemented. Refer to Alternative 1 for additional detail.

Direct Effects

Alternative 5 would have the same potential direct effects as Alternative 1 as the same ARS Sheep Station properties are proposed for grazing. This includes any effects related to the diversion of waters at the Humphrey allotment and Henninger Ranch and maintenance activities. In addition, the same mitigation measures would be applied. However, Alternative 5 proposes to graze an estimated 969 fewer sheep so this Alternative has a lower potential for ground disturbance, compaction, loss of vegetative cover and in-stream disturbance during stream crossings. The difference though would not be expected to be measurable as overall watershed condition health on these properties is good to excellent.

Refer to Alternative 1, Direct Effects for a detailed discussion, which includes road and fire break maintenance effects.

Indirect Effects

Alternative 5 would have the same potential indirect effects as Alternative 1 as the same ARS properties are proposed for grazing; and the same mitigation measures would be applied. This includes any effects related to the diversion of waters at the Humphrey allotment and Henninger Ranch and maintenance activities. However, Alternative 5 proposes to graze an estimated 969 fewer sheep so this Alternative has a lower potential for ground disturbance, compaction, loss of vegetative cover and in-stream disturbance during stream crossings. The difference though would not be expected to be measurable as overall watershed condition health on these properties is good to excellent.

Refer to Alternative 1, Indirect Effects for a detailed discussion, which includes road and fire break maintenance effects.

Cumulative Effects

Cumulative effects would be the same for all watersheds involved with ARS Sheep Station grazing properties and maintenance activities as described under Alternative 1.This conclusion incorporates the direct and indirect effects discussed above.

Snakey-Kelly and Bernice allotments would not be grazed. Cumulative effects would be the same as under Alternative 2.

The Mud Lake Feedlot, East Beaver and Meyers Creek allotments would be grazed. Cumulative effects would be the same as discussed under Alternative 1.

Compliance with Relevant laws, Regulations, Policies and Plans

This alternative would meet the intent of the Clean Water Act and the Executive Orders for wetlands and floodplains.

Other Relevant Mandatory Disclosures

There are none for Alternative 5.

Summary of Effects

Alternative 5 would have the same potential direct and indirect effects as Alternative 1 as the same ARS Sheep Station properties are proposed for grazing, and maintenance and water diversion needs are the same. In addition, the same mitigation measures would be applied. Alternative 5 would have a lower potential for these direct and indirect effects as fewer sheep would be grazed than in Alternative 1. The difference though would not be expected to be measurable as overall watershed condition health on these properties is good to excellent.

Cumulative effects would essentially be the same as Alternative 1 however the Snakey-Kelly and Bernice allotments would not be grazed. Cumulative effects for these allotments would be the same as discussed under Alternative 2.

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